SMART CITIES:

Green Architecture and Sustainability applied on buildings.
Evaluation systems for " blank"
Smart Cities and "converted" Smart Cities

Ramo de Doutoramento | Arquitetura
Especialidade
Tecnologias e Gestão da Construção

Nome do Doutorando:
MBA, MSc
ANA CLAUDIA DE OLIVEIRA

Nome do Orientador:
Doutor Carlos Alberto Assunção Alho

Constituição do Júri:
Presidente e Vogal:
| Doutora Manuela Cristina Paulo Carvalho Almeida Figueiredo,
Professora Auxiliar,
Faculdade de Arquitetura da Universidade de Lisboa.

Vogais:
| Doctor Luis Moya Gonzalez,
Professor Catedrático,
Universidad Politécnica de Madrid;

| Doutor António José Morais,
Professor Associado com Agregação,
Faculdade de Arquitetura da Universidade de Lisboa;

| Doutor António Álvaro Borges Abel,
Professor Auxiliar,
Universidade de Évora;

| Doutor Francisco Carlos Almeida do Nascimento e Oliveira,
Professor Auxiliar,
Faculdade de Arquitetura da Universidade de Lisboa;

| Doutor Carlos Alberto de Assunção Alho,
Professor Auxiliar,
Faculdade de Arquitetura da Universidade de Lisboa.

Tese especialmente elaborada para a obtenção do grau de **doutor**

DOCUMENTO DEFINITIVO | OUTUBRO | 2017

VOLUME I

VOLUME I

Figure 1 - Songdo Central Park image
(source: by the author, December 2014)

시작이 반이다

Starting is half the task

Sometimes, getting started is the hardest part off any task; just jumping in will move you forward.

I | ABSTRACT

Successive deployments of Smart Cities around the world are hindered by the difficulty in attracting a critical mass of inhabitants. New technology is not enough as a driver to guarantee a sustained adoption rate within the new cities. The concept of Climate Smart City aims at solving this issue by putting aspects related to liveability and sustainability at the centre.

While the role of architecture in Climate Smart Cities is even more important than in Smart Cities, the principles that underlie their design and, ultimately, their success, have never been systematically studied and assessed.

This research work systematises and validates the needs of Climate Smart Cities and then proposes a framework of principles for their planning, design and maintenance. The needs are validated with field studies of Songdo City in Incheon, South Korea, Ulaanbaatar, Mongolia and Minsk, Belarus.

By defining the guiding principles underlying the design of Climate Smart Cities, the proposed framework will also enable architects, engineers, decision-makers and, international organisations to benchmark the solutions to be implemented. These principles can be readily implemented in interventions planned for European cities, emerging cities and, underdeveloped cities subject to poorly strategic planning.

Key words: Climate Smart Cities, Smart Cities, Green Architecture, Sustainability, Neighbourhood creativity,

II | RESUMO

O desenvolvimento sucessivo de Cidades Inteligentes pelo mundo, tem criado uma atitude negativa e prejudicial que resulta na dificuldade de atração de habitantes para estes espaços. As novas tecnologias não são suficientemente impulsionadoras para garantir uma taxa de adoção sustentável dentro destas novas cidades. O conceito de Cidades Inteligentes Climáticas visam resolver esta questão tendo em conta aspectos relacionados na base da habitabilidade e da sustentabilidade.

Enquanto o papel da arquitetura nas Cidades Inteligentes Climáticas é ainda mais importante do que Cidades Inteligentes, os princípios que se encontram subjacentes na sua concepção e, em última instância, no seu sucesso, não foram ainda sistematicamente estudados e avaliadas.

Este trabalho sistematiza e valida as necessidades de Cidades Inteligentes Climáticas e propõe um conjunto de princípios para a sua planificação, concepção e manutenção. As necessidades foram validadas com os casos de estudo da cidade de 'Songdo City' em Incheon, na Coreia do Sul, em Ulaanbaatar na Mongólia e em Minsk na Bielorrússia.

Com a definição dos princípios orientadores subjacentes à concepção de Cidades Inteligentes Climáticas, o quadro proposto permitirá que arquitetos, engenheiros, governos, e organizações internacionais afiram soluções a serem implementadas mundialmente.

Estes princípios podem ser facilmente implementados em intervenções em cidades europeias, nas cidades emergentes e, em países subdesenvolvidos que estão sujeitos a um mau planeamento estratégico.

Palavras-chave: Cidades Inteligentes Climáticas, Cidades Inteligentes, Arquitetura Verde, Sustentabilidade, Bairros criativos,

III| Acknowledgements

This is an ending stage of my life, that I devoted to academic research since 1999. With the Architecture degree in Lisbon, the Erasmus project in Italy at Milan Polytechnic during 2001 until 2002, with the master's degree in Buildings Rehabilitation finished in 2008 it was a long run and it is completed. With a start in a Ph.D. in Urbanism and, with a change to the Architecture Ph.D. at Lisbon University, with the Energy MBA between 2011 in 2013 between Lisbon and New York at Pratt Institute in NYC Manhattan and, finally since the end of 2013, to this now, between Lisbon to South Korea at the Songdo city, or Lisbon to Belarus, at Minsk city.

I wish to express, to all the people, who was part of my career and, were an integrant part at my best and worst moments, my deepest: THANK YOU. Not being able to refer to all the persons, I want to praise and remember , all those, who were involved with their heart with me.

To my advisor, Ph.D. Arch. Carlos Alho, (FAUTL), for his strong support, his confidence in myself for so many years and constant concern and dedication and always believing in me: "Thank you for everything!"

To you my friend, Gonçalo Cardoso, for all the years that you were here, supporting me. I know that you are proud of my work, I'm proud of you!

To you Arch. José Antonio Jacinto Vieira, as a mentor for me! You taught me to fish! Thank you so much!

To Professor Han, from INHA University in South Korea, for their willingness and commitment by accepting this challenge to contribute their invaluable enthusiasm and professionalism.

To engineer Ferreira Pinto, who always follow my study reading all my work and believing.

An intense thanks you for my Minsk team in Belarus at the Belarusian State Technological University, 'Evgeni', 'Evgeni' and 'Alexandro'.

An enormous thanks to 'Duralex' that helped me so much with the sound of the music: Pedro, Tó, David, Plácido, Carlos & Leonel.

To you my motivation! You are strong! You never give up 'Eric'.

To Jorge Nicolau with their help and support! Thank you for your positive mind and energy!

To all my real, real friends, those were with me. Thank you so much!

Thank you, Line, for never stop believing in me.

To my fantastic mother 'Lena', for everything that she gave me. For her patience and dedication, you are everything to me!

To my exceptional father 'António', for being always helping me! From his force and pragmatism to face complex problems and being so patient and so unique!

To both, my greatest thanks and my family as well!

Doing this research was a chance of life, and it is impossible to come back again. This impressive improvement into my life created an openness of mind and spirit into my life. I learned that sometimes we need to loose things, and that things, are part of the process. We need only to accept.

I am very grateful for the experience.

IV | TABLE OF CONTENTS

VOLUME II
Annex

V | INITIALS AND ABBREVIATION

BIM	Building Information Modelling
CSC	Climate Smart Cities
DSO	Dubai Silicon Oasis
EU	European Union
GA	Green Architecture
GCF	Green Climate Found
GHG	Greenhouse Gas
ICT	Information & Communication Technologies
IEEP	Intelligent Energy Europe Programme
IFEZ	International Free Economic Zone
IOC	Intelligent Operations Centre
LEED	Leadership in Energy and Environmental Design
NCF	New Cities Foundation
NCS	New Smart City
POSCO	Posco Engineering and Construction Korean steel comp.
QFD	Quality Function Deployment
QoL	Quality of Life
SBS	Sick Building Syndrome
SC	Smart Cities
CWM	Construction Waste Management

TRM	Technology Road mapping
UB	Ulaanbaatar City
ULB	Urban Local Bodies
UN	United Nations
UNEP	United Nations Environment Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNFCCC	United Nation Framework Convention on Climate Change
UN Habitat	United Nations Human Settlements Programme
US GBC	United States Green Building Council
USA	United States of America
USSR	Union of Soviet Socialist Republics
WCCD	World Council on City Data
WPC	Well Planned City
WRI	World Resources Institute
WWF	World Wildlife Found
WWII	Second World War
YSCP	Yokohoma Smart City Project

Smart Cities	Intelligent Cities, Creative Cities, technology and quality of life integration.
Redraw	Draw something again, in order to make changes and improvements.
U-City	A new paradigm change in urban space creation that started in South Korea, a ubiquitous computing environment inside the city that fuses high-tech infrastructure and ubiquitous information service into the urban area.
Green Architecture	Different relationship between Buildings and Environment. Environmental technology, energy conservation, sustainability, and the conversion of all these elements into architecture as art.
IFEZ	Free Economic Zone in South Korea | Incheon
LEED	Leadership in Energy and Environmental Design – a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighbourhoods. Developed by the U.S. Green Building Council 'USGBC', LEED helps building owners and operators be environmentally responsible and use resources efficiently.
Songdo City	Incheon city's name in South Korea.
Masdar	Abu Dhabi city's name in United Arab Emirates.
Climate Change	Changes in the earth's weather, including changes in temperature, wind patterns and rainfall, especially the increase in the temperature of the earth's atmosphere that is caused by the increase of particular gases, especially carbon dioxide
Environment	The air, water, and land in or on which people, animals, and plants live
Environmental impact	Possible adverse effects caused by a development, industrial, or infrastructural project or by the release of a substance in the environment.
Sustainable Cities	A sustainable community is one that is economically, environmentally, and socially healthy and resilient. It meets challenges through integrated solutions rather than through fragmented approaches that meet one of the goals at the expense of the others. This requires a long-term perspective. One that is focused on both the present and future, beyond the next budget or election cycle.

Sustainable development	Meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs.
Desertification	Conversion of grassland or an already arid land into a desert through indiscriminate human actions magnified by droughts. Such actions include overgrazing, repeated burning, intensive farming, and stripping of vegetation for firewood
Ecological construction	Eco-friendly, or ecological, construction is building a structure that is beneficial or non-harmful to the environment, and resource efficient. Otherwise known as green building, this type of construction is efficient in its use of local and renewable materials, and in the energy required to build it, and the energy generated while being within it. Eco-friendly construction has developed in response to the knowledge that buildings have an often-negative impact upon our environment and our natural resources. This includes transporting materials hundreds or thousands of miles, which has a negative impact in the energy required to transport them, and also in emissions of hazardous chemicals from a poorly designed building that creates, and traps them.
Low emissions	Producing little emission of atmospheric pollutants.
Renewable energy	The energy from renewable non-fossil sources, namely wind, solar, aero thermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases." Source: Directive 2003/54/EC.

VII | Table of Figures

VIII | Table of Graphics

Chapter I | Introduction

1.1 – Relevance of Climate Smart Cities

S MART CITIES HAD BECOME TO BE PART OF OUR SOCIETY and they will mark coming generations our next generations. Their impact will depend largely on how spaces will be developed and used by citizens. Smart Cities consist only of relying on Technology, and they will not stand the test of time.

Indeed, built environment (spaces) reflect the massive technological advances. The advancement of technology is enabling people's lives into virtual spaces. Moreover, technologies like computer vision and segmented reality are creating a convergence between physical and virtual realities. Technology is thus creating a new concept of city, the Smart Cities that will determine and create a new type or urban culture.

Here in, the investigation will pursue a holistic vision of Smart Cities problem in which technology is subsumed to practical aspects of how people feel, or live in a urban area called smart city. The research seeks to conceive a Climate Smart City that somehow resist to the test of time with efficient Technology. It is well known that technology will become old very soon. Adding more or less IT to the buildings it is not of the issue, because the IT can be upgraded. The real issue is what kind of process can be defined, and put in place, to incrementally and introduce organicity into a Smart City is how to create a city that evolves to meet city's occupants.

According to JUCEVICIUS (2014b:146), the definition of smart city it is not consensual " *The analyses of publications show unclear differences between the definition of a digital city and a smart city.*" [1] Another component of this research focuses on the distinction between 'blank' cities and 'converted' cities. The so-called '*blank*' Smart Cities bring forward a number of problems. They are built entirely with new buildings and new technologies jeopardising the concept of 'authenticity'. As the focus into the investigation are the cities, where people live, and have their habits, citizens have a high level of comfort in well-planned areas. Individuals and spaces resist, but by the end, they can't be separated.

Solving problems on smart cities projects, will increase the quality of future constructions and planned areas in '*blank*' cities and interventions inside existent cities, will decrease health problems. The high relevance of this work has a base on Climate Change needs that are increasing day by day around the world. The top line of the investigation explains why the

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[1] Robertas JUCEVICIUS:Patasiene, IrenaPatasius, Martynas - Digital dimension of smart city: Critical analysis. **Elsevier**. ISSN 18770428. Vol. 156, n.º Procedia - Social and Behavioral Sciences (2014a), p.146-150.

development of Climate Smart Cities is so important to the future generations. Architectural Design principles for Smart Cities, are different from the principles for a new Climate Smart City. The investigation will present the most developed Smart Cities all around the world, in our days, and the description about why all of these cities are called smart. At the moment, " *Cities are the spaces where those without power get to make a history and a culture, thereby making their powerlessness complex. If the current large-scale buying continues, we will lose this type of making that has given our cities their cosmopolitanism.*"[2]

Smart cities into the document, are presented with cases from type 1, built from the scratch, like Songdo City, and are presented as Ulaanbaatar and Minsk, as study cases from type 2.

Climate smart cities methodologies, will be the base for observation into old and new cities. The implicit objective that introduce guiding principles list for future Climate Smart Cities into the Urban Design and in Architecture, are present in the course of the investigation. "*Nowadays contemporary smart cities have a development, and some similarities are possible to identify. India will be within the generation a majority urban country, millions of people will move to India Urban spaces. Smart Cities want to cluster smart people, smart institutions and create an economic model that will involve time.*"[3]

For example, according to PURI (2014) "*Across the world, the stride of migration from rural to urban areas is increasing. By 2050, about 70 % of the population will be living in cities, and India is no exception. It will need about 500 new cities to accommodate the influx*" followed by this statement, this is a respond to supply and demand solving environmental problem and it is on "... *a city where information technology is the essential infrastructure and the basis for providing necessary services to residents (...) The concept of smart cities originated at the time when the entire world was facing one of the worst economic crises. In 2008, IBM began work on a 'smarter cities' concept as part of its Smarter Planet initiative. By the beginning of 2009, the idea had captivated the imagination of various nations across the globe.*"[4]

Nowadays, smart cities knowledge combine different focus and specialisations, but at the beginning was much more focused on quality

[2] Sassen SASKIA - Who owns our cities, and why this urban takeover should concern us all. The Guardian: The Guardian, 2015. Disponível em WWW: <https://www.theguardian.com/cities/2015/nov/24/who-owns-our-cities-and-why-this-urban-takeover-should-concern-us-all >.

[3] Sanjeev SANYAL - Bloomberg philanthropies report 2014. USA: Bloomberg Philanthropies, 2014.

[4] Anuj PURI - What are smart cities? : The Hindu, 2014. Disponível em WWW: <http://www.thehindu.com/features/homes-and-gardens/green-living/what-are-smart-cities/article6321332.ece>.

of life improvements, and high scale investments.

Smart cities emerged in response to an urban dimension and a human need in a direction of sustainable development concept. A smart city can be described as 'smart' when the investments are in human needs, in social capital, in transportation, in modern 'ICT', communications infrastructures, sustainable economic development, and into a high quality of life. Following NOWICKA (2014) definition of a smart development " *City developing in the sustainable manner - economically, ecologically and socially - is the most competitive when it meets citizens' demands. It becomes the most attractive place for life and work for residents. At the same time, building an inviting place that meets the needs of city residents is a difficult task for local governments. Firstly to identify, and secondly to fulfil the citizens' continuously changing needs.*"[5]

A Smart City means efficiency, but an efficiency with determination as an action in which citizens are an integrant part, in development and structure.

The six structural criteria of Smart Cities described by CARAGLIU (2011) are a crucial base nowadays for developing a smart city in a urban space and known as 'smart,' such as: regional competitiveness, transport and ICT economics, natural resources, human and social capital, quality of life, and citizens participation in cities governance. Following the knowledge of the online Magazine Sustainable Cities Collective by Nina Bianchi & Kat Hartman, for them, smart cities can have a description as " *a skeptical image of a 'remote-control' city.*"[6] An intense critical view from these two specialists about, one of the worldwide cities developed from scratch. In other hand, other authors defend that there are distinct types of 'smart' cities, each with a corresponding set of principles.

An intense and expressive thought from JONG (2015:36) " *More specifically, we found six categories to be conceptually distinct enough to be seen as supported by a specific body of theories 'sustainable city', 'smart city', 'eco city', 'low carbon city', 'resilient city' and 'knowledge city'.*"[7] However, spaces considered 'smart' are using the six structural axes. The problem-solving ability and rapid response communication are key elements of these areas nowadays. Smart Cities also have a

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[5] Katarzyna NOWICKA - Smart city logistics on cloud computing model. **Elsevier**. ISSN 18770428. Vol. 151, n.º Procedia - Social and Behavioral Sciences (2014), p.266-281.

[6] Nina BIANCHI - What makes a city ' smart', anyway? : Sustainable Cities Collective, 2014.

[7] Martin de JONG, Joss, Simon, Schraven, Daan, Zhan, Changjie, Weijnen, Margot - Sustainable–smart–resilient–low carbon–eco–knowledge cities: making sense of a multitude of concepts promoting sustainable urbanization. ISSN 09596526. Vol. 109 (2015), p.25-38.

characterisation as 'innovative ecosystems' that can offer ample opportunities for sustainable, user-driven and intelligent services. The trust and preservation of ecosystems and climate change actions are the primary order of such cities for future efforts namely Climate Smart Cities where human beings, want to live and feel an improvement in a quality of life. However, the downside of the global economic pressures, has led to some planning errors, wrong management, and incorrect land use.

The Former Mayor of Bogota, Enrique Peñalosa, says that the architecture moment is the most important when a city it is planned. He transform his opinion in this words " *when a city is being decided, when is being designed, it's important to know what kind of life that could makes us happy, so first it is important to take some time to dream without restrictions, what are the ideals, and the ideal city.* " [8] This example can be a new way, or a new possible paradigm introduced into politics management for our future cities.

Following the AGGARWAL (2014) principles, the primary of Bloomberg Associates Emr Dir. Planning and Sustainability NYC, the challenge is " *about having smartness in every aspect about a city, smartness governance, smartness in institutions of management, biggest pieces of infrastructures are designed, set up and maintained and small pieces of low tech of innovation but on a smart number.*" [9]

To RICKY (2015), a professor of Cities & Urban Studies in London School of Economics, a smart city has to have an intelligent grow. He says the following sentence " *a Smart City needs to be a system which grows in an intelligent way, it is quite compact, it doesn't have a sprawl in terms of economic development smart, it means something entirely different, it means thinking about the way the city it will grow, it's not gone waste resources in the future.*" [10] The expression by Ricky can made us arrive to a believe that cities have to be planed not only for now but for ten or twenty years in advance, using the intelligent and smart concepts.

Madhav Pai, the current director of WRI/Embarq India, thinks that "*the policies need to produce a high quality of life. The main thing that a Smart City needs to do is meet the needs of low-income families to good education and good access to jobs. So the main thing that a Smart City needs to do is to produce a quality of life.*" [11] Mr Pai says correctly that

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[8] Enrique PENALOSA – Bloomberg philanthropies report 2014. Bloomberg Philanthropies, 2014.

[9] Rit AGGARWALA – Bloomberg philanthropies report 2014. Bloomberg Philanthropies, 2014.

[10] Burdett RICKY, Philipp Rode, – Who runs our cities? How governance structures around the world compare. **The Guardian**. Vol. Cities (2015).

[11] Madhav PAI – Bloomberg philanthropies report 2014,. Bloomberg Philanthropies, 2014.

the policies need to be directly focus on improving the level of life into a space.

The objective of a city is not to provide a description such as this: " *No designer city in South Korea, however, has attracted more attention than Songdo, the skyscraper-intensive, apparently eco-friendly 'smart city' built on reclaimed waterfront land in Incheon, home of the country's largest international airport. People know the place by various English names, from Songdo International Business District to Songdo Ubiquitous City (Figure 2), so called because of the 'ubiquitous' data-gathering technology meant to inform those in charge of how best to keep the city humming along. 'You have the strange feeling that this city was planned not for people, but as an architectural photography'* " wrote Robert Winter and David Gebhard. If the real result of an intervention goes directly to something similar to a 'photography and not as something productive and real, we can conclude that the result was not positive.

In MARSHALL (2014) article "*...You sometimes get the same feeling in Songdo.*"[12] This kind of statement identifies that perhaps something is not going in the direction of the initially planned design and describes a high possibility that the future may provide wrong results.

A possible top down approach translated, by WALRAVENS (2015:283) in some existent cities, or built from the scratch, was the following: " *with the optimisation of urban processes through technology in mind. The examples of Songdo and Masdar can be seen as the pinnacle of this particular vision of the Smart City.*" [13]

Both were criticised for being " *sterile, overly planned, prohibitively expensive, anonymous, uniform and conformist.*"[14]   The result of this analysis can determine a conflict into cities that, for being completed need enormous budgets, with payment deadlines, and at the moment didn't attract enough economic activity or jobs to make people effectively want to move and live there.

In 2016, these two examples of cities, Songdo and Masdar, were providing different results. Masdar city didn´t grow in the direction of the initial business plan GOLDENBERG (2016) explained in 'the guardian' in February of 2016 " *only 300 citizens were living in Masdar city, and most*

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[12] Colin MARSHALL - Welcome to paju book city, the republic of korean town inspired by hay-on-wye. The Guardian, 2014. Disponível em WWW: <https://www.theguardian.com/cities/2014/jul/16/welcome-to-paju-book-city-the-south-korean-town-inspired-by-hay-on-wye>.

[13] Nils WALRAVENS - Mobile city applications for brussels citizens: Smart city trends, challenges and a reality check. **Elsevier**. ISSN 07365853. Vol. 32, n.º Telematics and Informatics (2015), p.282-299.

[14] Idem, Ibid

of them are students at the Institute of Science and Technology".[15] She describes that the streets are desert, and she was calling this city as 'a possible world's ' first green ghost town.' In this situation, the first zero carbon city, goes no longer in the direction of a worldwide revolutionary vision, and it is doing an enormous damage to the initial investment under the project proposal.

In another direction, Songdo has a different perspective but needs investment as well to increase the development. The Korean city, called Songdo, has followed a different strategy, introducing the standard Korean construction, not using the initial project concepts and strategies laid out in the initial master plan, for example, postponing climate change measures on a smart growing city as a future project. It seems clear that, this kind of intelligent cities should and must be complex as a whole but, very authentic.

Figure 2 –Glass buildings in Songdo. Phase one Songdo Central Park,
(source: by the author 2014)

As BIANCHI (2014) said in the following " *Garlin Gilchrist, Detroit's new deputy technology director for community civic engagement, perhaps said it best a few days after MotM when he spoke at the#micities conference at the University of Michigan: 'Innovation cannot be copied and pasted'. True innovation is about dynamic relationships between people — and when we take a time to look around, we can see that people in cities all over are dancing. Everyone's got a unique jig. We can find moments to*

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[15] Susan GOLDENBERG - Masdars-zero-carbon-dream-could-become-worlds-first-green-ghost-town. UK: The Guardian, 2016.

harmonise the trumpets. What does the dance hall look like? " [16] Innovation in cities must be single and authentic, and most of the decisions need to be determined by the population.

Architects are responsible for providing in architecture, connection and joy to the population in simple ways. To develop intelligent cities, designers and architects imagine making people believe that in cities they can be free and creative.

Their experience in what is around, what is good and healthy, it is an integrant act of an architect task. Architects as human beings, every time that they developed a project, they learn more and become more human and more experienced in different areas, and this is why, it is such important to work with these professionals under processes like this.

One of the scopes for an architect, it is to plan well, implement and determine liveable cities. David Barrett's an American architect, that received an award from the American Institute of Architects in 2013, from his investigation in the last forty years about Architecture for Human beings have expressed in his book " *David's passionate, integrated, and warm-hearted approach to design includes deep listening. It can represent toning you down to become more present at the moment, with all your senses and awareness. To be in touch with the site, your clients, your colleagues and yourself...David Barrett focuses on this meaning ...'I've often felt that architecture is more built around experiences than it is objected themselves.'* " [17] Some questions nowadays start being projected actively in this field of Smart Cities or U-Cities for understanding if they create benefits to the population. There is a strong connection between real human beings and smart cities, and the objective is a continuous search for smart people in cities like this.

Another important concept in Smart Cities is '*Green Architecture*'. This area has to be connected with people, and it is, for people. Green Architecture is considered to be a new attitude applied to cities design and buildings and also, a methodology for architects, for technicians and common users. Green Architecture, should be implemented anywhere in the world, inside new towns and either in older cities. Future citizens will need to grow, with a high level of information of GA, with new techniques and in a more sustainable and greener living, because of the high problematic level under future climate change actions. Day by day, improvements are increasing under the preservation of our spaces. Green Architecture, or initially 'organic architecture' was started with Frank

[16] BIANCHI

[17] David BARRETT – A modern living architecture. 1st. 2014.

Lloyd Wright under construction and architecture. Architecture, in his view was " *merely something, anything, which may be built today. In contrast, organic architecture is a type of architecture from within outward. Organic means intrinsic in general. In the philosophical sense, wherever the whole contain the part, the part is integrant of the whole and where the nature of materials, the nature of the purpose, the nature of the entire performance becomes clear as a necessity. Out of that nature comes what character in any particular situation you can give to the building as a creative artist.*" [18]

Green Architecture, is now adapted to the new Climate Smart Cities and it is one of the principal elements, that was not previously integrated into the initial smart cities strategies because the thought was a result of very expensive costs. A new way of seeing ecology started in the 90's, with the new global eco-democracy by Theodore Roszak (1907–1981) a Polish-American sculptor and painter that said, " *In our hearts, we know there is something maniacal about the way we are abusing the planetary environment.*"[19] Human beings start killing the world long-time ago without taking into account (Figure 3).

Figure 3 - Living with the computer, magazine cover illustration 90s happiness (source: Taschen, James Wines, page 235, USA 1990's)

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[18] James WINES - Green architecture. USA: Tachen, 2000.

[19] Idem, Ibid

"*Man can hardly recognize the devils of his creation*"[20] says Albert Schweitzer in 2014, a German theologian, and philosopher, that is very connected with the technological Smart Cities. Schweitzer believes the men were not focusing on something that can be sustainable for the Future. Same years ago, Le Corbusier the best great 'modernist pioneer' in cities, on a review of the 20th century pointed out about the meaning of green architecture, " *Green Architecture presents a big issue. Too often the problem with so-called green architecture is the conflict between having a strong sense of mission and an admirable commitment to ecological design principles, versus an overly righteous moral posturing and a failure to convert noble objectives into an equivalent artistic expression.*" [21] This failure often results in very robotic and inhuman cities. This issue has a definite meaning into quality of future cities. Robotic cities will not be sustainable and will make people suffer from a very severe disease directly into the actual century, depression and loneliness.

Figure 4 - Musée du quai Branly, Paris
(source: Downtown 'Baltimorebettercities.net, 2016)

Smart Cities should also can be design into the concept of liveable cities or organic cities as it is possible to see into the (Figure 4) were it is

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[20] Margery MILNE, Lorus - There's poison all around us now. nytimes.com, 2014. Disponível em WWW: <http://www.nytimes.com/books/97/10/05/reviews/carson-spring.html?mcubz=2>.

[21] WINES

produced fresh air, nature sounds, intense sunny light, a high level of '*proxemia*' with nature will preserve the hearth and will improve the quality of life of future generations.

1.2 – Characteristics of Smart Cities

According to European Smart Cities 3.0 report,[22] a smart city has a model for a well-performing city with six features: Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living and Smart economy. These levels are connected with competitiveness, and with an innovative spirit, entrepreneurship, an economical image & trademark, combined with productivity, flexibility of the labour market and with the 'ability to transform' spaces.

The smart people concept, the second characteristic, has a connection with the social and human capital at the qualification level, on the affinity to long learning, with the social and ethnic plurality, with the flexibility, creativity, cosmopolitanism or an open mindedness and with the high participation in public life. About smart governance, the third element that combines, the way that cities have their management and with a decision-making involvement or public and social services, on transparent governance with political and determinant strategies and perspectives to the future of a city. The smart mobility is the connection between transportation and ICT that combine sustainability with innovative and safe transport systems.

The smart environment has a natural resources connection and an attractively of natural conditions, with the pollution, and with the environmental protection or even the sustainable resource management.

Smart living compare the quality of life with cultural facilities, the health conditions, the individual safety, housing quality, education facilities touristic attractively and the social cohesion.

According to LETAIFA (2015), from Université du Québec à Montreal, Canada on the Journal of Business Research in Elsevier, Smart Cities were presenting a model and a description by a particular design implementing strategies on buildings. The level of change into an existent city to became a Smart City need to be integrated with the territory.

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[22] Vienna University of Technology - Srf report. Vienna University of Technology 'TU WIEN', Department of Geography – University of Ljubljana and Research Institute for Housing, Urban and Mobility Studies (OTB) – Delft University of Technology, Centre of Regional Science (SRF), 2007.

'Smart Cities can call the new transformation,' 'Intelligent Cities' or even 'Creative Cities'. [23]

An '*Intelligent City*' is described as a high-level space of resources organisation, and that monitor integrates, and it is preventive to security and activities. Some examples of IC's are Singapore city, an intelligent island, Toronto City or even New Taipei City in 2016 analysis international data.

The concept of '*Creative Cities*' is based on a space that creates inspiration and that transform culture, that developed knowledge, changes energy into a quality of life, and that combines innovation and focuses on a common goal, redefining the city as a creative centre. Some examples are Montreal and Berlin according to 2016 tendencies.

The most heard and most discussed city's trend are smart cities, a space that combines the economic sector, the governance area, the mobility, the environment, living actions and people's needs into a unique place. Some examples are London, Stockholm, Amsterdam, Luxembourg and Vienna, all of them from the type 2.

According to smart living into the publication The Smartest Cities In The World 2015: Methodology [24], a concept that combines the quality of life for population and tourists either. The safety promotion, the social cohesion, new cultural facilities, the e-health and social services are primary areas inside a city called 'smart.' Boyd Cohen, a climate strategist, presents on his possible image definition into the six smart cities areas (Figure 5).

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[23] Ben LETAIFA, Soumaya - How to strategize smart cities: Revealing the smart model. **Elsevier**. ISSN 01482963. Vol. 68, n.º Journal of Business Research (2015), p.1414-1419.

[24] Boyd COHEN - The 10 smartest asia/pacific cities. Co.Exist, 2013. Disponível em WWW: <http://www.fastcoexist.com/3021911/the-10-smartest-asia-pacific-cities>.
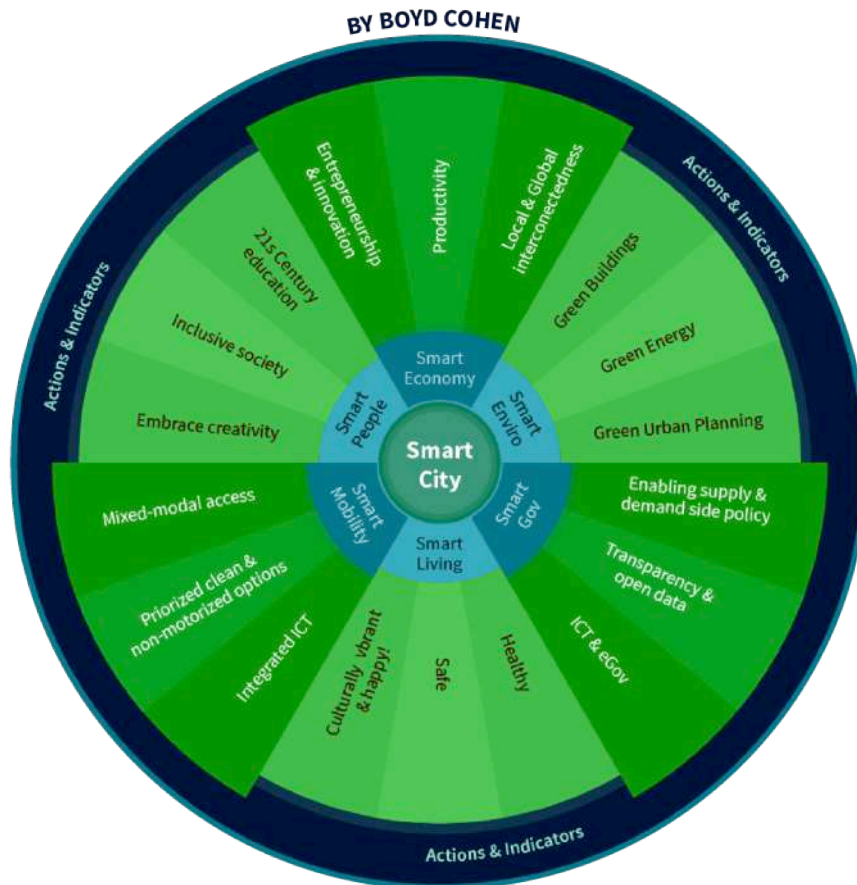
Figure 5 - The Smart City Wheel by Boyd Cohen
Source: www.wien.gv.at, 26 April 2016

Following the research from Mattoni (2015) "*Contemporary cities are the scenes of sudden and numerous changes from social, economical and environmental points of view and smart cities can be analysed and structured in five axes as mobility, energy, environment, community and economy. Mattoni developed a schematic process for cities* " The research started from the analysis of the concept of Smart City, its definition and theoretical evolution and best practices " *These evaluations highlight the need for integration and interoperability of different sectors, the careful planning of actions and strategies and the real time management of the territory.*" [25]

1.3 - Present day issues affecting Smart Cities

New concepts for cities begin to emerge worldwide, cities developed from scratch or even applications or improvements in existing cities.

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[25] Gugliermetti MATTONI, Bisegna - A multilevel method to assess and design the renovation and integration of smart cities. **Elsevier**. Vol. 15 (2015), p.105-119.

Interventions in 'blank' smart cities are entirely different from interventions into existent smart cities. Both combine different systems, concepts, and applications.

Environmental problems [26] as air pollution, polluted water, polluted soil, heavy metals, toxic nitrates and plastics that exist inside our cities are destroying our world day by day.

With the actual context, it comes clear that Smart Cities must focus on providing better quality of life, using fewer resources, improving the environment and making almost self-sustaining cities in order to produce own needs.

There, however is a generic belief that designing a city to this end, requires an 'astronomical' and sophisticated financing strategy that may be unsustainable from a business perspective.

In contrast, Hong Kong, following the construction waste solution that create impacts to the natural environment, had been change, during the last decades adding new series of policies including regulations and codes into CWM. In this direction Hong Kong " *is actively trying new CWM policies based on latest waste management philosophies available (e.g. reduce, reuse, and recycle principle, and polluter pays principle) Lu (2013)."* [27] During the Hong Kong process " *two lessons can be learnt from Hong Kong's experience in implementing CWM policies: (a) to form an interlocking policy system; and (b) to launch education and campaign of sustainable development in the society.*"[28] Some of these actions added into city intervention are beneficial to climate action worldwide.

This thesis will also seek evidence of the benefits of introducing Green Architecture concepts into cities interventions.

Some actions from entities or even countries, during the last years are happening "*In the history of cities, successful urban development has not been possible without an organised physical layout and a system of street interconnectivity within cities. Since ancient times, roads have played a critical role in the towns, connecting spaces, people, and goods, and thereby facilitating commerce, social interaction, and mobility. Streets, plazas and designed public spaces have contributed to defining the cultural, social, economic and political functions of cities. They were -*

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[26] RINKESH - Environmental problems. USA: FF Conserve Energy Future, 2014. Disponível em WWW: <http://www.conserve-energy-future.com/author/rinkesh>.

[27] Weisheng LU, Vivian W.Y. Tam - Construction waste management policies and their effectiveness in hong kong: A longitudinal review. **Elsevier**. Vol. 23, n.º Renewable and Sustainable Energy Reviews (2013), p.214-223.

[28] Idem, Ibid

and continue to be - the first element to mark the status of a place, from a chaotic and unplanned settlement to a well-established town or city."[29] Until today, streets were the focus of all the development, first with the paths to walk, after with the charret's, and at the last days with the cars. Cities worldwide are different, and even the organization of the urban system shows a different planning and a distinct image of the city. Some with piazzas but others only with systematic streets.

"*Nowadays, streets and the notion of public space are often forgotten. When planning the city, the multiple functions of streets are poorly integrated, and in the worst cases, are neglected. Streets are usually regarded as mere links in a road network, enabling travel between two or more destinations. This conventional representation of the route as a link has tended to define and use streets only through its movement function, ignoring or subverting the other functions, which are seen as 'collateral' uses of the street. Streets have thus progressively lost their multi-functionality as public spaces. Today, people are reclaiming their streets as public spaces in many corners of the world. Streets are being planned engagement. The planning and design of roads should also recover the needs of all users of this shared space: age groups, gender, economic status and model means.*"[30] UN-Habitat started since 1975 the official UN body dedicated to urbanisation. UN-Habitat has been working in different areas and many cities around the world and they are focus at the implementation of new concepts into cities.

Societies can get richer with more cars and more traffic, for example, Bagotá city to get equality, create kilometres of pedestrian cycling paths and start changing the city, day by day, in the direction of a better quality of life.

The most important in these actions is to find projects that self-finance themselves, using less or no money from the taxes peer (government) according to Bimal Patel, the President & Architect, CEPT University about Gujarat, Ahmedabad in India that start in the 90s with the Bagotá help. Also, another opinion by Ricky Burdett, professor of Cities & Urban Studies in London School of Economics, where he believes that the major function it is critical for a city development. He says that "*London is an example of a real city in 'big things', one thing is the environment, making cities that they don't have a harmful effect on the environment and the second big issue is that building cities that are kind to the people that live in there and with high social dimension and mayors and city leaders*

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[29] Joan CLOS - Joan, streets as public spaces and drivers of urban prosperity. Nairobi: UN-Habitat website, 2014. Disponível em WWW: <https://unhabitat.org/books/streets-as-public-spaces-and-drivers-of-urban-prosperity/>.

[30] Idem, Ibid

have an enormous size into changing. The vast project that is happening now is London City where London is trying to create 30,000 new jobs with some actions, and it is trying to think in long term of 30 or 40 years."
[31]The public sector put it all transports, water sources and provide all support for the framework to sustainable development. The private sector is making an investment in all that is needed to provide jobs, housing or infrastructure to make people feel that they live in a place that they want to live.

A similar effect is being made in NYC as it is possible to see with Rit Aggarwala words " *You can't be smart if you only think about traffic or economic growth, you have to think about multiple things at the same time.*"[32] and this, could be a possible sign of interventions that create results and that have a long term thinking.

" *Cities are matched to produce citizens*"[33] but will they be capable of producing processes and a sense of ownership for everybody? According to Bimal Patel, the President & Architect, CEPT University, India, the answer is 'yes', and the question is what kind of citizens are we creating with our cities today?

1.4- Research question

The Climate Smart City (CSC) is a new type of city that will combine a lively city, with climate change, transforming spaces into a quality of health and life with a Green Architecture. The combination of different authors, opinions and study cases, and a set of criteria, were developed to become the structure of the new Climate Smart City.

This type of cities, will develop new characteristics that people haven't felt during the last century. The debate and the opportunities were put forward over the past few years. From conferences, articles, scientists, and architects.

A new paradigm shift was introduced into the investigation, inside smart cities world called 'climate smart city.' Type 2 cities will be transformed with the new method to implement on existing cities with a high focus on Green Buildings.

Songdo, in Incheon South Korea, one of the study cases of a smart city

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[31] Bimal PATEL - How to make urban planning work,. India: Live Mint, CEPT University, 2015. Disponível em WWW: <http://www.livemint.com/Politics/NBuO3YnZHcRSC8r47M1VPN/Bimal-Patel--How-to-make-urban-planning-work.html>.

[32] AGGARWALA

[33] PATEL

type 1, features a high level of smart and green city elements, like the waste smart management and the centralised data centre for example. Songdo international city is a free trade and international business hub built on a reclaimed land. This city, was built as the first international real estate investment in South Korea's history with a goal of transforming South Korea into a commercial epicentre of North Asian regional markets, connecting with China, Russia, and Japan.

Is it Songdo a Smart City or, a Climate Smart City?

The question started to be a focus on demand in if Songdo could at the end being a 'beautiful city' or even if Songdo is only a Korean smart city or if it had arrived at the CSC level. This thesis will answer this question in the last chapter.

A project like Songdo was only possible to develop with a joint venture between a private company 'The Gale Company' US based and the construction branch of the Korean steel giant, a massive monopoly in the country called POSCO Engineering and Construction. To create something similar in Songdo, as smart city model, it was important to " *search for a well-qualified developer with experience in planning, finance, marketing in a large scale residential and commercial property*."[34]

The Gale International developer needs to add an intense knowledge of Green Architecture and Climate Change action into them territories following the Paris agreement.[35] The green responsibility and climate change actions that they need to add in this type of management software need an improvement and an implementation always since the beginning.

The combination of communication, developers and the political decision makers inside a place, it is an essential action into a master plan design of a city. Organisational dimensions such as policy, trade, law, development, construction, environmental planning, engineering, design, green architecture, citizen participation and culture, need to be use with mutual support.

It can be difficult to create a CSC with 100% of the criteria that the research presents but, it becomes clear that it will be paramount for the future cities, to embody a high level of Architecture and Green Architecture.

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[34] Gale International - Gale international, new songdo city. Republic of Korea: Gale International official website, 2015. Disponível em WWW: <http://www.galeintl.com/project/songdo-international-business-district/>.

[35] Paris 2015 AGREEMENT - Paris agreement. http://unfccc.int, 2015. Disponível em WWW: <http://unfccc.int/paris_agreement/items/9485.php#>.

1.5 – Research goals and contributions

Some of the 'smart cities' sustainability with adequate concrete tools on architecture design with a significant improvement on cities interventions. Architecture can change cities, and it is crucial aspect to produce passive results.

This thesis will develop guiding principles that will introduce improvements into SC, and will create new CSC from scratch, or adopt existent cities into CSC. Many of the problems on cities are passing and seem to be the result of 'generic cities' and not focusing on more healthy cities or the benefits architecture to inhabitants.

The main contribution of this thesis is a smart city development analysis framework matrix that enables to analyse smart cities towards Climate Smart Cities.

The impact of this work is far-reaching in that it provides a contribution to the global economic system and an improvement in the quality of life of the population with the introduction of Climate Smart Cities concept exposing different authors opinions and creating, a set of criteria to implement them into the territory.

The collected current worldwide framework and the state-of-the art from actual smart cities was the base for a method development named 'Matrix' to be used on Type 1 cities or Type 2 cities. The traditional concept in this research had a practical and functional base into sustainable and green architecture.

The objective of this investigation, was not to arrive at the creation of entire cities, or to create perfect cities, where everything is a dream and nothing is wrong. The goal, it is to build cities to live, with good and bad elements, with beautiful and ugly parts, with primary objects, but never in a 'standard' flatbed that can exist anywhere in the world, even in different scales as a car.

This research presents a 'Re-drawing', a new use of logic into the initial concept and an application of Green Architecture elements with a line of sustainable urban energy. The new action creates an importance of these concepts combined with design on smart cities development worldwide, giving emphasis to the benefits where, this type of interventions can produce a root planning in developed cities.

A small example of what this study can produce, is the action in Paris on L'Oasis d'Aboukir where, people can receive direct results day by day in a simple facade where the plants grow and increase transforming the street. (Figure 6).

Figure 6 - Before and After L'Oasis d' Aboukior
Source: Paris verticalgardenpatrickblanc.com, 2015

Another goal is to improve these new cities to be designed and built, improving their sustainability. To promote the type of intervention applied between the new network systems that can employ in existing cities from Type 1 and into Type 2 the adopted cities.

According to ALLIDINA (2015a) " *Experts argue that the transformation of London into a smart city will not only invite international investment but that it will also firmly establish the city as a global capital. The uniting of technology with the city doesn't have to bring Metropolis nightmares of the machine dominating man. In fact, the Internet of Things is set to empower city dwellers and create investment opportunities for businesses; Frost & Sullivan forecasts that the global smart city market will be worth $1,565 trillion in 2020.*"[36] The implementation of some different rules, or the adaptation to new paradigms will need to be connected with human habits to arrive to intense profits but connected with human needs.

" *Smart cities are an ecosystem of parts played by many different actors. No one company can do the whole thing. For example, a connected city*

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[36] Sarah ALLIDINA - Smart cities mean big business. UK: Raconteur, 2015a.

means a need for increased business efficiency with connected transport for on-the-go meetings and homes featuring smart offices kitted out with a plethora of connected devices for a smoother, more flexible working lifestyle. With the help of leading influencers, we explore the business benefits of the rise of the futuristic city, the essential role of collaboration between businesses and technology, plus the steps that London is taking through construction towards becoming a global capital."[37] A long-standing strategy between technology and business can create a foundation for long-term business structure.

The case studies are supported in objective terms with the 'matrix' analysis. Some of the research trends, will be identified and described to define characteristics based on diverse interventions worldwide.

The opportunity of living, feeling and investigate a smart city directly, created a new base to the investigation with a high background.

1.6 – Research methodology and design

The methodology and the design was organised into five fundamental parts. The first part, focuses on the explanation of why Climate Smart Cities are so important to develop. The second part, presents design principles for Smart Cities and for Climate Smart Cities and their differences. The third part, analyses smart cities projects around the world from a very complete list, and classifies them into 'smart' levels. The fourth part, will present the guiding principles for the future Smart Cities called Climate Smart Cities. The last part, focuses under the analysis of study cases: type 1 case study in South Korea, type 2 case study in Ulaanbaatar Mongolia and the third in Minsk Belarus where the concepts are explained and where the analysis use the 'matrix' as a classification tool worldwide to almost all cities. These research will enable developing theories in a direction of concept verification.

During the process, some ideas were developed and evaluated under a survey that supports the results obtained. Cities from type 1 that present themselves entirely new, had transformed the process much easier, to get more direct information from the new inhabitants. These was the clear point that the decision of creating a more developed survey under a city developed from the scratch was capable of resulting into better and more results. Therefore, the decision of following a criteria that put it in more evidence, one of the case studies more, was planned and was directed to the objective to study something more for the first time.

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[37] Idem, Ibid

The research followed specialist's, urban planners and architects ideas about creating an ideal concept of a city. The expert's opinions were possible to articulate a new type of knowledge to implement in the future urban areas.

The aim of the study, was to obtain results, of guiding principles or assumptions that will adjust to several facts. The events will confirm in the future, the principles managing theories at the subject. Each method achieved was based on facts from data, surveys and daily analysis of the city under the project.

The goal was to identify a model that would be possible to implement in these types of cities worldwide developing a prototype that would provide new guidance into the fast grow at the urban areas, based in what is happening today. A simple system will produce direct benefits in its design, its construction and its maintenance, and preservation through architectural elements complemented with a human sociological system. The work, was developed, based on some data provided from partial statements about the current reality.

In one of the study cases, Ulaanbaatar city in Mongolia from type 2, the Green Climate Fund from UNFCCC helped to developed international green projects proposals from cities where was tested an initial prototype.

The general research plan was based into the following twenty two points:

1. Problem identification;

2. Description of the problem;

3. Identification of the goals;

4. State-of-the-Art identification from existing experts and authors.

5. Development of comparative analysis of pre-existences;

6. Ident. differences between cities built from scratch & existing cities;

7. Creating the research brands;

11. Precise identification of sources of data;

8. Collection and processing of data;

9. Construction theoretical model type;

10. Identification of design criteria;

12. Analysis of data with population surveys;

13. Evidence of data with surveys of experts;

14. Simulation and data presentation;

15. Analysis of results;

16. Earnings presentation;

17. Data analysis by experts;

18. Presentation of proposed list of set of criteria;

19. Proposal for development of study cases;

20. Identification of future applications;

21. Conclusions;

22. Recommendations.

The data acquisition, concerning certain variables, was hindered difficulties in obtaining and understanding documentation about possible study cases. Most of the information it was even nowadays, written in other languages, as Korean, Mongolian or even with Russian, and had increase the difficulties on some informations. Other point was the allowance by governments to internal political documents from countries.

The theoretical method developed in this research had allowed to identify the possibility of creating a sustainable design process, that had contributed to a better development and a durability of smart cities concept by adding the level called, Climate Smart Cities, and making interventions in different layers or improvements in several areas.

The application of particular types of features produced significant results into the characterisation of the sustainable urban model implementation.

This theory attempted to build capacity to produce elements to support or sustain ideas or ideologies adapting performance criteria in developing the project or even in its maintenance.

With this method, much of the activity will entail the application of new controls in space, rules on activities in space, with new government regulations, new concepts, and philosophies acting under construction companies.

The measurement of this type of business, will always be complicated, as regards the size to obtain real results, even with technologies applied. The process becomes easier when are created centres for collecting internal data, from cities, and where it is possible to use information to make new actions for the future. Elements such as energy percentages, cities infrastructures, food production to reduce the importation, more local production, are some of the attitudes and possible actions in a city with CSC criteria.

The personal research design, developed into two specific areas, before the main research question, or the objectives that led this study were defined. One, was into the global pre-existing smart cities that have designed essential elements in this investigation and some literary criticism followed. Another essential element, was the set of some guideline parameters to introduced a theoretical analysis. At the same time, direct research responses, and a simple verification was made fewer than three cases studies, one from Songdo, city from type 1, the other one from Minsk a type 2 city and the last one from Ullanbatar from type 2 as well.

State of the Art put in place themes, and influenced the definition and characterisations of type 1 cities, built from scratch and in the cities of type 2 the old or existent.

These differences between types grow during the research understanding that each intervention was following distinctive guidelines.

Chapter II | State of Art

2.1- Introductory elements

C ITIES START HAVING HEALTH PROBLEMS. People are searching for a vast improvement, a new quality of life. The transformations into cities one hundred years ago to our cities today it is possible to identify fully. Cities consume 75% of worldwide energy production, and generate 80% of CO_2 emissions. Nowadays, vast and small districts are proposing new cities model because of two things: firstly the existent cities are polluted, and creating health problems for inhabitants and secondly, the new cities that were built don't have history or neither a collective memory.

One of the not − objective under the investigation was, to do not transform the analysis into a general 'mathematical concept' where all the cities can become smart cities, only because, there were a simple introduction of concepts. This research it will not possible give emphasis to a statement like this.

A smart city is a space where the combination of new technologies, and intelligent actions in urban spaces are incorporated into new areas or old areas. Cities like Masdar, like Songdo or even like Chandigarh in India are direct examples. However, the interventions must be differentiated between the type 1, from the scratch, and the type 2 the old cities with all their history.

Many world organisations, have for many years been researching, and developing projects aimed at improving cities and people's quality of life.

Different types of building certifications, have been created around the world. American certifications such as LEED or even others, are important to these new smart cities by following more closely the buildings transformation or maintenance.

Over the years, several *Rankings* have already been evaluated, and are part of the current development or cities improvement.

The concept, and development of Green Buildings has improved and introduced new trends in people's lives. Life and cities are constantly changing, and the same is true of the Smart Cities.

2.2- Smart Cities Definition

Directly connected with the investigation, the objective is to propose something for the future cities, and for existent cities that are open to change their own concepts in areas as energy, an extremely significant element, or under the pollution or air quality where is needed to be consistent. In our days, approximately 1.4 billion people, even today, still lack access to electricity, and about 3 billion people rely on fossil fuels as a primary energy source.

Our planet is, in serious environmental problems, and it is necessary to reduce emissions to protect the environment and pollute less. Countries need to save water, energy and transform their cities to 'Green' directions.

On every continent, people moved from the countryside to the principal. At that time, the objective was to share ability to provide quality of life for human beings inside the developed and technological or modern cities. Because of this, new proposals for cities, begin to emerge as the concept of saving the planet, using fewer resources, and improving the environment and making almost self-sustaining cities to produce their needs in the direction of some solve problems.

In India, a new recent country totally focus under the Smart Cities concept, where the Indian prime minister believes that " *Good governance is putting people at the centre of the development process.* " [38] But, at the end of the day, people will need to have preparation and knowledge about how these cities can be better for their lives.

" *Smart Cities focus on their most pressing needs and on the greatest opportunities to improve lives. They tap a range of approaches - digital and information technologies, urban planning best practices, public-private partnerships, and policy change - to make a difference. They always put people first.* " [39] Or even " *Smart Cities focus on the most pressing needs and the greatest opportunities through careful planning.* "[40] This Smart Cities concept started, with more action and objectivity after 2008 with the worldwide crisis but, different concepts were used since Gropius or even Le Corbusier at the last century.

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[38] Narendre MODI - Introduction from prime minister of india. 2015. Disponível em WWW: <India: smartcitieschallenge.in>.

[39] S MERCHANTNY - Smart city -india's plan for sustainable growth & quality of life,. India: Innovation Essence, 2016. Disponível em WWW: <http://smartcities.gov.in/upload/uploadfiles/files/Ujjain_SCP.pdf>.

[40] Idem, Ibid

The key forces, that influence the success or failure, are very distinctive using different indicators. In our days, it is complex to select the most suitable material, for what you want to defend and investigate. On the other hand, there are also several researchers, in assets that are poring over these matters, which provide, a lot of necessary background information.

The benefit of being able to experience the real inside of the buildings under a Smart City, and being able to live, within an intelligent city, produces a critical direct, and sensory research in data collection.

Since the industrial revolution, cities follow an economic grow but, not always with health conditions because of the high level of productivity and the incomes. With the new technologies, the sustainability point, and efficiency, smart cities can be analysed as good examples of cities patterns worldwide, the best examples in transportation, in buildings, in utilities, in road infrastructure and in "*smart cities principles.*"[41]

Following an analysis from Forbes, the number one, the best in an environment and smart parking was considered Barcelona in Spain in 2015. The second one, by Forbes, has determined New York in the USA, the best in smart street lighting and intelligent traffic management. The third one is London in the UK, the one that is high level in technologies and open data. The fourth one, was considered Nice in France that combine environment at a high level with the existent city, and the fifth one was Singapore, that has the high level of creative use of technologies.

Another example that improved highly in the city was Rio de Janeiro, where they had a base under the famous Carnival spirit and favelas for being a vibrant business hub and its beaches. They use the preparation for the 2014 World Cup, and the 2016 Olympic games, as an opportunity to revitalise itself, with a better transportation system, new ICT programs such as '*Rio Determine*'. Determine was built as "*an open-data system that makes available vast amounts of city information, also playing an important role in giving a boost to the economy. The municipality has built Knowledge Squares in nearly 40 low-income, crime-ridden neighbourhood, and 32 digital facilities, which have provided digital literacy training to 69,000 citizens. Thanks also to the discovery of vast offshore oil fields, Rio is now receiving twice the foreign direct investment of Sao Paulo.*"[42]   One intense point into this type of cities, it is the

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[41] Steffen SORREL - The top five smart cities in the world. Forbes, 2015. Disponível em WWW: <https://www.forbes.com/forbes/welcome/? toURL=https://www.forbes.com/sites/peterhigh/2015/03/09/the-top-five-smart-cities-in-the-world/&refURL=https://www.google.pt/ &referrer=https://www.google.pt/>.

[42] F GUERRINI - World's top 7 smart cities of 2015 are not the ones you'd expect,. Forbes, 2015. Disponível em WWW: <https:// www.forbes.com/sites/federicoguerrini/2015/01/28/worlds-top-7-smartest-cities-of-2015-are-not-the-ones-youd-expect/#17e9f8a87228>.

reducing costs and consumption inside the city to the core and basilar needs.

ICF is a new York think tank that analyses urban spaces. They describe smart cities as "*cities and regions that use technology not just to save money or make things work better, but also to create high-quality employment, increase citizen participation and become great places to live and work.*" [43]

Ordos city or Kangbashi town in China, located close to the Ordos Desert, it is one of the main cities of Inner Mongolia, represents one of the Bad pattern examples into smart cities constructions. The Ordos city, is considered even today, the biggest ghost town in the world, without a strategy, without possible future at the moment, and only the government can try to save with new strategies, with some decades of support.

Data collection on Smart Cities, since this is still a recent issue existing sources is not yet fully structured and guaranteed, but the worldwide changes had impose different circulations around cities "*Across the world, the stride of migration from rural to urban areas is increasing. By 2050, about 70 per cent of the population will be living in cities, and India is no exception. It will need about 500 new cities to accommodate the influx.*"[44]

A city is, a large and permanent place, with communities in which people live. In early 20th century, cities have undergone an unusual period. With the rapid development of the industry, the social structure and city life have been significantly impacted triggering the fierce contradiction and conflict between the traditional urban and industrialised modern city. Its impact and influence can be seen mainly in the following aspects:

1) The growth of industry in city, attracted a large number of people flowing into the city, causing the increase of the density of urban population.

2) The industrialisation needs to have broken the traditional urban pattern, and a new structure with the commercial and industrial centres, transport hub centres.

3) The industrial developments, well as population expansion have led to the traffic congestions.

4) The city it is polluted because of the industrial production, and the living condition was indigent.

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[43] Idem, Ibid

[44] UN Habitat - Time to think urban 53. Un-Habitat, 2013.

The Urban specialists of the last century, introduced important concepts, for example Michael Graves introduced Re-design cities where " *Design is a tool we use to touch people, engage their senses and enhance their lives.*"[45]   The concept of his postmodern classicism movement or the city's model from Le Corbusier " *L'architecture est une chose de l'art, un phénomène d'émotion, qui est en dehors et au-delà des questions constructives. Le but de cette construction est de garder les choses ensemble et le plaisir de l'architecture est.*"[46] At the urban focal points, the Courbusier's four principles, as decreasing the congestion in the city centre, increasing the density of population in the city centre, diversify ways of transportation and Green areas enlarge, were part of an initial project structure for future cities, and maybe the beginning of CSC. Léon Krier and Rodrigo Perez de Arce, introduced the concept of re-urbanisation inside Cities. Peter Eisenman and recently Daniel Libeskind or and Norman Foster are the major influencers in smart cities development. Some of their concepts were very important to new development of a city more connected with people.

A Smart City has a sustainable mark, an efficient sign, and need to use an intelligent management. Smart Cities collect data, promote energy savings, and have active citizen participation. These are the simple influences that the new system from SC can implement.

The Smart Cities origin, had a base on the economic crisis, on chaotic cities problems and at the inexistent quality of life inside cities. As it was said before, they can be from the Type 1 or even Type 2. From the Type 1, cities are created from scratch, and Type 2 the existent cities or old cities are transformed.

Inside each Type of smart city, there are two classifications: the auto sustainable or no sustainable. For example, Songdo City, in South Korea is the Type 1, built from the scratch with an investor, with the government support and with a technology firm called Cisco helping and managing the city. The Songdo city took a lot of design principles, from other cities around the world. The most centred park it is like 'Central Park' in New York, the 'Canal Walk' like Venice. Near and connected with the canal, with water from the ocean, they designed a Cultural centre like 'The Opera House' like Sidney, and they tried to integrate these buildings with technology. The individual health system in Songdo, directly by home, a direct connection with a doctor, where everyone can explaining symptoms in a direct video call or, even having individual classes with the opposite side of the world by only a screen. This is, one of the realities

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[45] Carl ABBOT - How cities won the west: Four centuries of urban change in western north america. USA: University of New Mexico Press, 2008.

[46] Naima JORNOD - Le corbusier ou la synthèse des arts. France: Skira, 2006.

that are happening nowadays under the city. This city has as well nomadic waste, no more waste tracks, not spending any more CO2 emissions but, in the end, it doesn't have a complete system that could call Songdo completely an 'auto sustainable' city totally supported by internal energy sources.

Into the Masdar case, another city from Type 1, in Abu Dhabi, United Arab Emirates, the project had a development as a renewable energy city, and the project says that it will be completely 100% carbon neutral based on solar power. The city had a design by 45% angle with the equator, so produced every point of the day shade, and the streets are very narrow creating a bit more shadows where create the possibility to enjoy the outdoors. This type of intervention can directly make people enjoying the outdoors and it will create benefits to the present global temperatures and for the increase in the future or to the urban heat island effect. Surfers like concrete, asphalt, more energy are absorbed, so the idea of this project was to create an oasis function because is in the middle of the desert, so they try to create cooling streets using design concepts. Norman Foster Architects developed this project directly from UK with their team. Cities like Santander and Barcelona from Spain, Vancouver in Canada and Canberra in Australia or London in the UK are Type 2 cities but are inside a 'Not Sustainable' classification at the moment. All of them plan to arrive at 'Auto Sustainable' status.

There is a city called Fort Laptop, Colorado in the US that presents characteristics from Type 2, and it is reaching at a level of 100% of solar energy production that can support the city needs. This town has auto-sustainable classification actually. This scenario was possible because of the climate conditions and the city's scale.

At the end, cities are crucial; people live inside cities, good strategic planning make cities the right way. Experience says that cities all around the world, most of them old, filled with history, are where the people feel comfortable inside.

During the last 20 years, the beauty concept starts being a subjective concept but Cities can't be subjective they need to have direct objectives.

But why people like some cities more than others? What makes an attractive city?

Science arrives at this conclusion for the planning of new Smart Cities:

a) '*Not too much chaotic and not too much ordered*' – It means balance, symmetry, and repetition. People don't like spaces where no one is in

charge of nothing, without planning. Excessive order creates boring cities. An existent quality with variety, with different forms and with different colours.

b) '*Visible life*' – It means live into streets. High buildings are the day life of thousands of people in the new technological centres where there are no activity or visible life. People need to feel proud of the surrounding spaces.

c) '*Compact*' – In ancient times poor people lived together in the same space and only rich people constructed second houses out of city town. Actually these houses, out of the city's life, became annoying and a disaster for city planning. Squares and public spaces where there are direct communication, not too big and not to small, sharing containment and not claustrophobia.

d) '*Orientation*' – Cities need to have marks of orientation. Inhabitants need the balance between small streets and long streets and people need privacy but not in high scale. The ideal is balance and equilibrium.

e) '*Scale*' – By Joseph Campbell "*…If you want to see what society believes in, look at what the biggest buildings on the horizon are dedicated to.*" This expression means that the city planning can see priorities of society. What is the primary focus on a city? What is visible from the window? The best scale of a building is five stories high maximum and very close to each other. Special buildings can exist, but they need to mark time and history surrounded by the five stories buildings. Above high buildings, people feel insignificant, small and trivial. This type of rules creates for the future an alignment with the best ambitions and the long term needs.

f) '*Make it Local*' – Unique spaces with history create local zones. Differences are part integrant of a city. Buildings and towns that can exist everywhere are not unique. Every society has different needs, different strength, and weakness. Cities need to have a strong character connect to places, using the unique local materials that nature creates. The objective needs to find the local architecture that makes the location unique and distinct.

The uncertainty of beauty, it doesn't combine with the Smart Cities objective. Smart Cities have rules, and that rules create the prettiness.

Building new things, can create regretting of the lost nature when the objective is completely the opposite and Architecture should follow the nature's design.

Smart Cities are an integration between Design and Technology. Together they can produce the highest quality of life for citizens, comparing with the cities of the past. '*Eco Cities*,' '*Green Cities*' or '*Sustainable Cities*' all of them follow these principles and are smart, but they are different in their concept. '*Urban forms*' or '*Urban Design*' affect cities areas, and the integration of technology result into better data and better decisions, for planning with leading into a good strategy to future for Cities.

When technology subject is emphasised, smart cities are an inspiration and an attractive market economically, but technology is for people, and technology is for people use and to improve citizen's life. There are now smart technologies, that allow cities to improve and to produce low emissions. Cities connection will be entirely transformed, and different in our next future.

Some of the principal characteristics that a smart city, in general, is focus on today are into ' *Integrated Legal Framework*' it means a creation of an integrated and harmonised regional, national and international norms forms in real estate sector, and into the land use level. Smart Cities area focus under a clear and harmonised set of laws, to enable investment and to create a movement for the exchange of real estate properties. Smart Cities are the focus on using efficient legal systems with substantial experience.

The urban planning and building laws, in the last years, gave particular attention to the social housing, in a direction of an efficient and equitable rental or a leasing market.

Inside smart cities, it is possible to see today a management responsibility for preservation, repair, and maintenance that are required by the properties, to maintain the economic function, and the local governments support high level.

However, the analysis of the unique historical, archaeological or artistically interest continues to beg a major point inside smart cities.

Another action that has been producing results, it is the registry or cadastre that create references into the urban planning in city councils. All this data free to informed and be seen by the citizens, are improving the social transparency action.

The efficiency of services is focus today, where governments are investing massive amounts of money, under the transformation of their methods.

If the action is smart cities from the scratch, the policies and energy

systems introduced the need, that has to be, in the direction of a special Governmental action taking into account of some direct investment, with the participation of some individuals. The existent model was already implemented worldwide. Without the Government support, the country in question, at the deciding moment of a use of all these concepts will understand automatically that they can't be implemented at this time. Thus, political beliefs, investments, market, business underway, the public debt and other government intrinsic characteristics are, starting factors for the implementation of similar solutions as smart cities.

Regarding energy systems also linked to political decisions, they are complementary and basic in this type of projects but also require large government or private investments.

Some of the solutions already implemented into these spaces, where some had an implementation inside and outside of the buildings are being supported today with specialist companies such as CISCO,[47] IBM as PAROUTIS (2014) made a description about IBM Smart Cities strategy "

is a long-term process aiming to transform city-based technologies and, in the process, help cities achieve their strategic vision."[48] or even SIEMENS [49] are current developmental milestones worldwide.

Inside this thesis, the primary research focus, it is under Smart Cities and Green Architecture, into existing or adapted or even in architectural and urban format, the greater focus on buildings and surrounding public spaces it is the principal impact. Nowadays, Smart Cities, are increasingly present world wide, and the habitability problems, use, and quality of life are stepping up with time. Thus entails, identifying effective new solutions and ideas for new interventions. The philosophy of Green Architecture is the ideal methodology to be applied, in new buildings inside these cities and, at the urban spaces. The quality of life and, authenticity, started to become a vital element to sustain these new Smart Cities. People search to life in different and creative areas.

This research was, developed based, on three case studies, one in Songdo City, South Korea, the other, in Ulaanbaatar city in Mongolia and the last one in Minsk the capital of Belarus. Opportunities for job creation, emerged within this area, are intensely interesting in the new cities application. The new city model may arise in the future, new

[47] CISCO - Smart+connected communities. Republic of Korea: Cisco, 2016. Disponível em WWW: <http://www.cisco.com/c/en/us/solutions/industries/smart-connected-communities.html>.

[48] Sotirios PAROUTIS;Bennett, MarkHeracleous, Loizos - A strategic view on smart city technology: The case of ibm smarter cities during a recession. **Elsevier**. ISSN 00401625. Vol. 89, n.º Technological Forecasting and Social Change (2014), p.262-272.

[49] SIEMENS - Infrastructure & cities - sustainable cities - siemens. SIEMENS online, 2015. Disponível em WWW: <http://w3.siemens.com/topics/global/en/sustainable-cities/pages/home.aspx>.

concepts of Architecture and Urban Design, based on facts and present realities that already exist into these cities, for example in Masdar, or develop over the time, but improvements concerning climate change and benefits, for future generations and, for the planet Earth are frighteningly relevant.

The investigation enhances an importance of differentiation between cities designed and built from scratch and, in old spaces or existing cities with personal authenticity. Smart Cities introduce an endless definitions and diverse opinions from specialists. It's impossible, nowadays, a complete knowledge that some experts can be wrong or can be right.

At the moment, there is a crisis under Smart Cities development where they are becoming too much technological, and the planners are not thinking in direction of citizens needs, because money talks more actively. This holistic vision that some authors have the problem in witch is not much about technology alone, and focus on people needs, and about to conceive a Smart City that somehow it will resist to the test of time, or, in opposite, these cities will become old very soon. Simple upgrades will be very expensive, and payments will decrease completely.

So how can a planner, introduce some organically actions evolving the city?

Smart Cities present different types today, has was mentioned before they can be from the Type 1 or Type 2 and, even the authenticity, can be introduced or maintained to support some of the problems, that exist at the moment, in several places in the world.

And, why some people like more old cities? Why some people like more new cities? There are fanatic people about living in Smart Cities?

The information about this field is becoming more active and secure during the pass of time. Following SASKIA (2015) "*It is easy to explain the post-2008 urban investment surge as 'more of the same'. After all, the late 1980s also saw rapid growth of national and foreign buying of office buildings and hotels, especially in New York and London. In The Global City, I wrote about the large share of buildings in the City of London that were foreign-owned at the height of that phase. Financial firms from countries as diverse as Japan and the Netherlands found they needed a strong foothold in London's City to access continental European capital and markets.*" [50]

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[50] SASKIA

Figure 7 - Illustration of an overpopulated city
Source: the Guardian, Sep 2014

The planet is in serious environmental problems, alerted Al Gore (2011) years ago. Smart cities are creating emissions reductions and trying to protect the environment and polluting less. Smart Cities, are trying to save water and to conserve energy in a better world. This marketing 'Line' is always present in a Smart City implementation worldwide. In every continent people have moved from the countryside to the city and, cities start being highly polluted, chaotic and full of people (Figure 7), with no ability to provide quality of life for human beings.

Figure 8 - Les trainées dus au trafic aérien au-dessus de Londres
Source: Jan Wille, Foundation for deep ecology, 2015

Occurrences like water contamination, a cause by oil split, acid rain, and urban drainage or pollution in another side, has a cause of gases and toxins produced by industries, factories and combustion of fossil fuels are destroying spaces. The soil pollution is a result from industrial waste that transforms territory infertile.

Figure 9 - Une centrale au lignite contamine l'air avec ses émissions polluantes
Source: Jason Hawkes, Foundation for deep ecology, 2015

The global warming is alerting governments and population, greenhouse gases emissions produced by the human hand, result into an increase of the global warming level (Figure 8) like rising temperatures of the oceans and, the earth surface acting on melting of polar ice caps (Figure 9), the rise in sea levels, the high standard of precipitation such as flash floods, desertification, and a huge snow level will be capable of destroying our cities or Smart Cities.

Another problem is the overpopulation, that is reaching to an unsustainable level, in some areas of the planet. Overpopulation, it is a problem, that will produce a high degree of a lack of resources like water and food into some zones. Developing countries and less developed countries, are the ones, that will be suffering first and, more intensely in the next years. Chemical fertiliser, pesticides and insecticides will create intense health problems worldwide. Natural resources depletion as fossil fuel consumption and, the Greenhouse gases action are creating extreme situations around the world and, strongly inside populated cities. Even if, there is now an improvement into a paradigm shift with renewable sources, it will not be enough, nowadays, with the development, an unique solution. Around the world, over consumption of resources and plastics uses, are creating a global crisis of waste disposal. The waste disposals, into the most developed countries are being dumped without carefulness, and either nuclear waste disposal, plastic, fast food, packaging and cheap electronic are destroying our world, in a high intense toxic level. Climate change, is acting intensely, in the last couple of decades, and the temperature is continuously increasing because of the fossil fuels, burning and gases emissions that are changing the world. Some occurrences of new diseases, changes in seasons, or even the frequent occurrence of floods, are changing the overall weather scenario.

Biodiversity is gaining losses with the human activity, extinction of species and inhabitants.

Figure 10 - Un paradis presque perdu : les Maldives, risque d'être submergée.
Source: Peter Essick, Foundation for deep ecology, 2015

Natural processes like pollination and coral reefs destruction (Figure 10), marine life and human activities that are the balance for ecosystems are disappearing. Forests that produce fresh oxygen and, they are natural sinks of carbon dioxide are going as well to disappear with deforestation. Our natural sinks of carbon dioxide and, new oxygen production are being destroyed and, as a result the temperature regulation and rainfall are changing. The action of cleaning green cover is dying because of the deforestation.

The ocean acidification is a direct impact of excessive CO_2 production, and science says, that the humans produce 25% and, there is an estimate for 2100 of a level of 150% that will completely impact into shellfish and plankton. The invisible ozone layer protects inhabitants from the sun's harmful rays, from reaching the earth but with toxic gases reaching into the upper atmosphere and, it is causing a hole in the ozone layer and an intense level produced around the world, are determining this problem as the most important one to act against for a crate benefits into climate.

Another significant and severe problem, is the acid rain that occurs due to the presence of certain pollutants in the atmosphere. Acid rain can be a cause of fossil fuel combustion, the erupting volcanoes, and sulphur dioxide from the nitrogen oxides into the atmosphere. This problem can affect directly health, wildlife, and aquatic species.

Clean water, will be in the next future a rare commodity, water will become a political and economic issue and, inhabitants that is possible to see in '*years of living dangerously TV series 2013*', that people will fight for this resource and, one of the active human actions that are filling our rivers, seas and oceans is the industrial development since the beginning of the century. Desalinisation can be another of the processes to be used, into the future as a possible solution. Problems like urban

sprawl, that result into land degradation, traffic increasing, the flora and fauna cancelation, environmental and healthy issues are some of the most connected problems to solve with the new Climate Smart Cities the called CSC. New humanised action into cities, it is creating dirty water with chemicals, toxins and disease carrying organisms. Intense pollution into cities is creating respiratory diseases, like asthma and cardiac-vascular problems and, high temperatures into these cities, encourage the spread of infections as 'Dengue' as a possible contemporary example.

Genetic engineering process food modification, is increasing the toxins and diseases into the food supply chain and this will change the human habits.

In New York City today, according to Rit Aggarwala principles, the principal of Bloomberg Associates Emr Dir. Planning and Sustainability NYC, the city, is doing an enormous amount of initiatives and, it token into a detailed look at what was happening and going on, and what was going wrong in NY and what were the trends in the last 20 years and, what strategies could affect the city. The water track system makes the bill more active; individuals have the biggest trust on the city government. At the beginning, it was real hard to have the state of the art of the recycling system, but now, 75% of the city's solid waste in 2030 will be covered and separated, by way of jobs creation and reinventing plants and reusing materials. Another big project was the high 'LINE' that had attracted 2 billion in private investment and, in our days had created a beautiful elevated park that changed the entire neighbourhoods character, and the city itself as well. The whole town created a new atmosphere.

In India, today, Mumbai for example, is trying to improve very hard into levels of quality of life. People are changing in how they see transportation. For the future, the old vision, it will be completely dead. Bicycle users or, energy producing is changing their minds. Their new concept of the Smart City is trying to create diverse cities where they are trying to allow intensely the Indian culture. Some cities are now under construction, and they are trying to be ready during 2016 and 2017. India wants to be a model for a future world. Their projects have a base on smartness, that can help and transform India's lives more productive and healthier.

In September of 2015, the president of United States of America, Barack Obama, went to Alaska in late summer, to look into the looming climate catastrophe that the world faces. As soon as he arrived, he tried to deliver the following message " *Climate change is no longer some far-off*

problem; it is happening here, it id happening now"[51] and then he repeated twenty four times the following expression " *We are not moving fast enough.*"[52] Only on June 2013, a detailed 75 point Climate Action Plan has been severely looked from the entire federal government to begin taking climate change where the will cut 32% of CO2 emissions by 2030.

Obama is still worried about the international action, for example, Russia as a major oil producer, may not be as concerned about climate change, as they need to be, it is the Obama's expression. For Obama, becoming climate change, is a national security issued and, it is a real international objective. The increasing drought, increasing floods, increasing erosion of coastlines that will impact agriculture, will increase scarcity in different parts of the world as had occur in Syria with the huge number of folks off farms and, the fields into the Syrian Cities. Human history says that, people under severe strain react badly, and this has an expression in nationalism, regarding war, in xenophobia, and nativism or either in terrorism. Obama thinks that this is now an opportunity and, it's time to build a kind of political consensus not just in America but worldwide where it is necessary to solve this enormous problem. He believes in his campaign slogan '*Yes we can*' another belief is that " *there are some amazing, beautiful things in the world that aren´t coming back. And that should give us pause. But I don't allow sadness because we've got too much work to do. The world is always changing, and there are going to change in our lifetime that I wish hasn't happened.*" [53]

2.2.1 – Initial Smart Cities

Chandigarh is a city and, a union territory in the northern part of India and, as a union territory, the city is ruled directly by the Union Government it is not part of either state. Chandigarh and adjoining cities of Mohali (Punjab) and Panchkula (Haryana) are together called Chandigarh Trinity, in our days.

This city it is known as one of the best experiments in urban planning and, in modern architecture in the twentieth century in India and classified as an example for the new interventions.[54]

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[51] Jeff GOODELL - The rolling stone interview to barack obama. USA: The Rolling Stone. Disponível em WWW: <http://www.rollingstone.com/politics/news/obama-takes-on-climate-change-the-rolling-stone-interview-20150923>.

[52] Idem, Ibid

[53] Idem, Ibid

[54] CHANDIGARD - The city beautiful official web of the chandigarh admin. India: Chandigard administration, 2016. Disponível em WWW: <http://chandigarh.gov.in/knowchd_general.htm>.

The shape of Chandigarh the city, is a rectangular one, designed as a grid-iron pattern, for the fast traffic roads. The way that Le Corbusier [55] planned the city initially, was in a very organised and ordered plant, with a clear circulation hierarchy and, transformed this place as one of the cities that the system appears almost fantastical, in a country whose urban centres are synonymous of chaos.

The city has an organisation, that has a division into several sectors, where each one, is working as an independent zone, with its markets, temples, and schools, all strategically localised at a foot distance of fewer than 10 minutes away of each extremity. Each sector/neighbourhood unit has a size of 800 m x 1200 m, and each is a self-sufficient unit having shops, school, health centres and places of recreations and worship. They are meant to be self-sufficient, with shopping and community facilities within reasonable walking distance. These units/sectors apparently explicit the principles of the modern movement. [56]

The city presents a shopping street of each sector and, it is linked to the shopping street of the adjoining segments thus forming one long, continuous ribbon-like shopping street and either, the central green of each area also stretches to the green of the next sector.

All city surroundings are green as well, with parks and tree-lined avenues to soften the effect of its primarily concrete, block-like buildings. The equipment's as educational, cultural and medical facilities are spread all over city and the industrial area, is set-aside in the *Master Plan*[57] for non-polluting, as far away from the centre as possible.

Chandigarh has done remarkably well, offering striking monumental architecture, a grid of self-contained neighbourhoods. More trees than perhaps any Indian city and, a way of life that juggles tradition with modernity and in 2015, in an article published by BBC [58] named '*Chandigarh as one of the entire cities of the world regarding architecture, cultural growth and modernisation*'.

According to Corbusier principles, this is a city that follows a general view where his policies for the enormous and modern cities are very organised, with a huge metric that sometimes block the creativity, block

[55] Rajnish WATTAS - Courbusier's creation india: The tribune-voice of the people. 2015. Disponível em WWW: <http://www.nytimes.com/2008/12/06/arts/06iht-IDSIDE6.1.18403973.html?mcubz=2>.

[56] UNESCO - Urban and architectural work of le corbusier in chandigarh. USA: United Nations, UNESCO, 2006.

[57] Maria THURACZY - Architectuul - city of chandigarh. http://architectuul.com, 2015. Disponível em WWW: <http://architectuul.com/architecture/city-of-chandigarh>.

[58] Jonathan GLANCEY, Is this the perfect city, UK: BBC, 11 December 2015 - Is this the perfect city. UK: BBC, 2015. Disponível em WWW: <http://www.bbc.com/culture/story/20151211-is-this-the-perfect-city>.

organist in this urban concept. A very rational given importance to automobile traffic and to the green areas and with the well-known concept of ' *neighbourhood units*' that can be considered new auto-sufficient centres.

But cities like the ones that Corbusier creates, are cities that could be built in any place. Le Corbusier had that problem with his urbanist ideas they are very radical ideas and, '*avant-garde*' but, with a generic concept that will arrive at a non-authentic action.

According to his plan for Paris, where, he just erases the entire city completely and, was doing it entirely from the scratch, he received some criticism. Contrarily to Paris, in Chandigarh, he tried to project into the territory following the local implication, topography, rivers and, was not a concept from the scratch without a soul.

Supporting Corbusier work the Indian city Chandigarh[59] probably can be called as an exception in his urban design character. The auto sustainable 'neighbourhood units' are part of an initial concept of '*smart sustainable*' and a generic action followed from different authors.

In the '*Inconvenient truths of Smart Cities*,' a smart city isn't a technology concept, it's the political challenge of, adapting one of the most powerful economic and social forces of our time, to the governments needs under the places to support these actions. A smart city management, after an intervention the market can't back it, the market demand to continue improving and shape with new technologies or updates.

Smart Cities aren't and, can't be 100% perfects, they will have a bottom up, and they will have top-down problems that can have an improvement during the time, Jan Gehl can call this "*the human scale cities movement*."[60]

Smart Cities working 100% with quality, doesn't exist is a utopia concept. This new kind of Cities, will grow and transform with time, with population and, for the population. Smart Cities are for everyone it has to be a global action not only a team of expertise creation into a '*magical space*'. Cities are being transformed into more technological spaces but without real sustainability. Current smart cities are a humanised and uncharacterised in our days. This action makes people don't want to live in towns that the area, principally, was built from the scratch.

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[59] Ajay DEEP, An Open Letter to Modi Ji for not including Chandigarh in the first 20 Smart Cities of India - Ajay Deep , India: Chandigarh Metro, Nov 2015 - An open letter to modi ji for not including chandigarh in the first 20 smart cities of india - ajay deep,. India: Chandigarh Metro, 2015. Disponível em WWW: <https://chandigarhmetro.com/smart-city-chandigarh-ajay-deep-open-letter-modi/>.

[60] J. GEHL - Cities for people. 1st. 2010.

But if we talk about existent cities, the results can be improved more quickly because people, are living there for a long time.

People enjoy transformation with time, according to the market demand, they try often to change to calm and structure spaces and, the areas will nee to have limits between privacy and technology to retain quality of life.

An intervention on a city from the scratch, when people start living inside they will receive in one only moment to analyses 100% of the existent information and technology otherwise, if you talk about existent cities the interventions will be more moderated and more structured during the time, has was exposed before.

For example, if someone moves to London will have a time balance differences between, new technologies and new spaces, and the person will have a long time, to understand and enjoy the new system or the old systems and, it will be a human decision. And this could be called the balance under resilient cities.
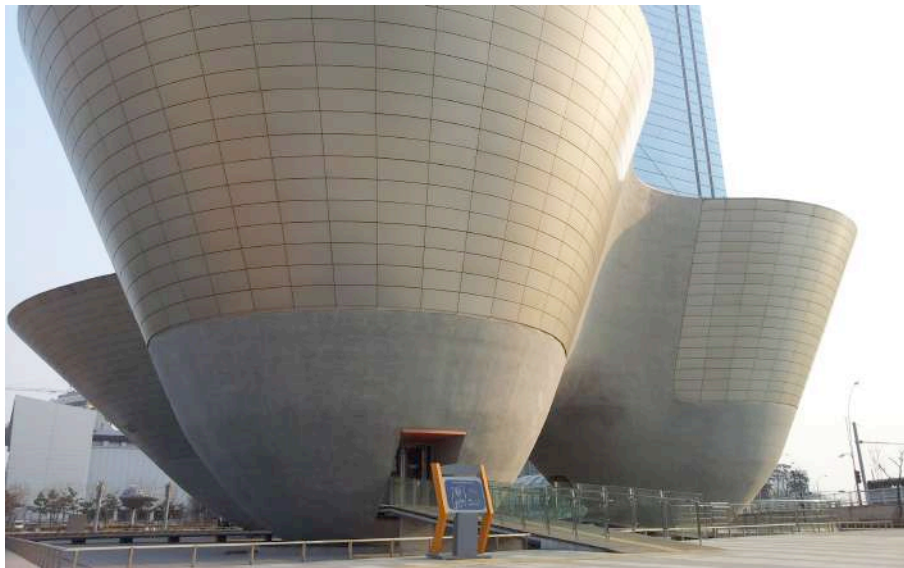
Figure 11 – Tri-bowl art centre in Songdo City
(source: by the author 2015)

But the time, changes the cities concept, altogether. Cities built 100 years ago, is now a new tendency, from conferences, scientists, and inhabitants.

A city that implements the sign and, paradigms that a human being recognises will be more sustainable, more economical and, will increase a faster green growth with a concept of a city, that uses signs and introduced old paradigms. So, why people build cities from the scratch? For making, only the market grows?

Smart Cities launched a new way of looking and facing the city. The type 1 Smart Cities are dream spaces, like Tri-bowl building in Songdo city (Figure 11) with the entire infrastructure but, should always create their own authenticity but, nowadays, they are falling under this point. History started to become incompatible with the development, and the smart cities shift paradigm made it possible that type 2 interventions are possible to be implemented under any space.

The new Climate Smart Cities will empower people and will be an extreme benefit to climate change. The future will need them.

2.3 – Classifying Smart Cities

Smart Cities start different directions, with different concepts. They are nowadays, all around the world. Old cities present different problems from new cities and, under construction they present differences between then as well. During the research, the differences between them start been so intense that, the analysis makes sense, when you separate the two worlds: one that the author designated by Type 1 cities built from the scratch and, the Type 2 designation from the author, as existent cities or old cities. A possible Type 3, that I will not use under this study, it will be connected with cities, that are at the total beginning of the development. These cities from Type 3, will need before, of a Climate Smart Cities application, a management intervention and a political action.

However, the cases studies were determined using the same model even if by them differences persist. In the end, the analysis over the matrix achieved results even if they are two distinct types.

2.3.1 – Type 1 Smart Cities

Following Smart Cities definitions, cities from Type 1, built from the scratch, are located around the world, as Masdar, Songdo or even Lavasa are three examples, where they seem to be similar to a '*Disneyland*' master plan but, in a real life, for living every day and, with a bigger developing income.

China start developing this type of cities but has some bad examples becoming 'ghost towns' as it was possible to see before at 'Ordos' city.

The concept of these type of projects, it is to become self-contained living and business district featuring air and sea transportation, a complicated logistics, international business centres, financial services, residences, schools and hospitals, shopping's, entertainment centres and transportation.

Type 1 Smart Cities have a definition as 100% empty platforms, with everything new. Some cities, where was a war intervention, can't be defined as type 1, because, after the war, some old elements remain and, can be transformed themselves into historical elements. In cities built from the scratch, one of the problems, is the non inexistent of neither old or historical buildings details.

Figure 12 – Songdo cover magazine
(source: KOREA, Korean Magazine, 2013 and Courrier 2014)

Korea Magazine in 2013 (Figure 12), present this type of cities a conjunction for buildings almost inside a smartphone, an integrated part of a smartphone. Standard images and standard way of living create melancholy and, lifeless architecture or even standardised architecture. At the moment that projects are under a very fast development and, with a standardised image. At the begging of the elaboration of this type of cities, different magazines, start to expose and determine ideas or concepts about how they were built, how were they born. The magazine ' *The Courrier*' was one of them in 2014.

Egypt, is starting to build a new city from this type, a new capital in the east of New Cairo. Canberra in Australia, between Melbourne and Sidney, created from the scratch in 1913 a project signed by Walter Burley and Marion Mahony Griffin but, can´t be called from the type 1. The same with Brasilia, designed by Oscar Niemeyer in 1960. Another example of this kind is Chandigarh, as was described before, "*Master planned by Le Corbusier, the state of Punjab required a new capital, after the previous capital of Lahore became part of Pakistan in the 1947*

partition"[61] and Chandigarh is considered one of the wealthiest cities in India even today. Another example, is Islamabad built in the 1960s in Pakistan to place Karachi as Pakistan's capital. Naypyidaw is the capital city of Myanmar, also known as Burma. On 6 November 2005, the administrative capital of the country was officially moved.

Astana (Figure 13) namely by the capital's name only in May 6th of 1998 of Kazakhstan. It is located on the Ishim River, in the north portion of Kazakhstan project by the Japanese architect Kisho Kurokawa from 1890, one of the founders of a post-war Japanese architectural movement, that fused ideas about mega architectural structures with those of organic biological growth.

Figure 13 – View of the governmental headquarters, Astana
(source: Flickr, February 2013)

Huambo Huambo city, in Angola, was built in 1928 and, until 1975 was called '*Nova Lisboa*' and, has been constructed as well from the scratch. Washington D.C., is another planned city from 1791, designed by Pierre 'Peter' Charles L'Enfant, a French-born architect and city planner, to create the new capital of US. Cities from the scratch present, a smooth reproduction of the actual needs on new materials and technologies. The implementation of this type of construction can be less complicated with a strategic planning. The negative point of this kind of intervention, is that the long return on investment, requires a broad and strong political and social support. Probably, the worst scenario, when the concept fails, the city can become ghostly very easy and fast.

Figure 14 - Lavasa night view
(source: ixigo.com, 2016)

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[61] Dario GOODWIN - 6 politically motivated cities built from scratch. Archdaily. Disponível em WWW: <http://www.archdaily.com/614257/6-politically-motivated-cities-built-from-scratch>.

Another example, is Lavasa, in India and, according KENNARD (2015) the €30bn mega-project inside the smart cities new world, can be a dream or, a real flop. For them, Lavasa definition is an " *invention of a US branding firm, having no meaning, but meant to conjure up images of mystery and exoticism with its abstract poeticism and hint at Hindi… hundreds of millions of people are expected to move into India's overcrowded cities over the next 25 years*" [62] … Lavasa (Figure 14 & Figure 15) is supposed to be modelled on principles of New Urbanism, the urban design movement that promotes walkable communities, with much of the land set aside for green and open space. " *The corporation claim 80% of the population will be able to access Dasve town centre with a 15-minute walk, for example. Lavasa's other influences reportedly include the picturesque Italian fishing village Portofino in the Italian Riviera, which lends its name to some of the city's streets and buildings.*"[63]

Figure 15 –The top view of the city of Lavasa, in India
(source: The Guardian 19 Nov 2015)

At the end Lavasa, is probably following the same problems from Songdo at the beginning *"The concrete innards and steel girders of various buildings to be finished at some time in the future, added to the lack of humans in the streets, give the place a strange ghost town atmosphere."* [64]

2.3.2 – Type 2 Smart Cities

Cities from the Type 2 are existent cities or old cities. There is a possibility to transformed them into different cities, that can produce or implement a new quality of life in population's lives. Old cities, are prepared to have historical elements, and the architecture that exists, it is

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[62] Matt and Claire Provost KENNARD - Inside lavasa, india's first entirely private city built from scratch. The Guardian, 2015. Disponível em WWW: <https://www.theguardian.com/cities/2015/nov/19/inside-lavasa-indian-city-built-private-corporation>.

[63] Idem, Ibid

[64] Idem, Ibid

very complex normally and, is a result of many years and from many cultures, that maintain and improve the quality of the art of the city. A no-standardises architecture building, an infinity of knowledge and, richness to inhabitants. The problem is, when it goes directly into the intervention, the project system and, the real action sometimes, takes years to get the work done. Old buildings, restricted areas, green spaces, existent monuments, are barriers to some important and necessary transformation and, into this type, one of the good things is about, the creativity that was needed to start some first implementations, or some different solutions where was, at beginning, determined that was impossible to change directly. Some challenges, can have integration with technological adaptation on buildings and cities and there are some benefits about this.

Figure 16 - Vancouver as a Smart City
(source: socalgreenrealestateblog.com, 2014)

Another good point on this, is the short-term return on investment, it means, people live inside this cities, they are not empty so, the economy maintain the same level, every single day even if the city is changing. Vancouver in Canada, (Figure 16) is an example of an initial Climate Smart City. They have a proposal for Vancouver 2020 following different criteria, more similar on what it is proposed under this research. Santander, a Spanish city is another one that supports and, it is following an initial CSC, implementing CSC actions year by year with a Smart City Base, with the following standards:

· Vision, leadership, work, and partnership;

· Producing Green Economy;

· Developing Green Jobs;

· Create Climate Leadership;

· Implement Green buildings concepts;

- Zero waste;

- Giving access to nature;

- Produce lighter footprint;

- Transform and provide clean water;

- Transform and produce clean air;

- Use the Co-benefit of food production to security;

- Green roofs;

- Smart grids introduction;

- Maintenance supports;

- Smart payments development;

- Climate results communication;

Rio de Janeiro, in Brazil, created a database, that was before, a Data Centre on the top and, high technologies taking care of the need around the city. The creation of this space, was a result of a need, for the 2014 World Games and the 2016 Olympic games, but this database is working as a central laboratory creating solutions and, preparing new actions on the territory.

Copenhagen, in Denmark, is a specialist city in Mobility (Figure 17). In 2014, Copenhagen win the prestigious World Smart Cities Award for its connecting plan and, according to the jury, they have the best plan in the world for collecting and using data to create a greener city. The action plan for Copenhagen during 2015 until 2016 was decisive to their paradigm shift under living habits. They focused under mobility, roads, and traffic management plan with the implementation of ITS (Intelligent Transport Systems) controlling the traffic with strategy. The other important measure was the CPH 2025 Climate Plan ' *A green, smart and carbon neutral city*' as a Climate Plan from the government.

Figure 17 – Santander, Rio de Janeiro, Copenhagen and Amsterdam cities
(source: city councils Santander, Rio de Janeiro, Copenhagen and Amsterdam)

Amsterdam, in Holland, introduced under their city plan, a strategy with a platform called '*Amsterdam Smart City*' (ASC) considered as an innovative platform for a future proof city. ASC is '*constantly challenging businesses, residents, the municipality and knowledge institutions to test innovative ideas & solutions for urban issues*'. The platform create an overview of what is happening in Amsterdam on these themes. This will help to connect the right people, to accelerate startup of projects in the city, to tackle the city challenges.

2.4. – Global World framework for Smart Cities

In today's world, the cities are facing a very significant population growth, an environmental attack unconscionable and, social economic problems that have become a challenge.

Figure 18 – Un-Habitat logotype
(source: Un-Habitat website, 2015)

Figure 19 - New Cities Foundation logotype
(source: newcitiesfoundation website, 2015)

The UN-HABITAT (2014:1) (Figure 18) for example is one of the UN programs, that monitors and attempts to improve these areas, " *There has been a phenomenal shift towards urbanisation, with 6 out of every ten people in the world expected to reside in urban areas by 2030. Over 90 per cent of this growth will take place in Africa, Asia, Latin America, and the Caribbean.*"[65] The UN-HABITAT (2014:3) identifies the need to monitor the development of these areas because "*...the consequences of this rapid urbanisation will be dramatic.*" [66] the results could affect the entire planet. '*New Cities Foundation*' (Figure 19) develop and support all this urban boom around the world " *Our mission is to shape a better urban future for all by generating and scaling ideas and solutions through events, research, and urban innovation projects...In all of our activities, we work with leaders from business, government, academia, civil society, the media and the arts*"[67] and are aiming for recognising "*What are the future trends for cities in the 21st century?*"[68]

'Parag Khanna', a manager partner at Hybrid Reality, one of the conferences developed by NCF, identified the following statement: " *in 2014, 50% of the population is urban, and 23% are part of mega population of over 10 million in about 600 urban centres, which is equivalent to 60% of GDP and in 2016 the new future demand will arrive at 60% by 2050. By 2025 it is predicted that 60% of the population go to urban, there are 37 megacities and that 1/6 of urban centres will be in China.*"[69] This important event, it is also identified in Indian cities, that they had to respond to an extraordinary boom in the last century. And the question arises as follows: How are they gonna build the capacity to absorb this population? What about the Indian culture, will be

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[65] UN-Habitat - Smart cities project guide,: **Nairobi**. Nairobi: UN- Habitat press, 2014.

[66] Idem, Ibid

[67] New Cities Foundation - About us - our mission. France, 2016. Disponível em WWW: <http://newcities.org>.

[68] Idem, Ibid

[69] Parag KHANNA - Future trends in the century of cities,. France: New Cities Foundation, 2015. Disponível em WWW: <http://www.newcitiesfoundation.org/wp-content/uploads/PDF/About-The-New-Cities-Foundation.pdf>.

implemented into the new 99 new possible smart cities?

Urban Population in 2050 compared with 2010:

Smaller ■ Larger but less than double ■ Double or more, but less than fivefold ■ Fivefold or more
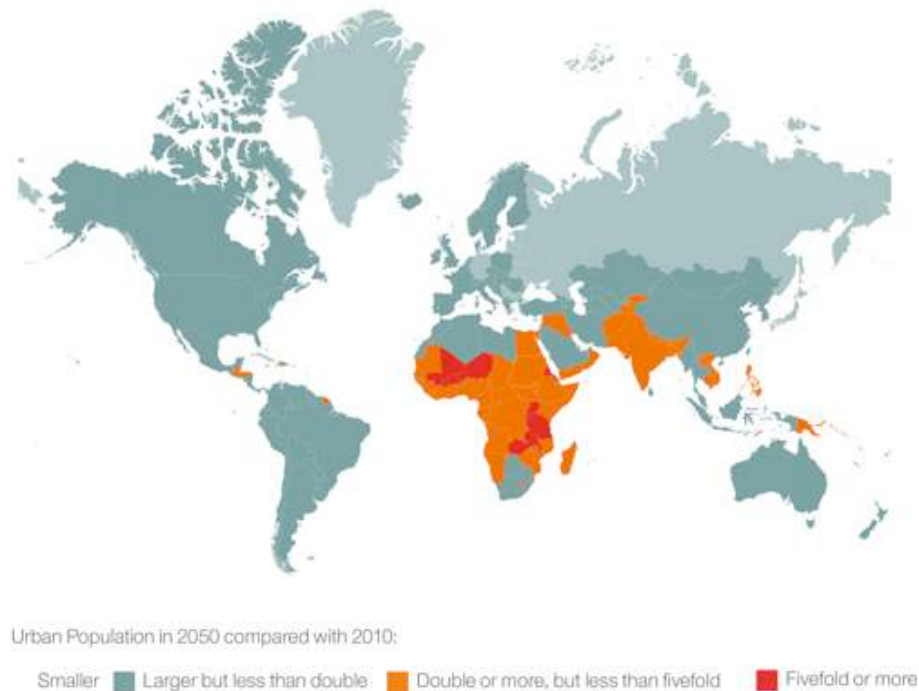
Figure 20 – Forecast urban population growth 2010-2050
(source: World Economic Forum 2014)

Some of the current cities, with a high level of development, are located many of them, in China, India, and the United States and, the future they will have a location in India and Africa (Figure 20).

Al Gore, the candidate who lost the election to George W. Bush since 2006, tried to demonstrate everything that might happen on the Planet. Present days prove the veracity of their arguments. One of his books, '*An Inconvenient Truth*' created a huge controversy and managed to get the message to a large part of the world " *inconvenient truths do not go away just because they are not seen. Indeed, when they are not responded to, their significance doesn't diminish, it grows.*" [70] Natural disasters are in our day-to-day, for example in Japan, Tokyo which features the most seismic zone of the world or, even the plain of the Pearl River Delta in China threatened by all natural disasters.

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[70] Al Gore - An inconvenient truth. Rodale Press, 2006.

Figure 21 – World Bank, gef and WRI logotypes
(source: world bank website, 2015)

Also the '*World Resources Institute*' (Figure 21) is developing strategies and, making interventions into global decisions " *Traditional models of city development can hinder economic growth, spur greenhouse gas emissions, and endanger lives. Compact, efficient cities can alleviate poverty, combat climate change, and make services like water, energy, and transport more accessible…WRI aims to ensure that cities drive economic opportunity while sustaining natural resources and improving the quality of life.*" [71] And what is being done currently, in the field of Smart Cities under consideration? Now in China " *The government is preparing to throw billions into urbanisation in China, but has it thought through the hardware challenges?*" However, the question that arises, and well, it is "*Can China build the 'new China?*" Will China, be able to respond to these needs? Will China, have the capacity and, the population will want to implement? China and India, over the past centuries were global developmental milestones, as is described in the book 'Billions of Entrepreneurs: How China and India are reshaping their future and ours' written by Tarun Khanna, where he describe in detail an analysis of China advancing and India in recent years and, the influence of these occurrences worldwide today. Also, 'China Business Review' had identified on September 2014 an article with the following " *China's command over the urbanisation process stands in stark comparison to the efforts of the world's second-largest emerging economy.*"[72] As recently as 1987, India was more urban than China, as a quarter of the population lived in cities, compared with China's 24% according to data from the World Bank. But China's pace of urbanisation overtook India's toward the end of the 1990s and raced ahead. " *More than half of Chinese citizens pass from an urbanisation in 2012, compared with less than a third in India.*" [73]

During the last years, China tried to arrive to some new solutions using different influences and supplies. The Linked Hybrid by Steven Holl

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[71] WRI – Our mission. World Resources Institute: WRI, 2016. Disponível em WWW: <www.wri.org>.

[72] Tarun KHANNA – Billions of entrepreneurs: How china and india are reshaping their futures and yours. 2008.

[73] Idem, Ibid

(Figure 22) it is a good example of a " *Geo-thermal wells (660 at 100 meters deep) provide Linked Hybrid with cooling in summer and heating in winter, and make it one of the largest green residential projects in the world (aiming at LEED Gold rating).* "[74]

China in recent years opted to apply a new urbanisation model " *urbanisation of population was 1.85, far above the international standard of 1.12 and leading to urban sprawl and the phenomenon of ghost towns... China's new style of urbanisation envisages half of the new buildings put up by the year 2020 to be 'green,' compared with just 2% in 2012.* "[75]

Figure 22 – Forecast Linked Hybrid apt. complex Beijing, China 2010-2050
(source: Steven Holl architect website)

One of the world examples, which functions as a city in the desert is Masdar " *A wholly-owned subsidiary of the Abu Dhabi Government owned Mubadala Development Company, a catalyst for the economic diversification of the emirate...Established in 2006, Masdar has a mission to invest, incubate and advance the establishment of a clean energy industry in Abu Dhabi and around the world... In 2008, Masdar City broke ground and embarked on a daring journey to develop the world's most sustainable eco-city.* "[76] This city had the architectural intervention by the British firm Foster and Partners, Sir Norman Foster "

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[74] Archidaily – Linked hybrid / steven holl architects. Archidaily, 2015. Disponível em WWW: <http://www.archdaily.com/34302/linked-hybrid-steven-holl-architects>.

[75] KHANNA

[76] Masdar UAU – Who we are. Masdar city, 2015. Disponível em WWW: <www.masdar.ae>.

The 640-hectare project is a fundamental component of the Masdar Initiative, established by the government of Abu Dhabi to advance the development of renewable energy and clean-technology solutions for a life beyond oil." [77]

The question of the future of this city is, will sustainability for many years still being a town in the desert? Will be able to sustain itself over time?

Some different actions continue growing, for example IKEA in Loures, Portugal is using a highly reflective Aluminium tubes with 1 top campanula receiving sunlight and ensures the penetration of natural light into the building. This action was implemented inside warehouses zones, office and public circulation. Annual savings in 9000 of € + electricity bill for health users (health) deKW savings / h year 200,000 - lower emissions of CO2 into the atmosphere - IKEA purpose - convert the full range of lighting in 100% LED by 2016.

One incandescent lamp, consumes 85% more than a LED. In the proximity of the extra water station in Frielas, the water leaves the treatment plant to have a use for the air conditioning of the building –and is used to generate heat and warm the building and otherwise to cool the building, reused water and less spending on clean water. 1 million and a half euros intervention in the building represents annual savings of 400,000 euros with a return on investment in approximately four years 3.75 years return.

Free use of bicycles increase exponentially in Europe, cities like Paris, London, Milan, Singapore, Lisbon or Madrid are intensively the system. The power of 'Green Energy' on Monocle was describing the following " *The power of Green Energy - From LED lights found in homes to luxury yachts powered by solar energy, Taiwan's firms are at the forefront of green research and design. Everlight, LOF Solar, Delta Electronics and Ship and Ocean Industries R&D Centre are just a handful of companies bringing innovative product design and green solutions to homes around the world. Delta has created innovative energy efficient 'green buildings' that are capable of saving 53 percent on electricity use and reducing water consumption by a massive 75 per cent"* [78] Some of this actions are being reproduced in other different countries nowadays.

"At the moment Lof Solar's colour BIPV (building integrated photovoltaic) cells come in a fantastic range of colours, including green, red, purple, brown and grey. Though a relatively young firm established in 2008, Lof

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[77] Norman Foster – Innovative architecture & integrated design. UK: Foster & Partners, 2014. Disponível em WWW: <http://www.fosterandpartners.com>.

[78] MONOCLE – Doing the soft power shuffle: How to be a winner in 2014. December 2013/ January 2014. 2014.

Solar's cell panels are already in use around the world. Seattle-Tacoma International Airport and China pavilion at Expo 2010 in Shanghai are just a few of the projects that Lof Solar has contributed to in recent years." [79] Solar cells panels is another solution that is trying to update in an exponential line to the actual market developing many different solutions.

As an autonomous territory, and former British colony, in southeastern China and, with the world's highest urban population density, space is a premium in Hong Kong. One company, the Green Patch, is set on maximising the little room on offer. Co-founded by David Sanders and, Fung Bing Law the firm creates micro-gardens that provide high-yield organic produce on small plots. Their efforts have led to a book, 'Growing Food in the City - Micro-gardening: A Practical Guide' that help people to produce their own food under the city.

Energy and development, are inseparable factors. All forms of exclusion, electricity are one of the most significant. Approximately 1.4 billion people still lack access to electricity and, about 3 billion people rely on fossil fuels as a primary energy source. The absence of reliable energy services limits income-generating activities and, hinders the provision of essential services such as health and education. Access to energy is vital to the social, economic prosperity, environmental sustainability and to achieve the Millennium Development Goals established by the United Nations worldwide.

For its opening vocation to the world, the EDP Group, committed to promoting access Energy (A2E - an acronym for access to energy) in developing countries, focusing on areas without connection to the power grid, helping to break your cycle of poverty. Assuming sustainability as a priority develops A2E Programs, which provide access to energy based on renewable energy solutions, especially solar, to contribute to the social, economic and environmental development of the most deprived communities.

The role of the EDP Foundation is to develop an integrated approach, from initial financing to the concern for future self-sustainability, of the implemented solutions. The very real positive impacts, observed in the lives of people and, communities on projects that have already been developed motivate the Foundation to want to go further. "*When the energy, in this case, is primarily solar energy, become people's lives regarding the quality of life, the possibility of creating business and employment, safety and education. And that's a very significant*

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[79] Idem, Ibid

contribution to what is not only the concept of sustainability but also development, in this case, sustainable development of these countries." [80]

Some architects were a mark under this generation of Architecture and urban design. For example 'Peter Eisenman' born in 1932, is one of the experts on North American Deconstructivist architects. Peter Eisenman created an object type "axonometric" that identifies a syntactic node where forms were revealed, but our mind was distorted to the vanishing point. This architect uses the geometric and, organic forms that cross over planes and structures. In his work, there is folding and cutting beams, profiles and surfaces. It is in 1980 that his DE constructivist architecture gained significant expression.

Another one that imposes a mark was 'Daniel Libeskind' born in 1946, the son of 'Holocaust survivors', has an adamant architectural language through geometric interceptions, fragments, and empty lines. During the last ten years, different actions were occurring in various parts of the world. Chinese Eco-City, one that it shall be made in the field, news of March 10 of 2014, which can develop the link between town and country and, reduces the rural exodus. In about 12 years, of Chinese government plans development, to carry 250 million people, from rural to built new cities. During these years many people were feeling the need to return to the field and drop the pollution of towns and riotous living. Beijing, is one of the places, where pollution has reached to unsustainable levels of pollution. Kunming, a prototype space constructed in the field that will contain a little town and camp where they are building sustainable buildings on a working farm. The project was developed by the Belgian architect 'Vincent Callebaut', in Kunming, in southwest China, will be built 22 hectares, in an old vacant industrial land.

This is, one of the solutions, that China is trying to implement to blend the advantages of town and country. The houses expect a high level of natural light, with the use of solar panels and geothermal production systems. The complex will present a "smart grid" and, may be stored internally to the energy produced by renewable sources applied. Cars and bicycles in the underground floors will also be able to save energy. Around the houses, there will be orchards and vegetable gardens. The goal is to cultivate organic food, in the city, that means direct subsistence and explains own Callebaut architect. The gardens also serve as a form of encounter between neighbours. A landscape open to all so that the houses, do not present boundaries and pass neighbourhood feeling to be stronger and intergenerational and intercultural relations improve. The design features three different types of houses 'Mobius Villa' of design in

[80] EDP – Edp foundation. 2015. Disponível em WWW: <https://www.edp.pt/en/sustentabilidade/fundacoes/fundacaoedp/Pages/EDP_Foundation.aspx>.

a loop, a terrace with a garden and, with the application of photovoltaic glass.

There will shutter inside the glass, walls will rotate along the day according to the need, for light and heat. The 'Mountain Villa' shows panels with algae for the production of bio hydrogen and the last to 'Shell Villa' planned a construction around a wind turbine. The actual construction does not have a fixed date, but this can be a city of a prototype for the new Chinese cities and, perhaps the world.

Another example, will be the new China's urbanisation plans for the period 2014 to 2020, with objectives centred on human and environmental intervention. They believe that this kind of response in the new urban layouts also serves as an engine for development and, centrality in sustainable and healthy economic system for humans according to the instructions of the CPC and the Chinese government. The demand for housing, is the biggest in the current Chinese development. At this time, the demand is higher than the current offer, soon the rules will change, and they will start to follow the right path.

The goal is also for people, from the countryside, to have access to infrastructure through the urban cities and, always present a concept of ecological environment. The action plan provides strategic direction, for the healthy development of urbanisation over a period of seven years. Now passes by the local authorities act, with a considerable intensity in the plan to review and work under the project.

Melbourne in Australia adopted in the city centre a new action strategy where it's cultural diversity, from the various cities in the world, where the roots of the current inhabitants are using a boom and, a new style of life into ethnic restaurants, where ancient architecture and modern architecture live together. About 1500 people, a week, in a growing city can create the following effect " *Currently, there is an excellent social separation, a contradiction concerning the significant development of electronic connections. The heightened culture of preservation of individual liberty or privacy contributes to the strengthening of this social isolation...Culture is the soul of society and the quality that fight against repression. It differentiates people in these globalisation and sameness times... They are witnessing the creation of an environmental catastrophe magnitude never before faced by humankind.*" Describes 'Richard Rogers' the Italian and English architect in one of his books.

Turan Khanna, a professor at Harvard Business School, explain what China in the last ten years was doing to their territory and the world when they decided to begin to build from day to day, with reduced time and a

reduced level of construction quality and neither urban sense of knowledge. South Korea with the intense pressure improve and make money start to copy and using some Chinese techniques, thinking that the solution was only with that action. Cities are like living organisms to suck resources emitting waste. The larger city, is more dependent become of the surrounding areas, and it goes without saying that the more people co-exist, more problems can generate as well.

2.4.1 - Who is doing what?

India, is about to become the largest economy in the world. Chris Matthews, in 2016 wrote about this future economy, where China's workforce has already begun to lower economy.

Following Ernst and Young, India workforce, will grow 900 million until 2020. As is known, the economic grow, is a result of capital goods, labour and, the growing labour force but, as support for this action, India needs to reinforce the infrastructure effectively to make the economy flourish. T. Khanna's book in 2011, about China and India development, was totally right. India, has focused on the ambitious, or in smart cities that they think it will solve all towns' problems. Over the next six years, India has the plan to transform 98 villages and towns that could cost and, in their study billions nowadays to get the result that they expect. What about the Climate study about this transformation? The conclusion of this field, will be something that the time will explain.

The world economic forum writes about " *why urban efficiency is essential for India's smart cities?*" The last statement made by Ravichandran Purushothaman, the president Danfoss India, in April 2016, about the plan of 100 smart cities project, that will cover 44% of India's consuming class that expect to receive inhabitants in an affluence growth clusters by 2025. India in COP 21, has also committed to reducing 30% to 35% of CO_2 emissions and, urban groups are at the moment a major problem and, it will increase in the future. The most complex issue is that 25% of the actual estimation from energy demand comes from the buildings, and 70% of the buildings that India needs are yet to be built.

One question that could be a supposition is how only six years will transform people's minds in India? And how they will learn and adapt to this new concept of houses or smart cities?

Ravichandran says, in his article, that to India work towards to climate-friendly, sustainable and energy efficient smart cities, it will be crucial if

they decentralise powers with clear mandates.[81] On March 9th, of 2016, the World Bank and GEF launch the new program of 'Global Platform for Sustainable Cities' a method that will support different projects around the world.

M.Venkataramanan, an Associate editor, wrote an article about 'The WIRED World in 2016', the fourth annual trends report, a standalone magazine that exposes what could come next. She exposes that Helsinki in 2016 has a " *mobility*" ticket to destinations via text message or app and, the service will plan the ideal route from your starting point, combining public transport, on-demand services and private vehicles. The concept is to connect the transportation system, private and public in a sustainable strategy. Venkataramanan pointed out, at the article, an expression from Vivian Balakrishnan in April 2015 " *We are not supposed to be here... What you see in Singapore is an exercise of desperate imagination. It's not about innovation because it's sexy, but because it's survival.*" [82] was written by the minister for environment and water resources, and as the head of the Smart Nation Initiative in Singapore, until October 2015.

"*A recent paper by the SMART team showed that the mobility demand of a city, such as Singapore, could meet with 30 per cent of its existing vehicles*" [83] says the architect and smart-city researcher Carlo Ratti from SENSEable City Lab, Massachusetts Institute of Technology (MIT).

The Singaporean government goal is to focus on reductions " *We don't want to increase the number of cars on our roads...Autonomous public transport makes more sense than autonomous private cars*" [84] says Professor Seng of the NRF.

Songdo International City, in South Korea, one of the study cases from this research, located in about 65km southwest of Seoul, another city has taken a very different approach, to getting on the digital grid. It's being built from scratch on 600 hectares of reclaimed land, with sensors, with high-speed fibre optics and, high-tech public urban systems designed into space. Tom Murcott, the actual executive vice-president of the real estate developer named 'Gale International' believes that continuing building the Songdo International Business District a new type of

[81] Ravichandran PURUSHATHAMAN - Why urban efficency is for india's smart cities. Switzerland: World Economic Forum, Cities and Urbanization, 2016.

[82] Madhumita VENKATARAMANAN - Smart cities will be necessary for our survival. UK: Wired, 2016a. Disponível em WWW: <http://www.carloratti.com/wp-content/uploads/2016/05/20160111_WiredUK.pdf>.

[83] Carlo RATTI - Senseable city lab. Massachusetts Institute of Technology. USA: MIT, 2015.

[84] Andrew NG - Self-driving cars won't work until we change our roads—and attitudes, . UK: Wired, 2016.

specialisation as a smart city to the territory will be part of the history " *The word 'smart' is used a lot in cities already, but that's limited to technical data sensor inputs, control systems, apps...From an infrastructure perspective, we could lay the very latest connectivity technology into the ground before construction.*" [85] Even with the partnership with Cisco, Gale International has spun out, a separate company called U-Life Solutions that will provide the internet-of-things for Songdo's buildings " *This will allow the occupants to control their air conditioning, their televisions, even their elevators...Cisco also built an HD telepresence system that we have installed in 14,000 residential units, which citizens can use to interact with city administrators, shopkeepers or healthcare workers.*" [86]

To run services such as waste disposal, engineers designed a system that uses pipes to suck rubbish from homes into processing that sort the material and recycle it. " *In 2016, there will mass implementation of all these services, and new ones developing prototyped by SparkLabs, a Korean hardware incubator whom we are working with*" [87] Murcott says. Songdo has this 'living lab' aspect and it is a pioneering spirit in the people who move here.

It's not only developed economies that are reinventing urban life. Large, growing cities in developing countries are also adopting. " *Sensors with sophisticated control systems can work in the towns such as Melbourne or London or Sydney, but 90% of people in cities don't live in cool, temperate climates they live near the equator, and there, most of this smart tech does not apply,*" says Gerhard Schmitt of ETH Zurich. " *These cities can be smart, but the innovations need to be affordable and usable.*" Schmitt's lab has projects underway in 20 central cities including Addis Ababa, Lagos, Mumbai, Yangon and Jakarta. " *In Addis Ababa, there is a long-term project called Addis 2050* " Schmitt says. " *We will be partially implementing plans related to a new energy grid in the city over the next year.*" [88]

Ultimately, though, it's not enough for a city just to have 'smart' technologies, " *We need to use cognitive designing as well citizens should be involved in the design of their cities,*" [89] Schmitt says. "*Technology will*

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[85] Madhumita VENKATARAMANAN - Smart cities will be necessary for our survival,. Wired: UK, 2016b.

[86] Tom MURCOTT - Gale international. Gale International: USA, 2015. Disponível em WWW: <http://www.galeintl.com>.

[87] VENKATARAMANAN

[88] Idem, Ibid

[89] Idem, Ibid

just extend and support human sensors." [90]

2016, then, will not just be the year of smart, but for the human and climate smart cities because of all the changes that are occurring nowadays.

What Susan Fainstein exposes on the book an ideology create an intense force that says " *when state power has a mobilisation for elite interests, effective democracy can counter its unjust effects*" [91] she emphasises as well that " *a further problem of the deliberative approach arises from the relation between speech and action. Significant changes in social consciousness require deeper transformations than mere verbal assent 'Lukács 1971*." She describes the concept that Karl Marx and Friedrich Engels (1947) when they criticise the 'Hegelians' assert about the world change resulted by a through struggle and, was not forced by ideas. In her book, she provides an individual approach that is a challenge the way that evaluates projects based on social justice. With her study, a new form a new contribution was developed for the evaluation of urban policy that can be used into this new Climate Smart Cities with an intellectual stimulation on civilisations.

2.4.2. - Who has done what?

In Songdo for example, CISCO was a mentor on IT technology for all city. In March 26th of 2014, was made an interview and, a visit to their IT Central in Songdo near the Central Park. They had developed products as 'screen detect', 'video concierge', 'video wall' and 'smart kiosk'. They start using a technology, where they could easily find the car and, automatically making the parking payment, said by MI Young Lee, from CISCO Korea, if someone forgot the car they have the solution.

The most and important development product, was the Platform monitoring system for the city. The platform presents a support on: fire action, emerge alert, subway station security information, and total Bridge control and can be visible at a display and goes directly to the security needs.

Inside this system, it is possible to have the command of the Buildings management, energy management systems and, even the most problematic part of the scheme can be controlled on the home interior rooms because of the senior citizens, caring a problem, that is at the moment a little controversial, in what respects to personal privacy.

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[90] Idem, Ibid

[91] Victor NEGRETE - The just city, . USA: Planetizen, 2011. Disponível em WWW: <https://www.planetizen.com/node/50215>.

In the Case of Posco Building, Cisco headquarters in Songdo, present a building that is entirely commanded by the internal team, at a central centre room. When Cisco starts to develop some of these products, they had try to create something that could directly connected with people's needs. Some cultural problems inside different countries, different preferences and, different point of views were the primary focus for the product development.

According to SASKIA (2015) " *A city is a complex but incomplete system: in this mix lies the capacity of cities across histories and geographies to outlive far more powerful, but fully formalised, systems - from large corporations to national governments. London, Beijing, Cairo, New York, Johannesburg and Bangkok - to name but a few - have all outlived multiple types of rulers and of businesses.*"[92]

Many services planned to be implemented in the city, to create a better quality of life for the population. But some of the ideas, were developed with different views. One of the biggest problems was a need for security in the area of press emergency. Some of the kiosks, were located directly in 'Gangnam' in South Korea. Some concepts like Landmark City and Smart Bus ere implemented today in Songdo city.

The city Wi-Fi was growing, during the city's occupation. One of the product developments more detailed, was for the Heath control hospital. The Korean history is still very recent and, an old man in a family has the power and, the respect that was given 20 years ago and, one of the focus for development was in a direct support to people from a family that were dying inside of home, without help and support. Elderly in Songdo can have this service and, can acquire a service that put them directly seeing the occurrences inside home on their computer during a regular and a working day.

According to LAVRIC (2015) in their study in University of Florida USA, they believe that a performance evaluation can have different results under a algorithms control. The explanation goes to the integration of algorithms into the Smart Cities concept and he explains that " *From the results obtained we conclude that the topology construction algorithm A3 provides the lowest number of active nodes and is recommended for use in Smart City concept.*"[93]

But a thus type of system creates a problem called privacy, and the service can activate energy with a single button. With this type of need, a

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[92] SASKIA

[93] Alexandru LAVRIC, Vaentin Popa - Performance evaluation of wsn topology control algorithms that can be used in smart. **Acta Tehnica Corviniensis - Bulletin of Enineering**. ISSN 2067-3809. Vol. Fascicule 4 (October - December) (2015), p.151-155.

tele-presence system was supported by Cisco and, prepared for the implementation and, the new concept of English lessons was the second choice for this service. Professors from Canada and the USA are giving direct lessons inside South Korean homes in Songdo City.

Another use of this system was, on first consultancies of plastic surgery in South Korea. The plastic surgery trend and, the clinics' visit create an embarrassing situation, and this system becomes the action more easy and comfortable, having a doctor on the other side of the screen giving pieces of advice and, creating possible solutions and interventions for the patience without living home. Consultations at home with the same system, with Gangnam clinics or others, psychologist consultation, health care consultation with a trainer fitness instructor and, some academic consultation with Yonsei University are the future tendencies for South Korea and who knows worldwide one day.

At Home, in an average house, a panel in the living room or, near the entrance is the centre of the system and, the decision maker at the apartment. The equipment can, switch off or turn on the light, heating or connect with the TV. Smartphones have a use, at the moment for different solutions, and one of the options it is the door open system and the switch on or switch off the light system or the heating system. Everything is connected with a human command by one touch.

Smart Education was another focus under the city decisions at the first phase project. If the energy doesn't work, Cisco creates some different solutions to solve the problem.

The workplaces connect between them, and with the Smart connect learning grid. With this type of system, professors can give their lecture in different countries and, with the many cultures at the same time.

Chadwick International School is one of the examples that can plan lectures like this. They have a school in South Korea, Songdo and, another one in California, where students from the same year can have the same professor but from a different country, can share completely different opinions and growing together under the educational system. This action is a new type of Education Centre. The visit to Cisco Songdo Headquarters with Dr. Ben Chung from Australia, where he made a presentation about the project from the beginning in Songdo and, around the world about cities intervention from Cisco worldwide. Cisco was the ICT base and, the support for Songdo in the last 15 years. They create a positive effect and an intelligent development.

During the conversation, the question arrived directly to " *why South Korea?*" and some new information, had arrived under the table. Cisco

had some objectives for this city Songdo and, with their knowledge from the last 50 years, to follow the biggest shift in history that, Seoul and surrounding area, they wanted to make money and doing a new type of community. Cisco company was planning something new and, very different from other places in the world. Concepts like a partnership, connection and communities were some of initial forces. Cisco was working under a small scale, and Songdo, was a new and unique opportunity to change their working range. Korea was with a high level of development, so Songdo was a prototype under development and an opportunity.

During the process, the 2008 crises transform the initial ideas and the money was not enough for the concept. Cisco had to change their strategy.

Inside Cisco strategy, they developed one headquarter directly inside Songdo, Incheon area. Even today, it is possible to see the operation room that manages the city and, the public spaces. This room has a development with Posco and Gale International support. Cisco learned, with Songdo experience and, incubating product space that the changes in politics take time and, it is always critical to ask first what are the people's needs and, only after this, can be created and developed solutions for them " *The technology is smart when the people needed.*" [94] The philosophies start a connection to a city that transforms children's education and, international English and intelligent tutoring with technologies. A new product called U-Life that was focused before, started in December of 2014 and was implemented a Pilot service under 50 residents in Songdo City. The product was free at the beginning and now is under the market.

In Hong Kong following LU (2013) they are increasing embracement of sustainable development as a new value added and " *P16: Best practice guide: In 2009, Hong Kong Construction Association issued the Best Practice* (Table 1) *Guide for Environmental Protection on Construction Sites to serve as a handy reference to frontline management teams in managing certain critical and environment-prone site issues including construction waste management.*" [95]

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[94] CISCO – City of the future: Songdo, republic of korea Cisco's The Network, 2014b. Disponível em WWW: <http://newsroom.cisco.com/Songdo>.

[95] LU
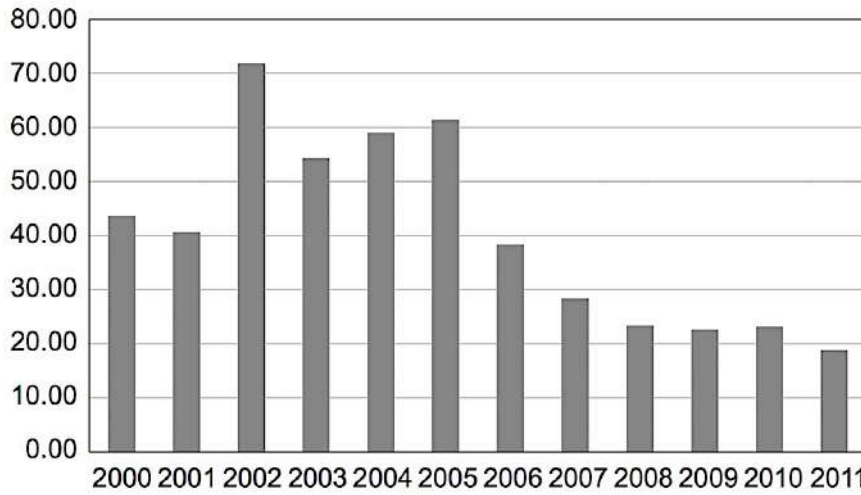
Table 1 - Waste generation construction GDP in Hong Kong (Unit: ton/M HK$).
(source: Weisheng 2013, Elsevier)

The next figure " *illustrates various solid wastes disposed of at landfills in 1991-2010. It is clear that domestic waste and construction waste are the two largest members in forming the overall municipal solid waste in Hong Kong. It can be seen from table that the portion of domestic waste remains largely unchanged over the past three decades regardless of the fluctuation (Table 2) in Hong Kong economy.*"[96]
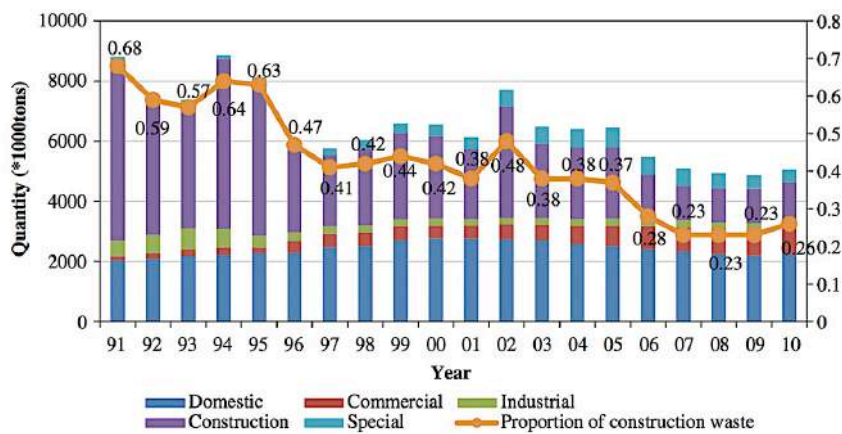
Table 2 - Quantities of construction waste in 1991–2010
(source: Weisheng 2013, Elsevier)

Hong Kong has a strong political view that connects with the populations needs and with the market demand. they look into these kind of actions under a different point of view but an intense level of development.

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[96] Idem, Ibid

2.4.3. - Who first did it?

Songdo in Asia, started the landfill for 'Songdo City' in 1997, 'Masdar City' was launched in 2006, but 'Chandigarh City', before all of these interventions, in India, was started by Corbusier in 1966.

In Europe, the first so-called Smart City in Germany, for example, was Mannheim. This German city has succeeded into a connection with every household in the area, to a smart energy network. The project is called 'Model City Mannheim' and aims to heighten the efficiency in energy provision and raise awareness about energy amongst the inhabitants.

But other cities, for example like Amsterdam, were actin during these years, creating 'Amsterdam Smart City', or in 'Copenhagen City' where they were considered the world's greenest city 2016, or even 'Tianjin Eco City' from Singapore government, or even in Saudi Arabia, the 'King Abdullah Economic City' in Jeddah. These are some examples worldwide.

There are around the world cities from type 1 underdevelopment, where their results are more slower, comparing with the new shift paradigm under cities from type 2 in different parts of the world.

2.5. – Related Work

It is online, at the Google platform a Data Base map called ' Smart Cities map' with a list and location of existent smart cities around the world. The current list, is under study and will soon be updated for 2016 on-going projects. On the list, there exist only developed projects, and there are existent and located real Smart Cities.

Figure 23 – Smart Cities Map
(source: Google maps, Jan 2016)

NAMES	CITY	COUNTRY	CONTINENT
Smart City Wien	Wien	Austria	Europe
	Zagreb	Croatia	Europe
Smart Aarhus	Aarhus	Denmark	Europe
	Copenhagen	Denmark	Europe
	Tallinn	Estonia	Europe
Urbanflow Helsinki	Helsinki	Finland	Europe
	Turku	Finland	Europe
	Issy-les-Moulineaux	France	Europe
Smart City Lyon	Lyon	France	Europe
EcoCité	Montpellier	France	Europe
Connected Boulevard	Nice	France	Europe
Europa City	Paris	France	Europe
	Frankfurt	Germany	Europe
Hamburg SmartPORT	Hamburg	Germany	Europe
Mannheim Smart City	Mannheim	Germany	Europe
Amsterdam Smart City	Amsterdam	Netherlands	Europe
	Eindhoven	Netherlands	Europe
Bari Smart City	Bari	Italy	Europe

Bergamo Smart City & Community	Bergamo	Italy	Europe
Bologna Smart City	Bologna	Italy	Europe
Brescia Smart City	Brescia	Italy	Europe
	Florence	Italy	Europe
Genova Smart City	Genova	Italy	Europe
Milano Smart City	Milano	Italy	Europe
Napoli Smart City	Napoli	Italy	Europe
Roma Smart City	Roma	Italy	Europe
Torino Smart City	Torino	Italy	Europe
Varese Smart City	Varese	Italy	Europe
	Venice	Italy	Europe
Verona Smart City	Verona	Italy	Europe
	Riga	Latvia	Europe
	Vilnius	Lithuania	Europe
	Luxembourg	Luxembourg	Europe
SmartCity Malta	Valleta	Malta	Europe
Porto Living Lab	Porto	Portugal	Europe
PlanIT Valley	Fundão	Portugal	Europe
Monaco 3.0	Monaco	Principality of Monaco	Europe
Kazan Smart City	Kazan	Russia	Europe
Skolkovo CentralDistrict	Skolkovo	Russia	Europe
	Glasgow	Scotland	Europe
Alcobendas SmartCity (RECI)	Alcobendas	Spain	Europe
Alcorcón SmartCity (RECI)	Alcorcón	Spain	Europe
Alicante SmartCity (RECI)	Alicante	Spain	Europe

Aranjuez SmartCity (RECI)	Aranjuez	Spain	Europe
Ávila Smart City	Ávila	Spain	Europe
Badajoz SmartCity (RECI)	Badajoz	Spain	Europe
Barcelona SmartCity (RECI)	Barcelona	Spain	Europe
Burgos Smart City (RECI)	Burgos	Spain	Europe
Cáceres SmartCity (RECI)	Cáceres	Spain	Europe

Castellón SmartCity (RECI)	Castellón	Spain	Europe
Córdoba SmartCity	Córdoba	Spain	Europe
Coruña Smart City	Coruña	Spain	Europe
Elche SmartCity (RECI)	Elche	Spain	Europe
Gijón SmartCity (RECI)	Gijón	Spain	Europe
Guadalajara SmartCity (RECI)	Guadalajara	Spain	Europe
Huesca SmartCity (RECI)	Huesca	Spain	Europe
Logroño SmartCity (RECI)	Logroño	Spain	Europe
Lugo SmartCity (RECI)	Lugo	Spain	Europe
Madrid SmartCity (RECI)	Madrid	Spain	Europe
Smart City Málaga	Málaga	Spain	Europe
Marbella SmartCity (RECI)	Marbella	Spain	Europe
Móstoles SmartCity (RECI)	Móstoles	Spain	Europe
Murcia SmartCity (RECI)	Murcia	Spain	Europe
Oviedo SmartCity (RECI)	Oviedo	Spain	Europe
Palencia SmartCity (RECI)	Palencia	Spain	Europe
Palma de Mallorca SmartCity (RECI)	Palma de Mallorca	Spain	Europe
Pamplona SmartCity	Pamplona	Spain	Europe
Ponferrada SmartCity (RECI)	Ponferrada	Spain	Europe
Rivas Vaciamadrid SmartCity (RECI)	Rivas Vaciamadrid	Spain	Europe
Sabadell SmartCity (RECI)	Sabadell	Spain	Europe
Salamanca SmartCity (RECI)	Salamanca	Spain	Europe
SmartSantander	Santander	Spain	Europe
SmartCity SantCugat	SantCugat	Spain	Europe

Segovia SmartCity (RECI)	Segovia	Spain	Europe
Sevilla SmartCity (RECI)	Sevilla	Spain	Europe
Tarragona SmartCity (RECI)	Tarragona	Spain	Europe
Torrejón de Ardoz SmartCity (RECI)	Torrejón de Ardoz	Spain	Europe
Torrent SmartCity (RECI)	Torrent	Spain	Europe
Valencia SmartCity (RECI)	Valencia	Spain	Europe
SmartCity VyP	Valladolid e Palencia	Spain	Europe
Vitoria SmartCity (RECI)	Vitoria	Spain	Europe
Zaragoza SmartCity (RECI)	Zaragoza	Spain	Europe
Malmo Smart City	Malmo	Sweden	Europe
Bristol Smart City Laboratory	Bristol	UK	Europe
	Londres	UK	Europe
	Manchester	UK	Europe

Table 3 - Smart Cities Europe

NAMES	CITY	COUNTRY	CONTINENT
Cairo Smart Village	Cairo	Egypt	Africa
Toyota City	Aichi	Japan	Asia
City of Kitakyushu	Kitakyushu	Japan	Asia
Kansai Science City	Kyoto	Japan	Asia
Yokohama Smart City Project	Yokohama	Japan	Asia
Qatar Smart City Doha	Doha	Qatar	Asia
	Singapore	Singapore	Asia
	Busan Green u-City	South Korea	Asia
Songdo IBD	Songdo	South Korea	Asia
	New Taipei City	Taiwan	Asia
SmartCity Dubai	Dubai	United Arab Emirates	Asia

Masdar City	Masdar	United Arab Emirates	Asia
Smart Commute Toronto-Central	Toronto	Canada	North America
Vancouver Digital Strategy	Vancouver	Canada	North America
	Winnipeg	Canada	North America
Ciudad Creativa Digital	Guadalajara	Mexico	North America
Data Dictionary CHICAGO	Chicago	USA	North America
Smarter Sustainable Dubuque	Dubuque	USA	North America
Smart City Memphis	Memphis	USA	North America
Smart City New York	New York	USA	North America
We Build Green Cities	Portland	USA	North America
SAN FRANCISCO Environment	San Francisco	USA	North America
Smart Cities USA	San José	USA	North America
Sustainable Seattle	Seattle	USA	North America
Inteligent City Búzios	Búzios	Brasil	South America
Operations Center Rio	Rio	Brasil	South America
SmartCity Santiago	Santiago	Chile	South America

Table 4 - Smart Cities Africa | Asia | North America

NAMES	REGION	CITY	COUNTRY	CONTINENT
	Beijing	Dongcheng District	China	Asia
		Chaoyang District	China	Asia
		Beijing Future Science and Technology City	China	Asia
		Lize Financial Business District	China	Asia
	Tianjin	Jinnan Economic Development District	China	Asia
		Tianjin Eco-city	China	Asia
		Shijiazhuang City	China	Asia

		Qinhuangdao City	China	Asia
	Hebei province	Langfang City	China	Asia
		Handan City	China	Asia
		Qian'an City	China	Asia
		Beidaihe New District	China	Asia
	Shanxi province	Taiyuan City	China	Asia
		Changzhi City	China	Asia
		Shuozhou City Pinglu District	China	Asia
	Inner Mongolia Autonom ous Region	Wuhai City	China	Asia
	Liaoning province	Shenyang City Hunnan New District	China	Asia
		Dalian Eco-technology Innovation City	China	Asia
	Jilin province	Liaoyuan City	China	Asia
		Panshi City	China	Asia
	Heilongji ang province	Zhaodong City	China	Asia
		Zhaoyuan County	China	Asia
		Huanan County	China	Asia
		Shanghai Pudong New District	China	Asia
		Wuxin City	China	Asia
	Jiangsu province	Changzhou City	China	Asia
		Zhenjiang City	China	Asia
		Taizhou City	China	Asia
		Nanjing City Hexin New Town	China	Asia
		Suzhou Industrial Park	China	Asia
		Yancheng City Chengnan New District	China	Asia

		Kunshan City Huaqiao Economic & Technological Development Zone	China	Asia
		Kunshan City Zhangpu Town	China	Asia
	Zhejiang province	Wenzhou City	China	Asia
		Jinhua City	China	Asia
		Zhuji County	China	Asia
		Hangzhou City Upper Town	China	Asia
		Ningbo City Zhenhai District	China	Asia

Table 5 - Smart Cities Asia | China

NAMES	REGION	CITY	COUNTRY	CONTINENT
	Jiangxi province	Pingxiang City	China	Asia
		Nanchang City Honggutan New District	China	Asia
	Shandong province	Dongying City	China	Asia
		Weihai City	China	Asia
		Dezhou City	China	Asia
		Xintai City	China	Asia
		Shouguang City	China	Asia
		Changyi City	China	Asia
		Feichang City	China	Asia
		Jinan West District	China	Asia
	Henan province	Zhengzhou City	China	Asia
		Hebi City	China	Asia
		Luohe City	China	Asia
		Qiyuan City	China	Asia
		Xinzheng City	China	Asia
		Luoyang New District	China	Asia
		Wuhan City	China	Asia

	Hubei province	Wuhan City's Jiangan District	China	Asia
		Zhuzhou City	China	Asia
		Shaoshan City	China	Asia
		Zhuzhou City's Yunlong Demo District	China	Asia
	Hunan province	Liuyang City's Baijia Town	China	Asia
		Shangsha City Meixihu International Service District	China	Asia
		Zhuhai City	China	Asia
		Guangzhou City Panyu County	China	Asia
		Guangzhou City Luogan District	China	Asia
	Guangdong province	Shenzhen City Pingshan New District	China	Asia
		Foshan City Shunde District	China	Asia
		Foshan City Lecong Town	China	Asia
	Hainan province	Wanning City	China	Asia
	Chongqing	Nan'an District	China	Asia
		Liangjiang New District	China	Asia
		Ya'an City	China	Asia
	Sichuang province	Chengdu City's Wenjiang District	China	Asia
		Pixian County	China	Asia
	Guizhou	Tongren City	China	Asia
		Liupanshui City	China	Asia

	province	Guiyang City Wudang District	China	Asia
	Yunnan province	Kunming City Wuhua District	China	Asia
	Tibet Autonom ous Region	Lasa City	China	Asia
	Shaanxi province	Xianyang City	China	Asia
		Yangling Demo District	China	Asia
	Ningxia Hui Autonom ous Region	Wuzhong City	China	Asia
	Xinjiang Uygur Autonom ous Region	Korla City	China	Asia
		Kuytun City	China	Asia

NAMES	REGION	CITY	COUNTRY	CONTINENT
	Anhui province	Wuhu City	China	Asia
		Tongling City	China	Asia
		Bengbu City	China	Asia
		Huainan City	China	Asia
	Fujian province	Nanping City	China	Asia
		Pingtan City	China	Asia
		Fuzhou City Cangshan District	China	Asia

Table 6 - Smart Cities | India

Figure 24 - Proposal Smart Cities India
(source: financialexpress.com, 2016)

NAMES	REGION	CITY	COUNTRY	CONTINENT
	Tripura	Agartala	India	Asia
	Uttar Pradesh	Agra	India	Asia
	Gujarat	Ahmedabad	India	Asia
	MIzoram	Aizawl	India	Asia
	Rajasthan	Ajmer	India	Asia
	Uttar Pradesh	Aligarh	India	Asia
	Uttar Pradesh	Allahabad	India	Asia
	Maharashtra	Amravati	India	Asia
	Punjab	Amritsar	India	Asia
	Maharashtra	Aurangabad	India	Asia
	Uttar Pradesh	Bareilly	India	Asia
	Karnataka	Belagavi	India	Asia
	Bihar	Bhagalpur	India	Asia
	Madhya Pradesh	Bhopal	India	Asia
	Odisha	Bhubaneswar	India	Asia
	West Bengal	Bidhannagar	India	Asia
	Bihar	Biharsharif	India	Asia
	Chhattisgarh	Bilaspur	India	Asia
Chandigarh S. City	Chandigarh	Chandigarh	India	Asia
	Tamil Nadu	Chennai	India	Asia
	Tamil Nadu	Coimbatore	India	Asia
	Gujarat	Dahod	India	Asia
	Karnataka	Davanagere	India	Asia

	Uttarakhand	Dehradun	India	Asia
	Himachal Pradesh	Dharamshala	India	Asia
Dholera SIR		Dholera	India	Asia
	Tamil Nadu	Dindigul	India	Asia
	Goa	Diu	India	Asia
	West Bengal	Durgapur	India	Asia
	Tamil Nadu	Erode	India	Asia
	Haryana	Faridabad	India	Asia
	Gujarat	Gandhinagar	India	Asia
	Uttar Pradesh	Ghaziabad	India	Asia
	Telangana	Greater Hyderabad	India	Asia
	Maharashtra	Greater Mumbai	India	Asia
	Telangana	Greater Warangal	India	Asia
	Assam	Guwahati	India	Asia
	Madhya Pradesh	Gwalior	India	Asia
	West Bengal	Haldia	India	Asia
	Karnataka	Hubbali-Dharwad	India	Asia
	Manipur	Imphal	India	Asia
	Madhya Pradesh	Indore	India	Asia
	Madhya Pradesh	Jabalpur	India	Asia

NAMES	REGION	CITY	COUNTRY	CONTINENT
	Lakshadweep	Kavaratti	India	Asia
Smart City Kochi	Kerala	Kochi	India	Asia
	Nagaland	Kohima	India	Asia
	Rajasthan	Kota	India	Asia
Lavasa City		Lavasa	India	Asia
	Uttar Pradesh	Lucknow	India	Asia
	Punjab	Ludhiana	India	Asia
	Tamil Nadu	Madurai	India	Asia
	Karnataka	Mangaluru	India	Asia
	Uttar Pradesh	Moradabad	India	Asia

	Bihar	Muzaffarpur	India	Asia
	Maharashtra	Nagpur	India	Asia
	Sikkim	Namchi	India	Asia
	Maharashtra	Nashik	India	Asia
	Maharashtra	Navi Mumbai	India	Asia
	NCT of Delhi	New Delhi Municipal Council	India	Asia
	West Bengal	New Town Kolkata	India	Asia
	Puducherry	Oulgaret	India	Asia
	Goa	Panaji	India	Asia
	Arunachal Pradesh	Pasighat	India	Asia
	Andaman & Nicobar Islands	Port Blair	India	Asia
	Maharashtra	Pune	India	Asia
	Chhattisgarh	Raipur	India	Asia
	Gujarat	Rajkot	India	Asia
	Uttar Pradesh	Rampur	India	Asia
	Jharkhand	Ranchi	India	Asia
	Odisha	Raurkela	India	Asia
	Madhya Pradesh	Sagar	India	Asia
	Uttar Pradesh	Saharanpur	India	Asia
	Tamil Nadu	Salem	India	Asia
	Madhya Pradesh	Satna	India	Asia
	Meghalaya	Shillong	India	Asia
	Karnataka	Shivamogga	India	Asia
	Dadra And Nagar Haveli	Silvassa	India	Asia
	Maharashtra	Solapur	India	Asia
	Gujarat	Surat	India	Asia
	Maharashtra	Thane	India	Asia
	Tamil Nadu	Thanjavur	India	Asia
	Tamil Nadu	Thoothukkudi	India	Asia
	Tamil Nadu	Tiruchirappalli	India	Asia
	Tamil Nadu	Tirunelveli	India	Asia
	Andhra Pradesh	Tirupati	India	Asia
	Tamil Nadu	Tiruppur	India	Asia
	Karnataka	Tumakuru	India	Asia
	Rajasthan	Udaipur	India	Asia

	Madhya Pradesh	Ujjain	India	Asia

NAMES	REGION	CITY	COUNTRY	CONTINENT
	Uttar Pradesh	Kanpur	India	Asia
	Haryana	Karnal	India	Asia
	Gujarat	Vadodara	India	Asia
	Uttar Pradesh	Varanasi	India	Asia
	Tamil Nadu	Vellore	India	Asia
	Andhra Pradesh	Vishakhapatnam	India	Asia
	Haryana	Karnal	India	Asia
	Rajasthan	Jaipur	India	Asia
	Punjab	Jalandhar	India	Asia
	Uttar Pradesh	Jhansi	India	Asia
	Andhra Pradesh	Kakinada	India	Asia
	Maharashtra	Kalyan-Dombivali	India	Asia

The last pages present, the most recent Smart Cities analysis worldwide. Inside the tables divided into groups, where they present smart cities around the world, the future smart cities in China and, the last future interventions in India.

According to Jung Hoon Lee in 2014, a massive development into smart cities around the world in a high speed are under construction " *most leading cities in Europe... as adopted ICT and green technologies as ways to the means to revitalise economic opportunities and to strengthen global competitiveness*"[97] and looking into the smart cities worldwide map, it is possible to have the perception of this conclusion.

Some of these cities are under study and, they probably change the project proposals in the next years.

2.6. – Certification systems on Buildings

Buildings are improving and, are using new certification methods worldwide. The more widely know, include BRE 'Environmental

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[97] Jung Hoon LEE:Hancock, Marguerite GongHu, Mei-Chih - Towards an effective framework for building smart cities: Lessons from seoul and san francisco. Ibid.ISSN 00401625. Vol. 89, n.º Technological Forecasting and Social Change (2014), p.80-99.

Assessment Method' (BREEAM), in the UK and 'Leadership in Energy and Environmental Design' (LEED) in the United States, are two of the most well-known at the moment. The 'Evaluation Standard for Green Building' (ESGB) in China, the 'Eco-Management and Auditing Scheme' (EMAS) in the European Union, the 'Comprehensive Assessment Scheme for Built Environment Efficiency' (CASBEE) in Japan Lee (2012), 'Sustainable Building Assessment Tool' (SBAT) in South Africa [98] [99]

The most ranked for example, in the Korean market, it is the 'Green building Certification Criteria Korea' (GBCS) but, some others are more connected with environmental issues such as energy efficiency and conservation are BREEAM, LEED, the SBtool (Sustainable Building Tool) and GBCC (Green Building Certification Criteria) and they could be more adapted to some new buildings in South Korea.

BREEAM from the UK is "...*the world's leading sustainability assessment method for master planning projects, infrastructure, and buildings. It addresses some lifecycle stages such as New Construction, Refurbishment, and In-Use. Globally there are more than 541,900 BREEAM certified developments, and almost 2,238,400 buildings registered for assessment since it was first launched in 1990.*"[100]

BREEAM works with an assessment process that evaluates the procurement, design, construction and, operation of development against targets, that are based on performance benchmarks and evaluations. Independent, licensed assessors carry out the system, and the system rated and certified, on a scale of Pass, Good, Very Good, Excellent and Outstanding.

Another type of buildings certification is LEED from the USA, or Leadership in Energy and Environmental Design, that says that their action is changing the way that people think, about how buildings and how communities are planned, constructed, maintained and operated.

The LEED supported by leaders, raised this certification to the most widely used third-party verification for green buildings, with around 1.85 million square feet being certified daily. The LEED certification has to be present in all phases of the development and can be implemented into homes to corporate headquarters and, the range of applicability is very vast, LEED is for all buildings.

Following sustainability issues projects pursuing LEED certification earn

[98] W.L. LEE - Benchmarking energy use of building environmental assessment schemes. Energy Build. 45,, 2012.

[99] Saleh H. ALUAMI, Yacine Rezgui, – Sustainable building assessment tool development approach. Sustainable Cities 2012

[100] BREEAM -. BREEAM, oficial website: BREEAM, 2016. Disponível em WWW: <http://www.breeam.com/why-breeam>.

points across several areas that address. After an analysis based on the number of points achieved, a project can receive one of four LEED rating levels: Certified, Silver, Gold and Platinum. " *LEED-certified buildings are resource efficient. They use less water and energy and reduce greenhouse gas emissions. As a bonus, they save money.*" [101]

GBI from Canada another certification for buildings, have the following rules " *Buildings have extensive direct and indirect impacts on the environment. During their construction, occupancy, renovation, repurposing, and demolition, buildings use energy, water, and raw materials, generate waste, and emit potentially harmful atmospheric emissions.*" The new action on a territory by Canadian government prompted the creation of green building standards, certifications, and rating systems.

The buildings mitigation impact on the natural environment, through sustainable design changed the paradigm into construction field.

The Green Building Initiative 'GBI' was created to assist the National Association of Homebuilders 'NAHB' in promoting its Green Building Guidelines for Residential Structures. " *Additional rating systems have been developed that were influenced by these early programs but are tailored to their national priorities and requirements or seek to go beyond the limits of current policy and building practices to address broader issues of sustainability or evolving concepts such as net zero energy, and living and restorative building ideas that improve the natural environment, or those that model nature's processes.*" [102]

ESGB, from Asia, it is the China's green building evaluation standard and comparison to the LEED rating system and, has a Three Star System to evaluate buildings.

The Ministry of Construction's, created the Green Building Evaluation Standard as a voluntary rating system that will encourage green development. China is now in the phase of rapid economic development ranking worldwide. In China, the annual building volume, with significantly growing consumption of resources year by year.

The idea of implementing this standard was to regulate evaluation on green buildings and, to promote the development of green buildings. This system presents two different standards where one is for residential buildings and, the other one, was for public 'i.e. large commercial'

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[101] LEED – Leed oficial website. 2015. Disponível em WWW: <http://www.usgbc.org/leed, >.

[102] WBDG, Whole Building Design Guide, oficial website www.wbdg.org, accessed in 24 Nov 2015

buildings. This measure will mainly evaluate residential buildings that are enormous in quantities and, public buildings that consume high levels of energy and resources, like office buildings, mall buildings or hotel buildings. To evaluate other buildings this standard can serve only as a reference.

Into this system the evaluation standard imposes itself a variety of prerequisites to 'control items' and credits designated by 'general items' divided into six categories as, first Land savings and outdoor environment, secondly Energy conservation, thirdly Water savings, fourthly Materials savings, fifthly Indoor environmental quality and at last Operations and management. Another category the seventh presented at the 'Preference items' contain strategies those are, both cutting-edge and, harder to implement.

GBCS designated Green Building Certification System of Korea to serve to evaluate the environment performance of a multi-unit residential building at first. GBCS objectives are to assess environmental performance of buildings and promote dissemination of green buildings in Korea.

In 2000, were developed four different GBCSs respectively the Korea National Housing Corporation 'KNHC', the Korea Management Association Quality Assurance 'KMAQA', the Korea Institute of Energy Research 'KIER' and the Korea Institute of Construction Technology 'KICT'. Only in July 2001, the Certification Integration Arrangement Committee had an organisation with the objective of creating the integration of the two systems, KOEAM2000 and GBRS and at the end of 2001 comes up the two systems integrated into the Green Building Certification Criteria 'GBCC' by Korea Institute of Energy Research. " *In 2003, GBCC for the school building was developed and will be enforced soon, and the integrated GBCC which applies to all types of buildings plans to be developed.*" [103]

Eco-Management and Audit Scheme from the European Union serve to " *exploiting the full potential of green growth.*"[104] EMAS is a voluntary environmental management instrument, which was developed in 1993 by the European Commission the existent system enables organisations to assess, manage and continuously improve their environmental performance. A developed scheme to be globally applicable and open to all types of private and public agencies and to register with EMAS,

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[103] Shik Shin KEE –: **Green Building Certification Systems, Japan: The 2005 World Sustainable Building Conference**. Japan, Tokyo, 2005.

[104] EMAS – Emas, about us, eu: European commission 2015. EU: European Commission, 2015. Disponível em WWW: <http://ec.europa.eu/environment/emas/index_en.htm>.

organisations must meet the requirements of the EU EMAS-Regulation.

The CASBEE from Japan follow the restricted rules " *Buildings, which consume and discard resources and energy in enormous quantities, are one of the architectural categories which we must act urgently to develop and promote techniques and policies able to assist the drive towards sustainability.*"[105] Comprehensive Assessment System for Built Environment Efficiency namely 'CASBEE' had a development according to the following policies. Firstly with a system should be structured to award high assessments to superior buildings, thereby enhancing incentives to designers and others. Secondly with an evaluation system that should be as simple as possible and thirdly with a system that should apply to buildings in a wide range of building types and fourthly with a system that should take into consideration issues and problems peculiar to Japan and Asia. CASBEE present different design stages action for Pre-design, for new construction, for existing buildings, for renovation, and specific purposes.

The Sustainable Building Assessment Tool called 'SBAT' aims to support sustainability performance improvements in buildings and construction processes. This tool can be used to set targets for sustainability performance, and it can also be used as well to assess and improve performance and providing confirmation of the performance where this is required. The tool had a base on a holistic approach to addressing sustainability and includes social, economic and environmental criteria to implement into design strategies. The principles align with the definition of sustainability developed by the World Wildlife Fund 'WWF' and define the " *sustainability as the achievement of a maximum Ecological Footprint (EF) and a minimum Human Development Index (HDI).*"[106] SBAT uses a measures performance of buildings and construction processes regarding the extent to which they support environmental, economic and social sustainability and ultimately the achievement of EF and HDI minimum standards. SBAT work with the following criteria, Environmental, Energy, Water, Waste, Materials, Biodiversity, Economic, Transport, Resource use, Management, Products, and services, Local Economy, Social, Access, Health, Education, Inclusion, Social cohesion.

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[105] CASBEE - Comprehensive assessment system for built environment efficiency. Japan, 2015. Disponível em WWW: <http://www.ibec.or.jp/CASBEE/english/>.

[106] Jeremy GIBBERD - The sustainable building assessment tool. 2015. Disponível em WWW: <https://pdfs.semanticscholar.org/ba1d/c72071e7a4b77884b033a07e892cef55fb02.pdf>.

2.7. - Ranking Smart Cities

" *The world is changing at light speed, and cities are growing and evolving searching for innovative, intelligent ideas and alternative futures...diverse cultures, geographies, and economies with only one common language, Data.*" [107]

The WCCD has the first system of measure performance with the ISO 37120 the first international standard for cities, and that has a precise method for defining indicators, that can help to measure performance in a universal language to drive sustainability, quality of life, investment and this database is from cities and, for cities.

Some analyses and classifications, have been developed into Smart City optical level, as city rankings. These studies and ratings, have involved some institutions and people of which we highlight 'ICF', responsible for the selection of Smart21 and Top7 Intelligent Communities of the Year. Monocle magazine was responsible, among others, for 'The Monocle Quality of Life Survey 2015' and integrating the TOP25. The 'Mercer' was in charge, among others, the Quality of Living, by 'Forbes' with The Top Five Smart Cities In The World and with the 'Triple Pundit' a Global Ranking of 'Top 10 Cities Resilient'. " *The Intelligent Community Forum Foundation is the non-profit membership association of the Intelligent Community Forum. Its members are communities honoured by the Forum's international awards program for Intelligent Communities, which use information and communications technology to grow prosperous, inclusive, sustainable economies. Having achieved so much already, the members of ICFF have formed this global network - a 'community of communities' - to boost their economic competitiveness, social health, and cultural strength through close and efficient collaboration. They are committed partners in building the community of the 21st Century. Membership in the Intelligent Community Forum Foundation is limited to the Alumni communities of the Intelligent Community Awards. No community will be accepted to membership except those that have qualified as a Smart21 Community, Top7 or Intelligent Community of the Year. Membership is in the name of the community and includes the right to an unlimited number of individual participants authorised by the community's designated representative.*" [108]   The community's membership includes Mayors, council members, City Managers or Chief Administrative Officers, Chief Information Officers and, senior IT executives, corporation counsels, economic development Officers are part integrant of the group. The

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[107] WCCD - World council city council. USA, 2015. Disponível em WWW: <dataforcescity.org>.

[108] Louis ZACHARILLA - Intelligent community. USA: ICF, 2016. Disponível em WWW: <http://www.intelligentcommunity.org/louis_zacharilla>.

Community Development Officers, Senior leaders of non-profit institutions in the community, including universities, schools, hospitals, social service organisations and chambers of commerce and business executives committed to the economic and social success of the community are the second part of the integrant group.

There exist a believe on Future Institutes that " *The Intelligent Community Forum is working with universities, institutes and Intelligent Communities around the globe to develop future Institutes for the Study of the Intelligent Community. Local founders of ICF Institutes take responsibility for funding, staffing, management and overhead of the Institute. The Institute's course of study and resulting research output are determined in collaboration between the Institute and ICF. Contributions to the Institute from ICF include advice and counsel on the Institute's formation, the on-going participation of our executives and fellows, access to ICF data, and the right to use ICF's identity in its work.*"[109]

In a study funded by the Province of Ontario, Canada, the Intelligent Community Forum defined critical success factors for the creation of Intelligent Communities. This list of Intelligent Community Indicators, as the study termed them, provided the first conceptual framework for understanding all of the factors that determine a community's competitiveness in the Broadband Economy. In its work since then, ICF has also identified some success factors for Intelligent Communities in both industrialised and developing nations.

The first principle, nominated broadband on the next essential utility, as vital to economic growth as clean water and good roads. Whatever the speed, the power of broadband is simple enough to express. It connects your computer, laptop or mobile device to billions of devices and users around the world, creating a digital overlay to our physical world that is revolutionising how we work, play, lives, educates and entertain ourselves, governs our citizens and relates to the world.

Into the second principle the knowledge workforce, in our days, all desirable jobs in industrialised economies and, increasingly in developing economies also and, that require a higher component of learning than they did in the past. It is by applying knowledge and, specialised skills that employees add enough value to what they do to justify the cost of employing them. In the future, any employee who's " *value-added*" does not exceed his or her salary cost that can expect to be replaced, sooner or later, by software or hardware. A continuous improvement in an evolving range of skills is the only route to personal prosperity.

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[109] Idem, Ibid

At the third principle, it is essential to the interconnected economy of the 21st Century. Intelligent Communities pursue innovation through a relationship between business, government and, such institutions as universities and hospitals. The Innovation Triangle or " *Triple Helix*" helps keep the economic benefits of local innovation and, creates an innovative ecosystem that engages the entire community in positive change. Investments in innovative technology, by government contribute to that culture and, improve service to citizens while reducing operating costs.

On the fourth principle, the digital equality is a simple principle: that everyone in the community deserves access to broadband technologies and the skills to use them. Like most principles, it is easier to understand than it is to live. The explosive advance of the broadband economy has worsened the exclusion of people, who already play a peripheral role in the economy and society, whether due to poverty, lack of education, prejudice, age, disability, or simply where they live. It has disrupted industries from manufacturing to retail services, enlarging the number of people for whom the digital revolution is a burden rather than a blessing.

Into the fifth principle, the sustainability an improvement on current living standards, while maintaining the ability of future generations to do the same, is at the core of sustainability. Throughout human history, economic growth has always involved the consumption of more resources and the production of more waste. As humanity begins to push up against the limits of the ecosystem to provide resources and absorb waste, we need to find ways to continue growth, with all of its positive impacts on the community, while reducing the environmental implications of that growth.

The sixth principle, advocacy where it is too common for a city's leaders or groups of citizens to set themselves against change, that would ultimately benefit the community. The willingness to embrace change and, the determination to help shape it, however, are core competencies of the Intelligent Community. Few places naturally possess those skills. They must be cultivated, often over years, through advocacy.

According to the international journal of Health Geographic in January 2014, the report " *prepared for the European Parliament's Committee on Industry, Research and Energy, and entitled 'Mapping Smart Cities in the EU' identified three key factors for successful smart cities (vision, people and process). These are: (i) the presence of a vision of inclusion and participation to avoid polarisation between urban elite and low income areas; (ii) the presence of inspiring leaders or 'city champions' who are able to foster participative environments, bringing together businesses, the public sector and citizens, with a focus on empowering citizens through*

active participation to create a sense of ownership and commitment; and (iii) the presence of a sound process, including the creation of a central office acting as go-between different stakeholders, open data provision, and various level of coordination and integration mechanisms (central and local) across ideas, initiatives, projects and stakeholders."[110]

The Intelligent Community (Table 7) Indicators provide communities with a framework for assessment, planning, and development, as they work to build prosperous local economies in the Broadband Economy. The Indicators also reveal the interactions that can create a "virtuous cycle" of positive change. Broadband connectivity feeds the development of a knowledge workforce, that uses broadband and other technologies for innovation. By making digital equality and sustainability their priorities, Intelligent Communities ensure that the benefits of growth are spread broadly and benefit future generations. And advocacy becomes the driving force that embeds these gains into the culture of the community.

Table 7 – Top Intelligent Communities
(source: intelligent communities website, 2015)

2015 TOP 7	
Arlington Country, Virginia	USA
Columbus, Ohio	USA
Ipswich, Queensland	Australia
Mitchell, South Dakota	USA
New Taipei City	Taiwan
Rio de Janeiro	Brazil
Surrey, British Columbia	Canada

Monocle a global affairs and lifestyle magazine, 24-hour radio station, website, and media brand lunched ' The Monocle Quality of Life Survey 2015' (Table 8) with 22 new metrics and the new additions have led to some dramatic changes in the order of the top 25 cities. " *Old favourites have slipped down the list, while we also welcome back one entry. And we have a new number one. We hope, as in previous years, the list provokes a stimulating and lively debate.*"[111]

Table 8 – Top Monocle
(source: Monocle website, 2016)

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[110] Maged BOULOS, N.Kamel, Agis D Tsouros and Arto Holopainen - Social, innovative and smart cities are happy and resilient' insights from the who euro 2014. **International Journal of Health Geographics**. Vol. 14:3, n.º Creative Commons Attribution License (CCAL) (2015), p.1-9.

[111] MONOCLE - The monocle quality of life survey. Monocle, 2015.

2015 Ranking	City	2014	2013
1	Tokyo	2	4
2	Vienna	6	5
3	Berlin	14	20
4	Melbourne	3	2
5	Sydney	11	9
6	Stockholm	4	7
7	Vancouver	15	19
8	Helsinki	5	3
9	Munich	8	8
10	Zürich	7	6

Mercer is the world's largest human resources consulting firm. Headquartered in New York City, Mercer has more than 20,500 employees, is based in more than 40 countries, and operates internationally in more than 130 countries. Mercer launched Quality of Living Survey ranks 221 cities from Vienna to Baghdad on the quality of life (Table 9). Countries with cities commonly ranked in the top 50 include Austria, Switzerland, New Zealand, Germany, Canada, Denmark, Australia, Sweden and the USA. Vienna has been ranked first for six consecutive years. The quality of the living survey is conducted to help governments and major companies place employees on international assignments. The survey also identifies those cities with the highest personal safety ranking based upon internal stability, crime, effectiveness of law enforcement and relationships with other countries. In this case, Luxembourg is top, followed by Bern, Helsinki, and Zurich all equally placed at number 2.

2015 Rank	2014 Rank	2012 Rank	2010 Rank	City	Country	Index 2010
1	1	1	1	Vienna	Austria	108.6
2	2	2	2	Zürich	Switzerland	108.0
3	3	3	4	Auckland	New Zealand	107.4
4	4	4	7	Munich	Germany	107.0
5	5	5	4	Vancouver	Canada	107.4
6	6	6	6	Düsseldorf	Germany	107.2
7	7	7	7	Frankfurt	Germany	107.0
8	8	8	3	Geneva	Switzerland	107.9
9	9	9	11	Copenhagen	Denmark	106.2
10	10	10	10	Sydney	Australia	106.3

Table 9 – Top Mercer
(source: mercer website, 2015)

Forbes, is a business magazine that published 'The Top Five Smart Cities In The World 2015' and, the first city is Barcelona, the second is New York City, the third one is London, the fourth is Nice and, the fifth is Singapore. 'Triple Pundit' a Certified B-Corporation, is a new-media company for highly conscious business leaders and, they published the following Global Ranking of 'Top 10 Resilient Cities'.

Resilient cities, those that are working to transition towards a low-carbon economy, while also preparing to avert the worst of climate change, are gaining interest and, attention from policy makers, city councils and others worldwide. In fact, today, leaders from the public and private sector, supported by ICLEI the Local Governments for Sustainability, founded in 1990 as the International Council for Local Environmental Initiatives and the U.S. Green Building Council, are launching a National Leadership Speaker Series on Resiliency and Security in the 21st Century. " *The battle to prevent catastrophic climate change will be won or lost in our cities...*" [112] C40-Cities Initiative " *Cities account for up to 80% of GHG emissions globally and are home to more than 50% of the world's population (headed to 60%, 5 billion people by 2030). As I mentioned in my previous post, if we refocus our efforts on the right solutions soon enough, we can mitigate the worst of climate change while*

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[112] ICLEI and USCGB - National leathership speakers series. 2014.

improving our city economies and growing corporate profits. Hunter Lovins and I recently published a book entitled Climate Capitalism to share stories of towns and companies around the world who are benefiting from that transition to the low carbon economy. Furthermore, the longer we wait, the more we will have to pay for adaptation."[113] And the Top 10 Resilient Cities in 2011 are the following 1 – Copenhagen, 2 – Curitiba, 3 – Barcelona, 4 – Stockholm, 5 – Vancouver, 6 – Paris, 7 - San Francisco, 8 - New York, 9 – London and 10 – Tokyo.

This table (Table 10) is purely indicative since all these rankings use different criteria and in some cases, periods may also not be coincidental (Figure 25).

ICF Top7 2015	MONOCLE Top10 2015	MERCER Top10 2015	FORBES Top5 2015	Triple Pundit Top10 2011
Columbus	1 Tokyo	1 Vienna	1 Barcelona	1 Copenhagen
Arlington	2 Vienna	2 Zurich	2 New York	2 Curitiba
Ipswich	3 Berlin	3 Auckland	3 London	3 Barcelona
Mitchel	4 Melbourne	4 Munich	4 Nice	4 Stockholm
New Taipei	5 Sidney	5 Vancouver	5 Singapore	5 Vancouver
Rio de Janeiro	6 Stockholm	6 Dusseldorf		6 Paris
Surrey British	7 Vancouver	7 Frankfurt		7 San Francisco
	8 Helsinki	8 Geneva		8 New York
	9 Munich	9 Copenhagen		9 London
	10 Zurich	10 Sidney		10 Tokyo

Table 10 – Ranking comparative table

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[113] ASP - Climate energy and security, american security project, . USA: Climate Energy and Security, 2015.
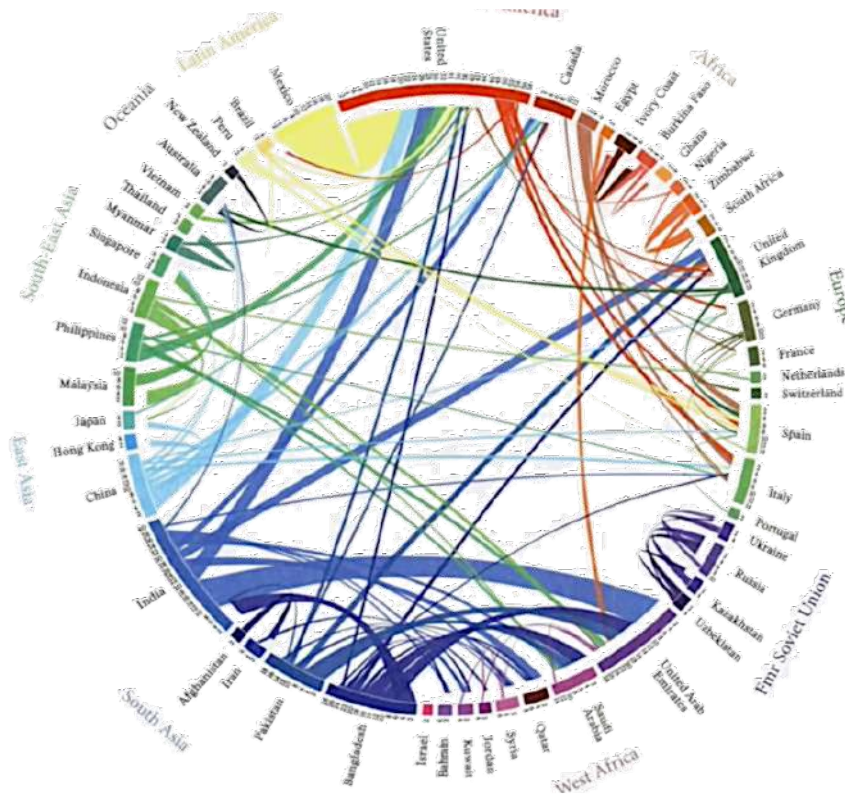
Figure 25 – Migrant people around the world
(source: knowmore.washingtonpost.com, 2015)

According to LAZAROIU (2012) rankings are analysis systems " *To enforce the development and achieve a good position, these cities have to point on identifying their strengths and chances for positioning and ensuring the comparative advantages in certain key resources, against other cities of the same level. City rankings are a tool to identify these assets.*" [114]

2.8.- Literature review

There are worldwide many organisations, think tanks, entities or even companies that study and, support this development on public knowledge. The United Nations has been very intense and, active in prowl of secure information and, scientifically demonstration for international actions into needed countries and climate serious problems.

Some important initial points focused by UN have a base on " *walkability, green areas and efficient use of energy.*" [115]   When UN-

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[114] George Cristian LAZAROIURoscia, Mariacristina - Definition methodology for the smart cities model. **Elsevier**. ISSN 03605442. Vol. 47, n.º Energy (2012), p.326-332.

[115] UN Habitat - Time to think urban 53 | 2013-2014. Nairobi, 2013.

Habitat talks about cities action in their documents, where exist emphasises concepts of more compact cities and more multifunctional but, keeping the minimum. In 2015 December 4th, UN-Habitat had launched principles guide to the Conference 'COP21' in Paris' and they highlighted the following " *In this as the world heads to a new climate agreement, parties and participants at the United Nations Climate Change Conference Cop21 in Paris highlighted the role of cities as the place where the struggle to mitigate climate change will be either won or lost. Cities play a critical role in emissions. Thus they must also become the major players in global efforts to bring down greenhouse gas emissions. With this sense of urgency, UN-Habitat launched the 'Guiding Principles for City Climate Action Planning' at the Climate Change Conference COP-21 in Paris. The publication establishes guiding principles for action planning in cities, based on international evidence and best-practices.*" [116] Into the report it is possible to understand that, at an international level or regional level, they develop a conclusion where the effect on global planning is increasingly recognising the tremendous importance and, a significant group of cities start to take climate change into action. Some mitigation and adaptation efforts are now priorities.

According to the ECE/HBP/147 document developed by UNECE (United Nations Economic Commission For Europe), WPLA (Working Party on Land Administration) and, REM (Real State Market Advisory Group) in 2010, they say that there are some principles on possible development of countries real estate sector, that can be implemented even in this New Climate Smart Cities with the addition of new actions.

The basilar information, from this document, that can be used intensely was " *The real estate sector also plays a fundamental role in the transition and consolidation of green economies, with the related generation of employment and growth...the present Policy Framework complements current efforts by authorities in the region to stem the effects of the present economic downturn.*" [117]

This list of criteria, can be helpful to improve the real estate market in a short run but, even developed a sustainable way of interventions is called green economies. Since 2008, this problem is under the table, about what are the possible problems around the world with the real state " *The Real Estate and the Financial Crisis: Causes, Effects, and Impacts on Development.*" [118]

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[116] Idem, lbid

[117] UNECE - Uce/hbp/147 doc: **UCE/HBP/147 document developed by UNECE**. WPLA (Working Party on Land Administration) and REM (Real State Market Advisory Group): United Nations Economic Commission For Europe, 2010.

[118] Paola DEDA - Note to correspondents united nations. 2008. Disponível em WWW: <UN.org>.

2.8.1- Smart Cities articles

Middle East Journal of Business, published from Dr. Bhopendra Singh, in a research about how Dubai is transforming the city into a Smart city for Expo 2020 [119] and, with a focus on three areas as smart economy, intelligent life and, smart tourism. Dubai is multiplying grow in technology with the exponential grow of the real state. Dubai has a focus at the moment on, an intense research under the city or Smart City transformation. Bhopendra describes the Smart City's model as only a combination of Smart People and an e-participation and, this connection will be resulting into a Smart environment, a Smart living, a Smart mobility and, a Smart Government that will, at the end, resulting into a Smart Economy.

Bhopendra focus of KOMNINOS (2006) about a possible naming about Smart cities a MESH where M=Mobile provided by the mobile devices, E=Efficient managing energy, water and, other supplies, S=Subtle an easy way to use to all, H=Heuristics with a continuous improvement. One of the conclusions from this author was, that Smart Cities are being conceived in general, following each nation's unique characteristics. Dubai, for example, has an objective to transform the city into ' *digital city*' or ' *wireless city*'. But Dubai, for example, has two issues as the shortage of water and, the male domination predominance and, they want to create free zone areas and, tax-free economies. Dubai has a zone called Dubai Silicon Oasis (DSO) that has, the most similar concept of what the government wants to propose for 2020.

The action plan for 2020, to Dubai, has a base fewer than six areas. The areas of electric cars to reduce the fuel consumption, the smart parking with traffic management and, public smart lighting system where is possible to control noise pollution, air quality, and traffic density. They are focused on the application of smart metering and, a smart grid to increase the use of the best-fit energy mix based on requirements. There exist a focus either on cloud computing, on building automation a direct remote control by IT and, an intelligent waste and, smart water management where can be detected the residue level, internal temperatures and, can send a wealth of information to empty. In this system, can be predicted routes for vehicles saving fuel and time. In conclusion, they are improving their system but, they didn't´t introduce a clear objective in how they will go to achieve in a direction of climate change.

[119] Bhopendra SINGH - Smart city-smart life - dubai expo 2020. **Midle East Journal of Business**. Vol. 10, n.º 4 (2015).

Poland or Polska, officially the Republic of Poland, it is introducing this smart city concept focusing at the moment in ICT integration.[120] One of the significant introductions by GONTAR (2013) a new concept of Smart Tourism, that is not integrated in smart city system definition, but in general can create benefits for residents and tourists as a global measure. (Table 11).

(¹) Note the differences in the scales employed between the two parts of the figure.
(²) 2012.
(³) Excluding nights spent in holiday and other short-stay accommodation establishments.
(⁴) 2013.
Source: Eurostat (online data code: tour_occ_ninat)
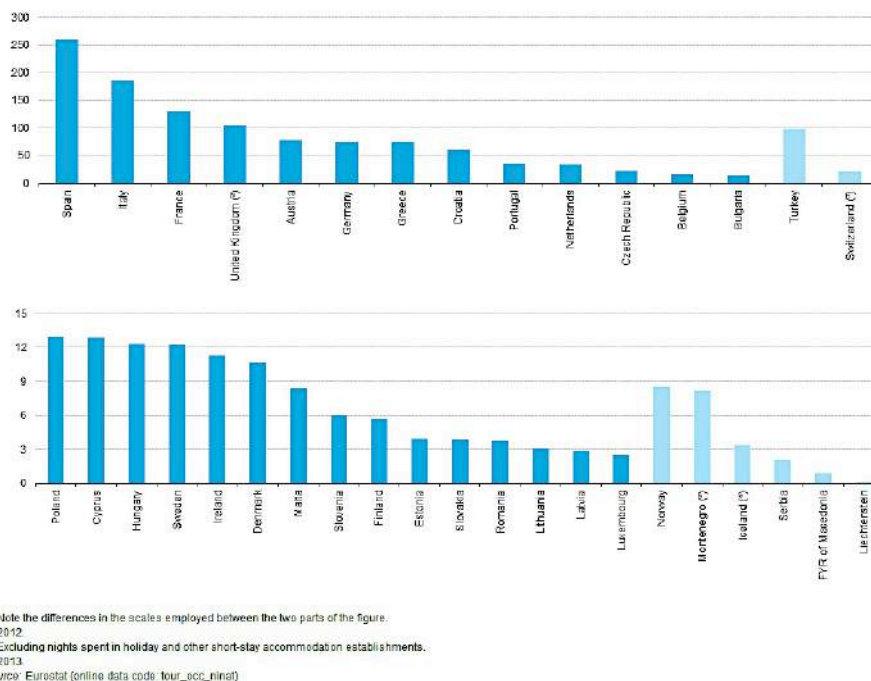
Table 11 - Tourism destinations, nights accommodations establishments, 2014 (source: Eurostat statistic, www.ec.europa.eu, 2014)

In this research, they tried developed the smart cities concepts application with a strategic approach. Even for Smart City Tourism was introduced at this scientific research a sustainable development as an improvement of the quality of life, following the limits of the environment for living style and under a technological progress investment. Companies like Accenture, Toshiba, IBM, CISCO, Siemens have products to implement around the world. In their study about Polish, Cities Bielsko-Biala, is the most advanced in the way of becoming a smart city after an analysis level.

For example, 'PURO Hotel' is the first action for Smart Tourism and, was implemented in Wroclaw the city that will be the European Capital of Culture in 2016. In this country, they are developing the e-tourism at a high level and, the three primary focuses are to make the city more

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[120] Beata GONTAR, Zbigniew Gontar, Anna Pamula - Deployment of smart city concept in poland . Selected aspects. **ORGANIZACIJU VADYBA: SISTEMINIAI TYRIMAI** ISSN 1392-1142. Vol. 67 (2013).

economically competitive, addressing to the quality of life, involving citizens.

Poland, will start finding EU funds to these new concepts and will start from the vision. LETAIFA (2015) can be revealed the Smart City model? [121] A clarification of how to design and, implement strategies for building smart cities can be seen in different ways, as was introduced before. The direct question inside this investigation is, how do cities become smart cities? And how do leaders strategise such projects? Some scientific research can answer to some of these questions.

The first part, of the scientific journal focus on three divisions explain the: Definitions of intelligent cities, Definition of smart cities and, Definition of creative cities. A smart city monitors, integrates infrastructures and organise clearly the resources. Cities like 'Singapore', 'Winnipeg' or 'New Taipei City' can be examples of this possible type of touristic Cities.

Inside the Smart Cities definition, in 'Letaifa' research, a city that focused on the six criteria's of the economy, people, governance, mobility, environment and living, combined into a smart action, it is the principal and initial measure. to insert inside a planning of a SC. There are some cities like 'London', 'Stockholm', 'Amsterdam', 'Vienna', 'Luxembourg', 'Turku', 'Eindhoven' or 'Montpellier' that are an integrant part of this group.

Creative cities need to share culture, to produce inspiration, to create knowledge and, developing 'artistic' centres. 'Montreal' and 'Berlin' are two examples of this type of cities. Through Giffinger report, from Vienna University of Technology, the six indicators are defining, the method that arrives at a possible model of a Smart City. The possible '*0*' by Letaifa research, will engage between three strategy levels, Macro, Mezzo and Micro and the strategic steps will be in combination with the approach, the multidisciplinary phase, the appropriation phase, the roadmap phase and the technology phase. The possible focus under these actions, will be under the scope, the mind-set, the agility, under accuracy and following the transformation.

The possible Smart Model, by the author, can have integration into different dimensions. They used three cities like 'Montreal', 'Stockholm', and 'London' as cases study examples for their research.

ANGELIDOU (2015) focused the research, into the smart city concept, as a conjuncture of four forces [122], the urban futures, the knowledge and,

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[121] LETAIFA

[122] Margarita ANGELIDOU - Smart cities: A conjuncture of four forces. **Elsevier** ISSN 02642751. Vol. 47, n.º Cities (2015), p.95-106.

under the innovation economy, the technology push and, the demand pull. In the urban futures, the most well known book that gives a vision of a healthy and, functional city in the industrial revolution was, in 1898, with E. Howard book. In his book was showed, the first idea of how could it be the ideal city for the industrial era. He believed that the future cities, should embrace industry and, its technological achievements. Around 1909 to 1916 speed, violence, machinery, industry, cars, airplanes and, the industrial city were representing a triumph of human over nature.

Figure 26 - Ville Contemporaine, 1922
(source: cityplanningcasestudies.tumblr.com, 2014)

For example, the Italian architect Sant'Elia, a member of the futuristic group in 1913, worked with the project called " *Città Nuova*" where he imagined an efficient city, fast-paced machine, with vast skyscrapers, multi-level traffic routes, bridges and aerial walkways.

Germany was developing, a plan that didn't promote plans for whole cities by Walter Gropius, the founder and the image of the initial Bauhaus movement said in 1923 " *we want, and an architecture adapted to our world of machinery, radios, and fast motor cars.*"[123] At that moment machinery Even Le Corbusier the modernist architect start following the tendency and, using names for his projects as '*Maison Citrohan*' (after the French Citroen automaker) or '*Plan Voisin*' (after the French aircraft manufacturing company). The '*Ville Contemporaine*' in 1922, by Corbusier

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[123] Idem, Ibid

(Figure 26) was planned, for a three million population where the city's heart was combining a group of sixty-story skyscrapers, for residential and office use, using steel and glass, the tremendous innovation at that time and, in comparison with our days 2016, this two materials almost alone create empty cities.

A valuable real time it may have been after the ending of the WWII or, Second World War, when the construction and, the future visioning were subsided and resulted in an expansion of the urban population increasing the shelter need and even proper living conditions toward, to the new cities development and suburbs, the '*New Towns*' movement. This concept started in the United Kingdom with Atkinson in 1998 and with Hall in 2002.

The movement by Angelidou, created an alternative over existing crowded and polluted cities, built with modern materials and new construction methods.

In the 1960s the urban scholars, start some speculation about the new technologies effect on cities and, players start to highlight the underlying how information can flow and at the very end would affect the environment, where some ideas were in the direction of fully mechanised cities.

Architects like Richard Meier, the 'Pritzker Architecture', awarded in 1981, or Takis Zenetos from Greece, or Marshall McLuhan USA, or Yona Friedman Hungry/France or even Ron Herron from England or some other groups supported this new tendency as Archigram from England since 1961. They were at that moment, an intense presence for that time.

Superstudio since 1966 from Italy and, Archizoom Associati from Italy either, since 1966 were, other two groups that were critical to the moment. '*Plug-in-City*', an image by Archigram or '*Walking City*' by Ron Herron in 1964, were presenting the concept of '*Electronic Urbanism*.' Angelidou, describes these images as "*a city model that embraces networked technology for social equity and creativity, in connection with the natural habit, economy of energy and time and sustainability.*" [124] Even at that moment there were communities connected in changing cities, but maybe the money factor was more intense.

Even in 1969, by Zenetos, the idea was to implement teleworking, tele services and, tele-education spaces. Can we call this a beginning of smart cities in 1969? Maybe not, but maybe a possible initiative that if needed nowadays for the current investigations.

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[124] Idem, Ibid

During the time the inter-urban information, the urban hierarchy of communications starts, creating an intense attraction, for example Richard Meier, in 1962 research about '*Communications theory of urban growth*' a study that describes the special effect between communications and, their network even the urban agglomerations.

'*Megapolis*' a concept developed by the geographer Gottman in 1961, called the concept of super-cities, where they have a result of sprawling transportation and, telecommunications systems or either the other concept that he introduced the '*Transitional Cities*' with new emerging metropolitan functions and, their impact on urban form. But in 1961 from Lewis Mumford an American historian, sociologist, philosopher of technology and, literary critic start to add some critics, to this new city concept, saying that was needed a complementary development of technology in a natural environment, to avoid the development of dark cities combining the industrial and, commercial chaos into cities.

During the 60s, 70s and 80s, the continuous evolution of the urban scale making an emergent society was creating a visionary way.

Only in the 80's 'wired cities', 'cyber cities', information cities', intelligent cities', 'digital cities' and 'virtual cities' that were day by day with transformation with ICT's. They receive the action, from the World Wide Web (WWW) in that these actions, where these influence start to be an enormous reality on population's, lives. Frances Cairncross, a journalist from " *The Economist*" shows in his book from 1997 " *The Death of Distance*" that how the world is changing, with the introduction of the WWW. With his provocative book where he argues that new communications technologies are rapidly obliterating distance, as a relevant factor in how we conduct our business and personal lives.

In 1991, another critic from Xerox Palo Alto Research Centre California Mark Weiser when he says, " *the most profound technologies were those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.*"[125]

Angelidou used a concept, which cannot be ultimately recognised by several authors because the smart cities are nowadays: the expression of " *the smart cities movement is predominantly a strategic vision for the future, rather than a reality*"[126] can have an understood as a non-existent project. The report from World Bank 2007 concluded," *Knowledge is an*

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[125] Idem, Ibid

[126] Idem, Ibid

everlasting foundation of development through the history humanity."[127]

After WWII, a new opportunity in the history emerges to implement development into cities with technology and, improving knowledge and innovation.

The trend at that time started to, in isolated locations creating non-war images sensations and Bletchley Park in 1939, in the UK probably were the first intelligent city, that have been realised with knowledge and, information flow. The central site for Britain's code-breakers during WWII and, it was ruined by the Government Code and, Cypher School (GC&CS), it regularly penetrated the secret communications of the Axis Powers, the most important the German Enigma and Lorenz ciphers. At peak 12,000 people lived and worked in Bletchley, but after the war, the existent reason behind these urban agglomerations ceased to exist, whereas sustaining them, was extremely costly, TOWNSEND (2013).

In 1995, the paradigm change and, the innovation processes started to take place locally. Places called 'learning regions,' 'regional innovations systems' or 'local innovation systems' were mostly inspired and sustained by the European Union at the time, giving priority to regional strategic innovation and technology policies.

It started to be evident that exist a strong link between knowledge management and, urban development and the cities operations can encourage education. The European Union, the World Bank, United Nations and, the Organisation for Economic Cooperation and Development, the major international organisations adopted this into their actions. Angelidou writes the following expression " *The knowledge economy played a significant role in the emergence of the idea of smart cities; it is one of the two strands of thinking that formed the current ideas about a smart city is, how it works, and what it can do.*"[128] With this statement, it is possible to intend that the environmental action, was not a priority.

The recent developments focus on wireless systems, increased performance, safety, real-time basis, big data's to identify trends and, at the moment these forces appear as two distinct effects technology push and, demand pull the tendency that is developing the existent smart cities. The existent smart cities are competing between them to attract highly mobile citizens and skilled workers, investors, tourists, and even international events.

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[127] Idem, Ibid

[128] Idem, Ibid

Angelidou developed an intense research under the area that this research was based on and, in her view, smart cities programs are under an intense implementation in hundred of cities on a global basis. In 2015 were identify 102 smart cities projects around the world with Europe leading the ranking " *Advanced technology and its large-scale deployments are no more an idea of fantasy; they are rather a reality and something achievable*"[129] says Angelidou.

At the end, cities are shifting the paradigm, and they need to create urban competitiveness, on efficiency inside the urban systems as living time, transportation time, on green development, on environmental protection on entrepreneurship and, at safety systems. Futures cities will need to be high in economic development, in investment attraction, under quality of life, in social inclusion, in notoriety and in prestige.

But the last 'trent' that is being implemented in cities, is the old time reproduction combining the recent innovations in technology and, some little examples are 'Silicon Valley East' in Asia, or 'Skolkovo Innovation City' in Russia, 'Konza Technology City' in Kenya, 'Sino-Singapore Guangzhou Knowledge City' or 'Songdo IBD' in South Korea. The last one, will be more studied at the fallowing chapters.

Angelidou, shares an important point, when she describes that the recent technological advancements have radically changed, the way that knowledge is produced and, the way that the cities are managed today.

'Barcelona', in Spain, can be a good example of toward an integrated approach 'smart city campus' where the city's vision focuses either in human capital advancement.

Another example given by Angelidou, is 'London' that is using a strategy to use a creative power, on new technologies to serve London and, improving Londoner's lives under the direction, of urban futures in climate knowledge dissemination and, cooperation with stakeholders. An integrated approach, for smart and intelligent cities in Angelidou's idea, is the combination of urban futures, knowledge and, innovation economy. The creation of physical spaces with meaning and, more functional, more integration into smart cities that result into urban citizens more informed and, networking more than ever, with the following areas of emphasis: advancement of human capital, improvement of social capital, behavioural change and human approach respecting diversity and individuality.

The last statements wherein direction of an identification of underlying principles of what is smart, into an urban context resulting into a help on

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[129] Idem, Ibid

strategic planning for the future development of smart cities.

Experts believe that " *new urban data can create more efficiency and, more enjoyable places to live*"[130] says GREGORY (2015). Most of the city governments are creating and, developing new long-range visions to projects and, making the cities better.

The new tendency is to work directly with academics, civil leaders, business and, individual citizens working together in a direction of pieces of information, about the urban systems to create benefits for all. And not as at the beginning, of the smart cities market, when the decisions were made by companies or small ' interesting' groups.

In Chicago for example, will be implemented new sensors, to get Data for Atmospheric scientists, to understand urban climate, air quality, temperature and precipitation, and for the social scientists to study the pedestrian's outs and flows. An action like this, it is to analyse, how people move inside the city or even, to the city planners being informed and, to help them making more intelligent decisions.

The Glasgow city with the project called 'Future City Glasgow' is trying to create an ecosystem of Data, says Colin Birchenall,, a technology architect that is working for this Glasgow project. One of the problems can be the privacy, but Charlie Catlett from the Argonne National Laboratory says that, the Data will be used but always protecting people's privacy even if the information is public. Anthony Townsend makes a paramount statement, a Senior Research Scientist at New York University's Rudin Centre for Transportation Policy and Management and, the author of the book called 'Smart Cities, Big Data, Civic Hackers, or even the Quest for a new Utopia' says " *You're not going to wake up one day and live in the city of the future…Cities are systems of systems. It takes a time to bring about large-scale change, but in the future, I think we will be living in the towns that fundamentally operate differently.*"[131]

The current European legislation can make the future of our smart cities FERRARA (2015). The tendency is the critical dependence green economy investment and demand, however, it is clear that at this moment that exists a lack of clear legal framework capable of the act, into a harmonious and efficient development of smart cities in Europe. With the exponential grows of renewable energy sources, the improvement on the quality of landscapes with the social and, cultural dynamic integrated with the direction of attraction of well-educated and, skilled workforce. The local law level, even if can be differentiated, will need to be in the

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[130] Gregory MONE - The new smart cities. **Communications of the ACM**. Vol. 58, n.º 7 (2015), p.20-21.

[131] A. M. TOWNSEND - Smart cities: Big data, civic hackers, and the quest for a new utopia. New York, London: 2013.

leadership of the general base and on their proposal. Rosario Ferrara, the author of the paper, ask to the European Union to start to talk with the scientific community, to develop a suitable legal framework for the European Smart Cities about the future for right decision, at European level and at National levels.

Duncan McLaren and Julian Agyeman gave another opinion from MIT, about the concept of sharing cities. They believe that future cities or as they call human cities, will need to prioritise sharing because, the people are natural sharers as said MCLAREN (2015). Probably, can be an utopian concept but in Colombia, Bogotá, the ex-mayor was intensifying the idea of saying that concept, even the rich people could ride buses, or even the Seoul's Mayor Park Won-Soon when he shares non-final versions of policy document's because of transparency. Probably be a real action, but it's not enough for a society or space where the rules will create levels of quality of living.

2.8.2- Green buildings

It is possible to create a basilar orientation for demonstrating how city's architecture can have a change according to, the real importance and, action in which the Green Architecture can produce results in the our days.

The Green Architecture has a definition as " *a philosophy of Architecture that advocates sustainable energy sources, the conservation of energy, the reuse and safety of building materials, and the siting of a building with consideration of its impact on the environment.*"[132] This line of architecture, can be used with many levels of intensity, providing, however, the need for minimal resources and enhance human satisfaction.

Of course, many important situations are infinite but, their excess may not produce the objective as a whole. Which also goes through an equilibrium solution " *Warren, Vt. — Dotty Kyle and Eric Brattstrom had an ambitious vision for the home they would build when they sold their bed-and-breakfast here seven years ago and retired...They were environmental and community advocates, so they wanted it to be as sustainable as possible — ideally net-zero, producing as much energy as it used. And because they would be living on a modest fixed income, they needed to make sure it was inexpensive to maintain...'It's clear now' he*

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[132] Wines JAMES - Green architecture,. **Encyclopedia Britannica**. (2015).

said. This was the wrong way to go." [133]

Demonstrate those populations need to be informed and, oriented to the results expecting results from the initial planning. As communication, can bring problematic situations and will act directly to the origin and under the productivity. A universal language and, indicatives signs allow to better complete results. They can demonstrate that a city is not static and that have organic elements. China, for example, starts believing that

Figure 27 – Caofeidianeco-city actual view
(source: the guardian, 2014)

buildings need only a certificate and this had resulted in a intense increase under cities density and repetitiveness without an organic range that, at the end resulted into 'ghost cities' (Figure 27).

Creative cities do not only build and, let people come in, as is done for an opening of the gates of a dam, without restrictions and laws. You should always personalised following up that is what makes cities ' *Quality Products*' or just spaces hopeless and abandoned. Some of the examples are the cities that have adopted the concept of Smart Cities and that today are ghost towns. 'As precious as gold' 'that was how then-president Hu Jintao described Caofeidian during his visit in 2006. " *It was pledged to be 'the world's first fully realised eco-city' - yet ten years and almost $100bn later, only a few thousand inhabitants have moved to this*

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[133] Sandy KEENAN - Was it too soon to be sustainable? : NYTimes.com, 2013. Disponível em WWW: <http://www.nytimes.com/2014/12/04/ garden/was-it-too-soon-to-be-sustainable.html?_r=0>.

land reclaimed from the sea." [134] Today this town, it is empty, and it one of the cities worldwide called 'deserted towns'.

Green Architecture, demonstrates that the ancient cities can develop and monitor the current spaces, without the need to be demolished. As 'Santander' for example, a port city on the Spanish coast is one of the examples below interventions of this kind with the start of systems that produce cost savings. However, it is still a further intervention in principle, to test and continually improve their applications and interventions in the territory. Knowing how people live and, how people relate to the city. Following the scientific research from YONIS (2014) Green Architecture can be completed by these criteria " *Human factors is the most important components of Green Architecture besides the main approach of energy consumption and preservation. That factors are reflected by introduce comfort and healthy spaces... the style of Green building of Japan architect Nikken Sekkei* (Figure 28)*...concepts of Japan Traditional Architecture with new technical approach... is by unit and immerge the natural element (sun light and heat-wind flow-earth temperature) as new tools in steps of design process.*" [135]

Figure 28 - Nikken Sekkei masterplan Singapore's High Line rail corridor
(source: AM2, November 2015)

The scientific research that talks about social problems on green buildings, and focused in human needs from DONG-XUE (2015) " *It is recognised that public attitudes and views towards green building may affect its application in daily lives, although studies on consumers' cognition are rarely carried out. The social problems related to green*

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[134] Gilles SABRIE - Caofeidian, the chinese eco-city that became a ghost town - in pictures. The Guardian, 2014. Disponível em WWW: <https://www.theguardian.com/cities/gallery/2014/jul/23/caofeidian-chinese-eco-city-ghost-town-in-pictures>.

[135] Ghada Mohammed YONIS - Human factors of green architecture, green building of nikken sekkei, . **Elsevier**. (2014).

building such as consumers' basic understanding, purchase intention, social and humanistic needs, public attitudes and behaviours, rebound effects and furthermore social acceptance." [136] The intense social support need to be connected with with the changes that the city suffer.

The obtained results were the following " *(i) green building's sustainable design has quite important influence over consumers' decision making process. The general public maintains a high regard for the advantages of green building, where better ventilation and lighting is a major benefit, saving energy and water are the second rated, and then land and construction material saving. (ii) Although the general public is not being familiar with the concept of green building, the majority of participants would pay more for green buildings over the standard building when they know the environmental impacts of them. (iii) Green building should not only be limited to energy performance- oriented, but also be user-oriented, the social and humanistic needs model is thus well established based on Maslow's Hierarchy of Needs."* [137] The Green Buildings tendency need to connect actions and, some of the knowledge about this type of interventions need to be part of the daily routine of everyone if, the objective is to implement the concept.

In most direct and practical investigation COLTON (2015) developed an experience for getting health results " *We examined associations of several health outcomes with green and conventional low-income housing, where the prevalence of morbidities and environmental pollutants is elevated...We used questionnaires and a visual inspection to compare sick building syndrome (SBS) symptoms and asthma-related morbidity among residents in multifamily units in Boston, Massachusetts, between March 2012 and May 2013. Follow-up was approximately 1 year later. Adults living in green units reported 1.35 (95% confidence interval [CI] = 0.66, 2.05) fewer SBS symptoms than those living in conventional (control) homes (P < .001). Furthermore, asthmatic children living in green homes experienced substantially lower risk of asthma symptoms (odds ratio [OR] = 0.34; 95% CI=0.12, 1.00), asthma attacks (OR=0.31; 95% CI=0.11, 0.88), hospital visits (OR = 0.24; 95% CI = 0.06, 0.88), and asthma-related school absences (OR = 0.21; 95% CI = 0.06, 0.74) than children living in conventional public housing"* [138] Under the general concept, Medicine can be supported to the new tendency. More healthy buildings and, more

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[136] Zhao DONG-XUE, Bao-Jiea, Johnson, Christineb Mou and Benc – Social problems of green buildings: From the humanistic needs to socil acceptance. Ibid.Vol. 51, n.º Renewable and Sustainable Energy Reviews (2015), p.1594-1609.

[137] Idem, Ibid

[138] Meryl D. COLTON, MS, Jose Guillermo Cedeno Laurent, ScD, Piers MacNaughton, MS, John Kane, MPP, Mae Bennett-Fripp, BA, John Spengler, PhD, and Gary Adamkiewicz, PhD, MPH – Health benefits of green public housing associations with asthma morbidity and building-related symptoms. **American Journal of Public Health**. Vol. 105, nr 12 (2015), p.2482-2490.

healthy apartment or even spaces, will decrease some of the diseases that exist nowadays. The combination between these two areas can create an intense benefit under people's quality of life.

One good example, built in Europe, Italy, Milan, is 'Bosco Verticale', that combines an intense urban and fashionable city with a special environment with gardens and fresh air inside a building, and thus transforming the paradigm of high rise living (Figure 29).

Figure 29 – Bosco Verticale, Milano ,Italy
(source: gatherliver.com, 2014)

The conclusion on the research said that " *Participants living in green homes had improved health out-comes, which remained consistent over the study period. Green housing may provide a significant value in resource-poor settings where green construction or renovation could simultaneously reduce harmful indoor exposures, promote resident health, and reduce operational costs.*"[139] The investment under Green spaces and Green Architecture create benefits under the climate action and for example, if an architect is contracted to transform an old hotel, he will need to be focused under a new green facade to create benefits under the air that circulates, under the interiors, in how people feel good living with nature and, in more technical focus, that building will need to reduce the water and energy consumptions and will have benefits from the facade to the thermic action into this new green paradigm.

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[139] Idem, Ibid

Chatting by	Entering and Leaving	Walking alongside
Standing alongside	Taking a breakday	Standing in doorways
Shopping next to	Interacting with	Looking at displays
Sitting on	Sitting next to	Looking in and out to

Figure 30 - Example of actions in a street
(source: Cities for People the where building meet the city, by Jan Gehl pag-7, 4)

Jan Gehl an architect, urban planner and professor, who dedicated his life to research on the quality of life, within the Urban pedestrian traffic and bike paths (Figure 30). It intensifies that cities are no doubt, to the people and, for the people, in his book 'Cities for People' where he describes what the architect Richard Rogers taught him " *Cities are the places where people meet to exchange ideas, trade, or simply relax and enjoy themselves...The compact city - with development grouped around public transport, walking, and cycling - is the only environmentally sustainable form of a city. However, for population densities...a city must increase the quantity and quality of well-planned beautiful spaces that are human in scale, sustainable, healthy, safe, and lively...Cities...they provide the*

structure that enables cities to come to life, and to encourage and accommodate diverse activities, from the quiet and contemplative to the noisy and busy. A human city creates pleasure for visitors and passers-by, as well as for those who live, work, and play there every day...As Jan says: 'We shape cities, and they shape us.' " [140] (Figure 31).

Figure 31 – Quai Brandly museum
(source: ecoprojects.blogspot.com, 2015)

2.9. – Summary

Polluted cities are nowadays and, it is expected to our next future more inhabitants into cities, and most of them will be located intensely in Asia, where the urban planning is changing at high speed, and it is creating empty spaces unliveable cities.

Some cities from Canada or, cities from the Northern Europe are the ones chosen in the last years, some of the most liveable places. These

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[140] GEHL

towns are calm and fresh areas but, most of them are old cities and not built from scratch.

The places called Smart Cities are using the six criteria to determine actions and future propose. The Green building certification followed specific rules not caring about the entire combination in a city, without caring about the rest of the quarters and, some buildings are alone and, were not built to be an integrant part of the city.

Smart cities presently show different definitions, but these areas are a real combination of bright spaces and technologies. The first existence of Smart Cities developed technological areas in the direction of robotic cities. The next future and even today, citizen's search for something more detailed and, more combined with the climate change requirements. Architecture can decide and make changes, inside the new possible type of cities the Climate Smart Cities, using new concepts and definitions that were implemented before into old studies and understanding that architecture is for people and not for the show.

Kevin Lynch and, his urbanist principles are basilar, to the creation of this new Climate Smart Cities. His introductory study increases the quality into the projects and, insert sustainability.

The diversification of building's certification around the world, are creating individual semi-systems inside cities. Future is asking for an entire city certification, where everyone will be responsible for improvements and validation.

The new certification can result in different tourist routes, all over the world. The climate change action had started since the 90s. The severe problems around the world, the overpopulation, the gas emissions, the rising temperature, the melting polar ice, the biodiversity and other are increasing exponentially, and cities are responsible for that at a high temperature.

India and China are focusing on changing, and they are developing different markets in climate change with different qualities and distinct quantity.

President Obama from the USA, focused directly on climate actions during his presidency. For him the work into climate change it is not fast enough yet. For him, all the countries are responsible and need to participate in this fight.

Type 1 Smart cities like: 'Songdo' in South Korea, 'Masdar' in Abu Dhabi, 'Lavasa' in India, 'New Cairo' in Egypt, 'Canberra' in Australia, 'Islamabad' in Pakistan, 'Naypyidow' in Myanmar, 'Astana' in Kazakhstan

are examples of cities, developed from the scratch and, they are the top new cities under development. Other examples are Huambo, called before 'Nova Lisboa' in Angola or even Washington.

Each of them presents different project proposals but, they pass through the intense development and the reduced development, sometime during their growth.

Type 2 Smart cities are a powerful group of spaces, called old or existent cities. These cities had grown through an organic development worldwide.

Canada presents the top high of these type of cities nowadays, starting with 'Vancouver' that passes for an intense and, progressive development in the direction of a smart action. Rio de Janeiro, another example following the same criteria, had prepared and transformed, for important events worldwide and developed internally.

Entities and organisations like Un Habitat, New Cities Foundation, gef, World Bank, WRI or Green Climate Fund are some on the list that works daily for improvement into climate change actions and, on cities improvements.

China tried to change in a new direction, and they are improving even their knowledge. The example of empty cities was the basilar fact of their change.

The UN continues to try to improve worldwide developing new solutions and new applications to our world and, to our cities. Today it is possible to look into different solutions worldwide and, they are creating new attitudes and better materials to our direct needs.

When the area is certification on buildings, the world presents many distinct solutions that with an implementation by governments or countries or even some new certifications.

The Top ranking had chosen, in some different countries, but rapidly they can change if directly some others improve in their actions.

In general, everything had started with some influence from the last architect's generation; they launch the control for what we have today. Empty cities are something that everyone is working on to change, and the green architecture control starts their presence and will be to stay in our minds, labor, and knowledge to improve our lives.

Chapter III | Methodology

3.1 - Introductory elements

T HIS CHAPTER DESCRIBES THE METHODOLOGICAL aspects of the research and, the explanation of the process. Presents a detailed methodological approach that has been adopted. A strategy, was developed to inquiry with a methodological design of the different phases under the research development. With a base on the research question and, the constant review of relevant research and theories, the research methodology was developed based on different types of issues and propositions with the suitable strategy and methods, to achieve the objectives.

Regarding the qualitative analysis, this research used from open interviews to observation techniques. The definition of Climate Smart Cities is based, on the collection of discourses well with meanings of cuteness and ideologies.

When this research introduces quantitative research elements, that will confirm or intensify the qualitative studies, it presents the results in statistical terms of the questionnaires in Songdo population and, through the matrix that allows to identify the possible level of CSC of each city, in order to be able to promote improvements.The data collection was based under scientific papers primarily, because these type of knowledge, nowadays is much more updated into easy where international document and technology are more faster than some developed thesis.

Under the case studies strategy, the three cities were different in certain levels but together they create a type of knowledge needed to the generic possible existent cities worldwide. The research had presented visits directly to the study cases and, were developed interviews directly with the specialists that were living in the cities or were integrant part on city projects. Living, working and studying directly the case studies between Portugal, South Korea and Belarus was a personal decision and, a personal action chosen to develop this research.

The created model called Matrix, combines different actions with different proportions that, together and applied under different cities, produce clearly some conclusions and recommendations for the future. The used sources, were basically the direct analysis under the territory and, the international organisations where they act worldwide in different places and even them with different sources. The international scientific knowledge under use architecture, engineering, sociology, green spaces and technological systems to improve their actions in the world.

3.2 – Qualitative & Quantitative research methodology

To construct the investigation model, was developed a strategy based on cases studies using a Qualitative approach and according to FELLOWS (1997:99) the word " *qualitative is used to describe research, which emerges from observation of participants.* " [141]

The Qualitative research methodology builds the theory, test and validates hypotheses and, can illustrate the validity.

In Qualitative research, the interest is to understand the individuals meanings construct, ie, how they make sense of their world and, the experiences they have in him. It also assumes that the meaning is embedded in the experiences of individuals and, that this average meaning through their own perceptions of the researcher. Moreover, this approach follows a strategy of primarily inductive research, so the product is richly descriptive study. In Qualitative research the researcher is the main instrument in the collection and, analysis of data MERRIAM (1998).

After all the combination and research of the data information, about Smart Cities, was used a system to develop the method. With three case studies, was used a table/matrix to analyse similarities. Two of them in the East Asia, South Korea and, other one in Mongolia and the last one in Eastern Europe, Belarus one influenced country by the Soviet Union. The data triangulation in each case study, with unobtrusive methods, documents and direct observation, was used as an important feature to assist data validation.

As pointed out by POLKINGHORNE (1983) [142] and, quoted by RUDESTAM (1992) " *Qualitative methods are especially useful in the generation of categories for understanding human phenomena and the investigation of the interpretation and meaning that people give to events they experience.*" [143]

For the validity, the rules achieved, are illustrated with cases studies, to understand the validity of the set of criteria proposed. Some points were determined in the base of the research and, boosters for scientific importance as looking to Architecture trends of the past ten years. During this time, spaces were created, where the main ideology is the

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[141] R & Liu FELLOWS, A., – Research methods for construction. 1997.

[142] Donald POLKINGHORNE – Methodology for the human sciences: Systems of inquiry,. USA: State University of N.Y. press, 1983.

[143] K. E. & Newton RUDESTAM, R. R., – Surviving your dissertation. 1992.

sustainable energy or even the characterisation of the state of the art identifying a steady overall improvement concerning actions by associations, companies, governments and people who are increasingly looking to improve their application.

The general information or, even the current speed of information will have a need to an integrant part of information, to citizens from smart cities. This type of architecture and city, is an explicit imposition, of the client, where the user then can totally transform a proposal.

To use the Quantitative research, was implemented a systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques. That was developed under a Matrix.

" *Quantitative research is often contrasted with qualitative research, which is the examination, analysis and interpretation of observations for the purpose of discovering underlying meanings and patterns of relationships, including classifications of types of phenomena and entities, in a manner that does not involve mathematical models.*"[144]

The quantitative methods are an integral component of five angles of analysis, promoted by the data percolation methodology MESLY (2015) which, includes qualitative methods, literature reviews, even considering the academic ones, interviews with specialists and, often the computational simulation, forming an extension of Triangulation of data that provide results.

The use of empirical relationships or, even associations using a general linear model form or, even with the construction of a nonlinear model or using factorial analysis.

A fundamental tenet of quantitative research is that correlation does not imply causality, although some scholars, such as Clive Granger, British econometrician a awarded the Nobel Memorial Prize in Economic Sciences, suggest that many correlations, may indicate a degree of causality GRANGER (1969).

This principle stems, from the fact that it is always possible to have a spurious relation, to variables among which covariance is found to some degree. Associations can have an examination between any combination of continuous and, categorical variables using statistical methods.

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[144] Massachusetts Institute of Technology – Gateway to the profession of planning: **11.201**. MIT, 2010.

3.3 – Data Collection

All the data collection for this research, were analysed and used in the creation of the model that has a base in ' a set of criteria for Climate Smart Cities'. The research was carried out in nine steps, described in four stages of data, as an initial data collection, with state of background information, a main data collection, a model creation, a summary and conclusions.

The initial exercise of collecting background information, enabled the authenticity in CSC problem, to be defined and, operationalised for research investigation. It also enabled the data needs to be identified. The result of this exercise is reported mainly in chapter II and, to some extent expanded upon in chapters III and IV. The main aim of the data collection exercise, was to satisfy the needs identified in the last section. This means that the object of this stage of the research, was to obtain a list of qualities 'parameters', which evidences the set of criteria to CSC. A further aim was to produce a list of qualities that achieves easily the objectives in order to be excluded.

As mentioned previously, two main data collection were employed in obtaining the data to satisfy the research needs: secondary data search followed and, augmented by collection of primary data.

The secondary data search, was carried out to produce an initial list of qualities and, their categories and sub-categories of the nature described above.The effort was concentrated, under the following areas to generate these data: The use of documentary research, based in the most relevant research and theories carried out by gef, Green Climate Fund from UNFCCC, The World Bank, The World Resources Institute, ICLEI local governments for Sustainability, UCLG United Cities and Local Governments, UNEP, Cities Alliance, UNISDR, Urban Climate Change Research Network, giz, Cities Footprint, Carbon Trust, and UN-Habitat.

The secondary data search described above, provided information on the parameters of authenticity criteria for CSC, in which were tested in the primary research developed by participant observation. The primary data collection was achieved through participant observation, in each of the three worldwide case studies. The justification for this strategy and method, was described in the beginning of this chapter. The objective of the primary data (produced by direct observation) was to validate the data produced by documentary research by triangulation. The primary research yielded a list of parameters, which formed the bases of the model (a set of criteria for CSC).

3.4 – Case studies strategy

According to YIN (1984) , case studies are the preferred strategy when " *how*" or " *why*"[145] questions that are being posed, when the investigator has little control over events and, when the focus is on a contemporary phenomenon within some real-life context.

A case study has been defined as: " *an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between the phenomenon and context are not clearly evident and in which multiple sources of evidence are used.*"[146] It is the relevance of the context and the great number and richness of its variables that leads the author to qualitative paradigm.

As stated earlier, the author selected case study strategies in order to build the theory to test and validate the observations, which was applied.

As stated by CACIOPPO (2002:124) " *the phenomena of concern in the case studies*"[147] are the occurrence and incidence of variations. To analyse the source, cause or effects of a variation outside of the context of the project would be meaningless.

The importance of this phenomenon, in association with its novelty and, the lack of reviews done in around the world and, more directly in Asian case studies, raises many questions, which the researcher hopes this investigation will bring about many answers.

As stated by DENSCOMBE (1998) many of the features associated with the case study " *can be found elsewhere and are not necessarily unique to this strategy*"[148] . Each strategy is a different way of collecting and analysing empirical evidence YIN (1989). Each has its own advantages and disadvantages.

The advantages of the case study approach are the dealing with the subtleties and intricacies of complex social situations, the possibilities that is allowed with a use of multiple methods, the opportunity to adopt multiple sources of data that facilitates data validation through triangulation. Another advantage is a non-pressure on researcher to impose controls and a concentration of efforts on one research site or

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[145] R. K. YIN - Case study research: Design and methods. London: 1984.

[146] Idem, Ibid

[147] Jonh T. CACIOPPO - Foundations in social neuroscience. Cambridge: The MIT press, 2002.

[148] M. DENSCOMBE - The good research guide for small-scale social research projects. 1998.

just a few sites.

The disadvantages were taken into consideration of the case study approach referred to by DENSCOMBE (1998) summarised with credibility of generalisations, with a perceived as producing soft data, with the difficulty in defining boundaries with the difficulty in negotiating the access and the observation effect on the studied case.

The investigation purpose cases studies strategy to build the theory, based on the type of question being asked: "*What are the parameters of criteria's for...*" [149] Climate Smart Cities?

This type of question is exploratory and the case study could be used amongst others. It is selected because of the relevant characteristics summarised from DENSCOMBE (1998:125) as a " *spotlight on one instance, an in-depth study, a focus on relationships and processes, and natural setting.*" [150]

The three study cases present their own differences. The selection of Songdo was due to the implementation and, definition of the first Smart City worldwide. Songdo, was chosen as a city designed from scratch and the first one that introduce the new concepts of Smart Cities and Technology systems. Being at the time, a city still to be studied in Europe, the idea of these place being a portray of new tendencies and possible solutions adapt to the new cities transformations.

The city of Minsk has been one of the chosen ones due to the development of the last years to be so restricted and so closed to the world what maintains a very original trait of what a city can present, and the challenge was to put under an analysis of intervention of a City like this, in how can be transformed directly into an intelligent and green city, not through the current state of development of many world cities. Thus, this one was characterised by a city of type 2, however, with some incidences of type 1 like, almost a city constructed of root but maintaining always the intense existent Soviet culture.

In the case of the City of Ulaanbaatar, an existing city characterised as type 2, it would become an already very developed city, with a very intense occupation and, a state of very high pollution where the possible actions were designated almost from the root to be able to obtain effective results. The intense Asiatic culture it change the actions and the possible interventions.

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[149] Idem, Ibid

[150] Idem, Ibid

Thus, the chosen cities followed an organisation and a determined definition of new cities (Songdo), cities in the beginning of development (Minsk) and cities in excess of pollution and housing number.

Country	Area	Population	Growth Rate	Rank	CAPITAL		
					Nome	rea	Population
Belarus	207 600 Km2	9,458,425	−0.31%	92	**Minsk**	**348,84 Km2**	**1,742,124**
Cameron	475 442 Km2	24,517,077	2.41%	54	Yaoundé	180 Km2	2,440,462
Hong Kong	1 104 Km2	7,403,093	0.72%	103	City of Victória		2,019,533
Japan	377 930 Km2	126,044,628	−0.24%	11	Tokyo	2 187 Km2	8,336,599
Mongolia	1566 000 Km2	3,052,109	1.42%	137	**Ulaanbaatar**	**4704 Km2**	**1,372.000**
Portugal	92 090 Km2	10,264,433	−0.35%	88	Lisboa	100 Km2	517,802
South Korea	100 210 Km2	50,707,105	0.38%	27	Seoul	605 Km2	10,349,312
South Korea	100 210 Km2	50,707,105	0.38%	27	**Songdo**	**17.7 Km2**	**40,000**

Figure 32 – World Population Review
(source: worldpopulationreview.com 2016)

According to the case studies, it was verified the various territories in population terms and using the factor dimension of territory and, population in terms of country, in terms of growth rate, and emphasising at the micro level identifying different cities by form to make their intervention more understandable, using other possible examples of cities worldwide.

We focused on the three case studies, perceiving their dimensions comparing with other territories with some similar elements and, identified the need for each intervention or project in detail to analyse it will have to be done introducing these factors. In case of simple application of this set of criteria from the new Climate Smart Cities, this data will not be contemplated.

So, only in the future, when developing projects, is the size or number of the population in each city, a factor that facilitates or hinders the implementation of an adapted Climate Smart City project.

3.5 – Visits and interviews

The visits were developed under a detailed planning and following a list of the best entities connected with the cities from the cases studies. The interviews were created following, a research base with questions connected with peoples needs and, following a criteria of new areas as construction from the scratch.

The two interviewers were chosen following the principle of a local being born in the country and the city, and conquer all the development and culture and the other, being foreign and being able to perceive the changes and follow the development of the town having another culture and Other personal identification. One of them being an architect and knowing the principles and the rules and having been part of the project and being local and another engineer being foreign but having also followed the project. A teacher was chosen to be more aligned to the study and to have looked to the development of the city in an independent prism and to be able to make a judgment of general population sense. The interviews were not developed in the other cities because they are existing and not built from scratch where problems are already known and have already been studied. This research defined as not being important to add elements already of existing studies, put more in evidence what was finished as constructed from the root from where it could withdraw more and different results.

A visit to several sites chosen as a case study provides a very wide range of information for research. In 'Ulaanbaatar', case study space has been investigated in detail with the national team, and intervention proposals were found financed by international organisations. In the case of Minsk entire survey, was done directly on site, with experts and citizens. In the case of Songdo research was direct with experiences in place for two years interviewing experts who built the city and, the own inhabitants, who presented the own opinion and helped in the investigation.

To support this research study, about Mongolian city Ulaanbaatar, specialists from UN Green Climate Fund like 'Hela Cheikhrouhou' the executive director of the International Fund, 'Youssef Arfaoui' specialist engineer from Tunisia a consultant at mitigation and adaptation, 'David Craig' a sustainable energy specialist consultant from New Zeeland, 'Demetrio Innocenti' a UNDP risk specialist consultant from Italy, 'Cliff Polycarp' a country programming specialist from India, 'Ousseynou Nakhooda' a specialist from World Bank and 'Tao Wang' an expert in mitigation and adaptation from China, were instrumental under solutions in this research, under the development and for the conclusions.

3.6 – The research strategy

During the research was used the qualitative and quantitative analysis based on documents and observation, to build and validate this theory, and finally, the case studies to illustrate the criteria achieved was crucial.

The boundaries of the research were the smart cities concepts, with their new technologies and the existent cities or old cities with their possible concepts of new green development.

Since this topic was great and multidisciplinary touching on several study areas, the data collection process began from the initial stage under investigation in January 2014. Different entities had a consultation were consulted, and there was a direct observation. An on-site case study to perceive better the subject of research and not just getting information through scientific papers since 2013 in South Korea, the study and research with government support from Ulaanbaatar from Mongolia and, the final part, directly in Minsk in Belarus.

In addition to all the information, INHA University, a Korean University was consulted with the Lisbon Faculty of Architecture with an MOU Agreement to increase the quality of the research. The action was follow-up by the Korean specialist, Doctor Professor Han, the architecture department dean from INHA who accompanied the investigation in 2014 directly in Incheon and Songdo, providing visits to Korean buildings under construction in progress, meetings with experts, guiding and introducing elements that contributed to the research development.

Over the research, was needed to reside between South Korea, Songdo International City, and Lisbon to develop the investigation directly in place. Between January and July of 2014 were carried out interviews with organisations and experts and, were also released researchers in several Korean universities and schools to get direct information or results from the city developed from the scratch. Since September 2014 to November 2014 the research was developed in Lisbon with a supportive team from the Ph.D. in Architecture at Lisbon Faculty of Architecture.

In late December 2014 and early 2015, it was closed the organisational structure of the research topics and has started the process of development and design the possible theoretical research model. Between the beginning of February 2015 and July 2015 with a partnership with Green Climate Fund from UNFCCC directly in South Korea, was possible to detail and investigate more about Climate Smart Cities. Using the development method and, with the data analysis, the results start transforming the study. This new action with the international

organisation from UNFCCC began by evolving on overall presentations of basic concepts, were sounded out experts, who identified flaws and benefits and, at the end had result into the first pre-conclusions of the research. The second part of 2015, was developed in Lisbon, understanding the new action and technologies that Europe was implementing in Portugal or, the rest of Europe. At the end of 2015, the research was moved to a new territory called Minsk in Belarus, was until June 2016 was determined and analysed the third case study that presented complete different influences, from the other case studies. The first printed document had delivery in April 2016, and according to with University process the analyse was in February 2017. The final analysis was in July 2017, and September 2017 was the dead line.

3.6.1 – Research design definition

According to YIN (1989), a research design is an action plan for getting from here to there, where " here" may be defined as the initial set of questions to be answered, and " there" is some set of conclusions (answers) about those issues. Between " here" and " there" may be found some significant steps, including the collection and analysis of relevant data.

3.6.2 - The Research design components

As referred by YIN (1989), for the development of case studies, five components of a research design are especially important the studies question, its propositions, if any, its unit(s) of analysis, a logic linking the data to the propositions, and criteria for interpreting the findings.

As YIN (1989) referred, the case study strategy is most likely to be appropriate for "*how*" and "*why*" questions. According to him, the initial author task was to clarify precisely the nature of the study questions. In this study, the questions were, if, these new smart cities or smart cities adapted to take into account the concepts of Green Architecture? There are two concepts, one is Green Architecture, and the other is Sustainability can these may be an antithesis when we talk about quality versus costs? Is it possible to create a 100% sustainable city? Can cities defined as smart cities of our days, in the current format, are entirely beneficial to humans? Or, how does the architectural factor can improve these cities? Or even, which strategies and procedures can be employed to obtain the necessary information?

These are some of the questions that were discussed during the process.

As YIN (1989) points out, the " *how*" and " *why*" questions do not indicate what to should study. " *Only if you are forced to state some propositions are you beginning to move in the right direction.*" [151]

According to YIN (1989), the third component is related to the " *fundamental problem of defining what the 'case' is.*" [152] Propositions would still be needed to help identify, the relevant information about these cases. YIN (1989), stated " *Without such propositions, an investigator might be tempted to collect, everything, which is impossible to do.*" [153]

As a general guide YIN (1989) referred, that the definition of the unit of analysis is related to " *the way in which the initial research questions have been defined.*" [154] Once, the general definition of the research, has been established, other clarifications in the unit of analysis become important.

Finally, YIN (1989) referred that, for almost any topic, that might be chosen, specific time boundaries are needed to define the beginning and end of the case. He referred that "*All of these types of questions need to be considered and answered to define the unit of analysis and thereby to determine the limits of the data collection and analysis.*" [155]

The fourth component goes to connect, with the linking data to propositions where according YIN (1989), one promising approach for case studies, is the idea of " *pattern-matching*" [156] described by CAMPBELL (1975:178) " *whereby several pieces of information from the same case may be related to some theoretical proposition.*" [157]

As a fifth criteria, for interpreting a study's findings, and currently, stated YIN (1989), there is no precise way of setting the criteria for interpreting these types of findings. According to him: " *One hopes that the different patterns are sufficiently contrasting so that the findings can be interpreted in terms of comparing at least two rival proposition*s." [158]

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[151] R. K. YIN – Applications of case study research. London: Sage Publications: 1989.

[152] Idem, Ibid

[153] Idem, Ibid

[154] Idem, Ibid

[155] Idem, Ibid

[156] Idem, Ibid

[157] CAMPBELL, D.T. (1975). Degrees of freedom and the case study. Comparative Political Studies, 8 (July). Pp. 178-193.

[158] Idem, Ibid

3.6.3 – Research process

According to 'Research Design' (Table 12), the investigation was structured using the following organisation. Throughout the study a panel of experts advises with constant feedback about the scientific area with the use and support of relevant literature.
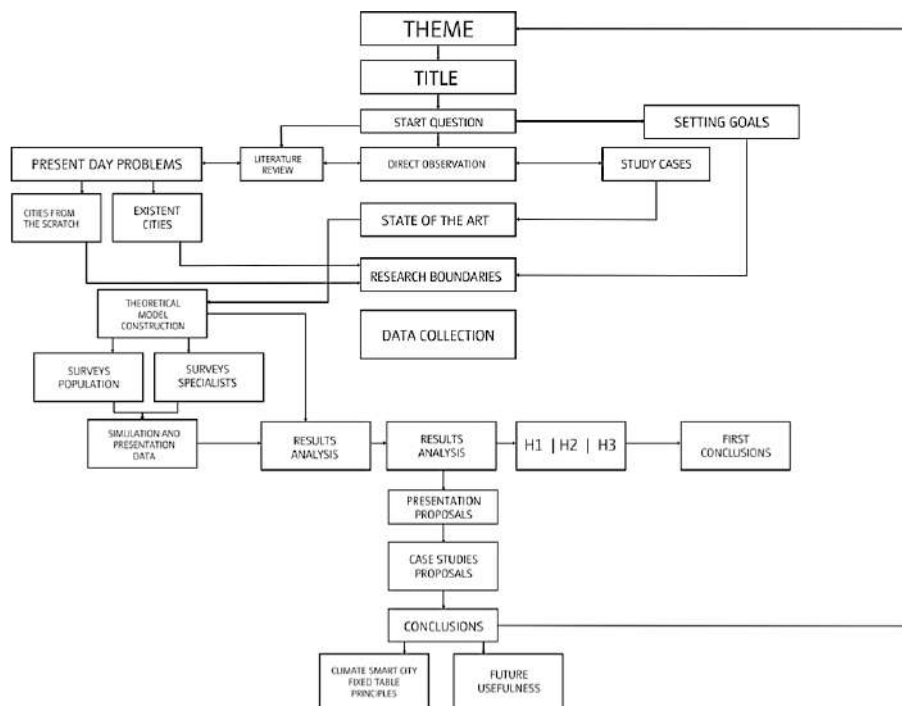
Table 12 - Research Design process

| **Step 1 – Initial Data collection** |
| **Step 2 – Key questions –** Smart Cities concepts |
| **Step 3 – Case Studies research** |
| **Step 4 – Direct analysis and** |
| **Step 5 – Develop method** |
| **Step 6 – Case Study comparative** |
| **Step 7 – Set of Criteria** |
| **Step 8 – Final Results** |
| **Step 9 – Recommendations for Future CLIMATE** |
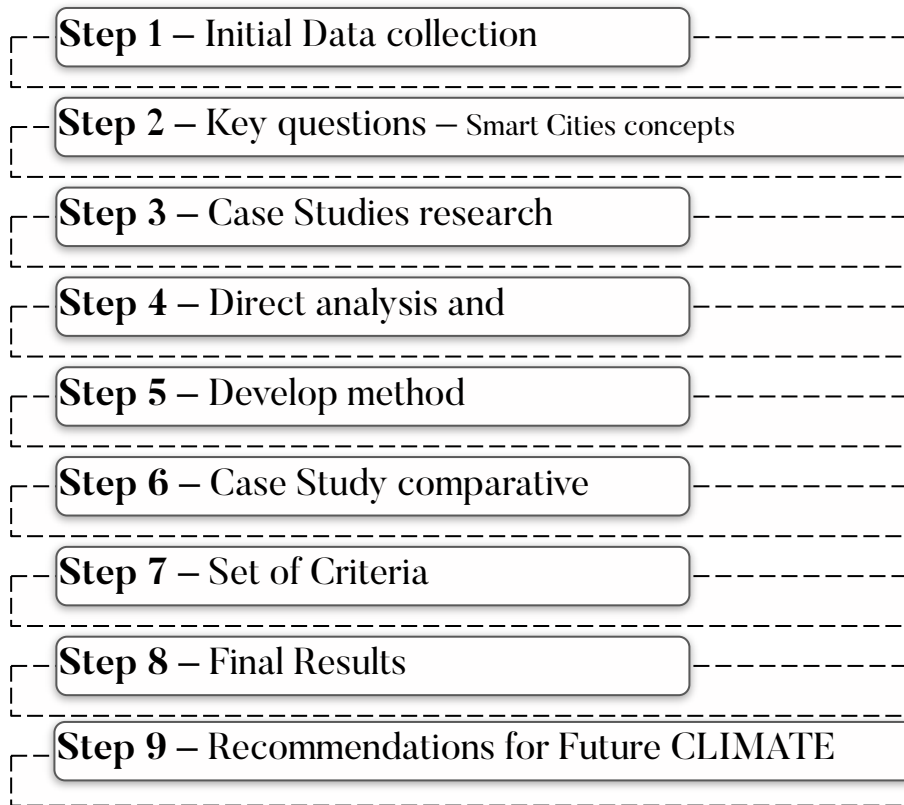
Table 13 - Research design steps

Step 1: From the initial literature survey, about type 1 smart cities, from the scratch and type 2 smart cities in existent cities worldwide. The literature survey about green architecture was used, the urban sustainable design focuses mainly on the relevant research and, conventions produced by International Organisations.

Step 2: Key questions about criteria's were developed and, six propositions were used based on the Smart Cities Ranking of European medium-sized cities experience:

| Smart Economy | Smart People | Smart Governance | Smart Mobility | Smart Environment | Smart Living |

Step 3: Based on suitability, of the type of key questions and, the objectives of research, the investigation selected the case study strategy to built the theory, in order to frame case studies. Different propositions about green, smart and sustainable criteria that were used in three cities:

· Ulaanbaatar;

· Songdo & Minsk.

Step 4: The direct analysis on places, determine practices and cultural actions into the territory. Direct interviews play an important role under the investigations determines social phenomenon, studying through classification and comparison. Was used to gain consensus, among forty-five inhabitants and experts in 'Songdo' South Korea. After reconsidering the allocations of existent building criteria and weighting the reasons for change, the aim of the second round connected with 'Ulaanbaatar' was to create a consensus about the definition of each parameter into the different project proposals.

Step 5: In order to test the criteria, a matrix with SC criteria and another one with CSC criteria was used to identify a consensus view, about the evidence on urban and green criteria and, to attempt, to identify the hierarchy in order to allocate their importance at international levels.

Step 6: The Matrix application can be repeated indefinitely, the greater number of rounds, the nearer, the group should come to a consensus. A new process of check and validation into the method, but according to HARMANTHY (1982) [159] it is difficult to have a full consensus between panellists. The results are organised international level, and each of them by professional subgroups that replicated or non-replicated into new process of check and validation into the method.

Step 7: Based on the set of criteria agreed under the matrix application, the investigation examined diverse existent cases.

Step 8: A new type of city, called Climate Smart City, will be one of the future supports into urban and architectural design proposals.

Step 9: Finally, the author has the possibility to summarise the findings, conclusions and limitations of this research in order to contribute to further research.

Each earlier stage, provided information for the next step. The activities that were carried out in each step are described first, followed by the detailed presentation of the data collection procedures.

3.7 – Model creation | Matrix

After obtaining the list of the parameters (qualities) of the Set of Criteria and, their indicating categories and sub-categories, the model building proper began. The first step taken was to structure these objectives and,

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[159] T. Z. HARMANTHY - The delphi method Complement to Research Fire and Materials, 1982.

variables by exploring relationships based on factual knowledge. This involved establishing and examining the dependencies, between related variables.

At the end of the structuring exercise, the final list of lower-level variables, on which the model is to be based was obtained. The resulting model was then, inspected to ensure that it performed as intended. These checks included the following:

1. Checking the propositions (qualities) made in building the model for their logic;

2. Checking the categories and sub-categories that were established, between related variables for their effects;

3. Checking the performance of the overall model, by testing it on a case study. This action was made in an model application into all case studies in order to validate and illustrate.

4. This matrix is independent of the size and population of the city to be evaluated, and these factors are present in the respective evaluation, which may make use, if necessary, of several statistical elements.

3.8 – Sources

The methods used, as the source of evidence in the case studies, are documents and participant observation expressed, by the photos and pictures that accompanied the text. The method used to test and validate the criteria it is the Matrix. The researcher took into consideration, the characteristics, advantages and disadvantages of each of the methods, in order to strengthen the research.

The document, as a source of evidence for case studies, has the advantages and disadvantages as follows:

The advantages of documentary research as quoted from DENSCOMBE (1998:125) are the following "*access to data is relatively easy and inexpensive;*" and "*cost-effective method of getting data permanence and availability;*" [160]

According to DENSCOMBE (1998:125), the disadvantages of the documentary research method as quoted are " *credibility of the source*" , " *secondary data*" and " *social constructions*" [161]

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[160] DENSCOMBE

[161] Idem, Ibid

The participant observation, as a research method, has the following advantages and disadvantages. The advantages of participant observation as quoted from DENSCOMBE (1998:125) can be described by the following indicators " *Basic equipment (the researcher itself); Non-interference (naturalness of the setting); Rich insights (complex realities); Ecological validity (context sensitive); Holistic (relationships between various factors); Subjects point of view (getting at actors meanings); Access (limited options); Commitment (demanding method); Danger (hazardous for the researcher); Reliability is open to doubt. Difficulty on study repetition; Representativeness of the data. Difficult to generalise from the findings;* " and, "*deception (ethical problems).* " [162]

According to MARSHALL (1989) " *The fundamental methods used in a qualitative research process, for gathering information, are (1) participation in the setting, (2) direct observation, (3) in-depth interviewing, and (4) document review.*" [163]

During the research, data were collected, from two main sources to satisfy the information requirements like MARSHALL (2014:102), that was defined by the research question. These were secondary and primary sources. The author used two important sources of data firstly " *The secondary from the theoretical world (research and theories)*" and secondly " *The primary from the empirical world (practice)*" [164]

The primary research refers to the collection of first hand data to satisfy the information needs, of the current research. It involved some kind of interaction with the subject of the study, which is described subsequently and, is mainly achieved based on direct observation during the case studies and in the future possible, a possible use of a cross case study with a comparative analysis in order to test the model.

Secondary data refer, to existing relevant data in the research area. They included data collected to satisfy the needs of some research, other than this one, which were relevant to the current research. The sources for the secondary data included textbooks, professional and trade journals, periodicals, newspapers and magazines as well as computer online databases. These are adequately referenced, throughout the thesis.

One of the main reasons why the secondary data search was carried out before the primary data was that, it afforded both time and cost economies. In other words it could be done relatively cheaply and,

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[162] Idem, Ibid

[163] MARSHALL, C., & Rossmann, G.B.. Designing Qualitative Research. Newbury Park, CA:Sage.1989

[164] MARSHAL, Catherine – Designing Qualitative Research, London: Sage publication, 2016, p.102

quickly too. As mentioned earlier, the sources for the secondary data were mainly from published material found in textbooks, conference proceedings and articles in journals, newspapers, periodicals and magazines. The obvious starting point was the scientific online international data base. Extensive use was made of library resources to locate the relevant references for review. This started with the drawing up of keywords and, phrases in the research area that were used to search library on line databases for possible references.

The references list from the initial library search, was assessed for their availability. The bibliographic references in the located references in turn yielded additional references to pursue. This process proceeded until there was only marginal benefit, from further search for additional secondary data.

The keywords used in the data search, included phrases such as: Green Architecture, Climate Smart Cities, Smart Cities, Sustainability, Energy on Buildings, Others keywords were Compatible Smart Cities, Resilient Cities, Green Cities, Eco-Cities conservation, authenticity, integrity, buildings, site and, a lot more.

Despite the cost and, time economies achieved with secondary data, there were certain drawbacks that did not make the data the sole source of information. The major drawback was that a number of the references, located were not relevant, to the problem being researched.

Because the secondary data was not collected specifically for this research, they could not satisfy fully all the data needs. As a result each located reference was assessed for its relevance to the problem at hand. The following questions were asked of every secondary data located after TULL (1990) & ZIKMUND (1991) with the following questions firstly " *How pertinent is the data?*", secondly " *Is the subject matter consistent with the investigation problem?*", thirdly " *Does it apply to the population of interest?*", fourthly " *Is the time period consistent with the needs of the current research?*" and fifthly " *Does it cover the subject of interest in adequate detail?*" [165] [166]

After the secondary data search, the collected data were assessed to determine what information was missing and, what information needed to be confirmed. As expected the collected secondary data did not satisfy all the data requirements of the research. Primary data was, therefore, needed to meet some of the requirements of the study.

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[165] D.S & Hawkins TULL – Maketing research: Measurement and method. New York: 1990.

[166] D & al. ZIKMUND – Business research methods. The Dryden Press. 1991.

There are two main means of obtaining primary data: by observing the population of interest or, by communicating with them CHURCHILL (1987). Observation involves the monitoring of the situations or subjects of interest and, recording the relevant facts, actions, events or behaviours. The second way of obtaining primary data was by communication method. It however involves the securing of responses to questions presented to target subjects. As referred earlier the author, used mainly direct observation, during the case studies, to collect primary data.

The main objective of this research was to achieve some consensus on authenticity criteria for CSC, that guide the decision making process for classification of Cities from type 2 or from type 2. These values were required for incorporation into a logical and consistent decision under the matrix.

The creation of the matrix, therefore, required the identification of the performance objectives, that decision makers, want to achieve. Since this is a thought process, the only viable means of securing the required information, was through communication with the target population.

This was an academic research, which had the seemingly conflicting objectives of, wishing to collect data from a sample covering worldwide. Time to collect and, analyse the data was not considered to be much of a determining factor in this situation, because of the relatively long duration of the degree programme. Besides, the results were neither required to solve an immediate management problem nor, would they have become out-dated in the time it would take to present the findings.

3.9 – Strengths and weaknesses

Into this research, was attracted to the qualitative research due to its adequacies to the research strategy.

STRENGTHS	WEAKNESSES
The data and analysis are grounded	The data may be less representative than with well-conducted quantitative research.
There is a richness and detail to the data	There is the danger of oversimplifying the explanations
There is a tolerance of ambiguity and contradiction	There is a possibility of de-contextualising the meaning.

There is the prospect of alternative explanations	The findings are necessarily more cautious and tentative, because it operates on the basic assumption that the findings are a creation of the researcher rather than a discovery of fact.
The descriptions and theories such research generates are grounded in reality	

Basically, the main reason for choosing a qualitative approach, came from argument MARSHAL (1989:102) " *The most compelling argument is to stress the unique strengths of this paradigm for research, that is exploratory or descriptive, that assumes the value of context and setting and that searches for a deeper understanding of the participant's lived experiences of the phenomenon*".[167]

The researcher is not looking for a verifiable and, an absolute truth WELLINGTON (2005:81) that function in a cause and effect model, of reality but, rather is establishing a relativistic view of the world.[168]

The use of theory in case studies is, according to HINE (2007:156) , " *not only an immense aid in defining the appropriate research design and data collection, but it also becomes the main vehicle for generalising the results*"[169] the context of the project, would be meaningless.

3.10- Analysis and discussion

After building the model (a set of criteria for CSC) and, using the matrix into the three different cases to start validating described into the chapter V, conclusions, were drawn on the research findings. The conclusions mainly addressed the research findings, in terms of the research objectives and, the main research question. Comments were then made, on the research itself, from any limitations and any effects, these shortcomings might have had on the findings.

The usefulness and, the potential of the new model were also commented under conclusions. Recommendations were then made, on the application of the model. Finally, further research work required to enhance the model was also suggested.

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[167] C. MARSHALL, & Rossmann, G.B., - Designing qualitative research. 1989.

[168] Jerry WELLINGTON - Succeeding with your doctorate. California: Sage publications, 2005.

[169] Damiao HINE - Innovative methodologies in enterprise research. UK: Edward Elgar, 2007.

3.11 – Summary

Based on the research question and constant review of relevant research and theories, the investigation explained into the chapter the research methodology based on suitability of propositions and the objectives of the study. Under the development was used the Qualitative method and was use the Quantitative methods in different moments of the investigation.

In this research, the data was collected from a direct analysis under the territory, a base under the more recent scientific international papers and through a significant influence from the best architectural influence nowadays under the cities.

The cases studies were chosen, using different controls and measures, because their differences were from the initial point and the city from scratch was the one that could provide more valuable information to the study.

The direct visits and the interviews produced real results to the study.

This chapter explains the reasons why (advantages and disadvantages) the author (based the research in " interpretative paradigm") chooses qualitative research methodology to generate theory from the data collected (explanatory model).

Preferred methods are explained to help case study strategy to achieve the objectives of the investigation. Into the research, Case Study Strategy used methods with documentation and with a direct observation and quantitative analysis using a matrix prototype. The study design presented nine steps to achieve the conclusions having a base under primary and secondary data.

The Matrix is analysing cities under the level of Smart Cities, and it goes after directly using the architectural patterns from Climate Smart Cities creating an analysis and given an evaluation.

One of the weakness was the language barrier that was creating difficulties under the data information from the study cases.

Chapter IV | Development criteria for Climate Smart Cities

4.1 – Introductory elements

T HE SET OF CRITERIA IN CLIMATE SMART CITIES will create a directional way to architectural needs in our future cities. Under construction developments, final building solutions and into design principles to afford improvements into these new type of cities called CSC.

For the urban system design today, the receipt is diversity, proper planning and an active implementation of a strategy. The Harvard University launch a new knowledge that supports and give direction to architects and constructions teams.

New natural materials are growing and, some can be part integrant of more green and sustainable cities. One of the examples was the bamboo, where is described all of the possible applications and their capacities to the buildings supporting new or old constructions.

Urban design space has an improvement with simulations and, real tests can be done using a 3d tool. Today this type of technology can support the small power decisions directly, and even new specialists can be part of the teams presenting different possibilities, new possible solutions or even or safe secure and severe occurrences.

The research created a list of 38 criteria, named Architectural patterns that were described in this chapter and they are the base of a design of a CSC.

Following the author research, Climate Smart Cities are a new tendency, that will be implemented worldwide in our next future. In this chapter, it will be possible to understand the difference between SC and CSC.

Architecture is an integrant part in all of these decisions. Many architects are preparing their attitude, their knowledge to be an integrant part of this new CSC tendency.

The urbanist principles, developed by Kevin Lynch many years ago, are important nowadays, to establish rules into the city design. Many of the influences from his book 'the image of the city' are being implemented in our cities e need to be an integrant part under CSC.

4.2 – Urban systems design

The Urban system design, is a new disciple that has a challenge and a responsibility to produce a new proactive design activity into the world. This new discipline, lanced by online courses ETHx from Harvard University it is a challenging for the next future. Urban systems have a position between naturally and, slowly growing cities. The action of this discipline had a location in a geometrically and, predefined cities or activities during the arbitrary growth. The base of this new action is, first of all, an empathic ability to feel the existent urban model and, the abstract movement into them.

Secondly, a study based on simulation of existent spaces or proposal spaces create data information can be tested, not inside the territory but, with an urban system model. The third action is, to use the simulation and, predict the different scenarios into the same space and, discuss them with decision makers or stakeholders. After all these measures, the result is a multidimensional model that a city, can use, to 'Built and Rebuilt'. Inside the urban system design, it is possible to find the following components, a complete system with a set of objects that together they form a whole. In another hand, the urban context it is made up buildings, by infrastructures, by the landscape, water, and other elements as parts and, all of them together, complementing with their 'individual behaviour'. The interactions between them, result at the end, in a highly complex system.

An Urban system can be underlined, in the desired way or, in a sustainable way to arrive at that stage and, the data information it is crucial. The three high levels into an urban design specification can be for example 'value creation', 'sustainability', 'population happiness', affordability of housing for all income classes level, the positive environment impact and, the surrounding contribution in the urban system.

The specifications for intervention are vital and, can work as a challenge into the project. In every intervention, it is needed to assemble a disciplinary team of experts to obtain specifications.

Figure 33 – Seoul street sculpture
(source: by the author 2014)

The action has to be divided by stakeholder's specifications, ranking discussions to toward a master plan or, a simple rule plan work. The results need to be shared automatically on media to everyone for quality improvement. " *The Urban Systems cannot exist in isolation. They are always connected to the hinterland or rural systems*" [170] . SCHMITT (2016) statement goes in the direction of the result after ten years to Masdar City, a city in the middle of the desert and, the result of Songdo located near an old town and at the coast. Songdo after ten years presented a more complex development, and Masdar needs more population and a bigger grow. " In fact, the combination of urban and rural systems will be on of the main features of future development." [171]

Modelling simulation can act openly into science and art combining both areas namely architecture design with territory design. And, what are the impacts on the city? (Figure 33) What kind of benefits does it create? Directly who will benefit from this research, will be to the technical or to the people who need to have information about what is being done and developed in the world over the last years? What will be the benefits from this? Populations, cities, governments, climate change businesses and countries will increase their quality if they start using this system.

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[170] Gerhard SCHMITT – Future cities. USA & Zurich: Harvard University studies Edx, Architecture at ETH 2016.

[171] Idem, Ibid

How will you benefit? For example, having a document, tools, software prepared with the necessary information could serve as a consultation for technical measures, governments or the general population. Other benefits will be present into the researched case studies.

The current research, can benefit directly with the organisation's as the international fund called GCF, since 2014, where the financial area starts and, the project development is a very new process and, it is at the establish initial rules time.

And the real benefits will be visible, when? The benefits will be during the present days and, for the Cities near future and populations? And, in which will be beneficial? Directly in urban spaces worldwide. Areas that have been built these new cities or under existing cities, are changing and improving, and they constitute a significant presence in the world's region. Advocating the importance of research to be implemented, this research, in particular, has a great significance as a subject that can change ways of acting into the territory, with current architectural concepts and quality of applications. Architecture has constant need to modernise as the technicians and, this new action into areas will gain in general, with this cycle.

The development of a proposed improvement, to an existing space, for a type 1 city, built from the scratch, may also be beneficial for the city itself, for decision makers to the urban space and, for architectural master plans. This proposal will provide, to current city managers a support element for the next future. Cities reflect marks of time and, society, culture, technologies, aesthetic sensibility reflects the changes. Surprising details are critical for a first town.

Variety is the basis of a healthy diet; a city has to show and adept diversity to this kind of diversity.

4.3 – Building constructions

The global construction approaches and, the context of the Information City, can have different knowledge following several specialists.

The growing interest, in the globalisation of the material flows in building and, renovating cities and smart cities.

The bamboo researching, following SCHMITT (2016) from ETH Zurich is one part of a composite that could become a valuable building material. The simple action on construction involves finding, processing, transporting, and assembling of material and, with a similar action, with a system development that can make direct changes in turn of the place

where the material exist. " *Construction used to be a localised activity, but with the advancement of development processes and building materials, almost every building contains components of a globalised economy. The construction process becomes more knowledge intensive, and the necessity of architects, designers, and territorial planners to understand construction as crucial stocks and flows process of the urban system increases. Information technology, information architecture, and the city information concept provide for the first time the opportunity to visualise and follow the life cycle of any material building part, building equipment, or even entire buildings. Construction is a typical example of material flows around the world, and probably one of the most energy and CO2 intensive activities. The result of construction is a building, a material stock. The building's lifecycle, energy consumption, and CO2 production by far exceeds the amount of energy that went into its original production. The construction site of a building or a city determines the sustainability and resilience of a building to a high degree.*"[172]   Placing buildings to locations, where they produce more resources than, they consume and, could become sustainable structures over the time and they can probably be the right choice (Figure 34).
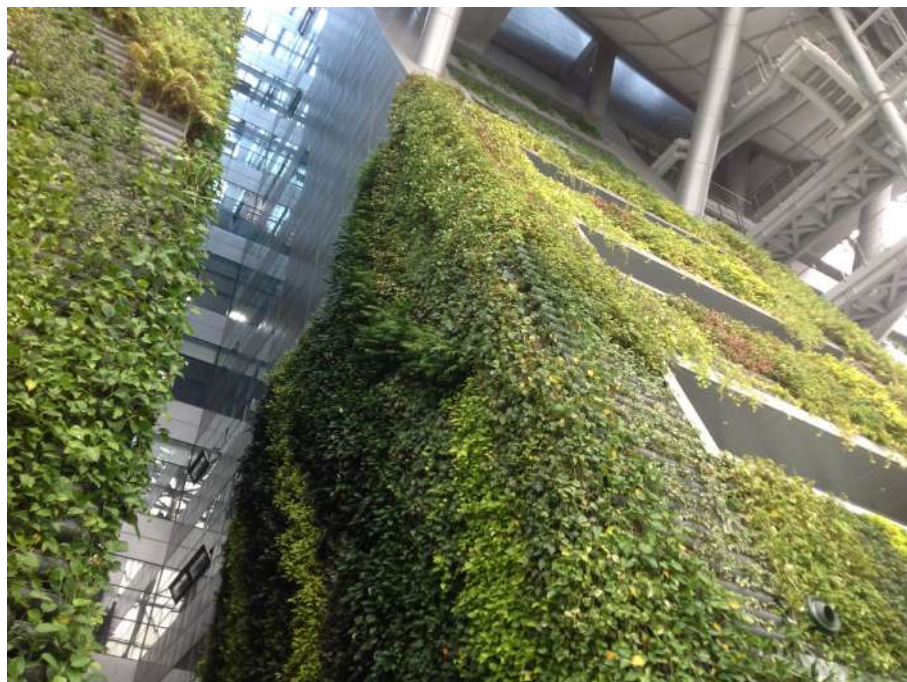
Figure 34 – Interior City Hall Seoul South Korea, green interior facades.
(source: by the author 2015)

A system of restrictions, protects the choices decision-making for buildings position intelligently, on a small site or, in high rises to floor

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[172] Idem, Ibid

level and orientation. Most of the early construction, took the material directly from the vicinity of the building site and, this development was using clay, stone and wood, in various variations and, they were chosen more often in temperate climates zones.

All the materials protected from the rain and ground moisture, even organic materials, could last for centuries. The material behaviour over the time can determine sustainability and new knowledge. Ancient timber buildings have a tiny carbon footprint. The rehabilitation discipline, exists to connect them, to modern standards of living. "*Choosing the right construction site in the tropics involved, like in temperate climates, protection from the elements and the enemies, as well as access to water, food, and transportation. The absence of snow and frost offers more possibilities than in temperate climates. In these areas, water plays a decisive role, as it is continuously available as an available stock and flow, providing for food and mobility. Construction sites can be created artificially if the ideal site cannot be found otherwise.*" [173]

San Francisco, for example, created much artificial land then, houses to their city. The same is true, on a large scale, for Hong Kong, Shanghai, or Singapore. The three places presented before, have a perfect location, but without available land, it is possible only with technical means to create more property. " *The end of a building often reveals the best view on the construction of the structure. In countries and cities where building materials are valuable for economic reasons, careful recycling of materials is also important for ecological reasons. So every building is taken apart carefully piece by piece. Almost turning it into an archaeological site, the recycling of buildings has become an art. This practice is already known for at least 3,000 years. The construction used to be simple. There were two primary approaches. Subtractive construction by carving material out of existing rock or earth, or additive structure by adding materials and building elements.*" [174]

According to KYLILI (2015) ZEB buildings namely Zero Energy Buildings, are defined as zero carbon emissions, in an annual analysis. For future challenges " *ZEBs will contribute significantly to smart cities on the energy efficiency, energy conservation, and renewable energy generation aspects. The review of past scientific works indicated that buildings can make the transition to ZEBs by reducing their energy consumption by at least two-thirds compared to their current energy consumption.*"[175]

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[173] Angeliki KYLILIFokaides, Paris A. – European smart cities: The role of zero energy buildings. **Elsevier**. ISSN 22106707. Vol. 15, n.º Sustainable Cities and Society (2015), p.86-95.

[174] Idem, Ibid

[175] Idem, Ibid

Today, the additive approach is dominating. Most of the technical construction support tools, are geared toward the sophisticated addition of layers. Nevertheless, the development process shows another aspect of the building as a system. The material, function and, process can be the hyperlink as part of the entire building system. This system is represented in an 'abstract form as information'.

" *Highest rates are to be seen in sub-Saharan Africa as well as Southeast Asia. Those territories coincide directly with the developing countries of our globe. When the field is future cities to be built, they will appear not in the northern areas, such as Europe or North America, but in the developing regions of the global South. In fact, looking at the world's fastest growing economies, is it possible to see that already today, seven out of the top 10 nations are located in Africa, while the other three belong to the greater Southeast Asian area. Around the turn of the century, the global GDP production of Africa was even surpassing the Asian nations. A tremendous effect, on the global consumption of building materials is acting in an intense level. Around the same time, as of the 2000s, cement and steel became the dominant and most used building materials in the world. This because the preferred construction method is steel reinforced concrete.*"[176] The intense market that, these countries support, will need to be more connected with the natural and, local materials. This, could be the new paradigm connected with new Climate Smart Cities. Intelligent countries and creative places, use or built their own needs and materials.

" *With an extreme pressure, the necessary skills are promoted from a huge industry. Even so, in most of the countries neither cement nor steel is produced. Unskilled workers are imitating westernised technologies without the necessary know-how addressing safety issues, nor the necessary machinery. As an effect, almost 90% of all cement today is demanded in developing countries, an incredible figure. And the same is true for steel, where more than 70% the global south use it.*" [177] The shift paradigm will be addressing many countries. A limited building construction was sprawl around the world causing today a CO_2 emission damage to the world.

Looking again at the African continent, out of fifty-four countries, only two are producing steel in moderate quantities: South Africa, on one hand, and Egypt. All other fifty-two nations have to import steel products usually from those countries that in the first place introduced these

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[176] Idem, Ibid

[177] Idem, Ibid

technologies. An action like this has consequences for the economic situation on a country scale. Taking the example of Ethiopia, according to the previous chart the fastest growing economy in Africa, you see once again that as of the beginning of the century, the gap between imports and exports of the whole country is getting bigger and bigger, accelerating the trade deficit of the entire nation. The by far the most significant majority of import goods into Ethiopia are building materials such as cement, steel, aluminium, glass, and machinery. It is evident that this condition creates a threat to the future development of the whole country and creates a situation, which is neither sustainable nor resilient." [178] The intense level of imports and exports it is danger for the world and, intensify the high CO2 emissions. The other point of view that this attitude with the market, is that countries not well developed, under high levels of money, are not prepared to see and to create strategies for the future, they only look at the day by day. The results on this action are damage for the future.

" *Therefore, it is important, when we talk about future urban concepts, that we need to think and develop alternatives, which are available in those areas where the highest urbanisation rates expect for our globe. Long years of investigation, looking for alternative building materials, one incredible and vigorous plant is growing in the same areas, the bamboo, It is almost a one to one match.*"[179] The bamboo structure can be utilised, as a building material, for bridges, houses and as scaffolding. Like true wood, bamboo is a natural composite material with a high strength-to-weight ratio useful for structures. Bamboo has a higher compressive strength than wood, brick or concrete and a tensile strength that rivals steel. This is the new tendency that the specialists are making their researches nowadays.

" *Architects and engineers are fascinated at the moment by the plant, which belongs to the biological family of grasses and can be found in more than 1,400 species worldwide. A single bamboo fibber can reach a tensile capacity strength which is much higher than steel. Therefore, it is important, when the field is future urban concepts, to think and develop alternatives, which are available in those areas where the highest urbanisation rates expect for our globe. First tests prove that our initial hypothesis, namely to create a material with higher properties than steel, can be achieved.*" [180] With a new tendency arriving, architects can analyse this new system as a benefit for future construction and And the

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[178] SCHMITT

[179] Idem, Ibid

[180] Idem, Ibid

lightness that this material can produce, instil creativity, and new forms that can be adapted to the shapes and trends that have been used for centuries, and can now create benefits in terms of climate change using a natural material.

" *We are even trying to replace steel as a reinforcement system in concrete applications, and at the same time thinking about ways to replace even concrete by a renewable material. Also, other widespread and easily available materials caught our attention, such as loam. We test slowly the opportunity to build two-story houses in Africa with this easy to handle substance.*" [181] An application of a different paradigm into cultural habits, can be at the begging a challenge for companies, for investors and for the clients. A new implementation like this under a territory, will increase the initial investment for the material and for the human resources.

"*For this study case, ETHx introduced Professor Philippe Block a new building technique called Catalan vaulting into Ethiopia, eliminating not only cement and steel but also the need for a scaffolding system since the tiles used to build the vault are glued together more or less in space with a fast setting gypsum. An action and a case like these with the introducing of another renewable resource, which can be found in all developing territories, since almost all of them are still agricultural based, is straw. Knowledge says that usually, the material is burned in fields after harvesting.*"[182] In a hot press, the starch contained within the homes act as natural glue. Construction panels have a manufacturing, which is used in small bearing applications.

The following statement ' Understanding the strengths and weaknesses of material determines the design possibilities', had a proven with a temporary building in Addis Ababa that it was possible to build two-story structures entirely made out of straw panels without any other load bearing materials in use.   Another intense resource being found everywhere on our planet is, a municipal solid waste. Different experiments worldwide are basilar for a concept development to small structures can be built immediately out or, specially designed waste products.

At the moment exist a search for alternative ideas and, systems in the area of Building Constructions, which could lead to a more resilient creation process or future cities.

In architecture, the facades design from the buildings into a CSC will

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[181] Idem, Ibid

[182] Idem, Ibid

need to be treated as bioactive actions. Existent buildings or new constructions can follow the CSC concept producing and, being integrant part of the city spending less energy and less water versus producing quality to inhabitants and, not being a 'garbage' into the urban space.

Nature will need to evolve the buildings and the building, with their unicity, will not be a dissonant object into the city and will act into the space like a tree.

4.4 – Urban design space

According to 'Reinhard Koenig' from Harvard University, the main geometrical elements of an urban system are streets, blocks or parcels, and buildings. In his opinion, these geometrical elements are the basis for all activities and interactions between people and into a city. These items have a substantial importance into the urban design, layout, arrangement, and relationships between each other. The high quality of urban design is a basilar element for a sustainable and resilient urban model, and the computer systems will be supporting these actions. The extraordinary numbers of interacting possibilities with elements, which represent buildings or streets, are the central knowledge into a city intervention.

One of the important questions that 'Koenig' reveal was the problematic in how it is possible to define what type of design version is much better, to introduce and what are the criteria's to use. Some of the new technologies added to tools for the design strategy, help as principal to support some decisions.

With simulations that show different aspects, as in functional areas, accessibilities, energy demand, the shadows zones can produce different decisions that in old times were not possible to take into account. With the computer support, it is possible to see spatial qualities and, properties directly into programs and, it will help to improve the design, finding urban design solutions that can fulfil the requirements as real as possible.

 " *Optimisation methods can help to find better solutions while we are not primarily interested in finding the best one since this doesn't make sense for complex urban planning problems.*"[183]

The multi-criteria optimisation process can have an inclusion in project proposals but, at the end, the responsibility of human architect will be to control the system for the production of meaningful results and, the final

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[183] R. KOENING - Urban design space, . USA: Harvard University, online courses, , 2016. Disponível em WWW: <courses.edx.org>. ISBN/ISSN Module 8.

goal of using information created by simulations. This type optimisation is to build a sustainable urban design and, looking into a vast territory " *the good solutions located on the mountains and the bad ones in the valleys*" [184] The climate change actions are very intense with the pass of the years and, the concentration of population as it is possible to see in Ulaanbaatar city, one of the case studies, as will be possible to explore further on, the pollution levels are massive because of the slums location.

In a new discipline optimisation by finding options because an urban planner "*can change the landscape of the design space*"[185] because, urban design it consists, in a multi-criteria optimisation process and, this group of elements create a primary system.

4.5 – Architectural patterns

In Climate Smart Cities, Architecture has to deliver a set of criteria that will help to plan and, to introduce this new type of city. The extensive use of the glass, for example, into the existent buildings of the most modern cities, will need to be moderate in CSC. The excessive use of glass construction interferes with human sleep and increases the temperature inside. Since bedrooms often cannot 100% blacked out, moreover, extensive use of glass facades will require more energy to be spent, thus affecting sustainability.

Following the anterior direction, the equilibrium between new technologies and a bioclimatic actions, have into the next future, to be taking into consideration, if a city that wants to become a CSC. The technology will need to be implemented smartly and, objectively without an excessive application and, the bioclimatic will need to be part of the city with an organised plan and an organised action.

Another one, that is now considered an integrant component of a project into CSC, and can be forgotten, it is the exercise outdoor and indoor quickly free to be used by everyone with elements like water, machines for training, stretch areas or zones to meditate are basilar to introduce inside of CSC city concept. Songdo, for example, proposed this idea organising one floor for training in each building that it is almost free, for the inhabitants during all year. A solution like this solves a problem that in outside, according to some countries in some months of the year, it is hard to be out of the home, to exercise. In Songdo, it is possible to train even day, even during the wintertime. An enormous level of people believes that continuous activity, creates benefits for health. Another

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[184] Idem, Ibid

[185] Idem, Ibid

measure that Songdo has, is about, the pedestrian threshold that refers the extent of a zone, within which one would walk or, take public transport rather than drive. The concept is to create a pedestrian zone, with an area within a short walk of fewer than five minutes.

In other direction, green parks and food production, need to be an integrant part of buildings and, inhabitants will be in charge of gardens and food production, transforming them into an integrant component of the city as CSC. This action can in the future completely change the paradigm and, give a greater importance to citizens into city responsibility or decisions. Into this research 36 points of criteria, were prepared to help the architectural and urbanist development into a CSC:

1. New Design Integration Paradigm

In this principle, the intense density has to be supported by diversity with business, residences, services, shops and pedestrian friendly paths. A large combination and a dense constitution of the same field create massive areas. During the time, if the trend change and, they start closing zones will generate emptiness. The rule into the principle it is a combination of functions (Figure 35).

Figure 35 – WE architecture and CREO ARKITEKTER A/S' Proposal for New Medical Center Moscow 2

(source: ArchDaily, Gallery of Competition Entry)

2. Ecologic landscape

In this principle, a local production and a continuous improvement by new plantations and CO_2 production, will support the landscape intervention. The existence of areas near the buildings, where people can plant and, can use some creativity is needed. The general and basilar concept of CSC with food production areas will be an integrant part of

the intervention into the territory (Figure 36).

Figure 36 – Street green intervention
(source: ecologic landscape, pinterest.com)

3. Mixing Private & Public

In this principle the combination between private areas and, public spaces need to be projected, in a way of not deliver full areas into the territory only with one certificate. This type of sectors will need to be mixed and independent at the same time. One significant example of this principle, it is the brutality of 'Forbidden City' in Beijing, an integrant part of the city that exists as an urban block. CSC search for diversity, and circulation, and fast access is a structural pillar (Figure 37).

Figure 37 - Public and Private areas
(source: interiorandlandscape.blogspot.com)

4. Auto sustainability | water, energy and food

In this principle, one of the most important and specific action from CSC proposal, it is focus on water treatment, energy consumption and production and, areas where the basic food production start to be an integrated part of a new concept of living with citizens and reducing Co2

emissions (Figure 38 & Figure 39).
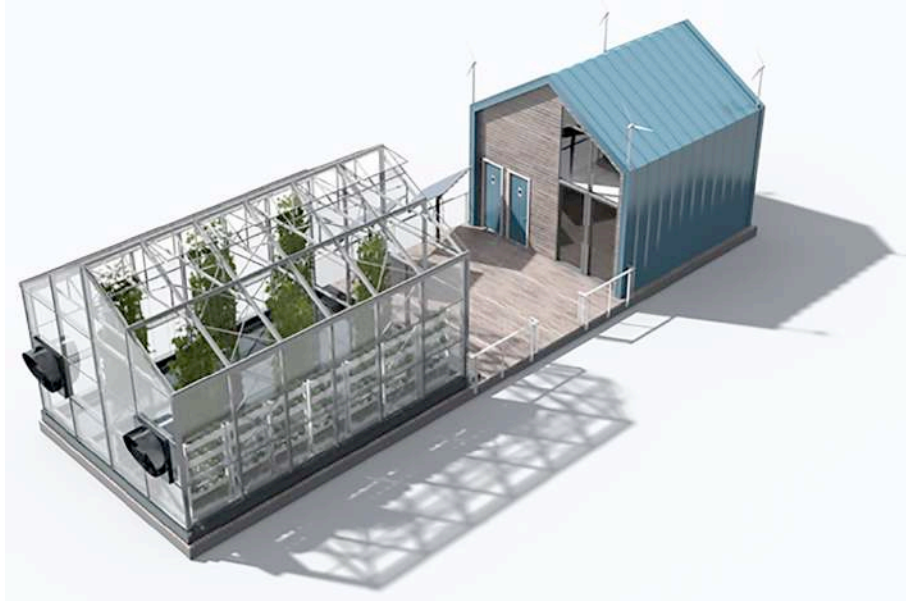
Figure 38 – House Salt & Water designed the conceptual Eco Barge as an eco-friendly learning hub for the citizens of Belgrade.

(source: bloglikes.com, 2016)

Figure 39 - City food production –
(source: www.powerhousehydroponics.com, 2015)

5.   Smart transportation

In this principle, the objective is a decrease into the number of cars circulation, on the city. For the public transportation, the aim is an extreme influence. The bicycle paths, will be crucial in a CSC. The result will be a less use of private car and low carbon emissions to the atmosphere. Into a design pattern, the areas and streets for cars, will be

reduced and strategically implement. It will act in case of a security action and, not a way of surviving.

Future will bring a new individual air transport briefly (Figure 40), where the streets will no longer be useful as they are today. The importance and the need to cars today, will be reduced in the future.

Figure 40 – Advanced smart transportation system 2020, futuristic Cars
(source: www.tuvie.com, 2016)

6.   Smart waste treatment

In this principle, the waste disposal can follow a centralised system similar to what exist in Songdo City where is entirely centralised at ground level or, can follow the system existent in Dubai SINGH (2015) where the transports collect the garbage and don't spend emissions. Another important rule of this principle, is the energy production that can be an integrant part of the scheme, producing results during the recycling action. The inner transformation of energy, can create a development in a sustainable matter. Songdo International city is an example, that can be reproduced worldwide, where they use a pneumatic waste collection system, which sucks wet and dry rubbish straight, to rubbish dumps through a network of pipes. This makes waste easier to dispose of and, lowers vehicle emissions from rubbish trucks.

Songdo also has three water networks (freshwater, sewage, and treated "grey water," which is used for irrigation and some toilet flushing) and every building, is able to recycle a large portion of its own wastewater internally. The city's planners aim for Songdo, to reuse 40% of its wastewater and, 76% of the waste created by residents and businesses. This is in addition to Songdo's current residents using 40% less energy per person than an average city, because of the building insulation, high-tech lighting, heating, and air conditioning systems, according to city

officials. ENVAC company is studying new possible solutions to implement under the market (Figure 41).

Figure 41 – ENVAC Self-Emptying Litterbins,
(source: envacgroup.com, 2016)

The integrated system in Songdo, the pneumatic waste collection system where people every day use a different garbage bag and, participate in the system results, implements a vital and social responsibility. In Songdo, the waste goes to a central trash and goes to an incineration centre, where is produced energy to the grid.

7. Smart Maintenance

In this principle, the maintenance will follow the smart policies during implementation and organisation. The architectural design and project definition will need a pre-organisation before construction in a direction of future cost reduction. One project proposal, of a maintenance plan implemented under construction, will decrease investment to preserve a healthy building (Figure 42). Some specialist teams, on the field, will need to be an integrant part under construction and, citizens will receive information under practical knowledge and theoretical knowledge.

Figure 42 - Plastic recycle roads
(source: www.wired.com, 2016)

8. Hydrologic city

In this principle, the existence of water elements creates equilibrium into spaces. The sound of the water, the blue colour produced by the water and, the freshness are important to be an integrant part of CSC spaces. One example is Alhambra in Spain, where the water is an intense presence and a mark, on the building and at, the green park. Venice in Italy is another example that the water can transform a city block or, an entire city with their integration. The 'Canal Walk' in Songdo City (Figure 43) is an attempt to 'small Venice' combining a commercial zone in a shopping mole.
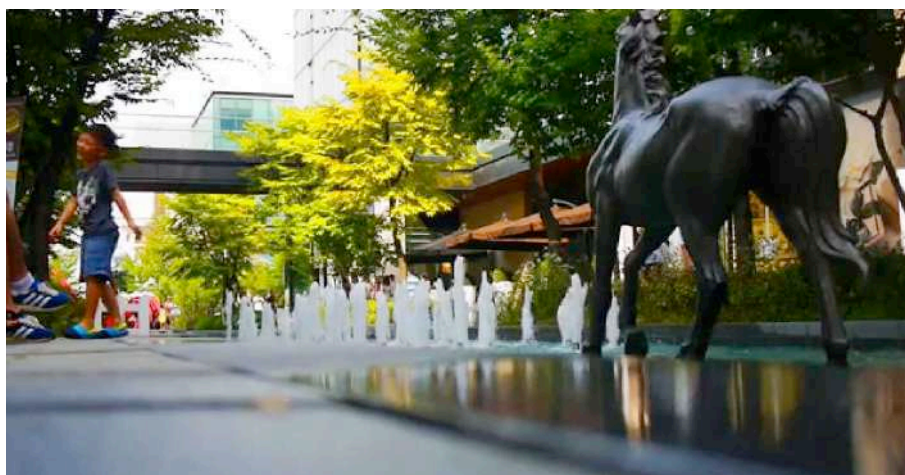
Figure 43 - Canal Walk, Songdo
(source: by the author 2014)

The falling water house, an idea from Frank Lloyd Wright, ZBASNIK (2014:290) it has the right principle and, it is one of the best examples to be integrated in a CSC. The water introduction produces a reduction of temperatures, a reduction into aerial sounds and, equilibrium into calm energies.

9. Air quality measures

In this principle, locations for quality measures, tests are necessary to exist on a territory. The information circulating into the city for citizens, it is crucial. The quality levels into spaces with precise information will make residents improve and qualify cities. Minsk is an example of a high level of air will quality because of their level of development (Figure 44).

Figure 44 – High quality of life, Minsk, Belarus
(source: by the author, 2016)

Under an intelligent system of cities management, under the principal scope, they will make everything to have the best level of these criteria introducing new ideas and, new solutions for some existent problems. The new measure will create a decrease on cars under the streets and, incentives to reduce air pollution and ether, an increase of bicycles under the city.

10. Soil quality conservation

In this principle, the distribution of dry soil, the treatment and, the access to land, will improve the future quality of construction at all levels. The soil action (Figure 45) and preservation in all territory of the city and, their security have to be, an important point under a project proposal.

Figure 45 – Flowers under street, Belarus, Minsk
(source: by the author, 2016)

11. Biodiversity

In this principle an improvement and, an intervention plan to the development and, a research on the territory for the most intense biodiversity method preservation application will be crucial. Generate locations of green spaces, animal's diversification and, existence biodiversity with distinct species, have to be an integrant part of the city. In Songdo some areas were at the moment preserved (Figure 46).

Figure 46 – Songdo poppies, springtime, red puppies
(source: by the author, 2016)

12. Cultural preservation

In this principle according to the city location, country or continent, the interaction with cultural elements implemented and, maintained by the city, create more dimension and more expression of the old times and, own history. Influences, materials and construction, can probability be possible marks under the urban interaction. In Songdo they rebuilt old Hanok's near the central park (Figure 47).

Figure 47 - Songdo, Central Park, bunny island and Hanok buildings. (source: by the author, 2016)

13. Social co-benefits

In this principle some items that combine social elements, will be creating combinations between spaces and human rights. A central building, where people can be together working socially, and the development of

Figure 48 – A community garden (source: gardeningknowhow.com, 2016)

different small spaces need to be built, as a support for the integration of this discipline into the city and, in the urban space.

14. Food security

In this principle, a necessary measure, implemented into areas that are in charge of food production for safety on cities are important in situations of intense and problematic situations. Production and open markets can transform cities. Food production can create a greater employment into cities.

Figure 49 - Food production
(source: gardeningknowhow.com, 2016)

15. Livelihoods Safeguard

In this principle, locations, views, green spaces and, area communications will create good health. The city management needs to implement a system to measure this level and inform the citizens.

16. Energy efficient design practices

In this principle, the energy efficiency design practices need to be implement into all interventions, on a city. Some small centres can be inserted into green spaces and, to be an integrant part of the smart school to children's during their grow to understand the system since our days and, being prepared for the future and for the next generations. Barcelona present some good examples of these new techniques (Figure 50).

Figure 50 - Smart building Barcelona
(source: Ottoyanna.com, 2016)

17.   International Green Buildings

In this principle, the concept of buildings transformation needs to adapt, to the different certification systems, in old buildings, and, into new buildings.
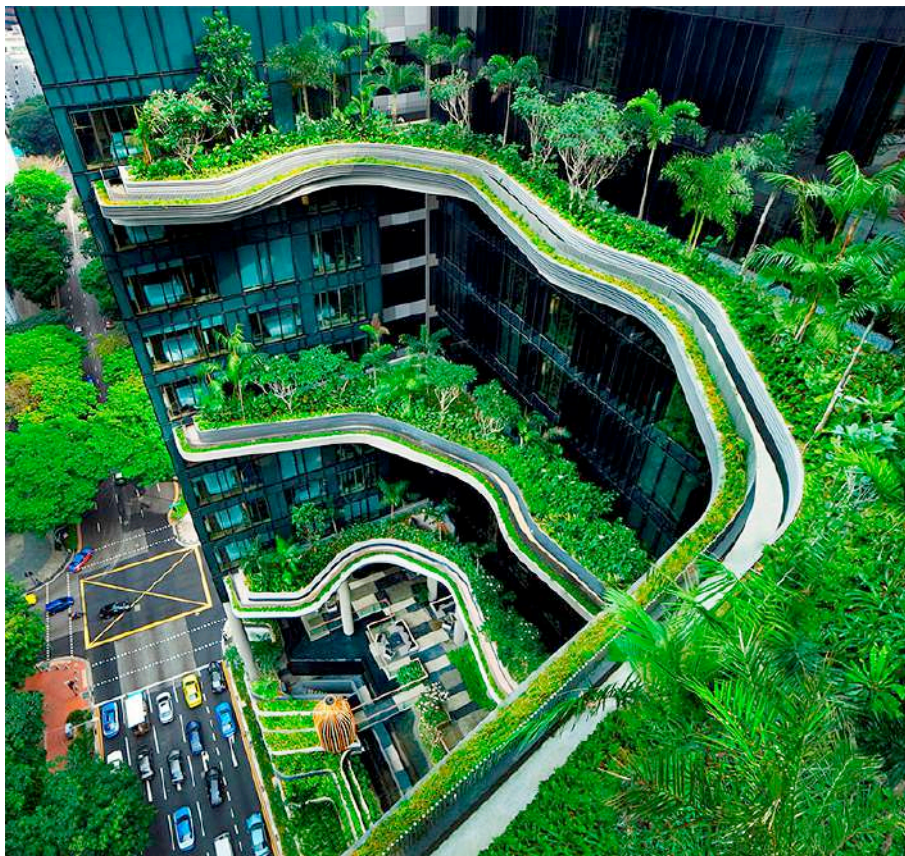
Figure 51 – ParkRoyal-Sky-Gardens-Bingham, Singapore
(source: legalparley.com, 2016)

In this new CSC, all the buildings will follow a certification, but this certification can have different characteristics into the vast possibilities around the world, Singapore is one example of a city with these actions (Figure 51), as was seen at the chapter number II of this research.

18.   Real estate Smart engagement

In this principle, the actual state action under these market, will need to have a particular position under the territory renting and selling houses and apartments in a 'green manner'. Participant people in charge of this area, will need to be prepared to explain, how the market works and, how the new cities will need to get results. In CSC people from this area, will need to be highly prepared, to act with quality and, qualification to support citizens.

19.   Resilience and Climate risk reduction

In this principle, cities will follow the momentum action worldwide ' *Resilience reflects a city's ability to persevere in the face of an emergency, to continue its core mission despite daunting challenges.*' Cities and their intervention will have a planned support for climate actions and, a strategy of particular intervention. In this principle, interventions will need to introduced security plans and, transformations of spaces into possible zones with new uses or, even areas underground where some food, energy and, water extra to supply to a particular time. Diverse strategies that prepare cities for the climate action damage are, an integrant part of these future cities.

20.   Flexible circulation

In this principle, cities have to be prepared to receive new inhabitants quickly and, they have to obtain quick and easy adaptation information (Figure 52). The signs and, the communication must be fluid, simple and straightforward so as, not to follow, the local cultural rules but, the international regulations. The careful system integration can cause situations for people as a, deficit number of inhabitants, remaining in the city. The standard of 5 minutes distance between spaces, in the direction of a non-use of cars, can be a strategic organisation for circulation inside the city.

Figure 52 - Welcome to new Climate Smart Cities
(source: by the author, 2016)

21.   Urban modelling techniques | walking and cycling

In this principle, a design and, a detailed grid, will need to be integrant part of city planning. A smart path to citizens and, a creative bike circulation will increase the quality of life of their citizens, similar to what exist in NYC (Figure 53).

Figure 53 - Five Autumn Bike Adventures Around NYC
(source: bikenyc.org, 2016)

22. Smart urbanisation

In this principle the inhabitants participation with digital measures and information participations (Figure 54)

Figure 54 - Vertical gardens at Parkroyal, located in the heart of Singapore's (source: Photo credit: Straits Times, 2016)

23. Smart management

In this principle the organisation and system that promote analysis and improvements into an economic and as a city manager.

24. Noise attenuation

Figure 55 - Green noise attenuation (source: by the author 2016)

In this principle the acoustic is important to establish rules, near the most important roads to transform spaces under quiet areas, improving walking paths and gardens (Figure 55).

25. 'Albedo' application

In this principle, this action with 'Albedo' will follow the Kevin Lynch criteria and, will complete the architecture intervention. This principle will complement the previous criteria. Micro climate with gardens are integrant part of albedo actions under the territory (Figure 56).

Figure 56 - Micro climate on gardens
(source: Llona's Garden, 2016)

26. Singularity

In this principle the authenticity and, the level of intervention, impose quality into buildings and, intense knowledge. Diversity measures introduced into projects, can transform their image and their occupancy.

The implementation of no standardised elements, make the result more rich and more personalised. Nowadays people search for what is special and unique. The vertical forest in Milan, by the architect Stefano Boeri, was an innovation under a developed city, remembering the old houses with nature, combining the organicity and giving a influence of ' normal city buildings' at the same time. During the construction they built two residential towers, that house more than 900 trees, 5,000 shrubs, and 11,000 plants (Figure 57).

Figure 57 – Vertical Forest, Designed by Italian architect Stefano Boeri
(source: gatherliverpool.com, 2014)

27. Emotional security

In this principle the security around the city, the liberty feeling and a safety sensation need to be present into the architectural proposal into space. Open areas with light and clear streets for citizens and for the entire urban space.

Figure 58 - Space security on the city
(source: therealstrategy.com, 2015)

28. Permanents and Impermanent

In this principle, rotation movements into cities, stable elements and, spaces that are not permanent like parties, festivals, circus and, other impermanent activities will need to have a place prepared and, a complete support from the city infrastructure.

Figure 59 - March Madness Music Festival
(source: discoverygreen.com, 2015)

29. Style and Creativity

In this principle, the visual image that buildings present to citizens and tourists, are an intense promotion for an enormous number of people, to visit or live in creative places. The image of the city structure rules and cultural habits. Architecture has a measure role and strong importance when we talk about spaces transformation.

Figure 60 – Singapore, a creative city by UNESCO
(source: en.unesco.org, UNESCO 2015)

One direct example with results is the 'Eco-mobility World Festival' in Suwon in South Korea supported by ICLEI and UNDP. It was needed a political courage, assertiveness to organised a similar exposition to built a festival like this. UNDP and ICLEI create into this action, a possible future of urban mobility, with an integrated urban planning and design

into mobility. The final result was, a Festival every single year and, different prototype interventions, that benefit the city and stay for ever with the population.

30. Colour diversity

In this principle, the element colour, has to be connected with the existent culture. The project proposals analysis will need to be connected and, the ambiance from the country will need to be integrant part of architect creativity. The incentive for colours development study and, smart colour integration without an excessive and intense transition are basilar for quality under spaces.

Figure 61 -The Colorful Cost in Manarola, Italy
(source: placestoseeinyourlifetime.com, 2015)

The colour equilibrium into the territory, can be a solution. ' Wassily Kandinsky's' for example had explored the relationship between colour and its viewers. He eschewed " *the greys, browns, and blacks of Cubism, embracing colour as the primary vehicle for expression.*"[186] Following his criteria where, he completely separated painting from a need, to depict a subject. The Kandinsky's art goal of to capture music in a plastic, to evoke the same feelings of a piece of music that could evoke through shades and hues. Kandinsky, developed a theory about the colour meaning proving that the creation of a relevant field into the creative world, the expansion of his philosophy into industrial design and architecture, append with 'De Stijl' movement. Colours can evoke emotions and can produce 'sounds' to population, says 'Kandinsky'.

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[186] Luke Barley - Kandinsky's color theory in architecture. Architizer, 2013. Disponível em WWW: <https://architizer.com/blog/kandinskys-color-theory-and-architecture/>.

4.6. – Climate Smart Cities

Climate change is appending today, now.

Climate Smart Cities, 'Climate' that combine the climate change, 'Smart' that connect the intelligent grid and, 'Cities' where exist the real action under the space. The UN Green Climate Fund call to this type of city, 'The Climate Compatible City' where the promotion of sustainable public transporting systems, the energy efficient, the resilient buildings and, infrastructure nor the efforts to safeguard live hoods with particular attention to urban poor are supported. The new Climate Smart Cities will decrease the rising levels will protect cities from the storm surges and, the heat stress. In moments of extreme precipitation, in inland and coastal flooding, will improve landslides and in drought moments.

Climate Smart Cities, in a direction of sustainable auto production of natural sources, will decrease the water scarcity and will reduce the air pollution.

Could it be possible to think in a small, romantic city, of an earlier time? Is it feasible to implement that feeling into contemporary cities where exist science and technology?

Changing a polis to a 'dynapolis' new dynamic types of settlements need, to interconnect in a smaller scale as says the Greek architect 'Doxiádis'.

A new notion of design integration where nature arriving at the achievement of a productive Landscape as agro-grid and, a urban agro-farm or an ecological Landscape as eco-grid, natural plant, green and, wildlife and either, the Urban structuring Landscape as private, public and hybrid organisation.

How could then set a Smart Climate City? Spaces with sustainability an active area, that contains an intelligent management, which promotes citizen participation, which brings together data and, works and, transform into information and, first of all, communicate properly with each other and even, for themselves. Cities are a contributing factor to climate change. Urban activities, are a major source of greenhouse gases. Estimates indicate that cities, are responsible for 75% of global CO_2 emissions through transport and buildings, being among the largest contributors. The initial origin of Smart Cities, has a connection with the global economic crisis in 2008.

Chaotic cities, unstructured spaces and low quality of life, is part of the three points of the triangle that create a need into inhabitant's lives.

A Smart City to be considered as such, must contain public security, intelligent buildings, sustainable energy, communications and smart payments, sustainable transport and water quality and either human lives. A lively city has to collect data, communicate and work all the information to justify the excess of 'connectivity'.

Within this format what will differ a CLIMATE SMART CITY to a Smart City?

A Climate Smart City promotes sustainable transport, network system, more energy efficiency, buildings and resilient infrastructure, supports all efforts to ensure the well being particularly in poor urban areas and built green architecture.

The UN-Habitat, promotes these actions in direct response to reducing the rising sea level, to global climate change, in response to "heat stress" in action to intense and destructive rainfall in action of air pollution in action the lack of water that already exists. In a world in action, to dry in action, to landslides in action, to flooding in coastal areas and, on action to earthquakes, among other problematic performances. IN general they participation under the CSC construction and implementation.

Cities from type 1 are built from the scratch, as was said before. They are usually built on platforms, with absolutely nothing. These spaces, do not initially contain historical elements that can contemplate some authenticity. Sometimes, the initial phase of these cities creates melancholic spaces and standardised buildings for the first inhabitants. In such new cities, the application of human needs is easier and more automatic. It is arguably easier to apply new technologies. But, the investment in such areas, it is proved today that the financial return, is extended in time and hard to finance in long running. This type of investment requires an exceptional political and, social support to be implemented. We are talking about cities like 'Songdo' or 'Masdar'.

The Smart Cities of type 2 are, existing cities that are beginning to adapt to the concepts of smart cities. Spaces are already inhabited, with a daily circulation of population and, continued daily the economic enrichment that allows a short-term financing. However, these areas require enormous challenges of implementing new technologies, which sometimes result in, increased costs. These are cities that already contain the outset barriers to adapt to current needs of the population. Spaces with historical elements to preserve, are often more complicated than standardised architectures. Type 2 cities example are 'Santander' or 'Vancouver'.

The Smart cities, on a whole, may continue to be applied in the world. In

general they can be from both types. The goal of this investigation is clear that, Climate Smart Cities are different Smart Cities and, the implementation of this paradigm shift, is crucial in today's world where the city has to have necessarily first to produce its energy and its water and secondly, have to be able to produce their own food in order to reduce emissions of excess transport and finally thirdly, be capable of retain water as security for maintenance and to the general production of the city.

" *Green society where humans, nature, and urban development exist in perfect harmony…People feel happier in Natural environment…low carbon in a green growth paradigm to humans and nature coexist amicably.*"[187] In urban and architectural definition of intervention areas, under the last century and, from the 70s by ' Michael Graves' with his concept of Re-design of the city, or even, the city model from ' Le Corbusier' are impressive influences nowadays. Other authors such as ' Paolo Portoghesi' an influencer in urban design or even, 'Colin Rowe' which may also have been present but, a biggest influence more focused on the design of the American city that had created structural basis of Smart Cities. Other examples such as 'Léon Krier', 'Rodrigo Perez', 'Peter Eisenman', 'Daniel Libeskind' and, recently 'Norman Foster', where all of them, were major influencers in these new concepts of intelligent cities or Smart Cities, being present during distinct times.

Places like Brasilia, Abu Dhabi or even some elements, introduced at the Expo in Lisbon, Portugal, can have a recognition as smart cities establishment key elements. Singapore city (Figure 62) is one ancient example of these attitude under the territory, where the measure part of the territory in green. It is possible to tell that they act ' in a brilliant way'. They were focus in both, under the methodology, developing the city as a case study and under the city Re-design as a whole or under parts.

This research was development based under the characteristics of a Designed dissertation or thesis, where the case studies demonstrates and, present a more artistic, architectural and structured proposal.

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[187] A. CARAGLIU, Del Bo, C., Nijkamp - Smart cities in europe. **Journal or Urban Technology**. Vol. 18, n.º 12 (2011), p.65-82.

Figure 62 – Singapore city in a spring morning
(source: by the author 2016)

All cities have several stages of construction and, they present some dominant types - housing and mono functionalities.

Kevin Lynch believes that, the following elements into a city, are the most necessary to transform and create liveable cities: the 'Albedo', 'Behaviour', 'Clarity', 'Cluster analysis', 'Context and sub context', 'Ecology', 'Japanese erotic cinema', 'Motion awareness', 'Performance requirements', 'Noise attenuation', 'Singularity' and the 'Slope and Climate,' 'Time series.'

Kevin Lynch believes that a city can have a division into five classes as: 'Paths,' 'Edges,' 'Nodes,' 'Districts' and 'Landmarks.'

He believes as well that, elements as 'Emotional security' and 'Intensity of Human experience' have an entrenchment into all cities.

'Rahul Mehrotra' from Harvard University, believes in 'Permanents and impermanent' elements are an integrant part of space or cities under development and that they can transform and make a city more liveable and smarter. He believes in Kinetic Cities, for new and intelligent cities.[188]

The style, the ornament and the functionality for 'Farshid Moussavi' the creator of the idea of 'The Function of Style' best known for 'f (style)' are

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[188] Rahul MEHROTRA - The static and the kinetic. UK: LSECities, 2016. Disponível em WWW: <https://lsecities.net/media/objects/articles/the-static-and-the-kinetic/en-gb/>.

part of everyday existence, but buildings are objects through buildings everywhere.[189]

The factor 'unit' has a use in the old times since the 1990s, but with diverse contemporary characteristics today. Buildings today face many challenges: space planning, security, sustainability and, sophisticated engineering that require specialist consultants on theoretic design architecture.

Distinct types of activities for people, into developing architecture, to improve quality, with time changing, most of the spaces change and, for example libraries had changed, schools had changed their needs and, architecture change every single day. Architects need to have the ability to act into buildings with knowledge. Farshid believes that, any style can be adopted for any nation and, can be accepted from any generation over the years and either, can generate new or unpredictable forms.

Even if the election of a new mayor, could imply costs in budget and under the program or, even at the building location, the environmental changes under the building envelope should be maintained. In general, this type of changes, the organisms in each element or part, can be a challenge for architects always, in respect of the conception buildings not as a unified but, as a confederation of elements wish we can call an assemblage, implementing affectivity into them Because of this, Farshid says that the following concepts in a project are: 'time,' 'authorship,' 'nationality' and 'unity' that is = to style.

Farshid believes as well that, architecture is an assemblage of large styles into one unique and new style, that glasses building outside as a facade are an error and, that the inside or the outside are in constant change and the method needs to have a use, as an agent of change. She believes too, that the way that an architect makes it together, is the exercise to collect together, the micro-polities of the everyday.

Cities start being in the direction of an 'Auto sustainable' level, in a direction to 'water production', to the 'energy production' and to the 'Food production'. Harvard University believes that, seven areas are key to designing a city, and they described like: 'space,' 'energy,' 'materials,' 'people,' 'capital,' 'water' and 'information.'

Theory entails research under the reality, at the planning and, on the city implementation. The experiment includes the conduction of the design research studies, with the city as a living laboratory.

Simulation is need, to make the invisible, visible and, to test and visualise

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[189] Moore ROWAN, Farshid Moussavi - We are in a world where ideas migrate: **The Guardian**. UK: The Guardian, 2014.

future scenarios. The cities of the future, will differ from each other much more than those, of the present, because they emerge in a globally networked knowledge, of the importance of liveability and sustainability. Future cities, increasingly will take into account, the active participation of people and as well, the climatic and economic context.

The height level of action, was difficult to identify as Alain de Botton described " *The beautiful houses not only fail as a guarantee of happiness but can also be accused of failing to improve the character of those who live there*" not only denominated 'beautiful buildings' count in a city development. Their content has changed interest and, they create benefits for humans and, it is today one of the priorities for urban development, following the sustainability principles. [190]

However, Botton identifies a current reality in his thought " *We have to ask what should be exactly the look of a beautiful building...What is a beautiful building?...How can anyone claim to know what is interesting?...The creation of beauty, once seen as the primary architect task, evaporated, silently, professional discussion and passed to a particularly confused imperative...*" [191] His idea seems to be right into a beauty meaning, standards can have different levels of applications. Any city can follow diverse beauty lines but, always following basic principles of development. The United Arab Emirates, for example, contain features in their city that south of China cities, will not provide. Elements of cultural principles, used materials under-construction or even, urban elements, will differ between cities.

With these differences, how can be possible to define a structure that contains a concept of a 'beautiful' Smart City? The answer is: The use of this research, as manual to implement CSC will create directly 'beautiful cities'. And why? Because this type of cities, will gave improvements and knowledge, about the 'beauty concept' implemented into cities with the CSC characteristics.

The truth essence of 'beautiful', as a scientific understanding, always have an expression in a city. The identification of criteria of what is 'beautiful', can be hard and complicated to identify but, the 'beauty' concept can produce sensations as 'Peter Zumthor' identifies in his book Atmospheres " *Dialogue as beauty. It is a reciprocal game of giving and take ... a surprise. An enrichment ... an array of built space that communicates with observers ... that infects ... homes caring man that let you live well and support it discreetly. Reading the place, the purpose of discovery,*

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[190] Allan de BOTTON – The architecture of happiness. 2009.

[191] Idem, Ibid

meaning, and purpose of the project to design, plan and formulate the work is therefore not a linear process, but multiple interlaced ... an aesthetic category." [192]

'Zygmunt Bauman' into his book Trust and Fear, he highlights the cities with the follow statement " *submit ourselves to the limits of our faculties: we know very well that we will never come to dominate the nature and our body completely also will never be immortal or also immune to the relentless course of time. So there is because another remedy that not contents ourselves with what exists. As a finding, which does not have to discourage us or break the will to live, but rather should serve as an encouragement and infuse our energy. While we cannot completely root out the pain, can in some cases eliminate it in part and others believe it. The question is knowing persists it, over and over again without faint."*[193] This requires new urban planning and, design curricula, which take into account much stronger the dynamics of future cities.

About 'boring buildings', that make boring cities the article from J. Urist on 'Science of Us' says "*New Yorkers have long bemoaned their city being overrun by bland office towers and chain stores: Soon, it seems, every corner will either be a bank, a Walgreens, or a Starbucks. And there is indeed evidence that all cities are starting to look the same, which can hurt local growth and wages. But there could be more than an economic or nostalgic price to impersonal retail and high-rise construction: Boring architecture may take an emotional toll on the people forced to live in and around it. A growing body of research in cognitive science illuminates the physical and mental toll bland cityscapes exact on residents. These researchers argue that humans are healthier when they live among variety — a cacophony of bars, bodegas, and independent shops — or work in well-designed, unique spaces, rather than unattractive, generic ones.* " [194] From Justin B. Hollander and Ann Sussman the authors of the book 'Cognitive Architecture' where they believe that " *designing for how we respond to the built environment' discover new findings in psychology and neuroscience that can possible help architects and planners better to understand clients."*[195] Architecture with the development, are under different types of investigations, that goes directly to some different areas, but some of them are very important to communicates with citizens under a city.

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[192] P. ZUMTHOR - Atmospheres. 2006.

[193] Z. BAUMAN, - Confiança e medo na cidade. Relógio D'Água Editores 2005.

[194] Nicos KOMNINOS - Knowledge, information and data for architecture and cities. Architecture simulation. . USA: Harvard University, 2006. Disponível em WWW: <http://www.urenio.org/wp-content/uploads/2008/11/2006-The-Architecture-of-Intel-Cities-IE06.pdf>.

[195] A. SUSSMAN, Hollander J., - Cognitive architecture: Designing for how we respond to the built environment 1st. 2015.

'Norman Foster' one of the most respected architectural professionals worldwide and, he has his ambitious goals in high-tech architecture. He is the Masdar 'father' and the beliefs that " *The use of sustainable materials for construction of all the buildings in the city (such as recycled steel, certified wood, low VOC producing compounds etc.), small carbon footprint existence (greenhouse gas reduction to minimum), renewable energy for the entire city, reducing construction footprints.*" [196]   Into the city, his idea was to implement the documentation processes, 'zero bureaucracy' for a cleaner environment." *Sustainable transportation within the city - powering all the vehicles circulating within the city using renewable energy methods only.*" [197]

'Junichiro Tanizaki' in his book 'In Praise of Shadows' was capable of expressing a certain level, into actions inside spaces " *I have had similar experiences. A few years ago I spent a great deal more money than I could afford to build a house. I fussed over every last fitting and fixture, and in every case encountered difficulty. There was the shoji: for aesthetic reasons I did not want to use glass, and yet paper alone would have posed problems of illumination and security. Much against my will, I decided to cover the inside with paper and the outside with glass. This required a double frame, thus raising the cost. Having gone to all this trouble, the effect was far from pleasing. The outside remained no more than a glass door; while within, the mellow softness of the paper was destroyed by the glass that lay behind it. At that point, I was sorry I had not just settled for the glass, to begin with. Laugh though we may when the house is someone else's we accept defeat only after having a try at such schemes.*" [198] The authenticity criteria under a project, have to be one of the big issues under consideration, when we talk about CSC. Authenticity is one of the key design factors, that Japanese architect's search for implement in every environment.

The importance of historical or old elements, in human lives, is one of the most important points at the success, into Type 2 Smart Cities.

Symbols in a city produce an automatic human reaction. 'Jan Gehl' also highlights the following "*...walking, stopping, resting, staying and conversing. Unpredictability and unplanned, spontaneous actions are very much part of what makes moving and staying in city space such a unique attraction. We are on our way, watching people and events, inspired to*

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[196] Steel TATA - Pre-finished steel for metal roofing and wall cladding. Europe: TATA, 2011. Disponível em WWW: <https://www.tatasteelconstruction.com/en_GB/Products/Building-envelope/Materials-and-finishes/Pre-finished-steel>.

[197] Idem, Ibid

[198] J. TANIZAKI - In praise of shadows. Japan: Leete's Island Books, 1977.

stop to look more closely or even to stay or join in." [199]   Defining and identifying elements of space that differ from area to area. However, the universal code is representing and guiding projects and human beings lives. Creativity and colours inside spaces located in the interior or exterior of spaces influence human actions and, Peter Zumthor transmits into his book Atmospheres "*I enter a building see a room and - in the fraction of a second - have this feeling about it. We have perceived environment through our emotional sensibility - a form of perception that works incredibly and which we humans evidently need to help us survive...I have no idea why that is so, but it's like that with architecture too.*" [200]

Figure 63 – Sustainable UN goals, World Health Organization
(source: un.org 2016)

Worldwide emergency measures for disasters action are an integrant part even into the initial master planning proposals. The demolition work is as well an important step that frequently is not integrated into a plan and ,is

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[199] GEHL

[200] ZUMTHOR

usually forgotten in planning and it is not inserted into architecture projects. Demolitions can act into climate change and materials need to be recycle under their processes. The UN launched the SDG's goals in September of 2015, where they want to organise the actions into 17 different areas (Figure 63). These organisation can be a base for future interventions even at a micro level. The world health organisation is promoting 'healthy lives, for all for all ages' and they are spreading this message around the world. Nowadays, these concerns must be attached to any proposal and, particularly in this type of cities, called CSC whether in the occurrence of an earthquake, a storm, a large fire or other catastrophic event. In this investigation we want to emphasise the possible hypotheses that accompanied the proposal on the method type. The CSC will use the first seven measures do initiate the strategic plan, but the complete implementation will connect all 17 measures. These seven will be the number 3, 6, 7, 11, 12, 13 and 15 (Figure 64).
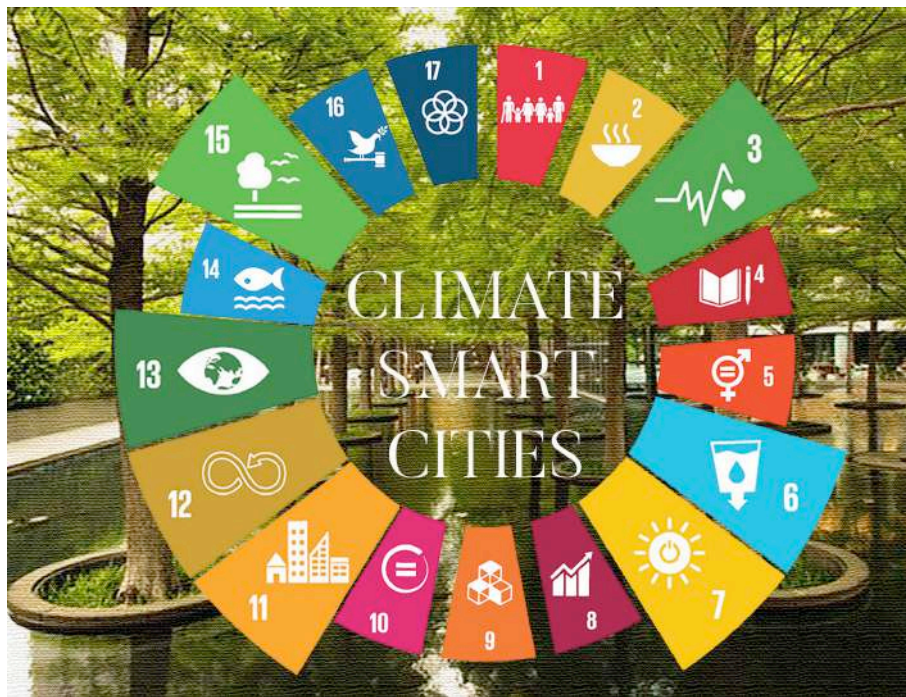
Figure 64 – Sustainable UN goals connected with Climate Smart Cities (source: by the author 2017)

The Buildings Maintenance is an area that has been neglected for many years but in such cities, it is a structural existence. All maintenance plans after construction there is a need of a constant dedication. Facilities Management discipline is crucial to any city nowadays.

The 'free trade action' between cities, as we have the example into Greek history, into modern China with Hong Kong and Shanghai or other coastal cities, can be one of the possible ways of making a continuous green growth. One of the first objectives in a 'free trade city' is the high

quality of development on local life patterns, international cultures and, global influences. The second objective has a base on language, using as a foreign language like English as the principal or communicational language in our days, with an outstanding conductor of communication.

4.7. – Architecture role into Climate Smart Cities

"*At the beginning of the second decade of the 21st century, networks of urbanised centres are the predominant framework of life in Europe, the United States, South America, and Oceania.*"[201] The city centres are nowadays the base of new living system that support the countryside.

"*At a time where architecture is all about spectacle…Cognitive Architecture that buildings and cities profoundly affect our lives. Design impacts our senses, our psyche and our disposition, drawing on our history and our evolution as a species*"[202] say Moshe Safdie an international architect and founder of 'Safdie Architect' from the book about 'Cognitive Architecture' where she wants to emphasise the importance of our senses into a city, that can at the end determine species.

A Smart City isn't a technology concept, and it's the political challenge of adapting one of the most powerful economic and social forces of our time, to the needs of the places governments supporting these actions.

Smart Cities are not perfect, they will have a bottom up, and they will have top-down problems that need to have an improvement during time, 'Jan Gehl' calls this as "*the human scale cities movement.*"[203]

For example, 'Toyo Ito', the Japanese Architect explains what organic architecture is for him, as he had under his project, a cancellation of the classic style and, the introduction of a new dimension on the interventions. He believes that "*The architecture has to know to follow the diversity of society and must reflect it … simple a square or a cube can not contain this diversity.*"[204]

Another way of seeing architecture as an individual object and, with

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[201] SCHMITT

[202] SUSSMAN

[203] GEHL

[204] ARCHINEWS – Alcino soutinho. Portugal: Archinews magazine, 2009.

natural concepts, maintaining traditions, 'Mecanoo Architecten' wins an international competition in Taiwan for the 'Bayan Plaza' there is now under construction, that was " *inspired by the local Banyan trees with their iconic crowns. The curved steel structure has a construction in cooperation between a local and a Dutch shipbuilder. Underneath this roof is Banyan Plaza, a generous, sheltered public space. Residents can wander through here day and night, practice Tai Chi or stage street performances along walkways and in informal areas.*" [205] In the end, the old traditions that were occurring in a space can even continue with the new building, with a smart integration where people will be able to continue meditation and, Tai Shi will continue possibly to be the principal practice under relaxed and old area. The idea is to projected spaces, where their implementation is a continue part of the city part and not killing their soul.

And what is real architecture? Following Steven Holl [206] ideological mind for him the architecture is similar to plastics arts. An architect works from the abstract to real action, and that is the opposite of plastic artists that use the reverse process. Art can be defined as an object developed that has support for the concept, security, economy, climate responsibility, function and engineering. In certain actions to follow the concept spaces and the light is sacrificed.

The use of art raises the spirit, and architecture has the objective to inspire through the light and space. The construction will cause an impression on human beings, a sensation. For 'Steven Holl', space contained movement through plans, perspectives, and movement or, the music sounds. Architecture is the art of Space.

Architecture has the liberty to connect organically concepts and shapes. Architecture has a strategy to connect all pieces in an exact way and when apiece disappears the machine doesn't work. The idea of architecture can be seen to expose a 'spectacle' from the light action, from materials, and details. The art is transmitted and linked through space phenomena, light. And sometimes the objective is concluded and sometimes it isn't.

However, it should not be neglected, the habits' problem that differs from continent to continent, from country to country and, from area to area from culture to culture, which can always produce distinct and complex results to identify.

[205] MECANOO – Bayan plazza, netherland: Mecanoo architecten. Netherland: Mecanoo, 2015. Disponível em WWW: <http://www.mecanoo.nl/Projects/project/54>.

[206] Steven HOLL – What is architecture? (art?),. USA: The Brooklyn Rail, 2013. Disponível em WWW: <http://www.stevenholl.com/recent-press/275>.

Inside the investigation, the literature identified was based on Smart Cities and Architecture on many current frameworks. The research had a support by explanatory conceptions that allow today to understand and analysed the various realities.

A model was set up based on theories analysed by facts and, representations that show the variables and a set of hypotheses.

4.8. – Urbanism Principles

Since 2005, Harvard University has questioned the urban planning at the Design magazine " *the United States has both been declared dead and celebrated as newly alive because of the vigour of Smart Growth and New Urbanism thinking and deeds. So what is its actual condition? Thirteen exemplary planners and scholars of planning here address that question by looking at the plan most conspicuous in their fields of vision. The result is a highly nuanced and complex picture revealing a transitional state in which both top-down and bottom-up planning have strong roles, and in which high-quality architecture is both supported and suppressed.*" [207]

Kevin Andrew Lynch, an American urbanist, the author of 'Image of the City' in 1960, a well-known city planner and a designer graduated and either a professor at MIT. In his book's he reveals elements in a built structure, of a urban spaces, as an important perception of the city. The book that he wrote in 1981 was 'Good City Form,' in which he believes at the connection between human values and, the physical forms into cities, with three theoretic constructs as cosmic or ceremonial centres, the machine city and the city as an organism.

In 1972 Kevin Lynch wrote another book called 'Managing the Sense of a Region' in this book he proposed planning activities and design as a profession. Into conclusions, the improvement of the region quality had to act into environmental issues management, selecting priorities, quality conservation, ecology, politics and behavioural science.

From his book 'Image of the City' Lynch says that cities have a construction in vast spaces, a city will have an evaluation by its surroundings and present elements, the people's perception have an enormous importance and elements like nodes, paths, edges, landmarks can make cities better. The 'Image of the City' analyses problems and opportunities on the forms and at the public areas. The legibility concept on a city exists in his mind to make people understand the layout of the place with mental maps, with mental images of the towns constraints, but

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[207] HARVARD – Urban planning now: What works, what doesn't?: **Harvard Design Magazine**. USA, 2005.

can be entirely different from person to person.

The basilar elements defined by Lynch have a base on mental representations that contain unique elements as paths, channels by which people can move along as roads, sidewalks, rails and others. People move either by edges, originally and, have a division by lines between two areas railway lines, seashores, highways or others. The third basilar element is districts, groups of buildings with large or medium size on sections of the city with the healthy neighbourhood as college campus, suburbs or art zone areas.

Lynch believes that landmarks or reference points make people oneself oriented, elements like signs, distinctive buildings, different stores can coordinators in a humanised mind. Another important point of his view are the nodes, the strategic spots where will be given extra focus as intersections. In his opinion popular city centres, 'piazze' and others can determine energetic points into a city. The quality of physical objects will create in observer a strong or a vivid image and, it means, that the monitor will maintain that image in his mind easier. Cities are the formal organisation and an unique paths very well organised, gain and in high imaginable level.

Another way to determine if the city has the Lynch idea of a city, a simple image needs to be enough, to recognise that city instantly. City's elements create a complete space and thy are very dependent under the level of this type of items, and these items will need to have meaningful, for example, well-designed paths including special lighting, clarity of direction to create safety zones and areas.

If elements like nodes, landmarks, districts or edges present similarities will create a better sense of comfort to inhabitants and these items designed into beautiful forms will increase the ability to remember patterns easier to learn and having fresh in humans mind.

A city that respects the human dimension and built with the optimum size, and where the technological evolution need to follow the same settlement as says the Greek architect 'Doxiádis' since 1947. He believes, as a first principle that the maximisation of human's potential, is the contact with elements of nature, such water and trees, with other people and only after with men work such as buildings and roads. Human feeling are very harmful even in the best environment if a wall without doors surrounds him, he will feel imprisoned. His second principle has a base on the minimisation of the effort of natural elements that will need to be very near otherwise he will not move more. As a third principle he believes that walls and houses representing fortifications will not be healthy for a human beings, each has designated energy, and this creates an

optimisation of man's protective space, distance selection always keeping contact without any sensory or psychological discomfort the 'proxemia' concept. The optimisation of the quality of inhabitant's relationship with his environment, will lead and it will be the aesthetic and physiological architecture influence. Into art, some areas areas like nature, networks, human, shells, and society are connected to the tips of a stars.

The fifth principle, that he believes, is that man organises his settlements in an attempt to achieve an optimum synthesis, of the other four principles, and the optimisation can depend on time and space, conditions and, with the man ability it will be created a synthesis. Doxiádis says that the combination of the fifth principles result in a 'successful human settlements' a balance between a man-made environment and nature. The first principle that he exposes, had an implementation when the implementation is in floors, walls, doors, windows, roofs to potential the contacts and minimise the energy expended the second principle. On another hand, it creates separation from the others, as it is possible to see under the third and fourth principle into a construction man-made

Figure 65 – Green Urbanism organization
(source: slideshare.net slide2014)

" *Time place is a continuation of the mind, as fundamental as the space-time that may be the ultimate reality of the material world. Kevin Lynch's book deals with this human sense of time, a biological rhythm that may follow a different beat from that dictated by external, objective*"[208] The centre Lynch interest id on how this innate sense affects the ways we view and change or conserve, or destroys our physical environment, especially in the cities. New forms of city's analysis based on Kevin Lynch principles and the COP 2015 decisions create a new way of investment under the planning of new cities. Kevin Lynch is one of Great Urbanist authors, responsible for one of the most famous and influential works called ' *The Image of the City.*'

Based on an extensive study in three Northern American Cities, where people was questioned about the perception of the City, and about how they would be structured using the Lynch book 'The Image of the City' and how they could locate themselves into a space.

Lynch identified as the main conclusion that the elements that people use to structure their city's image could have, an organisation into five groups types: Roads, Boundaries, Districts, Nodes and, Landmarks. It also concluded that the perception occurs with time since it is impossible to grasp the entire city at once. Therefore, time is essential. Moreover, there is nothing that an individually experience, but about its surroundings. The crucial point is that similar elements, located in different contexts, also acquire different meanings.

Figure 66 - Green facade, 'Lapa' House, Lisbon.
(source: reynaers.pt, 2015)

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[208] K. LYNCH – The image of the city. 1960.

Every citizen has certain associations with parts of the city, for example this image connect an idea of a building from north Europe, but it isn't, this image is from a building in Lisbon, Portugal (Figure 66). In general the image that a person makes in mind, is imbued with memories and meanings, so, not everything can be generalised, despite the apparent " *universality*" of the five elements identified by Lynch.

The key concepts of his mind are one of the basics is the readability, understood as the LYNCH (1960:2) " *Ease with a coherent pattern.*" [209]

It is important to bear in mind that, the legibility that Lynch refers is the one from the visual aspects of the city, it means, does not take into account non-visual schemes, such as streets numbering or other systems that may contribute to the readability but are not connected correctly to the city's image.

Structure and identity of the environment is a vital skill for all animals that move and, on the other hand, the sense of disorientation is distressing for people living in the city. A simple environment provides security and enables a more intense urban experience since the city explores its potential view and expresses all its complexity.

According to Lynch, the environmental perception can be analysed according to three components: Structure, Identity, and Meaning. The identification of an object implies its distinction about other things, its recognition as a separate entity, i.e., it's identity. Besides, the city's image should include the spatial pattern or object relationship with the viewer and other objects, that Lynch called structure.

Concerning the 'Meaning', Lynch is more cautious, not delving much into the concept or its study. The emphasis is on Identity and Structure. Nevertheless, the author argues that the object must have a meaning to the observer, whether practical or emotional and, it is closely linked to their identity and their role within a broader framework.

Another Lynch's important concept is the imageability, understood as the LYNCH (1960:9) " *Quality of a physical object that gives a high probability of evoking a strong image in any observer. It refers to the colour, shape or arrangement to facilitate the formation of imagery heavily identified of the environment, powerfully structured and highly useful.*" [210]

The imageability concept has a connection to the idea of readability

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[209] Idem, Ibid

[210] Idem, Ibid

since 'substantial' increase the likelihood images to construct a clear and structured view of the city. LYNCH (1960:10) " *A city with imageability (apparent, legible or visible) in this regard would be formed, distinct and memorable this will invite the eyes and ears to greater attention and participation.*" [211]

According to Lynch, paths are for LYNCH (1960:47) " *channels along which the observer customarily occasional or potentially move. Can be streets, sidewalks, transit lines, canals and roads railways.*" [212] Paths have a consideration as the main structural elements of environmental perception for the interviewed people from Lynch. Because people realise the city while traveling the highways, they do not just structure their experience but also structure the other elements of the image of the city, and some specific paths can become particularly pertinent in the following signs:

-The concentration of a particular type of use (intensively shopping streets, for example);

-Different spatial qualities (too wide or too narrow, for instance);

- An intense treatment of vegetation;

- Existent continuity;

- Visibility from other parts of the city, or allow ample visual to other areas of the city;

-Very precise origin and destination.

When the primary paths have no identity, the overall image of the city suffers. The corners are important points in the city structure since they represent a decision, a choice. At these points, the viewer's attention tends to be heightened, and therefore these elements positioned along the intersections tend to be more easily noticed and used as references.

Lunch consider Edges as linear elements constituted by two distinct sides regions, forming linear breaks in continuity. The more strongly limits are, those perceived not only prominent visually, but also in a continuous way and without permeability to movement.

Barriers may be considered (rivers, roads, viaducts, etc.) or as connecting elements (linear squares, pedestrian streets, etc.). They may have directional qualities, as well as the paths. Along a river, for example,

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[211] Idem, Ibid

[212] Idem, Ibid

there's always a notion about what direction it is taking since the Riverside provides this guidance.

Another feature of the limits is that they can have a segregation effect in cities. Numerous restrictions act more as a barrier than as a liaison ultimately tear as parts of the city, and damaging a vision of the whole.

In Lynch districts, conception neighbourhoods are LYNCH (1960:66) " *fairly large parts of the city in which the viewer 'enters' and that are perceived as having some commonly identified characteristics.*" [213]

At this point, it is important to clarify that the neighbourhood's expression, or even districts expression, can lead to confusion. The Lynch's concept refers to a perceived area as relatively homogeneous with the rest of the city or at least as having a certain common feature that distinguishes it from the remainder of the urban fabric. It is, therefore, a visual criterion and perceptual. The following considerations relate to the concept adopted by Lynch. In his opinion 'neighbourhoods' are not administrative boundaries.

The characteristics that determine neighbourhoods can be bases in various natures: Textures, Spaces, Shapes, Details, Symbols, Building Types, Uses, Activities, Inhabitants, Conservation level, Topography, etc.

Neighbourhoods play a significant role in the city's legibility, not just regarding guidance, but also as an important part of city's living and may have different limits. Some are accurate, well defined, and others are softer, undefined. Likewise, some may be " *introverted* ", *others* " , " *extroverted* ".

When Lynch describes 'Nodes', he defines as strategic points in the city, where the observer can enter, and they are necessary into the focus. Under the point, the question is, where to go, and where are we coming from are required determinations. The variation is connected with the used scale for analysing the city's image: can be corners, squares, neighbourhoods, or even a complete city, in a case of analysis on the regional level.

Transportation is organised by confluence points system with potential locations for subway stations and bus terminals.

Another type of 'Nodes' are " *thematic concentrations*", such as purely commercial centres. Such sites act like 'Nodes' because they attract many people and are used as benchmarks. Lynch also concluded that the the

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[213] Idem, Ibid

spatial form is not essential to a 'Node', but can provide it with greater relevance.

Marks for Lynch are specific elements on which the viewer does not. They can be from different scales, such as towers, domes, buildings, sculptures, etc. Its main feature is the singularity, some aspect are unique or memorable under the context. The achievement can follow two ways: to be seen from many locations, or by establishing a local contrast to the closest elements.

They seem to use often by people more used to the city, especially those less prominent landmarks, smaller, more common. As people become more knowledgeable of the city, they start to rely on different elements, rather than be guided by the similarities, using small reference elements.

Kevin Lynch an associated professor at MIT, he made innovated theories in seven books, changed the people image of cities using the example of Boston and much others around the world.
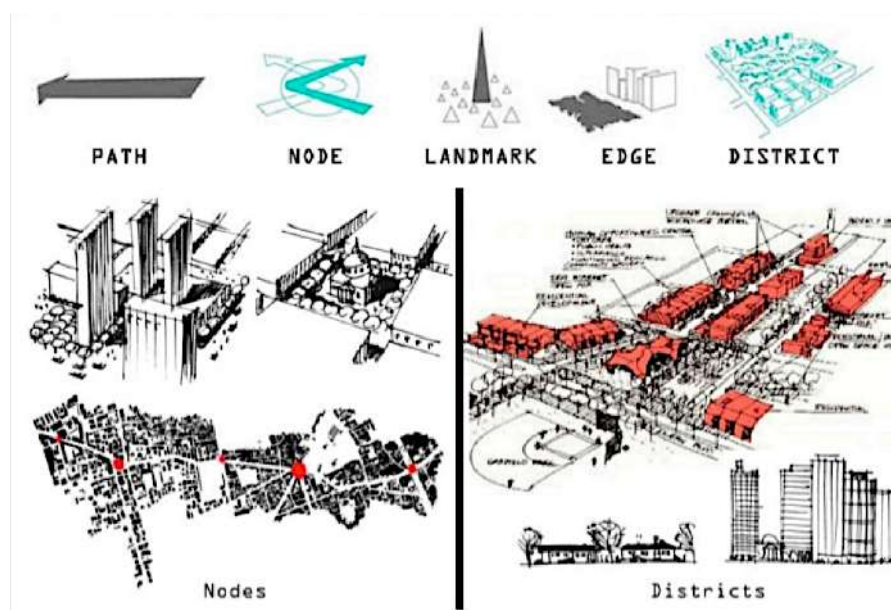
Figure 67 – Kevin Lynch principles
(source: slideshare.net)

Evan Mather, an independent landscape architect from Lon Angeles, and he has a documentary where he describes Kevin Lynch (Figure 67) in detail saying that the city. His construction under a draw on a vast scale in long space of time. In every instant is there more things appending that we possibly could see. Images have stories and meanings: behaviour, body comfort, clarity, cluster analysis, context and sub-context, ecology, Japanese erotic cinema, motion awareness, performance requirements, noise attenuation, albedo and singularity, slope and climate and time

series. In Lynch's opinion, the existent five types of elements into a city are the 'Paths' and they are the channels along trust the observer customer, occasionally or potentially moves, the enormous importance of paths may be seen as a total network, refuting relationships can be regular and predictable.

'Edges' are the linear elements not used or considered as ways. They have breaks and continuing elements and, they can be throat as a major boundary.

'Nodes' are the conceptual anchor points in our cities. Their junctions a convergence of paths and moments of a shift from one structure to another and are related to the concept of the journey.

Figure 68 - The garden cities of tomorrow
(source: E. Howard, book)

'Districts' are the medium to large sections of the city, which the observer mentally enter inside, and it is recognisable of having some shared and identifying characters.

'Landmarks' are another type of point references but in this case, the observer does not enter and it is external.

A city have to be built for one person, in a general concept. It started in the 1850s the first settlements under advanced technology. With industrial revolution development create the concept of the healthy and functional city as E. Howard in 1898 presented in his book " *The Garden Cities of Tomorrow*" (Figure 68). The central elements of this time, and that were affecting decisions and people, were the hydroelectric power, automobile development, air navigation development, photography, and cinema were present. Art and architecture believed that future cities should combine industry and its technological achievements. During 1909 until 1916 a violence and fast transportation were more a triumph according to nature. In 1913, by A. Sant'Elia an Italian architect, the ' *Città Nuova*' that presented surreal drawings is showing the possible future for future cities.

After this, Bauhaus movement during 1919 until less 1932 in Germany creates some ideas and concepts about cities. Walter Gropius believed that " *We want an architecture adapted to our world of machines, radios, and fast motor cars*" (Honour & Fleming, 2005).[214]

Le Corbusier was an architect, an urbanist, a designer and writer, in 1922 produced his plan ' *Ville Contemporaine*' a three million population project built with still and glass and with sixty-story skyscrapers for residential and office use. During his living time he created important knowledge for our cities of today. After the Second World War (WWII), with the cities transformation, some expansions and the new need for security and shelter or, even proper living conditions, led to a new development of new and planned cities with suburbs, living the city centre, that in many cases was destroyed. These new planned cities were now an option to crowded and polluted cities, built with new materials and with newly constructed methods.

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[214] ANGELIDOU

This new concept starts to develop a new tendency of thinking in mechanised cities as it is possible to see with 'Archigram' on " *plug-in-city*" or '*walking city*' by Ron Herron in 1934 or even the "*Electronic Urbanism*" by T. Zenetos that expose a connection between the network technology and the social equity and creativity in relation to natural habitat, the economy of energy and a new sustainability. On March 10th of 2016, Robert Steuteville, an editor on CNU Journal, Public Square and senior communications adviser for the Congress for the New Urbanism described the '*four phases of New Urbanism*' a new concept of Urbanisation (Figure 69) that focus on cities revitalisation that starts changing spaces.
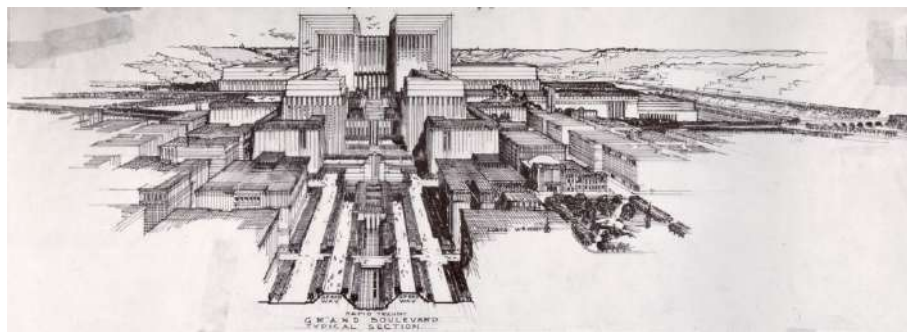
Figure 69 - Città Nuova, Sant'Elia architect "surreal drawings"
(source: Web.stanford edu, Elsevier 2014)

The Greenfield movement is revitalising historic cities and towns creating a past inspiration that is called walkable places. The last thirty years the suburbs, were creating enormous problems to cities, so the new urbanism focuses on a new solution. The term TNDs, Traditional neighbourhoods Developments can be a new alternative to the conventional master planned communities. There are at the moment transformed places as laboratories of ideas. A mixed-use district, with main streets and centres, make people circulate. An old type of buildings was introduced again, for example, shop front flats, courtyard housing, mixed-used buildings and Nowadays, were reintroduced slower moving, narrow residential streets, boulevards and proper avenues with a new urban-rural transecting implementation. A new concept of 5 minutes walkable, forgetting the suburban development creating a new human habitat, combining a phase one as a concept. As a phase two, a new focus on infrastructures and services into historical and towns centres it is another principle. The need for new spaces from the scratch, started to be with less quantity in this new ideology.

The new urban street design as they call, will be helping to repair the cars circulation between historical centres and industrial districts. The direct

objective of second phase is to preserve the old walkable, the mixed-use neighbourhoods on historic street grids and disappears with large conventional suburban development. The third action has a base on a suburban retrofit, called as sprawl repair or 'Retrofitting Suburbia'. The suburban places will be transformed as well, into walkable areas. Multilane arterials will be designed in a new shape into Green spaces; there is an example of Lancaster, CA, Boulevard.

The fourth phase, is a focus on the arrive at the city's concept 100 years ago, where cities connect internally and externally, and this means, that suburbs will grow into zoning laws and will be time after time create a separate use.

This 'New Urbanism', can directly be a base help to build and determine the new Climate Smart Cities. This type of transformations can take generations. Architecture, building types will play a critical role in cities revitalisation.

The 'Science of Us' published an article in April 2016 by Jacoba Urist explaining ' The Psychological Cost of Boring Buildings' in New York City. The publication arrive at a point that every corner has bank or a 'Starbucks', and there is indeed evidence that many cities are starting to look the same and high-rise construction can produce a symptom called 'boring architecture' that will transform the emotional system to the people that is forced to live in and around it. Seoul city, with the intense grown without a planning is transforming streets, into boring places, the different asian 'Starbucks' or imitations to Parisian bakeries, are repeated street by street without authenticity.

Science says that humans are healthy when they live among variety as " *cacophony of bars, bodegas, and independent shops - or work in well designed, unique spaces, rather than unattractive, generic ones.*" [215]   The book presented in this article called ' Cognitive Architecture: Designing for How We Respond to the Built Environment' by the urbanism Professor Justin Hollander and the architect Ann Sussman where they explain in detail the influence of the cognitive architecture into an intervention.

4.9 – Type 1 Climate Smart Cities

Cities built from the scratch are considered Type 1 Smart Cities. The advantage of this kind of cities is that, the urban plan can be laid out since the beginning.

[215] SUSSMAN

The empty platforms can create an ideological freedom that creates an enormous problematic. Firstly represent vast possibilities of projecting. Secondly, no limits mean no orientation and thirdly, an open creativity mind can transform spaces into something more personal when the objective is to take the right decisions and more direct to the sustainability way of living.

Free areas don't have historical elements, as it is possible to have in old towns. Some essential elements from the old cities can be implemented as well in the new CSC.

The new technologies applied to cities can predict different spaces, and with the new rules from CSC can be possible to determining areas with some scientific orientation.

The biggest problematic into new spaces is how to distribute equipment's and areas, zones, green spaces, paths and how to organise the territory. Some of the Kevin Lynch, principles concepts, if they are implemented with organisation inside a city, even following different criteria they will take real results. For example standard architecture is forbidden into cities from the scratch where they will create empty cities and fragile spaces.

Type 1 allows adapting more quickly all the space for new technologies. When the action is built and make interventions, not everything can stop in a city like this because inhabitants, that live in that town, will feel loneliness and emptiness, felling's that can make people move to other cities, and that will create less economic development into a territory and where the objective is the opposite.

4.10 – Type 2 Climate Smart Cities

Existent cities are plain of elements that are impossible to destroy, impossible to erase and they need to be part of the future strategy. Old cities have a huge level of restrictions the difficulty goes through the connection between all elements, and they use the discovering of possible solutions. Historic elements are integrant part of the cities, and they need to be analysed in detail, to create a real composition as a scenario for the development, as the composition of a film telling a new story. Decisions need to be made under a direction of the best decision knowing that some history sometimes need to improve or be changed in the direction of a new modernity.

The rich diversity of architecture of buildings into existent cities will help

into the liveability that CSC want to implement and, to use in direction for the sustainability but, at the end, not everything can be used, they will need to be detailed chosen with a hard study and investigation. Type 2 smart cities have more difficulty to adapt the spaces with new technologies. The amount of money to invest into type 2 smart cities can be strategically organised by phases and, the city, even if one phase stops, continue completely surviving, people will stay living in the same place producing and increasing economy and making more money for the next interventions.

4.11 – An evaluation matrix for Climate Smart Cities

Based on the analysis performed in several surveys throughout the work was obtained a Matrix under this investigation, that ranks equally and analyses cities towards a level of sustainability that can support the development of Climate Smart Cities.

The first phase of the Matrix was developed with GCF support and, at the second phase the Matrix adapt and reorganise levels using the six criteria for smart cities as it was described before.

The development Matrix is in direction to help experts, institutions, international organisations, architects and population to start seeing the city with a new Paradigm Shift.

The architect 'Norman Foster', on his TED Talk in 2007, in Munich Germany, expresses that 'the green agenda is the issue of the day' and he asked about how can experts be and work in an intelligent way anticipating this kind of actions. Climate change in 2007 for Foster is " *not about fashion, but about survival.*"[216] He in focus that 'green' can be cool and can be a celebration of lifestyle. This singular Matrix wants to achieve to 'Thomas Friedman' thought in 2016 about "*living and thinking the main street*" [217]

The Matrix wants to achieve to a bigger picture of the city. Foster said " *You can not separate the buildings from the cities infrastructure*"[218] , and he was right, projecting and implementing only buildings alone will not develop achievements to improve smart cities. Norman Foster presented

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[216] Germany TED Talk - Norman foster: My green agenda for architecture. TED Talk, Munich, 2007.

[217] Thomas L. FRIEDMAN - The world we're actually living in, . USA., 2012. Disponível em WWW: <http://www.nytimes.com/2012/09/30/opinion/sunday/friedman-the-world-were-actually-living-in.html?mcubz=2>.

[218] TED Talk

the energy consumption into a graphic that was presenting the energy consumption and, he made a simple change putting together Buildings and transports. Together the 70% in activities in cities and infrastructures, he insists that, the sustainability problems can't be separated from the nature of the cities in witch the buildings are apart. He gave the 'Detroit' example where everyone depends on cars. Our work in sustainable cities will create convenient distances with ventilate and healthy buildings under surroundings.

'Sir Norman Foster' in focus on the concept of green action " *it's a lifestyle, an ecologic agenda it can´t be a sacrifice...what we were before mobile phones? We were totally connected with the outside" and why we cannot do it again?* "[219] The new tendency will go directly to this attitude, old cities are serving as inspiration for new cities.

A possible method can be similar to Jucevicius's opinion "*In order to find the relation between a smart city and digital dimension it is necessary to find a set of indicators strongly related with digital dimension. The analysis of various studies shows many different indicators, but the motives of choice of the given indicators are less clear. It may seem that in many cases those indicators have been chosen intuitively. Some authors use as few as 28 indicators, some - up to 400. Also, the number of indicators concerned with the digital qualities is different studies.*" [220]

Theoretical considerations, into JUCEVICIUS (2014a) scientific research, have been used to develop as conceptual model for evaluation of the importance of a digital dimension for a smart city. They had use the follow matrix (Table 14).

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[219] Idem, Ibid

[220] JUCEVICIUS;PatasienePatasius

Table 14 - Smart City factors used by Giffenger's (2007) and Cohehen (2013) together with the number of digital indicators (for Giffinger) and the factors (for Cohehen) and the total number of indicators and factors

Smart economy	Used	Smart people	Used	Smart governance	Used
Innovative spirit	G, C	Level of qualification	G	Participation in decision-making;	G
Entrepreneurship	G,C	Affinity to lifelong learning	G	Public and social services	G
Economic image & trademarks	G	Social and ethnic plurality	G	Transparent governance	G
Productivity	G, C	Flexibility	G	Political strategies & Perspectives	G
Flexibility of labour market	G	Creativity	G, C	Demand policy	C
International embeddedness	G	Cosmopolitanism/Open-mindedness	G	Transparency & open data	C
Local and global interconnectedness	C	Participation in public life	G, C	ICT & government	C
		Education	C		
Digital/Total	G(2/12), C(2/3)	Digital/Total	G(1/15), C(3/3)	Digital/Total	G(2/9), C(2/3)
Smart mobility	**Used**	**Smart environment**	**Used**	**Smart living**	**Used**
Local accessibility	G	Natural conditions	G	Cultural facilities	G, C
(Inter) national accessibility	G	Pollution	G	Health conditions	G, C
Availability of ICT-infrastructure	G, C	Environmental protection	G	Individual safety	G, C
Sustainable innovative and transport systems	G, C	Sustainable resource management	G	Housing quality	G
Mixed modal access	C	Green buildings	C	Education facilities	G
		Green energy	C	Touristic attractiveness	G
		Green urban planning	C	Social cohesion	G
Digital/Total	G(2/9), C(3/3)	Digital/Total	G(1/9), C(3/3)	Digital/Total	G(0/20), C(1/3)

"One of the most detailed studies is R. Giffinger's report. The components of R. Giffinger's model (Giffinger et al., 2007) include: Smart Economy, Smart Environment, Smart Governance, Smart Living, Smart Mobility, and Smart People. Each characteristic is described by the set of factors used by Giffinger (2007) and Cohehen (2013). In total, 74 indicators were selected: 48 (65 %) are based on the local or regional data and 26 (35 %) are based on the national data. The factors used by R. Giffinger are marked by G, and the factors used by B. Cohehen are marked by C. The table also shows the number of digital indicators JUCEVICIUS (2014b: 146) (for Giffinger) and the factors (for Cohehen) and the total number of indicators and factors."[221] Taking into account Giffinger and Cohehen table, this research creates a new table called Matrix following their statements, following the six areas but with a focal direction of Architecture into the territory and even focus on direct objectives of green and climate spaces.

4.11.1 – Using the matrix

" The third instalment in our series, Raconteur Guides for Business, reveals the business potential of connected cities. As technology and the city unite through the Internet of Things, enterprises are set to cash in on

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[221] Idem, Ibid

the transformation of urban life."[222]

The developed model was determined by a list of criteria that was part of an integrant analysis based on old architects and urbanist and with the support of the actual actors on the territory.

The matrix is divided by SC criteria and by CSC criteria with the 30 elements. Both use percentage levels and result into a final result number that analyse any city and, can give a brief situation point of cities needs, to those who are in charge of fast decisions.

The SC matrix the six criteria, where they can be analysed by area, and with a more architectural point of view where the CSC Matrix analyse a city with a new paradigm shift using the 30 new elements.

In this research, were used the three case studies, and they were analysed together into a table putting they at the same level and arriving to a general analysis under the SC Matrix and under a CSC Matrix, showing how three different cities can have different results into similar areas.

Futurity, the developed Matrix of this investigation, from SC or from CSC can be used from different cities worldwide, with distinct population or development growth.

4.12 – Analysing results

Table 15 – Potential intervention areas Matrix basic knowledge.

GCF Result Area (RA)	Type of Intervention	Possible project/ programme areas for GCF consideration	Main benefits	Main challenges to look at for risk mitigation
Adaptation RA 1	Solar panels energy production	Solar panel application for eating water, outside Buildings and Houses.	Energy relies on the nuclear fusion power from the core of the Sun. The range is from solar water heating with solar collectors or attic cooling with solar attic fans for domestic use. It reduces the energy consumption	Firstly location for the Solar panel and space to implement the needs. Secondly project plan maintenance of the system. Thirdly the authenticity of the Building.

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[222] Sarah ALLIDINA - Smart cities mean big business,. UK: Raconteur, 2015b. Disponível em WWW: <https://www.raconteur.net/contributors/sarah-allidina>.

Adaptation RA 1	Photovoltaic panel production	Energy farms to produce energy for cities, to make cities become self-sufficient.	This form of energy relies on the nuclear fusion power from the core of the Sun. The complex technologies of direct conversion of sunlight to electrical energy using mirrors and boilers or photovoltaic cells.	Firstly location for the Photovoltaic panel and space to implement the needs. Secondly project plan maintenance of the system. Thirdly the authenticity of the Building.
Adaptation RA 1	Mechanical wave energy	Energy produced by energy movement near Islands or coasts.	Wave power is the transport of energy by ocean surface waves, and the capture of that energy to do useful work — for example, electricity generation, water desalination, or the pumping of water (into reservoirs). A machine able to exploit wave power is generally known as a wave energy converter (WEC)	Firstly location for wave energy park. Secondly project plan maintenance of the system.
Adaptation RA 1	Wind energy production	Wind farms projects and Turbines projects in land or water	The movement of the atmosphere is driven by differences of temperature at the Earth's surface due to varying temperatures of the Earth's surface when lit by sunlight. Wind energy can be used to pump water or generate electricity, but requires extensive areal coverage to produce significant amounts of energy.	Firstly the initial price of equipment. Secondly project plan maintenance of the system.
Adaptation RA 1	Biomass energy production	Biomass centres	Energy from plants. Energy in this form is very commonly used throughout the world. Unfortunately the most popular is the burning of trees for cooking and warmth. This process releases copious amounts of carbon dioxide gases into the atmosphere and is a major contributor to unhealthy air in many areas. Some of the more modern forms of biomass energy are methane generation and production of alcohol for automobile fuel and fuelling electric power plants.	Firstly the initial price of equipment. Secondly project plan maintenance of the system.
Adaptation RA 1	Geothermal energy production	Volcanic areas or with low sun production	Energy left over from the original accretion of the planet and augmented by heat from radioactive decay seeps out slowly everywhere, everyday. In certain areas the geothermal gradient (increase in temperature with depth) is high enough to exploit to generate electricity. This possibility is limited to a few locations on Earth and many technical problems exist that limit its utility. Another form of geothermal energy is Earth energy, a result of the heat storage in the Earth's surface. Soil everywhere tends to stay at a relatively constant temperature, the yearly average, and can be used with heat pumps to heat a building in winter and cool a building in summer. This form of energy can lessen the need for other power to maintain comfortable temperatures in buildings, but cannot be used to produce electricity.	Initial Investment cost. Maintenance supply.
Adaptation RA 1	LEED light production	Urban Cities streets support plan projects	Energy consumption reduction.	Maintenance support after implementation and information results.

Adaptation RA 1	Marine Tidal energy production	Urban energy production to support the energy consumption on the city.	Energy produced by the water movement	Water unpredictable changes, cost versus return
Adaptation RA 1	Parabolic thought energy production	Energy farms to produce energy for cities, to make cities become self-sufficient.	A parabolic trough is a type of solar thermal collector that is straight in one dimension and curved as a parabola in the other two, lined with a polished metal mirror. The energy of sunlight which enters the mirror parallel to its plane of symmetry is focused along the focal line, where objects are positioned that are intended to be heated. For example, food may be placed at the focal line of a trough, which causes the food to be cooked when the trough is aimed so the Sun is in its plane of symmetry. Further information on the use of parabolic troughs for cooking can be found in the article about solar cookers.	Firstly location for the Photovoltaic panel and space to implement the needs. Secondly project plan maintenance of the system. Thirdly the authenticity of the Building.
Adaptation RA 1	Tower and heliostat energy production	Energy farms to produce energy for cities, to make cities become self-sufficient.	The solar power tower, also known as 'central tower' power plants or 'heliostat' power plants or power towers, is a type of solar furnace using a tower to receive the focused sunlight. It uses an array of flat, movable mirrors (called heliostats) to focus the sun's rays upon a collector tower (the target). Concentrated solar thermal is seen as one viable solution for renewable, pollution-free energy.	Firstly location for the Photovoltaic panel and space to implement the needs. Secondly project plan maintenance of the system. Thirdly the authenticity of the Building.
Adaptation RA 1	PV thin film energy production	Outside Buildings and Houses projects. Streets appliances projects. Streets information Signage projects	A thin-film solar cell (TFSC), also called a thin-film photovoltaic cell (TFPV), is a second generation solar cell that is made by depositing one or more thin layers, or thin film (TF) of photovoltaic material on a substrate, such as glass, plastic or metal. Thin-film solar cells are commercially used in several technologies, including cadmium telluride (CdTe), copper indium gallium dieseling (CIGS), and amorphous and other thin-film silicon (a-Si, TF-Si). This technique is one of the best solution to start applying on Old Buildings, on Rehabilitation spaces.	Firstly location for the PV thin film panel and space to implement the needs. Secondly project plan maintenance of the system. Thirdly the authenticity of the Building.
Adaptation RA 1	Combustion of Municipal Solid Waste To Energy production - WTE	Waste treatment projects	WTE is a proven, environmentally sound process that provides reliable electricity generation and sustainable disposal of post-recycling MSW.	Government total support and maintenance.
Adaptation RA 1 and RA 3	Large hydro renewable energy production (DAM)	Dam projects	Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity.	Initial investment, maintenance

Adaptation RA 1	Small hydro renewable energy production	Water support to Houses	Small hydro is the development of hydroelectric power on a scale serving a small community or industrial plant. The definition of a small hydro project varies, but a generating capacity of up to 10 megawatts (MW) is generally accepted as the upper limit, which aligns to the concept of distributed generation.	Investment versus results. Maintenance after project development.
Adaptation RA 1	Natural Gas CCGT (combined Cycle Gas Turbine)	Nature gas sources to energy productio n projects	Combined Cycle Gas Turbines (CCGT)are a form of highly efficient energy generation technology that combines a gas-fired turbine with a steam turbine. The design uses a gas turbine to create electricity and then captures the resulting waste heat to create steam, which in turn drives a steam turbine significantly increasing the system's power output without any increase in fuel.	Cost of investment in technologies not well developed
Adaptation RA 2	Transformation of existing buildings in Green Buildings projects	Rehabilitat ion Buildings projects	More quality for inhabitants, less energy losses, water consumption reduction, more health.	Different phases of intervention. Verification during construction. Maintenance support after construction.
Adaptation RA 2	Smart Urban Planning transformation projects	Urban planning support projects	Cities with more quality	Different areas intervention
Adaptation RA 3	Fresh Water projects	River interventio n projects	Water quality, air quality and health quality	Maintenance support after intervention.
Adaptation RA 3	Rainfall control projects	Support on interventio n in Urban space projects	To reduce the catastrophes inside cities after rainfall	Enough intervention for result in a supportive project
Adaptation RA 3	Clean drinking water and Flood control	Support projects for new water infrastruct ures projects Flood control projects	To give health to citizens	Maintenance support after intervention.
Adaptation RA 3	Restoration of cultivated organic soils projects	Urban land projects	Air quality to citizens	Maintenance support after intervention.
Adaptation RA 3	Restoration of degraded lands projects	Urban land projects	Air quality to citizens	Maintenance support after intervention.

Adaptation RA 4 and RA 3	Transportation	Green Transportation projects Bike lanes Projects Reduction automobile traffic routes projects Walking routes projects		Maintenance support after intervention.
Mitigation RA 1	Energy sharing and energy participation programs	Communities support for the cities, for the smart and sustainable concept	Having a community support for better results	support communities and not only one community
Mitigation RA 1	Sustainable livelihood projects	Rehabilitation projects	Creation of liveable cities, diseases, health	Projects where the support need to be in a percentage
Mitigation RA 2	Urban intervention	Urban water projects Urban food projects Urban Health projects	Low emissions, air quality benefits, GHG	Maintenance after construction
Mitigation RA 3	Emissions reductions	Energy projects Buildings projects Transports projects	Low emissions	Correct projects and community participation
Mitigation RA 3 and RA 4	Water supply projects	New water systems or rehabilitate water system projects	Less losses on water supply	Maintenance after construction
Mitigation RA 3	Sanitation projects	Sanitation grid projects	Health systems for inhabitants	Maintenance after construction
Mitigation RA 3	Weather events intervention projects	Urban intervention projects	Prepare cities for disaster risks	Maintenance after implementation
Mitigation RA 3	Electricity projects	New grids or Old grid rehabilitation energy projects	Less losses and less energy consumption	Feasibility projects without enough information
Mitigation RA 4	Coastal systems	City urban plan interventions projects	Ecosystems maintenance, quality production	Percentage of GCF participation

Table 15A – Architectural Prototype SC

SIX INDICATORS		Areas	Designation
1	1	Efficiency	Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result.
2	1	Top Management	Space and infrastructure coordination facilitates on a wider range of activities.
3	1	Energy Savings	Reducing energy consumption through using less of an energy service
4	1	Cost versus effectiveness	Equilibrium versus expense to action time
5	1	New economic system	Revitalised and sustainable economic system
6	1	Smart payments	Easy and fast payments
7	2	Active citizen participation	An articulation of the debate over rights versus responsibilities.
8	2	Quality level	The general well-being of individuals and societies (QOL).
9	2	Social support	Projects accepted and co-organised by inhabitants
10	2	Historic elements	Old and special elements inside the city
11	2	Management of Human resources	Specialised systems to employment system
12	2	Green jobs	New work market connected with the sustainable development
13	2	Young population	Future generation sustainability
14	2	Smart Education	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.
15	2	Lighter footprint	Reduction measures of human demand on the Earth's ecosystems
16	2	Dynamic	Always active or changing and having motion, or physical force.
17	3	Collect Data	Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.
18	3	Green Buildings	Green construction or sustainable building) refers to both a structure and the using of processes that are environmentally responsible and resource-efficient
19	3	Safety	Technology that assists in reducing or avoiding accidents.
20	3	New Technology	New systems application, more effectiveness, more results with less time. Productivity.
21	3	Wide and Strong Political action	Political support from governments
22	3	New industries	New markets, new creativity
23	3	Marketing concept	Clear information arrived to the citizens
24	3	LEED Green certification	International building sustainable certification
25	3	Smart Health	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.
26	3	Zero waste	A philosophy that encourages the redesign of resource life cycles so that all products are reused.
27	3	Scale city	The main focus of the city

28	4	Green Transports	Transport that is sustainable in the senses of social, environmental and climate impacts and the ability to, in the global scope, supply the source energy indefinitely
29	4	Technological adaptation	High and costly equipments application
30	4	Management Tool	Existing management equipments
31	4	Network Connector	Central system management
32	4	Smart Lighting	uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on Light inside the city, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.
33	4	Smart grids	A modernised electrical grid that uses analog[1] or digital information and communications technology to gather and act on information - such as information about the behaviours of suppliers and consumers - in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.
34	5	Sustainability	Capacity of an ecosystem to absorb disturbance and still retain its basic structure and viability.
35	5	Green roofs	A roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.
36	5	Agriculture production	Cultivation of animals, plants, fungi, and other life forms for food, fibre, biofuel, medicinal and other products used to sustain and enhance human life
37	5	Local food	or the local food movement is a movement which aims to connect food producers and food consumers in the same geographic region, in order to develop more self-reliant and resilient food networks, improve local economies, or for health, environmental, community, or social impact in a particular place
38	5	Water conservation	encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand
39	5	No standardised Architecture	Diverse architecture, unusual architecture, unique
40	5	Equilibrium on caos	General measure applied inside a city given a natural equilibrium
41	5	Compact city	Or city of short distances is an urban planning and urban design concept, which promotes relatively high residential density with mixed land uses.
42	6	Natural Resources	Amounts of biodiversity and geo diversity existent in various ecosystems.
43	6	Public spaces	A social space that is generally open and accessible to people
44	6	New materials	Type and quality of the materials
45	6	Diverse architecture	Different buildings and intense sense of culture
46	6	Limitations	Limits on technology application
47	6	Green grow paradigm	Development focus on Sustainability
48	6	Clean air action	Actions to implement the Clean Air Act have achieved dramatic reductions in air pollution,
49	6	Liveable	Annually measures "quality of living" standards, using data such as crime rates, health statistics, sanitation standards, and expenditures on city services
50	6	Strong Communication	Information circulating very fast around the city

The levels of each city, as smart cities, were assessed through a matrix organised according to the following indicators, considered essential for this evaluation.

INDICATORS	
1	SM_ECONOMY
2	SM_PEOPLE
3	SM_GOVERNANCE
4	SM_MOBILITY
5	SM_ENVIRONMENT
6	SM_LIVING

Each of these indicators is composed of several areas, which in total complete a list of 50 elements, were evaluated in person or through written elements about the subject, and then scored according to the following scoring table, after the respective implementation percentage has been calculated.

SCORING		
YES	> 90%	1
PARTIAL 75	>75% <90%	0,75
PARTIAL 50	>50% <75%	0,5
PARTIAL 25	>25% <50%	0,25
NO	< 25%	0,1
NOT APPLICABLE	0%	0

After the analysis and scoring of all areas, the total points are obtained for each city, which can reach up to 50 points – number of the areas of the matrix. With these elements, one can evaluate the level of each city in terms of a smart city, which varies between 0 and 1 (dividing the total points by 50).

The levels of each city, as climate smart cities, were assessed through the analysis to the following 30 areas, and applying the same scoring table.

AREAS	CLIMATE SMART CITIES
1	New Design Integration Paradigm
2	Ecologic landscape
3	Mixing Private & Public
4	Auto sustainability	water, energy and food
5	Smart transportation
6	Smart waste treatment
7	Smart Maintenance
8	Hydrologic city
9	Air quality measures
10	Soil quality conservation
11	Biodiversity
12	Cultural preservation

13	Social co-benefits
14	Food security
15	Livelihoods Safeguard
16	Energy efficient design practices
17	Green Buildings
18	Real estate Smart engagement
19	Resilience and Climate risk reduction
20	Flexible circulation
21	Urban modelling techniques – on walking and cycling
22	Smart urbanisation
23	Smart management
24	Noise attenuation
25	Albedo' application
26	Singularity
27	Emotional security
28	Permanents and Impermanent
29	Style and Creativity
30	Colour diversity

After the analysis and scoring of the 30 areas, the total points for each city is obtained, being 30 points the possible maximum. With these elements, one can evaluate the level of each city in terms of a climate smart city, which varies between 0 and 1 (dividing the total points by 30).

4.13 – Project Financing

Figure 70 – Green Climate Fund logotype
(source: GCF by the author)

Green Climate Fund (Figure 70) noted the important role cities play to achieve the required paradigm shift towards green investments in the world, and how challenging is any strategic implementation and following maintenance integrated approach "Building better, in a more productive way, cities can boost economic prosperity and help tackle climate change. A shift to more compact urban growth, connected infrastructure, and coordinated governance could increase long-term urban productivity and yield environmental and social benefits. All cities can improve resource productivity in the short term through cost-effective investments in building energy efficiency, waste management, transit and other measures." [223] Every time that GCF is an integrant part of a project " *The fund need to give feedback on how well the Project Concept fits the six criteria in the Fund's Investment Framework.*" [224]

It is true Guidance Notes that the analysis of the project is made and analysed. The development of Guidance Notes is based on relevant sections of the Analysis of the Expected Role and Impact of the Green Climate Fund (GCF/B.09/06) or Impact Assessment determined by the board. The projects that can produce Impact Potential will be connected with Fund's objectives and result areas in Mitigation and Adaptation. The projects to analyse will need to create a shift in low-emission sustainable development (GCF/B.09/23).

Projects that move the population from the slums to efficient buildings connect with a reduction of tonne of carbon dioxide equivalent (tCO2 eq). Transformations into Government Buildings on a country changing the light system for LEED will be connected to energy reduction in Infrastructures. Buildings rehabilitation or, buildings change in Green efficient systems improving the number of households with access to low emissions can another type of project to support. Intervention in a city centre with the new green Smart Cities concepts being a part of a decrease in energy spending in buildings, cities, and industries centralising data information, transforming data into visible to increase quality of live and savings. Cities expect to be in the future auto sustainable to survive, producing energy and converting water. Science believes that auto sustainable projects will develop the market if they were based on low emission power suppliers as wind farms or photovoltaic central to supports city's needs. These kinds of projects are a base of most of the entities from United Nations worldwide.

Mobility in the towns is transforming societies. Reduction of car's

[223] WRI & GGGI - Better growth, better climate: The new climate economy report. WRI & GGGI,, 2015.

[224] GCF from UNFCCC - Decision gcf/b.09/23, annex iii,. South Korea: Green Climate Fund,, 2015a.

number, decreasing of the routes number and increasing the public transportation or even projects that implement new paradigm with bicycle paths will connect with the increasing of low-carbon transport.

Projects that improve maintenance on cities land, near rivers, green parks as cleaning the existent water, re-planting and rehabilitate natural parks will be contributing to emissions reductions.

The waste treatment inside cities can be a very danger to Inhabitants. An effective and efficient waste management will help emissions reduction, for example, new recycle systems used for producing their energy will be supporting the future needs inside a city.

The projects that created Impact Potential will be connected with Fund's (GCF) objectives and result areas in Adaptation will be projects that increase climate resilience sustainable development. Projects that promote the reduction of vulnerability and that will increase resilience for producing less CO2 as an intervention of LEED light in streets light systems.

A project of combustion of Municipal Solid Waste to Energy (WTE) production will protect the infrastructure if energy from the grid fails. During the days, this system can improve and produce energy for citizens. An action like this is climate responsive to the planning and the development.

Cities that have the highest level of seismic risk will need to be prepared with effective systems for supporting the natural actions. Smart Cities need to be technological but the support on physical measures, and the decrease of vulnerable infrastructures it is crucial.

Projects that support cities making changes using technologies to help inhabitants to stay on their territory because for example of water levels, it's a project that has a major task to implement.

To reduce climate risks in cities, the projects need to promote a continuous maintenance. For example, streets don't just convey cars and people, among the contaminants are heavy metals, or oil and grease, sediment, pesticides, herbicides, and fertilisers from adjacent properties, or even household waste. Projects for the new Climate Smart Cities that combine intervention on streets with strategically designed landscaping and paving materials that capture and filter storm water before it becomes polluted runoff are acceptable interventions.

In urban rights-of-way, such green storm water infrastructure can include tree planting, rain gardens, swales and pure permeable pavement. Similar actions will promote an increase in ecology and hydrology of cities.

Into the Paradigm Shift Potential, the contribution to global low carbon development will be based on projects that bring Innovation as new PV thin film energy applied on roofs houses for example or projects that present scalability that create probably benefits on total costs of implementation. The wind farms are another type of project that can be analysed and supported nowadays.

Another possible action is a focus on some projects after implementation. The possible positive results having a possibility of replication in another region or country, with the same concepts, for example, solar bike paths generating energy can be other main focal point in financial support from an international organisation.

Under the Sustainable Development Potential, Climate Smart Cities develop environmental co-benefits, as the air quality, improvement on the soil quality, conservation, and biodiversity. These types of cities will bring social co-benefits, as health impacts to inhabitants, educational benefits and promote the cultural preservation.

The economic co-benefits will be a focus on green market jobs, poverty alleviation, improvement of local industries, an increase of productivity and competitive capacity.

The Climate Smart City has the objective to focus on gender-sensitive development impact reducing the inequalities expecting to address the needs of women and men to change vulnerabilities and risks.

The Value added while Cities continue growing, and people living inside Cities will increase exponentially, the international organisations would be prepared to help on retrofit and upgrade existing infrastructures, and support efforts to strengthen the resilience of urban systems. Cities are now part of the 'GEF' strategy from The World Bank as other organisations all around the world. These entities will have the capacity to complement its grant funding with larger scale finance. It can help to unlock requisite investments with financing tailored addressing particular risks that impede greater investment in more resilient or lower emission approaches to urban development GCF (2015c:27) " *The Fund has the potential to build on new emerging partnerships to encourage climate action in cities and to finance implementation. It is also aided by the fact that a variety of organisations, including sub-national institutions such as agencies that manage municipal financing and private sector actors, may be eligible as accredited entities. Increased efficiency of Buildings in urban environments is a significant potential source of emission reductions.*"[225]

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[225] GCF from UNFCCC - Stockholm environmental institute. South Korea: Green Climate Fund, 2015c.

Today, climate change is having a powerful effect on how buildings are designed and constructed.

Smart Climate Compatible Cities are part of the necessary targets for GCF from UNFCCC, and the paradigm shift is the Energy self-resilience, Cities need a self-energy production and water transformation. The Smart maintenance and the Food security are a key on future cities. "

Green society where humans, nature and urban development exist in perfect harmony...Humans feel happier in Natural environment...low carbon in a green growth paradigm to humans and nature coexist amicably."[226] From the GCF's Impact Analysis (GCF/B09/06) enhancing Cities emerged that Smart Climate Compatible Cities that combine Buildings, Industries, and Appliances. Projects will connect both Energy Generation and Access, combining Transports, and be being a part of Forestry and Land Use, create the structure of all Mitigation projects inside GCF in South Korea entirely.

" *Getting information about noise, about pollution, about traffic, about weather conditions allows cities to stream line the city operations, reduce costs and always improve overall sustainability. Improve economic sustainability, social sustainability and environmental sustainability.*"[227] Cities, in general, are not empty, and they will be part of Livelihoods of People and Communities projects areas being connected with projects about Food, Water, and Health. The intervention on cities will support changes in Infrastructures and Built Environment, and Cities need to preserve and maintain Ecosystems and Ecosystems Services, and these main areas support Adaptation's projects completely at GCF.

The Climate Compatible Cities, are simple GCF's Smart Cities model analysis that can offer substantial Mitigation and Adaptation benefits, through the promotion of sustainable public transports systems, more energy-efficiency, more resilient buildings, better infrastructure and efforts to safeguard livelihoods. If the potential projects develop an increase in energy efficiency of buildings and appliances, this action, has significant mitigation potential with substantial economic returns.

The application of better technologies, energy-efficient design practices, incentives that change behaviour to reduce energy use in buildings can be another benefit into Climate Compatible Cities. The world is creating a competitive market for green buildings, and the engage with real estate industry is crucial to improving construction design standards and approaches.

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[226] IFEZ - Songdo international city - objectives. South Korea, 2014. Disponível em WWW: <https://www.ifez.go.kr/eng/en/m3/sd/screen.do>.

[227] CISCO - **Barcelona city,** . USA, 2014a. Disponível em WWW: <https://newsroom.cisco.com/feature-content?type=webcontent&articleId=1024698>.

The potential to develop and pilot innovative instruments that scale up available financing for larger scale investments, potentially in a partnership or tandem with efforts to strengthen policy, pricing, standards and other incentives for efficiency, may present a possible niche for international organisations worldwide.

Climate smart cities base will have a supported by a project city as a starting point, considering the needs and behaviour of individual people and their interactions with each other. The first principle has a base on the consideration of urban life before urban place and the account of an urban place before the technology to attract more residents. The second principle is based on a sustainable demonstration, scalability, and resilience over an extended timeframe because of the future changes.

The third idea inside a possible proposal the project will need to demonstrate flexibility over an extended timeframe because of the population circulation.

A fourth concept is based on future needs for technology infrastructures in new or renovated buildings they should be built to contain sufficient space for actual needs and future impositions and enough spaces for support and quickly access to infrastructures for the next changes.

A fifth concept will alert to projects that have a flexible functionality, in accesses, infrastructures, and interior spaces because of the fast changes. The principle numbers six it is focused on wireless connectivity in highest standards with the capacity to expand, and the data can be open without addition expenditure. The seventh principle is that the property development should indicate how they would attract business and residential tenants through providing up-to-date sustainable infrastructures for heat and power such as smart metering, local energy grids, and solar energy.

The idea number eight has a base on an action of consultations on plans for new developments should fully exploit the capacities of social media. Virtual worlds and other technologies to ensure that communities affected by them are given the widest, most immersive opportunity possible to contribute to their design.

The presence of the social media for the informal approach needs to be connected with the management companies, local authorities, and developers and this is the ninth principle. The tenth principle is linked to the local authorities that need to support social and technological programs for the communities.

The eleven principles are the connection between urban developers that

should support and cooperate with local food initiatives and help them succeed.

The twelfth principle is based on the residential accommodation needs that should incorporate space for environmental monitoring, interactive portals, and connectivity to enable remote control support and tele-health systems and home working. Projects for Cities have a need to demonstrate since the beginning that they will improve with the latest urban modelling techniques particularly in walking and cycling it is represented as the thirteenth principle. These new projects need to contain the concept applied on the offices the remotely working or mobile working that will succeed in the future is the fourteenth principle.

Transports plans need to disconnect with the traditional transports demand, and new technologies and green application is the fifteenth principle.

The last principle sixteenth has based on a clear understanding of the new developments that need to demonstrate that the design takes account of the latest best smart urbanism.

All Cities projects to be financing have a need to emphasise primary financing innovations for GCF brings to the climate fund space. Firstly, GCF can lead to both private and public sector clients. Secondly, the GCF is not an AAA-rated institution. The GCF has a much greater capacity to bear the risk. The GCF does not require sovereign guarantees, for example. Thirdly, the GCF can bring the full range of financial market instruments to keep in climate finance that is new.

Let's assume that the GCF receives a Funding Proposal from an Accredited Entity (AE), with a no-objection from the country's NDA. Let's think that the technology aspects are moderately innovative and that the policy and institutional issues look sustainable, i.e., mainly driven by the private sector. However, the AE requests a 100% grant from the GCF. How do we respond?

Figure 71 – Seoul city pollution
(source: by the author 2015)

The best way to deal with this question is to ask the PSF to iterate with
the AE through an agreed financing model.

In Smart Cities built from the Scratch, the investment model is different
from the type that is used for the existent Cities becoming Smart Cities.
The estimate costs of interventions need to be analysed carefully and in
details to not increased 100% because of the constructions costs.

South Korea, the location of the fund, is one of the cities that it needs an
extensive improvement into pollution action (Figure 71).

4.14 – Summary

For the new CSC, some new urban systems design are using models,
tools and a new diversity of systems under cities proposals or analysis.
The objective is to create and implement diversity under spaces.

Under materials existence, concrete is one of the many materials around
the world that their distribution is creating intense levels of CO_2.
Worldwide construction has changed, and the action into the territory
started following different rules and against sustainability work. A new
paradigm will need to be implemented to deliver positive results. A new
material more developed and studied nowadays called Bamboo that
started to be implemented around the world and will have a direct

connection with the CSC principles.

An urban design space with quality and producing more liveability into cities will be based on urban system design but will follow differently, and personal rules will be taken from the Data information. The combination of different areas of a project in a city has to think for the first moment or project into a strategic plan under all interventions. With the new technologies the urban system design was improved, and the addition the virtual model or the simulations are possible to predict future actions based on different layers

The set of criteria developed in the research can be in the future a base for sustainable development into Climate Smart Cities or future cities. The 30 elements that were developed for design in a direction a CSC and in what a proposal will need to prepare as well. The difference between SC and CSC are intense, but they support each other.

The UN goals, the SDGs started to be integrated under new interventions with international organisations, and they will be a support for CSC, using all of the 17 elements, but starting with six basilar.

The principles from Le Corbusier with his book from the image of the city were supporting this new type of draw under a city. The 'Archigram' proposal from 1934 or even the new tendency from 'The new urbanism' is giving an impressive support to all the CSC future development under cities.

The architecture paradigm into the towns had changed during the time because of the economic pressure and was transforming cities into non-liveable spaces but with the climate change action cities are now being converted, and they follow in direction to cities that exist one hundred years ago in the most well-known cities worldwide.

Cities from the scratch or new interventions following rules can directly implement the criteria but innovating and at the same time risking and 'painting colours' into the city with diversity not forgetting to implement systems that transform cities completely auto-sufficient in a direction to food production and water and energy consumption supply. Into old or existent cities CSC can't destroy the cultural existence and need to create more accessible fluxes and more fast technologies.

The new Matrix model will create a simple analysis into a different kind of city always in a direction to sustainable, and smart improvement is obtaining results. The GCF is one of the possible existent entities that are prepared to support and finance this type of interventions worldwide.

Chapter V | Study Cases

5.1 – Introductory elements

CITIES HAVE THEIR OWN LIFE AND THEIR CULTURES. Delivering results from a city action, the developed investigation had an immediate and intense research, with a direct communication and visualisation with the spaces itself. In this direct investigation, three cities are the case studies.

The first one into the document is Ulaanbaatar, the Mongolia's capital, an old town and the larger city in the country. In this city are living almost 1.3 millions of population and, there are passing a danger level of air pollution especially in the wintertime because Ulaanbaatar's location. The city exists in a valley between relatively high mountains, which shield the city from the winter winds and, thus obstruct air circulation. The author of this research, had a direct connection with the city mayor and, with the responsible team from Mongolia's current government proposing solutions to implement into the city. The proposals are exposed under this document.

The second case study is a city built from the scratch or, maybe the first built completely new, called Songdo International Business District in Incheon near Seoul town in South Korea. The author lived and worked directly in the city, two years and explore at a high level the process from the initial part of the construction. Songdo is a well-planned city that has a high degree of development but with the crises, the plan changed the proposal and the standard Korean buildings began to occupy and, to be built around the first phase of construction. This city has some criteria of sustainability but, the city has at the moment still a 'robotic' way of living that makes people want to live in another city. The city town management, made high efforts to grow into a smart and green paradigm but yet with level of results.

Minsk city, in Belarus, is the third case study, a city with a slow development comparing with the real world, with a high level of influence from the old Soviet Union and actual Russia. The city present a development similar to European cities thirty years ago and, they maintain some attitude under the territory that will be needed for the future Climate Smart Cities presented this research.

The three cases want to become real climate smart cities or in a direction of that new type of city (Figure 72).

Figure 72 – Case studies at the World Map | Minsk, Ulaanbaatar and Songdo.
(source: by the author 2016)

5.2 – CASE STUDY 1 | Ulaanbaatar as a Climate Smart City

Ulaanbaatar is the principal City in Mongolia, with a territory of 1,815 squares miles and nine districts. Ulaanbaatar was founded in 1639.

With over one-third of the country's population, Ulaanbaatar is by far Mongolia's largest city. It is also the transport and industrial centre of the country. Often shortened to UB by foreigners, but not by locals, Mongolia's capital still has the look and feel of a neglected European city from the 1950s, but not for long.

The old Soviet cars and buses that were possible to see newer Japanese models are replacing circulating in the city. Apartments are being converted into flashy shops, and it seems that every young Mongolian now has a mobile phone. Ulaanbaatar prides itself on being an increasingly modern, though still very laid-back, city. Despite all this, men and women still stroll along the main streets in traditional dress.

Built along the river, the Tuul Gol, and surrounded by picturesque mountains, the centre of Ulaanbaatar is dominated by Soviet-style high-rise apartment blocks. About 250,000 locals live in sprawling suburbs on the outskirts of the city, opting to live in traditional Ger.

The topography makes for excellent hillside views overlooking the city, however, during winter the view is frequently obscured by pollution (Figure 73). This environmental problem is further exacerbated by temperature inversions caused by the coal burning those powers the Soviet-built heating system.

Figure 73 - Un simple fermier ne peut plus supporter l'odeur putride.
(source: Lu Guang, Foundation deep Ecology)

Despite being the national capital and largest city, Ulaanbaatar retains a relaxed, small-town atmosphere. It is a very pleasant place to visit and to base for trips around the country. The city has impressive monasteries and museums and excellent cultural shows. Spending some time here before heading out to the glorious valleys, steppes or desert of Mongolia

is considered a good experience.

Ulaanbaatar city council with a governmental support it is following a possible proposal of a Green City Development project. The principal objective of Mongolia's government is to transform UB into a smart city. Mongolia has an adamant and intense climate, and is a massive multiplayer when it comes to the global warming, and it is felt by the population and by the other countries. Mongolia is one of the most vulnerable countries worldwide. In January of 2015, ' The Guardian' exposed in an article the tenth worst polluted countries and Mongolia is at the eighth position of the ranking. Slums are an important force for this pollution into the city. For a better analysis of Ulaanbaatar city developed a possible project with the Green Climate Fund from UNFCCC, a program of proposals that were helping this type of analysis.

The presented proposals were important to understand investment priorities and how they can arrive in an integrated solution with a combined proposal, where GCF can analyse possible financial support, to transform Ulaanbaatar into a smart city. As was presented before, smart cities can be considered from Type 1 or the Type 2 interventions inside old and historical cities. Ulaanbaatar is part of cities from the Type 2.

Based on the projects proposals, was developed a brief analysis of each proposal explaining the content of the projects, the best practices to implement and how the proposals can become a Paradigm Shift to GCF as future projects for a possible financing.

The developed matrix, presented in this thesis, helped on project proposals analysis for Ulaanbaatar.

For this study case, was prepared a table that evaluates, project by project, with the six smart cities criteria's

For Ulaanbaatar became a possible smart city in the future, they will need to use Sustainable and Green Grow criteria's, because they are a city from the type 2 but they are from the scratch on some areas, as for examples the slums area, where they can possibly destroy to increase the quality of life to inhabitants.

5.2.1 – City's introduction Ulaanbaatar city

Figure 74 - Ulaanbaatar slums
(source: www.aljazeera.com and www.eurasianet.org 2015)

Ulaanbaatar, Mongolia's capital, has an annual grow by 4%, Almost 40% of the national population has an intense concentration in the city. With the Japanese Grant Aid Projects, a rapid water demand growth and groundwater resource development has been implemented over the last decade. In a similar level of 60% of the Mongolian population, are in Ulaanbaatar city in the urban area. The largest part of the population is located in 'Ger' area (Figure 74) existent around the city centre and, consuming water from not sustainable systems.

This rapid extension of the city created an industrial wastewater containing heavy metals that are cleared from the leather tannery factories and it 's hard to handle the sludge. In 'Ger' area it doesn't exist implemented necessary sanitary facilities. According to the ground water, human wastes contaminated this system, and it has become a serious problem.

The Mongolian economy has been in full shape, expanding by 11.0% year-on-year, but this economic growth, however, is also causing inflation, which reached 16% in August 2012, and the capital expenditure is increasing quickly. Mongolia has some of the world's largest untapped mineral deposits, including copper, uranium, coal and gold. The slowdown of the Chinese economy and deteriorating economic conditions in Eurozone had substantial negative impacts on the demand for Mongolia's mineral output. On the change of land classification, Ulaanbaatar in 2001 had 69% of agricultural land and passed to 52,6% in 2011. In urbanised and other settlements in 2001 experienced 4.6% and passed with 12.5% in 2011 and on forest classification, in 2001 they had 23.5% and in 2011 they pass to 16.5%. This percentage reflects the progressing urbanisation trend over the last ten years.

The population continues increasing exponentially in the city. They arrive from rural regions, and they are living inside the apartment's zone or inside the 'Ger' area. The apartment's area was based on the old 'Ulaanbaatar City Development Plan' while 'Ger' area exists without any urban planning system and is expanding fast with people coming from the countryside. The 'Ger' area surrounds Ulaanbaatar city centre, and it is expanded more in the northern periphery according to the city centre.

	The Apartment Area	The Ger Area
Urban Area	Generally formed by urban planning	Formed haphazardly without planning
Buildings	Multistory buildings	Houses of one story
Water Supply	Equipped with household water supply	Purchase from a water kiosk and/or water wagon, and delivered to house by wheelbarrow
Sewerage	Toilet, drainage and sewers are installed	Pit latrine within the plot or a shared toilet. Sewage treatment and service of carrying out excreta by vacuum truck is limited
Garbage collection	Household collection with almost 100%	Collection service is provided in case of payment of collection fee

Table 16 – Comparison of living conditions between apartment area and Ger area (source: city hall Ulaanbaatar, 2007)

This type of urban planning is creating a significant conflict between population, not only in deference to their buildings and townscape but also concerning urban infrastructures such as roads, water supply, sewer, heating systems and other layers. The following table can indicate these differences (Table 16). Ulaanbaatar city presents, a substantial problem on the social infrastructure and services level that is given to the following board (Table 17).

Issue	Current Problems and/or Necessities of Improvement
Road Transportation	Increasing traffic congestion; Decreasing levels of safety and amenity of road transportation; Unsatisfactory level of public transportation; Low awareness of road users; Deficient road transportation infrastructure/facilities such as damaged road pavement; Significant temperature differences (-40°C in winter to +35°C in summer) also causes damage.
Water supply	Increase in capacity of water supply; Development of new water resources; Improvement and/or rehabilitation of water supply facilities and equipment; Demand-side management applied to water saving.
Sewerage and Wastewater	Enhancement of treatment capacity; Proper management of industrial wastewater; Improvement of sanitation in the Ger area.
Power Supply	Additional construction and rehabilitation for generation plants are necessary. A new power generation plant is required as well to increase capacities and enhance the heating system. The introduction of new power sources other than coal is another planning concern in the long term.
Heating System	Enhancement of capacity; Expansion of the heating network; Development of a local cluster system to supplement the centralized system; Reduction of air pollutants
Air Pollution	Improving air quality is the top issue that people require; Degradation of ambient air quality is taking place especially during winter; Reduction of air pollutants with coal burning boilers in the Ger area; Regulation of emissions from boilers for heating.
Solid waste Management	Poor waste collection network; Inadequate self-treatment and illegal dumping of wastes; Limited capacity of existing disposal sites; No medical and toxic industrial waste treatment system.
Natural Disasters	Flooding causes severe urban disasters, which often takes place as a result of degradation of the water-retaining capacities of the land. The northern hilly areas, where numerous houses have encroached upon, are especially problematic; Earthquake is another potential disaster, because the Ulaanbaatar City area is not located on an earthquake-free zone.

Table 17 – Current problems necessities in social infrastructures.
(source: City hall Ulaanbaatar city, 2007)

Air pollution is one of the most pressing environmental issues of Ulaanbaatar City. The smoke discharges from the factories, smoke from household coal stoves in the winter season and exhaust fumes from second-hand, the ill-maintained vehicles and 'Ger' areas, are the main problems into this city, that are affecting the whole world.

The existent city's urban layout increase this problem, the natural constraints are the heaps that surround the city that create a result like low temperatures and low mixing heights in the winter season, which limits the dispersion of pollutants and enhances their ambient concentrations (Figure 75).

Figure 75 - A child stands next to a Ger in Ulan Bator
(source: citylab.com, 22 June, 2013)

The 'Ger' area is consuming more than 350 thousand tons of coal and 1.6 million tons of flammable wood. The highest priority by the Ulaanbaatar citizens is the ' *Clean air*' in the city. The following table indicates the importance of this problem (Table 18).
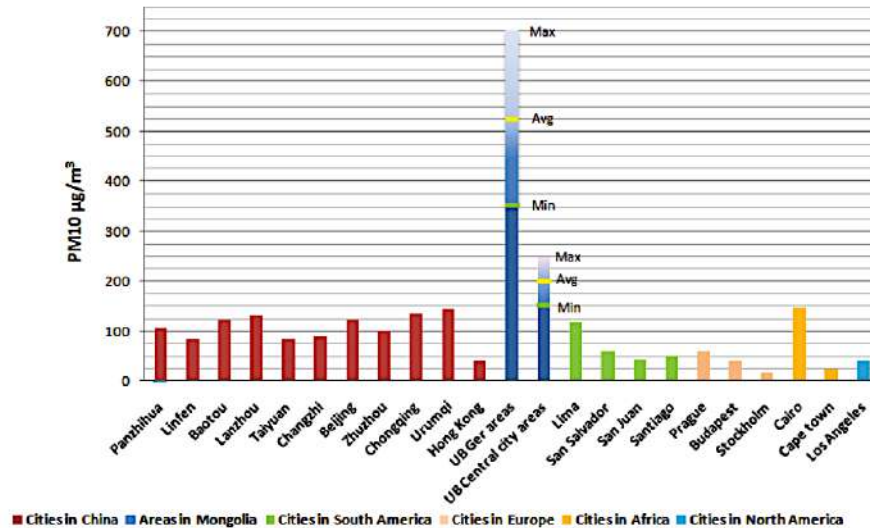
Table 18 – Concentration of PM in Major cities in the world
(source: world bank 2011)
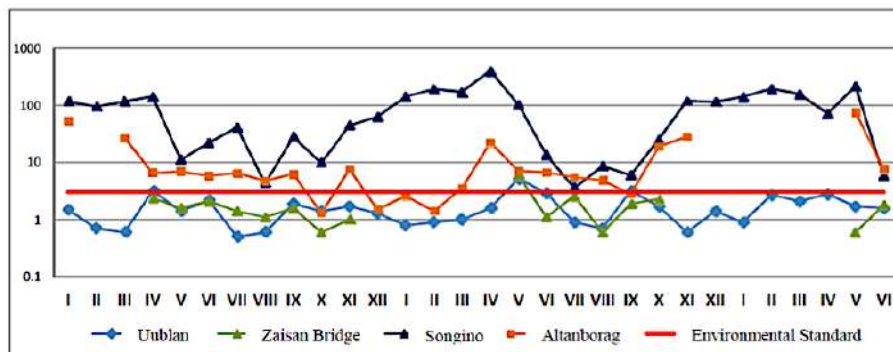
Table 19 – Monthly change of BOD '2010-2012 first half'
(source: Central laboratory of National)

The water quality presents another intense issue for the Ulaanbaatar citizens. Areas like 'Songino' and 'Altanborag' are exceeding the standard environmental values as we can see in the following table (Table 19)

" *Their domestic water use barely reaches ten litters per day, way below the 50 to 100 litters per day the World Health Organisation (WHO) identifies as the threshold to ensure that most basic needs are met. As the government develops its plans to improve water infrastructure in the Ger districts and move some of the dwellers to modern housing, domestic water usage will rise: owners of modern apartments in Ulaanbaatar currently use more than 200 litters per day, according to 2010 usage figures. At the same time, additional water will be needed to cater to the*

city's growing industrial and economic activities. Total water usage is set to double by 2030 and triple by 2040, according to estimates by the Korean International Cooperation Agency (KOICA)." [228]

The increasing number of automobiles inside Ulaanbaatar city centre, Ger area, industrial zones and apartment's areas has a recognition that soil is becoming more and more contaminated year by year.

According to the solid waste analysis, the existent apartment's areas are using an old system, and they are without an explicit or sustainable regulation. The highest problems are directly in Ger areas with the poor sustainable action for the future. Ulaanbaatar has a feasibility study made by JICA called 'Study on Solid Waste Management Master Plan Project' developed in 2007 explaining in details the current situation and this is the material that the Ulaanbaatar is using to promote the new smart city.

5.2.2 –City's problems

Ulaanbaatar government was present in Incheon in South Korea to meet with GCF for help and support into their strategy for UB and according to the 'Economic Development Strategy City of Ulaanbaatar 2015'. Ulaanbaatar wants' to follow concepts as a high-tech production of good and services as a smart city and the long term goals for UB city are the satellite cities development, on buildings and green infrastructures maintenance and a full integrated transportation.

The development vision for Ulaanbaatar from UB organisation was at the moment in May 2015 a strategy focus on becoming a smart city and improving the quality of citizen's life Ulaanbaatar highly.

It is important at this point to explain in detail more, the enormous problems that will cut the possibilities to transform the city into a smart city.

5.2.3 – Project proposals analysis

The GCF received from Mongolia's delegation that visited GCF's Songdo headquarters on May 18th and May 19th, 2015, and they presented eight project proposals for Ulaanbaatar as a future possible Smart City.

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[228] Jacopo DETTONI - Is ulaanbaatar running out of water? Scarcity problems will emerge in 2015, and intensify from 2020 onwards. Asia Pacific: The Diplomat.

01 - SCHOOL Project

02 - INSULATION Project

03 - WASTEWATER treatment plant Project

04 - ECO PARK Project

05 - EMEELT Project

06 - TUUL River Project

07 -TUUL MULTIPURPOSE WATER RESERVOIR COMPLEX | DAM project

08 - SKYWAY Project

PR 01 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"THERMO-TECHNICAL REHABILITATION OF ULAANBAATAR CITY'S SCHOOL AND KINDERGARTEN BUILDINGS"

INTRODUCTION:

A project proposal in 42 schools and 50 kindergartens with an expected result of 38.35 million of kilowatt and a 2.32 million USD annually of savings and this project can save 28.380.00 tons of CO2 per year.

Was sent to GCF team a detailed report for this intervention developed by GIZ.

The amount of money proposed for this project is 37.6 million USD,

NOTES:

Firstly, some schools will need to have different levels of rehabilitation. Some windows will need to have a change, some roofs will need improvement, some new electrical systems will be required because they are in danger levels, and some walls will need full interventions. This project can increase the cost after the new feasibility study. An energy efficient building retrofit study needs to be part of this response.

Buildings will need to produce a minimum quality to arrive at a sustainable level.

One of the gaps of the project can be the delay if the intervention can have a development by the private sector or the public sector. All the time from authorisations needs to be part of the performance.

To make this project as an initial stage of the Smart City intervention, need to combine the private sector and the public sector, the communities and the daily maintenance to arrive at an approved sustainable level.

According to the Smart City level of intervention, this project is the Type 2, where the Buildings are old, and some could have Historic elements, the architecture is not standardised, and the buildings have technical limitations.

From each Building, it will be needed support on Data Information from energy spending, cooling, air quality, and other possible sources. This Data needs to be centralised and used for future improvements.

The Paradigm Shift of this intervention can be the creation of green transportation system support, as green buses, car sharing or bicycle systems.

The second part of the Paradigm Shift can have a base on the application and intervention of spaces that kids can start planting, outside or even inside of the Building, for educating the future generation of Mongolia, to treat the Nature as a gift.

The third concept of the Paradigm Shift can pass by, with low-cost intervention to improve the water reduction on buildings. Bathrooms and kitchens with a simple tap system and with the option of collecting the data on how much water they spend per month can solve a water supply system.

PR 02 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"CENTRAL TREATMENT PLANT REHABILITATION"

INTRODUCTION:

A project for all citizens of Ulaanbaatar citizen's based on a rehabilitating of the existent Building of Central Treatment, Water Plant that treat

170.000m3/per day and a construction support of a new Building that will handle the 250.000m3/per day.

The total financing amount is 300 Million USD.

There is a report made by JICA, NJS Consultants, TOKYO METROPOLITAN SEWERAGE SERVICE CORPORATION, BUREAU OF WATERWORKS, TOKYO METROPOLITAN GOVERNMENT from August 2013.

The Mongolian government officially request the Japanese government to carry out the implementation of development plan including technical cooperation and the creation of this feasibility study for this project.

The existent studies were conducted by the collaboration of the following three units: (a) A Consultant Team (JV of NJS Consultants Co., Ltd. And Tokyo Metropolitan Sewerage Corp.);

(b) The Bureau of Waterworks of the Tokyo Metropolitan Government, (c) The senior advisor of JICA dispatched as a short-term expert.

NOTES:

JICA from 2013 well develops the project feasibility study proposal, but for a GCF support, they will need to develop a more recent update.

There are missing studies that connect these buildings to the City Master Plan, to the transport services integration.

It has to be part of the project the maintenance support plan for the Rehabilitated Building and New Building.

As a Paradigm Shift on this project, the populations need to be informed about the water treatment levels after the intervention.

A second tier of the Paradigm Shift inside this project can be the Data Information from the Old building and the new facility on a Central.

A third point of the Paradigm Shift can be the creation of a zone where Schools and Universities can visit and understand how water will be treated in the future.

The Fourth Paradigm Shift idea is to create a green transportation for this new Zone as an integrated plan for building a Green Grow and inside a

smart city plan.

PR 03 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"TUUL AND SELBE RIVER VICINITY IMPROVEMENT"

INTRODUCTION:

The Tuul River runs from east to west through the southern side of the city centre. Tuul River has a basin area of 50.400 km2 and runs from the 'Henteyn Nuru' (a mountain) for a total length of 819 km and merges with the 'Orhon' river, which is a tributary of the 'Selenge' river that runs into lake 'Baikal'.

This project is an integrated solution to improve the water quality of TUUl River and protecting Ulaanbaatar city from the floods. TUUl River has 1878.9 Hectare areas, and the 'Selbe' river has 21.3-hectare area. This part of the soil and the air pollution is contaminating all Ulaanbaatar cities. The project objective is to create an increase in the river flow speed. A four-year propose intervention project with a financing of 60.03 Million USD.

NOTES:

The experience from the last years says that Ulaanbaatar water has a limited reserve and could arrive at a limit, and the evaporation exists at a high level.

Ulaanbaatar has a high degree of flood hazard in Summer time.

The pollution in the river affects population's health.

This project proposal will follow the rules of the smart city from the Type 1, whereas a Paradigm Shift, all the development projects around the river, need to follow the rules and the concepts of standard Green Buildings definition. Collecting data information. The new possible infrastructures to support the stream will need to provide data information to the Central.

The maintenance level needs to exist as an integrated part of the project plan to maintain a continuous sustainability.

Even if some spaces are not together, the public areas need to have an integrated approach between them producing a Paradigm Shift in this project.

Smart payment needs to have smooth operations; Green transport systems, cars, and bike sharing systems can be another part of the Paradigm Shift of this project proposal.

An important detail in the project is the application of Natural and Traditional Materials Application (NTMA) from the country or the region a Paradigm Shift in this initiative.

PR 04 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"ECO PARK"

INTRODUCTION:

A project for a new zone, that could be sorting the waste, recycling products and will reduce the pollution inside the city. The project consists of seven new outlets of solid waste processing in two different locations.

Presently, the waste is buried in the landfill without sorting. This situation creates a direct impact on soil and water contamination.

The project presents a complex on the West part of the city and another complex on the East part of the city.

NOTES:

This project proposal needs a feasibility study with scientific Data Information to show, in detail, the benefits of climate change. The location, in this proposal, is a priority because of the transportation and the delivery. The project will need to have a secure system for a new grid or a Green transportation.

The new buildings inside the compound will need to follow the type 1 criteria's for smart cities definition. Maintenance project integration it is a strategic element to the project.

The Paradigm Shift in this project will have a base on the transportation

system. The city centre needs to connect with these places as an integrated part of the urban plan of the smart green city to reduce the CO2 emissions. For the project plan a chapter need to explain how this new complex could be part or could work with the town in a morphologic urban structure if future growing arrives very near the both complexes.

The second Paradigm Shift in this project can be the creation of new forest plantation around the new zone transformation. A project like this will create from the begging a sustainable connection between public space and urban scale.

PR 05 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"THERMO INSULATION OF PRE-CAST BUILDINGS"

INTRODUCTION:

The thermo-insulation project for 1077 buildings, in 14 residential districts, the project is based on old and pre-cast residential apartments, the project count with an initial financing amount of 250 million USD.

This demand is the upshot of the buildings that had a construction between the years of 1965-2000 and, the result was a high rate of heating energy losses.

Thus, the aim of this intervention is to cut the heating losses in 30%, and this will reduce the greenhouse gases.

This project implementation has a period of 9 years, from 2016 to 2025.

The general concept is to rehabilitate buildings, creating efficiency, to supply the gap of houses with quality in Ulaanbaatar city (Figure 76).

Figure 76 – Difference between slums and new construction
(source: www.euro-khan.com, 2015)

NOTES:

To reduce 30% of the loss in heating, the raw materials to implement, need to demonstrate a high degree of quality.

The buildings will deliver an intervention on windows, the outer walls, roofs improvement, at the floors and either at the existent doors, the elements in a house, that produce losses, and that can preserve directly thermic levels when they are changed or rebuilt.

This project proposal, based on smart cities context, even the feasibility study, need to present the maintenance plan after construction with the private or public sector support or both together. For security, in an investment like this, being sustainable, financing will need to respond in the future in almost 10 or 15 years in the daily maintenance.

The Paradigm Shift in this project can start with community integration and support. Citizens need to be informed of the project actions, to result in best practices for the best outcomes. The Data Centre collection is the second part of the Paradigm Shift in this project.

The other Paradigm Shift of this project can be based on co-benefits of food production and green roofs development. This can create a social responsibility in the community. Smart payment systems are sustainable to this type of interventions.

To re-habilitate buildings in an integrated plan the public spaces vs. urban forms need to connect. But if this doesn't happened, it goes against

two principles for a sustainable city of 'visible life' and that it 'makes it local' [229]. The rehabilitation needs to support the external area to connect the buildings and create compact cities and not empty spaces and empty cities. So, with a project proposal based in this criteria's, can be a Paradigm Shift.

Green areas and green parks to support inhabitants need to be part of this Paradigm Shift.

Another Paradigm Shift can be the Green Transportation to this new zones inside the city, less parking cars and more bike uses.

This project will connect the Type 2 of Smart Cities rules to implement the smart city rules.

The last Paradigm Shift concept inside this project proposal can be the NTMA (Natural and Traditional Materials Applications) introduction, materials transportation from other countries or locations increase green gas emissions.

PR 06 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"EMMELT - LIGHT INDUSTRY PRODUCTION TECHNOLOGICAL"

INTRODUCTION:

The new UB city Master Plan has as a priority the relocation of 'Emeelt' area. This master plan was revised based on the report called "Study of City Master Plan and Urban Development Program of Ulaanbaatar City" (UBMPS) and was prepared with the assistance of JICA in 2009 and approved by the City Council in February 2012.

This project proposal is to build a new industrial wastewater treatment plant in the Emeelt village. The concept is to relocate and expand the three-treatment capacity of 'Khariga' industrial wastewater plant that contains the wastewater from animal skin processing industries. The city council approved this idea in December 2010.

NOTES:

Transportation system needs to be created to support inhabitants and

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[229] GCF from UNFCCC - Internal staff guidance note for cities,. Republic of Korea, 2015b.

workers. New equipment's and services are fundamental to develop inside the new zone, allowing the energy self- reliance concepts.

The Paradigm Shift for this project proposal is the Smart and Green Transportation from the city centre, the bicycle circulation inside the new complexes promoting Data Information to the Central system and developing an innovative integrated maintenance system.

Another important point and a possible Paradigm Shift in the project is the social co-benefits from a project program conceived. Zaragoza in Spain is an example a project is developed for the citizens and by the people, where the empty spaces inside the city have to find a new function during the relocation putting this part inside the project proposal.

All the buildings will be new, so the implemented rules inside this building and outside need to follow the concepts of smart cities type 1 and follow as well the six principals to perform in a city.

This new centre doesn't need to be empty. The project proposal needs to address a solution for the introduction of new markets creating liveable spaces. The danger social level failure, it will affect investment and planning.

Experience says that normally near these new industries centres new cities could be visible and grow. For this reason, the new construction can't create barriers with industrial centres and the following town. Even if this is produced from the scratch, it can't be a block on urban green and sustainable growth.

PR 07 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"TUUL MULTIPURPOSE WATER RESERVOIR COMPLEX" – DAM

There is a pre-feasibility study from "PRESTIGE GROUP" CO., LTD.

The Dam construction could complement the Tuul River project proposal.

INTRODUCTION:

This project proposal is based on the pre-feasibility study with the National water program.

The project is aimed to the reliable water supply for Ulaanbaatar city in the future. Hydropower generation, complex building construction, and facility with water treatment, solving the water supply for the large industry, consumers and form an ecosystem in the Tuul River.

The current situation had a base on a centralised water supply system with four sources. A new Dam project will solve the following problems:

Ulaanbaatar city water supply issues;

Hydropower electricity production;

Irrigated agricultural engagement;

Pisciculture support;

City flood risk protection and Tuul River's ecological run-off compose.

Features	Measuring unit	Quantity
Investment	million tugrug	361 310.3
Period of project	year	25
Period of construction	year	3
Depreciation quantity in a year	Million tugrug	8 708.0
Value added tax	%	10
Income tax	%	10
Discount interest	%	5.0

Table 20 – Project proposal investment for GCF – PRO3

NOTES:

All ecological systems need to present the final proposal more detailed than the chapter VII carefully. The environment inside the pre-feasibility study presented (Table 20). The Paradigm Shift for this project can exist only after the implementation a replication in other countries or regions after comported results.

PR 08 – ULAANBAATAR CITY GREEN DEVELOPMENT PROJECT

"SKYWAY"

INTRODUCTION:

Ulaanbaatar's pedestrian traffic network fails to facilitate safe journeys adequately.

The city does not have systematic cycle tracks, and the traffic congestion reaches its peak during winter and roads become slippery and icy.

Similarly, air pollution worsens and adversely affects people's health, especially that of pedestrians.

The focus of this project is to reduce the pressing issue of traffic congestion, to provide safe, pleasant and warm conditions for pedestrian and cycling journeys and to provide safe, pleasant and warm conditions for disabled and extraordinary needs travellers.

The proposed infrastructure is a prefabricated system, which the installation could be faster, comfortable durable, a project for 2016 until 2020, four years duration.

The project present 3 phases, the 1st phase with 7.2 km, gives the 2nd period with 27 km and the 3rd stage with 14 km. The project pretends to cover 50 km in total in the city, on a complete project intervention.

There are not data about the climate changes implications.

NOTES:

A project with this level of intervention can replace an existent city altogether.

This particular project can be a start for a sustainable city, but could not be the first and principal action. This concept is something that can change streets and the city centre. The new element, it will be a part of the city.

The down zone of the element will need to be carefully developed, to create life above the element at the same level that you are creating the new object, but the treatment, it has to be the same inside and outside in all the distance.

Removing people from the streets can't result in an increasing number of

the cars on the streets. The objective has to be the opposite, to take cars from the city. The new element can't be an urban barrier.

This new feature needs to maintain a sky view. The project proposal needs to develop a demolition plan and a risk seismic proposal as well.

The used energy by the lifts and escalators presented on the project proposal will need to be produced by a sustainable source because this system can increase the investment and the energy consumption.

The possible Paradigm Shift in this project can be the sustainable energy producing with solar panels heat the water for kitchens or the warming system. The other Paradigm Shift idea can use photovoltaic panels to provide energy for supporting all LED lights inside this new structure.

Another Paradigm Shift can be the application of Green Building concepts, to create new green jobs, like winter gardens, bringing the nature inside and using the NTMA systems.

A new Paradigm Shift can be implemented using the proposed Architectural structure, to develop a green public transportation adapted to the same structure.

Producing energy from the implemented glass on the facades can be another Paradigm Shift for this project.

PART III – UB as a SMART CITY

How can Ulaanbaatar become a Smart City according to GCF?

Ulaanbaatar has grown very quickly, without sustainability, Mongolia has now the opportunity to use the best practices with GCF help to establish a plan based on the Smart Cities concepts to 'GCF.' [230]

Ulaanbaatar has two challenges to overcome, firstly, Mongolia is highly vulnerable to climate change, and the faster warming is growing so there's Adaptation needs and secondly the high levels of pollution that the city of Ulaanbaatar is suffering and adding the lack of necessary access to sustainable water, sustainable energy, and sustainable sanitation. Secondly, Mongolia needs to develop the city using the public and private partnership approach.

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[230] GCF from UNFCCC – Smart cities presentation document. by the author,. Republic of Korea: Green Climate Fund, 2015c.

For Ulaanbaatar become a smart city they need to show that they are using a sustainable approach to the urban transformation that could deliver a project connected to the Climate and Green development principles. For example, for the Climate impact, the first criteria, the project need define the areas that will impact on, CO2 emissions, water preservation, or others leading issues.

The second criteria in the project need to show a Paradigm shift of the City and to the world that could have a connection with a real transformation with the cultural action of the population, with the wrong energy waste.

The third activity of the project has to contain the country's needs and the priorities and with the fourth action needs to explain that is a clear need for the country.

A supporting decision from GCF to a project need to include an explanation about the money that has an introduction well explained using an efficient manner.

The first possible Paradigm Shift at the urban plan intervention as a smart city could be of an initial structure of the project a creation of a platform that improves local dialogue and cooperation to an effective plan, to implement, monitoring.

An evaluation and the development of local climate action can have a beginning with a centre that will combine data Information and transform it into results.

Secondly, another Paradigm Shift to Ulaanbaatar becomes a smart city, and the urban planning has to connect with smart cities definition[231] and a direct implementation of a Green Grow.

Their strategy will need to follow the six principles of a smart economy, smart people, smart governance, smart mobility, the smart environment and the bright living and these areas need to be integrated into an initial pre-plan to complement each of the project proposals.

The time that Mongolia will lose into the first phase to find the right partner could transform the sustainability of the future intervention.

GCF can participate alone or with other investors into this transformation with a well-developed proposal.

The GCF can participate alone or with other investors into this transformation with a well-developed proposal.

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[231] GCF from UNFCCC - Internal staff guidance note,. Republic of Korea: Green Climate Fund, , 2015b.

After a massive analysis of the Ulaanbaatar case, the intervention could not only be a coal removal, and it's been connected with resilience action. The urban development in Ulaanbaatar city, space where almost of the population lives, needs help but only in an integrated manner.

As GCF support can be 50% of resources in Mitigation and 50% in Adaptation, so when it comes to an urban development project, it will be possible to help Mongolia in the design of support. The buildings, the water, and the energy adaptation to the climate change could be a win-win, and urban development is one the areas that GCF can support in both. For GCF the gender-sensitive approach is expected in each project proposal. "According to the Poverty Mapping in Mongolia, jointly undertaken by the National Statistical Office and UNDP based on the 2010 Population and Housing Census, the provinces having the highest poverty level are from... the Western region... In 2012, a proportion of people living below the poverty line was 27.4% of the total population in 2012. Overall, 23.2% of the urban population and 35.5% of the rural population are poor. The factor of the vulnerability of the country's population to climate change... increase the risk of migration to cities... increasing poverty and unemployment in the provinces... particularly the capital city of Ulaanbaatar... lack of access to improved water and sanitation facilities... the risk of infectious diseases..."[232]

In the Impact Potential, GCF and Mongolia can benefit from the CO2 tonnes reduction, from the households low emission energy and the low-carbon transport transformation. Can benefit was well from the new management of land and waste that contribute to emission reduction, with recycling and composting low-carbon strategies.

With the implementation of these new project proposals from Ulaanbaatar UB city, additional benefits will be implemented reducing the vulnerability and will increase resilience and the infrastructures will be less vulnerable.

This type of projects can create regulatory systems for climate – responsive planning and development for the future, even as, the climate information use will pass to be a central point of decision making. A strengthening will exist in the adaptive capacity and reduced exposure to climate risks and risk reduction processes.

The paradigm shift potential into Ulaanbaatar can have a base on innovated systems with a Data Centre Information (DCI), with innovative solutions, with new market segments creating a new business model and a new process to make decisions in a City.

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[232] WORLD BANK - The world bank mongolia, poverty. USA: The World Bank, 2014.

These new connecting systems on different projects with an integrated approach scale up the scope reducing the total cost of implementation. The replication theory of change is entirely possible in other geographical areas, regions, communities or countries.

With a DCI the monitoring and evaluation can share lessons learned and can be incorporated within other potential projects.

This new management system in a city, with the smart cities concept introduced, provides a long-term financially sustainable continuation, focusing the interventions in new business activities at the local, national and international level.

The projects results will act as changes and an incentive for the markets, reducing costs and risks and eliminating barriers to the implementation of low carbon and climate resilient solutions.

On the regulatory framework, this new type of city management will create an advance in the national or local regulatory promoting investments in low-emission or climate resilient development.

The creations one only Data Information Centre that collect everything will decrease test costs. With scientific information from this centre, the percentage of success creates an increase in replicability possibilities.

Each of the anterior project proposals has a possible sustainable development potential such as improving the air quality, the soil quality, conservation, biodiversity and the CO_2 emission reduction (Figure 77).

Inside a city, the social co-benefits will have a connection with health impacts, educational impacts and even cultural preservation. Economic co-benefits will be active with this new-implemented system with a new job market, with the poverty alleviation, a possible growth of private funds attraction, productivity increase, competitive capacity, benefits in energy security and substantial improvements in water supply and agricultural productivity.

Figure 77 – Ulaanbaatar one of the most polluted places worldwide
(source: news.mn, 2015)

Using the Data from the city, it is possible to focus on the development of reduction gender inequalities in climate change impacts in an integrated approach.

The initial support from GCF it will be possible determine future errors and anticipate the potential extra costs without a smart management plant for an Urban Plan transformation. All project proposals that were presented in this document create benefits to minorities, elderly, children, and female heads of households or other target population. Ulaanbaatar city will have a low level of a support of existent institutional and implementation capacity according to the economic standard of the country nowadays. A next phase can probably be analysed after the feasibility project proposals, the cost-effectiveness results for each project and a combination of the integrated approach. The Ulaanbaatar matrix analysis under Smart Cities result into 16.5 points into the table as is possible to see on (Table 21 and Table 21A).

The GCF approved a project connected with Mitigation in GCF results areas of 'Energy generation and access' and ' Buildings, cities, industries and appliances and it goes directly to connect with the " *UN Sustainable Development Goal #7 Affordable and clean energy. It was approved in December 2016 it will end in 5 years with $60.0m.*" [233]

The gef (Global Environment Facility) did in 2000 a support for

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[233] GCF from UNFCCC - Mongolia proposal. GCF: GCF, 2016. Disponível em WWW: <http://www.greenclimate.fund/documents/ 20182/490910/GCF_B.15_13_Add.01_-_Funding_proposal_summary_package_for_FP028.pdf/3fd1df6e-18eb-45be-83db-3c3706821d9d>.

Mongolia to " *The project is to reduce CO2 emissions from burning coal for heating. This is to be achieved by helping super-insulating, straw-bale building technology to be commercially successful on a large-scale in Mongolia. Also, less wood will be burnt for heating, further reducing CO2 emissions and protecting shrubs and forests.*"[234] With an amount of 1,749,650.00 USD. Started in 1998 and finished at 2007.

Another one supported by gef was " *This project would reduce the GHG emissions from urban stoves by 25% and fuelwood consumption/forest loss in Bogd Khan Reserve reduction by: (i) training 100 engineers for modification, installation and troubleshooting; and (ii) provide cost-effective knowledge as to the advantages of upgrading current stove to the urban dwellers.*"[235] With an amount of 1,572,363.00 USD. Started in 1999 and ended in 2007.

During this process gef supported was well the " *Identification of climate change technology needs. Capacity-building to address climate change technology needs. Climate change education and awareness. Preparation of programs to address climate change.*"[236] With an amount of 98,000.00 USD. Started in 2000 and ended in 2002.

It ended in 2013, a financing of 3,840,000.00 USD, that started in 2005 with the following props " *The project objective is the reduction in the annual growth rate of GHG emissions from the buildings sector in Mongolia, by improving the energy utilisation efficiency in new construction in the residential and commercial buildings sector.*"[237]

In 2018 will end the project " *To accelerate transition to energy efficient, low-carbon transport system in Mongolia.*"[238] With an amount of 78,289,000.00 USD, that started in 2012.

In general, Mongolia was searching for an integrated system that they call Smart City, but the need to follow an integrant system following the CSC principles and not only different financing without strategy.

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[234] gef – Projects support: **gef**. gef: The World Bank, 2017. Disponível em WWW: <https://www.thegef.org/projects?views%5B0%5D%5Bview_dom_id%5D=fa10052dbcfdc5b0b5dba17675e504b5&views%5B0%5D%5Bview_name%5D=projects_listing_search&views%5B0%5D%5Bview_display_id%5D=page&views%5B0%5D%5Bview_path%5D=projects&f%5B0%5D=field_country%3A110&index_id=main&search_api_views_fulltext=&facet_field=field_p_implagencies>.

[235] Idem, Ibid

[236] Idem, Ibid

[237] Idem, Ibid

[238] Idem, Ibid

5.2.4 –City's Matrix checklist

	SIX INDICATORS	Areas	Designation	POINTS	OBS
1	1	Efficiency	Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result.	0.1	They are working on measures without a planned implementation
2	1	Top Management	Space and infrastructure coordination facilitates on a wider range of activities.	0.1	With small and difficult level of implementation
3	1	Energy Savings	Reducing energy consumption through using less of an energy service	0.1	With a low level of intervention under the city because of the dimension
4	1	Cost versus effectiveness	Equilibrium versus expense to action time	0.1	The level of effective action it is under construction
5	1	New economic system	Revitalised and sustainable economic system	0.1	Under construction
6	1	Smart payments	Easy and fast payments	0.1	Under development
7	2	Active citizen participation	An articulation of the debate over rights versus responsibilities.	0.1	Under a level of development with the citizens support
8	2	Quality level	The general well-being of individuals and societies (QOL).	0.1	A close market influenced by Russia and China
9	2	Social support	Projects accepted and co-organised by inhabitants	0.75	An intense level of community divided but groups
10	2	Historic elements	Old and special elements inside the city	1	An old city even after the war action and the Mongol influence
11	2	Management of Human resources	Specialised systems to employment system	0.1	An intense number of persons at a territory without prepared infrastructures
12	2	Green jobs	New work market connected with the sustainable development	0.75	Under development but with the total support from the actual government

13	2	Young population	Future generation sustainability	0.5	With a high level growth rate
14	2	Smart Education	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0.1	A low development at the moment
15	2	Lighter footprint	Reduction measures of human demand on the Earth's ecosystems	0.1	A reduced percentage
16	2	Dynamic	Always active or changing and having motion, or physical force.	0.5	A high level of population. A government with old methods
17	3	Collect Data	Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.	0.1	No centralised data collection
18	3	Green Buildings	Green construction or sustainable buildings refers to both a structure and the using of processes that are environmentally responsible and resource-efficient	0.1	Under the studies without application at the territory
19	3	Safety	Technology that assists in reducing or avoiding accidents.	0.5	The differences between the population produces huge conflicts
20	3	New Technology	New systems application, more effectiveness, more results with less time. Productivity.	0.5	They are working base at the UM system support with projects on going

21	3	Wide and Strong Political action	Political support from governments	1	The political agents are supporting 100% this changes
22	3	New industries	New markets, new creativity	0.75	They are implementing some creativity but they are focus yet at the basilar system
23	3	Marketing concept	Clear information arrived to the citizens	0.1	The low level of development in some areas cut the communication system
24	3	LEED Green certification	International building sustainable certification	0.1	They are not focused directly in only this certification. They are using others
25	3	Smart Health	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0.1	They don't have a strategic plan for this action. In the future this could be na intense problem for the city
26	3	Zero waste	A philosophy that encourages the redesign of resource life cycles so that all products are reused.	0.1	The wast system is under na intense change
27	3	Scale city	The main focus of the city under a simple observation	0.75	An intense perception of a city centre with history and residential areas
28	4	Green Transports	Transport that is sustainable in the senses of social, environmental and climate impacts and the ability to, in the global scope, supply the source energy indefinitely	0	They still use the old methods. Under development of a new system
29	4	Technological adaptation	High and costly equipments application	0.1	The economical level can introduced this actions at the moment
30	4	Management Tool	Existing management equipments	0.1	They need a more educated population to support the changes
31	4	Network Connector	Central system management	0.1	They are working on a new system

32	4	Smart Lighting	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on Light inside the city, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0.1	Under the application of new simple technologies
33	4	Smart grids	A modernised electrical grid that uses analogy or digital information and communications technology to gather and act on information – such as information about the behaviours of suppliers and consumers – in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.	0.1	Under study for implementation
34	5	Sustainability	Capacity of an ecosystem to absorb disturbance and still retain its basic structure and viability.	0.1	Under a new development
35	5	Green roofs	A roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.	0	High temperatures in winter time

36	5	Agriculture production	Cultivation of animals, plants, fungi, and other life forms for food, fibre, biofuel, medicinal and other products used to sustain and enhance human life	0	They produce near the city
37	5	Local food	The local food movement is a movement which aims to connect food producers and food consumers in the same geographic region, in order to develop more self-reliant and resilient food networks, improve local economies, or for health, environmental, community, or social impact in a particular places	0.75	In certain areas they have their own production
38	5	Water conservation	Encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand	0	They are needing intensely a change under the water system
39	5	No standardised Architecture	Diverse architecture, unusual architecture, unique	0.5	They have na intense patrimonial except into the new areas
40	5	Equilibrium on 'caos'	General measure applied inside a city given a natural equilibrium	0.1	The 'caos' under the city it is covering the equilibrium because of the intense pollution
41	5	Compact city	Or city of short distances is an urban planning and urban design concept, which promotes relatively high residential density with mixed land uses.	1	A long territory without the right infrastructures

42	6	Natural Resources	Amounts of biodiversity and geo diversity existent in various ecosystems.	0.75	A use of a mix with regional materials and materials from China
43	6	Public spaces	A social space that is generally open and accessible to people	0.1	Maintaining only the mongol urban design
44	6	New materials	Type and quality of the materials	0.5	Intense diversification on materials use
45	6	Diverse architecture	Different buildings and intense sense of culture	0.75	Diverse architecture with different levels
46	6	Limitations	Limits on technology application	1	Under technological development, low level
47	6	Green grow paradigm	Development focus on Sustainability	0.1	Under a paradigm change
48	6	Clean air action	Actions to implement the Clean Air Act have achieved dramatic reductions in air pollution,	0.1	Intense level of pollution without a structure
49	6	Liveable	Annually measures "quality of living" standards, using data such as crime rates, health statistics, sanitation standards, and expenditures on city services	0.75	A low level of life quality
50	6	Strong Communication	Information circulating very fast around the city	0.1	Low communication because of the different economic level
TOTAL				15.8	

ULAANBAATAR			15.8
YES	> 90%	1	
PARTIAL 75	> 75% ≤ 90%	0.75	
PARTIAL 50	> 50% ≤ 75%	0.5	
PARTIAL 25	> 25% ≤ 50%	0.25	
NO	≤ 25%	0.1	
NOT APPLICABLE	0%	0	

Table 21 - Matrix Ulaanbaatar as a SMART CITY

	Areas	Designation	POINTS	OBS
1	New Design Integration Paradigm	A new concern With the spaces around And their integration	0.1	They are not building with this orientation
2	Ecologic landscape	New plantations and CO_2 production	0.1	They preserve as much as they can, but it is not enough at the moment
3	Mixing Private & Public	A concern for the whole and not for the individual	0.1	With no security, the division from communities it is huge
4	Auto sustainability | water, energy and food	Overall production of areas in a macro view eliminating only the micro view	0.1	They are very distance for this action
5	Smart transportation	A concern for the development of a new transport network	0.1	They are studying different solutions
6	Smart waste treatment	Application of quality systems in the treatment of waste	0.1	Working on a possible future solution
7	Smart Maintenance	Training and implementation of field teams and high technology equipment	0.1	They still use reactive measures for all the problems that the city presents. The government is working under a solution
8	Hydrologic city	Application of balance between the various spaces through water elements	0.1	The hydrological intervention exist as a patrimonial from the Mongolian generation
9	Air quality measures	Application of information and measurement systems	0.1	They are working under a urgent solution to implement
10	Soil quality conservation	Verification and reservation systems and soil protection through applied scientific research	0.1	These action will be the most difficult and danger process from the future city intervention
11	Biodiversity	Protection enhancement of key elements in each space	0.1	Only after a huge international support and a n intense work from the government and from communities, the biodiversity will be
12	Cultural preservation	Protection and rehabilitation of culturally interesting spaces	0.1	They have a Mongolian influence into the city centre or even at the Ger area that with a structured intervention, the city can gain special territories
13	Social co-benefits	Application of systems and even spaces that complement social action with communities	0.1	The huge division of different levels of live position, will be a barrier for this action

14	Food security	Changing the paradigm of food production within cities	0.75	At the Ger area there are na action very similar from the anterior villages
15	Livelihoods Safeguard	Protection of spaces against climate change	0.1	The level of pollution it is under high levels of danger for the human health
16	Energy efficient design practices	Introduction of training and learning systems on best practices	0.1	The low level of investment from the government it at the moment not producing possible investments
17	International Green Buildings	Introduction of a Green Building with all international tendencies combined into na intervention	0.1	The level of the building are under a minimum quality of life. The buildings are following the same construction level
18	Real estate Smart engagement	In the introduction to the real estate market supporting with knowledge and marketing	0.1	They are distance from this possible action
19	Resilience and Climate risk reduction	Introduction of new systems of action in case of emergency situations	0.1	United Nations and other international organisations are working under a possible resilience plan
20	Flexible circulation	Implementation of fast and clean crossing routes within cities	0.1	The intense number of people living inside the city it is creating a huge danger caos
21	Urban modelling techniques – on walking and cycling	Application of cycle paths or even footpaths in order to have new flows	0.1	Inside the city centre, the huge existence of urban traffic with old vehicles, makes walking and cycling impossible
22	Smart urbanisation	Intelligent planning network application with 5 or 10 year strategies	0.5	United Nations and other international organisations are working under a possible smart intervention
23	Smart management	Application of network of action in the spaces of intelligent form with strategies to 5 or 10 years	0.1	Without a structural plan, the city action from specialists will be difficult to act into implementation
24	Noise attenuation	Application of elements that improve auditory quality in spaces	0.1	Only after a possible intervention, the city can act into a change on noise levels
25	Albedo' application	Application of systems of different heights in order to make spaces cozy	0.1	Without planning the city it is not focus under this action
26	Singularity	Verification and application of elements that make interventions unique and create	0.75	The number of population and the strong action into special moments and spaces that exist into the territory without planing

27	Emotional security	Application of verification and monitoring systems in spaces	0.1	The low level of life quality produces danger into areas
28	Permanents and Impermanent	Application of new and technological equipment to support this trend	0.75	This is na area where they are special because of the population's number
29	Style and Creativity	Research and application of new methodologies and techniques	0.1	They have their own creations but with the principal focus at the moment doesn't go under this direction
30	Colour diversity	Existence of various typologies and colours in spaces	0.5	With two different areas of colours, new buildings and the Ger area
	TOTAIS		5.75	

ULAANBAATAR			5.75
YES	> 90%	1	
PARTIAL 75	>75% <90%	0.75	
PARTIAL 50	>50% <75%	0.5	
PARTIAL 25	>25% <50%	0.25	
NO	< 25%	0.1	
NOT APPLICABLE	0%	0	

Table 21A- Matrix Ulaanbaatar as a CLIMATE SMART CITY

5.2.5 – UB as a Smart City

The general recommendations for this integrated approach with Ulaanbaatar UB city are starting with the regional lead at the moment for Mongolia and the readiness support from GCF or other possible entity.

GCF, for example, can use the Pillar 4 for the readiness support pipeline development with NDA's agreement to help Mongolia to prepare and plan out the competitive RFP (request for proposals) process to develop a Private PPP (public-private partnership) project this massive project. GCF can help on how doing it properly, how to make PPP successfully, defining what is needed to do it properly. Based on the Mongolia's vision for the city and in particular the UB city organisation, GCF can help to look at them together as a program, and phase it as was described before.

The first step can be the combination of the top priorities, almost ready to go, with a small support of mature, that could bring the investors faster

and at the same time made GCF required for the support. The technical specifications and the environmental impact levels will be present into the project to clear knowing that Mongolia is developing a resilient city with low emissions and in the direction of a Smart City. Since Mongolia can build everything fresh at the moment, with an increase on money investment from GCF or other entity can be a support Ulaanbaatar to start in the right way.

Making the connecting of the clusters to the project proposal Insulation has the energy efficiency content, and the Wastewater treatment plant project has the water preservation and the Tuul River project has the ecosystems needs.

For a financing from GCF, it is expected from Ulaanbaatar replicability project's [239] well developed for the future. GCF suggest three options:

The first choice, GCF support it will confirm if Ulaanbaatar prove that is using the right technical qualification, to ensure that it has to be done is a sustainable manner. The second option is a no need for pillar number 4 from GCF readiness support. The third option is that Mongolia has already the partners, but is not secure that need financing, or have gaps in the funding so you can work with GCF again. GCF can help Mongolia to structure the investments. After a detailed analysis, GCF can decide for example to start working first with three different projects to arrive at feasibility studies from Energy, from Waste and Water namely:

02 - INSULATION Project

03 - WASTEWATER treatment plant Project

06 - TUUL River Project

Feasibility studies project development will need to be made in the future. The transformation into projects will need to have an architectural proposal and a financing proposal with a final Modelling 3D and terms of reference. Calculating results with the developed matrix in each project based on GCF needs could be a possible solution. A study of the UB city support on the Data Analysis and crutch can be another act. The development of a possible general 'Sustainable Master Plan' including the project proposals explaining the integrated approach can support the second phase. As a third step can be integrated a feasibility study project from the new Data Centre information.

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[239] GCF from UNFCCC – Gcf/b–09/23. South Korea: Green Climate Fund, , 2015a.

Areas	PR 01	PR 02	PR 03	PR 04	PR 05	PR 06	PR 07	PR 08
Sustainability	0.75	0.75	0.75	0.75	0	1	0.75	0.75
Efficiency	0.1	1	1	0	0.25	1	0.75	1
Top Management	0	0.5	0.5	0	0	0.25	0	0
Active citizen participation	0.1	0.75	0	0	0	1	0.75	1
Collect Data	0.75	1	1	0	0	1	1	0.75
Energy Savings	1	1	1	0	0.25	0.5	0.75	0.75
Natural Resources	0.5	0.25	1	0	0	1	0.75	0
Green roofs	0.25	0.1	0	0	0	0	0	0.5
Agriculture production	0	0.1	0	0	0	0	0	0
Local food	0.1	0.25	0	0	0	0	0	0
Quality level	0.5	0.5	1	0	0	1	1	0.5
Green Buildings	0.5	1	0	0.75	0.25	1	0.5	0.5
Green Transports	0.1	0.1	0	0	0	0	0	0.75
Water conservation	0.75	0.75	1	0	0	1	1	0
Public spaces	0.5	0.1	0	0	0.25	1	0	0.75
Safety	1	0.75	1	0.75	0.25	0.75	0.75	0.5
No standardised Architecture	0.5	0.1	1	0	0	0	0	0
New materials	0.75	1	1	0	0	1	0.75	0.5
New Technology	1	0.75	1	0	0.25	1	1	1
Social support	0.5	0.5	0	0	0	1	0.5	0.75
Wide and Strong Political action	0.25	0.75	1	0	0	1	1	1
Cost versus effectiveness	0.1	0.5	1	0	0	0.75	0.5	0.5
Historic elements	0.1	0.25	0	0	0	0.75	0	0
Diverse architecture	0.75	0.1	1	0	0	1	1	0.75
Limitations	0.1	0.1	1	0	0	1	1	1
Technological adaptation	0.5	0.25	1	0	0.1	1	1	0.75
Management Tool	0.1	0.1	0	0	0.1	0.75	1	1
Network Connector	0	0.1	0	0	0.1	0	0	1
New economic system	0	0.25	0	0	0	0	0	0.75
Management of Human resources	0.5	0.75	1	0	0	0.75	1	1
New industries	0.5	0.75	1	0	0	1	1	1
Green jobs	0.75	1	1	0.75	0.25	1	1	1
Young population	0	0.5	0	0	0	1	0	1
Marketing concept	1	0.1	0	0	0	0	0	0
LEED Green certification	0.5	0.5	0	0.1	0	0	0	0.5
Smart Education	1	0.1	0	0.1	0	0	0	0
Smart Lighting	0.75	0.75	0	0.1	0.25	1	1	0.5
Smart Health	0.5	1	0.75	0	0	1	0	0.5
Green grow paradigm	1	0.75	0.75	0	0	1	1	1
Zero waste	0	0.25	1	0	0	0.5	0	0
Lighter footprint	1	0.5	0.75	1	0	0	0.75	0.25
Clean air action	1	1	0.75	0.1	0	0	0.75	0.25

Smart grids	0.25	0.1	0.25	1	0	0	0	0
Smart payments	0.75	0.1	0.25	0	0	1	0	0
Equilibrium on caos	0.1	0.75	0.25	0	0	0	0	0
Liveable	0.25	0.5	1	0.75	0	0.75	0	1
Dynamic	0.25	0.1	1	0	0	0.75	0	1
Compact city	0	0.5	1	0	0	0	0	1
Scale city	0	0.1	0.25	0	0	1	0	0
Strong Communication	1	0.25	0.75	1	1	1	0.75	0.5
TOTAL per project	21.9	23.25	27.25	7.15	3.3	26.25	16.25	20.5

YES	> 90%	1
PARTIAL 75	> 75% ≤ 90%	0.75
PARTIAL 50	> 50% ≤ 75%	0.5
PARTIAL 25	> 25% ≤ 50%	0.25
NO	≤ 25%	0.1
NOT APPLICABLE	0%	0

Areas	PR 01	PR 02	PR 03	PR 04	PR 05	PR 06	PR 07	PR 08
New Design Integration Paradigm	0.1	0.25	0.25	0.25	0.25	0.25	0.25	0.75
Ecologic landscape	0	0	0.5	1	0.25	1	0.75	0
Mixing Private & Public	0.75	0	0.5	1	0.25	0.25	0.25	0.5
Auto sustainability | water, energy and food	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Smart transportation	0.75	0.1	0.1	0.1	0.1	0.1	0.1	0.75
Smart waste treatment	0.75	0.1	0.75	0.75	0.75	0.75	0.75	0.1
Smart Maintenance	1	0.1	0.75	0.75	0.75	0.75	0.75	0.75
Hydrologic city	0.1	0	1	1	0	1	1	0
Air quality measures	0.25	1	0.1	1	1	1	0.5	1
Soil quality conservation	0.1	0.25	1	1	0.25	1	1	0
Biodiversity	0.1	0.1	1	1	0.25	1	1	0.5
Cultural preservation	0.25	0.1	0.5	1	1	1	1	0.1
Social co-benefits	1	0.1	0.25	1	1	1	0.1	0.75
Food security	0.25	0.25	1	1	0.25	1	1	0.1
Livelihoods Safeguard	0.1	0.1	1	1	0.1	1	1	0.1
Energy efficient design practices	1	0.5	0.75	0.25	0.75	0.75	0.75	0.75
International Green Buildings	0.75	0.75	0.75	0.1	0.75	0.75	0.75	0.75
Real estate Smart engagement	0.1	1	0	0.1	0.1	0.1	0	0.1
Resilience and Climate risk reduction	0.1	0.5	1	0.75	0.75	1	1	0.1

Flexible circulation	0	0	0	1	0.25	1	0.1	1
Urban modelling techniques – on walking and cycling	1	0.75	0	1	0.25	1	0	1
Smart urbanisation	0	1	1	1	0.5	0.75	0.75	1
Smart management	1	0.25	1	0	0.5	0.5	0.75	1
Noise attenuation	0	0.75	0	1	0.5	1	0	1
Albedo' application	0	0	0	1	0	0.75	0	1
Singularity	0.5	0.25	0	0.75	0.1	0.1	0	1
Emotional security	1	1	0.5	0.1	0.1	0.75	1	0
Permanents and Impermanent	0.5	0.1	0	1	0.75	0.75	0	1
Style and Creativity	0.25	0.25	0	0.75	0.5	0.1	0.25	1
Colour diversity	0.75	0.25	0.25	0.25	0.1	0.1	0.25	0.75
TOTAL per project	11.05	9.9	13.3	18.75	9.95	16.85	12.9	15.45

Table 22 – Project proposal matrix analysis

Applying the new Matrix with the Climate Smart Cities 30 areas, is possible to see and analyze that the results are different from the Smart Cities Matrix application. Before there were the number 02 - INSULATION Project, the number 03 - WASTEWATER treatment plant Project and the number 06 - TUUL River Project. The result from CSC Matrix was 04 - ECO park project, 06 - TUUL River Project and 08 - SKYWAY Project. The number 06 was one of the winers in both Matrix's, the other were more complete giving to the city a possible better Shift Paradigm.

5.3 – CASE STUDY 2 | Songdo as a Climate Smart City

Songdo it is a city built from the scratch on 600 hectares of reclaimed land in the Incheon waterfront in South Korea or Republic of Korea. Songdo is a city that has a distance from Seoul of 65 kilometres in the southwest from the capital.

Songdo International district connects the international airport with a Free Economic Zone. The initial project had the objective of built schools, hospitals, apartments, office buildings and cultural equipment.

Today, this is considered one of the most expensive projects worldwide with a 40 billion project in 10 years.

An influence of New York into the Central Park and an influence of Venice at the Canal Walk mark and idea or a space called 'Songdo.'

Into the initial master plan, one of the demands was the reduction of the GHG emissions and one average city can produce 780,00 tons and the proposal of Songdo was to produce 260,000 tons only.

The other objective was not building into Songdo conventional buildings that expand annually 674,000 tons of CO2 emissions and following the new buildings with LEED certification the CO2 per year will have a change for 250,000 Tons.

Another objective that was not a priority and Songdo will need to have an improvement, and it has an estimate of CO2 emissions from transportation win a scenario of 65,000 residents in a typical low-density. The car-dependent produce 109,200 Tons of CO2 and the proposal for Songdo was to divide into two areas as the use of diesel buses that will reduce to 17,290 Tons and as a potential into new Songdo city using hydrogen buses that will reduce to 7,740 tons only.[240]

One of the magical systems implemented into Songdo Master Plan was the '5 minutes walks radius.'One of the things that Korean people miss into Songdo International City is the Mountains that exist into the Korean peninsula where people can dedicate time to agriculture uses, and can have a definition as a vital natural resource. In Songdo project, the explanation for the land reclamation was the following image (Figure 78).

Songdo it is a Smart City or it is not a Climate Smart City. Different entities were developing the project and making this city possible.

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[240] Eliot ALLEN - Measuring the environmental footprint of new urbanism: **Bether cities and towns**. USA:

Figure 78 – Songdo city view from the mountain
(source: by the author, 2014)

City maintenance it is a daily task. The waste seems that doesn't exist, and the bicycles are so many, and they circulate on the streets. Songdo has Green equipment's, Green books, and Green home furniture? Has it Green and healthy food for Songdo inhabitants? Not yet. A city like Songdo can be implemented in Dubai, Milan, and Lisbon or New York?

Songdo has an intense Future of improvements on strategies for the City. They will improve the heating systems, under the cooling systems and the citizen's support. They are growing every single day. The mobile phone will be soon being the real command of the city. The cars will be electric, the public transportation will change, and the home deliverance will be very fast. Songdo can become a Climate Smart City if they change the paradigm as soon as they can.

5.3.1 – South Korean development

How is Korea?

South Korea or Republic of Korea, located in East Asia (Image 00) and the southern part of Korean Peninsula. South Koreans lead a distinctive urban lifestyle where half of them are living in Seoul Capital area, probably the third largest city in the world with 25 million residents with almost the fourth largest economy. In 1910 Korea was annexed by the Imperial Japan and only in 1945 the Korean peninsula had a division into North and South Korea but during 1950 to 53 the North Korean invaded the South declaration from 15th June 2000' (Figure 79).

The official language is the Hangul in all Peninsula. The enormous and fast transformation into a developed country transformed South Korea in one of the highest income equality worldwide. At the moment, South Korea is the leader in carbon green growth, and the home of UN Green Climate Fund and GGGI committed to helping developing countries into a new paradigm shift.

Figure 79 - Korean traditional architecture location in Asia
(source: Gale international book)

South Korea is the country known as the 'Samsung' producer, 'LG' producer, Hyundai-Kia father and is considered by 'Bloomberg Innovation Index' one of the most innovative countries in the world. It is the country that presents the faster Internet speed and with ICT Development e-government 4G LTE coverage.

The country has an area of 100,210 km2 and a GDP of $1.849 trillion.[241]

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[241] IMF - Estimate, international monetary fund,. International Monetary Fund,, 2015.

The Korean Architecture (Figure 80) can be characterising by naturalistic tendencies, simplicity, the economy of shape, and the avoidance of extremes. The sharply Chinese curving roof had a modification in Korea into a gently sloping roof for example. Sharp angles, high lines, perpendicular planes, and garish colours are all avoided and where they are implemented is walkways very soft and very subtitle with a typically quiet inner harmony.

Figure 80 – Hanok architecture
(source: by the author, 2014)

The traditional Korean architecture must have been similarities to ' Tang Architecture' [242] where it is possible to see in the main hall of 'Tōshōdai' Temple in Kyōto in Japan, also is believed to be a good example of Tang-style architecture. In Korea 'chusimp'o style' is how is called the adaptation of the Tang architecture and it is 'characterised by the so-called column-head bracketing, or complexes of brackets that project above the heads or capitals of the columns, with or without intercolumnar struts 'inclined supports.' One of the best examples of chusimp'o architecture can be 'Muryangsu' Hall of Pusŏk Temple the hall of thermal life, dating from the 13th century and it is the oldest wooden structures in Korea that exist. At a colonial period, the Japanese constructed most of

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[242] Karen Eva CARR - T'ang dynasty architecture,. Professor researcher at Portland State University. USA, 2015. Disponível em WWW: <http://quatr.us/china/architecture/suiarchitecture.htm>.

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the public buildings, with an influence of Western architectural styles and in our days, Japanese architecture or Japanese building doesn't exist or are hidden because they were a shame for the Korean culture after 1948. For example, the city hall building in has a Japanese constructed building but with new façade that they transform into a Green Building without knowing seeing and remembering the Japanese presence (Figure 81).

Figure 81 – Seoul City Hall
(source: by the author, 2015)

Until the 70s the Korean architecture trend was to adopt the International style. The prominent architects during this period were 'Jung-op Kim' and 'Sukun' Park. At the 80s the variety of architectural projects had an enormous expansion, with the adoption of postmodernism, including a reinterpretation of traditional Korean architecture into the principal cities.

The Korean construction:

South Korea in the last ten years had been a focus on the sustainable development-connecting environment and industrialisation with harmony (Figure 82). Successful sustainability can't be realised only taking into account the environmental issues. According to the data analysis results in Elsevier by KIM (2015), there are gaps between the importance value of soft skills and long-term benefits factors. In a perspective of South Korean contractors, it is important to exist a balance between important

and tangibly performed factors as well as between environmental, economic, and social issues it as an essential for the sustainable action and not only for the 'exterior image'.

Korea had already introduced sustainable building assessment systems and it is being conducted in the field of sustainable construction.

Figure 82 – Seoul general view with mountains
(source: by the author, 2015)

The advanced study from KIM (2015), suggests the adoption of a balanced approach to the three issues as the environmental issues with economic and social actions. The soft-skill and long-term benefit factors present a significant gap in this sustainable effort into Korean construction [243] . But into the study was able to identify that the social category present. The post-war time the Korean commerce was dominated by conglomerates concentrating a huge percentage of industry in a handful of companies like Samsung, POSCO, Daewoo and others.

And how Korea start believing in Smart Cities? [244] A position from NLEE (2008) on their Master thesis explain the huge investment that the Korean market decided to support the enormous scale that requires years of development. In 2008, the city at the moment called New Songdo City (NSC) on an example of a mega-scale development phenomenon in 1,415 acres in the late 1990's of reclaimed land in Incheon near Seoul.

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[243] Sangyong KIM, Whang Seoung-Wook, Kim Gwang-Hee, Shin Yoonseok, - Comparative study on the construction cost including carbon emission cost for masonry walls. **Elsevier**. ISSN 03787788. Vol. 96, n.º Energy and Buildings (2015), p.187-192.

[244] Junho NLEE, Jeehyun Oh, - **New songdo city and the value of flexibility: A case study of implementation and analysis of a mega scale project,** . USA: MIT, 2008.

Figure 83 – Han River Seoul city margins
(source: by the author 2015)

NSC was considered on archetype and an excellent laboratory to explore into a new mega-project strategy and the implementation of modern project designs. These U-cities, a Korean designation, start having serious sociological problems that cannot persist into the future with the lack of employment and lack of knowledge about the methods of use of these advanced technologies. The internal organisations responsible for these new cities are producing some sustainability failures.

Directly in the middle of Seoul, it is possible to circulate into one of the world's best green design implemented into an existent territory, called Cheonggyecheon River linear park (Figure 83). This intervention has implemented with the objective of a creation of a green oasis in the middle of a concrete jungle, in this case in Seoul. Builded in a 3.6 mile long with biodiversity and supporting the economic development. In the 40's the river was cover by concrete because of sanitations reasons. 30 years after, was constructed one railway in a high level and this area was not used by the public because was dark and empty.

During 2002 to 2005 a new action killed the railway and a new project for this area was part of a huge investment by the Seoul city council. With water from the Han river. This action create benefits to air pollution and the intense urban heat.

Figure 84 – Seoul city today
(source: by the author 2014)

As an opportunity, South Korea is passing a very intense moment of research (Figure 84) and according to (Jun Hoon Lee 2012) "Firstly, the developed roadmaps have provided the first comprehensive and unified view of current and future trends for smart city development in Korea, since there was no prior strategic guidance available...

Secondly, structuring the layers and time frames for smart city development was found to make an important contribution to the overall program objectives... Thirdly, one of challenges in developing the integrated roadmap was dealing with a large number of R&D researchers and other stakeholders, to enable a comprehensive and broad view of smart city development for the roadmap."[245]

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[245] Jung Hoon LEE, Robert Phaal, Sang-Ho Lee - An integrated service-device-technology roadmap for smart city development. **Elsevier**. Vol. 80, n.º Technological Forecasting & Social Change (2013), p.286-306.

5.3.2 – City's introduction

In South Korea neighbour, the city of Songdo, located 56km west of the capital Seoul (Figure 85), is being built on an artificial island, which promises to be the most intelligent and sustainable city in the world. We are living in an era of change, awareness of the people to prevent the increasing degradation of the environment and natural resources.

Figure 85 – Songdo beach
(source: Pinterest 2014)

Several initiatives are being taken worldwide to save the planet from the scarcity of natural resources such as the conscious use of water and electricity, research on new sources of renewable energy and recycling materials that were discarded. Countries in Europe and Asia, the level of awareness of the problem is high and is where we see the greatest transformations. In Japan, the city of Fujisawa is an example of these changes. In final stages of construction, the responsible engineers promise to make it a totally smart and sustainable city.

In China, several condominiums with sustainable proposals are being built on the outskirts of Beijing capital apace. The countries in frank economic and technological expansion did not want to stay behind their neighbours

Architecture, intelligence, and sustainability. In South Korea neighbour, the city of Songdo, located 56km west of the capital Seoul, is being built on an artificial island, which promises to be the most intelligent and sustainable city on the planet. Started in 2000 and with an estimated cost of US $ 35 billion, Songdo is the largest private investment real estate history. Most of the money came from real estate Gale International and Morgan Stanley investment bank.

The money is intended in large part to the creation of a "universal network" - which will use the Internet to connect not only people but also objects, houses, and cars. As the city is being built, the Cisco telecommunications giant is installing sensors in the asphalt, the streets, and buildings. Each of these sensors sends data continuously to a control centre where information about the buildings, energy demand, the asphalt and traffic conditions, as well as external and the internal temperature will be collected and analysed. The brain of the city. The city will have a control centre that will be the brain and will lead nearly every action. Traffic cameras, for example, will monitor how many pedestrians are on the sidewalk. Thus, to reduce costs, empty street lights may be dimmed while the busy have enhanced lighting.

Typical stresses may also be detected early on roads or structures, to prevent costly delays caused by larger works. Another innovation is designed to avoid traffic problems faced by all cities: labels with Radio Frequency Identification (Radio-Frequency Identification, or R Fid, its acronym in English) will be placed on all license plates. These devices are tuned to a particular frequency and connected to a processor of low consumption. The tag sends a signal identifying the central control occurring in less than one second, and when all cars are within the system, an accurate picture of traffic in the city can be obtained in any situation, at any time. Songdo has 46 green parks and 21 churches in all area (Figure 86).

Figure 86 – Songdo IFEZ city presentation
(source: IFEZ bulletin 2013, South Korea, Incheon)

The technology will allow the control centre to adjust the range of the lights, create diversions and provide early warnings.

Even the traffic lights have high-tech, with ordinary incandescent bulbs being replaced by LED - needing only 1% of the energy of the old to light. The element that must have a greater effect on the lives of the residents, however, will be the telepresence. The screens will be installed in all homes and offices and even in the streets, allowing people to make video calls from any location. The technology integrated into the heart of

Songdo is only part of the story. The goal of a smart city is at the same time create somewhat artificial but also sustainable, with minimum impact to the environment.

The most important natural resource for humans is water. UN data from 2006 show that an average of US cities residents, use 575 litres of water per day. Any new city will increase the overall use of the resource, but an intelligent land design, rainwater retention mechanisms, and treatment of water "dirty" sinks and dishwashers and clothes will allow the Songdo irrigation system use only one-tenth the amount of clean water that would be expected for a city of this size.

An ecological architecture combines planting vegetation on top of buildings will reduce a loss of rainwater and combat the effect of "heat island" generated by cities, since plants absorb sunlight and will use them for photosynthesis, cooling the air around you. Moreover, Songdo not needs garbage collection. A centralised system for collecting, working through pressure, will take away the liquid and solid waste, eliminating the need for garbage trucks circling the city.

With the population of our planet continuously growing, creating smart cities and the development of urban centres already seem inevitable.

In addition to creating new cities where new technologies are part of a project, the existing large cities must commit to building partnerships with citizens and with the private sector by implementing intelligent technologies as well as promoting people behaviour change as the issues environmental, improving the quality of life of all.

A key component of the agenda is the annual EE Visionary. These awards honour employees from around the world for his leadership and commitment to promoting energy efficiency and increase the productivity of energy through innovative programs and policies. The 2,014 beneficiaries EE Visionary Awards represent a spectrum of local government entities, national and global.

Songdo International Business District, ' *City of the Future*', in Incheon, South Korea will receive a Visionary Award EE for the implementation of various policies and technologies in urban planning, efficiency, and conservation. Commissioners 'Lee Jong-Cheol' will accept the award on behalf of Songdo.

5.3.3 – Urban planning project

The new Songdo City a project of a free trade and international business hub and considered the first international real estate investment in South Korea's history. This new city has a location at the commercial epicentres of North Asian regional markets, among China, Russia, and Japan. The initial objective was to house nearly 65,000 residents in different typologies and urban settings. The original project was a joint venture between The Gale Company and POSCO Engineering and Construction. Over the last forty years, South Korea presented a transformation from a predominantly rural society to one overwhelming urban.
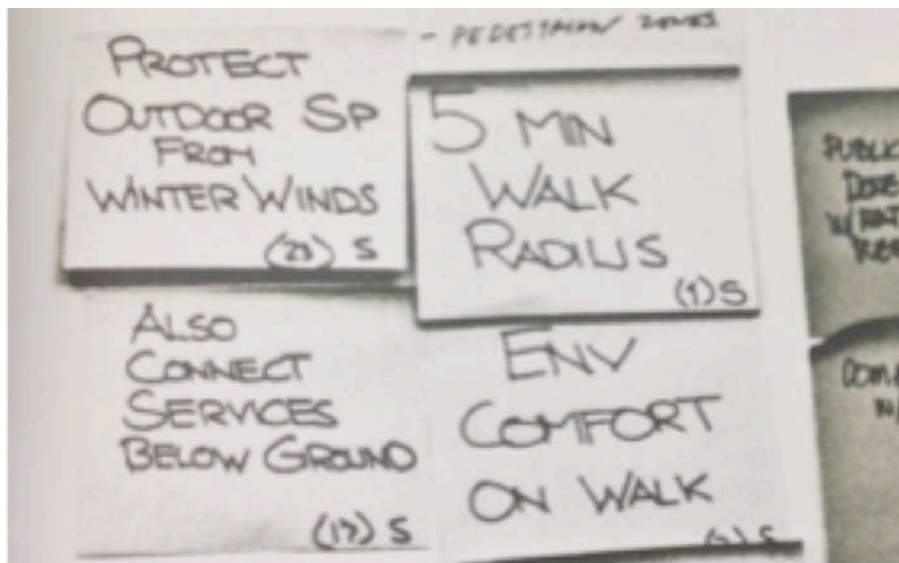
Figure 87- KPF draft design on the wall
(source: Gale international and KPF book, 2009)

Songdo exists, and it is not a utopia. Songdo was projected to be a Korean free economic zone and a business hub for North Asia. In 3,000 acres of landfill in a project since 1992 with Daewoo and the foreign architect company called OMA after 1998. The policy climate into Korea changed to an international joint venture to favouring the foreign investment and loaning Korean land. The US-based Gala International Company and the Korean steel giant POSCO were managing the joint venture and KPF (Kohn Pederson Fox) (Figure 87) the New York architects. During more than two years the master plan was developed to 50,000 residents.

The Incheon International Airport was a project that the Korean government made the support into in another reclaimed land but supporting all the potential international development.

The free trade city concept it is old even the Greeks with Delos or the northern Europeans with 'Lubeck', or China with Hong Kong or other examples of coastal cities show scientifically that cities with this type of characteristics developed a distinctive quality of life, culture and extraordinary architecture and Songdo wanted to follow the same idea. A city that will focus on huge parks and in mega-lane avenues following the European, American, and Asian popular cities where people love to live work but creating an adaptation to the Korean context. The objective in Songdo was to be a hybrid city, using either the small paradigm of small-scale urban village retail with the high-rise buildings. Seoul was growing during the years and expanding the centre and in 2010 it is possible to understand that Seoul creates different centres into one only city.

Songdo an artificial land (Figure 88) using the tidal flats along the west coastline that in the worst-case scenario cause massive environment damage with the land reclaiming. Into the land reclaiming decision was an alternative to disturbing the delicate balance of the mountain ecology.
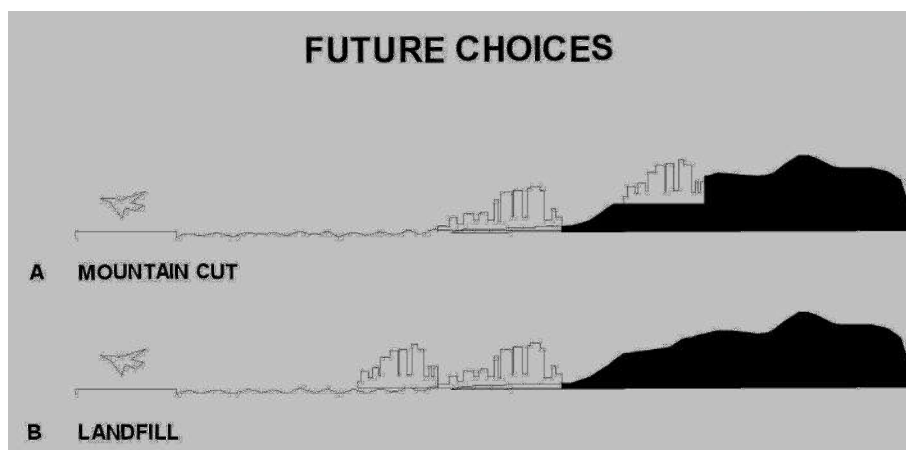
Figure 88 - Landfill project Songdo
(source: Gale international and KPF book, 2009)

The initial idea of the master plan was to connect the concept of home, school, nature, work, entertainment and shopping into a ' *perfect city*'. The project had the idea of educating children in local public international schools, to visit a museum or aquarium, to play golf, tennis or sail, theatre, opera or see movie in movie theatre, with different hotels, boutiques, with government offices where, can be possible to solve problems and a high quality of a healthy system with a hospital. Songdo was planned to follow into an organic whole, similar to the 'radiant city' the ship by Le Corbusier, but the economic system destroyed this action

with the passing of the years. To support this concept they follow 'Pudong' for commerce, 'Canary Wharf for financial services, 'Brasilia' for a government, 'La Defense' for corporate business, 'Putra Jaya' for technology. The heterogeneity is easy to see into the most of the Seoul new city centres, where the organicity doesn't exist. Varieties of particular order according to Kevin Lynch principles like narrow streets, wide boulevards, grid patterns or wandering paths that reflect the grown of a city and create high levels of 'happiness.' Cities built without organicism can be called as depressing cities, monotonous cities as in China is possible to find some or in other countries. This project tried to implement changes of scale, interruptions of geometry and varieties of an open space character. " *The vitality of the urban condition arises from the diversity of experiences that a city offers to its inhabitants.*" [246] KPF was planning the have innovative designers from around the world, a real architectural festival, and this goal was achieved in turn of the Central Park (Figure 89). The multiplicity of materials and forms as an objective, palette of materials and colours from limestone of Paris, the brick of Chelsea or the clapboard of San Francisco were inspirations:

Manmade Landscape;

Pedestrian city = Graduated density;

Zoning tent;

Pedestrian;

Models of Urban Centrality;

Urban archetype overlay;

Building typologies;

Building typologies;

City grain;

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[246] MURCOTT

Figure 89 – Central Park, Songdo
(source: by the author 2014)

As Maria Teresa Bilotta [247] points out in his article on 22 December 2014, Songdo is the first Smart City in the world, and you will find yourself being completed during 2015, which in reality will not happen even in 2015 due to several factors. Songdo is a sustainable city, Green, full of technology and innovation. In the centre of the city, Songdo contains a Central Park as a copy of the Central Park in New York. A city built from scratch that already has a development of ten years, with many stakeholders and with its history and a long tradition since the beginning of its earthworks.

However, according to Antony M. Townsend, in his book published in 2013 about the Smart Cities " *Songdo was originally conceived as «a weapon fighting trade wars» the idea was «to entice multinationals to set up Asian operations at Songdo»... with lower taxes and less regulation.*"[248] Songdo since its origin which introduced the concept of a Free Economic Zone, a space with a different management of the rest of the country but it worked only for foreign investment leaving part of quite the Korean investment, but which led to major financial problems the difficulty of marketing internationalisation. Songdo was a huge government bet, but being a long-term investment, changes of political cycles were not beneficial to the development of the project.

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[247] Maria Teresa BILOTTA - Songdo, south korea: The world's first smart city - in pictures. The Guardian, 2014. Disponível em WWW: <https://www.theguardian.com/cities/2014/dec/22/songdo-south-korea-world-first-smart-city-in-pictures>.

[248] TOWNSEND

The underlying conceptual model for this research dispels the notion adjacent. Will be identified some of the interlocutors and identified some of the buildings and their architecture and the particular case of innovations of study chosen for this research: Songdo International City in South Korea.

This research presents a proposal for the case study of space with the Re-drawing logic to the concept and application of Green Architecture elements. The logic of Sustainable Urban and Energy, demonstrating the importance of these concepts in the design and development of Smart Cities worldwide, giving emphasis to the benefits that this type of intervention can produce in developed cities root planning who committed errors.

The theoretical method developed in this research allows us to identify the possibility of creating a sustainable design process that contributes to a better development and durability of Smart Cities. Can after a complete analysis of this research determine that all cities can be transformed Intelligent or Smart Cities, with different levels and improved in several areas under the city. The application of particular types of features can produce significant results in the characterisation of a sustainable urban model to apply.

The study identifies the essential characteristics of a Smart City through an identifying and characterising matrix.

But, there are some facts that can influence this action at the territory. A planed city can result into criticisms from some groups of urbanists that believe that Songdo was not using the historical principle of the slow urban development. These criticisms go directly to an existent demography mostly composed of a restricted part of the upper middle class, such that the low income population and older people are absent. A second analysis points out that Songdo has a feeling of artificiality, due to the uniformity of the buildings and the lack of architectural diversity, coming from the same period.[249]

In addition to these issues, urban planners and technologists point out that there is a very high risk of using a large number of innovative technologies in the city without allowing these technologies to be absorbed by the population or even allowing them to be validated by their users. An example of criticism concerning the technological aspect of the city stems from the conflict between the ease and the lack of privacy generated by the "excess" of control of the urban infrastructure

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[249] Richard SENNETT - No one likes a city that's too smart. The Guardian, 2012. Disponível em WWW: <https://www.theguardian.com/commentisfree/2012/dec/04/smart-city-rio-songdo-masdar>.

and the flows of people through the city. [250]

5.3.4 – 1ˢᵗ Phase construction

City of Songdo International, the map presented by IFEZ after construction 2013 (Figure 90).

IFEZ represent the Incheon Free Economic Zone authority and have a presence as a support centre for foreign residents in Songdo City. They provide support on daily living, on business activities, with administrative support under the buildings system, with educational courses and with the international exchange events. IFEZ provide basic counselling regarding legal, labor, tax and real estate related issues under a help to expats in Songdo.
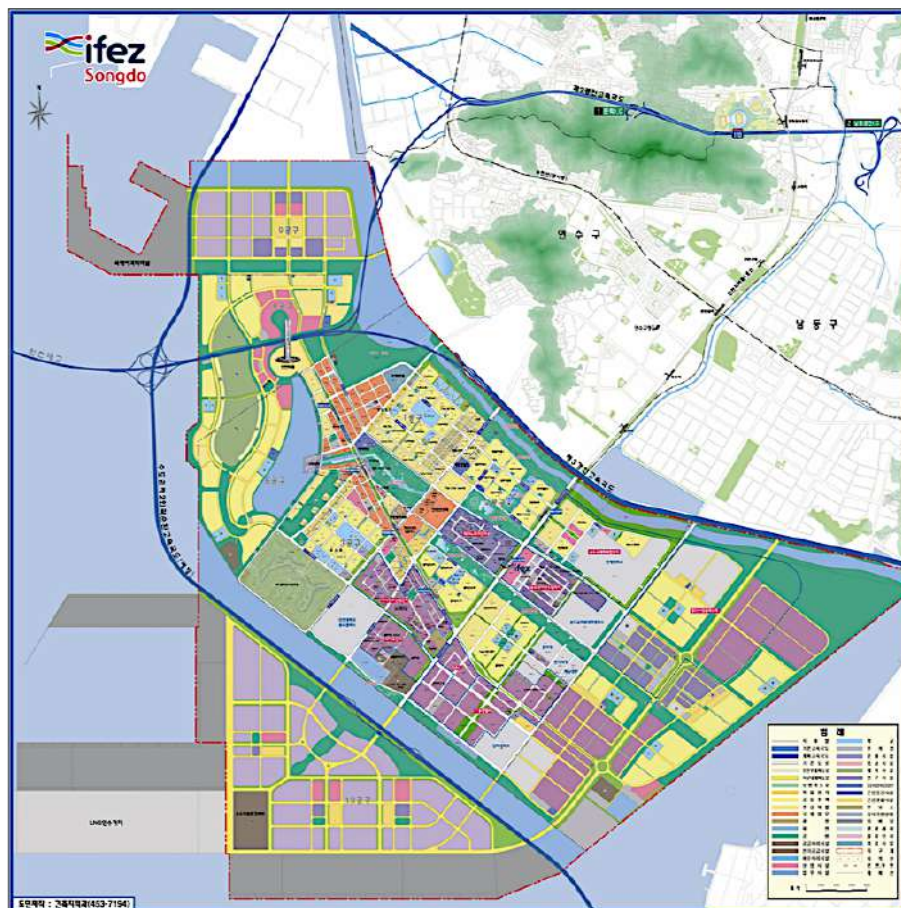
Figure 90 – Songdo Map
(source: IFEZ 2013)

Songdo was built as international city, and a possible family-oriented place to live and work.

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[250] Pamela L. O' Connell - Korea's high-tech utopia, where everything is observed. New York Times, 2015. Disponível em WWW: <http://www.nytimes.com/2005/10/05/technology/techspecial/koreas-hightech-utopia-where-everything-is-observed.html?_r=0>.

KPF worked in a 1,500 acres Master Plan (Figure 91) with the associate architect 'Kunwon' from South Korea in a master plan proposal for Songdo City for a huge client called NSIC a combination between Gale International and POSCO E&C JV in Incheon South Korea. First in 2007 had wined the People's Choice Award for Urban Design the HKIA award and in 2008 had wined the Sustainable Cities Award from Land Institute, Financial Times.

Songdo was developed with a model for the future sustainable city located as the gateway Northeast District and with a '...diverse array programatic elements with a pedestrian friendly city, with walkable streets, 40 percent green spaces and with an idea of active street life.'

Figure 91 – KPF proposal
(source: KPF website, 2014)

The existence of Chaos on a mesh Urban Authenticity implemented to space is what these new cities fail when they want to conceive a simple design and work of monitoring.

There is an intense sociological work that is under development in this type of U-Cities. People seek balance, nature, and comfort but feel comfortable as well in old cities and towns with soul.

Songdo was formerly the ocean. Masdar was formerly the desert and Lavasa was formerly in a valley. The initial idea of all of them was to create a town that was in harmony with people, the opposite of a chaotic city and out of time.

Incheon in South Korea has consideration of a dynamic city, since the beginning of the history, but one of the Mayor's of Incheon Metropolitan City describe " Incheon has always been a pioneering and innovative. Incheon opened the Enlightenment Period of Korea and led the modern industrial development of the country, serving as the 'driving force' behind the Republic of Korea...Incheon was designated as the nation's first free economic zone and houses a world-leading international airport and sea port...to host the Green Climate Fund Secretariat (GCF)...as host city of the 2014 Incheon Asian Games...Incheon, the 'heart of Republic of Korea' is powerfully reverberating." [251]

In 2002, the 1s are announced plans for the "Northeast Asia Business Hub".

In 2003 it created the IFEZ

In 2004 Ground breaking of Songdo International Convention Centre

In 2005 development of districts 5 and 7, and connecting the beginning of the new metro line.

In 2006 opens the UN APCICT in G-tower.

In 2007 occur the finalisation of the districts 6.08 and Central Park in Songdo.

In 2009 opens the "Incheon Bridge" and start up the holes for the Songdo Global Campus.

In 2010 it completed the Songdo International School, Chadwick school, and the "headquarter" Posco moved to Songdo.

In 2011 it made the protocol between Samsung Biologics and Dong A

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[251] IMC, Incheon Metropolitan City, Republic of Korea: neargov.org, accessed in 22 November 2015

Pharmaceuticals.

2012 Green Climate Found opens in Songdo in G-Tower; The SUNY (State University of New York) Korea opens in Songdo in Songdo Global Campus

2013 is made 'Amkor' protocol technologies with 1 billion dollars to complete the construction of the G-Tower (Figure 92).
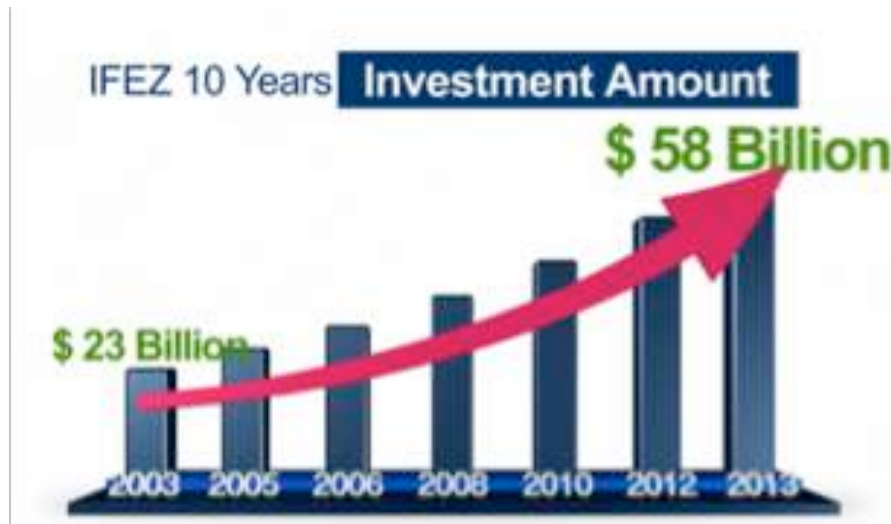
Figure 92 - Songdo IFEZ city presentation graph
(source: IFEZ bulletin 2013)

In 2003 they appeared specialists and visionaries worldwide. The goal was to create the most vibrant and spatial space in the region, to create the most beautiful and highest quality of life worldwide.

Over the years, the city began to gain expression.

2008 convinced inauguration

2009 Inch. Songdo Bridge connecting airport opening and Central Park.

2010 relocation of the company POSCO E & C

2010 Opening Chadwick International School.

2010 Opening of the Jack Nicklaus Golf Club

2011 Opening of Samsung research centre E-Land investing in Songdo

2013 The opening of Green Climate Fund and the World Bank.

2013 opening of the "NC" cube.

Figure 93 – Central Park view, Songdo
(source: by the author, 2013)

A city planned for the future with a very fast connection to the existing airport, 15 minutes by car or taxi to one of the best if not the best airport in the world (Figure 93).

The Incheon International Airport is the largest in South Korea and one of the busiest in the world. Since 2005 is considered the best in the world by the Airports Council International and received the Skytrax award a 5 star ranking. It is open since 2001 and replaced the airport 'Gimpo' now only makes domestic flights to Tokyo, Osaka and 'Sanhai'.

This airport also serves as a transportation hub for the entire Asia and in 2006. It is named as "Incheon International Airport" and is located in Jung-gu area, which was an amalgamation of two islands, Yeongjong and Youngyu in construction It lasted eight years from 1992 to March 2001 for the completion of the 1st phase.

Figure 94 - Korean landscape Songdo
(source: by the author 2016)

The second phase was completed on 20 June 2008. There is also a 3rd phase that Korean government is planning to implement by 2015 of 4 trillion won that contains the performance of a train connecting the airport to the centre of Seoul which is 70 Km from distance. The 4th phase provides a flow of 100 million passengers in order to consider one of the 10 busiest airports in the world in 2020. The English architect Terry Farrell and the Korean company SAMOO architecture designed the airport in a landfill (Figure 94).

Songdo has begun his process with concepts of LEED certification win direction of a sustainable development.

Songdo is a city where globally education is a key point - Songdo Global University Campus – 'Global Education' with the objective of an exceptional quality of life for all inhabitants. A city recognised worldwide as having a very high level of quality of life. The G-Tower building is the place where some international organisations like the United Nations and so on.

One of the goals of this city is receiving more and more jobs created by

Korean companies and foreign where people can breathe clean air.

Jacques Attali, French economist, writer and futurologist said, ' Songdo International City is a city model is Ecopolis' (Figure 95).

Ban Ki-moon, United Nations Secretary-General also pointed out at the 2009 Global Environment Forum "Songdo will be the global city surpassing Dubai or Manhattan in New York City."

In 2008, Songdo IBD was winner of the annual award for Sustainable Cities Award by the Urban Land Institute and the Financial Times.

Figure 95 - Songdo bike circulation on streets
(source: by the author 2016)

Rodrigo Brancatelli, a reporter for the state of São Paulo, develops an article March 18, 2012 which stresses the importance of the existence of streets, alleys, traffic, churches, residents themselves, which identifies what are these connections between the citizen and construction, between form and function, between the capital and the opportunities that create big cities like London, New York, Tokyo, Sydney, Sao Paulo and others who are born small spaces and joined an endless number of people and the its development never ends. The big question he asked is, how does a city built on the sea, can an overnight adopt the characteristics of a metropolis with so many of these, and so many years of history and development?

He describes Songdo, an area of 6 square kilometres, will not beachfront but on the Yellow Sea and 65 km from Seoul, in the case of one of the largest private real estate investments already made. It identifies the sensors in the asphalt to understand the movement from one room to another and for the lighting of pathways decrease when not one to spend in order to save electricity. Also stresses the electronic label to be applied to bottles, where all the locals that recycle will have a direct discount on taxes, but this attitude is not happening.

Another of the innovations he stresses is reusing water from residential reuse in irrigation. The garbage, it indicates, both organic and recyclable is transported through pressurised pipes, eliminating the need for collection. David Moore one of the directors of the project says, "Songdo is a global city in Asia, a few hours of major cities in the region, not just an amusement park." David, stresses the exceptional sale at the beginning of construction, the first sales in that for the first 2,600 apartments appeared 21,000 buyers and sales in the 2nd phase of the 25 thousand units in 2 billion worth was sold in just one day.

5.3.5 – Occupancy

David Moore, an engineer by profession, arrived in South Korea, Seoul in 1995 through the "Trafalgar Construction Corporation" company due in 1990 after the terrible events in 'Gangnam' in Seoul in South Korea, where people have died due to calculations failures structural and quality check failures and the bridge that collapsed also fell in Seoul, placed throughout the building and check on construction companies with the Korean Government. It began to emerge a huge fear in the structural part to the lack of quality since this is a free Parent relatively recently where the quality of teaching at this time was not the best.
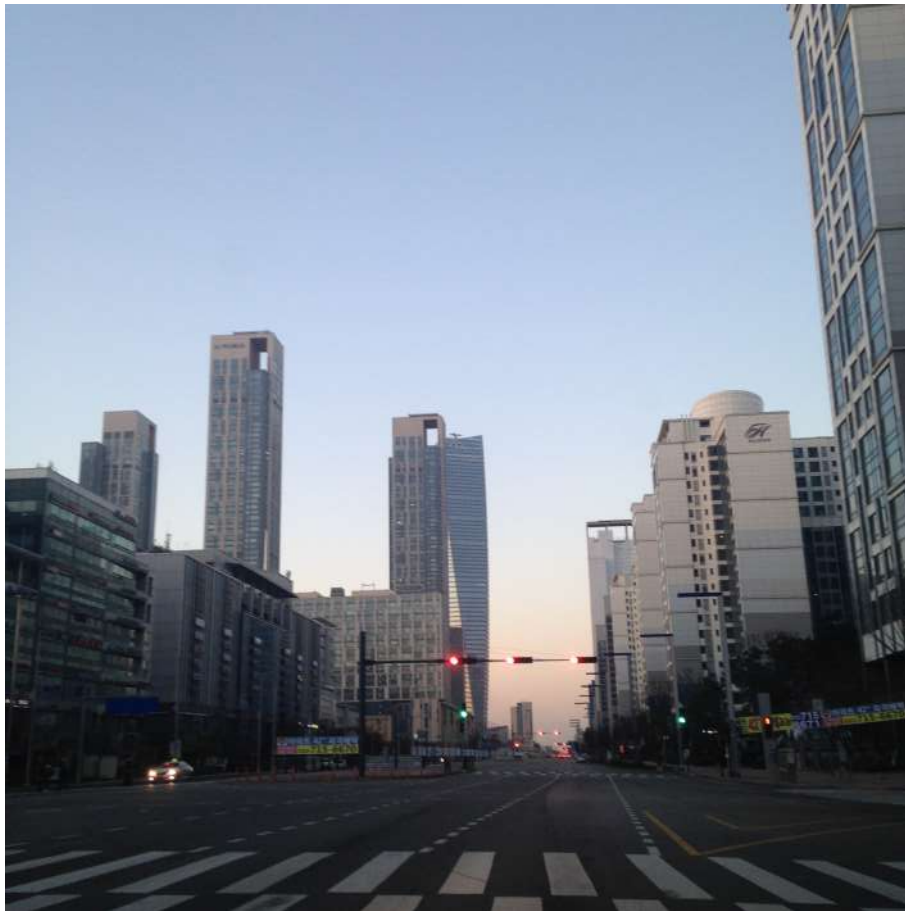
Figure 96 - Principal Street to enter in Songdo by the bridge from Incheon
(source: by the author 2015)

So Samsung contracts teams to work related to engineering and construction supervision performed by Samsung. From this time came into being enormous pressure on the quality of what was produced and applied. American and British teams occupied the market with great force. Later, after a few years, David Moore and a team of engineers, created a company specialised in this type of inspection because the market demanded. There was lack of such services. Until these companies enter the market there was enough corruption in the choice of materials, the choice of subcontractors and this trend has created a new way of working. This company has had its own customers and contained an excellent portfolio through all the works that had developed to the big Samsung's construction company.

In 2004, Moore makes this company to embrace a new project that saw the call Songdo City. This was the opportunity to be part of a team that will build a city. The company who accompanied from the start of the project was the International Gale (explain what is what the market). The principle was to create a 'join venture' between Gale International and POSCO in order to start the project. The construction company Daewoo

was the company always suitable for this new challenge, but Posco, a relatively new company has performed more available and open to this opportunity.

Thus, Gale International in the United States, found another business partner to KPF, Kohn Pederson Fox Associates where both companies have accepted the risk of the project would be a failure because of the investment that was needed in the overall design.

5.3.6 – City today

Figure 97 – Songdo Central Park today
(source: by the author, 2014)

Songdo is located in Seoul Metropolitan City, near the principal international airport of Seoul South Korea with a direct connection by a bridge with 21 km about 18 minutes distance in 1500 acres along Incheon waterfront.

This city is located in the Seoul-Incheon 'Gyeonggi' region where to exist 24 million of residents. To arrive in Seoul from the Songdo city to Gangnam it takes 45 minutes, and it is very near the high level of countries with a high development.

In 2001, Gale International, a privately owned real estate development based in New York, was invited for being responsible for the project development of Songdo International City in Incheon South Korea a land on the ocean. Incheon metropolitan city, in 2002 create a joint venture

Posco E&C for making the project more complete. In 2005 the Master Plan was completed and the construction start in a normal rhythm.

In 2009 was finished the Songdo Convensia a convention centre is the first project completed in Songdo IBD and opened for business, the Central Park (Figure 97) and the first commercial and residential units opened. The Incheon Bridge was completed, and Songdo was connected finally to the International Airport. In 2010 some international schools and the International Golf Club was complete, some of the core equipment into the city. In 2012 the Green Climate Fund started, and the World Bank Korea begin their work worldwide. Some of this entities were basilar for the city structure as 'Gale International' and 'Posco E&C'. IFEZ (Figure 98) it is responsible now for the management of the town. The 'KPF' architectural company was in charge of the master plan, 'ARUP', 'Nicklaus', 'CISCO', 'u-Life Solutions' and '3M' are the first initial Songdo partners, and they still are an integrant part of the city. 'Incheon U-City' and 'u.Life Solutions' are the first development products that Songdo presented to citizens.
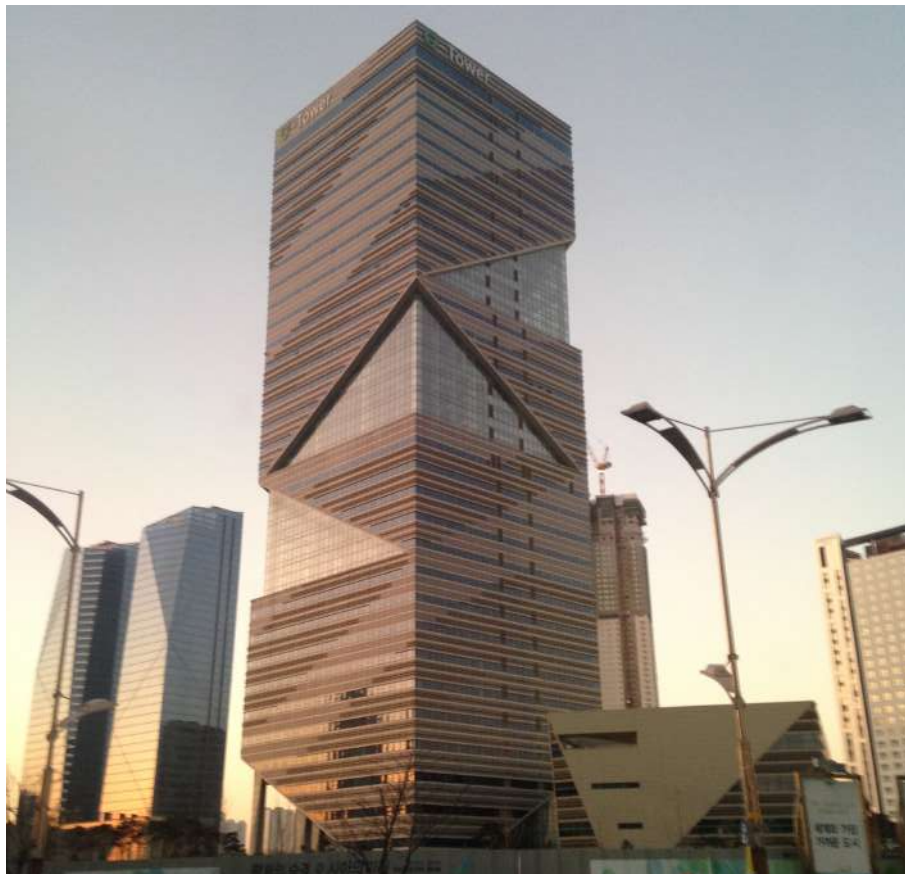
Figure 98 - G tower in Songdo, International organizations
(source: by the author 2014)

Figure 99 – Central Park and 'Tribowl' in Songdo
(source: by the author 2015)
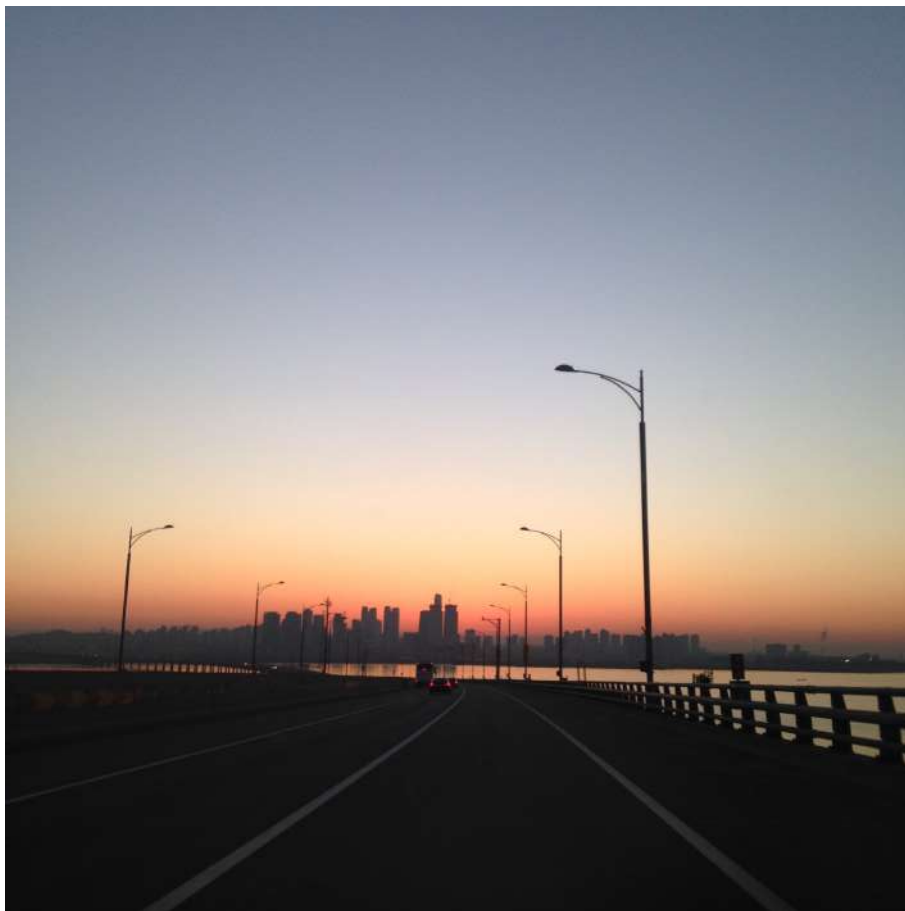
Figure 100 – Sunrise, Songdo view
(source: by the author, 2015)

Figure 101 - Sharp II images, Songdo 1st phase construction
(source: by the author 2015)

Figure 102 - Sharp II images, Songdo 1st phase construction
(source: by the author 2015)

Figure 103 - Garbage special transformation, Songdo Street, near buildings
(source: by the author, 2015)

Songdo present an intense Green action. They implemented the first LEED buildings in South Korea, the First LEED Songdo Convention centre, First LEED Chadwick International, First LEED The Sharp Central Park I and First LEED Sheraton Incheon Hotel

In our days there are 36,000 residents currently live in Songdo IBD.

Songdo has a fine living and a particular and distinctive (Figure 99). The first phase of the construction was focused on details and into the 'latest sustainable technology'. Actual data beginning of the occupation of its construction will be presented to the present day and will be identified some of the sociological problems which are described in some thesis already developed. Songdo produce a special sky colour during the winter that intensifies the city image (Figure 100).

In "The Sharp" Songdo Central Park II (Figure 101 & 102), apartments will contain a panel that manages each compartment, which identifies the temperature for the heat and the cold. It runs through a radiant floor system and a higher supply air and temperature system.

The apartment contains a manual in Korean language explaining how everything works, which makes it difficult for those who do not know well the language, should be all initially in English. This complex, for example, called "The Sharp" Songdo Central Park II contains abroad, a childhood

playground for children, contains exercise machines located, small tennis courts and all urban infrastructure to support the building. Inside contains a fully equipped gym with machines, an internal space for the practice of golf, a group classroom where the condominium-hired teachers for lessons are organised.

Our 'RC' floors Portugal is the equivalent across Asia to the floor 1. Floor count starts on the ground floor and the first floor.

In the basement -2, the assigned B2 presents the car park, where currently there is a fascinating feature, which is an almost rule all cars are parked and be reversing. The entrance to all buildings to get to these garages or parks, two ways divide the road, the entrance to the residents who have a label with a sensor in the car, the entry for goods, taxis or visitors and the exit zone of all cars. In designated the 1st floor, a huge bike park that occupies almost the whole floor, always full, the area of mailboxes and near the main entrance, an event room and toilets of support and security zone that in the service 24 on 24 hours (Figure 103).

Spaces gym, golf room, sauna and winter garden and garden to the extreme level are in the so-called level 2.

The remaining floors contain fortieth or fiftieth-floor apartments with different areas and different types to be able to give the customer the chance to choose. Every owner or lessee, as the manual is provided, which contains all the information of the House, this equipment to their maintenance. This guide is called as the "Green Life ."
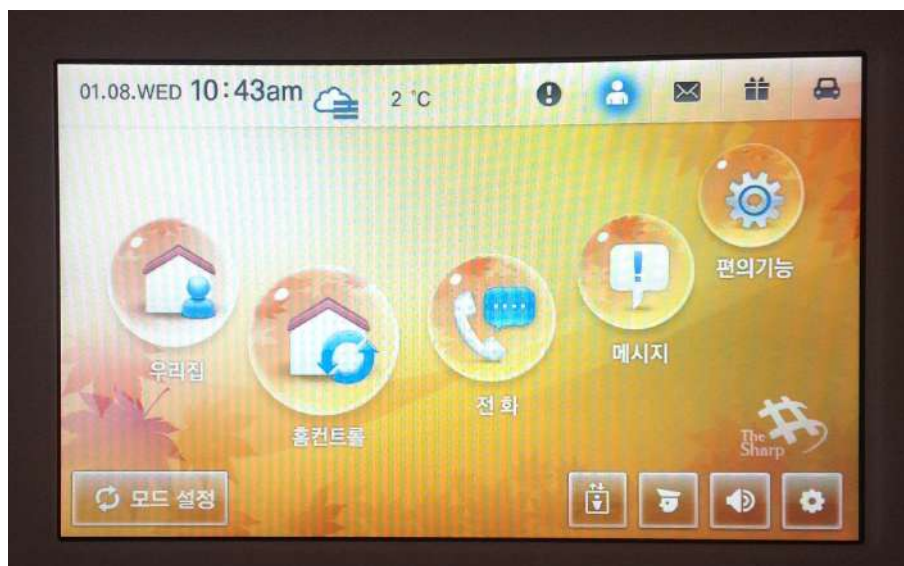
Figure 104 - The touch panel inside Sharp I apartments Songdo
(source: by the author, 2015)

In these complexes, the first phase of Songdo construction, in particular, this area of the city had followed an American architectural design.

The general image of the city presents a rich expression that the buildings represent the first phase.

Inside the compound, there are apartments from type A (T2) with 98,83 m2, from type B (T3) with 139.76 m2, from type C (T3) with 143,26m2. The type D (T3) with 144,34m2, from type E (T3) with 181,45m2, from type F, the biggest (T3) with 183,10m2. The type G (T3) with dressing room with natural light and Jacuzzi 199,03 m2, from type H (T3) with 199,19m2 closet with interior and sanitary installation with natural light and the type I with the same area.

This complex also features much larger apartments as the type J (T3) with 393,96m2, type K (T4) with 393,96m2, type L (T4) with 394,58m2, type M (T4) with 394, 58m2, type N (T4) with 394,69m2.

The last type presented in the condominium, the type O (T4) with 400.93 m2 where apartments have the total larger area inside the complex and for the concept of big families.

Each apartment features a centralised system, a touch panel where is contained the floor heating, air heating, the lighting, opening and closing the gas in each compartment by the panel.

Then there is a second mechanism that generates the lighting in the living room and hallway area according to the need and intensity.

Soon after leaving the hall there is a mechanism divided into four sectors, general cutting gas, generally cut off electricity on or off, or just general cutting of lighting – the CUT OFF SWITCH (Figure 104).

There is a key to entering the apartment. Yes, there is a code to select or move from one original card. However, note that this system works on batteries and is necessary to have close attention to the system and always have recourse cells, or even a standalone key system on the door cannon (Figure 105 & Figure 106).

Figure 105 – 'HomNet' key to enter on building and at the apartment in Sharp II
(source: by the author 2015)

Figure 106 – Entrance door system at the intelligent building in Songdo Sharp I
(source: by the author 2015)

Of note, the special detail, radiant floor heating is always made up of the apartment entrance quota. An Asiatic tradition it is still used in Songdo, all

the people within the Korean homes walk up shoes, which requires that each entry hall contain a proper place for the placement of the shoes.

No one enters the house footwear is a cultural issue, respect, and cleanliness and that will get to the concept of typical Korean home, Hanok (explain here the traditional Korean architecture) always in the lobby a closet to put on shoes and a small step makes up the radiant system back down in ceramic floor area of sanitation.

The waste system the situation is special. The garbage bags have to be purchased in special places because the waste system. On each floor, there is an area of practice where an opening is to junk foods, organic and another opening for household waste.

Figure 107 - Garbage bag, for Sharp I waste system, organic waste, Songdo (by the author 2015)

Figure 108 - Garbage bag, for Sharp I, waste system.
(source: by the author 2015)

There is also a sound system in magazines, which receives daily information from the data centre building information.

The kitchen has some innovations like the sink system where there is a second filtering appliance food, so there are no blockages in plumbing. There is also a piece of pedal type for the water determination to waters expenditure is more controlled.

Regarding security, there are the outer chambers in which it is possible to have to access inside the house, either to the playground be to all the other ones. To the entrance of the bicycle parking lot, there is an entry card, and in the entry hall, there is also a card that triggers the door and automatically calls the elevator, he bring programmed directly with the

floor in the elevator.

Underground, the floor -1, called B1 there is an area of recycling where we can divide the garbage and get filter various levels of recycling.

Following the new Dubai intelligent waste system that Singh (2015) where to explain the detection of the waist level, internal temperature, and an empty notification can be predict and routes of electric vehicles and can save time. In Songdo's solution maintenance, it will cost the double of this action and the initial investment cost it was bigger than this new solution in Dubai.

Figure 109 – Garbage system connected entirely city grid.
(by the author 2015)

For a building to be considered LEED Platinum Green Certificate it will have to contain an intervention, the insolation of the building is one of the most critical interventions to save energy and to produce results. The more insulation we put more insulation can get. However, the correct application is essential to a good result. To obtain results in a single wall insulation should be very well applied to 6 points: top, bottom, front, back, left side and right side without any voids, gaps or compressions. The insulation must also be applied in all conduits implemented in and connected to the same wall and the roof or the floor in order not occur losses.

Sometimes, upper sub-walls or barriers solutions produce tremendous results or less. In apartments who do not have air conditioning, and could be the future, the important thing is to be the prevention of heat input

from outside. So the roofs should contain or reflective colours (for reflection) or green areas. This kind of assistance the implementation of the "Green Roofs" are certainly solutions to better use because they create shading on the roofs and make them reduce solar incidence which will freshen the interior and collect rainwater in addition to creating a peaceful and balanced picture to neighbourhoods.

Another of the techniques to be applied is the sealing of the roof, so there is no type of cracking or failure and all the insulation work in full.

There are also two important sources in this kind of buildings the terms into account, the light and the air quality or natural. Angela Brooks, chief architect at Brooks + Scarpa Architects says that the architect to start drawing with concern for better natural light, and better natural ventilation is the best ways to start a "Green Architecture Project" to improve the quality of lives of those who will live there and produces energy savings.

The humidity of sanitary facilities and the gasses produced in the kitchens will be routed directly to the outside in previously sealed, soundproofed and insulated pipes.

Also, Sarrah Letts, the executive director of community Corporation of Santa Monica, says that building Green Buildings improved economic management of the own inhabitants of the building. The experience of living in a building of such spending on gas, water and electricity will significantly reduce where people may invest more in other things such as health and education, which will produce an improvement on the economic situation.

One of the major requirements for LEED certification is the protection of the building during the work of contamination. All materials, even during the work should remain fully protected, and the connection of the outside to the inside must be sealed, so that the garbage building does not spread the applied pipes. Also, the walls themselves in the course of construction should remain protected from water and moisture.

As well as the doors and windows should contain an extremely high quality so the water does not penetrate and will not serve as conductor elements of internal energy losses.

Green Architecture is a new approach applied to the design of cities and buildings and a used methodology for technicians, users, and for spaces.

This concept should not be applied anywhere in the world and even in older cities.

The population will keep growing with new techniques for more sustainable and greener living.

As we all know over the years, our planet is becoming environmental problems. This task of preserving Cities is a common global goal. We all, from day to day, need to improve our spaces, preserving what is from everyone and everyone belongs.

With this research many architects, engineers, designers or even simple users of buildings or even curious results may take and use solutions in everyday life. In this investigation, the best Green Architects and the respective definition will be identified.

Smart cities or U-cities will be characterised by interactive elements and Songdo City in Incheon in South Korea will be the case study.

The current occupancy date, from the beginning of its construction to present time will be identified, and some of the sociological problems are an integrant part of the research on some themes already developed.

The solution to European cities or other areas in the world which lack the intervention strategy and where cities are disappearing and dying without a strategy and the future sustainable action for our generations will be proposed. Will be proposed as well, one solution for growing and maintenance of this new Smart Cities.

The Green Architecture is a new attitude applied to the design of towns and buildings. It is a methodology that we use us, technicians, and we space users. This concept should be implemented anywhere in the world to be in new cities, either in older cities. The population should continue to grow with new techniques in a more sustainable and greener living.

As we all know over the years, our planet is more and more environmental problems. This task of preserving cities is a common, global goal. We have all day by day to improve our spaces but preserving that which belongs to everyone and belongs to everyone.

With this research many architects, engineers, designers and even simple users of buildings or even curious may withdraw relations and use solutions for day-to-day.

This study links the scientific field of Urbanism and Architecture with a more complex area that sociology.

The case study seeks to develop alternative ways of formulating the urban development on smart cities and Smart Cities this case built from scratch. This project is presented as a prototype to rethink the planning,

construction and management of this new type of cities and particularly in this quarter of the town of Songdo International City in Incheon in South Korea very close to the great metropolis of Seoul, one the most developed and populated Smart Cities in the World today.

This study marks the latest concepts of sustainable interventions on cities taking into account the global challenges of today.

Dimensions, innovations, and communications are key in the design act, construction and own use. The paradigm shifts over time and the influences. Geographical can determine the success or failure in this type of interventions.

An approach to urban design with a green and sustainable quality attitude, introducing a so-called sense "international standard" may be a possible answer.

This hypothesis is based on (talk about two or three authors of Green Architecture)

The presentation in detail the characteristic data in place and a link to the past and current events can produce a solution hypothesis for the particular chosen location.

With the application of the concepts on the proposal and based on the matrix developed operational concepts emerged, divided into categories. Voids are created, boundaries, processes, and circulations and are designed a complete result for this sustainable proposal.

A problem that is very common in Songdo from the initial Phase is the solar incidence on the facades.

The sunlight is one of the crucial points of an architectural intervention, projecting following the Earth's rotational movement is 23° in respect of translation movement produce beautiful results. According to the time of year the latitude of the location in question, the sun makes its journey.

If the sun is entirely direct to the glass, the summer time will produce a high cost on energy to support intense temperatures inside the buildings.

The area of 40% of the space in Songdo it is green spaces with walking paths, biking paths to go work and to arrive at school. City's boutiques and cafés are present in all quarters.

The Songdo Central Park has a beautiful 101 acres where is possible to relax and receive some quality of life but continuing growing day by day.

5.4 – Songdo Climate introduction

This chapter explains what were the actions that Songdo added before under the project, that today represents, the direction of climate change or climate smart cities.

The initial project, was in the right direction of intelligent sustainability, using Green Mobility and Green home deliverance concepts.

Since the beginning, South Korea, and Incheon city council focus under an objective of transforming Songdo International City into a town, where everyone wants to travel in, to see and to live inside.

With the label of the first smart city in the world, making improvements and having the top continuous technological development, it has been several wager governments in South Korea.

Firstly, these last identified actions will improve the quality of the actual city inhabitants.

Secondly, some of this actions will create the biggest impact for new citizens and new opportunities into the market.

And thirdly, this will create a significant impact on climate and auto-sustainability into cities worldwide as an example.

Figure 110 - Designed by Modostudio, Piazza d'Armi Urban Park (source: evolu.us, 2016)

5.4.1 – Possible intervention

In a Macro level, what can be done in Songdo, following the Climate Smart City principles into a city, Songdo presents a very significant potential to be to develop in a direction of a Climate Smart City in a high scale. As Songdo has a structure from the scratch, and a new paradigm under the society that started to live in a " different" city. Some new concepts, can be much more added and with a potential high level of results.

In a Micro level one of the possible positions that can be implemented into the town and following the climate smart cities intervention and principles it is 'Singularity'. Enormous streets similar to the New York streets are not creating the same impact has was thinking. The distance is transforming the space impersonal. An introduction of new creativity, new creative spaces, opening the territory to different economic inhabitants, and not only the rich people, the introduction of new design paradigm with Piazza's into the city opened 24 hours a day, or more hydrologic elements, investing on biodiversity to attract more people from everywhere can be some of the possible new actions into the territory.

When citizens feel at home, they feel connection with the materials, with the colours, with the smells or even with the food. To this city arrive to some cities like, Hong Kong, Rome, New York, or others, the cultural level will need to be improved into the high level as it is possible.

One of the errors that maybe where made at the begging of the plan was the un investment under the health smart system and under the cultural dynamic initiatives. And why these two actions? Because, people will feel safe and more health with a smart medical service even out of their countries, this actions made people believe that they will have the basilar needs not only at their homes. The other option that was put it in other level of investment was the cultural measures inside the city that could be possibly a principal and natural way of attraction fro people from around the world. People don't leave only to work in a beautiful building or in a beautiful house, people need to feel different moments, actions, need to have diversity and an intense level of new information.

This two actions, after the direct research could be integrated in a new possible Climate Smart City from the scratch for a more intense and fats results to receive people from worldwide.

5.4.2 – City's Matrix checklist

	SIX INDICATORS	Areas	Designation	POINTS	OBS
1	1	Efficiency	Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result.	0.75	Insufficient internal production
2	1	Top Management	Space and infrastructure coordination facilitates on a wider range of activities.	0.75	The decisions are influenced by the city government
3	1	Energy Savings	Reducing energy consumption through using less of an energy service	1	Direct energy saving by wast the treatment
4	1	Cost versus effectiveness	Equilibrium versus expense to action time	0.1	New equipments under development and study
5	1	New economic system	Revitalised and sustainable economic system	0.75	New technologies under a medium or old slow system
6	1	Smart payments	Easy and fast payments	0.75	Many payments with na only card
7	2	Active citizen participation	An articulation of the debate over rights versus responsibilities.	0.5	Missing of an increase under na international language
8	2	Quality level	The general well-being of individuals and societies (QOL).	0.75	High level o QOL with low cultural level
9	2	Social support	Projects accepted and co-organised by inhabitants	0.1	Low international language level
10	2	Historic elements	Old and special elements inside the city	0	City built from the scratch
11	2	Management of Human resources	Specialised systems to employment system	0.25	Professional jobs under development
12	2	Green jobs	New work market connected with the sustainable development	0.5	General education without detailed specialisation
13	2	Young population	Future generation sustainability	0.75	A high level of population increase

14	2	Smart Education	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	1	A good level of intelligent and efficient education
15	2	Lighter footprint	Reduction measures of human demand on the Earth's ecosystems	0.5	Internal materials from different areas of the country
16	2	Dynamic	Always active or changing and having motion, or physical force.	0	A new city under transformation
17	3	Collect Data	Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.	0.75	All the information is connected under a platform
18	3	Green Buildings	Green construction or sustainable buildings refers to both a structure and the using of processes that are environmentally responsible and resource-efficient	0.5	The first phase introduced a LEED green high level certification
19	3	Safety	Technology that assists in reducing or avoiding accidents.	1	Central data information street by street
20	3	New Technology	New systems application, more effectiveness, more results with less time. Productivity.	1	A developed city with a different governance
21	3	Wide and Strong Political action	Political support from governments	1	A city that had to survive from the support of different governments ideas
22	3	New industries	New markets, new creativity	1	An intense growing market based under the sustainable city

23	3	Marketing concept	Clear information arrived to the citizens	0.5	The factor language it was since the beginning a barrier
24	3	LEED Green certification	International building sustainable certification	0.5	There are two levels of certification: LEED certification and the national Korean buildings certification implemented under this city
25	3	Smart Health	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0	The initial project promoted the smart health on the city but during the first and the second phase was not a priority
26	3	Zero waste	A philosophy that encourages the redesign of resource life cycles so that all products are reused.	0.75	The wast system under the ground level and under the buildings was developed in a high level
27	3	Scale city	The main focus of the city under a simple observation	0.5	The clear message from the city it is connected with the habitation park
28	4	Green Transports	Transport that is sustainable in the senses of social, environmental and climate impacts and the ability to, in the global scope, supply the source energy indefinitely	0.5	The city maintain the entrance from old cars and it is in direction of implementation of new transportation technologies
29	4	Technological adaptation	High and costly equipments application	0.75	The city governance invest into top level products to be implemented and tested
30	4	Management Tool	Existing management equipments	1	Centralised general management and individual buildings management
31	4	Network Connector	Central system management	1	A high level system implemented

32	4	Smart Lighting	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on Light inside the city, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	1	The city it is 100% connected with sustainable
33	4	Smart grids	A modernised electrical grid that uses analogy or digital information and communications technology to gather and act on information – such as information about the behaviours of suppliers and consumers – in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.	1	The energy production it is supported with the national energetic grip
34	5	Sustainability	Capacity of an ecosystem to absorb disturbance and still retain its basic structure and viability.	0.75	Infrastructure inserted under the general project
35	5	Green roofs	A roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.	0.5	Most of the small buildings present a green garden at the roof
36	5	Agriculture production	Cultivation of animals, plants, fungi, and other life forms for food, fibre, biofuel, medicinal and other products used to sustain and enhance human life	0.75	Na intense level of organised production

37	5	Local food	The local food movement is a movement which aims to connect food producers and food consumers in the same geographic region, in order to develop more self-reliant and resilient food networks, improve local economies, or for health, environmental, community, or social impact in a particular places	0.25	Low percentage of production
38	5	Water conservation	Encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand	0.75	A high percentage of conservation from rain water
39	5	No standardised Architecture	Diverse architecture, unusual architecture, unique	0.5	With a projected first phase
40	5	Equilibrium on caos	General measure applied inside a city given a natural equilibrium	0.25	A characterised new city without caos
41	5	Compact city	Or city of short distances is an urban planning and urban design concept, which promotes relatively high residential density with mixed land uses.	0.75	One of the principles on the first phase of the project
42	6	Natural Resources	Amounts of biodiversity and geo diversity existent in various ecosystems.	0.5	A high percentage of green spaces under the territory
43	6	Public spaces	A social space that is generally open and accessible to people	0.5	Huge percentage of open spaces without social intervention
44	6	New materials	Type and quality of the materials	0.75	New intervention of materials

45	6	Diverse architecture	Different buildings and intense sense of culture	0.25	A small intervention with cultural
46	6	Limitations	Limits on technology application	0.25	A all city connected by cameras street by street
47	6	Green grow paradigm	Development focus on Sustainability	0.5	An intense market connect with na intense level of revenues
48	6	Clean air action	Actions to implement the Clean Air Act have achieved dramatic reductions in air pollution	0.1	The information level is 100% productive but na intense level of pollution from the country and from China
49	6	Liveable	Annually measures "quality of living" standards, using data such as crime rates, health statistics, sanitation standards, and expenditures on city services	0.75	An intense percentage between green areas and the constructed territory
50	6	Strong Communication	Information circulating very fast around the city	0.25	A small level of marketing from city governance using the international language
TOTAL				29.55	

SONGDO			29.55
YES	> 90%	1	
PARTIAL 75	> 75% ≤ 90%	0.75	
PARTIAL 50	> 50% ≤ 75%	0.5	
PARTIAL 25	> 25% ≤ 50%	0.25	
NO	≤ 25%	0.1	
NOT APPLICABLE	0%	0	

Table 23 - Songdo SMART CITY matrix analysis

	Areas	Designation	POINTS	OBS
1	New Design Integration Paradigm	A new concern With the spaces around And their integration	0.75	A city that was focus on new actions
2	Ecologic landscape	New plantations and CO_2 production	0.5	They invest into a territory with 50% in green areas
3	Mixing Private & Public	A concern for the whole and not for the individual	0.1	A territory where most of the areas are private

4	Auto sustainability | water, energy and food	Overall production of areas in a macro view eliminating only the micro view	0.25	The city's plan it goes in a different direction
5	Smart transportation	A concern for the development of a new transport network	0.5	An introduction of electric vehicles at the city
6	Smart waste treatment	Application of quality systems in the treatment of waste	1	The investment and the maintenance of this system was a central point under the initial international proposal that they maintain very well
7	Smart Maintenance	Training and implementation of field teams and high technology equipment	0.75	Exist a centralised centre with most of the data from the city and there are different small buildings maintenance adaptations
8	Hydrologic city	Application of balance between the various spaces through water elements	0.1	There's not a strategic plan for the city
9	Air quality measures	Application of information and measurement systems	0.25	When the levels arrive to a danger to human health, the city has an alert system
10	Soil quality conservation	Verification and reservation systems and soil protection through applied scientific research	0.5	At the city territory the adaptation was analysed but outside of the territory the connected waters are not getting the same treatment
11	Biodiversity	Protection enhancement of key elements in each space	0.25	The new technology adaptation it is not putting in account the natural diversity
12	Cultural preservation	Protection and rehabilitation of culturally interesting spaces	0.1	A city from the scratch doesn't have cultural elements
13	Social co-benefits	Application of systems and even spaces that complement social action with communities	0.25	The city has a problem with the language barriers
14	Food security	Changing the paradigm of food production within cities	0.1	The food production is coming from outside of the city
15	Livelihoods Safeguard	Protection of spaces against climate change	0.1	The central services are under studies development
16	Energy efficient design practices	Introduction of training and learning systems on best practices	0.75	The city it is TOP world in some technologies applied on buildings
17	International Green Buildings	Introduction of a Green Building with all international tendencies combined into na intervention	0.25	The city uses only the LEED system and the Korean green certification

18	Real estate Smart engagement	In the introduction to the real estate market supporting with knowledge and marketing	0.1	There is not an international engagement and neither a preparation fro the new systems and technology into this human resources
19	Resilience and Climate risk reduction	Introduction of new systems of action in case of emergency situations	0.1	The city is under development studies into this area
20	Flexible circulation	Implementation of fast and clean crossing routes within cities	0.5	The city was using initially the project plan proposals with the 5 minutes rule, but with the crises the plan had changed
21	Urban modelling techniques – on walking and cycling	Application of cycle paths or even footpaths in order to have new flows	1	The city can improve this system but presents a high level into the total territory
22	Smart urbanisation	Intelligent planning network application with 5 or 10 year strategies	0.75	They are under an intense study with USA support from the initial project with Gale International
23	Smart management	Application of network of action in the spaces of intelligent form with strategies to 5 or 10 years	0.75	The city in general present a more intelligent management that in a normal city
24	Noise attenuation	Application of elements that improve auditory quality in spaces	1	In general, it is a calm and not noisy city
25	Albedo' application	Application of systems of different heights in order to make spaces cozy	0.75	The city invest into almost 50% of the territory into green spaces
26	Singularity	Verification and application of elements that make interventions unique and create	0.1	They are not implementing unique solutions
27	Emotional security	Application of verification and monitoring systems in spaces	0.75	The cities organisation produces security into communities
28	Permanents and Impermanent	Application of new and technological equipment to support this trend	0.25	With big territory empty but with a slow adaptations to new technologies
29	Style and Creativity	Research and application of new methodologies and techniques	0.1	An intense development of technological buildings without diversification
30	Colour diversity	Existence of various typologies and colours in spaces	0.25	A city with a high level of glass colours
	TOTAIS		12.9	

SONGDO			12.9
YES	> 90%	1	
PARTIAL 75	>75% <90%	0.75	
PARTIAL 50	>50% <75%	0.5	
PARTIAL 25	>25% <50%	0.25	
NO	< 25%	0.1	
NOT APPLICABLE	0%	0	

Table 23A - Songdo CLIMATE SMART CITY matrix analysis

Figure 110A - Songdo grow today 2017
(source: by the author 2017)

5.5 – CASE STUDY 3 | Minsk as a Climate Smart City

In Belarusian history, is easy to identify the original architecture that they developed after the war. Their monuments exposes significant trends, about a nation that pass from different intrusion and wars that made then observe different ideas, philosophies, socialist buildings and the capitalism. Minsk is known by the enormous library in glass as is possible to see at the image (Figure 111). The colours that can be identified under the city are not connected with red or yellow, and more grey and black. The architecture that they have present under the city is not standard but the opposite, an intense architecture with authenticity and influence from Soviet Union.

Minsk is a city from the type 2, an existent town, but very young comparing to the European cities.

Figure 111 – Minsk National library 2015
(source: by the author, 2015)

5.5.1 – Nowadays in Minsk

If people think of Minsk as an undeveloped, boringly-grey and unattractive former Soviet city, it is a complete mistake.

Minsk is the capital and largest city of Belarus, Minsk has a river called 'Svislach' that produce humidity to the area, and there are different zones built near the river with an enormous authenticity. With the administrative capital of the Commonwealth of Independent States (CIS), Minsk survive with a special administrative status in Belarus and is the administrative centre of Minsk Region.

City authorities consider the September 2nd of 1067, the exact founding date of the city. Minsk is nowadays populated by two million people, and present a very clean European capital. A simple detail that the city has is that any kind of wall graffiti is removed in a matter of hours. Minsk continue be considered the 'Europe's last dictatorship' and still remains the least visited country in Europe. For entering the country today, the visa procedures are complicated and very expensive.

The Second World War devastated Belarus country and the capital Minsk, only a tenth percent of the city survived. After this occurrence, a well-planned restoration and, a good amount of the best 'Soviet architecture result under a recreation of a stunning Eastern European capital'.

With many languages, Mink, throughout its history received different countries. At the beginning, most of its residents were spoking 'Ruthenian' the language that later was modernised and become the Belorussian language. In 1569 the official language was Polish and only at the 19th century, Russian language became the official for the administration, schools and newspapers. Most of the residents of Minsk at the moment use Russian exclusively in their everyday lives at home and at work Although Belarusian is understood as well but the Russian impact and influence is enormous, but the English language is lacking.

Under the geographic point of view, Minsk is located on the southeastern slope of the Minsk Hills, a region of rolling hills running from the southwest, on the upper reaches of the river ' Nioman', to the northeast — that is, to ' Lukomskaye' Lake in northwestern in Belarus. The 220 metres (720 ft) is the average altitude above sea level. The most recent ice ages, shaped the physical geography of Minsk.

The ' Svislach' river, flows across the city from the northwest to the southeast, formed by water flowing from melting ice sheets at the end of the last Ice Age is in the 'urstromtal', an ancient river valley and these is one of the six smaller rivers within the city limits, all part of the Black Sea basin. Most of the green areas in Minsk are made by a 'mixed forests typical' of most of Belarus, with a constitution of Pinewood and mixed forests border the edge of the city, especially in the north and east. Most of the forests were preserved and transformed into parks following the city's growth and one of these examples is 'Chelyuskinites park'.

The solution that they found as defensive fortifications, because the western parts of the city are the most hilly, was to decide to built on the city on the hills.

With a moist air of the Atlantic Ocean and the dry air of the Eurasian landmass, Minsk has a warm summer hemiboreal humid continental climate (Koppen Dfb). They own its location between the strong influence of the moist air influences. The weather is unstable and tends to change very often. The average in January is −4.5 °C, while the average in July temperature is 18.5 °C. The lowest temperature was recorded in January of 1940 was −40 °C and the warmest was on July 1936 was 35 °C.

Figure 112 – Minsk city, river
(source: by the author, 2015)

The precipitation analysis in Minsk, have annual data of 690 millimetres, corresponding to 27in, two thirds of these precipitation occurs under the warm period and one third occurs under the cold period with snow and rain. With a very similar climatic regime like Stockholm, Minsk, throughout the year, most winds are westerly and northwesterly, bringing cool and moist air from the Atlantic.

Following the statistics from 2012, Minsk-based companies produced 21.5% of electricity, 76% of trucks, 15.9% of footwear, 89.3% of television sets, 99.3% of washing machines, 30% of chocolate, 27.7% of distilled alcoholic beverages and 19.7% of tobacco goods in Belarus and they are considered the biggest industrial centre from Belarus. Minsk has at the moment 11 theatres, 16 museums, 20 cinemas and 139 libraries. With all these cultural action and attitude, Minsk is considered the major cultural centre of Belarus.

The 'Republican centre of radioactive and environmental control' it is the institution from Belarus, that analyse, support and do the monitoring of the ecologic situation of Minsk city. During 2003 to 2008, the data from the overall weight of contaminants says that was an increase from 186,000 to 247,400 tons.

Minsk city, because of financial reasons, and by Russian influences, changed from gas to 'mazut', a heavy, low quality industrial fuel oil for heating their houses. This decision has worsened the ecological situation in the country.

Nevertheless, the biggest influence to the air pollution, is produced by cars. Every year, the Belarusian traffic police implement different solutions based on "Clean Air" program to prevent the use of cars with extremely polluting engines. A maximum level of normative concentration of formaldehyde and ammonia in the air is exceeded in only one district located in Minsk city. The Chromium-VI and nitrogen dioxide are other the major contaminants under three districts, which are situated in the southeastern part of Minsk, because they are the most polluted areas in the city.

In Transportation, Minsk has an extensive and old public transport system. The system has 8 tramway lines, over 70 trolleybus lines, 2 subway lines and over 100 bus lines. Trams were the first public transport used in Minsk, since 1892 the horse-tram, and since 1929 the electric tram. Since 1924, the Public buses have been used and since 1924, and since 1952 the trolleybuses in Minsk. 'Minsktrans' is the company that operates all the public transports, a government-owned and funded transport not-for-profit entity. Since January 2008, 'Minsktrans' operates with 1,420 buses, 1,010 trolleybuses and 153 tramway cars in Minsk.

The Metro line construction, in Minsk, began in 1977. The first line started to operate in 30 June 1984 with a regular train service along the station 'Institut Kultury' to the station 'Moskovskaya'. The line build in Minsk was the ninth metro system built in the USSR. An enormous detail the Minsk metro lines are close to the surface because of the due to the level of ground waters, and the stations are located closer to the surface approximately 10-17 meters. The tunnels and even the stations were built with a high degree of reliability and precision in order to keep the city's architectural outlook intact and every station has its own inimitable architectural image and concept.

Minsk metro ranks 4th among 16 metro systems of the Commonwealth of Independent States with the number of transported passengers the. The Minsk metro is today behind only the metro systems of Moscow, Saint Petersburg, and Kiev, but maybe in the future stations, could change in some results.[252]

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[252] belarus.by - Metro minsk. belarus.by: belarus.by, 2016. Disponível em WWW: <http://www.belarus.by/en/travel/transport-in-belarus/minsk-metro>.

Figure 113 – Subway Minsk city, 'Moskovskaya' station
(source: by the author, 2015)

The only airport open today, the Minsk National Airport, located in 42 km to the east of the city, was opened in 1982 very near the current railway station opened in 1987. The airport is small and flights to Europe and to the Middle East ate the moment.

Minsk was destroyed during the WWII in 1942 to 1943, but the population continue with a high connections with the war conditions and they have and enormous respect for seniors that were suffering from the war.

Minsk, with an area of 409,5m2 and with a population of 2.009 million, presents a height level of Soviet architecture and their monuments. This is a city that present 'Stalinist' architecture and boulevards, 'Soviet' statues and beautiful architecture, an city from Eastern Europe closed to Europe but open to Russia. Most of the Soviet style buildings are in concrete with communist rules.

The USSR is a presence and an active memory of the population (Figure 112), even today, they act in the direction of only one nation.

Belarus has a small monthly income, but Minsk is transforming the territory into a modern city where people are well-dressed, and where the restaurants are well presented.

Figure 114 – War Museum, Minsk
(source: by the author 2015)

In the former Soviet Union WWII named 'the Great Patriotic War' cities like Moscow, Kiev and Minsk have large museums that are dedicated to the horror moments and their history and results.

"*In the mainstream media, Belarus is mainly known as Europe's last dictatorship. Located in Eastern Europe, it was once part of the Soviet Union, before declaring independence in 1991. The country owes its current political reputation to its leader, Alexander Lukashenko, who has served as the president since 1994 and implemented some Soviet-style policies. At the same time, the imposed image of the country, frozen in time, hardly reflects its real essence, particularly for its emerging generation.*"[253] There are some remaining elements under the city, after the war, and they were integrated.

The medium income it is very low comparing to the rest of the European Union, for example a house in the city centre can cost of 70.000€.

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[253] archive.web.org - The celebration of the 940th anniversary of minsk will start with ringing of bells. Wayback machine, 2007. Disponível em WWW: <https://web.archive.org/web/20080615151345/http://www.minsk.gov.by/news/4.09.2007/5/8411/eng>.

They are connected with the old Soviet Union, and they meant most of all the rules from them a very high connection with Russia (Figure 113), most of the people speaks Russian even if they have their language that is a little bit different from the Russian, but the new generations are no longer using. They are fanatic for music, some go Sunday to the church, and they go to the circus as we go to the cinema, during the week the go to opera as a romantic program, they are fanatic for parks, by music and they love to drink vodka, and cognac.

Figure 115 – Entrance war Museum Minsk, 2015
(source: by the author, 2015)

Regarding public transportation, the tram, the metro and buses continue being part of the Belarusian government and maintain their communist world. In USSR a subway system was an important and prestige project into a city and developed by the government. In Minsk city, the subway stations are stylish and beautiful decorated has was said before. The cheap plastic coins are valid for one ride for everywhere, it is an old costume from USSR that is brilliant for the new Climate Smart Cities in the futures. The population use every time buses or tram, there are card systems for month passes less £15 to use everywhere. Minsk is considered a city with a good transportation system. The Soviet Union propaganda is part of style decoration even today, into streets and buildings. A presence of the friendship between the army (Figure 115) and most of the old people used from the government to win the support of its citizens but the world have change, people are more informed, and internet has everything, and this nation is becoming to need a little of fresh air, and it will get maybe from the new generations.

Pollution Moscow vs Minsk

	Moscow Improve Data	Minsk Improve Data
Air Pollution	High 63.99	Moderate 40.28
Drinking Water Pollution and Inaccessibility	Moderate 43.87	Low 37.50
Dissatisfaction with Garbage Disposal	Moderate 43.87	Low 26.92
Dirty and Untidy	Moderate 41.75	Low 21.43
Noise and Light Pollution	High 61.30	Low 30.77
Water Pollution	Moderate 54.09	Moderate 48.21
Dissatisfaction to Spend Time in the City	Moderate 46.96	Low 28.12
Dissatisfaction with Green and Parks in the City	Low 39.05	Low 26.79
Contributors:	*109*	*18*
Last Update:	*April, 2016*	*February, 2016*

Purity and Cleanliness Moscow vs Minsk

	Moscow Improve Data	Minsk Improve Data
Air quality	Low 36.01	Moderate 59.72
Drinking Water Quality and Accessibility	Moderate 56.13	High 62.50
Garbage Disposal Satisfaction	Moderate 56.13	High 73.08
Clean and Tidy	Moderate 58.25	High 78.57
Quiet and No Problem with Night Lights	Low 38.70	High 69.23
Water Quality	Moderate 45.91	Moderate 51.79
Comfortable to Spend Time in the City	Moderate 53.04	High 71.88
Quality of Green and Parks	High 60.95	High 73.21
Contributors:	*109*	*18*
Last Update:	*April, 2016*	*February, 2016*

Index ⓘ	Moscow	Minsk
Pollution Index:	63.71	42.45
Pollution Exp Scale:	111.51	71.08

Air pollution data from World Health Organization		
	Moscow	**Minsk**
PM_{10}	33	26
$PM_{2.5}$	22	17
PM_{10}Pollution Level:	Moderate	Low to Moderate

Pollution Moscow vs Minsk

Table 24 – Minsk pollution

Minsk has a very high level of buildings rehabilitation, because of their knowledge after the war, most of the countries that were destroyed after the war had an intense preparation under buildings restoration, and Minsk is one of that places. Minsk it can be considered a city with a great potential to be develop at a high level under a Climate Smart City.

The most famous streets after the WWII were built with the security rule for the atomic bombs, the idea of a building allowing to not fall destroying the other buildings with an atomic bomb attack, so this is the reason why the streets are so large. A negative action of the dimension of these streets, is the significant distance between the circulations that is probably increasing the number of cars inside the city.

Transportation	[Edit]	[Edit]	
One-way Ticket (Local Transport)	0.27 $ (0.24 €)	1.58 $ (1.40 €)	+483.79 %
Monthly Pass (Regular Price)	15.25 $ (13.55 €)	40.53 $ (36.00 €)	+165.78 %
Taxi Start (Normal Tariff)	2.00 $ (1.78 €)	3.94 $ (3.50 €)	+97.03 %
Taxi 1km (Normal Tariff)	0.35 $ (0.31 €)	0.56 $ (0.50 €)	+62.31 %
Taxi 1hour Waiting (Normal Tariff)	3.10 $ (2.76 €)	16.66 $ (14.80 €)	+436.95 %
Gasoline (1 liter)	0.66 $ (0.58 €)	1.59 $ (1.41 €)	+142.70 %
Volkswagen Golf 1.4 90 KW Trendline (Or Equivalent New Car)	17,801.34 $ (15,811.15 €)	28,146.81 $ (25,000.00 €)	+58.12 %

Table 25 – Belarus national transportation
(source: Belorussian National University, 2015)

However, the government in Belarus has 88% of the percentage of the market, only 12% is private. The electric sector and the water sector is 100% public, and the city council has the total decision of the territory. This is a problem for a creative and open market under a country.

5.5.2 – Minsk history

The provincial city within the Principality of 'Polotsk', was noted, under the 11th century in 1067, and these are the earliest historical references to Minsk. Only in 1242, the Grand Duchy of Lithuania had the Minsk presence as an integrant part. In 1499 Minsk started to receiving town privileges

Minsk 'Voivodeship' in 1569, it was the capital of the 'Polish–Lithuanian Commonwealth'. More late, in 1793, as a consequence of the Second Partition of Poland, became part of a region annexed by the Russian Empire. Minsk was the capital of the Byelorussian Soviet Socialist Republic in the Soviet Union, after the Russian Revolution, during 1919 until 1991. The Mongol invasion to Russia affected Minsk, but the escape their attack during 1237 to 1239. Another occupancy but brief of Minsk was made by the ' Grande Armée' during French invasion of Russia in 1812. All of the initial street names, were replaced by Russian names, though the spelling of the city's name remained unchanged nowadays.

It was in 1860, that Minsk city, with a population of 27,000, that were at a exponential level with an important trading action. From this occurrence a construction boom led to the construction of buildings with 2 and 3-story brick and stone houses in Upper Town.

The 'Opera and Ballet Theatre' is an amazing building with more than 80 years and with a typical 'Soviet Constructivism' style. The Opera and the

Ballet were very important at the time, but even today, the events continue with a high importance, but with a different condition, people is dressed in a different way. Around the building, all the trees under the park are telling stories and the sculptures are 'talking with the old spirits'.

Figure 116 – National Opera and Ballet of Belarus, 2015
(source: by the author, 2015)

Minsk's improvements on transportation gave to the city an enormous development. The Moscow-Warsaw road was laid through Minsk in 1846. More late a railway link between Moscow and Warsaw ran via Minsk in 1871, and a new railway from Romny in Ukraine to the Baltic Sea port of Libava was also built in 1873. The new transportation action under the Minsk city made these area an important rail junction and considered a manufacturing hub.

In 1872, the municipal water supply was introduced in the city. Twenty two years after, in 1890, the telephone was working in Minsk.

In 1892 the horse tram started their service, and two years after, in 1894, the first power generator was working to the city.

By 1900, Minsk had 58 factories employing 3,000 workers. The city also boasted theatres, cinemas, newspapers, schools and colleges, as well as numerous monasteries, churches, synagogues, and a mosque. According to the

In 1897 Russian census, was describing that more than half of the city population were Jews, more less 47,561 with a city with a total of 91,494 inhabitants.

For Minks, the First World War affected tremendously the city development. Minsk was suffering being a battle-front city in 1915. With the beginning of the evacuation of residents to the east, most of the

factories were closed down because Minsk started housing the military hospitals and military supply bases became completely the headquarters of the Western Front of the Russian army.

The Soviet workers were established in Minsk in October 1917, drawing much of its support from disaffected soldiers and workers from the Russian revolution that has an immediate effect in Minsk city.

In 1922 a reconstruction programme and development begun, and 29 factories were completely operating, like schools, museums, theatres and libraries near 1924.

The period between 1920s and 1930s, Minsk became centre improving the development of Belarusian language and culture. They focused on rapid development with dozens of new factories being built and new schools, colleges, higher education establishments, hospitals, theatres and cinemas.

" *Before the Second World War, Minsk had a population of 300,000 people. After Germany invaded the Soviet Union on 22 June 1941, as part of Operation Barbarossa, Minsk immediately came under attack. The city was bombed on the first day of the invasion and came under Wehrmacht control four days later. However, some factories, museums and tens of thousands of civilians had been evacuated to the east.*" [254]

It was in 1942, Minsk had become a major centre of the Soviet partisan resistance movement against the invasion, in what is known as the German-Soviet War. Minsk was awarded the title Hero City in 1974. Minsk's population was reduced to a mere 50,000 in 1944.

The strategy after the Second World War, for Minsk was to rebuilt and not reconstruct again. The Stalinist architecture was the principal focus on the historical centre during the 1940s and 1950s. A new enormous dimension of buildings, 'the grand buildings', broad avenues and wide squares.

Arriving to 1960s, the rapidly grow of the city with the industrialisation, Minsk's population reach to 1 million in 1972 and 1.5 million in 1986. The mass migration of young, unskilled workers from rural areas of Belarus, and the migration of skilled workers from other parts of the Union, make Minsk the new house of a new expansion of population, and a new historical centre.

The economic crisis occur during the early and mid-1990s, resulting in high unemployment and underemployment. Many development projects

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[254] Idem, Ibid

were halted, and in the late 1990s, there was a house boom since 2002 and some improvements under the transportation and infrastructure.

The September 8th September of 2017, the Minsk city will celebrated 950 years since its founding.

5.5.3 – Minsk key stone points

Figure 117 – Gates of Minsk,
(source: by www.followingsunsets.com, 2016)

The two-towered building is the first sight they come across when arriving in Minsk by train. These 'Gates of Minsk'(Figure 117), with a classical Soviet style and are one of the most recognisable buildings in Belarus and built after the Second World War. Workers, soldiers, farmers and engineers, that represent the foundation of Belarusian people are sculptures displayed in each tower. The biggest clock in the country, located on the left tower, was brought from Germany as a war trophy and it is considered the 'post-war icon.'

Figure 118 – Minsk, church of Saints Simon and Helena
(source: by www.followingsunsets.com, 2016)

Another focal point under the city is the church of Saints Simon and Helena located on one of the principals squares. The church is made by only red-brick that is the opposite of normal churches in Europe. Was build by ethnic Poles in Belarus and It is a Roman Catholic church. Under the Soviet era, this 'neo-Romanesque' church and was transformed into a theatre and cinema but today is a catholic church. The biblical statue of Saint Michael continue existing under the entrance and is slaying a dragon (Figure 118).

Figure 119 – Island of Tears, Mink
(source: by www.followingsunsets.com, 2016)

In a representation to the more than 700 Belarusian soldiers who died in the Soviet-Afghan war, this unique monument is the representation and the dedication to all these destroyed families in Belarus. All of the names are carved under a small chapel surrounded by bronze sculptures of mourning mothers giving their last breath all fallen sons. This fantastic island is surrounded by winding 'Svisloch' river and is accessible via small bridge from 'Trinity' district, the oldest district in the city. This area of the city creates an old centre where the city grew and become a centre of development for the city.

The National Library of Belarus with an architecture as a diamond made by glass and steel Also called ' Diamond of Knowledge' or the 'Belarusian Diamond'. This architectural object, is one of those buildings you either love or hate. Either way, at the perfect observation deck is possible to admire Minsk in all its glory, as is possible to see under the image (Figure 120).

Figure 120 – Minsk Top View from the Library
(source: by www.followingsunsets.com, 2016)

5.5.2 – Possible future intervention

One of the principal streets, the one that has the height level of pollution is the 'Praspiekt Niezalieznasci' very near the city centre and, from the governmental building.

Analysing the city map they have a possible high level of Climate Smart City development. The definition of the information on a city can described the existent architecture and the possible urban scale. The information can make the invisible visible at the city level and can help to understand the components of the city.

Secondly, the information can be transformed into a metaphor for structuring and ordering the vast world of data that they have today but are loosing every single day.

Even for mega cities, industrial cities, green cities, liveable cities, prosperous cities, smart cities or even innovative cities, the future is about the begin and it is important to prepare in advance. Minsk after all the changes that had before, is ready to become a CSC.

Figure 121 – Minsk city center near the river
(source: by the author, 2016)

The a future intervention in Minsk could start to reduce the risk of the pollution level into the more powerful and traffic automobile, implementing the electric cars. The strong strategy that they can implement into the ecology and sustainability on Universities and schools, will need to be the real next step. The application of green areas in front of the streets will need to be more intense, even if they have some today, because the distance between buildings, a definition of Soviet architecture, where the war influence changed the distance between buildings or the rule atomic bombs for the buildings collapses, will need to be reduced by the implementation of new systems. Another problematic under the city, that can be changed as well, is the energy production that it is not the main point into Belarusian culture, because of the cost that they have today with the Russian system, but they are polluting the world, without 'knowing'. One of the lines from Kevin Lynch about the 'Japanese erotic cinema' is one element that doesn't exist in Minsk city. The existent culture is not yet prepared to receive this type of concept but singularity theory it is something that will need to be more developed in the direction of a new and open creativity into streets, they are not an open culture to some new tendencies.

The large patch of existing green spaces around the city (Figure 121) and the respect that they have for the nature, make Minsk a great 'liveable city'. The application and intervention of new technologies and, one command centre, where are generated data information for new decisions is crucial for developing the fist phase of making Minsk into a Climate Smart City.

5.5.3 – City's Matrix Checklist

In this point, it will be analysed the city in a general way with the principles of a Climate Smart City.

	SIX INDICATORS	Areas	Designation	POINTS	OBS
1	1	Efficiency	Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result.	0.5	They are working on that measures without implementation
2	1	Top Management	Space and infrastructure coordination facilitates on a wider range of activities.	0.1	With small level of development
3	1	Energy Savings	Reducing energy consumption through using less of an energy service	0.1	With a low level of intervention under the city
4	1	Cost versus effectiveness	Equilibrium versus expense to action time	0.75	The level of effective action it is under construction
5	1	New economic system	Revitalised and sustainable economic system	0.1	Under construction
6	1	Smart payments	Easy and fast payments	0.1	Under development
7	2	Active citizen participation	An articulation of the debate over rights versus responsibilities.	0.1	Under a level of development without the citizens support
8	2	Quality level	The general well-being of individuals and societies (QOL).	0.5	A close market influenced by Russia
9	2	Social support	Projects accepted and co-organised by inhabitants	0.75	An intense level of community

10	2	Historic elements	Old and special elements inside the city	1	An old city even after the war action
11	2	Management of Human resources	Specialised systems to employment system	0.75	An intense connection with populations inside the country following the Soviet action
12	2	Green jobs	New work market connected with the sustainable development	0.1	Under development but without a total support from the actual government
13	2	Young population	Future generation sustainability	0.75	With a down growth level in all country
14	2	Smart Education	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0.1	The level of the development under the country
15	2	Lighter footprint	Reduction measures of human demand on the Earth's ecosystems	0.1	An intense need or more development
16	2	Dynamic	Always active or changing and having motion, or physical force.	0.75	Under an intense development from new generations
17	3	Collect Data	Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.	0.1	Without general systems
18	3	Green Buildings	Green construction or sustainable buildings refers to both a structure and the using of processes that are environmentally responsible and resource-efficient	0	Without governmental measures under application

19	3	Safety	Technology that assists in reducing or avoiding accidents.	1	A safety city with old rules
20	3	New Technology	New systems application, more effectiveness, more results with less time. Productivity.	0.5	Under development
21	3	Wide and Strong Political action	Political support from governments	0.1	With a very small participation from the government
22	3	New industries	New markets, new creativity	0.1	Under the begging of the process
23	3	Marketing concept	Clear information arrived to the citizens	0.1	All the information it is coordinated by the government
24	3	LEED Green certification	International building sustainable certification	0	The energy from Russia arrived to a price that it is not sustainable huge amounts under investments
25	3	Smart Health	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on education, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0.1	With a similar process to what Russia has at the moment and with influence from the Soviet union
26	3	Zero waste	A philosophy that encourages the redesign of resource life cycles so that all products are reused.	0.1	They are not taking into account the level wast treatment worldwide
27	3	Scale city	The main focus of the city under a simple observation	0.75	There is a general concept around the territory, theres many areas together
28	4	Green Transports	Transport that is sustainable in the senses of social, environmental and climate impacts and the ability to, in the global scope, supply the source energy indefinitely	0	The level of transportation it is under development
29	4	Technological adaptation	High and costly equipments application	0.1	With low economic level

30	4	Management Tool	Existing management equipments	0.1	Under an old system
31	4	Network Connector	Central system management	0.1	Under development
32	4	Smart Lighting	Uses digital technologies or information and communication technologies (ICT) to enhance quality and performance on Light inside the city, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.	0.1	The products are arriving to the Belorussian market
33	4	Smart grids	A modernised electrical grid that uses analogy or digital information and communications technology to gather and act on information - such as information about the behaviours of suppliers and consumers - in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.	0.1	Under development
34	5	Sustainability	Capacity of an ecosystem to absorb disturbance and still retain its basic structure and viability.	0.75	The level of development is low and that creates a strong potential to the city
35	5	Green roofs	A roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.	0	The intense level of temperature and the snow decreases investments in this field

36	5	Agriculture production	Cultivation of animals, plants, fungi, and other life forms for food, fibre, biofuel, medicinal and other products used to sustain and enhance human life	0	The paradigm about the agriculture under the city it is not accepted at the moment
37	5	Local food	The local food movement is a movement which aims to connect food producers and food consumers in the same geographic region, in order to develop more self-reliant and resilient food networks, improve local economies, or for health, environmental, community, or social impact in a particular places	0.75	They have na organised production
38	5	Water conservation	Encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand	0.1	With na intense architecture under patrimonies
39	5	No standardised Architecture	Diverse architecture, unusual architecture, unique	0.75	An organised city connected with the Soviet influences
40	5	Equilibrium on caos	General measure applied inside a city given a natural equilibrium	0.5	With na intense architectural diversity
41	5	Compact city	Or city of short distances is an urban planning and urban design concept, which promotes relatively high residential density with mixed land uses.	0.75	A city retaining the most of the origins
42	6	Natural Resources	Amounts of biodiversity and geo diversity existent in various ecosystems.	0.75	They still use natural and regional materials

43	6	Public spaces	A social space that is generally open and accessible to people	0.75	The urban city development maintain the initial drawing
44	6	New materials	Type and quality of the materials	0.1	Intense use of natural materials
45	6	Diverse architecture	Different buildings and intense sense of culture	0.5	A high influence from Soviet Union on architecture
46	6	Limitations	Limits on technology application	0.75	With a low internet development
47	6	Green grow paradigm	Development focus on Sustainability	0.1	Low support
48	6	Clean air action	Actions to implement the Clean Air Act have achieved dramatic reductions in air pollution,	0.75	They have a low level of pollution under the city at the moment
49	6	Liveable	Annually measures "quality of living" standards, using data such as crime rates, health statistics, sanitation standards, and expenditures on city services	0.75	The community sense create security
50	6	Strong Communication	Information circulating very fast around the city	0.75	They have a strong community support with influence from Soviet union
TOTAL				18.7	

MINSK			18.7
YES	> 90%	1	
PARTIAL 75	> 75% ≤ 90%	0.75	
PARTIAL 50	> 50% ≤ 75%	0.5	
PARTIAL 25	> 25% ≤ 50%	0.25	
NO	≤ 25%	0.1	
NOT APPLICABLE	0%	0	

Table 26 – Minsk matrix SMART CITY analysis

	Areas	Designation	POINTS	OBS
1	New Design Integration Paradigm	A new concern With the spaces around And their integration	0.1	They have a close government to innovation

2	Ecologic landscape	New plantations and CO2 production	0.75	They maintain the initial respect from the nature inside the city
3	Mixing Private & Public	A concern for the whole and not for the individual	0.5	The territory shows the differences between public and private but they are integrated under the city
4	Auto sustainability | water, energy and food	Overall production of areas in a macro view eliminating only the micro view	0.1	They have the old cycle system that Europe was using 20 years ago with the natural food support
5	Smart transportation	A concern for the development of a new transport network	0.1	They still use the old transportation from Soviet Union
6	Smart waste treatment	Application of quality systems in the treatment of waste	0.1	There is no garbage division
7	Smart Maintenance	Training and implementation of field teams and high technology equipment	0.1	The buildings look old because they are not following the new tendencies about pre maintenance
8	Hydrologic city	Application of balance between the various spaces through water elements	0.75	The city has the original urban design from Soviet Union
9	Air quality measures	Application of information and measurement systems	0.1	The doesn't have systems to measure the air quality in different spots
10	Soil quality conservation	Verification and reservation systems and soil protection through applied scientific research	0.75	The soil doesn't have a high level of pollution at the moment
11	Biodiversity	Protection enhancement of key elements in each space	0.75	The city maintain most of the Biodiversity under the city
12	Cultural preservation	Protection and rehabilitation of culturally interesting spaces	0.75	The Soviet Union influence produce quality interventions on buildings
13	Social co-benefits	Application of systems and even spaces that complement social action with communities	0.75	Communities are strong between them with the Soviet Union influence
14	Food security	Changing the paradigm of food production within cities	0.1	They are still using the old system
15	Livelihoods Safeguard	Protection of spaces against climate change	0.1	The country and the city are not prepared for the climate action
16	Energy efficient design practices	Introduction of training and learning systems on best practices	0.1	The energy cost from Russia doesn't a new need on the city

17	International Green Buildings	Introduction of a Green Building with all international tendencies combined into na intervention	0.1	The city construction system it is under an initial development
18	Real estate Smart engagement	In the introduction to the real estate market supporting with knowledge and marketing	0.1	The city it is prepared for the normal market
19	Resilience and Climate risk reduction	Introduction of new systems of action in case of emergency situations	0.75	The city it is prepared for a war action. Minsk was rebuilt following the rules of a war protection
20	Flexible circulation	Implementation of fast and clean crossing routes within cities	0.1	The city connects between the old places without a smart connection with the new built areas
21	Urban modelling techniques – on walking and cycling	Application of cycle paths or even footpaths in order to have new flows	0.5	The city has the old paths that are still used by the citizens
22	Smart urbanisation	Intelligent planning network application with 5 or 10 year strategies	0.1	They are under studies development
23	Smart management	Application of network of action in the spaces of intelligent form with strategies to 5 or 10 years	0.1	They are under an initial development plan
24	Noise attenuation	Application of elements that improve auditory quality in spaces	0.5	It is a city with a low noise pollution
25	Albedo' application	Application of systems of different heights in order to make spaces cozy	0.75	The spaces maintain the original plan and the Russian traditional areas
26	Singularity	Verification and application of elements that make interventions unique and create	0.5	The city has their own personality during all this years and close to the world
27	Emotional security	Application of verification and monitoring systems in spaces	0.75	The city presents high level of security
28	Permanents and Impermanent	Application of new and technological equipment to support this trend	0.1	They are focused under a Russian influence
29	Style and Creativity	Research and application of new methodologies and techniques	0.5	They are under a research and future development
30	Colour diversity	Existence of various typologies and colours in spaces	0.75	With a mist of different colours
	TOTAIS		11.5	

MINSK			11.5
YES	> 90%	1	
PARTIAL 75	>75% <90%	0.75	
PARTIAL 50	>50% <75%	0.5	
PARTIAL 25	>25% <50%	0.25	
NO	< 25%	0.1	
NOT APPLICABLE	0%	0	

Table 26A – Minsk matrix CLIMATE SMART CITY analysis

5.6 – Final results

The world's current development nowadays, has an urgent need to redraw architectural concepts, in an action of the urban planning. Climate Smart Cities will be the future for cities and future generations.

Firstly, as an initial development concept of these urban areas, based on the climate change actions, transforming the existent chaotic cities is a need.

All the advanced research, goes in the direction of an increase in more quality of life to people and thirdly, the market itself that has to develop under the guidance of a green and sustainable architecture.

Part of future planners, managers, and builders of these cities, expected work in the direction of the new type of responsibly and quality, not to transform this new scientific research into an only fads or trend.

Humans also seek exclusivity, and if these cities, do not pass to give what people need, where they feel safe and with a high quality of life they will move to other places. Trend's will disappear and, will be overtaken by new concepts or more personal ideas. The new sustainable action or more truly intelligent is entirely approved by the citizens.

Populations are currently very well informed and even developed in different levels nowadays. The introduction of a new development must support and never work as simple static artwork object.

On SMART CITIES, more correctly the architecture, need to follow an

improvement. It is not just the image, the beauty and the photogenically that are in the account to positive results. The complementarity between Green Architecture and developmental psychology applied to cities it has to exist in all measures in urban intervention. In the end, it has to be people making and transforming cities, and not cities changing people. Creating unique pieces, award-winning buildings, this, will not create complete and full cities. Alone, those objects create empty territories.

Cities and architecture need to be connect in on all levels. Communications at the same speed of a 4G WIFI network (or others in the future) making people happy and working in the symphony and, at the same time, only with this measures people will feel truly at home in these type of places.

The challenges will go in a direction of innovation containing multidisciplinary teams to working every day, and continuous improvement and to realise the people needs not being focused only and only to the economic function and business. A sense of responsibility should exist on the part of the perpetrators and planners making and maintain quality, but people is wanting to live in these cities and not in normal cities as mentioned above.

The solution to the locking of this kind of rampant development of a sustainable city, with the very powerful economic aspect and, little accountability from the world sustainability factor is undoubtedly the application of the places called CLIMATE SMART CITIES. These new cities, already with a section directed to the improvement of climate change, let the Smart Cities world be develop to a close enough objective and crucial to our present days.

At the beginning, history says that, the paradigm of transformation and, name change may be decisive for a paradigm shift into cities of ideology.

This research is an original piece according to research carried out, seems to be a complete new identification of definition into cities from the scratch or existent or old territories. Such cities will be a benefit directly to climate change and the UN SDG's are saying that has was described before.

The boundaries between the city and its surroundings have to be always dynamic, and it is constantly evolving. A new trend is currently under

implementation, and it seems like the old concept of the city, from one hundred years ago is returning. This new trend is now proving that the standard cities are producing less and with worst results, and people feel more comfortable living in old cities.

The first conclusion for an intervention on a future Climate Smart City is on a planning stage. The importance of the creation of a Datacenter where can be can be combine all informations, in a unique place on our next five or ten years. However, even at the planning time, the strategy of diversification on the territory on 4 or 5 points creates good results for cities future, as is concluded from Seoul and S. Francisco analysis.

Steven Poole, from 'The Guardian', in 2014, introduced the concept of the destruction of the democracy, but Climate Smart Cities have a possibility of changing the peoples freedom.

		Songdo		Ulaanbaatar		Minsk	
	SIX INDICATORS	POINTS	Dif	POINTS	Dif	POINTS	Dif
1	Efficiency	0.75	0.25	0.1	0.9	0.5	0.5
1	Top Management	0.75	0.25	0.1	0.9	0.1	0.9
1	Energy Savings	1	0	0.1	0.9	0.1	0.9
1	Cost versus effectiveness	0.1	0.9	0.1	0.9	0.75	0.25
1	New economic system	0.75	0.25	0.1	0.9	0.1	0.9
1	Smart payments	0.75	0.25	0.1	0.9	0.1	0.9
	Totals 1	4.1	1.9	0.6	5.4	1.65	4.35
2	Active citizen participation	0.5	0.5	0.1	0.9	0.1	0.9
2	Quality level	0.75	0.25	0.1	0.9	0.5	0.5
2	Social support	0.1	0.9	0.75	0.25	0.75	0.25
2	Historic elements	0	1	1	0	1	0
2	Management of Human resources	0.25	0.75	0.1	0.9	0.75	0.25
2	Green jobs	0.5	0.5	0.75	0.25	0.1	0.9
2	Young population	0.75	0.25	0.5	0.5	0.75	0.25
2	Smart Education	1	0	0.1	0.9	0.1	0.9
2	Lighter footprint	0.5	0.5	0.1	0.9	0.1	0.9
2	Dynamic	0	1	0.5	0.5	0.75	0.25
	Totals 2	4.35	5.65	4	6	4.9	5.1
3	Collect Data	0.75	0.25	0.1	0.9	0.1	0.9
3	Green Buildings	0.5	0.5	0.1	0.9	0	1
3	Safety	1	0	0.5	0.5	1	0

3	New Technology	1	0	0.5	0.5	0.5	0.5
3	Wide and Strong Political action	1	0	1	0	0.1	0.9
3	New industries	1	0	0.75	0.25	0.1	0.9
3	Marketing concept	0.5	0.5	0.1	0.9	0.1	0.9
3	LEED Green certification	0.5	0.5	0.1	0.9	0	1
3	Smart Health	0	1	0.1	0.9	0.1	0.9
3	Zero waste	0.75	0.25	0.1	0.9	0.1	0.9
3	Scale city	0.5	0.5	0.75	0.25	0.75	0.25
	Totals 3	7.5	3.5	4.1	6.9	2.85	8.15
4	Green Transports	0.5	0.5	0	1	0	1
4	Technological adaptation	0.75	0.25	0.1	0.9	0.1	0.9
4	Management Tool	1	0	0.1	0.9	0.1	0.9
4	Network Connector	1	0	0.1	0.9	0.1	0.9
4	Smart Lighting	1	0	0.1	0.9	0.1	0.9
4	Smart grids	1	0	0.1	0.9	0.1	0.9
	Totals 4	5.25	0.75	0.5	5.5	0.5	5.5
5	Sustainability	0.75	0.25	0.1	0.9	0.75	0.25
5	Green roofs	0.5	0.5	0	1	0	1
5	Agriculture production	0.75	0.25	0	1	0	1
5	Local food	0.25	0.75	0.75	0.25	0.75	0.25
5	Water conservation	0.75	0.25	0	1	0.1	0.9
5	No standardised Architecture	0.5	0.5	0.5	0.5	0.75	0.25
5	Equilibrium on caos	0.25	0.75	0.1	0.9	0.5	0.5
5	Compact city	0.75	0.25	1	0	0.75	0.25
	Totals 5	4.5	3.5	2.45	5.55	3.6	4.4
6	Natural Resources	0.5	0.5	0.75	0.25	0.75	0.25
6	Public spaces	0.5	0.5	0.1	0.9	0.75	0.25
6	New materials	0.75	0.25	0.5	0.5	0.1	0.9
6	Diverse architecture	0.25	0.75	0.75	0.25	0.5	0.5
6	Limitations	0.25	0.75	1	0	0.75	0.25
6	Green grow paradigm	0.5	0.5	0.1	0.9	0.1	0.9
6	Clean air action	0.1	0.9	0.1	0.9	0.75	0.25
6	Liveable	0.75	0.25	0.75	0.25	0.75	0.25

6	Strong Communication	0.25	0.75	0.1	0.9	0.75	0.25
	Totals 6	3.85	5.15	4.15	4.85	5.2	3.8
	TOTAIS	29.55	20.5	15.8	34.2	18.7	31.3

Table 27 - Final SMART CITIES matrix

	AREAS	Songdo		Ulaanbaatar		Minsk	
		POINTS	Dif	POINTS	Dif	POINTS	Dif
1	New Design Integration Paradigm	0.75	0.25	0.1	0.9	0.1	0.9
2	Ecologic landscape	0.5	0.5	0.1	0.9	0.75	0.25
3	Mixing Private & Public	0.1	0.9	0.1	0.9	0.5	0.5
4	Auto sustainability | water, energy and food	0.25	0.75	0.1	0.9	0.1	0.9
5	Smart transportation	0.5	0.5	0.1	0.9	0.1	0.9
6	Smart waste treatment	1	0	0.1	0.9	0.1	0.9
7	Smart Maintenance	0.75	0.25	0.1	0.9	0.1	0.9
8	Hydrologic city	0.1	0.9	0.1	0.9	0.75	0.25
9	Air quality measures	0.25	0.75	0.1	0.9	0.1	0.9
10	Soil quality conservation	0.5	0.5	0.1	0.9	0.75	0.25
11	Biodiversity	0.25	0.75	0.1	0.9	0.75	0.25
12	Cultural preservation	0.1	0.9	0.1	0.9	0.75	0.25
13	Social co-benefits	0.25	0.75	0.1	0.9	0.75	0.25
14	Food security	0.1	0.9	0.75	0.25	0.1	0.9
15	Livelihoods Safeguard	0.1	0.9	0.1	0.9	0.1	0.9
16	Energy efficient design practices	0.75	0.25	0.1	0.9	0.1	0.9
17	International Green Buildings	0.25	0.75	0.1	0.9	0.1	0.9

18	Real estate Smart engagement	0.1	0.9	0.1	0.9	0.1	0.9
19	Resilience and Climate risk reduction	0.1	0.9	0.1	0.9	0.75	0.25
20	Flexible circulation	0.5	0.5	0.1	0.9	0.1	0.9
21	Urban modelling techniques – on walking and cycling	1	0	0.1	0.9	0.5	0.5
22	Smart urbanisation	0.75	0.25	0.5	0.5	0.1	0.9
23	Smart management	0.75	0.25	0.1	0.9	0.1	0.9
24	Noise attenuation	1	0	0.1	0.9	0.5	0.5
25	Albedo' application	0.75	0.25	0.1	0.9	0.75	0.25
26	Singularity	0.1	0.9	0.75	0.25	0.5	0.5
27	Emotional security	0.75	0.25	0.1	0.9	0.75	0.25
28	Permanents and Impermanent	0.25	0.75	0.75	0.25	0.1	0.9
29	Style and Creativity	0.1	0.9	0.1	0.9	0.5	0.5
30	Colour diversity	0.25	0.75	0.5	0.5	0.75	0.25
	TOTAIS	**12.9**	17.1	**5.75**	24.25	**11.5**	18.5

Table 27A – Final CLIMATE SMART CITIES matrix

One of the conclusions into the Matrix between the three case studies is that the area number 4 'smart mobility' is the one that differs in a height level from Songdo the city that has the highest score. The most significant areas than justify the difference between Songdo the highest-level city on the matrix analysis and Ulaanbaatar e Minsk cities are the areas 4 'smart mobility' and the area 3 'smart governance'.

One of the conclusions was obtained from the group number two 'smart people' where in old cities, Ulaanbaatar and Minsk, the level in both is higher than in a city from the scratch. These conclusions can connect with an improvement in this field on cities developed from the scratch because all cities or existent cities are still more intense and more prepared for 'receive' people. Making an assessment by indicators, it appears that in one 'smart economy' the difference and complex systems

between Songdo and Ulaanbaatar is high due to the organisation of the two cities. Songdo presents a level of organisation above the town of Ulaanbaatar today. For Minsk, the difference is smaller because the Minsk city still retains the organisational influence of the former Soviet Union cities.

In point number 2 'smart people' it appears that both cities have a score higher than Songdo. This occurrence may be justified by the greater cohesion still existing in ancient cities, for Minsk, the difference is more evident due to the country having a smaller opening to the world. The government presence in the economy it is still 88%, and the state decisions are more closed than any of other cities worldwide. In point number 3 'smart governance' the difference between the town of Ulaanbaatar and Minsk due to the further development of Mongolia's town presenting further development in the area of 'new industries.'

In point number 4 'smart mobility' is possible to identify the difference between the two ancient cities and the root of built town where communication and technology are more easily adaptable and dynamic. Point 5 'smart environment' Songdo is less punctuated because there has mostly still difficult elements to identify and re-apply in cities built from scratch and are more prevalent in existing cities.

In point number 6 'smart living' Songdo and Ulaanbaatar are similar, and Minsk present a high level because of the quality air, more liveable spaces, more tough communication level terrain, in natural resources and public spaces. Architecture trend in the last 20 years has been creating spaces where the main ideology is the Sustainability, but the economic action transformed and deformed some cities around the world. Only with real actions of climate change and catastrophes, the political decisions shift the paradigm.

In a generic conclusion, after a comparative analysis under the studied cities, theres a verification that exist an intense way to follow under these cities, in what we understand about a smart city, and in what we believe that is a Climate Smart City, and with this results some numbers can be presented like smart cities levels:

SONGDO	ULAANBAATAR	MINSK
59,1%	31,6%	37,4%

And Climate Smart Cities levels as:

SONGDO	ULAANBAATAR	MINSK
43%	19%	38%

An ideal climate smart city is not easy to achieve, however, it is possible and necessary to implement some measures that allow us to reach this type of cities.

Nowadays with that change into the political world and the social pressure, associations, companies, governments want only now implement and improve the new concept of cities. Data information developed from cities need to be the information circulating is not yet properly structured, and humans need to be increasingly knowledgeable about this area.

Another important conclusion is that zones and the interveners are asking for this type of architecture and city. During the time more research and training is developed, faster populations are informed and understand the methodologies and participate in the development of these towns.

It is entirely positively that the business opportunity for Architects, Planners, Engineers, Sociologists and many more areas as needed in the elaboration of those cities.

Chapter VI | Conclusions

6.1 – Conclusions

The number and the level of polluted cities it is increasing exponentially. Many of them, are located in Asia and research says that the number of the cities in that area, will increase and, they will be build at high speed without control. Nowadays the most liveable cities are located in Canada and Northern Europe. The individual 'Green Building' certification created singular buildings forgetting the entire concept of the city. Architecture failed at the point that is not creating benefits to entire cities and it is most of the time focus, on single objects out of the grid and out of the attention of climate change.

Cities arrived to a high consumption of energy worldwide. Smart Cities present an enormous number of different definitions but most of them combined the six criteria determined from European Union. More recently cities like Barcelona, New York and Rio de Janeiro gain space into the analysis of the smart cities actions, inserting new creative ideas to become more smart and intelligent spaces.

Cities like Ordos in China are bad examples of what had been done in the last ten years in China connected with the Smart Cities system they are sprawling a bad example worldwide.

The old experience from architects like Corbusier, Michael Graves, Leon Krier, Peter Eisenman, and Daniel Libeskind are still influences for the future Climate Smart Cities.

In a generic position Smart Cities were a reflex of the population needs and a reflex of societies.

Interventions into cities from type 1, from the scratch or interventions in spaces from type 2 are different and have distinctive ways of action into the territory.

Examples like Songdo in South Korea, are interventions in direction of Climate Smart Cities but, with an addiction, of a completely auto sustainable system receiving energy from the grid to support the city. Songdo was developed by KPF and created a complete sustainable plan into the first phase of the project. Masdar, the sustainable city in Abu Dhabi with a different plan, developed by Norman Foster, created a 100% carbon neutral intervention that exist today, without sufficient population to support the future needs. In opposite Songdo is still growing receiving population but transforming the city into a Korean normal city.

The principal objective for this research was the study of Smart Cities, type 1 from the scratch and existent cities from type 2 and where they were going in the future. The conclusion of this investigation made arrive to the creation of a new tendency called Climate Smart City.

The second objective was to demonstrate that smart cities are developed nowadays not towards the future and not according to climate change actions. In opposite, CSC combine and integrate climate change attitudes and construction.

The third goal was to determine a set of criteria that would work as a manual guidance for future smart cities projects worldwide, and the guideline correctly was created supporting a much complete planed city called CSC.

The fourth objective was to develop a model to analyse the existent sustainability on cities of type 1 and type 2and for this objective created a matrix with a system that can analyse SC and even CSC.

The fifth goal goes in the direction of the identification of the most important points on a future Climate Smart City worldwide and they were described using a system with thirty points.

In conclusion, the first objective identifies that cities are distinct from each other or from the type 1 or from the type 2 where their evaluation and interpretation are different. The number of type 1 cities is still less than the number of type 2 cities. In type 2, was also concluded, that their intervention is more slow and have more difficulties on implementation and acceptance by citizens. As an opposite, from cities of type 1 was concluded that they occur more evenly and quickly and have a huge potential application of new technologies and new creativity.

In another point o view, the type 1 cities, have a problem to improvise, concerning their placement and maintenance in sustainable factors. As for the type 2 cities, are already complete in people.

In objective number two, it demonstrates that the Smart Cities, that are to develop from scratch are not showing a guideline towards the determinants of current climate change with improvements, knowing that the cities will continue to be responsible for an enormous number pollution worldwide.

Today the development of the entirely technological market, that forgot the human and architectural sense that cities had 100 years ago. The technology in this new market began to become surplus and, is deteriorating human space intro of freedom of expression.

In goal number three determining criterion allows us to understand the lack of structure applied in the last smart cities that were mentioned under the investigation. Several authors point out actions that go against the excessive application of technology and not giving importance in determining urban and green space with quality.

Into the goal number four the development of a model as a matrix that can evaluate different cities based on the same criteria can be analysed cities of type 1 and type 2 cities, with a different population, different territory and distinct location.

The present research and study was based in three different cities of which two are type 2, Ulaanbaatar in Mongolia, Minsk in Belarus and a type 1 Songdo in South Korea. Under the research, these cities were analysed by the matrix from SC and CSC. With this model, it is possible to identify the differences in both cities and to get results, and conclusions even if they are complete different cities.

In goal number five after extensive analysis, were identified some points and some principles of possible application in a future Climate Smart City to determine elements that exist in green cities and places where people liked to live in quality.

Some of the difficulties under the work development started by the constant need to go directly to the places, getting as much as possible informations from the city centres, to transform them into case studies and, the long permanence into the city built from scratch, where it was possible to take place in much of the necessary information from a new possible science discover.

Regarding the balance of the analysis of the three case studies presented, it is important to note one decisive factor.

In order to bring out to this work the most significant data from each case study, and to balance them in the most useful outline to the respective final results, an important decision was taken by the author — to give more emphasis to the case study of the city built from scratch 'Songdo' city, for one major reason: once it constitutes a very recent example of a serious large scale smart city project, it has a much wider variety of technological information and processes and, most important of all, it is still very poorly studied by science and by the overall state of the art.

Thus, even if the final resulting differences between the three case studies — whether in documentation, interviews and surveys — may be one of the weaknesses of the investigation, the author believes that this was the

most fruitful approach to each case study, in regard to the whole spectrum of this investigation.

Another point more complicated than determined some of the information was a linguistic issue that has become challenging in cities with languages like Korean, Russian and Mongolian.

One of the great experiences and an impressive driver under information about the world market and international projects, was the possibility of the author to be working and consulting in the Green Climate Fund UNFCCC. The knowledge from this international organisation made possible to arrive to a different level of research, identifying different problems in architecture and putting them under the view of everyone, transforming even a simple architect into a believer on Climate change fight developing the new Climate Smart Cities everywhere.

6.2 – Future research recommendations

Cities can be clusters, and some aspects make the cities resilient.

In our day's cities are presented as dynamic systems where physical boundaries have mostly disappeared.

Nowadays the temperature into a city is increasingly determined by the way the city lives and no more from the primary geographic location.

According to cities ranking's, that is possible to see at the chapter number II, hot and noisy cities don't have a location under Top positions, and it is possible to verify that the towns located in the first places of the list are healthy, calm and green in general.

Is scientifically proved that constant noise level into a city, especially during the night-time it is damaging human health, but the same sound creates different reactions in people. In this situation, equilibrium is the only choice to create liveliness and life quality into the city.

A long-term sustainability must be at the root of every decision we make about design, in electronic devices, at home, in the neighbourhood, in a park, in all cities.

Another possible future research can be an investigation of an implemented city as a prototype, where can be probably concluded that the real society has a possibility to change into new places like CSC.

Other possible investigation could connect with climate changes and

their actions into CSC and how they can probably be managing the future.

The more technical research on Green Buildings will have to be part of a future investigation, and this is a much more detailed area that should be addressed in an independent study. This type of performance on buildings will greatly determine the quality of future cities, and perhaps in a post-doctoral research, a more 'micro' investigation will emerge on how buildings built and maintained throughout life should be.

Following the economic level of data analysis from cities and, their commercialisation using the new technologies, can be studied as a direct revenue versus the benefits for Cities in general and even a study about how the intelligence collected from citizens can create benefits to in long term of sustainability.

The wrong way, of sustainable development of urban models, started to be evidenced by the scarcity of resources and maladjustment to violent and tumultuous realities, natural or of human origin, which highlights this approach and investigation on intelligence in cities and not the cities knowledge.

The more technical research on Green Buildings will have to be part of a future investigation, and this is a much more detailed area that should be addressed in an independent study. This type of performance on buildings will greatly determine the quality of future cities, and perhaps in a post-doctoral research, a more 'micro' investigation will emerge on how buildings built and maintained throughout life should be.

It is not the cities that can be intelligent, but the societies that inhabit them that must be prepared. The urban tuning that focuses on the strategies of political and economical marketing sustained in the transaction of the immensity of data produced within the cities with the support of the technologies, which create industries with additional needs that go against the concept of intelligence.

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