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DESIGNING A GENERAL CONTRACTOR BUSINESS MODEL FOR SMART CITIES

JURY

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DEDICATION

I dedicate this work to my family who supported me in both the good and bad times. Above all, I bestow it to my wife, who cheerfully sacrificed time, energy and bread so I could fulfill my dream. Her infallible love and absolute backing allowed me to get to the shore when I was drowning in doubt. Not to forget my beautiful little four angels, Gabrielle, Daniel, Diane and Ellie — my raison d’être.

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ABSTRACT

This thesis embarks upon three subject themes: smart cities — general contractors — and business models. The smart city notion is on the rise today and cities around the world seem to be in a race to become smart, fast. Converting big cities into smart cities is a call that almost all cities around the globe have already made or would undoubtedly make in the near future to be able to cope with the various repercussions of urbanization. Smartness is a vague expression that could relate to anything and everything (e.g. infrastructure, people, governance, etc.). In the present study, we focus our attention on smart constructions, large and smart ones in specific —and endeavor to decrypt the key problems encountered today by France based construction companies —and suggest plausible solutions for their resolve. Our research findings showed that there is no single business model that could fit all smart cities around the world, as smart cities should account for the particularities of both people and territories. The GC BM (General Contractor Business Model) for smart cities — inspired from Copenhagen's experience in this domain (*the need of a strategi for the successful building of smart cities*) — was built using the Triple Layered Business Model Canvas. Succinctly, the GC BM is a dual-use (*a business model within a piloting tool*), stage- and solution-based, multisided, six-stratum business model. It exhibits the dynamics of problems faced in construction over the course of a construction project lifecycle — from initiation to closure — down to upstream the value chain — and puts a question mark on the usefulness of generic business models in construction. In our opinions, business models in construction are destined to fail — until stratified.

KEYWORDS

Connectivity, human centricity, urbanization, big city, sustainable city, smart city, city-as-a-platform, construction industry, general contractor, strategi, central operator, construction project lifecycle, technology lifecycle, value chain management, value creation, value networking, business model, strategy, tactic, business model innovation.

ACRONYMS

AIIB	Asia Infrastructure & Investment Bank
AMT	Additive Manufacturing Technology
ART	Augmented Reality Technology
BIM	Building Information Modelling
BM	Business Model
BMI	Business Model Innovation
BT	Business Technology
CCTV	Closed-circuit TeleVision
CLD	Causal Loop Diagram
CM	Construction Manager
CPLC	Construction Project Lifecycle
CVP	Customer Value Proposition
DSR	Design Science Research
EU	European Union
GC	General Contractor
GDP	Gross Domestic Product
GHG	Greenhouse Gas
ICT	Information & Communication Technology
IDI	In-Depth Interview
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IS	Information System
IT	Information Technology
LCA	Life Cycle Assessment
MIS	Management Information System
MSP	Multisided Platform
PM	Project Manager
R&D	Research & Development
ROI	Return on Investment
TLC	Technology Lifecycle
U-	Ubiquitous-
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States
USD	United States Dollar
VRT	Virtual Reality Technology
WW	World War
WWW	World Wide Web

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FOREWORD

The WWW (World Wide Web) — the internet — and the ICT (Information & Communication Technology) — are all key, fairly recent, and successive inventions that have substantially altered and shaped the world we live in (as we know it!) — turned our existence upside down, and affected each aspect of our lives, even the tiniest ones. Having said that, let us now reconsider how life is organized on earth. For this, let us simply think of the planet like an inhabited human body (— an interlocked system). It is the transit system of roads and railways, bridges and tunnels, as well as air and seaports that enable our mobility across the continents —that is the vascular system that powers the human body. Likewise, it is the oil and gas pipelines and electricity grids that distribute energy and ensures the unblemished work of the nervous system of communications; additionally, it is the internet cables, satellites, mobile networks, and data centers —which allow for the smooth exchange and storage of information. Alike the human body, the main components of the earth system are interconnected by flows of energy and materials —and so; we believe — a disruption of any of those flows would unquestionably sway the system in its entirety.

Today, this ever-growing infrastructural system — *connectography* as labeled by Parag Khanna[1] — consists of several million kilometers of roads, railways, pipelines, and internet cables. It represents a quantum leap in the mobility of people, goods, resources, knowledge, and ideas. It is an evolution of the world from *political geography*: how we legitimately divide the world — to *functional geography*: how we actually use the world. It is hence quite evident that *connectivity* — rather than *sovereignty* — has developed into the organizing principle of the human species.

'Our yearly spending on global infrastructure is anticipated to rise to USD9 trillion within the coming decade' Mr. Khanna indicated. *'We will build more infrastructure in the next forty years than we have in the past four thousand years'* he added.

[1]How megacities are changing the map of the world? TED Conference, February 2016. Note: The Foreword was inspired from Mr. Khanna's Ted Talk. Available from: https://www.ted.com/talks/parag_khanna_how_megacities_are_changing_the_map_of_the_world/discussion?;anguage=en (The webpage was last visited on 12-12-2019)

Thus far, Asia is topping the list of continents whose countries are investing the most time and money to promote their connectivity, both regionally and internationally. In collaboration with some adjacent countries, China —for instance— has recently announced — in 2015 — the creation of the AIIB (Asia Infrastructure & Investment Bank), a multilateral development bank that aims to support the building of infrastructure in the Asia-Pacific region. Beyond connectivity, the twenty first century seems to be characterized by a second megatrend: *planetary urbanization*. According to Parag Khanna, *'over 67% of the world's population will live in cities by 2030 — megacities in specific'* — a justly rational quarrel, as megacities are nowadays on the rise and could be easily dotted anywhere in the world:

— The technology powerhouse of Silicon Valley (US) is a very good example of a megacity extending from San Francisco, going south through Palo Alto, all the way down to St Jose;
— The sprawl of Los Angeles is another worthy example of a megacity, spreading south all the way to San Diego, crossing the Mexican border, to finally reach Tijuana. San Diego—Tijuana is a binational conurbation, comprising over five million residents as well as a joint airport terminal;
— One additional example of a megacity is America's northeastern megalopolis — stretching from Boston to New York, to Philadelphia and Washington — the so-called *Bos-Wash corridor*. The latter is the second most populous megacity in the US with over 50 million residents.

However the megacity trend looks like a viral phenomenon, Asia remains by far the dwelling of the biggest megacities in the world:

— From Tokyo, to Nagoya, to Osaka stretches the world's largest megacity. It comprises over 80 million people and accounts for most of Japan's economy;
— China's megacities seem to be on the rise as well, as clusters are coming together with populations reaching 100 billion people. The Yangtze River Delta for instance, which is a triangle-shaped megacity cluster, covers an area of about 100 thousand square kilometers and is home to over 115 million people (as of 2013). In 2018, the Yangtze

River Delta had a GDP (Gross Domestic Product) of about USD2.2 trillion — roughly the same size as Italy today.

These facts are weighty — also to some extent witty — especially when we picture global diplomatic institutions (e.g. Group of Twenty) basing their memberships on economic size rather than national representation. Under a similar scenario, some Chinese megacities would be granted access and have seats at the table, while whole countries like Argentina or Indonesia would see their partaking being revoked. The exact same leaning (*towards increased connectivity*) could be found in other countries, say: India (Delhi), Iran (Tehran), and Egypt (Cairo-Alexandria corridor). And there is Lagos too — Africa's largest city in Nigeria's commercial hub — with plans to create a rail network that would make it the anchor of a vast Atlantic coastal corridor — stretching across Benin, Togo and Ghana, to Abidjan. In other words, in some parts of the world, whole and entire countries would in time become suburbs of megacities — a plausible setup in a megacity world.

Going forward, it is worth noting that people normally move to cities to be connected, and connectivity is why these cities ultimately prosper. Whether it is Sau Paulo, Istanbul, or Moscow, (actually!) anyone of them has a GDP approaching or exceeding 33% to 50% of their entire national GDP. Bringing up the case of Gauteng province in South Africa — enclosing Johannesburg and Pretoria (the capital) — it too accounts for more than 33% of the country's GDP. Equally importantly, the latter is also home to the offices of almost every single multinational that invests directly into South Africa —and (circuitously) the entire African continent.

As-is, planetary urbanization seems to be like a good thing, a promising megatrend. Yet, we ask, is it *risk-free*? For some, urbanization is a source of negative externalities that would lead to frustration on the long run. In their views, urbanized cities are destroying the planet —and would continue to do so in the future. Hitherto, today, there are over 200 intercity learning networks booming, focusing on a single goal: *sustainable urbanization* — and having a lone objective: *upholding the well-being of people*. Fair talk indeed, nevertheless, could we put our faith in such upmarket promises? Yes, we can. Looking into the matter from a different perspective, we may ask ourselves the following question:

- Do we really believe that developed nations, through summits held recurrently, would eventually succeed to reduce GHG (Greenhouse Gas) emissions and stop climate change? No, we do not.

We could reverse global warming by injecting sulfur into the stratosphere — an unconventional solution to an exceptional problem. Yet, until now, there is no need for such eccentric tenacities (happily!), especially that human beings have already started to mitigate the carbon intensity of their respective economies via intercity handovers of technology, knowledge, and policies. That is, to say that cities have been formerly part of the problem — but, now, are part of the solution. What is more, if one travels through megacities from end-to-end, he could easily notice extreme disparities within the same geography — another serious challenge for sustainable urbanization — and still, our global stock of financial assets has never been greater, approaching 300 trillion dollars. That is four times the actual GDP of the world. Indeed, we say, since the latest financial crisis, we have taken on some huge debts, but — sadly! — did not invest them in *inclusive growth*. Therefore, it is only when —sufficient and affordable public housing projects are built —and robust investments in transportation networks are made that alienated cities and societies would come to feel complete again.

According to Parag Khanna, *'connectivity is an opportunity — one of the most important asset classes of the present century.'* Besides *connectivity* and *equitability*, megacities could also make the world more peaceful. How? By looking at regions of the world with dense relations across borders, we cannot see but trade and investment trails, as well as stability. In Europe, past WW2 (World War 2), once industrial integration kicked off, it in due course led to the rise of the EU (European Union). In North America, the most important streaks on the map are not the US-Canada or US-Mexico borders, but the dense network of roads and railways, pipelines and electricity grids, as well as water canals.

Now, let us go back to Asia, Southeast Asia in particular. This region of six hundred million people is evolving into the so-called *Pax Asiana* — a peace among Southeast Asian nations. A similar phenomenon is underway in East Africa where six or so countries are investing in inter-nation railways and corridors so that noncoastal countries could get their commodities to the marketplace. At last, we wonder whether connectivity could overcome the patterns of rivalry among the great powers. And to amply answer this question, what would be better than to look at the experience of East Asian countries in this respect; after all, this is the region where WW3 was supposed to break out.

China and Japan — on one hand — have had a long history of rivalry, often, deploying their air forces and navies to show off their strengths in island disputes. Then, just some time ago, Japan started making large investments in China — Japanese cars are selling big in China — and guess where the largest number of foreigners residing in Japan comes from? *BOOM*, you have got this one right too: China. China and India — on the other hand — have also fought a major war and have three outstanding border disputes, but today India is the second largest shareholder in the AIIB. The two countries are currently working together to build a corridor distending from Northeast India, through Myanmar and Bangladesh, to Southern China —and their trade volumes have grown from USD20 billion a decade ago — to USD80 billion today.

We finally settle by saying that: '*connectivity has remarkably developed into a new reality — a reality that imparted cities and nations to aggregate over time into more diplomatic and well-off totalities*.' '*Though no one could oath for sure today that WW3 would not breakout, anyone could realize why it has not happened yet'* — we conclude.

‘When we try to pick out anything by itself, we find it hitched to everything else in the Universe.’

— John Muir

INTRODUCTION

Connectivity has become a reality today — and the upsurge of megacities at the international level is not expected to cutoff anytime soon. Neither is the flow of the world population in destination of urban centers. In fact, the UN DATA[2] show that over half of the world population lived in cities in 2015, and this figure is likely to rise by an extra 10% in 2030. As previously evoked, people tend to migrate to large urban centers in search of opportunities and connectivity. And these same reasons — we suppose — would continue to drive this kind of migration towards big cities. Consequently, those big cities would eventually capture a significant share of the world's wealth and their giant potential would attract further newcomers. With that said, it is genuine to enquire whether today's big cities are all equally and sufficiently equipped, urbanized, and structured to receive superfluous inhabitants (—The answer is obviously: No, not at all!). As well, we may ask: *what would happen if an increase in population ends up being unaccompanied by a comparable increase in economic performance*? (—Normally, the quality of life of inhabitants would plunge!)

Tokyo (Japan), Delhi (India), Shanghai (China), Sao Paolo (Brazil) and Mexico City (Mexico) are the world's most densely populated megacities today — with respective populations exceeding 22 million. Lagos (Nigeria), Kinshasa (Congo), Dar Es-Salam (Tanzania), and Bombay (India) are megacities to be — currently in the making. However strange this may sound, urbanization has proved to be a contagious phenomenon that is spreading fairly, swiftly across the world (Schaffers et al. 2011). Overall, this phenomenon (of urbanization) would eventually defy any nation, from the perspective of basic goods and services, and minimum infrastructure required — a challenge that could not be resolved but through satisfactory innovation: *the creation of smart cities*[3].

[2]United Nations, Department of Economic and Social Affairs, Population Division, 2018. World Urbanization Prospects: The 2018 Revision, Online Edition. Available from: https://esa.un.org/unpd/wup/Publications (The webpage was last visited on 12-12-2019)
[3]ibid

Though the notion of smart cities is not new, it is the managerial approach that policy makers, city governors, mayors, and project owners frequently opt for to building smart cities that would make the whole difference, mainly by rendering smart cities — smart again. Frequently, smart city projects are conceived and built following a *top-down approach* with the aim to improve the places we, people, live in, yet they repeatedly fail to hit the target and reach envisioned goals (Turok, 2014). Why? Conventionally — and mistakenly — construction companies used to (and they sometimes still do!) overweigh the significance of the technology, data, and cutting-edge computing — while disregarding the foremost component of any successful smart city: *people*. To be sure, for a smart city to succeed and reach its full potential, it should not solely focus on the technology or the infrastructure. Instead, it must be about — reflect the needs and wants of — and be built for — *the people* — else, *the people* would reject it. By choosing a *people-centered approach* (to building smart cities), we inspire collective thinking, ideas exchange as well as the democratization of the development of cities, and instigate the city-as-a-platform concept. Consequently, projects would be then conceived with a thorough understanding of real city problems —following a *bottom-up approach*, exactly as opined by city stakeholders: *citizens*, *businesses* and *visitors*.

Adding that human-centric smart cities could only be planned and developed when citizens have the opportunity to make their voice heard by governments —as to plausible ways that may possibly be implemented to better city operations. This concept goes farther than thinking of the citizen as a source of data — but as a source of new ideas too (Neirotti et al. 2014). Definitely, engaging members of the public early in the conception-construction process could help eradicate any disapproval when smart projects or initiatives are implemented. Smart cities formerly focused on connecting infrastructure for better insights, but the attention is nowadays bit-by-bit shifting towards engaging governments, citizens, and businesses with the objective of providing upgraded city services and a higher quality of life (i.e. enhancing the citizen experience). That is, to say that smart city projects are now deemed successful —if and only if they are accepted and validated by the people — a prerequisite.

While the motivation of cities remained intact over time that is, the founding of livable environments, where people and businesses could thrive together — the setups used to this end evolved favorably. Data is now put in the hands of both end-users and policy makers to drive better decision-making, and collective thinking and intelligence are setting the ground for the creation of hands-on solutions to some of the toughest urban snags encountered today.

Within this framework, it is worth uttering that a number of cities (Barcelona, London, etc.) have already started — only a few years ago — to upgrade their infrastructure systems via the implementation of sensor technology and data analytics. They are doing so in an effort to lift the performance of their physical infrastructures and the use-value of their urban assets: public transit, waste management services, wastewater systems, and roads (among others). The *SmartSantander* project in Santander, Spain (Hernandez-Munoz & Munoz, 2013) — an extensive real-world experimental facility, spreading across four European countries (Spain, Germany, the UK and Serbia) — is a great example of a human-centric smart initiative. Truthfully, as big cities around the globe are expected to shelter superfluous people in the future, smart initiatives and enablers like the *SmartSantander* framework have been growing in strength and gaining momentum in recent years, hence shimmering the need for better and more efficient methods for the management and development of big cities overall.

RELEVANCE

Hurried urbanization puts an incredible amount of pressure on urban centers, presenting challenges for cities to provide economic opportunities and environmental sustainability, and ensure the safety, protection and wellbeing of their inhabitants (Moir et al. 2014). Prosperous cities tend to overcome these defies by seeking sustainable and resilient growth. The IoT (Internet of Things) in smart cities — and smart city technology account for only part of the solution. The other part however, has to do with *adaptability*: the adoption of a new business model that allows for the optimization of the construction industry’s value chain. This is genuine as the conception and construction of smart real estate, often grasped as megaprojects, take years to be completed, *up to twenty years*. Whereas the TLC (Technology Lifecycle) is relatively shorter, *up to fifteen years*, which signifies that there is a high risk that the implemented technology would reach its tipping point —and so become obsolete— even before the construction project has been finalized or delivered to clients (Kordas et al. 2015).

On another note, it is worth indicating that businesses as much as governments are facing the challenges of urban growth — and their capacity to drive continued growth is being put to the question. Actually, for businesses to be able to attract the educated talent desired, they need (at least at first) their head offices to be based in livable (and blooming) cities (Nam & Pardo, 2011). Toting that the attractiveness of cities is function (among other factors) of their respective economic power and influence — which means that talented people would not choose to migrate to big cities unless they have a good reason to do so. In this sense, cities are responding by finding ways (adequate platforms, business models, frameworks, structures or ecosystems) to speed up construction works and improve decision-making processes, not only by consulting with governmental entities — but with businesses and residents too, thus tapping into the collective intelligence of the city in its entirety (Termeer & Bruinsma, 2016).

IMPORTANCE

Big cities (or megacities) have long been engines of economic growth and opportunity. A World Bank analysis[4] of 750 cities around the globe found that from 2005 thru 2012, economic growth in almost three-fourth of cities outpaced their respective national economies. By 2025, the world's top 600 cities are estimated to account for more than half of global GDP. London today accounts for almost 20% of the UK's GDP. In the US, the Bos-Wash corridor —and the Los Angeles Metropolitan Area account for nearly 35% of the country's GDP[5]. That is to say that the world is now seeing a nonstop concentration of population in cities. And cities that are not suitably equipped to handle growth (or flop to adapt to this new reality) are likely to see their environments and residents suffering from negative consequences. Now, this challenge is becoming more and more relevant as quite a few big cities around the world (e.g. Lagos, Bombay, etc.) are undergoing such an explosive growth.

Recapping — a smart city is not only about implementing smarter things (conversely to what is believed today!), but also about endowing stakeholders (policy makers, residents, project owners, project managers, etc.) with the right tools and frameworks so they could make smarter decisions. In Amman, Jordan — for example, the city authorities have lately adopted a data-driven approach to streamlining the waste management process, which allowed for the successful optimization of existing fleet management system[6]. Not only in Amman, but also all over the globe, cities are adopting shrewd managerial approaches to building their own smart cities. All of this reads great, yet we note that there is currently no unique, matchless and unrivaled smart-city model that countries around the world could use — at any time, in any way — to refurbish or build their own. And that the conception and development of smart cities is almost certainly to vary from

[4]Competitive Cities for Jobs & Growth: What, Who, & How? The World Bank Group, 2015. Available from: http://documents.worldbank.org/curated/en/902411467990995484/pdf/101546-REVISED-Competitive-Cities-for-Jobs-and-Growth.pdf (The webpage was last visited on 12-12-2019)
[5]The Dozen Regional Powerhouses Driving the U.S. Economy. CityLab, March 2014.
Available from: https://www.citylab.com/life/2014/03/dozen-regional-powerhouses-driving-us-economy/8575/ (The webpage was last visited on 12-12-2019)
[6]Facing the challenges of a new era: smart city projects. ASCIMER, July 2014. Available from: http://eiburs-ascimer.transyt-projects.com/files/14_MaqousiAli_Presentation_%20%5BASCIMER%5D.pdf (The webpage was last visited on 12-12-2019)

one country to another — based on each country's specificities and available resources. Additionally, any smart development, we presume, involves numerous key players — and it is the interplay between those players throughout the lifespan of the construction project that determines whether the latter would eventually succeed or fail (Ke et al. 2015; Komninos et al. 2015). This in fact sheds light on the key role of the *general contractor* who brings all stakeholders involved in construction projects together, hence tying up the construction value chain, down to upstream.

MANAGERIAL QUESTION

The present research project revolves around five major themes — sequentially, going from the wide-ranging to the more specific: *connectivity*, *smart cities*, *smart constructions*, *general contractors*, and *business models*. Indeed, the prime puzzle that this thesis aims at solving could be written as follows:

- How to design a *general contractor* business model for the building of smart cities?

Exactly so, as a means to an end —we assume that — better-off smart city projects (in France in specific) are ran, managed, and built by general contractors —in partnership with other construction actors. As a result, the value chain of the entire construction industry — we expect — would be optimized and connectivity among various stakeholders given a boost —so would be ultimately the livability of big cities and the quality of life of residents in general.

(These assumptions are still to be validated in due course of this research!)

OUTLINE

This thesis follows a funnel structure — split into six chapters, as follows:

- Chapter I focuses on smart cities and the key roles that general contractors could play in building smart cities. An extensive overview of smart city notions and theories are proposed. That is, a full review of the existing literature on smart cities is presented, coupled with a full description of relevant theoretical models, notions, and concepts. A historical synopsis of the emergence of the concept of smart cities is also suggested. Moving forward, some detailed, real-life examples of successful smart cities around the globe are proposed. Global smart-development best practices are depicted too — in an attempt to inform an expert managerial business model to building spot-on smart cities.

- Chapter II embarks upon business model theories. The features, constituents, and importance of business models are methodically conversed. Additionally, light is shed on recent literature extensions relating to business model innovations.

- Chapter III describes the research methodology used for the achievement of the study. Our envisioned business model is designed using a blend of strategic management tools, explicitly: *design research science* and the *triple layered business model canvas*. Insights on the matter are gathered qualitatively, through in-depth interviews carried out with academics and industry experts, based on a specialized discussion guide.

- Chapter IV describes the business model design process, primarily how our idea of a new business model developed over time, and how it cultivated year-over-year to finally turn into something tangible, a dual-use business model, at the end of the Executive DBA program.

— Chapter V classifies the main problems faced in the French construction today and suggests plausible solutions for their resolve. Precisely, using the triple layered business model canvas, problems and solutions are dispersed across the different dimensions of a construction project: *economic*, *social*, and *environmental*. To those dimensions, as you would notice, we add an extra one: the *technical*. In addition, the linkages between problems and solutions are highlighted, narratively and visually — through dependency graphs and construction process maps. Additionally, an in-depth explanation of the research findings is proposed throughout this chapter. The main discussions revolve around topics such as the need for a central operator to lead smart developments, the potential benefits of a new business model in construction, and the opinions of key stakeholders apropos the envisioned business model and the role of general contractors in improving the configuration and enactment of the construction industry's value chain. Lastly, Chapter V elucidates how innovation is part of construction processes on various levels —and how innovative procedures in general are likely to soar over time from augmented managerial and technical connectivity.

— Chapter VI discusses our theoretical and methodological contributions to the literature on smart cities, general contractors and business models.

— Finally, we summarize the entire research by putting forward some recommendations to both industry players and policy makers as to what could be done to better crack smart developments' inherent problems, irrespective of whether those problems are of a technical and-or legal nature. Hence, we make a call for all stakeholders to join forces to embolden the development of smart cities — and render them — literally, smart again. Research limitations and avenues are also marked in the conclusion.

CHAPTER I. FROM THE BIG ISSUE TO THE MANAGERIAL QUESTION

Thus far, we have established with quite some confidence that *functional geography* has come to prevail over time — today, overruling the significance and governance of *political geography*. Likewise, we have pointed out that *planetary urbanization* is putting stern pressure on big cities as to their capacity to take extra inhabitants in. And that this pressure has been later passed on to the construction industry —which is currently hastening smart developments: *smart cities*. As well, we have shed light on the importance of promoting macro-level connectivity as a means to boosting economic growth, and sponsoring environmental sustainability and political stability[7].

Besides macro-level connectivity, we herein endeavor to demonstrate that connectivity is critical at micro-level too (Hanna, 2009). Clearly, there is a need now to institute strong micro-level connectivity (within the construction industry) and rethink existing stakeholder management approaches —for the most part to allow for a healthier stakeholder immersion throughout the various stages of a CPLC (Construction Project Lifecycle). Actually, the establishment of sturdy connections among construction actors — while keeping communication channels open at all times — has become a precondition for construction projects' success. This is palpable — we would say — because, often, stakeholders have distinct interests and concerns, and strong micro-level connectivity — should it exist — would ensure the timely, consistent and relevant exchange of information between them —and so, finally, the positive execution of smart developments.

But then again — we trust that — micro-level connectivity could not be wired but through the intervention of a key industry player — who is concurrently a connector and a maven: *the general contractor*.

[7]The Smart City in 2030. First Workshop on Network 2030 by Pr. Otthein Herzog (Universitaet Bremen, Germany). New York City, October 2018. Available from: https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201810/Documents/Ottein_Herzog_Presentation.pdf (The webpage was last visited on 12-12-2019)

This chapter, divided into two sections, explains the smart city concept (Section A). After that, the research is further prolonged to announce the crucial role of the general contractor within the value chain management in construction (Section B).

Exactly as we see it, the general contractor role may be instituted based on the existence of (one main issue —) broad organizational gaps and disintegrations within the construction industry's value chain, which often hold construction actors back from proposing value-adding innovations to their clients. As for the solution to this one issue, it is nowhere to be found, we proclaim, but in a newly designed — centralized — stage-based business model.

SECTION A. ON SMART CITIES: A LITERATURE REVIEW

Over the course of my professional career as a *general contractor*, I have had the chance to handle numerous construction projects and amass sufficient knowledge about the current state of the market: its strengths, weaknesses, threats faced and future prospects to be seized. In my personal view, smart cities are likely to shape the future of urban developments. And the smart city market in France has lots to offer and been exponentially growing in size, especially with the global urbanization trend which vented in recent years and has been on the rise since then.

Practically, smart city projects refer to long-term construction projects, which are recurrently labor — capital — and technology intensive. To say the least, they are source of value and varied revenue streams that could possibly benefit all construction actors[8].

At the moment, however the number of construction actors — intervening at different junctures throughout the construction value chain for the execution of smart city projects — is big, the difficulty encountered in the context of smart developments has in fact nothing to do with the count of intervenors per se — but with the absence of an entrepreneurial entity that could resourcefully orchestrate those interventions, avoid overlapping roles, and guarantee the successful delivery of projects (Flyvbjerg & Hom 2002; Flyvbjerg et al. 2003).

[8]Xiong (2018). Cost-Benefit Analysis of Smart Cities Technologies & Applications. A thesis submitted to the Faculty of the University of Delaware. Available from:
http://udspace.udel.edu/bitstream/handle/19716/23818/Xiong_udel_0060M_13359.pdf?sequence=1&isAllowed=y
(The webpage was last visited on 12-20-2019)

1.1. HISTORICAL SYNOPSIS

The apprehension for sustainable development of urban centers has been a key preoccupation since old times. And the aspects that typify the cities of tomorrow have been embraced over the years, and the lexis that outlines the features of those cities was pointedly enriched in the past few decades, chiefly to better explicate the hefty number of concepts endorsed by stakeholders (Eremia et al. 2017). Today, this lexis has again altered, with some specific terms gaining or losing ground over time (―Tables 1 & 2).

Domain	Social	Economic	Governing
Garden cities	Participative cities	Entrepreneurial cities	Managed cities
Sustainable cities	Walkable cities	Competitive cities	Intelligent cities
Eco-cities	Integrated cities	Productive cities	Product cities
Green cities	Inclusive cities	Innovative cities	Efficient cities
Compact cities	Just cities	Business-friendly cities	Well-run -led cities
Smart cities	Open cities	Global cities	Smart cities
Resilient cities	Livable cities	Resilient cities	Future cities

Table 1. The cities of tomorrow, conception of success
Source: Adapted from Guerrero-Pérez et al. (2013)

Post 1950, *sustainable city* was the most popular English term used to label future urban developments. *Digital city* followed in the late nineties. Its popularity ensued from its in-built ability to connect with and reflect the exponentially growing importance of ICT at the time. Nevertheless, in 2009, the interest for the said term has stumbled and was gradually replaced by a new one: *smart city* — which embraces elements of sustainability and social inclusion, concurrently suited to the evolution of IoT (Deakin, 2012). In the following subsections, light is shed on the two concepts of *sustainable* — and *smart* — *cities*. Later on, a deep dive into the main features and models of smart cities, and a quasi-complete inventory of all definitions for smart cities is presented.

Term	Popularity	Regional popularity	Popularity in countries	Popularity in cities
Future cities	Stable	Global	India, US, Canada, Australia, UK, Mexico, Brazil	Minneapolis, Singapore, Mumbai, New Delhi, Phoenix, San Francisco, Pune
Eco-cities	Stable	Asia	Philippine, Singapore, Malaysia, India	Chandigarh, Tianjin
Smart cities	Fluctuating interest	Europe, Northern America	Italy, Spain, Belgium, UK	Barcelona, Bologna, Torino, Roma
Intelligent cities	Stable	Northern America	US, UK	London
Sustainable cities	Stable	Commonwealth	Australia, UK, Canada, US, India	Vancouver, Singapore, Washington, Auckland, Portland, Dubai, London, Austin
Compact cities	Stable	Mixed	Australia, UK, US	Salt Lake City, New York City
Liveable cities	Rarely used	Commonwealth	Australia, UK, Canada, Singapore	New York City, Singapore, Melbourne, Pittsburgh, Vancouver
Digital cities	Stable, following a drop in popularity	Mixed	US, Ireland, Philippine, UK	Kansas City, Oklahoma City, Dublin, Minneapolis
Innovative cities	Stable	Mixed	US, UK, India	Bangalore
Green cities	Stable	Northern America	US, Australia, Canada	New York City

Table 2. Geographic trends in future city term usage
Source: Adapted from Moir et al. (2014)

1.1.1. *SUSTAINABILITY, UNFOLDED*

The idea of sustainability grew out of the cognizance that the prevalent model (at the time!) of socioeconomic development was oblivious to the ecological calamities produced by industrialized economies — as well as to mounting social disparities among people and nations (Najam, 2005). As of 1970, budding concern over humanity's influence on the environment ignited a global environmental movement that ended up in a UN Conference on the Human Environment in Stockholm, Sweden. Initially, the said conference was met with much resistance from represented emerging countries, who probed the lawfulness of environmental issues as a global priority. The statement from Ivory Coast demonstrates this conviction pretty well: *'more pollution problems are better than more poverty problems, as far as they are proof of industrialization'* (Rowland, 1973). As described by Najam (2005), global environmental debates are still today very much a bequest of industrialized versus emerging economies.

After Stockholm, the debates have budged from solely focusing on environmental problems —to (collectively) concentrating on environmental and socioeconomic development —now, acknowledged as the concept of *sustainable development* (Prizzia, 2007). The Brundtland Report[9] described sustainable development as *'the development that meets the needs of the present generation without conceding the ability of future generations to meet their own'* (WCED, 1987). Since it first stepped onto the world stage, the sustainable development concept has experienced extensive broadcasting and become the key sermon promoting the environment in its many circles: science, technology, economy, and urban planning (Bibri & Krogstie, 2017).

Being prone to effortlessly confuse the concepts of *sustainable development* and *sustainability* with each other, it seems vital at this point to elucidate that the latter describes a long-term goal or sought-after end-state that could be preserved over time, while the former accounts for initiatives and projects undertaken to attain the ultimate goal of sustainability (Höjer & Wangel, 2015).

[9]*Our Common Future* i.e. *The Brundtland Report* was published in 1987. Targeting multilateralism and interdependence of nations in the search for a 'sustainable development' path, it sought to recapture the spirit of the Stockholm Conference which had introduced environmental concerns to the formal political development sphere.

The UNESCO[10] — on another note — has demarcated sustainability as *'a paradigm for thinking about the future in which environmental, societal, economic and cultural concerns are well-adjusted in the pursuit of an improved quality of life.'* As per Elkington (1997), sustainability is commonly described as an equilibrium of its three dimensions — economic, social and environmental — and is also referred to as *the triple-bottom-line perspective of people, planet and prosperity*. Currently, the most prominent school of thinking within the European sustainability logic is *ecological modernization* (Baker et al. 1997). It basically aims at swapping a manufacturing-based economy with a cleaner, service-oriented one (Pepper, 1998) — including (but not limited to) improvement in energy and resource-efficiency.

In the twenty first century, the works carried out by scientists at IPCC (Intergovernmental Panel on Climate Change) have helped withstand the significance and consideration given to the environmental aspects of sustainability on the global stage. Similarly, their harsh notices against business-as-usual inferences on the environment have created a global call for a sustainability transition. Definitely, today, sustainability has become an end-goal in the face of unconventional challenges (Rittel & Webber, 1973), and a plausible solution to wicked problems (e.g. global warming).

1.1.2. <u>*THE SUSTAINABLE IN A CITY*</u>

As the world's population is becoming increasingly urban (—see Foreword & Introduction), sustainable development is, now, perhaps, the single-most central architype influencing research and dialogue around urban development — bestowing it a high-level global policy recognition (De Jong et al. 2015). Generally, the sustainable city concept became dominant in Europe via the Aalborg Charter (1994)[11] — which is an urban sustainability initiative, comprising over three thousand signatories today, making it the single most successful European effort in sustainable urban development. It is goal is evident: *'to render urban settlements inclusive, safe and secure, strong and sustainable.'*

[10]Sustainable Development. Available from: https://en.unesco.org/themes/education-sustainable-development/what-is-esd/sd (The webpage was last visited on 12-20-2019)
[11]Also known as *The Charter of European Sustainable Cities and Towns towards Sustainability*. Retrieved from http://www.sustainablecities.eu/the-aalborg-charter/

Outside of Europe, the Melbourne Principles[12] (for sustainable cities) were drawn up in Australia during a planning session leading up to the 2002 Earth Summit held in Johannesburg, South Africa (UNEP, 2002). They consist of ten brief statements on how cities could become more sustainable — among which — just to cite a few: 1) the need to build on the characteristics of ecosystems in the development and nurturing of sustainable cities, 2) recognize and build on the distinctive characteristics of cities, 3) expand and enable cooperative networks to work towards a common and sustainable future, and 4) enable continual improvement based on accountability, transparency and good governance.

The definitions for a sustainable city are numerous and variable. Actually, Rogers (1998) conceptualized a sustainable city as a place where higher quality of life is realized, in tandem with policies that efficiently cut demand on resources outside of the city. Other scholars (—e.g. Meadows, 1999) approached the term from a changed angle, an eco-friendly one. Their respective sustainable city representations focused on a city's ecological perforce, assessing and dipping pollution and GHG emissions —as well as energy and water consumption (among other goals). Moving forward, Rode and Burdett (2011) opted for a socio-economic explanation, where social equity, together with a greener living environment, should be considered for the development of sustainable cities. They pointed out that cities should offer proximity, density and variety which would eventually yield productivity benefits for companies, and help stimulate innovation and new job creation via, say, high-tech clusters in big cities (e.g. Silicon Valley).

Going farther, other academics (De Jong et al. 2015; Ahvenniemi et al. 2017) have recently recognized that understanding the rapports between people, their activities and the environment is key to sustainability. In this context, Bibri and Krogstie (2017) avowed that a sustainable city aims at achieving a dynamic balance among economic, environmental and socio-cultural development objectives (Figure 1) —outlined by a local governance system characterized by heightened citizen contribution.

[12]Melbourne Principles for Sustainable Cities (UNEP, Integrative Management, Series Number I, Division of Technology, Industry and Economics). Available from: https://archive.epa.gov/bns/web/pdf/melbourneprinciples.pdf (The webpage was last visited on 12-20-2019)

SUSTAINABLE CITY			
Social Development	Economic Development	Environmental Management	Urban Governance
• Education and Health • Food and Nutrition • Green Housing and Buildings • Water and Sanitation • Green Public Transportation • Green Energy Access • Recreation Areas and Community Support	• Green Productive Growth • Creation of Decent Employment • Production and Distribution of Renewable Energy • Technology and Innovation	• Forest and Soil Management • Waste and Recycling Management • Air Quality Conservation • Adaption to and Mitigation of Climate Change	• Planning and Decentralization • Reduction of Inequities • Strengthening of Civil and Political Rights • Support of Local, National, Regional, and Global Links

Figure 1. The four dimensions of a sustainable city
Source: Adapted from UN (2013)[13]

This holistic vision of a sustainable city entails a resourceful, local, balance-seeking process that outspreads into all areas of local decision-making and aims to unceasingly improve various urban systems, design- and function-wise. The governance dimension is therefore key, as it necessitates cooperative effort from different stakeholders to take an all-inclusive approach to solving cities' complex challenges.

This rationale is hypothesized via the quadruple-helix model (Figure 2) —in which governmental authorities, the private sector, and universities join forces —with the people— to find solutions to shared problems (Arnkil et al. 2010). Definitely, this archetype of *collaborative urban governance* — which is more and more supported by ICT (Termeer & Bruinsma, 2016) — has the potential to cut across outdated prerogatives and practices (Lubell, 2015) —and is seen as fundamental for the creation of a sustainable city (Kordas et al. 2015).

[13]United Nations (2013). World economic and social survey: Sustainable development challenges. https://www.un.org/en/development/desa/policy/wess/wess_current/wess2013/WESS2013.pdf (The webpage was last visited on 3-4-2020)

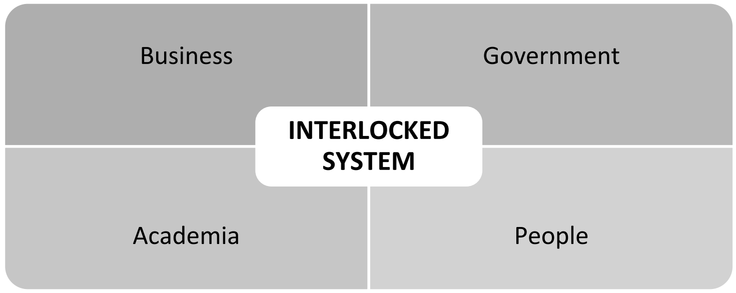

Figure 2. The quadruple-helix model
Source: Adapted from SIP-SSC (2015)[14]

1.1.3. *THE START OF SMART*

While the sustainable city model was conventionally grasped as the choicest, it has nevertheless been, in recent years, bested by the smart-city model (De Jong et al. 2015). In fact, the modern understanding of a smart city is integrally related to the advent and swelling use of ICT and computing (Harrison & Donnelly, 2011; Kitchin, 2014). In advanced economies — high-quality infrastructures, cutting-edge technologies, and investments in energy efficiency are all quoted as main ICT-driven benefits conferred to cities (Bibri & Krogstie, 2017).

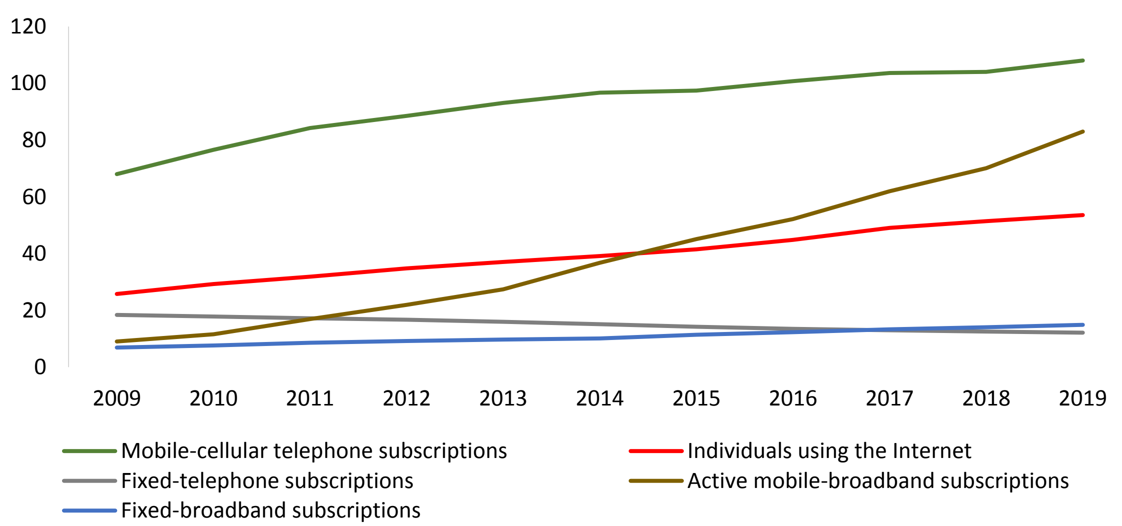

Figure 3. Global ICT developments, Y2009-19
Source: Adapted from ITU (2019)[15]

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[14]SIP-SSC (2015). Strategic innovation agenda for smart sustainable cities. Available from: https://www.diva-portal.org/smash/get/diva2:812341/FULLTEXT01.pdf (The webpage was last visited on 3-4-2020)
[15]ICT Development Trends & Approaches for Digital Transformation. Available from: https://www.itu.int/en/ITU-D/RegionalPresence/AsiaPacific/SiteAssets/Pages/Events/2019/RRITP2019/ASP/ICT%20Development%20Trends%20and%20Digital%20Transformation%20ITU%20ITP%202019.pdf (The webpage was last visited on 3-4-2020)

Nowadays, although the fallouts of the wide-scale deployment of ICT are still not very well understood — and a cheap and reliable internet is not yet a reality for the bulk of people in the world — the network, both in terms of infrastructure and content, has grown speedily since inception, and is goading vast innovation and improved user engagement (Figure 3). As per Turok (2014), the deployment of more ICT in the cities of emerging countries has been cited as a driver of efficacy in urban infrastructures, providing inferior costs in city operations and backing innovation-and-poverty-abolition up. In some instances, being the case of Hong Kong and Singapore in specific, urban economies tend to circumvent the need to retrofit existing infrastructure by building ICT into new ones during their initial construction stages.

The burden, today, is put — we would say — on the shoulders of governments too; they are constantly seeking to gather and monitor data in connection with governance, infrastructure, the economy, and the environment (UN-Habitat, 2016). Kitchin (2014) affirmed that the use of data allows cities to assess their performance in various aspects (crime prevention — to energy efficiency — to informing investment) and progress the quality of their public offerings. Indeed, today, performance measurement has become a key element in the eyes of both officials and planners. This is factual because the use of data enables cities to not only measure their own performance and make evidence-based decisions, but also compare and benchmark themselves against other cities, nationally and internationally. Now, connectivity has reached a tipping point, and the IoT is being gradually replaced by the *Internet of Everything* — cleverly labeled as *everyware* —a network of networks where billions of connections could create unparalleled opportunity in making cities manageable in new comprehensive and lively ways (Greenfield, 2006).

Within this context though — Silk & Appleby (2010) signposted that the efficient exchange of information necessitates data accessibility, which is only possible via the publication and standardization of basic datasets: *Open Data*. Accurately, Open Data aims at nurturing the average citizen’s contribution in urban governance —and is, sort of, a commitment to transparency and accountability.

Before concluding the present subsection, we restate that the smart city concept is still comparatively new, thus far a debated topic — and, just out of interest, we proceed by asking: Where did the idea of *smart city technology* originated? (Surprisingly, Bill Clinton, the former US president, takes all the credits for this one!) Back in 2005, through his charitable organization — The Clinton Foundation — he defied network equipment maker, Cisco, to use its technical savoir-faire to render cities more sustainable. As a result, Cisco devoted USD25 million over a five-year term to research the topic, spawning the so-called Connected Urban Development Programme. The latter involved working with the cities of San Francisco (US), Amsterdam (The Netherlands), and Seoul (South Korea) on a number of pilot projects to verify the technology's potential.

In 2010, the year Cisco's pledge expired, it launched its Smart & Connected Communities Division in order to commercialize the products and-or services that it had developed during the programme. Similarly, not too far behind, IBM had a similar vision to using IT (Information Technology) to make cities, say, smarter. At the time, both corporations were fully focused on smart cities; however, their respective approaches to building those cities diverged importantly:

— IBM's strategy —on one hand— was underpinned by its recent focus on information management and analytics. Through acquisition and internal R&D (Research & Development), the company succeeded to arm itself with analytical procedures and data processing technologies that are indispensable to understand massive amounts of sensor data;
— Cisco's projects —on the other hand— ranged from modified or upgraded projects —such as a partnership with the Metropolitan Transit Authority in New York to improve rail and station monitoring — to completely new ones such as Songdo, South Kora — a sustainable city to be built on reclaimed marshland.

Clinching, we wonder: Did Cisco win the bet. Yes, it actually did. As the investment made came first in the smart city make-a-thon, henceforward instigating a global market whose current value measures up to billions of dollars —and with hopeful prospects (Bloomberg's!) to grow further in the future — to reach USD253 billion by 2025[16].

[16]Bloomberg, Business. Issue: November 2019. See full report: https://reports.valuates.com/sreport/QYRE-Othe-1K199 (The webpage was last visited on 12-27-2019)

1.2. DEFINITIONS, FEATURES & MODELS

A review of academic literature revealed that the use of the term *smart city* has increased exponentially —as of early 2009— to the extent that it eventually turned into the most widespread city category describing sustainable urban development (De Jong et al. 2015). It became a catchword —drawing increased attention among research agencies, universities, governments, officials, and specialized companies. All over the world, there has been hasty proliferation and promotion of smart city programs —and the market potential for smart city solutions has been dogged to be substantial (Etezadzadeh, 2016). China, for instance, is urbanizing hurriedly, and the Chinese government is currently undergoing a thrust to renovate its cities with over one hundred initiatives in the pipeline: eco-cities, low-carbon cities, and smart cities (SIP-SSC, 2015). Alike, India has announced, a few years back, plans to develop smart cities in response to the country's growing population and pressure on existing urban infrastructure (Smart Cities India, 2015).

Today, though the rise in popularity of the smart city is sturdy, the dissemination of initiatives in countries with poles apart needs makes it problematic to find shared definitions and common trends at the global scale. To say that there is no clear-cut definition of the term *smart city*, nor a general agreement on what its inherent features are (Caragliu et al. 2011; Dameri, 2013; Neirotti et al. 2014; Kitchin, 2014; Albino et al. 2015). Definitely, while smart city projects in Latin America tend to be strappingly focused on the improvement of security, local government management, and mobility — in Asia, the emphasis is rather put on the improvement of infrastructure and mobility —and, in Europe, the concentration is on boosting the efficiency of public offerings, building a socially-inclusive culture, and enhancing citizens' well-being (Neirotti et al. 2014).

According to SIP-SSC (2015), a smart city uses ICT to enhance its livability, workability and sustainability. Similarly, the US Office of Technical & Scientific Information[17] affirmed that a city is qualified as smart if it monitors and integrates conditions of all of its critical infrastructures — including: roads, bridges, tunnels, railways, seaports, water,

[17] Found in (Eremia et al. 2017)

power, and major buildings — so that it could better optimize its resources, plans its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens. Another astute smart city definition is that of (Guerrero-Pérez et al. 2013) —who resolved that a smart city could be seen as a determined geographical space able to efficiently manage resources as well as wastes generated by lifestyle. From their side, Georg et al. (2012) suggested a reasonable macro-definition of smart city projects; according to the authors, *'smart city projects are nothing but the sum of several interconnected, smart micro-projects (e.g. infrastructure, telecom and ICT, as well as smart buildings and districts).'* Thus, *'a smart city project is an aggregation of a number of varied-sized -shaped smart projects'* they added.

Refer to Table 3 for an extensive, non-exhaustive listing (from least to most recent) of definitions for smart cities.

DEFINITION	Author/s, Year
A smart city is one that monitors and integrates the conditions of all of its critical infrastructures to better optimize its resources, plan its preventative maintenance activities, and monitor security aspects while maximizing services to its citizens.	Hall (2000)
A smart city performs in a forward-looking way in terms of its economy, people, governance, mobility, environment and living, and is built on a combination of endowments and the activities of self-decisive, independent, and aware citizens.	Giffinger et al. (2007)
A smart city connects its physical infrastructure, ICT infrastructure, social infrastructure and business infrastructure to leverage the collective intelligence of the city.	Harrison et al. (2010)
Smart cities use smart computing technologies to make the critical infrastructure components and services of a city—which include city administration, education, healthcare, public safety, real estate, transportation, and utilities— more intelligent, interconnected, and efficient.	Washburn et al. (2010)
A city is smart when investments in human and social capital, and traditional and modern communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.	Caragliu et al. (2011)
A smart city infuses information into its physical infrastructure to improve conveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make better decisions, deploy resources effectively, and share data to enable collaboration across entities and domains.	Nam & Pardo (2011)
Smart cities should embody two main ideas: 1) Smart cities are all about networks of sensors, smart device, real-time data and ICT integration in every aspect of human life and 2) Smart cities should do everything related to governance and economy using new thinking paradigms.	Cretu (2012)
A smart city is a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce and an increased life quality.	Bakici et al. (2012)
A smart city is a well-defined geographical area, in which advanced technologies cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a well-defined pool of subjects, able to state the rules and policies for the city government and steer development.	Dameri (2013)
Smart cities use data, information and IT to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration among different economic actors, and to encourage innovative business models in both the private and public sectors.	Marsal-Llacuna et al. (2015)
The smart-city concept is a tool for the creation of sustainable communities. It incorporates a mixture of transparent and collaborative governance schemes where citizen participation is key.	Simard (2015)

Table 3. Defining smart cities
Source: Compiled from various sources

Given the scope of this research and the objectives assigned to it — we came up with our own definition of a smart city. It pours as follows: *'A smart city — we believe — is a city that is conceived, developed and ran by the government and the people, both being smart, for the sake of promoting citizens' well-being and ensuring a better quality of life for all.'*

Moving on, the term *smart city* has firstly emerged out of the increasing use of ICT, big data, IoT, and ubiquitous computing in cities. According to Caragliu et al. (2011), the smart city concept was announced as a strategic stratagem to encompass modern urban production factors in a common framework and, in particular, to highlight the importance of ICT for enhancing the competitive profile of a city. And so — we recap — a smart city is one that uses ICT strategically in its administration to provide efficient services to citizens, monitor policy outcomes, manage and optimize existing infrastructure, and employ cross-sector collaboration and enable new business models.

In the same way, Schaffers et al. (2011) saw the three key domains of potential smart city applications to be the innovation economy, city infrastructure and utilities, and city governance. They argued that in order to become smart, a city needs to: (1) create a rich environment of broadband networks that support digital applications, and to (2) initiate large-scale participatory innovation processes for the creation of applications.

The smartness of a city is thus given by the set of physical and legislation infrastructures (Eremia et al. 2017) that support economic development, ensure social inclusion, and allow environment protection (Figure 4). Table 4 highlights the directions of development of a city and provides examples of various applications by means of which the main objectives of a smart city could be achieved.

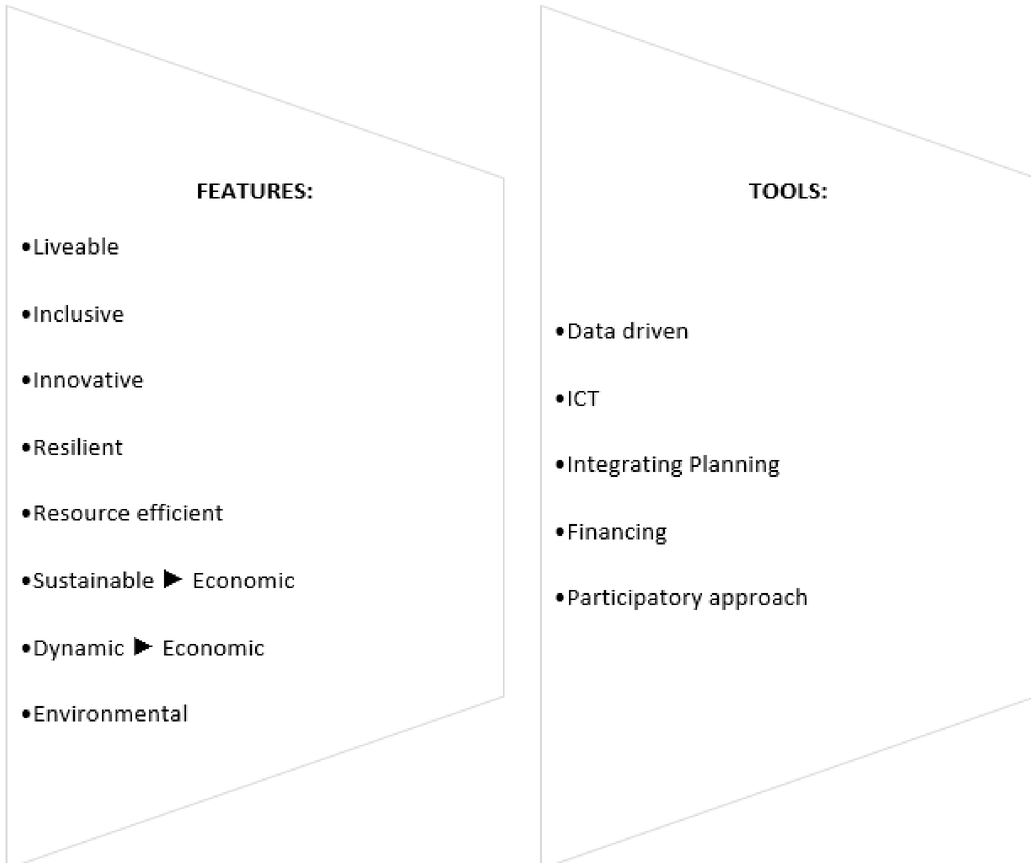


Figure 4. Smart cities' features and tools
Source: Adapted from Eremia et al. (2017)

AREA OF APPLICATION	DESCRIPTION	EXAMPLES
Smart Buildings	Incorporating the advantages of communication and control systems.	Optimizing the heating systems, ventilation, and air conditioning.
Education, Health	Apps that improve the activity in these domains and ensure the access to all citizens to high-quality services.	Monitoring systems of the old people, monitoring by telemedicine.
Smart Energy	Smart electrical energy system that interconnects all utilities and end-users via smart infrastructures.	Smart Grid apps, optimization of network operation, comply the environment standards, smart lighting.
Smart Grid	Real-time consumption metering of energy, water, and natural gas.	On-line information of the consumption, wireless smart meters.
Smart Utilities	Intelligent management of the water distribution system and wastewater.	Smart wastewater systems, real-time solid waste monitoring.
Smart Parking	Managing parking places using sensors and CCTV.	Monitoring systems of the vehicles.
Integrated Supply Systems	Synchronizing supply and demand; measurement, monitoring and organization of the transportation around the supply chains of the cities.	n/a
Smart, Integrated Transport	Traffic monitoring and real-time optimization using all transportation means.	CCTV for traffic, smart parking networks, minimizing the impact on the environment.

Table 4. Directions of development of smart cities
Source: Adapted from Meijer et al. (2016)

Reaching this point, we carry on by divulging the main smart city models, explicitly those of (Giffinger et al. 2007; Cohen, 2012; Tobergate & Curtis, 2014). Largely, the holistic models of (Giffinger et al. 2007) and (Cohen, 2102) are said to be the most illustrative as to their capacity to demonstrate and exhibit the strategic components of a smart city in general — in the number of six (Figure 5).

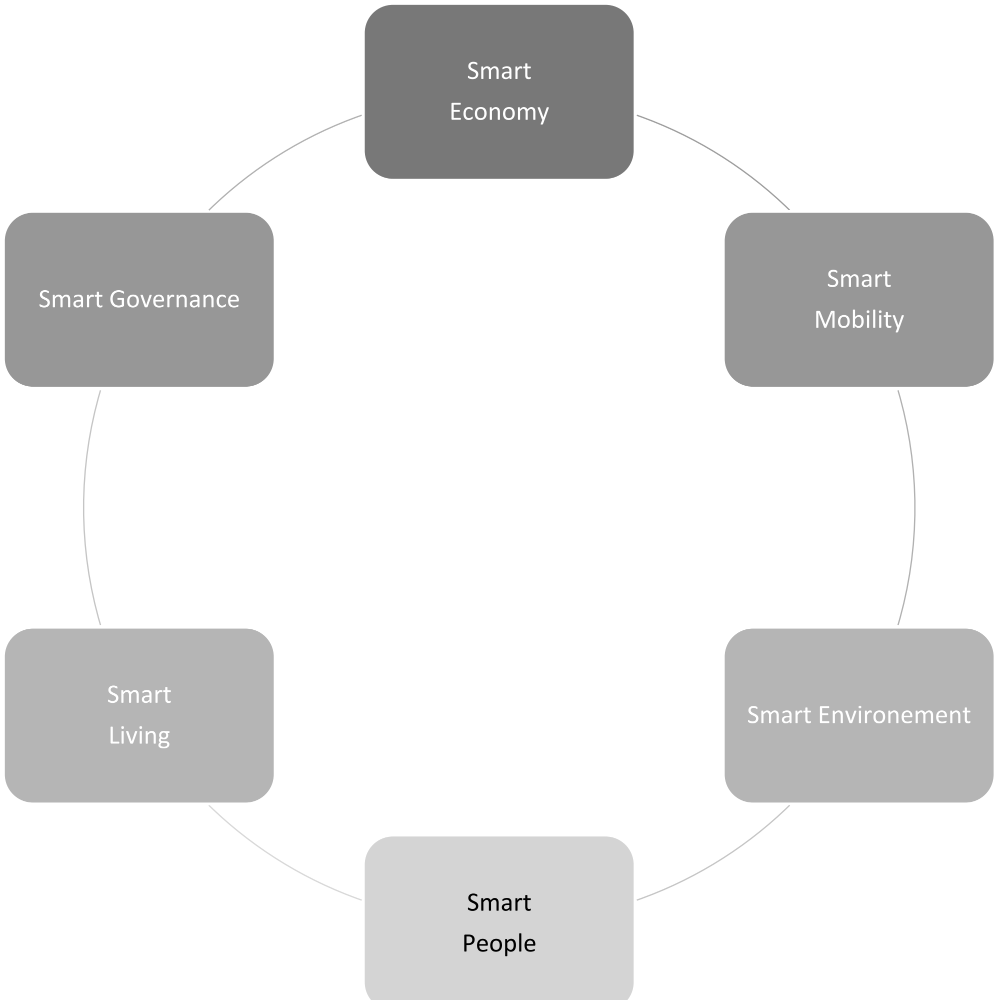


Figure 5. The main components of smart cities
Source: Adapted from Giffinger et al. (2007)

As per Giffinger et al. (2007), smart cities should be instituted on the basis of a smart combination of endowments and activities — precisely as advised by connected, self-governing and sentient citizens. Table 5 offers in-depth insights into smart cities' main components.

▼Smart Economy: • Innovative spirit • Entrepreneurship • Economic image, trademarks • Productivity • Flexibility of labor market • International embeddedness • Adaptation	**▼Smart People:** • Level of qualification • Affinity to life-long learning • Social and ethnic plurality • Flexibility • Creativity • Cosmopolitanism, open-mindedness • Participation in public life
▼Smart Governance: • Participation in decision-making • Public and social services • Transparent governance • Political strategies and perspectives	**▼Smart Mobility:** • Local accessibility • National and international accessibility • Availability of ICT infrastructure • Sustainable, innovative, and safe transport systems
▼Smart Environment: • Attractiveness of natural conditions • Environmental protection • Sustainable resource management	**▼Smart Living :** • Cultural facilities • Health conditions • Individual safety • Housing quality • Education facilities • Touristic attractivity • Social cohesion

Table 5. A deep dive into smart cities' main components
Source: Adapted from Giffinger et al. (2007)

Nevertheless, since these components were established back in 2007 (as part of the European Smart Cities initiative), numerous authors (Batty et al. 2012; Lazaroiu & Roscia, 2012) have referred to them year-over-year to develop more elaborate frameworks and strategies: Boyd Cohen's (2012) Smart City Wheel (Figure 6).

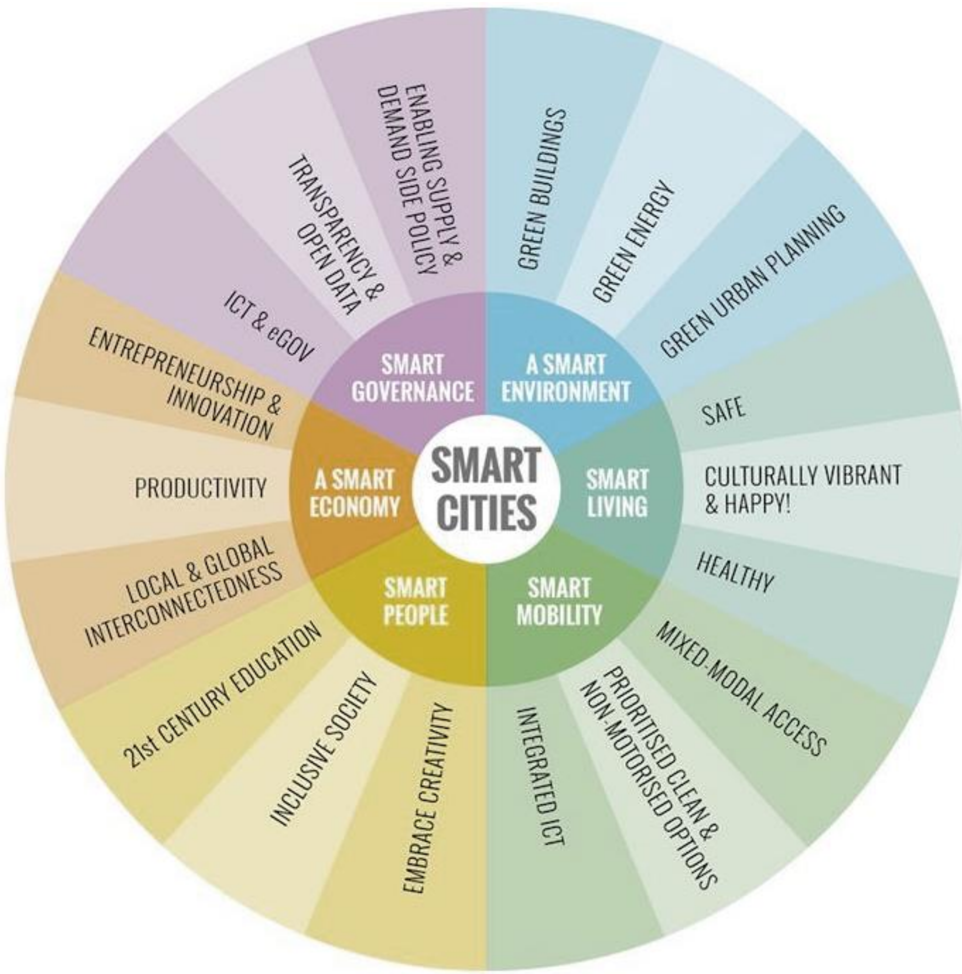


Figure 6. Smart City Wheel
Source: Cohen (2012)

A synthesis of the works of Giffinger et al. (2007) and Cohen (2012) by Simard (2015) allowed for a better understanding of the relevance of smart city components vis-à-vis snags faced by urban settlements today. According to the author, it is of foremost worth to have the support of the governing bodies (as a first step) *ex ante* the initiation of any process-project. In the realm of smart cities, she said, it is required that citizens take part in the project-process (become active stakeholders) —and so, contribute to the success of the process-project. Subsequently, ensuing from (Simard, 2015), we carried out by classifying smart city components into primary and secondary components. In our views, once the primary components have been fittingly anchored and established, the other (secondary) ones — in the number of four — all being of equal importance — should follow (Figure 7). Indeed, however a city is well governed and the number of smart people it integrates is large, there is no chance, we avow, that it could be established and qualified as smart unless it fits all six components in, primary and secondary.

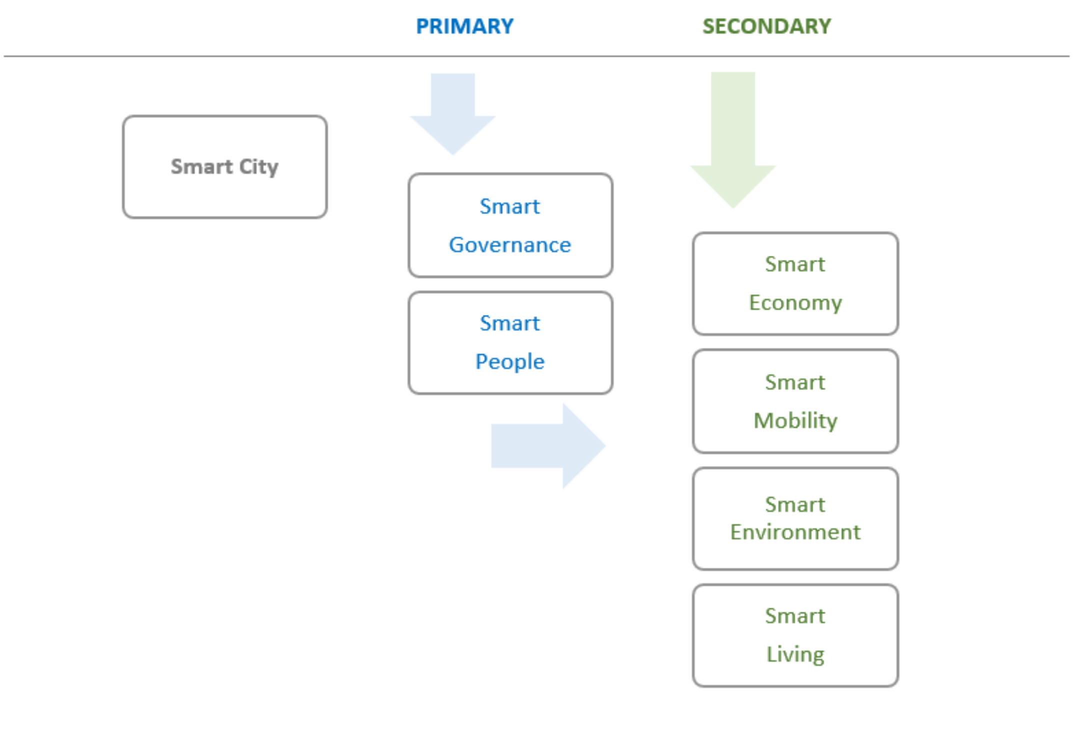


Figure 7. Giffinger et al.'s (2007) work revisited
Source: Created by the author — inspired from Simard (2015)

Yet again, Tobergate and Curtis (2014) have too made a great use of existing works on smart cities by proposing an attuned illustration of the dimensions of a smart city. Precisely, they added three factors (or better say *headers*), under which all six smart-city dimensions could be prescribed.

Technology Factors	Human Factors	Institutional Factors
• Physical infrastructure • Smart technologies • Mobile technologies • Virtual technologies • Digital networks	• Human infrastructure • Social capital	• Governance • Policy • Regulations and directives

Table 6. Smart cities' core factors
Source: Adapted from Tobergate and Curtis (2014)

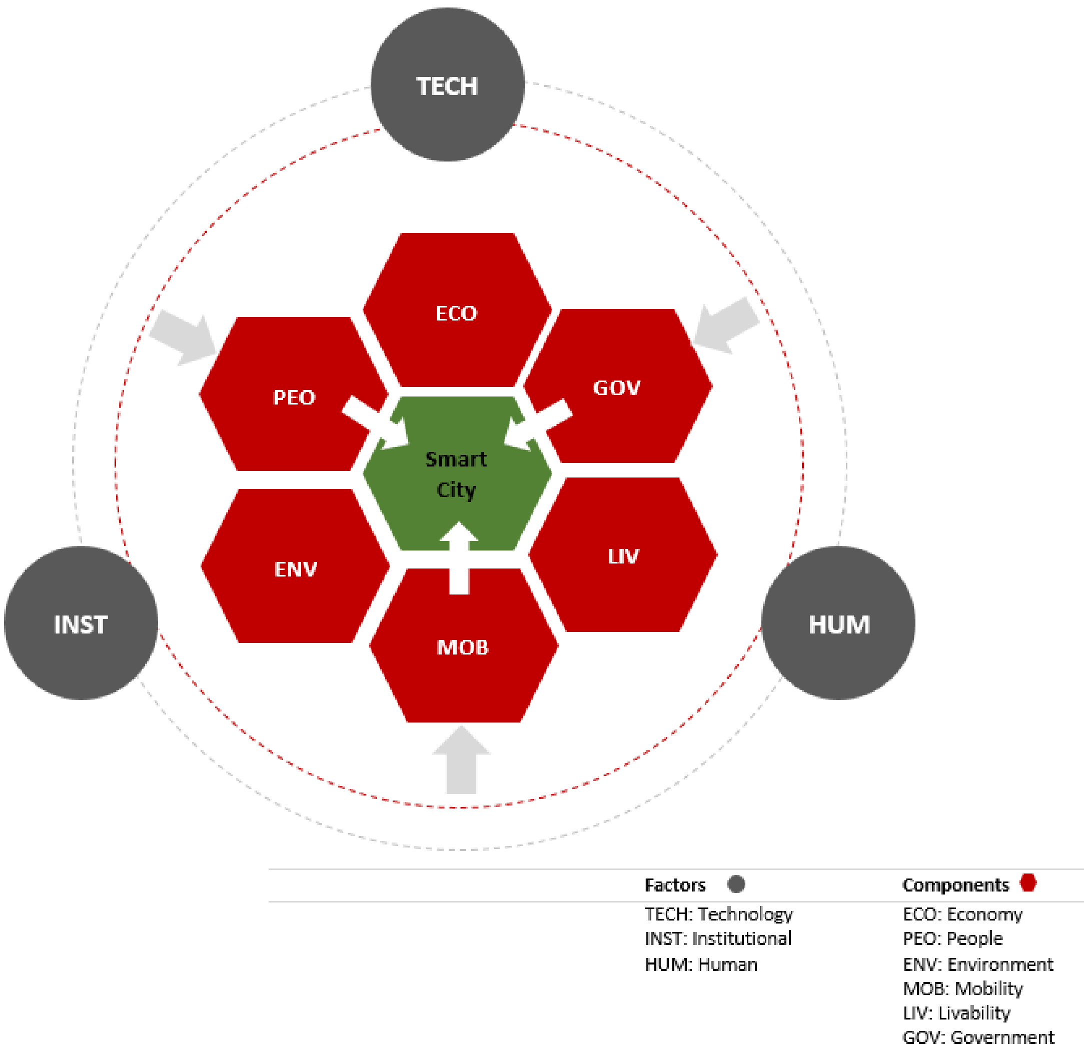


Figure 8. Smart city: factors versus components
Source: Adapted from Tobergte and Curtis (2014)

As reported by the authors, it suffices to break the factors (first layer) down to get to the components (second layer) (Figure 8) —then, the factors, through their respective parts

(—see Table 6), would act as a conductive thread for components (primary and secondary), which, blended, would finally fuel the development process of smart city strategies around the world. The next subsection features some real-life, global examples of smart cities and initiatives. Using plain text, it briefly exposes international developments and improvements made in this field.

1.3. EXAMPLES OF SMART CITIES & INITIATIVES

With smarter transit systems to greener buildings, smart cities are briskly transforming the way people think about urban living. To better clarify this global penchant towards smarter urban living, five examples of smart projects and initiatives from around the world are exhibited below. As you would notice, the proposed smart city tour kicks-off in Europe (Spain) and ends in Asia (South Korea). The fifth edition of the IESE CIMI (Cities in Motion Index) inspired our choice of smart cities[18].

As formerly evoked, the idea of *smart cities* is vague, easily associable with a whole bunch of lots of things (smart living — smart security — smart governance — smart people — smart anything and everything), and its connotation is variable, changing across continents, nations, or even cities (within the same nation). This reasoning — we believe — helps substantiate the subjective nature of the term. As well, though smart cities are quite abundant today, history has shown that not all of them were destined to flourish (*Remember*? A top-down approach to building a smart city is conceivably to fail —especially that stakeholders often misinterpret the term *smart city*).

Truly — we here-and-now proclaim that — not all smart cities are equally successful — genuine — or human, thus we raise the red flag on Songdo (South Korea) and Dubai (United Arab Emirates) for being *mere technology demonstrators* rather than *habitable cities* (Rochet, 2014).

[18]IESE Cities in Motion Index 2019. Available from: https://blog.iese.edu/cities-challenges-and-management/2019/05/10/iese-cities-in-motion-index-2019/ (The webpage was last visited on 3-4-2020)

1.3.1. *BARCELONA, SPAIN*

With over 120 active projects, classified into twenty two programmes covering all areas of the city management, from public space and mobility to open government, Barcelona was named, a few years back — in 2014, the European Capital of Innovation[19]. A year later (in 2015), it was termed — together with New York, London, Nice, and Singapore — one of the world's smartest cities.

Since 2011, the city has been working hard and fast to turn the hypothetical smart city concept into reality. Obviously, they succeeded to do so! Investment wise, Cisco turned out to be one of the city's key technology providers. It invested almost USD30 million to build a new center focusing on the IoT for urban systems. Cellnex Telecom in turn, a wireless telecom company, integrated existing city services into one system (i.e. the Urban Platform of Barcelona) and has been running the city-wide network ever since. Due to its extensive use of the IoT and the successful implementation of its strategies, Barcelona is now regarded as one of the top leaders in the global smart city market. Actions developed under Barcelona Smart City strategy lie on three axes: international promotion, international collaboration and local projects. Among the various smart projects that Barcelona has developed in recent years, we cite the following:

- The Apps4 BCN portal, an application that provides a virtual meeting point portal for people to look for apps and improve their experience of the city;
- Smart Transportation through which the city aims at showing its commitments in becoming the frontrunner in the utilization of renewable energy, particularly in the transit sector (e.g. the development of electric vehicles);
- Smart Education, the so-called Smart City Campus, enabling supportive environment for businesses, research centers, and universities to promote synergies and generate urban laboratory;
- Smart Governance via the establishment of an e-government program, the Open Data BCN, though which Barcelona intends to open up the city database to the public, in

[19]Data in subsection [1.3.1] was pulled out from a consultancy report — drafted by Rahyaputra V., Khawarizmy N. M., & Saputri N. R. — and entitled '*Barcelona's smart city: The frontrunner in digital transformation'*. Available from: http://cfds.fisipol.ugm.ac.id/uploads/files/posts/72/CFDS_CASESTUDIES_BARCELONA.pdf (The webpage was last visited on 12-27-2019)

order to increase transparency and credibility; also, to provide and universalize open data access to reach all stakeholders. Beyond, Barcelona has created a Smart City Personal Management Office with the purpose of coordinating and synchronizing all city projects, operations deemed *smart*.

1.3.2. *AMSTERDAM, THE NETHERLANDS*

Ordinarily, smart city projects should benefit the people who live, work and visit the city in which they are implemented[20]. In our view, these projects are a dynamic way to use technology to build a better working world. Amsterdam's smart city initiative has originally progressed from an early period of experimentation, a trial-and-error phase, at the end of which the city opened up its data to the public. Now, the initiative, which is in its second stage, is characterized by more solicitous and focused efforts that would ultimately enable the city to spur innovations and improve the quality of its offerings. Table 7 below displays the main lessons that could be learned from Amsterdam's experience in the area of smart city development.

1	Strong governance: • The backing of the political establishment is critical!
2	Proof-of-concept projects: • Pilot projects are key! • Data matter, whether big or small.
3	Human-centric approach: • Listen to citizens' needs and propose suitable solutions.
4	Create a pool of talents: • Attract and retain talented people; • Develop university programs dedicated to smart cities.
5	Build strategic alliances: • Work with partners, inside the city government and outside.

Table 7. The five strengths of Amsterdam's smart city
Source: Ernest & Young

[20]Inspired from a consultancy report, drafted by Frank Harmsen (E&Y Advisory), entitled *Amsterdam's Intelligent Approach to the Smart City Initiative*. Available from: http://marketing.mitsmr.com/PDF/EY-SponsoredViewpoint-Amsterdam.pdf (The webpage was last visited on 12-27-2019)

1.3.3. *LONDON, UNITED KINGDOM*

London is a global smart city leader, known for creating innovative solutions and cracking urban challenges by making data accessible to all, at all levels[21]. Indeed, this was possible thanks to the London Datastore, a free and open data-sharing portal with over 700 datasets, launched back in 2010. Also, to the recently activated London Office for Data Analytics Programme, which allowed for increased data sharing and collaboration for the benefit of all Londoners. The *Smarter London Together* roadmap was first set in 2013 —and last updated in 2016, suggesting a new approach to building a smarter London based on collaborative assignments between the city's local authorities and public services. The city's smart strategies incorporate plans to (among others): upgrade transit systems, improve the environment, shrink health inequalities, render housing affordable to all, and stimulate economic development (Table 8).

Assignments:	Strengths:	Best practices:
• More user-designed services • Strike new deals for city data • World-class connectivity and smarter streets • Enhance digital leadership and skills • Improve city-wide collaboration	• City Data (London Datastore) • Data, tech and the environment (CleanTech, FlexLondon) • Data, tech and transport (Transport for London's track record, TfL) • Data, tech and safety (Public Interactive Dashboards) • Data and test-beds (Queen Elizabeth Olympic Park)	• Put people first and respect diversity when designing digital services or adopting new technology • Lead in data innovation but build trust and transparency in how public data is used • Be better connected and open to new techs in the built environment • Strengthen digital leadership in public services and enhance the digital skills and understanding of citizens • Make city-wide collaboration and tech partnerships better to design and share what works for citizens across public and community services

Table 8. Towards a smarter London
Source: Greater London Authority, 2018 www.london.gov.uk/smart-london

[21]Subsection [1.3.3] synthetizes London's Mayors' roadmap to transform London into the smartest city in the world. The report is entitled *Smarter London Together*. Copies of report are available from: www.london.gov.uk/smart-london (The webpage was last visited on 12-27-2019)

1.3.4. *COPENHAGEN, DENMARK*

Copenhagen[22] — in contrast to other analogous cities in the world — is focusing its effort and strength on promoting green-technology use and becoming carbon-neutral by end of year 2025 (Figure 9). Today, the city is viewed as a center for clean technology innovation — being Europe's cleanest (—and healthiest) capital, as well as one of the greenest capitals in the world. Within this framework, as of 1996 up until now, the city has succeeded to condense its carbon emissions by over 50%. Huge investments have been made in this respect, totalizing USD1 billion.

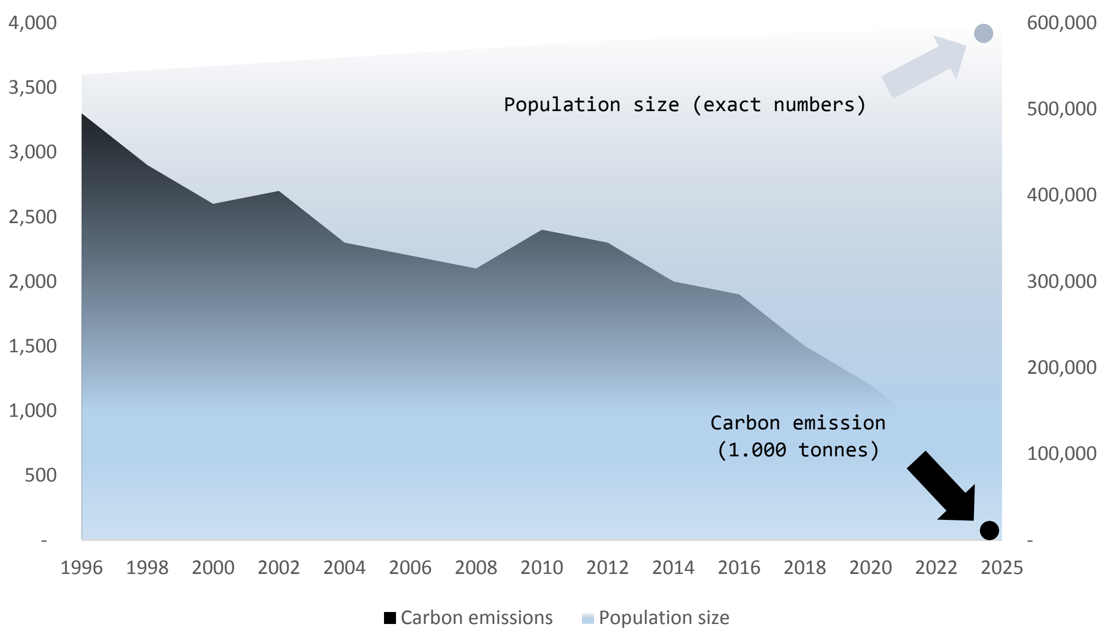


Figure 9. Copenhagen: carbon emission versus population size
Source: Compiled from various sources

Bicycle lanes and super cycle highways were created, enabling half of the city residents to bike (rather than drive) to work or school (Copenhagen's vision is to become the world's best city for cyclists!). Moreover, in order to cure the road congestion snags, the city installed a smart traffic management system to optimize traffic flows; as well, it cheered citizens to adopt modes of green transportation by triggering a dynamic pricing

[22]Data pulled out from a presentation prepared by local authorities, entitled: '*Copenhagen Smart City*'. Available from: http://e97f7d10b0a403e208e5-9fbee7de8d51db511b5de86d75069107.r75.cf1.rackcdn.com/Copenhagen.pdf (The webpage was last visited on 12-27-2019)

model that consists of adjusting toll and parking rates on demand. On another note, Copenhagen has carried on by installing cost-efficient waste collection and recycling systems, allowing the city to recycle half of its wastes, most of which are used to firewood its district heating network (to which 98% or so of households are connected). Besides, the city installed an energy-efficient district cooling system that relies on extracted cold seawater and allows to substantially reducing energy consumption, by nearly 70% relative to a conventional air-conditioning system. (—see Table 9 below for a selective listing of elements of smart city projects and initiatives in Copenhagen)

Smart Projects:	**Smart City Initiatives:**
Work with: — targeted use of data in solving problems — new technology or known technology in new ways — efficient use of the city's resources — new ways of involving citizens or companies	• Cooperation across administrations • Project coordination board ► One *strategi* for smart city • Focus on lighthouse projects — Open city data platform — City map — Big data platform with partners — City solution lab • Mobility projects and intelligent transport systems • Digital infrastructure

Table 9. Copenhagen: Smart projects and initiatives
Source: Compiled from various sources

1.3.5. *SEOUL, SOUTH KOREA*

Songdo international city is part of the Incheon Free Economic Zone —along with Yeongjong and Cheongna. The function of each region is as follows (Sang Keon et al. 2016)[23]:

- Songdo is in charge of international business relating to IT and BT (Business Technology), as well as R&D;

[23] *International Case Studies of Smart Cities: Songdo, Republic of Korea*. Report published in June 2016. Available from: https://publications.iadb.org/en/international-case-studies-smart-cities-songdo-republic-korea (The webpage was last visited on 12-27-2019)

- Yeongjong focuses on aviation logistics, tourism, and leisure; and
- Cheongna concentrates on international finance, high-tech industry, and distribution.

In terms of infrastructure, the area consists of the very famous Incheon International Airport[24] —which operates as the hub airport of northeast Asia. At present, Songdo is still under development with plans to invest a few extra billions until 2022, to furnish the city and harden its infrastructure so it could lodge additional residents in the future. Moreover, as part of the country's project to build a cutting-edge green city, Songdo has been converted into a U-city (Ubiquitous-city) (—see Table 10).

• U-city construction and basis • Public-private partnership corporation	• Construction work • Integrated Operation Center	• Spread public-private partnership service model • Enlarge overseas export
2005-2014	**2015-**	**2020-2022**
U-City Construction Plan — Introduction period	***U-City Construction*** — Construction period	***City Competitiveness*** — Spread period

Table 10. Establishing Songdo city, targets and steps
Source: Adapted from Sang Keon et al. (2016)

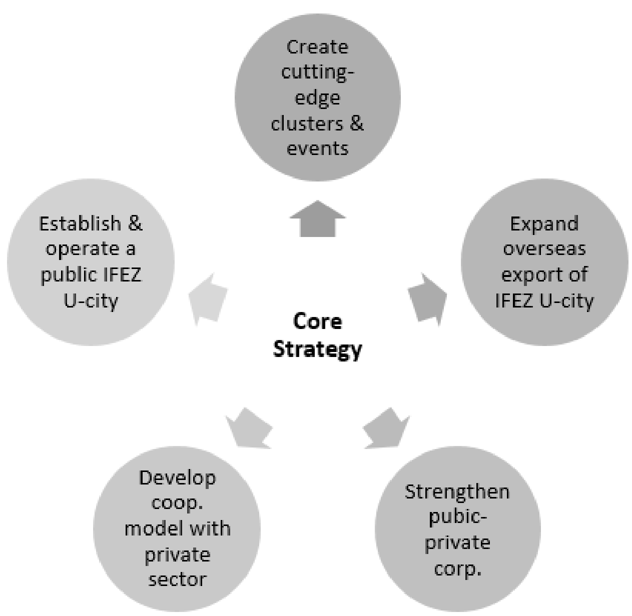


Figure 10. Songdo U-city's core strategies
Source: Adapted from Sang Keon et al. (2016)

[24]Ranked first for airport services (for ten consecutive years) —and second for international cargo transportation.

Largely, the U-city in question is divided into public and private services (Figure 11). Accurately, public services are designed to provide around-the-clock services in various categories (traffic management, and crime and disaster prevention)[25], while private services are intended to offer facilities that would mend the quality of people's day-to-day lives. As for eco-friendly services (U-bike, U-street, U-foreigner Support Mobile Service, etc.), they are offered as specialized services through the city's U-IT platform.

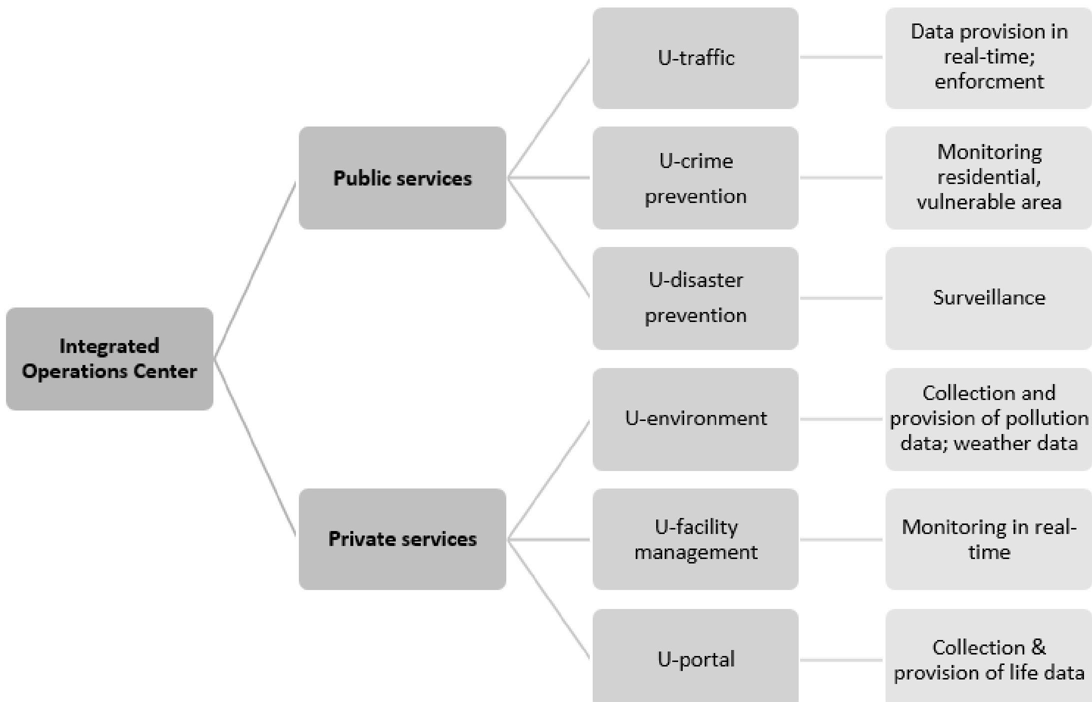


Figure 11. Songdo U-city integrated operations center
Source: Adapted from Sang Keon et al. (2016)

Songdo U-city is conceived based on a top-down managerial approach —and carried out based on comprehensive plans and construction procedures. Tested in 2014, the latter was activated two years later — in 2016. However the U-city looks like a front-line creation today, (sadly!) its present-day structure requires quite a few alterations ex ante the implementation of services. The snags faced arose — we proclaim — due to ample differences in requested versus required levels at both the conception and construction stages of the project. In fact, technologies have been rapidly developed (in the past decade

[25]Songdo U-city collects 24-hours real-time data from on-site equipment such as CCTV, sensor devices, and traffic detectors. Systems in Songdo are being built so that the data gathered could be eventually stored and analyzed in order to provide citizens, tourists and businesses with expedient public offerings.

at least!) and citizens' request levels (standards) have improved (risen) too. And so — apart from the high odds that used technologies might become outdated upon project completion, the plans of related entities and on-site equipment need to be clearly identified as well, so that for example to avoid wasting budgets on duplicate systems.

Before jumping on to the next subsection in which an overview of the size and potential of the global smart city market is presented, we close this one by sketching a comparative table that summarizes the main components of fifteen different smart cities.

Table 11 below shows the similitudes and deviations among various — international — smart city models. If read vertically (▼), scores given to smart cities could be paralleled and frontrunners invited up to the podium. However, if read horizontally (►), a listing of most-versus-least popular smart city components could be proposed[26].

[26]The data shown in Table 11 is only indicational and directional, and could not be, in any way, considered as utterly true. It was compiled for the purpose of the present research project only. It might include slipups and-or inaccuracies.

SMART COMPONENTS ▼		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL (15 PTS.)
A.	**MOBILITY**																
—	Traffic Management		●	●	●	●	●	●	●	●	●	●	●		●	●	13
—	Smart Infrastructure, Roads, Lighting	●	●	●	●				●	●	●	●	●			●	10
B.	**SOCIAL, LIVABILITY**																
—	Community Work, Service	●	●	●		●	●		●	●	●	●	●	●		●	12
—	Safety, Security: Crime Prevention		●		●	●	●			●	●	●	●		●		9
—	Safety, Security: Disaster Prevention		●				●						●		●		4
—	Streets' Cleanliness	●	●		●				●	●							5
—	Facility Management		●						●	●							3
C.	**ECONOMY**																
—	Trade Patterns (Import, Export)																-
—	Job Creation, Opportunity		●								●			●		●	4
—	Technology, IoT, Big Data	●	●	●	●	●	●		●	●	●	●	●	●	●	●	14
—	Inclusive Growth		●		●					●				●			4
D.	**GOVERNANCE**																
—	Open Data, Transparency	●	●	●		●	●		●	●			●	●		●	10
—	City-Wide Collaboration, PPP	●	●	●	●	●	●		●	●	●		●	●		●	12
—	Managerial: Bottom-up Approach		●		●	●			●					●		●	6
—	Human Centricity, User-Designed Service		●	●	●	●			●	●				●			7
—	One Strategi				●					●							2
E.	**PEOPLE**																
—	Education, Talent		●	●		●			●			●		●		●	7
—	Improved Connectivity: In-In, In-Out	●	●	●	●	●	●		●	●	●		●	●		●	12
F.	**ENVIRONMENT, HEALTH**																
—	Less Pollution, Carbon Emission	●	●	●	●	●		●	●	●	●	●				●	11
—	Waste Management, Recycling	●	●		●	●		●	●	●	●	●	●			●	11
—	Green Modes of Transport, Buildings	●	●	●	●		●	●	●	●	●	●				●	11
—	Healthcare						●				●	●	●				4
—	Usage of Renewable Energy		●	●	●	●		●	●	●	●	●				●	10
G.	**OTHER : ADAPTABILITY, FLEXIBILITY**	●	●	●	●	●			●	●	●	●		●		●	11
TOTAL (24 PTS.)		11	21	13	16	14	10	5	17	18	14	12	11	11	4	15	

<u>LEGEND:</u>
1= Barcelona, Spain; 2= Amsterdam, The Netherlands; 3= London, UK; 4= Copenhagen, Denmark; 5= Seoul, South Korea; 6= Singapore, Singapore; 7= San Francisco, US; 8= Helsinki, Finland; 9= Dubaï, UAE; 10= Nice, France; 11= Oslo, Norway; 12= Shanghai, China; 13= Milan, Italy; 14= Lahore, Pakistan; 15= New York, US

● indicates ***main or primary components*** of respective smart city models. Unmarked components are relatively less significant.

Table 11. Components of international smart city models: comparison
Source: Created by the author

1.4. SMART CITY MARKET OUTLOOK

Big cities are now facing growing pressure due to the snowballing motion of urbanization. Therefore, the need for operative solutions for managing urban settlements, and bettering sustainability and livability has eventually led to the global upsurge of smart cities (Chui et al. 2018). In the main, smart cities denote the incorporation of ICT to boost the performance and quality of urban offerings to condense resource consumption and costs[27]. Indeed, global ICT companies[28] have been soundly pushing for the adoption of their technologies —a major catalyst in industry growth. Nonetheless, smart cities are developed and applied to a huge number of different domains —and the smart city market, comprising myriad sectors, is not in any way exclusive to ICT. That is to say that all companies (regardless of the sectors they operate in!) would eventually be constrained to reconfigure their value chains and adapt their business models to up-and-coming market changes.

Driven by industries' renewed interest, availability of technology, and all-inclusive participation of industry stakeholders, the global smart city market is expected to reach USD2.3 trillion by 2023 —and grow at a perpetual CAGR (Compound Annual Growth Rate) of 29% thereafter[29]. As well, estimates by Frost & Sullivan[30] suggested that investments to be made in the smart city market, covering smart solutions that would lead to the adoption by cities of a specific mix of smart parameters, are possibly to bounce to USD1.6 trillion by 2020. Concisely, the global smart city market is segmented based either —on location (Figure 12): North America, Europe, Asia-Pacific, Latin America, and the Middle East & Africa —or on application (domain): building, healthcare, transportation, infrastructure, governance, security, and energy (Figure 13).

[27]The weakness of current economic model lies in the fact that it is not sustainable in the sense that it would reproduce the same negative externalities or dysfunctionalities encountered today (carbon emissions, waste production and urban nuisances)
[28]ABB Limited, Accenture, Ericsson, Oracle Corporation, Hitachi, IBM, Schneider Electric, Cisco, Microsoft, Intel, Honeywell International, Huawei, and Siemens (among others)
[29]Transparency Market Research (2014). Rising trend of automation to drive global smart cities market growth. Available from: https://www.transparencymarketresearch.com/pressrelease/smart-cities-market.htm (The webpage was last visited on 3-4-2020)
[30]Smart Cities: Frost & Sullivan Value Proposition. Available from: https://ww2.frost.com/wp-content/uploads/2019/01/SmartCities.pdf (The webpage was last visited on 1-8-2020)

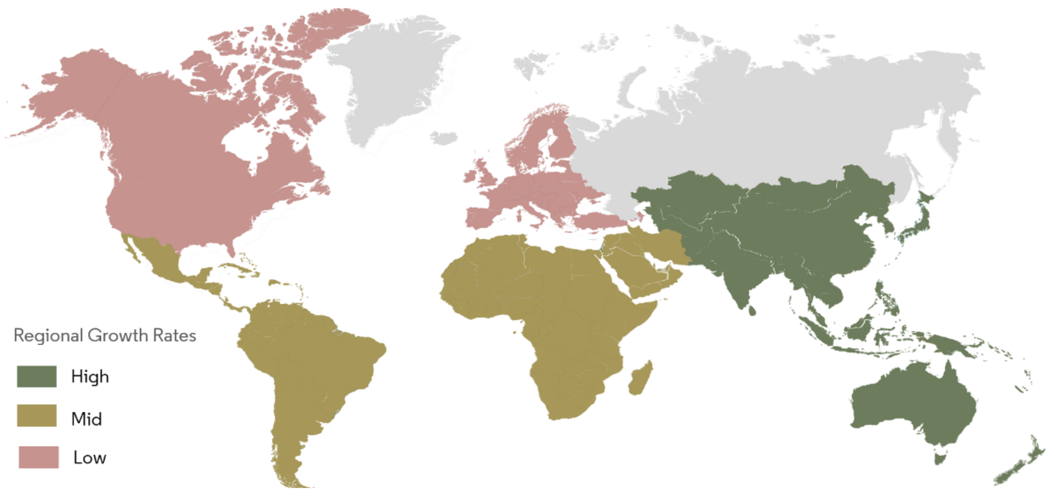
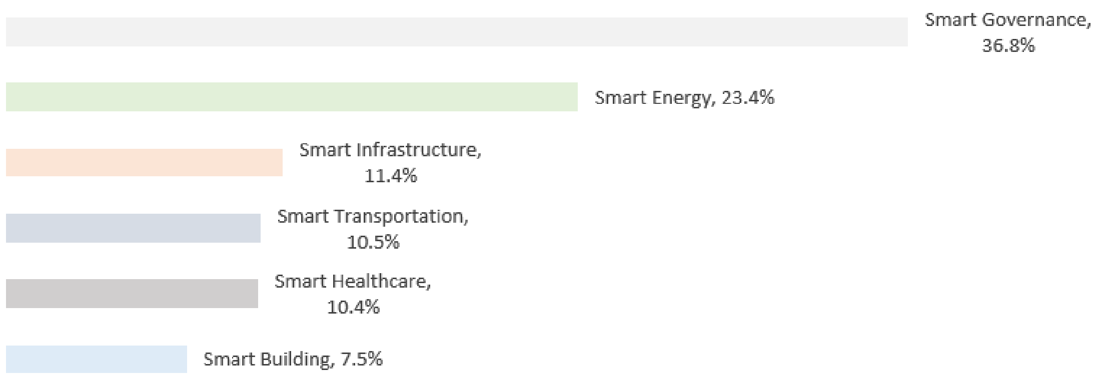


Figure 12. Smart city market: growth rate by region, 2019-24
Source: Mordor Intelligence[31]



• Smart Governance: Market Value: USD1230.26 billion CAGR: 11.6% (2012-25) More projects coming up in North America, MEA and EU	• Smart Energy: Market Value: USD781.66 billion CAGR: 28.70% (2012-25) Highest growth expected in North America	• Smart Infrastructure: Market Value: USD381.53 billion CAGR: 12.0% (2012-25) Highest growth in North America and Asia
• Smart Transportation: Market Value: USD351.13 billion CAGR: 19.6% (2012-25) Market growth in Latin America, MEA, and Eastern Europe	• Smart Healthcare: Market Value: USD348.5 billion CAGR: 8.8% (2012-25) North America to dominate this market with over 50% share by 2025, followed by EU	• Smart Building: Market Value: USD248.65 billion CAGR: 4.1% (2012-25) China & India are the fastest growing markets followed by Japan & Korea

Figure 13. Global smart city market, by segments: 2016
Source: Frost & Sullivan Analysis[32]

[31] Smart Cities Market - Growth, Trends, and Forecast. Available from: https://www.mordorintelligence.com/industry-reports/smart-cities-market (The webpage was last visited on 3-4-2020)
[32] Smart Cities. Frost & Sullivan Value Proposition. Available from: https://ww2.frost.com/wp-content/uploads/2019/01/SmartCities.pdf (The webpage was last visited on 3-2-2020)

Today, the smart city market stands to benefit from initiatives taken by governments, residents, and businesses to implement projects and solve (pending) urban problems (Townsend, 2013). The *Smart Cities Council*[33] is a great example of a business-led initiative — the sector's oldest and largest smart city network — that is sponsoring the interests of its members through advocacy and lobbying actions (SIP-SSC, 2015). Definitely, for city officials, national governments, and supranational states —smart city projects offer the enticing potential of creating more livable, secure, competitive, and sustainable settlements — the reason why they are presently on the lookout for greater-than-before deregulation and privatization (Kitchin, 2014). Within this context, we move on by inquiring: *are all cities vowed to be smart*?

1.5. ARE ALL CITIES VOWED TO BE SMART?

Through their studies of several European cities — Caragliu and Del Bo (2016) acknowledged that every city in the world has the potential to become smart. According to the authors, the smart city model is one of urban development, a go-smart path along which cities could be spotted at divergent positions. Chui et al. (2018) on another note — stated that *smartness* is an ongoing process —and that lots of work is still to be achieved, even by the most advanced cities, to be able to cross the smart-city make-a-thon finish line. *'In fine, a smart city should be labeled by the objectives it intends to achieve rather than the countless solutions it has to offer —and so, a smart city is not a goal by itself, but a means to an end'* they added.

By and large, smart cities cannot be abridged to mechanical solutions implemented within to rationalize operations. This is factual because the latter goes above and beyond to cover a series of factors and-or components which — if efficiently put together — could help cities make better decisions and boost the quality of life of their citizens (Rochet, 2014; Etezadzadeh, 2016). Literarily speaking, *quality of life* is a vague term with loads of magnitudes — going from the quality of the air citizens breathe (environment, pollution), to how safe they feel walking the streets (safety, security), to how fast could they travel

[33]For more information, please visit: https://smartcitiescouncil.com/

between two points (transit, traffic), to how happy they feel in the neighborhoods they live in (sociability, livability), to a whole bunch of different things (Chui et al. 2018). This, to some extent, infers that *smart city* and *quality of life* are two interrelated notions, one leading to the other, both having the same resolves and goals.

Bettencourt et al. (2007) and Harrison & Donelly (2011) insisted on the fact that a city is better off regarded as an *adaptive complex system* — a *system of systems*. Therefore, a given city — a complex living ecosystem of social interactions that is — cannot be deemed smart, unless the synergies and connections between its citizens are also considered to be smart. This idea was originally endorsed by (Dedijer & Jéquier, 1987; Cronin & Davenport, 1991) who bethought *citizens* to be at the heart of smart cities — not as mere receivers of information, but as producers too. At present, after years of trial-and-error, policy makers around the world have finally realized that smart city projects debut and end with people (Chui et al. 2018).

Furthermore, in order to circumvent dysfunctional urbanization (which was a popular sensation in the two past centuries!) — a smart city in general cannot be created in disconnectivity with its territorial history, culture, tradition, and evolution (Etezadzadeh, 2016) —but, on the contrary, it should have its own modus operandi, and be conceived and built based on nation-specific skins. (*Remember*? There is no common model for smart cities development —and a city cannot settle for copying good practices from other cities by importing and applying them *ex nihilo*). Here and now, however the smart city development phenomenon seems to have become viral — a global trend, we point out that its spread was (and it still is!) disproportionate —and here is why:

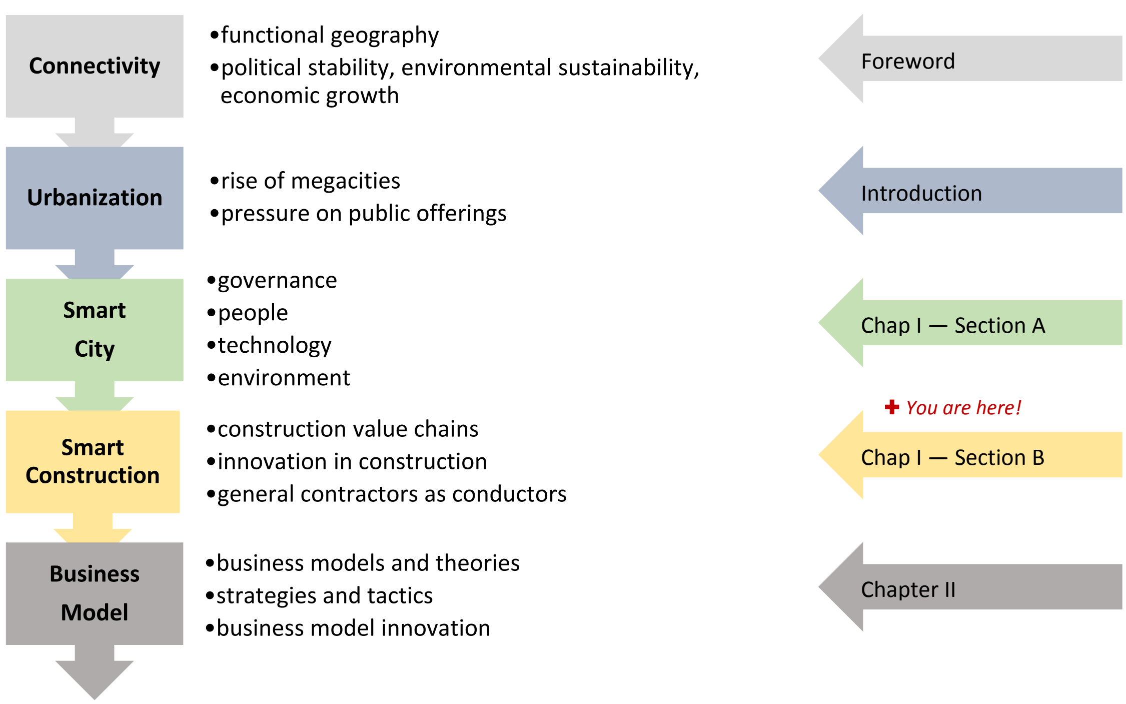
— Consortiums held to support the smart city market have only, at least to-date, focused on specific regions and domains;
— Absence of a systemic model that enables the global adoption of ICT as well as of cohesive smart cities' visions and strategies;
— Growing concerns with regards to data privacy and security;
— Pronounced need among budget-conscious cities to verify ROI (Return on Investment) prior to wider execution of smart plans;

— Lack of multi-stakeholder buy-in —and adequate financial models and resources that would support the development of smart city markets.

And so, we answer: by competently using their own resources and endowments — refining communication infrastructure and web-based services — allotting ample financial resources and adopting appropriate funding schemes — and creating apposite value chains that ensure a fair interplay between stakeholders — all cities around the world could become smart, at skewed rates, each in its own skin.

PARTIAL CONCLUSION A

Up until now, we have shown that *connectivity* is key —and that *functional geography* has taken over. This new reality has reshaped and wired connections between countries; it helped ease political tensions, mitigate environmental risks, and uphold economic growth. Further, we have indicated that people tend to migrate to big cities in search for more connectivity and opportunities. *Urbanization* has become a trend, transforming big cities into megacities, and megacities into smart cities. Long story short — *smart cities* is a combination of smart governments and smart citizens. And the government-citizen bond is lifted by the presence of smart technologies. Literally, big cities are being revamped to resemble smart villages i.e. to merge man, nature, and technology. For the construction of smart cities, we asserted that — there would be need for more *adaptability* and *flexibility*. Through the implementation of a *new business model*, a fair interplay among construction actors could be ensured. And this fair *interplay* is to be sustained, raising Copenhagen's case at this point, by *a strategi*, an entity that could expertly orchestrate complex smart city projects: the *general contractor*.



SECTION B. A GENERAL CONTRACTOR: A MAVEN, A CONNECTOR

This section assesses the role of the general contractor in construction projects; it shows how his influence on a project's final output is likely to vary — increase or decrease — based on contrasting intervention scenarios. This is spot-on because general contractors are often disposed to play a series of roles in construction projects — rather than just one role[34].

Exactly so, instead of enforcing the role of the general contractor, we attempt to describe it as-is, factually and objectively. All other things being equal, we demonstrate how a general contractor could fundamentally contribute to the success of large construction projects in general, and of smart developments in specific.

Structured sequentially — this section's narrative pours as follows:

- It starts with a description of the construction industry value chain, followed by a listing of change agents that enabled improved value creation in construction in recent years; a portrayal of old-versus-new construction value chains and processes is also exposed. Additionally, for the purpose of complex construction processes (smart constructions), a concise *innovation in construction* overview is presented;

- Then, the role/s of the general contractor are introduced —and enlightened. And analogies between *general contractors* and some other construction actors for the administration of smart developments are suggested;

- We conclude by exhibiting how *general contractors* and *music conductors* are unusually very much alike.

[34]Two Sides of the Same Coin? The Differences between General Contractors and Construction Managers. Available from: https://jobsite.procore.com/construction-manager-vs-general-contractor-roles-differences/ (The webpage was last visited on 1-15-2020)

1.1. NEW VALUE CHAINS IN CONSTRUCTION

Essentially, value chain is a model of the corporate value forming process introduced by Michael Porter back in 1985 (Porter, 1985). Used for decades to understand and analyze industries, it has been treasured for its capacity to portray the chained linkage of activities that exist within traditional industries. By definition, value chain analysis is a process where companies pinpoint their primary and secondary activities that add value to their final products and services, and then scrutinize these activities to diminish costs or boost differentiation (Peppard & Rylander, 2006). Therefore, basically, value chain represents the activities that companies engage in when transforming inputs into outputs.

As products and services have become ever more dematerialized, and value is more-than-ever-before being created in networks and alliances (rather than by solitary stakeholders), the focus has progressively shifted towards *value networks*, denoting the co-creation of value by an assemblage of actors in the network. Referring to Santoni and Taglioni (2015), a value network is a business analysis perspective that describes social and technical resources within and between businesses; it exhibits interdependence and accounts for the overall worth of products and services.

Afar from the *value network approach*, a superlative concept has newly emerged that is, the *shared value concept* — positing that value creation should not solely benefit companies and-or customers, but the society in its entirety. As expounded by Porter and Kramer (2011), companies, by (naïvely!) concentrating on the expansion of their short-term financial benefits, have a tendency to overlook the utmost unmet needs in the market and broader influences on their long-term success. As a result, they remain ensnared in a nonoperational, constricted approach to value creation. Also, they time-and-again disregard the depletion of natural resources, the viability of suppliers, and the economic agony of the communities in which they operate — all being key factors, responsible for their business success on the long run. Similar conclusions could be found in Stabell and Fjeldstad (1998). Indeed, the authors avowed that a threefold value configuration analysis (*value chain*, *value shop*, and *value network*) is required for one to be able to examine and comprehend the logic behind firm-level value creation, not only in the realm of the construction industry, but across a series of other industries and sectors. (—see Table 12 for an overview of alternative value configurations)

	Chain	**Shop**	**Network**
Value creation logic	Transformation of inputs into outputs	Re-solving customer issues	Linking customers
Primary technology	Long-linked	Intensive	Mediating
Primary activity categories	▪ Inbound logistics ▪ Operations ▪ Outbound logistics ▪ Marketing ▪ Service	▪ Problem-finding and acquisition ▪ Problem-solving ▪ Choice ▪ Execution ▪ Control, evaluation	▪ Network promotion and contract management ▪ Service provisioning ▪ Infrastructure operation
Main interactivity relationship logic	Sequential	Cyclical, spiraling	Simultaneous, parallel
Primary activity interdependence	▪ Pooled ▪ Sequential	▪ Pooled ▪ Sequential ▪ Reciprocal	▪ Pooled ▪ Reciprocal
Key cost drivers	▪ Scale ▪ Capacity utilization		▪ Scale ▪ Capacity utilization
Key value drivers		▪ Reputation	▪ Scale ▪ Capacity utilization
Business value system structure	▪ Interlinked chains	▪ Referred shops	▪ Layered and interconnected networks

Table 12. Alternative value configurations
Source: Adapted from (Stabell & Fjeldstad, 1998)

As one of the world's largest consumer of raw materials (—contributing to roughly 40% of global GHG emissions)[35], the construction industry is expected to grow steadily, 2018 thru 2023, at an annual rate of 4% — in terms of market value, with major growth prospects in residential, commercial, and infrastructure projects (Gawer & Cusumano, 2014). This anticipated growth along with the imperative toward decarbonization have created the impetus for *sustainable construction*. Today, construction companies are becoming more accountable for their contribution to global emissions —and so, are facing societal pressures to make negative externalities smaller and find practical ways

[35]2018 Global Status Report - Towards a zero-emission, efficient and resilient buildings and construction sector. Available from: https://www.worldgbc.org/news-media/2018-global-status-report-towards-zero-emission-efficient-and-resilient-buildings-and (The webpage was last visited on 1-15-2020)

to decrease their carbon footprint. Likewise, Lehdonvirta et al. (2009) asserted that the construction industry has actually transformed into a service business, and construction companies are now seen as mere service providers, which infers that the era of technical specification and cost minimization is briskly ending. (We nevertheless remain hopeful by acknowledging that there are ample technology-driven prospects for the heightening of customer value creation in construction)

Figures 14 and 15 shown below, respectively map the actual supply and value chains in construction — as presented by Vrijhoef and Koskela (2000).

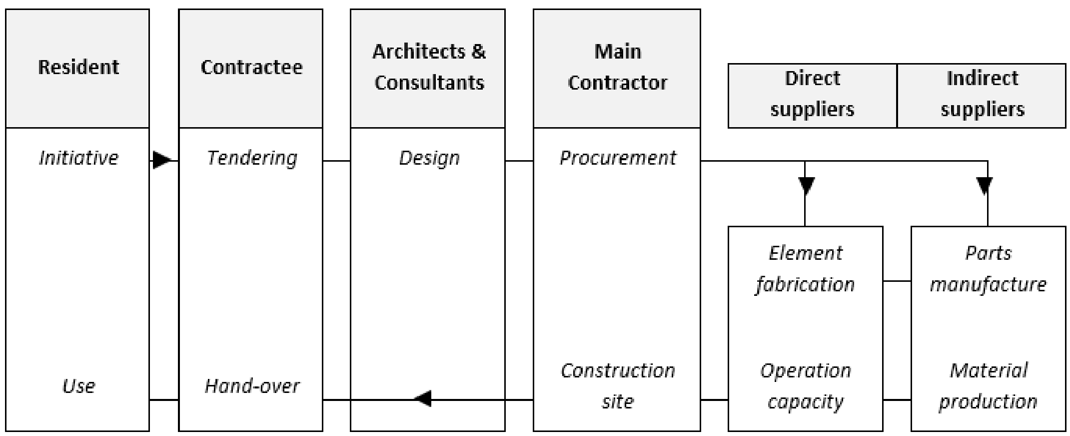


Figure 14. The actual construction supply chain
Source: Adapted from Vrijhoef and Koskela (2000)

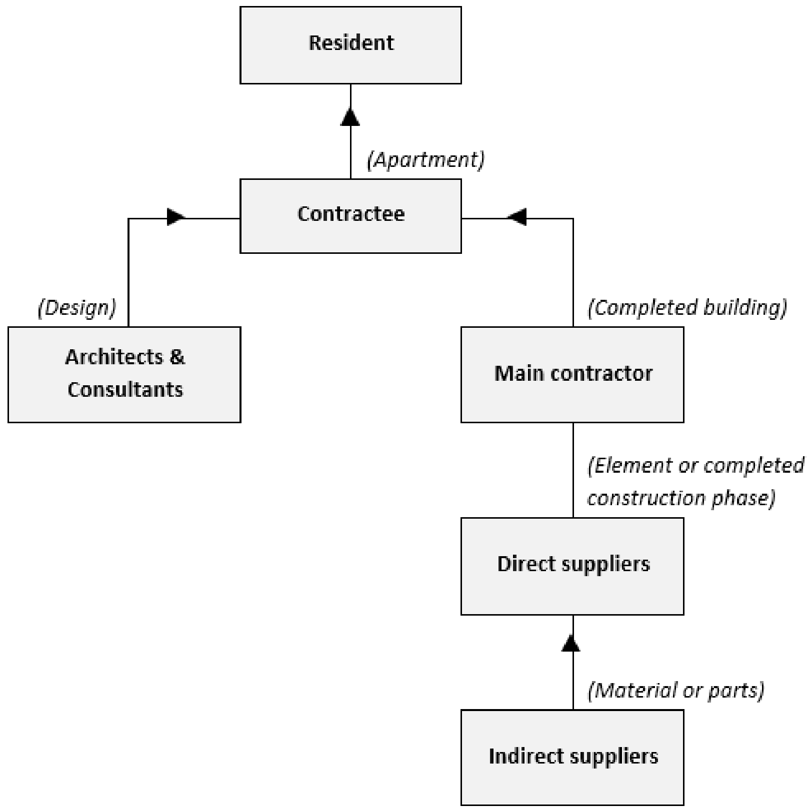


Figure 15. The actual construction value chain
Source: Adapted from Vrijhoef and Koskela (2000)

Moving forward, we curtly describe some of the change agents that latterly gave value creation in the construction industry a significant boost (―see Table 13).

(―see subsection [1.8] for further insights into *innovation in construction*)

Additive Manufacturing Technologies (AMTs) —or— 3D Printing Methods	▪ Campbell et al. (2012) summarized the benefits that could ensue from the adoption of AMTs by companies, namely: customization, improved functionality, reduction of total amount of parts and aesthetics; ▪ AMTs have been forecasted to revolutionize the construction industry (3DRS, 2015); ▪ Lim et al. (2012) estimated the potential advantages of AMTs for construction and came up with the following list: increased freedom of design, reduction in mold costs, and integrated functionality of individual components; ▪ AMTs enable the cost efficient manufacturing of large, geometrically complex, unique components, from materials applicable to construction; ▪ AMTs are highly relevant for the construction industry as it is directly linked to logistics, customization, virtual models, and manufacturing.
Virtual Reality Technologies (VRTs) —&— Augmented Reality Technologies (ARTs)	▪ Several projects have employed VRTs/ARTs in visualizing BIM[32] models (—see Figure 16); ▪ VRTs/ARTs are changing manufacturing, and enabling mass customization on a formerly unpreceded level; ▪ Used to visualize 3D models in future construction sites, they help guide real-world construction activities (Behzadan & Kamat, 2005); ▪ Consumer products enabling VRTs/ARTs have been announced by prominent ICT companies, such as: Samsung, Sony, and Google.
Multi-Sided Platforms (MSPs)	▪ MSPs connect two or more sides of the market via online services, benefiting from network effects; ▪ They act as a foundation upon which external innovators could develop their own complementary products, technologies, or services (Gawer & Cusumano, 2014); ▪ Well-known examples of MSPs — disturbing traditional business models — are: Uber (taxi services), Airbnb (accommodation services), and Amazon (retail services); ▪ MSPs thrive on data-driven customer understanding, enabled by faster innovation capabilities and greater profits than industries' averages in general (Weill & Woerner, 2015).

Table 13. Change agents in the construction industry
Source: Created by the author — compiled from various sources

Without a doubt, new knowledge and high-tech have been (and they still are) creating competence-based growth and breakthroughs in some of the nascent fields of today's society: artificial intelligence, robotics, navigation, and data analytics. And the across-the-board adaption of these applications — (we believe!) — would eventually have the knack to transfigure the entire value chain of construction (—see Figures 16 and 17).

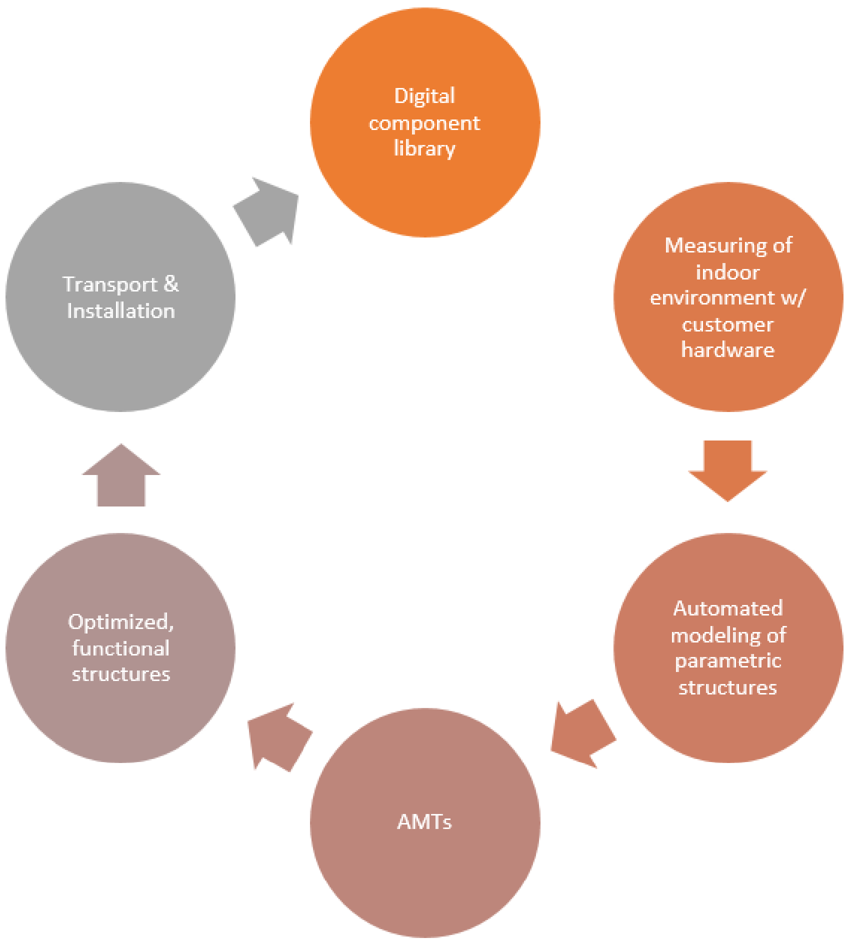


Figure 16. The future of construction process
Source: Adapted from Virtanen et al. (2014)

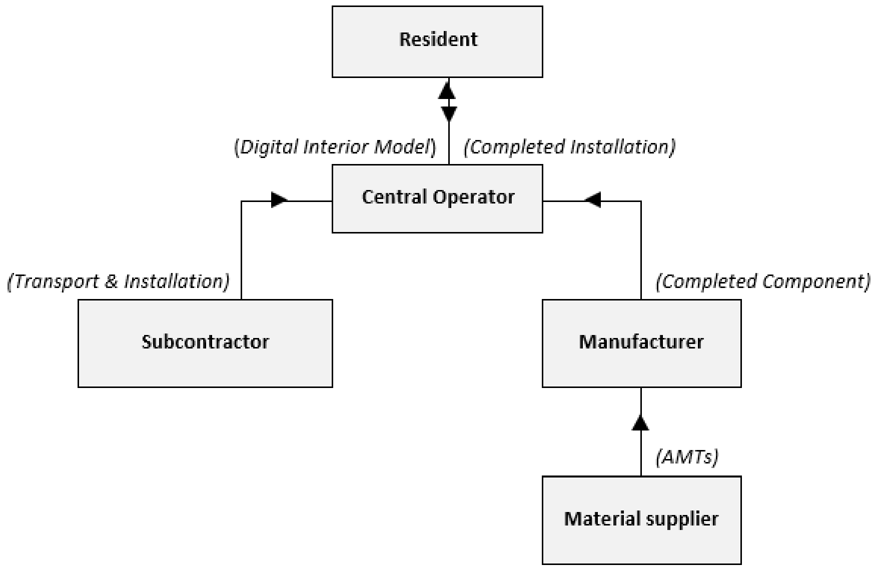


Figure 17. The future construction value chain
Source: Adapted from Virtanen et al. (2014)

When looking at the construction value chains (actual vs. future one), one could straightforwardly see that the variances lie in the beginning —and later parts— of the chain.

Economically, this suggests an incremental upsurge of value in trifling steps —to hasty upsurge of value in one jump. Commentating Figure 17 (—relative to Figure 15), the *central operator*[36] has noticeably more control over the manufacturing process in terms of both scheduling and price determination. Moreover, the amount of logistics and pieces held in storage are condensed, ensuing in subordinate quantities of resources being tied in the process. For clients (residents) and designers, the amount of customizability is amplified —and so, fewer conciliations are to be made to fit the design to the offerings of manufacturers. In the last parts of the chain, the central operator turns into a central stakeholder. For small-sized operations, the roles of designer, manufacturer and contractor may be merged into one. This is enabled by the clients —providing the digital data of the site, the use of IoT —enabling clients to make some design decisions, and the use of AMTs —for the production of more complex components. Overall, the amount of

[36]Also known as *online contractor* — the equivalent of a *general contractor* — as labeled in this research project. Kindly refer to subsections [1.4] and [1.5] in Section B for more insights into the roles played by *general contractors*. A detailed explanation of the *general contractor* business model for the construction and management of smart cities is available in Chapter 4.

stakeholders involved in the construction process is curtailed, prompting fewer communication and procurement steps.

Currently, the analysis of future construction value chains remains subject to numerous reservations —especially that the forecasts made, often deemed unsatisfactory, account for technical developments only. In addition, it seems very optimistic to assume that a single value chain could serve all situations encountered in the construction industry. That is, retrofitting a single apartment — and building a new residential area — are inherently distinct projects — of different scales, and comprising dissimilar producer-customer rapports. Thus, it is baloney to believe there is a common value chain, which could flawlessly fit all types of construction projects (Virtanen et al. 2014).

1.2. THE CONSTRUCTION PROJECT LIFECYCLE

Every stakeholder involved in the process of scheduling, scheming, sponsoring, building and operating physical facilities related to construction projects, gain different viewpoints over time on project management for construction (Figure 18). Indeed, the contribution of proficient knowledge could be very advantageous, predominantly when it comes to large and complicated projects (smart developments). In the same way, it is of foremost importance for all stakeholders to comprehend how the different constituents of a construction process are connected together.

As conveyed by Hansen and Birkinshaw (2007), the poor coordination and communication among stakeholders could eventually result in waste, excessive costs, and unsolicited delays. And it is typically the responsibility of the project owner (and to a lesser extent the project manager) to assure that such flaws do not take place. Egbu (2008) found that the implementation of the project owner's viewpoint would help stakeholders to focus on the completion of the project by paying close attention to the details of the process of project management for construction projects. Indeed, this would abate the old concept of bringing decisions based on the bygone roles of stakeholders involved in the project (e.g. project owners and managers, architects, general contractors, and others).

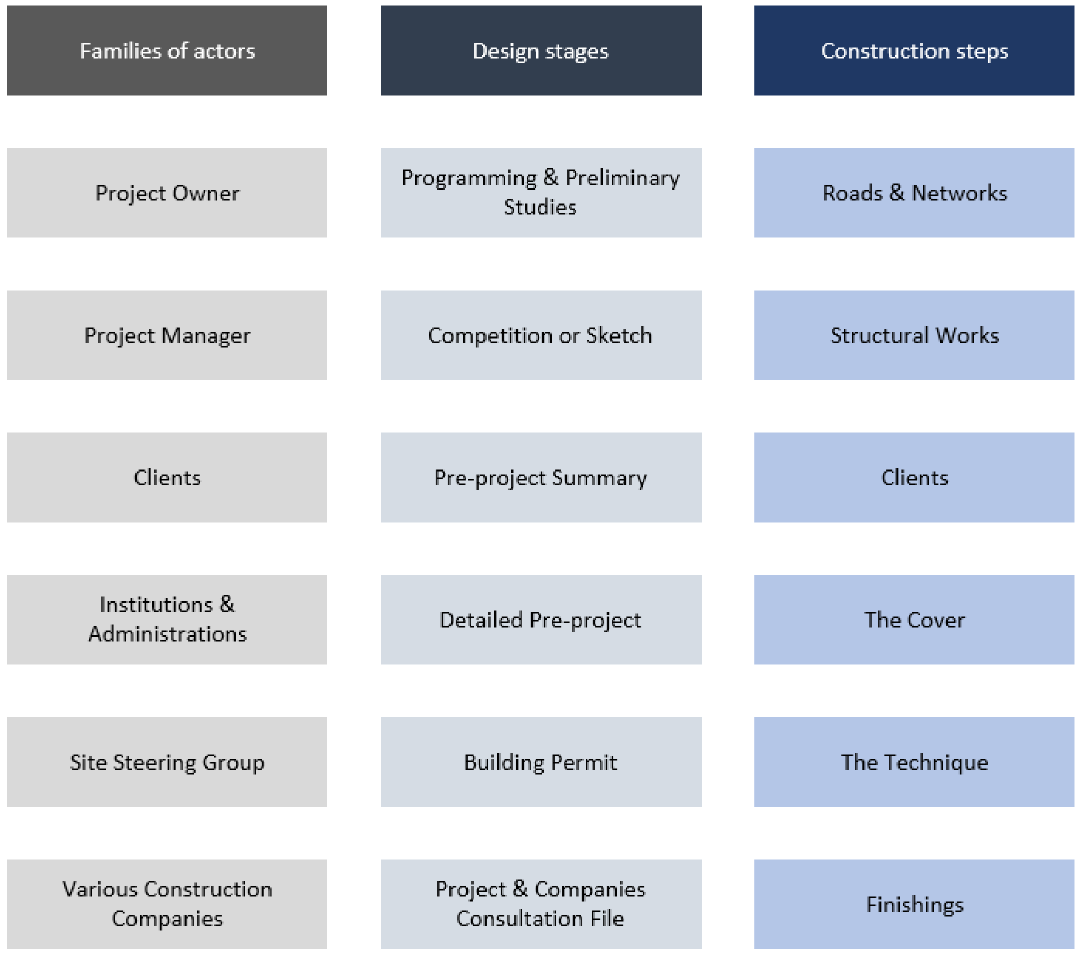


Figure 18. The building blocks of a construction project process
Source: Adapted from Direction des Immobilisations & Cloutier (2005)

Following this logic, stakeholders would contribute their proficiency through opinions in improving the productivity and quality of their works. Adding that for construction actors to be able to induce substantial improvements, they must first know the construction industry, its working environment and the institutional constraints affecting its activities, as well as the nature of project management (Carassus, 2004). It is therefore astute for project owners to have a perfect understanding of the whole construction process to sustain company control of the quality, suitability, and budget of the finalized project.

The typical CPLC — represented in Figure 19 — consists of five major phases, explained in Table 14. On a side note, see Figure 20 for a complete view of a construction management process.

In practice — based on the nature, size and urgency of the project — these development phases may not be firmly sequential, as some of them might require iteration, while the others could be carried out in overlapping timeframes. Further to that, it is worth asserting that project owners are conceivably to gain in-house capacities to handle the works in every phase of the construction process. Yet, if impossible to do so, they tend to outsource part of — or the entirety of — the jobs, by requesting external expert services — those of a general contractor or a construction manager for instance — to conduct and monitor the works carried out in each and every phase of the project.

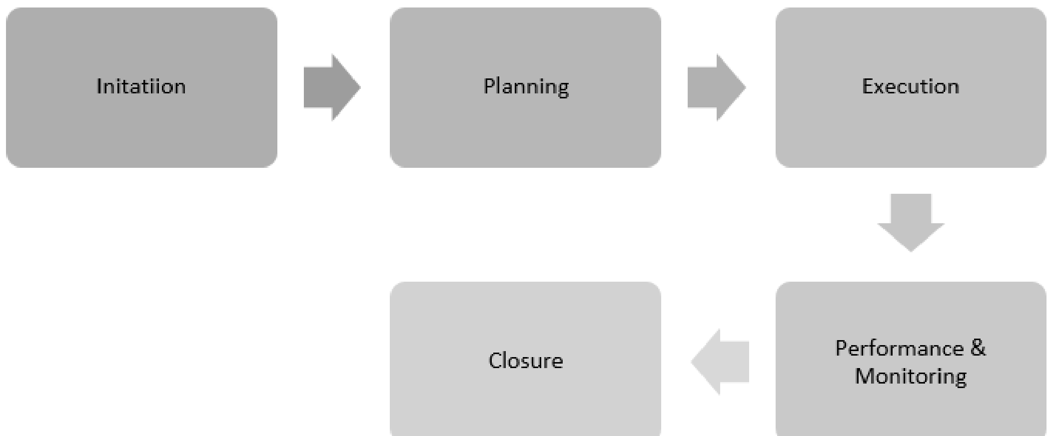


Figure 19. Major CPLC phases (a)
Source: Compiled by the author[37]

[37]Top Five Project Management Phases. Available from: https://project-management.com/top-5-project-management-phases/ (The webpage was last visited on 1-25-2020)

I	Initiation	▪ Identify objectives or needs ▪ Carry out feasibility study ▪ Initiate project to implement approved solution/s ▪ Appoint 'project manager' ▪ Identify major deliverables and participating work groups
II	Planning	▪ Identify all of the works to be done: tasks, resources, and strategy ▪ Build a project plan outlining activities, tasks, dependencies, and timeframes ▪ Scope Management: Coordinate project budget (cost estimates for the labor, equipment, and materials) by project manager ▪ Monitor cost expenditures during project implementation ▪ Provide quality targets, assurance, and control measures ▪ Define acceptance plan, listing the criteria requested by customers
III	Execution	▪ Put project plan into motion ▪ Perform assigned tasks (by construction actors) ▪ Communicate work progress through regular team meetings ▪ Compare progress reports with project plan to measure the performance of project activities ▪ If needed, plan corrective measures (to bring the project back to the original plan) ▪ Keep key stakeholders (including project owners) informed about the project's status ▪ Indicate possible end point in terms of cost, schedule, and quality of deliverables in status report ▪ Review deliverables for quality, against acceptance criteria
IV	Performance & Monitoring	▪ Measure progress and performance of project activities (in tandem w/ execution phase) ▪ Trak project activities with project management scheduling
V	Closure	▪ Provide final deliverables to 'client' ▪ Handover project documentation to the business ▪ Terminate supplier contracts ▪ Release project resources ▪ Communicate closure of the project to stakeholders ▪ Conduct lessons-learned studies to examine what went well and what went wrong

Table 14. Major CPLC phases (b)
Source: Compiled by the author[38]

[38]ibid

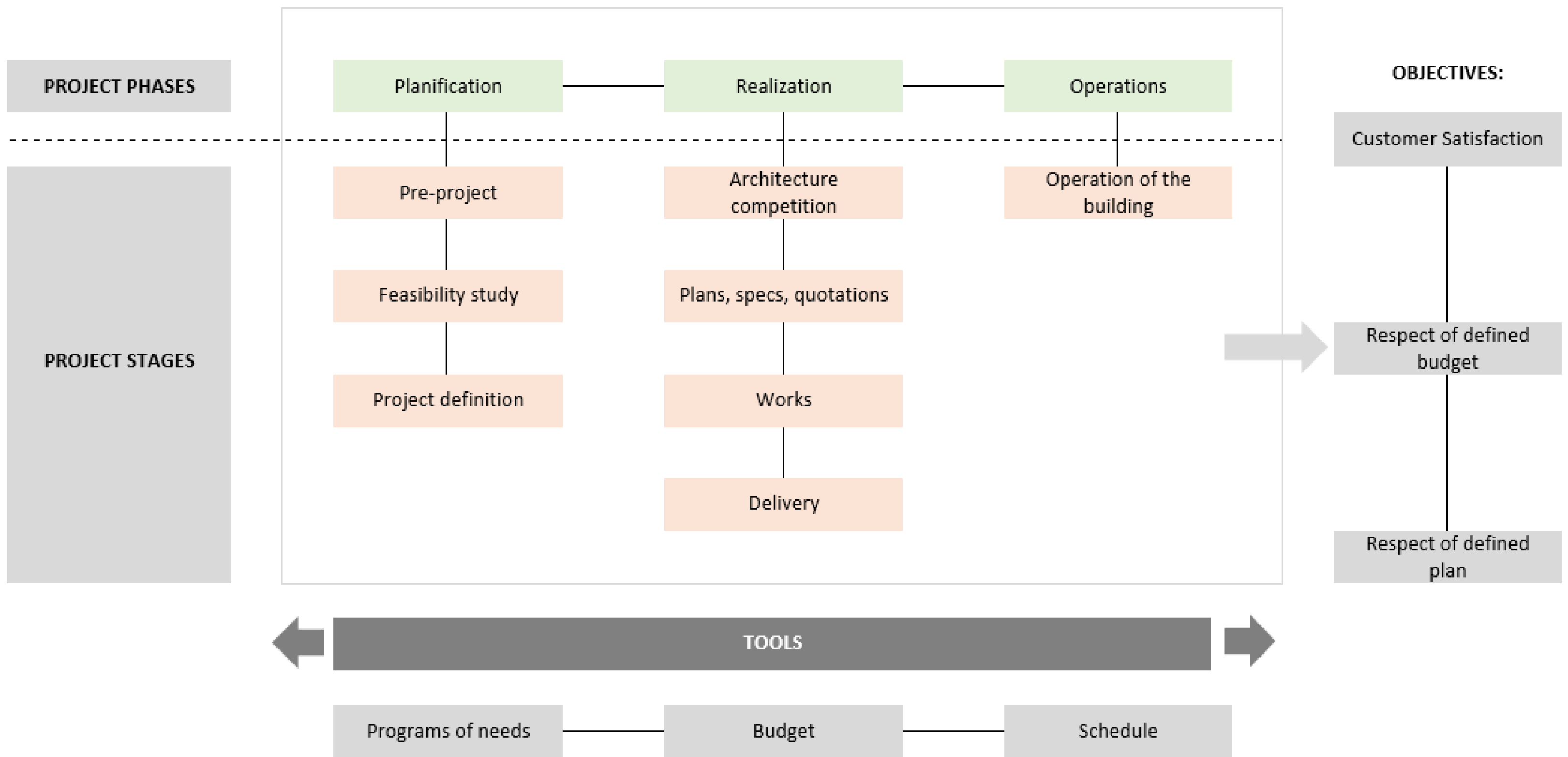


Figure 20. The construction project management process
Source: Created by the author

1.3. INNOVATION IN CONSTRUCTION

Innovation could be a key source of competitive advantage for construction companies (Slaughter, 2000). Yet, the construction industry provides an example of a sector within which customary measures do not echo the real extent of the innovative activity that is occurring —and is often seen as one of the less inventive sectors (Barrett et al. 2007). This discernment, we proclaim, is possibly unwarranted because much of the inventiveness remains out of sight, as it is co-developed at the project level. Being a project-based and disjointed industry, the arrays of innovation in construction are divergent from those of others. Though a sizable amount of research has been performed in this respect to-date, more research is still needed to investigate different types of original activities carried out throughout the CPLC.

As per Gann and Salter (2000), project-based companies need to competently manage their project processes and business models since their resources are embedded at both project- and company-level. *'It is the mixing of these two collections of resources that enables the company to be competitive'* they added. On another note, Brusoni et al. (1998) indicated that business models are ongoing and repetitive —whereas project processes are more likely to be temporary and unique, the reason why companies must incorporate the experiences of projects into their perpetual business models to ensure the coherence of their businesses.

At the moment, there is a swelling tendency to consider a broader view of innovation in construction, one that resonates the many ways in which innovation occurs in practice. Damanpour's (1992) definition of innovation is fittingly inclusive: *'it is the adoption of an idea or behavior, whether a system, policy, program, device, process, product or service, that is new to the adopting organization.'* Phillips (1997) on the other hand, distinguished between technological innovation and organizational innovation. For the author, the former incorporates substantial technological improvements in products and processes —whereas the latter comprises major changes in organizational structures. By the same token, Slaughter (1998) suggested five innovation models ranging from incremental innovation — which is a slight change based upon current knowledge and skill, to drastic innovation — a breakthrough in technology that alters the character and nature of an industry. A few years later, Blayse and Manley (2004) emphasized that construction is partly manufacturing and partly services industry. And that the characteristics of innovation in the service industry are different than those in the manufacturing industry.

As a weighty economic variable, the measurement of innovation has enticed lots of attention in academic circles in recent years. However, due to the intricacies of construction processes in general, evaluating innovation remains a difficult task to fulfill. Generally, construction is a very diverse sector and there is no precise way in which innovation occurs. As per (Lansley, 1996), the occurrence of innovation within the construction industry is often characterized by the extensive adoption of new practices because of advances in technological processes and business models. For (Barrett et al. 2007), innovation could be observed at three different levels — the sector-, business-, and project-level — with the sector-level being the most visible type while the project-level is the most concealed one. *'The construction sector is an interlocked system involving many stakeholders — among which clients who have the potential to act as innovation creators'* the authors alleged. In this context, clients could spur innovation in construction by:

- Exerting pressure on the supply chain partners to improve overall performance (Gann & Salter, 2000);
- Helping them to devise strategies to cope with unforeseen changes[39];
- Requesting high standards of work (Barlow, 2000); and
- Recognizing explicit and pioneering requirements for a project (Seaden & Manseau, 2001).

Knowledge provision, operative leadership, and dissemination of innovations are too, among the key roles that clients could play in this respect (Egbu, 2008).

[39] ibid

(As formerly noted—) The existing literature on innovation in construction neglects project-level innovations, for the most part due to snags encountered when trying to monitor different activities carried out by stakeholders in each phase of the project. As put by (Marceau et al. 1999), the management of innovation in construction is convoluted by the sporadic nature of project-based production in which, repeatedly, there are broken learning and feedback loops. For that reason, we believe that a deeper understanding of the different types of innovative activities carried out throughout a CPLC is necessary to enable their effective application and management —and consequently, value creation that could ultimately benefit everyone and everybody.

1.4. THE GENERAL CONTRACTOR

Following the copious readings I did —as well as the several investigations I have carried out in my assiduous search for some real and relevant information about general contractors, I could now resolutely corroborate that the existing academic literature on the matter is quite meager. This is true given that all of my attempts to gain insight into the role of general contractors in general — and in construction management services in specific — have unluckily reached a dead end.

However, for the purpose of building this subsection, I have conducted some extra analyses and succeeded to draft a text that comprises ample real-world information about general contractors, specifically: what do they do, how do they compare to other construction actors —and, following a Freakonomics-style thinking to business[40], what do they and music conductors have in common —and why is this so important. The ensuing narrative is drafted based on secondary data, pulled out from specialized magazines, websites and blogs — including talks held with peers who — alike myself — are whizzes in the building and construction industry. In some parts of the text, I step in by voicing my personal standpoint to elucidate some technical nuances that would have otherwise remained elusive.

[40]For more information, please visit the following website: http://freakonomics.com/archive/ (The webpage was last visited on 1-25-2020)

1.4.1. *ROLES & RESPONSIBILITIES*

GCs (General Contractors)[41] could serve a construction project from many different roles and positions. Naturally, the responsibilities of GCs vary depending on the size and complexity of construction projects[42]. Indeed, GCs are responsible for a plethora of details in the course of a given construction project. Finding the right talent to get the job done is imaginably one of their most central missions, not the only one though. Today, there are lots of discussions about the varied roles that GCs could play in a project (Figure 21). And there are so many instances of GCs who spread themselves too tinny in an endeavor to satisfy different types of projects and clients (—see Table 15). Fascinatingly enough, a crucial shift in that direction is currently on the go[43].

By definition, a GC is a stakeholder —an entity or a person— who manages the construction work in its entirety, supervises daily activities at the construction sites, and ensures all construction works are carried out properly. Moreover, a GC supplies the labor, building materials, machinery, raw materials —and all the other kits needed for the successful completion of construction works in general. For industry experts, the GC is a 'central operator' who proposes made-to-measure solutions to clients, and expertly manages worksites, tradespeople, deadlines and budgets[44]. Typically, GCs are hired via a bidding process. Regularly, the lowest qualified bid is selected for the job. The GC's set price is based on the contract terms and the construction drawings. Should the GC disburse less than its bid, then it would profit on the differential. On the contrary, if the GC's bid is over budget, then the project owner would be as well over its budget limit (from start) —and would need to adjust it accordingly [either by paying extra money to cover the costs, changing the project's specs, or reducing its scope — which enlightens why the rapport between the GC and the owner is habitually seen as a competitive one] (Yang et al. 2010).

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[41] Sometimes referred to as: *Main Contractors*

[42] Important Facts You Need to Know About a General Contractor. Available from: https://construction.laws.com/general-contractor (The webpage was last visited on 1-25-2020)

[43] Who is a Contractor (definition)? Available from: https://www.letsbuild.com/blog/contractor-role-duties (The webpage was last visited on 1-25-2020)

[44] What is the role of general contractors in construction work? Available from: http://www.accconstruction.ca/what-is-the-role-of-general-contractor-in-construction-work/ (The webpage was last visited on 1-28-2020)

Adding that GCs do not always have the required expertise for completing all construction works by themselves. For that reason, they maintain a network of specialized subcontractors. (GCs' have their own construction value chains!) GCs are the *big picture thinkers*[45]; they are involved in construction projects from the inception phase to the delivery of final product —whereas subcontractors (for instance) step in to fulfill particular tasks (e.g. concrete formulation, plumbing, electricity, carpentry) —and then step out as soon as the tasks are completed.

Among others, GCs' role involves upholding direct contact with clients to keep them instructed on work progress —as well as with other construction actors (architects, engineers, and others) throughout the whole CPLC.

On another note, often, GCs handle hiring and are liable for instructing new workers on the specifics of the job. To be sure, in any project, there are a number of codes, laws, and regulations that GCs must abide by at all times. They must follow applicable labor laws, including organized union contracts under which their staff work —and must be aware of safety regulations for various jobs and equipment operators. The GC is hence responsible for guaranteeing all of these situations are fittingly handled, whether they encompass securing medical attention for an incapacitated worker, locating backup equipment —or expediting a supply order. When work progress is delayed, the GC must look for ways to get the project back on original track. This is imperative because delays in construction projects are frequently very costly (Ramanathan et al. 2012).

Contract wise, project owners may possibly add a no-damage-for-delay clause in the contract signed, thus, frequently, shifting the burden of risk for delays to the GC. Hence, by rereading the above-mentioned, one could openly attest that:

— It is very complicated to suggest a precise definition for the role/s and duties of a GC (due to the versatile services that GCs are capable of providing!);
— Yet — quite easy to ratify that GCs are both mavens (experts in the field of building and construction) and connectors (orchestrating the works of all construction actors).

[45]Interview with Raymond Vigneau, Owner of Metal Building Contractors, Inc. Available from: https://home.howstuffworks.com/home-improvement/construction/planning/why-hire-a-contractor1.htm (The webpage was last visited on 2-5-2020)

We lastly point out that the advent of high-techs (IoT, big data, and others), and the upsurge of smart constructions and initiatives around the world — coupled with the pains that the construction sector has been facing in terms of project delivery — have altogether paved the way for scripting (and endorsing) a new job role description for GCs.

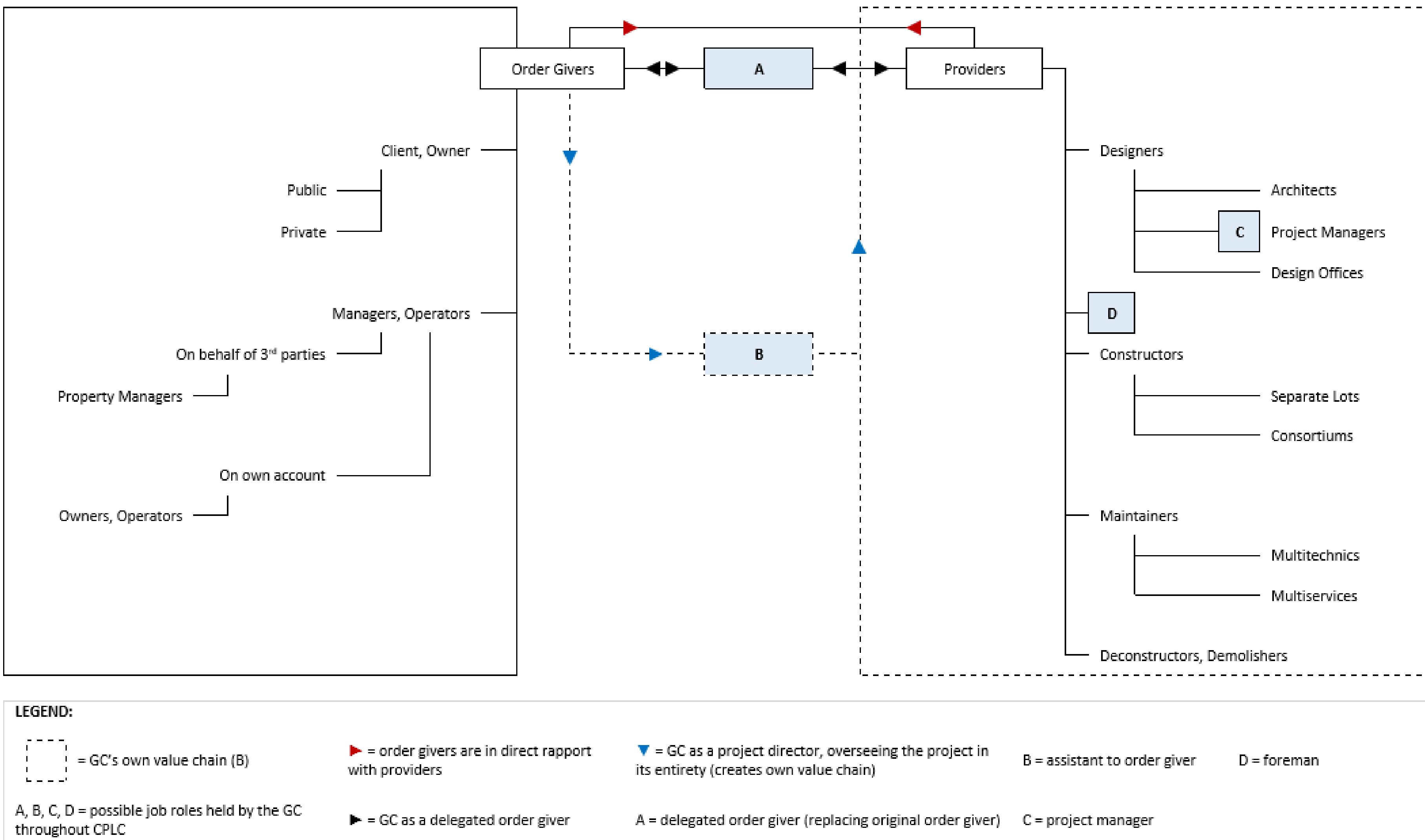

Figure 21. Construction sector: Organigram

Source: Created by the author

SCENARIO:	A	B	C	D
Job role title:	*Delegated Project Owner*	*Assistant to Project Owner*	*Project Manager*	*Foreman*
Involvement:	More	←	→	Less
	Early parts of value chain	←	→	Later parts of value chain
Intervention:	France-based construction operators, sizeable general enterprises in specific, due to the copious operational and managerial issues they are facing while executing full-scale, smart developments, are now endorsing such roles. This is indeed the case of *Bouygues Construction* —and *Vinci Construction*.		As conveyed earlier, GCs play several roles and hold different positions along the construction value chain. Such roles could be performed by GCs at any time —and in any project, regardless of its type or size.	
Added value — Overall contribution to the success of the construction project:	Very High	High	Mid-to-High	Low
Level of challenges encountered:	Nil	Insignificant	Moderate	Extraordinary
Selective list of challenges encountered:	None	Trivial operational issues	One or more of the challenges listed below could be bumped into under scenarios C & D: ▪ Disregard of defined plans ▪ Cost or budget overrun ▪ Scheduled timeline overrun ▪ High risk of technological obsolescence upon delivery of project ▪ Liability concerns as to who is responsible of what ▪ Criticism of final product (by clients) ▪ Customer dissatisfaction	

Table 15. General contractors' roles
Source: Created by the author

1.4.2. *GENERAL CONTRACTORS VS. OTHER INDUSTRY ACTORS*

GCs, in contrast to other construction actors, have the potential to play several roles and hold various positions — A, B, C, or D — within the construction value chain. In view of that, the contribution of GCs' to the overall success of construction projects is likely to fluctuate, go up or down, based on whether they are consigned to interfere at the very early stages of the chain —or in later parts. The challenges faced by GCs are by the same token possibly to vary based on intervention stage/time. Put simply, the higher (earlier) the involvement of GCs in large-scale construction projects in particular, the lesser the challenges encountered at later stages would be. As well, the lesser the odds that time and cost flouts (among others) would arise as the execution of works progresses.

As shown in Figure 21 —and then expounded in Table 15 — a GC's added value would be hypothetically maximized under scenarios A and B —mainly because he will be given the prospective to create his own value chain, and manage the different parts of the project on his own, in the best way possible, in conformity with the owner's requirements. Within this framework, GCs would have utmost control over all the aspects/attributes of the project, manage all construction services as they see fit, and consequently be able to deliver the project on time and within budget. If the opposite happens that is, should any defies arise (divergence from original plan), they would then be the only ones to assume the entirety of ensuing costs. Under scenarios C and D however, GCs have marginal contribution to the success (or failure) of a construction project —and so, cannot be held responsible for any of the operational snags that they might come across, but those directly linked to their mandates.

We carry on in our investigation by exposing the roles of two industry actors, namely: *construction managers* and *project managers*, in terms of what they do and how do they compare to GCs.

1.4.2.1. *CONSTRUCTION MANAGERS*

A large construction project prompts a cacophony of various sounds —due to the large number of intervenors immersed in it. And for those intervenors to create beautiful tunes together —a conductor is needed for guidance and direction. For owners, attaining the looked-for outcomes on a full-scale project is a big defy that they take on a daily basis. Coordinating the many layers of subcontractors, suppliers and other personnel —among the other numerous factors to look after and account for— is a balancing act that requires attention and fortitude. (We believe—) The people who could accomplish these key tasks fall into one of two roles: GCs (General Contractors) or CMs (Construction Managers).

The ultimate goals of both roles are practically the same that is, to put all of the puzzle pieces together and execute the design according to what the project owner wants and what regulations demand. Indeed, GCs and CMs have the same objective of completing the project to the satisfaction of the owner[46]. However, have you ever marveled about the dissimilarities between GCs and CMs? They might look as if they have the same jobs — yet how similar are their jobs really? Despite the apparent similarities between the two, a GC and a CM go about their roles a bit differently, as each one of them has his own set of unique financial structures and duties —and so, strategies for the safe and proficient execution of construction projects in general. Other key differences have to do with their organizational structures, how they are selected for — and their entry points to — projects, as well as their associations with project owners[47].

Commonly, GCs and CMs are considered to be the main contractors on the job, offering contrasting ways to building projects. And the decision to appoint either one of them: *chief conductor of the orchestra* — depends upon the owners' partialities which could vary on a project-by-project basis. Anyhow, for everyone to work off the same music sheet, in harmony with the owner, seems to be a fundamental thing (—see subsection

[46]Two Sides of the Same Coin? The Differences between General Contractors and Construction Managers. Available from: https://jobsite.procore.com/construction-manager-vs-general-contractor-roles-differences/ (The webpage was last visited on 1-25-2020)
[47]Construction Managers vs. General Contractors: What is the Difference? Available from: https://esub.com/construction-manager-vs-general-contractor/ (The webpage was last visited on 1-28-2020)

[1.10] for a rogue analogy between GCs and music conductors). But why do project owners tend to favor CMs over GCs? The answer is simple. Owners prefer to work with CMs because of the personal relationships they have developed with them over the years —and their appreciation of — and familiarity with — their work.

Nonetheless, it is not unusual for a GC to act as a CM. Truly, a GC who handled a few projects for a given project owner —and developed a certain bond with that owner, could be afterwards, perchance, asked to operate on a new project as a CM. The drive for doing so is less about money —and more about trust and a preference for the style and substance of how the GC constructs. This overlay between the two roles — that is, GCs acting concurrently as GCs and CMs — (we believe!) has a best-of-both-worlds benefit, especially for owners, in that it evades the now-and-then confrontational rapport between them and GCs while upholding GCs' close ties with subcontractors[48].

Table 16 exhibits the CM-GC (Construction Manager-General Contractor) project delivery method as an alternative to other methods: D-B-B (Design-Bid-Build) and D-B (Design-Build).

As per (Arthur, 2017), the use of CM-GC and D-B methods has substantially increased in recent years. *'These methods are hands-on routes for curbing construction project durations, delivering projects more expertly and speedily, and founding early cost certainty during project delivery'* the author added. Equally importantly, Le Masson and Weil (2009) —and Rosati and Conti (2016) explained that the CM-GC method — being either best value or qualifications-based — allows for owners, designers and-or architects, as well as GCs to work together to tweak the scope of construction projects and make rational project management decisions.

In addition, Flyvbjerg (2014) admitted that, under the CM-GC method, GCs are not nominated, at least not anymore, through passive bidding processes —but based on valid credentials, past performances and success records.

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[48]What is the Difference? General Contractors vs. Construction Managers. Available from: https://www.suretybondsdirect.com/educate/general-contractor-vs-construction-manager (The webpage was last visited on 1-28-2020)

Level of Design Completion	*Fully developed scope*	***Jointly developed scope***			*Undeveloped Scope*
Project Delivery Method	*D-B-B*	***CM-GC***			*D-B*
Procurement Procedure	*Low Bid*	***Best value***	***Qualifications-based***		*Sole Source*
Payment Provision	*Unit price, lump sum*	***Max. Price***		*Cost Plus Fee*	*Cost Reimbursable*

Table 16. Project delivery system spectrum
Source: Adapted from Gransberg and Shane (2015)

1.4.2.2. *PROJECT MANAGERS*

In construction, project completion is always the ultimate goal, but achieving project completion in an efficient and timely manner could sometimes be challenging, requiring the intervention of a PM (Project Manager). Hence, we ask: What do PMs actually do? And how do they compare to GCs?[49] Both GCs and PMs play a key role in construction projects. While PMs execute their duties at a somewhat higher level, ensuring that there is coordination between different entities in a construction project — GCs too, coordinate between different employees, specialists, and subcontractors they work with to ensure that projects are successfully completed. Consequently, while both actors carry an obligation to bring different bodies underneath them together, GCs and PMs operate at different levels in the construction management process. This is in fact a source of confusion for people trying to figure out what set these two management positions apart.

For small- to medium-sized construction projects, the owner (client) could possibly choose to work with a GC who will not only perform much of the construction works

[49]General Contractor vs. Project Manager. Available from: https://gillilandcm.com/2018/12/06/general-contractor-vs-project-manager/ (The webpage was last visited on 1-28-2020)

—but also help coordinate between different parties involved in the process and serve as the focal point of contact for the client. Nevertheless, status quo, for larger projects, the coordination of different entities involved in the project would be the duty of the PM.

Despite some similarities in their roles, (as you might have guessed by now!) PMs and GCs remain poles apart. Generally, PMs are accountable for high-level coordination of construction projects. Unlike GCs, which are chiefly responsible for the actual physical construction of a project (partially or wholly), PMs work closely with all parties involved in a project to ensure that the owner's goals have been met, the project has persisted under budget, and the project is delivered on time. PMs serve in their role as team leaders and primary liaisons with the client. As for clients, they tend to closely work with a project management team —so that the scope and goals of a project are clearly defined, the so-called strategic plan development process. When creating a strategic plan, the PM and the client join forces to define the scope of the project, the desired completion timeline, and budget. Besides crafting a budget that aligns with the client's expectations, PMs are also liable for implementing that budget and ensuring the project remains on (or below) budget throughout the whole CPLC. (This is central because large construction projects are infamous for running over-budget)

Ceteris paribus, a competent PM would ultimately add value to a given construction project by defining an all-inclusive budget that incorporates all expenditures, capital and operational, and by sticking to that budget over time. Furthermore, PMs oversee the execution of projects and assemble the teams that would complete them. Assembling teams is often carried out by issuing a *request for proposal* to concerned entities: architectural, engineering, and general contracting companies. During this process, PMs are expected to perform a certain level of due diligence to ensure the companies chosen have experience with similar project types, as well as the needed qualifications and KB (Knowledge Base)[50] to fruitfully complete the assigned project. Subsequently, PMs

[50]A KB is a technology used to store complex structured and unstructured information used by a computer system.

oversee contract negotiations to guarantee that the scope of the project, budget and timeline are clearly understood by all parties in the project team (—see Table 17).

GCs	• Are typical business entities; • Have their own complement of staff — pool of subcontractors; • specialize in certain types of construction and in certain construction sectors; • Are chosen via bidding processes and involved during construction and in the daily direction and operation of projects; • Ensure that all works are completed properly and on time; • Complete physical works onsite with the help of their teams of construction workers; • Could serve as CMs and be involved in construction projects early on as an advisor (this is factual when there is an established rapport between them and the owners; in this case, GCs no longer need to submit competitive blind-bid proposals but realistic ones based on insight into the development of the design).
CMs	• Could be an individual, a group of people, or an organization; • Are selected based on qualifications and experience (rather than bids); • Are paid on a fee-based pricing — get a percentage of the total project cost (no competition for profits like with GCs); • Are brought on at the very beginning of the project providing input on the design and working with subcontractors to provide accurate costs and timeframes; • Uphold collaborative, win-win rapports with the owners and tend to work exclusively for them; • The people on staff with CMs are estimators, accountants, or other professionals with duties that come into play before, during, and after a project; • Are involved during pre-construction and work with the design architects; • Work with onsite managers who handle the projects during construction; • Advise owners and lead construction workers; • Are responsible for setting/keeping schedules and monitoring finances.
PMs	• Are involved in all aspects of the construction project, including pre-construction activities, construction administration and post-construction; • Understand the clients' objectives and priorities, and ensure that all project consultants are in line with these objectives; • Manage staff according to target capacity, budget, timeframe, and quality of project; • Are on-site throughout the entire project —and in comparison to GCs and CMs, they oversee it from pre-construction to closure; • Are possibly, under particular settings, to supervise CMs and/or GCs on behalf of clients.

Table 17. General Contractors v. Construction Managers v. Project Managers[51]

[51]The difference between a Project Manager, Construction Manager and General Contractor. Available from: https://watchdogpm.com/blog/the-difference-between-a-project-manager-construction-manager-and-general-contractor/ (The webpage was last visited on 1-29-2020)

1.5. HOW DO GENERAL CONTRACTORS RESEMBLE MUSIC CONDUCTORS?

(Talking music! —) Conducting is the art of guiding the concurrent performance of several players[52] through hand gestures, usually with the aid of a baton[53]. Put differently, conducting is a means of communicating directions to musicians during a performance[54]. Actually, there are many formal rules on how to conduct properly —as well as a range of conducting styles that are perhaps to vary based upon the education and complexity of the conductor. In general, a conductor's prime aim is to unify performers, set the tempo, ensure well-timed entries by ensemble members, execute clear beats, listen analytically and shape the sound of the ensemble, and control the pacing of the music.

(As you would have thought!) Communication is nonverbal during live performances —yet, it is verbal during rehearsals —where conductors may stop the playing of a piece to orally request some style changes or ask for adjustments in the tone of a certain section.

In an orchestra, the smallest instrument is the piccolo which is a half-size flute, while the strings are the largest family of instruments —and come in different sizes: the violin (being the smallest), followed by the viola and the cello, and the double bass (being the largest). Referring to Figure 22 shown thereafter, the first chair violin, generally the best violinist of all, sits to the music conductor's left, next to the spectators. He is the 'concertmaster' — the leader of the violin section — who, in smaller orchestral settings, has the potential to lead the ensemble on his own —hence, to act as a music conductor.

[We hope you can sense by now the concealed resemblances between the roles played by conductors and concertmasters (owners, PMs, CMs, and GCs), and how these roles are conceivably to change based on the size of the orchestra (construction project)!]

[52] A full-scale orchestra playing a symphony comprises over ninety musicians, while a smaller orchestra playing a chamber piece for instance, includes 45 musicians tops.
[53] Louis Spohr claimed to be the first to introduce a conducting baton to England in the 1820, but reports indicate that Daniel Turk conducted the Halle Orchestra with a baton ten years earlier — in 1810.
[54] The conductor of an ensemble. Available from: https://www.liveabout.com/what-is-a-conductor-2456662 (The webpage was last visited on 2-1-2020)

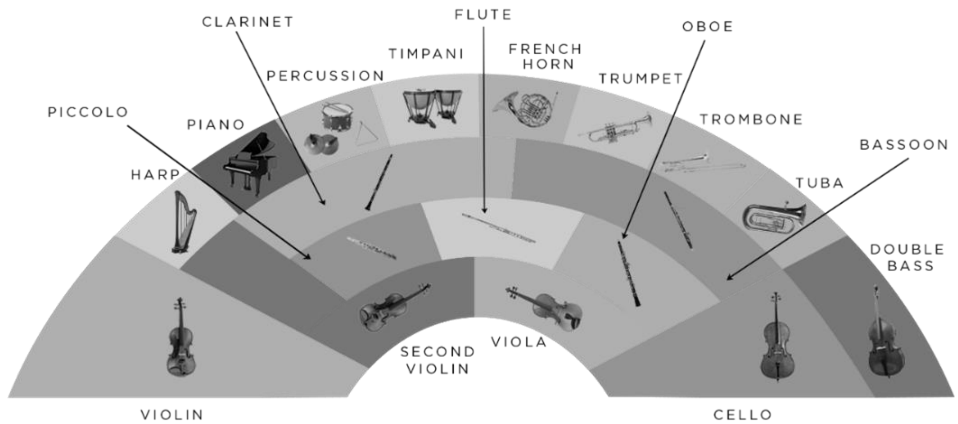


Figure 22. Sections of the orchestra[55]

In the music industry, a conductor is occasionally referred to as a director —or chief conductor. Other conductors, chiefly those who lead choirs, are at times titled choral directors, chorus masters —or choirmasters. Conductors of concert (military or marching) bands on the other hand, keep hold of a variety of designations: band directors or bandmasters. And senior music conductors are routinely called maestros. (BOOM! GCs are given several names too: main contractors, prime contractors, head contractors, and others)

Now that we know just a little bit more about orchestras and music conductors, we may proceed by asking the following peeping questions[56]: Why orchestras are structured the way they are? Why do not the oboes and tubas sit in the front? Why do not flutes and violins swap positions? Why do not trombones and French horns sit right up front with the music conductor? In fact, (we believe!) there is pretty much of a good reason for why everything we experience (in life) is the way it really is —and the orchestra's seating arrangements are no exception. In an article[57] for The Florida Times-Union, Courtney Lewis — the Jacksonville Symphony Music Director — gave a concise enlightenment for why players sit where they do. According to Mr. Lewis, '*orchestras owe their present-*

[55]Sections of the orchestra. Available from: https://www.thinglink.com/scene/682291240225472514 (The webpage was last visited on 2-1-2020)
[56]Why the orchestra is seated that way? An explanation. Available from: https://www.wqxr.org/story/why-orchestra-seated-way-explanation/ (The webpage was last visited on 2-1-2020)
[57]ibid

day configuration to two phenomena (surprisingly!): industrialization and urbanization.' *'The current seating arrangements are a fairly contemporary development'* he said.

Until the 20th century, the violins, first and second, were seated opposite each other, for the most part to create a *stereo effect* with the two sections playing off one another. A few years later, the influential conductor — *Leopold Stokowski*[58] — showed up. Mr. Stokowski was an alchemist; he tried seating the orchestra in every conceivable way in an effort to find the perfect amalgam of resonances. (This is actually the onus of the central operator who efforts to bring all construction actors together in order to create beautiful melodies rather than mishmashes of conflicting sounds)

But it was only in the 1920s that Stokowski made a modification that stuck. Trusting that all violins should be placed together to help the performers hear one another better, he proceeded by organizing the strings from high-to-low and from left-to-right. The *Stokowski shift* — as it then became known (—a new orchestral structure)[59], was espoused by orchestras all over America. In the UK, the same arrangement was favored a few years later, leading to its general adoption across the country. This structure, though unpopular at first, did gain influence and power over time. And the outcome? (You guessed it right!) Composers from around the world started writing music pieces that took advantage of this arrangement. (Hooray! New business structures seem to be as contagious as viruses)

Reverting back to conducting, a conductor must comprehend all elements of musical expression (tempo, dynamics, and articulation) —and have the ability to communicate them effectively to an ensemble (This is also true for entities consigned to lead construction projects!). The talent to communicate nuances of phrasing and expression through gestures is likewise a prerequisite for one to becoming a competent conductor[60]. This is indispensable because dynamics in music are often signaled with hand gestures and communicated by the size of the conducting movements —with larger shapes

[58]He served as the music director of the Philadelphia Orchestra.
[59]The equivalent of a new business model — or value chain — in construction.
[60]What is the career path to becoming a conductor? Available from: https://www.connollymusic.com/stringovation/career-path-to-become-a-conductor (The webpage was last visited on 2-1-2020)

representing louder sounds. Moving forward, the indication of entries — that is, when a performer (or section) should begin playing — is called *cueing* (—corresponding to when-and-how each construction actor is supposed to intervene throughout a CPLC). A cue prognoses with cert the exact moment of the coming beat so that all players affected by the cue could start playing in chorus. A cue is vital to indicate when performers should change to a new note. And cueing is achieved by engaging the players before their entry and executing a clear preparation gesture, often directed toward the specific players[61]. (The latter statement explains why strategic project management plans are so important)

To sum up, conductors act as leaders to the orchestras they conduct; they choose the works to be performed and study their scores[62]. Nevertheless, within particular frameworks, they could also handle a series of executive tasks (e.g. schedule practices, plan concert seasons, hear auditions and choose participants, and promote their ensemble in the media). Indeed, the role/s that a music conductor could potentially play vary greatly between different conducting positions and ensembles. (We hope you are being able to keep count of the numerous similarities between GCs and conductors)

In some cases, a conductor could be the musical director of the symphony, choosing the program for the entire season. In other cases, the conductor could attend some or all of the auditions for new members of the orchestra, to ensure that the runners have the required playing style and tone, and meet the highest performance standards. Under different settings, conductors could be simply hired to prepare a choir for a number of weeks, which will afterwards be directed by another conductor. A bunch of other conductors on the other hand — could have a substantial public relations role, giving interviews to the local news channel and appearing on talk shows to promote the approaching season concerts. (It is clear that music conductors, very much like GCs, play different roles and stand at different positions along the musical value chain)

[61]What is a music cue? Available from: https://www.mediamusicnow.co.uk/information/glossary-of-music-production-terms/what-is-a-music-cue.aspx (The webpage was last visited on 2-1-2020)
[62]An orchestral score shows all parts of a large work, with each part on separate staves in vertical alignment, and is for the use of the conductor. Thus, the conductor could see at a glance what each performer should be playing and what the ensemble sound should be.

Once again, we wonder: Why is there even a music conductor at all?[63] [Traditionally, all orchestras played without conductors, directed by concertmasters. It was only at the start of the 19th century that orchestras got big enough for a conductor to be necessary. Indeed, year-over-year, orchestras have turned into very large affairs. Alike stakeholders involved in large and complex construction projects, every musician in a full-scale orchestra could have a dissimilar idea of cueing, speeding, and playing. Therefore, the main reason for a music conductor is to interpret the music and allow performers to get through the piece played seamlessly, without stopping. Furthermore, a conductor ensures that all instruments are impeccably orchestrated so that none of them ends up being drowned out].

Before closing, let us first envision how [the last paragraph] would read (or sound like!) if we are to talk about GCs rather than conductors? By swapping a few words only, the following narrative could be retrieved:

— (Traditionally, all construction projects were administered without GCs, directed by project owners. It was only recently that construction projects got big (smart) enough for a GC to be necessary. Indeed, year-over-year, construction projects have turned into very large affairs. Alike performers in contemporary orchestras, every stakeholder in a full-scale construction project could have a dissimilar idea of planning, scheduling, budgeting, and construction management services. Therefore, the main reason for a GC is to oversee construction works and allow for stakeholders to get through the project being built seamlessly, on time and within budget. Furthermore, a GC ensures that the tasks fulfilled by construction actors are impeccably orchestrated so that none of them ends up being drowned out) —

Astonishing, right? Anyhow, regardless of whether you appreciate this made-up reconciliation between GCs and music conductors, no one could negate that the resemblances between the two are exceptionally flagrant (—see Table 18).

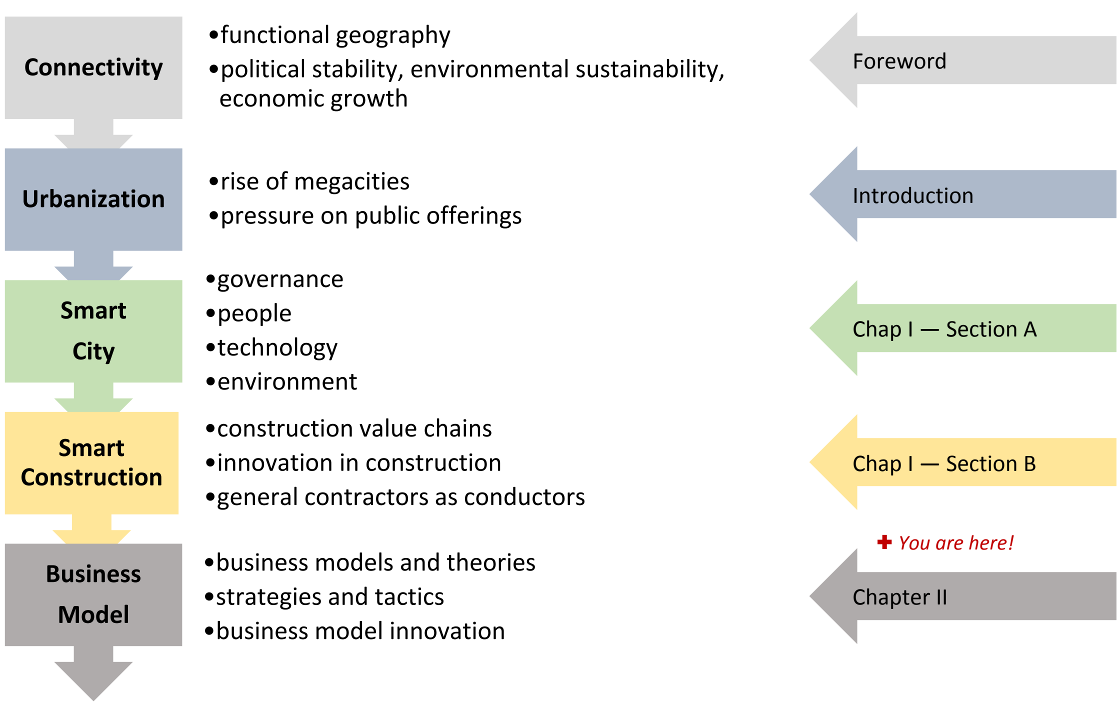
[63]Why do orchestras need a conductor? Available from: https://www.classicfm.com/discover-music/instruments/conductor/what-does-a-conductor-actually-do/ (The webpage was last visited on 2-1-2020)

	General Contractors ▾	Music Conductors ▾
Involved in:	All types of construction projects, counting large ones too (e.g. smart constructions)	Symphony orchestras and philharmonics, large ones mainly.
Other given titles:	Main contractor, primary contractor, prime contractor, and others	Chief conductor, main conductor, senior conductor, maestro, and others
An expert:	Yes	Yes
A connector:	Yes	Yes
Main duties:	• Supervise and manage the execution of construction projects • Communicate with stakeholders at all times to keep them informed about work progress and potential snags • Have their own networks of construction actors • Conduct pilot tests and feasibility studies • Direct and (co-direct) projects (scenarios A & B) • Decide on construction project management processes • Ensure fair interplay between all stakeholders • Handle nontechnical tasks (e.g. scheduling, planning, following-up with clients)	• Ensure the accurateness of musical pieces and symphonies performed • Communicate with musicians at all times, during performance, through hand gestures to keep them orchestrated • Recruit instrumentalists • Run rehearsals and auditions • Conduct (and co-conduct) concerts • Select entire music programs • Make sure all performers are playing harmonically • Handle managerial tasks (e.g. scheduling, planning, interacting with the audience)
Objectives:	• Customer satisfaction • Deliver project on time and within budget • Bringing construction actors together to create an interlocked working system	• Audience satisfaction • Deliver great performance by setting the right tempo and shaping the sound of the ensemble • Unifying performers to create one sound, one orchestra

Table 18. General Contractors versus Music Conductors
Source: Created by the author

PARTIAL CONCLUSION B

Thus far, we have shown how the co*nstruction value chain* has evolved with the upsurge of *innovations in construction*, paving the way for the intercession of a new actor, the *central operator*. The latter is to act as a *music conductor*, harmonizing the performance of all industry players so that large-scale, smart developments end up being impeccably built. Following Stokowski's bearing, we have also established that a single value chain is unimaginably to fit all types of projects, hence the need to conceive new ones (one or more) that could ensure a better interplay between instrumentalists, including ICT companies and end-users. Similarly, we have evidenced that *business models*, being more perpetual than *construction project processes*, are grandly decisive of companies' long-term business success. Additionally, we have ascertained that GCs are both mavens in the field of construction —and connectors, possessing their own networks of backers. Pretty much like music conductors, GCs are frontrunners with the ability to play various roles and hold different positions athwart the construction industry's value chain (CMs, PMs, assistants to project owners, delegated project owners).



CHAPTER II. ON BUSINESS MODELS

This chapter examines the existing academic literature on *business models*. This is fundamental because the prime aim of our study is to design a new business model that would be a better fit, say more appropriate for the handling of large construction projects. The business model that we intend to build is that of a general contractor (strategi or central operator) who would be consigned (by a project owner) for the administration of smart developments, from conception until delivery of final product. Yet, for this to be conceivable, we, as a starter, endeavor to comprehend the specificities of business models —and then search to recognize the various paths to business model innovation. In other terms, we intend to describe the rationales based on which companies seek to create and capture value in various settings (economic, social and environmental) —and elucidate the process of business model innovation which, we believe, is part of a company's open set of business strategies. With that said, Chapter 2 is structured as follows:

- First, the business model notion is clarified — an overview of the most prominent representations of business models is presented — and the relationship between different sets of business model arrangements and value creation is embarked upon;
- Next, we demonstrate how business models are forthrightly linked to a company's business strategies —and, as a result, are decisive of its business tactics;
- Then, the process of business model innovation —as a means for crafting, applying and authenticating new business models— is explicated; also, we pinpoint the major gaps in the research on business model innovation today;
- Finally, we close by providing some real-world business model innovation examples —and by discussing the best managerial practices that could help executives in general, and those in the construction industry in specific, to take business model innovation to the level of a consistent and corrigible discipline.

2.1. DEFINITIONS

Almost thirty years ago, following the rise of the WWW in the mid-nineties, the BM (Business Model) concept has been envisaged by numerous authors via distinct subject-matter lenses ―and has been gaining ground since then (Zott et al. 2011). It is only after the advent of computers and spreadsheets ― Magretta (2002) said ― that BMs became popular. Prior to that, successful BMs were created unintentionally —neither by design nor by foresight ―and became clear only after the fact. At the outset, BMs were only concerned with e-business (e.g. e-commerce, e-market, etc.) ―and it is only after a short while that the scope of BMs has been protracted (Timmers, 1998) ―and BMs were used to assess other phenomena (e.g. innovation and technology management). Indeed, BMs came to be the new basis of competition, replacing product features and benefits as the playing field on which companies emerge as dominant or laggards (Chesbrough & Rosenbloom, 2002). Nowadays, the existing literature on BMs suggests the prevalence of four school of thoughts[64] (Zott et al. 2011), explicitly: (1) *BM* as a *central unit of analysis,* (2) *BM* as a *system-level*, *holistic approach* to expounding how companies capture value and generate profit, (3) *BM* as a *strategic means* to explaining both value creation and value capture phenomena, and (4) *BM* as a *platform* where the activities of focal companies and their partners are expected to play a key role in the conceptualization of BMs in force.

Moving on, we wonder: *What is exactly a BM*? In spite of the recent deluge in the literature on BMs, we affirm, a definitional clarity on BMs is still nonexistent today (Zott et al. 2011; Bucherer et al. 2012) ―and BM is repeatedly studied without a clear definition of the concept. (We remain optimistic nonetheless, trusting that these emerging themes may one day lead to a more fused study of BMs) According to Massa et al. (2017), BM constitutes a key vehicle for innovation at corporate level ―and that, in two ways: (1) by allowing executives to connect innovative products and technologies to a realized output in a market ―as well as (2) by being a distinct source of innovation per se, paired

[64]In contrast, other authors such as (Gassman et al. 2014) talked about seven schools of thoughts, yet for the purpose of this research, we stick to the classification suggested by (Zott et al. 2011) to signpost that there is still no common definition for BMs among scholars.

to customary dimensions of innovation (product, process, managerial, and others). Likewise, Lambert and Davidson (2013) ―and DaSilva and Trkman (2014) acknowledged that a BM exhibits how a company generates, conveys and captures value. It enunciates the content, configuration and management of the activity system that carries a value proposition to the customer.

For Ferrero et al. (2015), BMs are the method that a company uses for its functioning — encompassing the aim, schemes, and persons who join forces to bring added value to customers. A simple case of customer needs being fulfilled by totally distinct BMs, the authors specified, is *car transportation*. Getting from point A to point B could be served by a car that is either bought, leased, rented, or shared. The main product is basically the same, while the activity system underlying the product shields a spectrum of distinct BM design choices. Overall, value capture is enabled by the company's ability to homogenize and mechanize operations across the activity system ―and the purpose is not to add intricacy, but to allow for scalability via simple, operative activity systems.

Going forward, Micheal Lewis[65] ― in his book entitled *The New, New Thing: A Silicon Valley Story* ― spoke of BMs as *artworks*. And like any artistic production, he emphasized, it is one of those things that people sense they could spot at first sight without being able to explain them. Indeed, he suggested the meekest of definitions — *'it is how a company plans to make money.'* By the same token, Magretta (2002) avowed that BMs are stories — stories that elucidate how companies work. The author declared, *'any decent BM would be able to answer the following age-old questions ― who is the customer? ―what does the customer value? ―how does the business work? ―and how could value be delivered to customers at an appropriate cost?'* In the same context, Weill and Vitale (2001) recognized that BMs depict roles and rapports among a company's customers, partners, suppliers, and manufacturers. Similarly, Morris et al. (2005) associated BMs with the manner ―or the art― of conducting business to ensure the sustainability of the company, indicting the following definition: *'a BM is a method of doing business by which a company could sustain itself by generating revenues.' 'A BM*

[65] A soft copy of the book is available from: https://epdf.pub/the-new-new-thing-a-silicon-valley-story.html

tells how a company makes money by identifying where it is positioned in the value chain' the authors added.

As for Amit and Zott (2001), a BM describes the content, structure, and governance of transactions designed to create value through the exploitation of business opportunities. A BM, they added, is conceived by a company to create and capture the largest market value possible from the products and-or technologies it is commercializing. The quality and the level of the economic outcomes, they concluded, depend upon the efficiency of the BM being used. Subsequently, they asserted, '*the more a BM is efficient and ingenious, the more the market value of the newly commercialized products, created and captured through it, would be great.*' Osterwalder (2004), we proclaim, had a significant contribution in this respect too ―defining a BM as a conceptual tool that contains a set of interconnected elements ―and allows expressing a company's logic of making money. In like manner, Demil and Lecocq (2010) demarcated a BM as the way a company operates to ensure its sustainability. *'Companies should focus on sources of value creation that are inherent in the BM itself and could be accessed through it'* the authors avowed.

On another note, Zott and Amit (2010) signposted that BM design is a key decision for start-ups ―and a critical, perhaps more difficult, one for established companies with prospective plans to redefine their existing business structures. The authors pictured a BM as an *activity-system-design framework* that encourages holistic thinking (―see Table 19). As reported, *'a BM is geared toward total value creation for all parties; the greater the total, the greater the company's bargaining power, and the greater the amount of value it could appropriate; it is a template of how a company conducts business and how it delivers value to its stakeholders.'*

Design Elements	
Content	What activities should be performed?
Structure	How should they be linked and sequenced?
Governance	Who should perform them, and Where?
Design Themes	
Novelty	Adopt innovative content, structure or governance
Lock-In	Build in elements to retain business model stakeholders
Complementarities	Bundle activities to generate more value
Efficiency	Reorganize activities to reduce transaction costs

Table 19. An activity system design framework
Source: Adapted from Zott and Amit (2010)

A fairly comparable definition could be found in Demil et al. (2015) — written as follows: *'a BM enlightens the logic of a company, the way it operates, and how it creates and captures value for its stakeholders.'* Table 20 shown below displays a listing of some other prevalent definitions suggested for BM.

Definition	***Author/s***
The BM is an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues.	*Timmers (1998)*
The BM is the heuristic logic that connects technical potential with the realization of economic value.	*Chesbrough & Rosenbloom (2002)*
BMs consist of four interlocking elements, which, taken together, create and deliver value. These are customer value proposition, profit formula, key resources, and key processes.	*Johnson et al. (2008)*
A BM is a *reflection* of the company's *realized* strategy.	*Casadesus-Masanell & Ricart (2010)*

(Cont.)	
A BM articulates the logic, the data and other evidence that support a value proposition for the customer and a viable structure of revenues and costs for the company delivering that value.	*Teece (2010)*
A BM is a meta concept to exemplify the business strategy of a company. The components of a BM are four: customer, customer engagement, monetization and value chain, and linking mechanisms, which aim at capturing the essence of the cause-effect rapports between customers, the company and money.	*Baden-Fuller et al. (2017)*

Table 20. BM definitions
Source: Compiled from various sources

To finish, we say, given the scope of our research and the objectives assigned to it, we choose to adopt Timmer's (1998) definition of BMs; also, to some extent that of Demil et al. (2015). As we see it, BMs are meek strategic tools that companies resort to, to better depict the relationships they hold with different actors (suppliers, customers, etc.) along the industry value chain. These tools, we affirm, enable companies to better visualize the practices via which they capture and create value. From our perspective (as an expert in the French construction industry), a BM is a give-and-take, looping process that describes a company's moneymaking rationale.

The next subsection delves into the main *constituents* and *representations* of BMs —exactly as found in the literature stream on BMs.

2.2. CONSTITUENTS & ILLUSTRATIONS

The internet was the prime driver that led to the growth of interest in BMs —and the resulting rise of an extensive literature that spins around the topic (Magretta, 2002; Yip, 2004). In fact, the count of e-business scholars who aimed at differentiating between primary- and secondary-class[66] areas of BMs' constituents has significantly amplified over time. A listing of those is available in Table 21.

[66]Denoting respectively most and (relatively) less important business models' components.

Primary-class areas	***Secondary-class areas***	***Author/s***
• Value stream for partners and buyers network • Revenue stream • Logistical stream	n/a	*Mahadevan (2000)*
• Profit stream	• Customer selection • Value capture • Differentiation and strategic control • Scope	*Stewart & Zhao (2000)*
• A system made of components, linkages between components, and dynamics • Customer value • Revenue sources	• Scope • Price • Connected activities • Implementation • Capabilities • Sustainability	*Afuah & Tucci (2001)*
• Mission • Structure • Processes • Revenues • Legal issues • Technology	• *Mission:* goals, vision, value proposition • *Structure:* actors and governance, focus • *Processes:* customer orientation, coordination mechanism • *Revenues:* source, business logic	*Alt & Zimmerman (2001)*
• Concept • Capabilities • Value	• *Concept:* market opportunity, product and service offered, competitive dynamic, strategy for capturing a dominant position, strategic options for evolving the business • *Capabilities:* people and partners, organization and culture, operating model, marketing sales model, management model, business development model, infrastructure model • *Value:* benefits returned to stakeholders, benefits returned to the company, market share and performance, brand and reputation, financial performance	*Applegate (2001)*

(Cont.)		
• Sustainability • Revenue stream • Cost structure • Value chain positioning	n/a	*Rappa (2001)*
• Value proposition • Customer segments • Partners' network • Delivery channel • Revenue stream	• Relationship • Value configuration • Capability • Cost structure	*Osterwalder (2004)*
• Products and services delivery • Customers • Costs structure • Income	• Network • Network externalities	*Bonaccorsi et al. (2006)*
• Costs • Revenue stream • Sustainable income generation • Goods and services production and exchanges	• Pricing strategies • Relationships • Network externalities	*Brousseau & Penard (2006)*

Table 21. The constituents of business models
Source: Adapted from Zott et al. (2011)

Long story short, scholars (Lucking-Reiley & Spulber, 2001; Amit & Zott, 2001; Afuah, 2004) who concentrated on e-business as an area for research on BMs have been interested in understanding the functioning and operability of companies engaging in unusual, internet-based ways of doing business ―as well as in the first-hand roles that those companies could play in their respective ecosystems. To do so, they have invested lots of time and effort to define and represent generic BMs, rather than propose causal justifications or conduct empirical analyses. Their descriptive contributions, we assert, highlighted, to some extent, the notion of value (customer value, value proposition, and others), financial aspects (e.g., revenue streams, cost structures), and other elements associated with the architecture of the network between the company and its partners (delivery channels, network relationships, and others).

As per Zott et al. (2011), each of these constituents are possibly to account for part of a generic BM, and could help scholars to set different arrangements (types) of BMs apart. In fact, the authors added, a BM is neither a value proposition, a revenue model, nor a network of relationships per se ―but all of these elements combined.

Up until now, many academic researchers have tried to embody BMs via a blend of informal textual and-or purposeful graphical illustrations. Weill & Vitale (2001), for instance, presented a set of simple graphics envisioned to provide tools for the study and design of e-business initiatives. The graphics of their BM focused on three classes of matters: *participants*, *rapports*, and *flows*.

Equally importantly, Tapscott et al. (2000) suggested a *value mapping approach* to portray how a business web actually works. The latter shows all key classes of *participants* and *value exchanges* between them ―and exhibits the shape and nature of a BM, thus enabling companies to run plausible BM simulations before engaging in real-life projects. Other scholars have provided a *BM ontology* ― being a conceptualization and validation of the elements, rapports, and lexis of a BM (Osterwalder, 2004) ― organized into several stages of decomposition with snowballing levels of complexity. In the same manner, Gordijn and Akkermans (2001) came up with a *conceptual modeling approach* for the representation of BMs. Their ontology scrounges notions from the business literature (actors, value exchanges and activities, and others) ―and uses them to model networked assemblages of companies and end-users who create, dispense, and consume things of economic value.

The upcoming subsections list and explain four noticeable BM representations; also, clarify how those representations (not all, but some of them!) serve the purpose of our empirical research ―and to which extent.

2.2.1. *BUSINESS MODEL CANVAS*

Osterwalder's (2004) conceptual tool encloses a set of interrelated elements, which set the path to the clear-cut expression of a company's BM. As indicated by the author, *'it is implausible for companies to be able to develop or design innovative and effective BMs unless they pay thorough attention to their constituents.'* The competent conception of a new BM — whether a company intends to redesign or reinvent an existing BM, or even create an entirely new one — is indisputably a tricky event (Gassman et al. 2014).

Overall, companies often use Osterwalder's BM canvas as aid to develop new BMs —or analyze and map existing ones. Originally, the latter was inspired by the works of various scholars (Amit & Zott, 2001; Applegate, 2001; Weill & Vitale, 2001; Afuah & Tucci, 2001, Chesbrough & Rosenbloom, 2002; Magretta, 2002); specifically, Osterwalder (2004) identified the building blocks of existing BMs —as exhibited in the literature, synthetized and conceptualized them, and then put them together to create one puzzle, a distinctive BM (Figure 23).

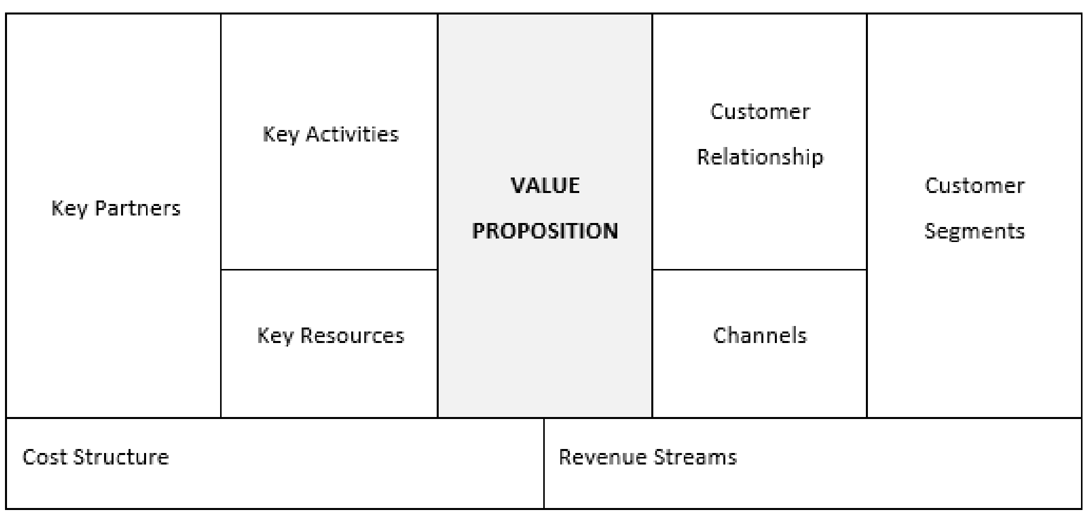


Figure 23. Osterwalder's business model canvas
Source: Adapted from Osterwalder (2004)

Once we zoom in on the BM under examination, we get a vision of the latter's ontology (Figure 24) that is, a detailed sight of the various elements and rapports describing the money-earning logic of a company. Largely, the ontology comprises *nine building blocks*, the so-called *BM elements* —where each *element* (e.g.—*value proposition*) could be decomposed into a distinctive *sub-element* (e.g.—*offering*). This decomposition allows for the reconsideration of BMs on different levels of granularity and based on particular needs. Indeed, in order to better comprehend value —and to construct innovative offerings, Osterwalder (2004) suggested a *conceptual (systematic) approach* outlined in the value proposition element that makes value innovation easier. This, according to the author, would enable companies to identify and map their existing value proposition and compare it to that of their rivals. Osterwalder's BM, we stress, revolves around one dominant notion that is, *value proposition* —being the first and most central of the nine elements of the BM ontology, perceived as the declarations of remunerations that are transported by the company to its external populations (Bagchi & Tulskie, 2000). Plainly, *value proposition* denotes how items of value are swathed and offered to satisfy customer needs; it describes the way a company sets itself apart from the competition —and is the main reason why customers choose to deal with one company instead of another[67].

By itself, Osterwalder's BM canvas is global and comprehensive, at least from an economic standpoint. This is accurate as it covers all BM elements spread along the value chain, *up*- and *down-stream* —going from the company's dealings with partners, to production activities bearing in mind the availability of resources (*infrastructure management*) —and then protracting to shield the logistics needed for the commercialization of products or services to targeted market and customer segments (*customer interface*). As well, it helps a company to ensure a better trade-off between its cost structures on one hand —and its revenue streams on the other hand (*financial aspects*). The limit of the model nevertheless, lies in the fact that it is *profit-oriented*, solely focusing on the economic aspect of business activities, hence overlooking some other, equally important aspects, say: *social* and *environmental*.

[67]ibid

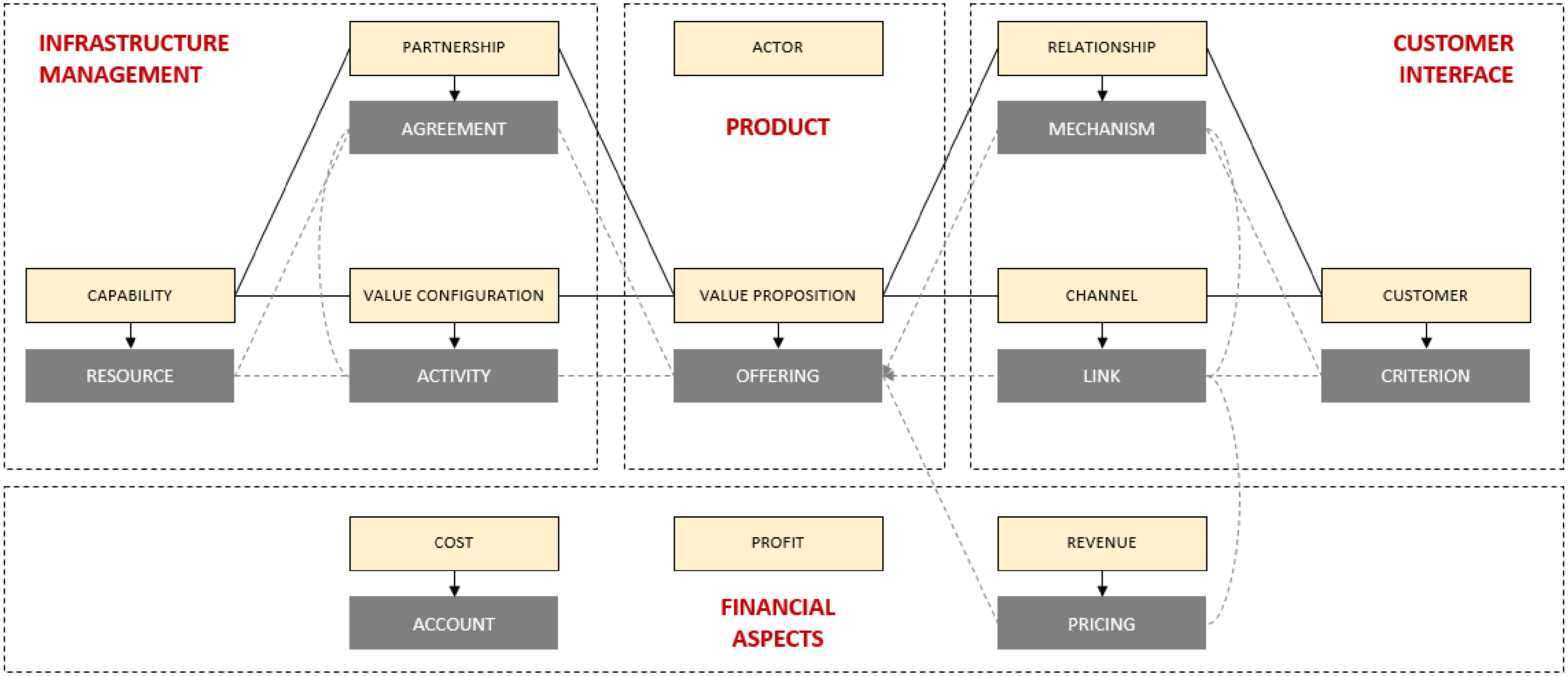


Figure 24. Osterwalder's business model ontology

Source: Adapted from Osterwalder (2004); Osterwalder et al. (2005)

2.2.2. *CAUSAL LOOP DIAGRAM*

Casadesus-Masanell and Ricart (2007) indicated that developing new BMs would enable companies to strengthen and sustain their current market positions by developing and implementing new products, services, or even technologies. The authors acclaimed the *inductive perspective* to building BMs in general —through a CLD (Causal Loop Diagram)[68]. *'A BM consists of different part sets,'* the authors professed, *'and the choices made on how the company should operate —and the prospective consequences that might ensue from these choices are interrelated'* they added, *'which infers that every corporate choice made would inevitably lead to some consequences, one or more, positive or negative.'* Indeed, as put by Kiani et al. (2009), CLD is a valuable tool that helps companies to capture the gestalt of BMs and provide executives with significant insight into BMs to better apply them. BMs, they said, show how companies operate by choosing how to liaise with their adjacent environments.

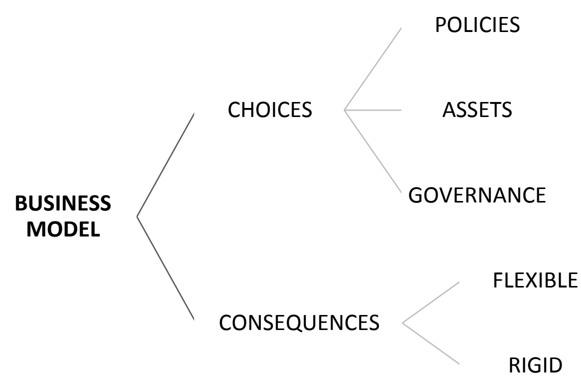


Figure 25. Elements of a business model
Source: Adapted from Casadesus-Masanell and Ricart (2011)

Looking at Figure 25, Casadesus-Masanell & Ricart (2011) divulged that corporate decisions are threefold. First comes *policy choices,* which slot in all means of action that a company employs to cover the different facets of its operations. *Asset choices* follows, invoking decisions made vis-à-vis tangible resources. Third and last, there are the *governance choices,* which designate the structure of contractual arrangements that

[68]A Causal Loop Diagram helps with understanding and analyzing complex systems by identifying the key variables in a system —and the cause and effect relationship between them.

confer decision rights over policies and assets. In order to better elucidate the imbrications of choices versus consequences, the authors gave the example of a BM of a company that operates a fleet of trucks (*asset choice*). The company, they said, has a *governance choice* to make that is, to choose between buying and owning the trucks ―or leasing and operating them. No matter the company's choice, they added, the decision made, true or false, right or wrong, would potentially pointedly sway its ability to create and capture value, positively or negatively.

Ryanair is another great real-world example that exhibits how a company could use CLD to depict its own operating BM. Table 22 summarizes the choices made (or the business strategies opted for)[69] by *Ryanair* versus the consequences that later on ensued from these choices ―which eventually resulted in the creation of the so-called *Ryanair*'s BM ―also known as *Ryanair*'s low-cost strategy BM. According to Casadesus-Masanell and Ricart (2010; 2011), it is the recurrent process of dotting the causality linkages between various choices and consequences that would convert a company's BM into a CLD (Figure 26). '*The choices made and the suing consequences are creators of BMs*,' the authors added. '*And the rigidity or flexibility of a given consequence is measured by its elasticity or inelasticity to the variations in the choices made*' they concluded.

Choices		***Consequences***
Secondary airports	________	↓ Airport fees
↓ Tickets prices	________	↑ Volume
↓ Commissions to travel agents	________	↓ Cost
Standardized fleet of 737s	________	Bargaining power with suppliers
Single-class	________	Economies of scale
High-powered incentives	________	Attracts combative team
No meals	________	Faster turnaround
Nothing free	________	↑ Revenue
Spartan headquarters	________	↓ Fixed cost
No unions		Flexibility in rostering staff

Table 22. Ryanair: choices and consequences
Source: Adapted from Casadesus-Masanell and Ricart (2011)

[69]*Ryanair*, a low-cost airline, focused on offering cheap fares in order to capitalize on the market; it offered fares, which were 20% lower than the cheapest fare of its rivals. As well, through the standardization and diversification of its services, the said company was able to uphold, even boost its standing in the marketplace.

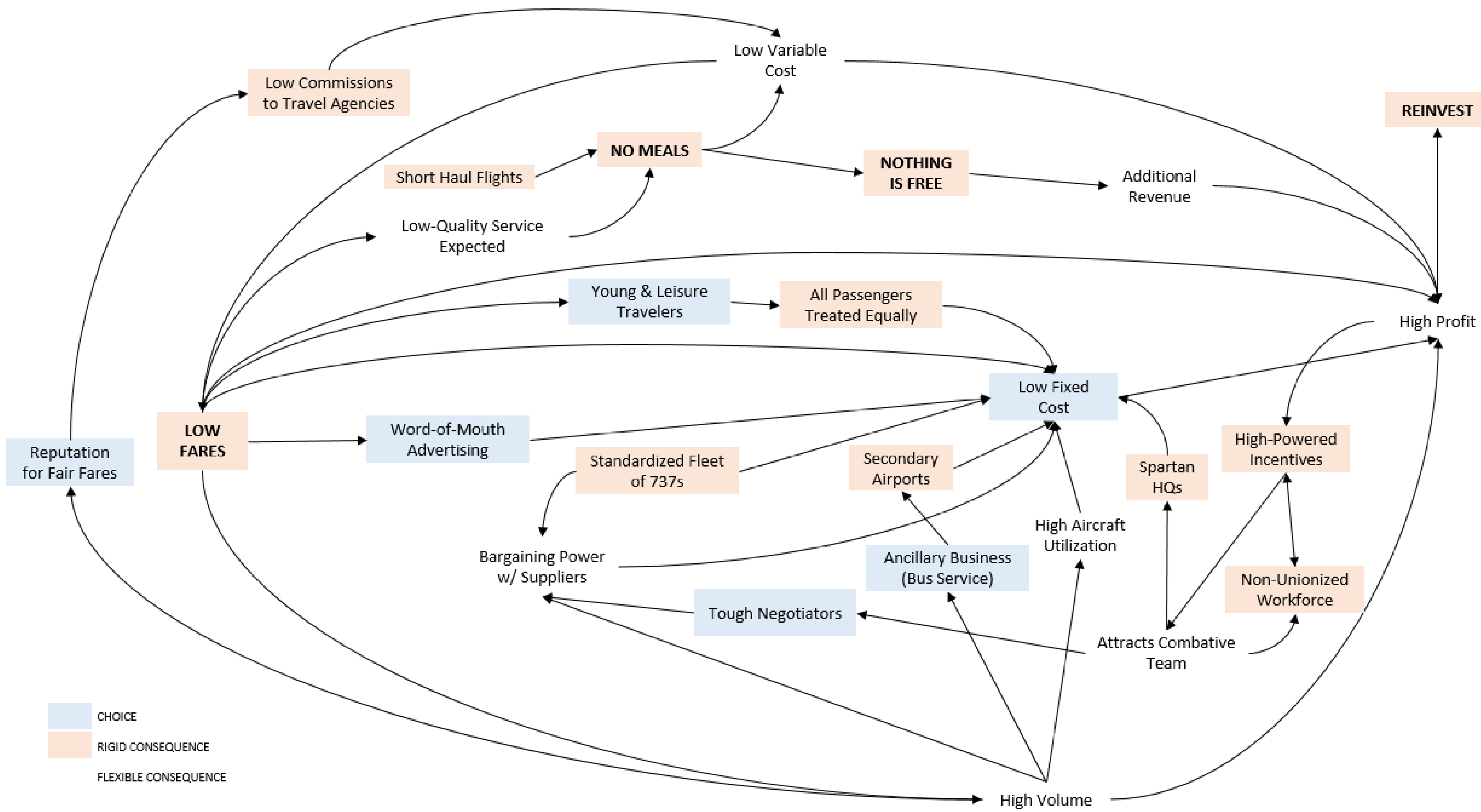


Figure 26. Ryanair's (low-cost strategy) business model
Source: Adapted from Casadesus-Masanell and Ricart (2011)

Before we jump on to explaining the RCOV framework ― we close this subsection by mentioning that the logic behind the CLD is partially espoused in our empirical research to build and conceptualize the *stage-based construction process map*, a *piloting tool*, by which we mark all the potential connections among and within the elements of our envisioned BM.

2.2.3. *RCOV FRAMEWORK*

Similarly to other scholars, Demil and Lecocq (2010) contemplated BMs from a *configurational viewpoint* ―and came up with the RCOV framework (Figure 27) which is currently one of the most cited representations in the academic literature on BMs. Because of its dynamism, features and parsimony ―the latter seems to have a certain edge over other comparable BMs. The RCOV model was first known as the RCOA model (Lecocq et al. 2006; Demil & Lecocq, 2008) ― but due to subsequent refinements and tweaks, it took a new form ―and so, was labeled otherwise. RCOV stands for *Resources & Competences* (RC), *Organization* (O), and *Value Proposition* (V) ―denoting the three basic elements of the BM under examination ― whereas RCOA is short for *Resources & Competences* (RC), *Offerings* (O), and *Activities* (A).

In a broad sense, the RCOV model follows a defined logic that could be précised in the following manner: a company builds its BM by making various choices to generate revenues from different sources. And the choices made comprise a chain of *resources and competences* to be valued, namely: a business-to-customer *value proposition* and the business *organization* per se, internal and external. Moving forward, the *resources and competences* are valued through the supply of products or services on markets. The *organization* on the other hand, refers to the set of operations that a company deals with and choose from (*value chain*) ―and the associations it holds with other stakeholders, partners (*value network*).

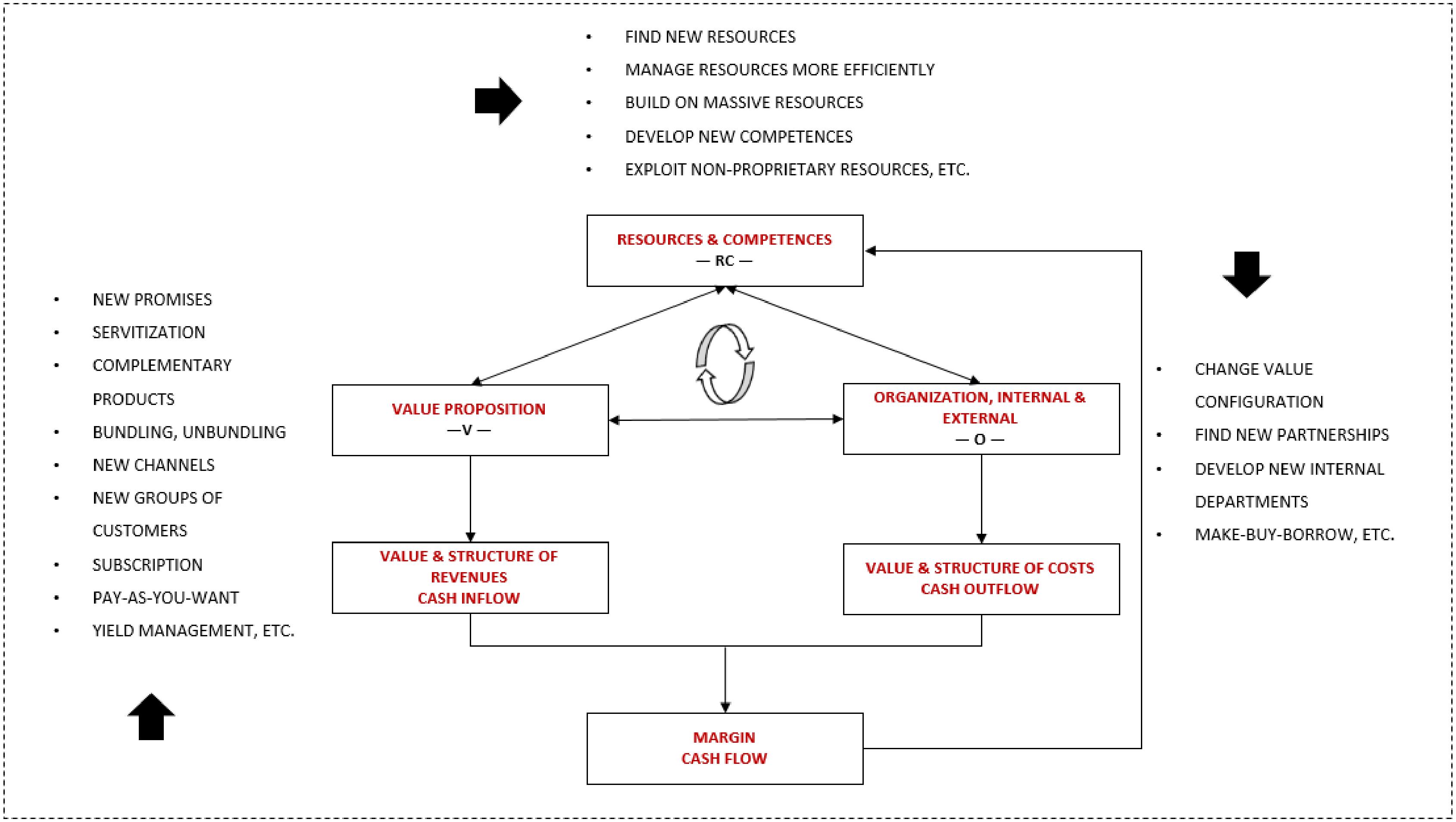


Figure 27. RCOV framework

Source: Adapted from Demil and Lecocq (2010)

The model's three basic elements determine the structure and the volume of costs and revenues of a business and therefore its profit margin ―and the sustainability of its BM. The *cost structure* is driven by the organizational configuration a company deploys, while the *revenue structure* is rather based on the exclusivity and attractivity of the products or services it offers to its customers.

In drawing things to a close, we note that — though the customer by itself is not a direct element of the RCOV model, it is — or at least may be — a constituent of a company's external managerial structure, thus part of one of its main elements (*Organization*). This is central because customers are certainly to play a decisive role in the success (or failure) of a company's BM —and so, for companies to incorporate *customers* in their BMs is an indispensable thing, not just for hypothetical reasons —but for practical ones too. A comparable proclamation was repeatedly made throughout our text (―see Chapter 1) to underline the pivotal role that people (―a primary smart city component) could play (―as producers of data and value) in the conception and design of victorious smart cities. Moreover, based on the RCOV framework, it is sort of palpable that the positioning of a given company within the value network is critical for its long term business success; also, the way the latter chooses to integrate both *Resources-and-Competences* components in its own BM would eventually sway its organizational structure and influence its ability to create and capture value.

> *Recapping, the TLBMC constitutes the foundation of our envisioned solution-based BM, which aims at identifying the main problems faced at the construction industry level ―as well as at suggesting actionable insights as to what the possible solutions might be. The CLD on the other hand informs the carcass of our piloting tool. Through dependency graphs, the latter would enable construction companies to track their works every step of the way. As for the RCOV framework, we take the rationale behind it, especially its R-C-O components, to further elucidate the budding changes in our new BM.*

Now that we have defined BMs, demarcated their integral components, and explained their conceptual representations, the next subsection identifies different *business model arrangements* that describe and clarify the various ways companies engage with stakeholders to create and capture value.

2.2.4. *TRIPLE LAYERED BUSINESS MODEL CANVAS*

Pigneur et al. (2015) stretched Osterwalder's BM canvas out — consisting of one layer only (*economic*) — by adding two extra layers to it: *environmental* and *social* —thus rendering it more *sustainable* and *customer-integrated* (Figure 28).

As per Sherman (2012), these supplementary layers parallel Osterwalder's BM canvas by underlining the interconnections, which support environmental and social impacts disjointedly, and lengthen it by drawing links across all three layers to bear a cohesive triple bottom line perspective of managerial impact. The TLBMC (Triple Layered Business Model Canvas) is one of the best strategic management tools that companies could presently use to explore the sustainability of their new BMs —as it explicitly shows how they could bring value to their businesses (Abraham, 2013). The said BM representation is interesting by itself because it did well by converting a *profit-oriented* BM (Osterwalder's original representation) into a *human-centric* one. At its core, the TLBMC stirs the shift from incremental and secluded innovations —towards more integrated and complete sustainability-oriented innovations, which, we trust, are better suited to meeting ongoing international crises, and energy and factor constraints (Adams et al. 2015).

As a tool, the TLBMC bridges business model innovation (Spieth et al. 2014) —and sustainable BM development (Boons & Lüdeke-Freund, 2013) —and helps companies to overcome barriers to sustainability-oriented change (Shrivastava & Statler, 2012; Lozano, 2013) by allowing them to creatively rethink their current BMs and communicate potential innovations.

Furthermore, as a multi-layer BM canvas, the TLBMC endows companies with a clear and somewhat easy way to visualize and discuss the multiple and diverse impacts of their BMs. Therefore, instead of attempting to condense multiple types of value into a single canvas, the TLBMC allows companies to explore economic, environmental and social values in a bidirectional manner, horizontally and vertically, among and within layers (and building blocks). Simply put, the TLBMC provides a concise framework to encourage visualization, communication and collaboration around innovating more sustainable BMs (Boons & Lüdeke-Freund, 2013). In contrast to Osterwalder's BM canvas, the TLBMC offers companies the opportunity to address a triple bottom line where each canvas layer is dedicated to a single dimension —and together they provide a means to integrate the associations and impacts across layers.

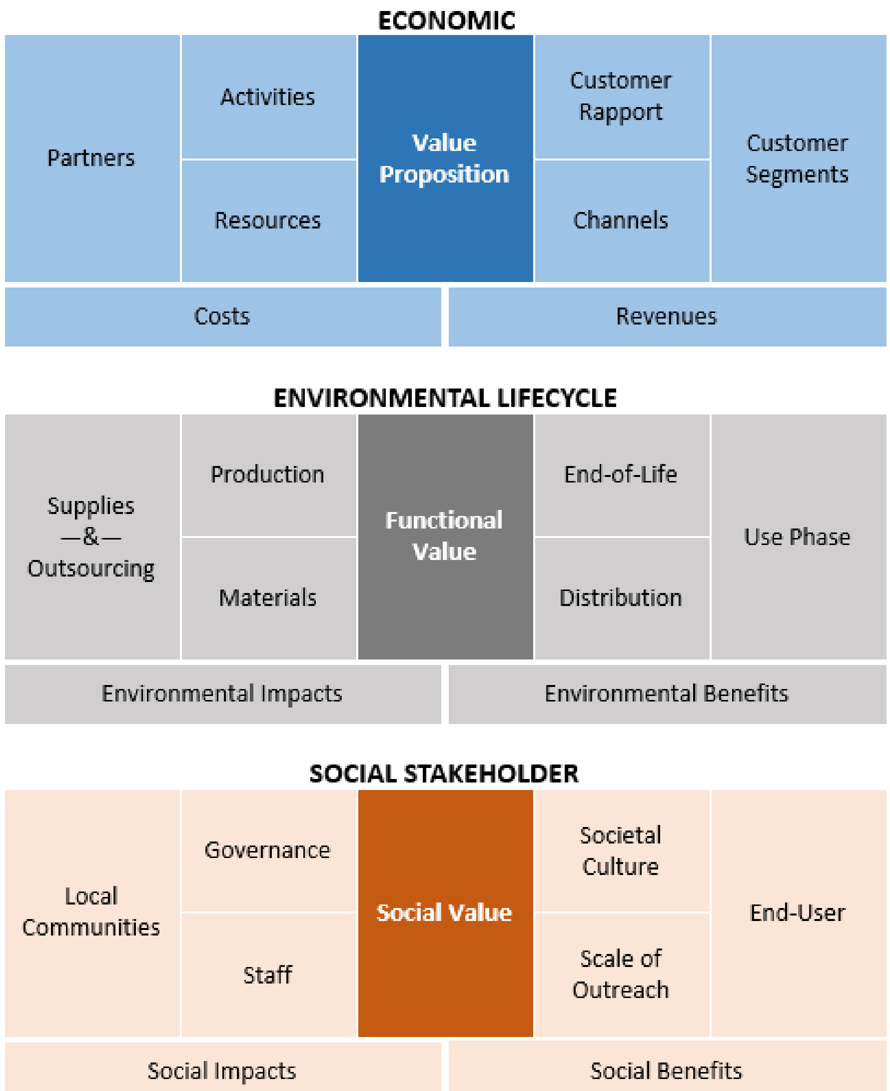


Figure 28. The triple layered business model canvas
Source: Adapted from Pigneur et al. (2015)

Putting the *economic layer* aside, the *environmental layer* of the TLBMC, as mentioned by Abu-Jbara (2019), stems from research and practice on LCA (Life Cycle Assessments) —which offers an assessment of environmental impacts across multiple types of indicators over the entire lifecycle of a product. Linking LCA to business innovation may possibly support competitive product and business model innovation, and hearten continuing impact measurement and improvement of sustainability-oriented innovations over time (Chun & Lee, 2013). With regards to the TLBMC's *social layer*, it strives to balance the interests of a company's stakeholders rather than just focus on profit maximization. Alike the *environmental layer*, the *social layer* extends the original BM canvas by scrutinizing a company's BM based on a *stakeholder perspective* (Mitchell & Coles, 2003). Backsliding to Figure 25— we recognize that the TLBMC's *environmental layer* revolves around one chief element, *functional value*, which defines the focal output of a product or service delivered by a company; *social value*, on the other hand, being the TLBMC's *social layer*'s chief element, relates to a company's mission which focuses on creating advantage for both its stakeholders and the society as a whole.

As far as we are concerned, for the purpose of this research project, we choose to adopt the TLBMC as a means or strategic tool for conducting BM analysis and innovating towards a more sustainable, human-centric BM in construction (that of a *general contractor* for the managing of smart developments). The TLBMC, we believe, constitutes the wholesome foundation for our envisioned BM, which accounts for smart city components (*people*, *living*, *governance*, *economy*, *mobility*, and *environment*). The similarities between smart city components (on one hand), and the TLBMC's layers and building blocks (on the other hand) are obvious, even at first sight —thus our choice of the said BM canvas. (—see Chapter 3 for more details in this regard)

2.3. BUSINESS MODEL ARRANGEMENTS & VALUE

The present subsection builds on various insights on customer[70] value to identify the different sets of arrangements (types) — depicted in BMs — that describe how companies prompt *value creation* (for customers) through *value networking* (with partners). The most relevant filament of the literature that links with our research goal is the *conceptual approach* which gives *value* a chief role (Teece, 2010) —and sees the BM as a hasty and

[70]The terms *client, customer, consumer, user,* and *end-user* —are used interchangeably throughout the present subsection.

simple illustration (―see previous subsections) of how companies generate financial earnings (Chesbrough, 2010; Baden-Fuller & Haefliger, 2013).

As formerly noted, the BM literature which was, customarily, to some extent, regardless of the reasons, careless about customer value per se (Pauwels & Weiss, 2008; Zott & Amit, 2010; Osterwalder & Pigneur, 2010; Zott et al. 2011) has now become (unsurprisingly!) more and more customer-oriented (Baden-Fuller & Haefliger, 2013).

> *The evolution of the smart city concept followed a somehow similar path. After the advent of the WWW, the modern city archetype has become a mere technology demonstrator ―and it is only recently that it became people-centered, conceived and administered following a bottom-up approach.*

The main idea conversed herein borrows from the marketing literature (Vargo & Lusch, 2004; Gronroos & Voima, 2013) ― spins around the fact that customers have become *co-producers of value* ―and comes hand in hand with the sociological view that value creation necessitates *social construction* (Pinch & Bijker, 1984).

> *These assertions fit perfectly with the rationale behind our envisioned BM, where end-users — as creators of innovation — are expected to play a vital role in the building of smart cities and the handling of smart construction projects.*

We take these ideas as given ―and explore the first pair of BM *dyadic* arrangements (Baden-Fuller et al. 2017) for the co-creation of value: *product BM* vs. *solution BM*. Yet, before we delve into the explanation of these, we reasonably start by settling on what *value* is. For this research, we assume *value* to denote *use-value*, standing for the *utility* that customers may gain from using a particular product or service. This is candid because, as put by Vargo and Lusch (2004), a product or service is considered worthless unless the customer could (literally!) use it or do something beneficial with it, for enjoyment or any other purpose.

***The PBM (Product Business Model)* —** it is when use-value activities are performed, succeeding the act of purchase —and away from the provider. In such a case, the *providers*' arrangements for engaging with *customers* is labeled the *PBM* (Baden-Fuller et al. 2017). Even though this conception of the product and its use-value is captured in the sphere of the *final customer* only, the exact same logic could also apply to a *middle agent* representing the final customer – such as in business-to-business situations where an *actor* in the value chain may step on the scene on behalf of the *end-user*.

***The SBM (Solution Business Model)* —** it is when the *provider* directly engages the *final customer* in the production process, resulting in the latter's use-value being co-created. This situation is labeled the *SBM* (Gronroos and Voima, 2013; Baden-Fuller et al. 2017). From the standpoint of the *provider*, the skills and assets needed to produce a *solution* are not the same — being far greater than those required by a *product*. In such a setting, the *end-user* is more involved in the process and sometimes forced to change his demeanor to fit arising new situations. Adding that a *SBM* is said to be meaningful to the *end-user*—if and only if the ensuing use-value is larger than that gotten from the *PBM*.

> *Our envisioned general contractor BM is human-centric, based on the active involvement of end-users throughout the whole project management construction process, as data providers and creators of innovation. Unmistakably, the PBM relates to the old construction value chain where construction companies tend to care more about the expected value of their profit margins and less about the well-being of their customers and the quality of their deliverables. In contrast, the SBM bears a resemblance to the new construction value chain, involving a central operator who will oversee the resourceful running of construction projects and ensure end-users are engaged in every step of the way.*

In the first pair of BM arrangements (—the product- and solution-based BMs), we said, there are only two players involved in the process of value creation. However, in certain cases, when the product is far more complex, there might be more than just one provider on stage, thus transforming the *dyadic* rapport into a *triadic* one. This is mainly the case of *paired providers*, selling *complementary products* (printers on one side—and paper and ink on the other). In such a case, we proclaim, the essential *dyadic*, two-player rapport remains unchanged – because only one *final customer* would ultimately benefit from use-value when all the elements have been put together (Teece, 2010).

Our distinction between *dyadic* and *triadic* BMs echoes with the literature on technology strategy — particularly the contributions of Zott and Amit (2010), and Thompson and MacMillan (2010) who disclosed that companies could have access to several value networks —meaning that technology has endowed companies with new forms of value creation gears, which are orchestrated in the sense that value is currently being created in gig, by a *company* and a surfeit of *partners* —for multiple *end-users*.

Now sliding to the *triadic* BM arrangements, they are in the number of two (Baden-Fuller et al. 2017): *the matchmaking BM* and *the multisided BM*, explained below:

The MMBM (Matchmaking Business Model) — it involves three players: the *company* that arranges the market (—the platform owner) and *two customer segments*, *buyers* and *sellers* who trade an underlying product or service. If we take the case of *Uber* for instance; *Uber*, being the *matchmaker*, would be behind *value creation*. For *buyers* (the persons looking for rides), the condensed search time and effort to find a ride means that they may enjoy greater use-value from the service provided via the *matchmaker*. For *Uber*, this increase in use-value is source of potential yield. As for *sellers*, they are paid on a ride-by-ride basis —therefore, the more rides they achieve (*buyers* they serve), the bigger their pays will be.

The MSBM (Multisided Business Model) — it entails three or more players, where the *company* (—the platform owner) creates a set of dealings among *two or more otherwise detached customer segments*. The *first customer segment* is called the *customer beneficiary* who receives a set of products or services at a trifling price, paid for by a *second segment* called the *paying-customer* who profits from creating value for the consumption of the first segment. Central to this BM is the win-win process by which the *two customer segments* are brought together, as follows: the *paying customer* profits from the *customer beneficiary*, using the product or service —and the *customer beneficiary* profits from the presence of the *paying customer*, paying for the product or service. Specialized magazines offering the option of free-of-charge advertisement constitute a great example of a *MSBM* arrangement (—see Table 23 shown below for a quick overview of all four BM arrangements).

We finish by affirming that the list of BM arrangements exposed herein is extensive, yet non-exhaustive; also, by pointing out that technology has no objective value by itself and remains latent until it is commercialized via a competent BM (Chesbrough, 2010).

Indeed, according to the author, BM change is not solely driven by technology, but also by how we think and why we think that way, therefore, in most cases, managerial processes must be changed too.

Do you remember the case of *Songdo City* in South Korea where technology has been broadly used to improve the *capital product* (—the creation of a smart city) —but failed to do so? In this case, technology did not bring any value at any level; the final product, a mere technology demonstrator, has been deemed unusable and unlivable —and so, no value has ultimately ensued from it, neither for construction companies nor for the citizens of the city. In opposition to South Korea's experience, *capital products* are now being offered on a *SBM* basis with noticeable improvements in value for end-users (Baden-Fuller et al. 2017) —being in line with our envisioned BM, centering on managerial rather than just technological perfections.

> *Our envisioned BM follows a two-sided dyadic, solution-based arrangement —encompassing three key actors: the general contractor (the construction company, a middle agent, a conductor) —and two different customer segments, up- and down-stream the construction value chain, the project owner (first customer, represented by the general contractor) and the end-user (final customer).*

	Customer Use-Value	Example	Customer Engagement Mechanism	Author/s	General Contractor Business Model	Impact of Technology on Business Model
DYADIC ARRANGEMENTS (COMPRISING TWO PLAYERS)						
Product BM	*Customer obtains use-value via consumption after purchase*	• A washing machine used at home; • Frozen food that is cooked and eaten at home.	***Transactional:*** Provider puts product or service on market via a value chain with limited interaction post purchase	Vargo & Lusch (2004)	Old construction value chain	*Insignificant*
Solution BM	*Client obtains use-value in presence of and with help from the provider*	• A meal that is consumed in a full-service restaurant; • A strategy consultant who works with the customer to co-create a solution.	***Relational:*** producer and customer co-creates in real time	Gronroos & Voima (2013)	New construction value chain (—based on the involvement of a *central operator*)	*Insignificant*
TRIADIC ARRANGEMENTS (COMPRISING THREE OR MORE PLAYERS)						
Matchmaking BM	*Customer obtains us-value from reductions in search effort in finding a product or service*	Renting a previously unknown apartment via an independent platform provider	An auction house that connects potential clients with suppliers, thus saving search effort	Marshall (1890) —found in Komleh (2018)	***Special case I:*** Whenever a real estate brokerage company is involved in the process	*Significant*
Multisided BM	*Customer obtains use-value from consuming a product or service and gains extra value on account of dealings with others*	• A free magazine offering content and advertisements both of which are valued by readers; • A web-based free game that contains advertising valued by the players.	A platform that supplies a product or service that contains extra benefits from 3rd parties – that typically pay for the whole package	Rochet & Tirole (2006)	***Special case II:*** Whenever a specialized magazine offering the option of free-of-charge advertisement is involved in the process	*Significant*

Table 23. Fundamental business model arrangements
Source: Adapted from Baden-Fuller et al. (2017)

Before we embark upon *business model innovation*, we reserve the following few subsections to clarify the nuances between the two notions of *business strategy* and *business model* —and extend our investigation to cover *business tactics* too. However, on the surface, these notions seem to be identical —yet, in point of fact, they are not, being different constructs (Casadesus-Masanell & Ricart, 2010). As put by the authors, *a business model* is a reflection of a company's *realized strategy*; '*it is the direct result of strategy, but it is not strategy itself*.' By the same token, Magretta (2002) acknowledged that a *business model* is not the same thing as a *strategy*, despite the fact that many people use both terms interchangeably today. A *business model* describes, as a system or platform, how the pieces of a given business fit together, but it does not factor in one critical dimension of performance (e.g. competition). In reality, every company is expected to run into rivals at one point in time and, when it does, it will be the job of *business strategy* to deal with it[71]. And so, we assert, by clearly separating the realm of *strategy, business models*, and *tactics*, we would have access to an integrative framework based on which better *business models* could be built and further progress in the field of *business model innovation* could be made.

2.4. AN AMALGAM OF STRATEGIES & TACTICS

A BM, we recap, is a simplified representation of how a company makes money (Casadesus-Masanell & Tarzijan, 2012). Referring to the *decision making model* shown in Figure 29 below, it seems quite evident that it is the fundamental set of decisions that form the business and allow for its continued existence and profitability (Lee & Stinson, 2014).

[71]ibid

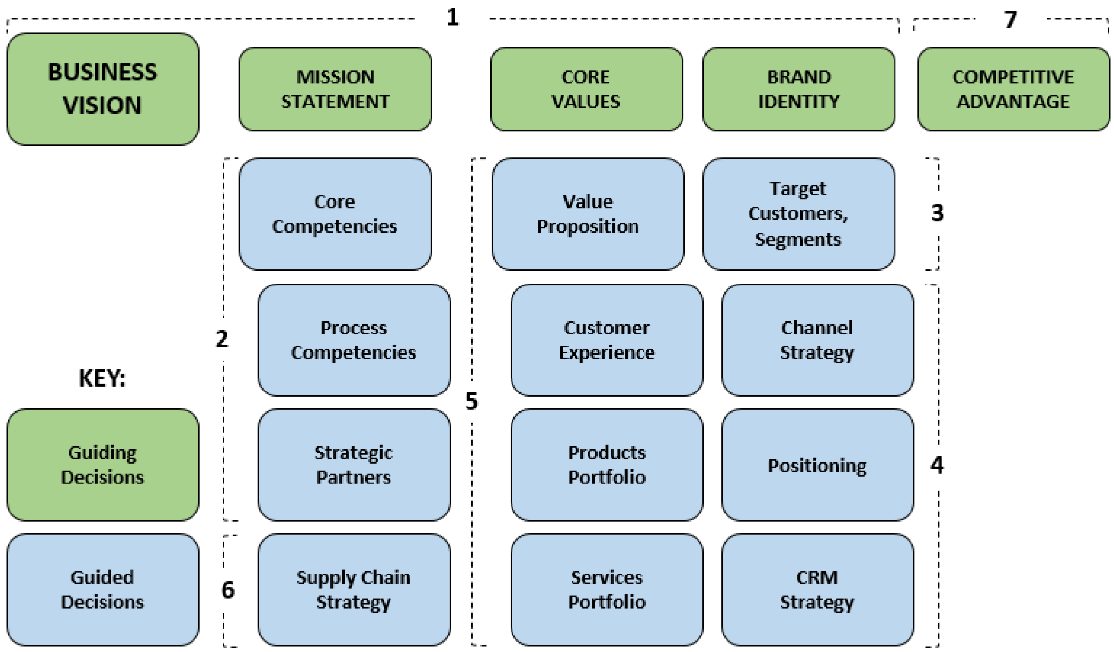


Figure 29. The decision making model
Source: Created by the author — inspired from Lee and Stinson (2014)

Essentially, a company's business plan documents these key decisions, adding information that supports the alternatives chosen and demonstrating a viable BM. After viability, the company should identify how to sustain its operations in the face of rivalry (Massa & Tucci, 2014).

As per Magretta (2002), choosing a competitive-advantage strategy typically identifies the areas where the company should focus its innovation (or investment) efforts to boost customer value proposition over time. To incorporate the concepts of *strategy*, *BM*, and *tactics* however, we set off by introducing the *generic two-stage competitive process framework* (Figure 30). The rationale behind the latter, we add, is quite straightforward; it pours as follows: normally, companies start by choosing a logic of (strategy for) value creation and value capture, which would be reflected in their BMs. Later, they make tactical choices driven by their intents to maximize stakeholder value. Therefore, sequentially, *strategy* comes first and *tactic* follows; and *BM* falls in between the two. With that said, we use the term *stractics* in the next subsections to denote *BMs*, being concurrently —a reflection of a company's sets of strategies —and an influencer of its sets of tactics.

Figure 30. The generic two-stage competitive process framework
Source: Adapted from Casadesus-Masanell and Ricart (2010)

2.4.1. *STRATEGIES*

Strategy is defined as a provisional plan of action intended to realize a precise objective. It is the art of creating value (Normann & Ramirez, 1993). Moreover, as described by Eisenmann (2002), a critical element of strategy is the set of committed choices made by management. In like manner, Porter (2001) pointed out: *'strategy is the creation of a unique and valuable position, involving different sets of activity systems.'*

Reliable with the previously mentioned, *strategy* refers — in our research project — to the provisional plan as to which BM to use and when. The word *provisional* is of great significance here —indicating that strategies contain provisions as to what to do even for eventualities that may end up not happening. For example, a given company (*Y*) facing a potential entrant (*X*) in the industry would normally have as a strategy, a plan (*A*) as to what to do if (*X*) enters the market —and a plan (*B*) as to what to do if (*X*) refrains from doing so. Assuredly, only one of the two options would end up taking place, hence forcing (*Y*) to take necessary action. However, in the case of an *outsider* looking at (*Y*), as reported by Chesbrough and Rosenbloom (2002) —and Johnson et al. (2008), he would only be able to perceive the company's realized strategy (*A* or *B*) — not the full one (*A* and *B*).

Reverting back to *Ryanair*'s case, when the company was at the brink of bankruptcy — back in 1991, its strategy was an action plan to transfigure its, at the time, standard-full-service-airline BM. Rivkin (2000), in his article entitled *'Dogfight over Europe: Ryanair (A),'* richly described the four alternative actions plans that *Ryanair*'s executives opted for to escape proximate economic failure, namely: (1) become the Southwest of Europe, (2) add business class, (3) become a *feeder* airline operating from Shannon's airport, or

(4) exit the industry. Besides the fourth option, all other, we proclaim, entailed a different BM — and the specific way *Ryanair* executed these plans was through *one realized strategy* —linking to *one specific BM*.

2.4.2. *TACTICS*

Tactics (in comparison to *strategies*) describes the remaining choices available to a company by virtue of the *strategy* —and so, the *BM* it is currently using. Consider the case of *Metro*, for instance, the world's largest newspaper measured by circulation (Khanna et al. 2007; Casadesus-Masanell & Ricart, 2010). It is *free* and *Ad-sponsored* —and it is published in over one hundred cities. In each city it enters, it races with local newspapers sold at positive prices. Being *Ad-sponsored*, *Metro* specifies the rates that it would charge to companies that wish to advertise in it. *Metro* also chooses the exact number of pages that each edition of the newspaper has, the exact number of Ads, the accurate balance between news and opinion pieces —and so on —and so forth. All of these choices are part of *Metro*'s *tactics*. *Metro*, though, cannot amend the price of its product because its BM is *Ad-sponsored* —and so, the product must be given away for free. In other terms, *Metro's BM* disallows the company from using *price-of-the-newspaper* as a parameter that could be altered depending on the intensity of rivalry and other external factors. For that reason, we conclude, the latter is not part of *Metro's set of tactics*.

Now, we proceed by enquiring: *Why tactics are essential anyhow*? They are so because they play a crucial role in determining how much value is created and captured by the company (Casadesus-Masanell & Ricart, 2010). In the case of *Metro*, advertising rates and the number of Ads displayed in the newspaper ended up influencing readership-and-advertising revenues. In fact, as progressively more Ads were included, readers became increasingly annoyed and less disposed to reading the newspaper. Equally, as the advertising rates rose, the count of advertisers wishing to advertise in the newspaper plunged —thus crushing *Metro*'s revenue, profit, and value capture.

> *To further illustrate the essentiality of tactics in the business world, we raise the case of cars —where the car itself designates the BM. Certainly, the way the car is built places constraints on its use-value that is, what the driver could or could not do with it. A large — powerful 4×4 car, for instance, makes it stiff for a driver to maneuver on the narrow streets of the city of Paris. In contrast, a small — powerless compact car would create more value for the driver by making this task far less cumbersome. Thus, under specific settings, there are tactics that are possible with the compact car that would be impossible with the 4×4. Put differently, we conclude, the shape of the car —being an element of the BM— is decisive, in some particular cases at least, of its use-value and so, its overall worth.*

So far, we have argued that *tactical choices* define how much value is created and captured by the company using them —however, as per Casadesus-Masanell and Ricart (2010), there is still much more to *tactics* than this —with their influence, the authors alleged, reaching out, now and then, to other companies with which the focal company interacts. At this level, we are referring to the idea of *tactical interactions,* which denote the various ways companies influence each other by acting within the bounds set by their respective BMs. Generally, *tactical interactions* arise when a company's BM is put in contact with that of another company (—e.g. mom-and pop stores and discount retailers)[72]. And when this materializes, there would be *consequences* on both companies' BMs —where feedback to the rest of the system is dogged not only by the focal company's *tactical choices,* but by those made by the other company too (McGrath, 2010).

In finale, we affirm, a BM employed by a company determines the set of tactics available for it to compete against, or to cooperate with, other companies in the marketplace. Therefore, BMs and tactics are closely related and mutually dependent, with the likelihood of one influencing the other (Yip, 2004).

2.4.3. *STRACTICS*

Having introduced the notions of *strategies* and *tactics* (and earlier, *BMs*), we — once again — use the *generic two-stage competitive process framework* to conceptually

[72]ibid

integrate and relate them (―see Figure 31). As described by Casadesus-Masanell and Ricart (2010), BMs are presumed to lie in between *strategies* and *tactics*. And the linkage between the two concepts is called *stractics*, a real-world terminology that we use in our text to designate the amalgam of *strategies* and *tactics* at corporate level.

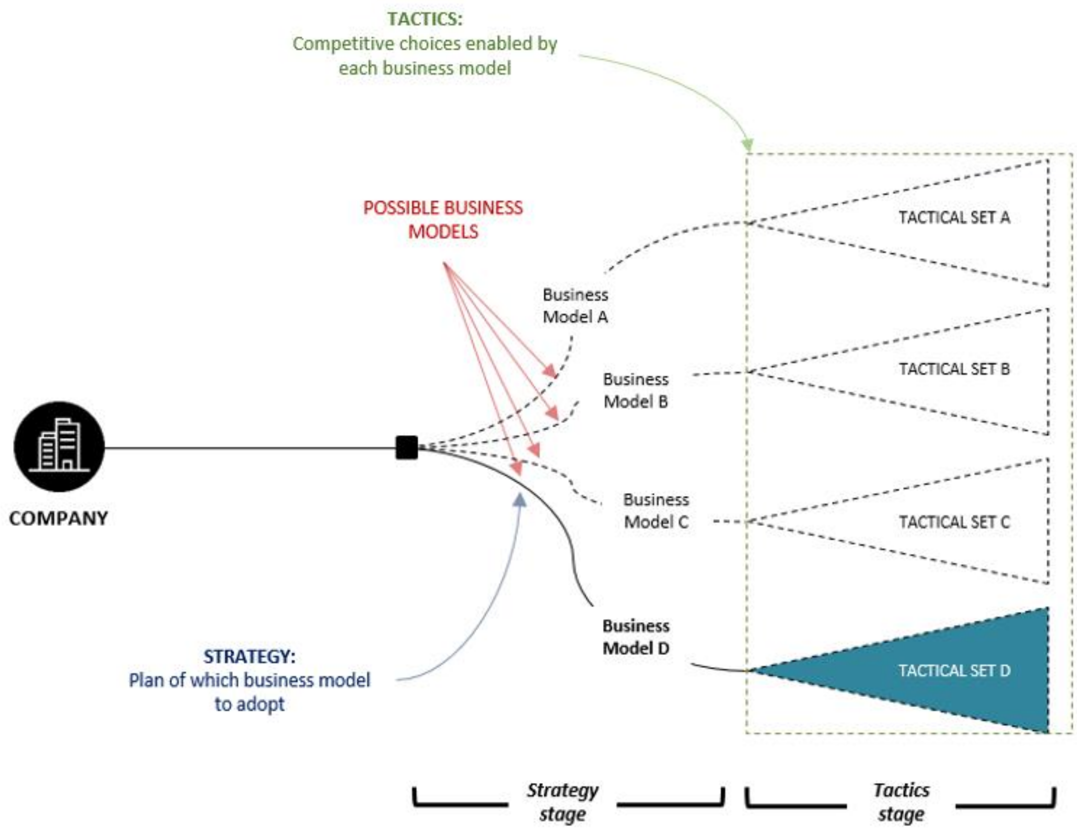


Figure 31. Strategy, business model, and tactics
Source: Adapted from Casadesus-Masanell and Ricart (2010)

Precisely so, it is a company's choice of a strategy that would depict which BM to espouse ―and so, which set of tactics to apply based on circumstances and needs. As formerly noted —a *strategy* is a provisional plan of action as to which BM to use —and the available actions for *strategy* are choices that constitute the raw material of BMs. Based on *strategy*, companies define long-term goals and ways to fulfill them. Consequently, *strategy* entails designing (redesigning) BMs to allow for companies to reach their prefixed durable business objectives. With regards to *BMs* in particular, they are nothing but a plain reflection of a company's realized strategy. As for *tactics*, alike *strategies*, they are concrete action plans, courses of action that occur within the bounds drawn by the company's BM. Nonetheless, in contrast to *strategies*, *tactics* are generally oriented toward smaller steps and shorter timeframes.

Within this framework, and to better cement the prevalent dependencies between all three notions, we recall the *car* example put forward earlier—but this time, we suppose that the driver has been given the chance to bring all the changes he wants to the *car* (e.g. color, fuel consumption capacity, power engine, and others) —prior to operating it. Business wise, the changes made (one or more, minor or major) symbolize *strategies* because they *ipso facto* alter the car (*BM*) in its entirety. And the company's *competitive process framework* would discharge in the following manner —in that order: (1) the design and building of the car is *strategy* — (2) the car itself is *BM* — and (3) the driving of the car is *tactics*.

This reasoning relates to our research project in so many ways. Mainly, by the fact that what we are proposing is an industry-level BM change, an organizational innovation (a new business strategy) that construction companies may opt for to better manage smart developments. As well, given that construction companies may have on one or several BMs (moneymaking logics) — we, through the present study, offer them one more, plainly, a new set of *stractics* they could rely on for the resourceful achievement of their smart construction projects.

The upcoming subsections present a lengthy primer on the passage from BM to BMI (Business Model Innovation) —describe the four main streams of research on BMI — and underscores the main gaps in the research on BMI today.

2.5. ON BUSINESS MODEL INNOVATION: A LONG PRIMER

Over the years, the scope of creating CVP (Customer Value Propositions) has extended from delivering basic products and services —to crafting advanced BMs (Stonehouse & Snowdon, 2007; Massa & Tucci, 2014, Laszczuk et al. 2017). Porter (2001) netted this paradigmatic shift by declaring that a strategic fit among many activities is crucial, not only to competitive advantage — but also to the sustainability of that advantage. Indeed, it would be stiffer, the author stated, for a competing company to match a collection of interlocked activities than to copy a specific sales force approach, match a technology process —or duplicate a set of product features. And positions built on systems of activities, the author later on concluded, are far more sustainable than those built on individual activities.

Within this context, the old dictum of *building a better mousetrap*[73] — as a means to make the world beat an innovation path to a company's doorstep— springs to mind. Knowing that all companies have some sort of a BM (evidently!), we, as a result, assume that the key questions that should be asked at this level are the following (Morris et al. 2006): *Have the elements of the BM purposely been thought through following a customer-centric approach? Does a company decisively design all elements of the BM or does it focus most of its innovation on upgrading the core product*? As put by Carassus (2004), all eggs are often put into one basket, that of product innovation, with the majority of companies constantly searching for differentiation through superior products while at the same time neglecting opportunities in other parts of the BM. Actually, to grasp the entire activity system is a complex task that frequently ensues in both overlooked areas and designs that are built on the dominant logic of the industry (Massa et al. 2017).

We carry on by asking: *How could a company guarantee that its newly designed BM would end up delivering as planned?* According to Christensen et al. (2006), four areas should be investigated for a company to be able to establish a systematic overview of opportunities — exploit BM design — and enhance customer value creation (Figure 32).

[73] *A better mousetrap, the business of invention*. AbeBooks.fr - ISBN 10: 0951385607 - ISBN 13: 9780951385609

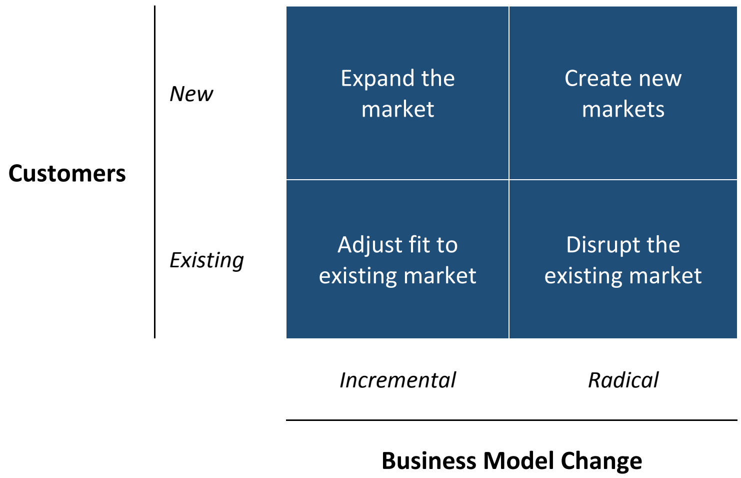


Figure 32. Typology of business model innovation opportunities
Source: Created by the author — Inspired from Christensen et al. (2006)

It is all about adjusting the current BM to exploit opportunities in existing markets. In fact, the shifting needs of existing customers —and a turbulent environmental context constitute a window of opportunity for companies to amend their BMs (Chesbrough, 2010). Under similar settings, simple incremental moves in some areas of the BM could be subjugated to achieve significant business goals. *TDC* (Tele Denmark Communications)[74] is a great example of a company which, via the introduction of a free-music service layer has vividly changed the stickiness of its BM —and diminished loss in market share via improved customer loyalty and satisfaction. And so, as informed by Souto (2015) —and Foss and Saebi (2017), changes brought to the table for the creation and design of new BMs do not necessarily, always have to be radical —because simple moves, time and again, suffice to clutch new differentiation factors and accomplish great results in existing markets. But then, *what about redesigning the current BM to expand the market?*

Incremental change in the current BM may be leveraged to expand the market by attracting non-customers, thus converting latent demand into real demand (Lindgart et al. 2009; Koen et al. 2011). The practice of serving products in small, reasonable sizes is a broadly used strategy by global consumer brands to enter emerging markets. In the

[74]The Need for Innovations in Business Models. Final Policy Brief (Deliverable 5). European Commission, DG Research & Innovation. Available from: http://ri-policy-analysis.eu/fileadmin/ripolicies/documents/bmi/policy_brief/eriab-bmi_pb_new_business_models.pdf (The e-document was last visited on 3-13-2020)

Philippines, for instance, seven out of ten smokers purchase their cigarettes by the stick rather than by the pack; also, eight out of ten Filipinos buy their shampoos by sachet rather than bottles (Rodolfo & Sy-Changco, 2015). Here again, similarly to *TDC*'s case, the core product is left intact, while both innovative distribution setups and packaging designs became recipes for business success. *So, now, how about tossing a new BM that would disrupt the existing market?* In some cases, inspecting the needs of current customers might lead to the discovery of attractive sub-segments which are not suitably served by the current BM (Kumaraswamy et al. 2018). Certainly, the detection of underserved or overserved customer segments could pave the way for important managerial decisions. This is chiefly the case of *Nestlé's Nespresso*[75] which, by eliminating the risk of failing to brew the perfect cup of coffee —and decreasing the time it takes to make a nice single-shot espresso, succeeded to identify and acquire an attractive niche of espresso drinkers (Söderberg, 2019). In contrast to high-end disruptions typically achieved via notable technology leaps, low-end disruptions on the other hand are accomplished via simple cost-cutting measures (e.g. *Ryanair*).

Moving forward, we enquire: *What about designing entirely new BMs?* Schiavi and Behr (2018) precised that designing new BMs could be leveraged to create wholly new markets where large groups of customers have been, intentionally or unintentionally, locked out. Nevertheless, the authors added, in some specific cases, minor BM tweaks —such as sachet marketing are just not enough —and so, a complete overhaul is required at times for a company to be able to commercialize CVP for new markets. Table 24 shown below describes the growth opportunities that could be grasped through BMI. These opportunities, we say, could be explored and exploited by any company to sustain growth and delight customers. As per Markides (2013), introducing a better BM into an existing market is the definition of a disruptive innovation. Obviously, new BMs are not launched out of the blue, the author indicated, but rather closely aligned with overarching the strategic growth ambitions of the company. And so, the author added, a diagnosis of the strengths and weaknesses of current BMs must form the basis for any thoughtful attempt to pursue any generic growth opportunity.

[75]ibid

	ADJUST FIT TO EXISTING MARKET	DISRUPT THE EXISTING MARKET	EXPAND THE MARKET	CREATE NEW MARKETS
Customers	Existing	Existing	New	New
Level of change	Incremental	Radical	Incremental	Radical
Characteristics	Improve the existing BM to attract and retain customers in existing markets characterized by intense competition	Develop new BM to exploit opportunities in either underserviced high-end segments or overserviced low-end segments	Improve the existing BM to fit needs of customers in unserved markets or segments of non-customers	Develop new BM to exploit opportunities in new markets or segments of non-customers

Table 24. Generic growth opportunities

Source: Created by the author - Inspired from Markides (2006; 2013)

To date, several scholars have suggested signs that could indicate that a company's current BM is running out of gas. According to McGrath (2010) for instance, the first symptom is when innovation to a company's current offerings create smaller and smaller improvements. In such as case, the author suggested, BMI is the only solution available. Similarly, Foss & Saebi (2017) affirmed that BMI is a crucial capability for companies seeking to reinvigorate a lagging core, defend against industry disruption or decline, or even drive breakthrough growth. *Amazon*[76] is a good example of a company that drove BM change in a resourceful way. At start, the company was the earth's biggest bookstore; twenty years later, that bookstore turned into a leader in cloud computing, and started delivering groceries and producing Emmy Award-winning television series.

Unlike other types of innovation, changes to the BM infers changes to the foundational decisions upon which the business operates (Massa & Tucci, 2014) —meaning that BMI is most likely to be radical and transformational. Changing the entire BM design (relative to incremental innovation: mere product innovation or technology enhancements) is possibly to be associated with higher risks, the authors said, with the possibility of disrupting the current business. Hence, '*to find the right timing for a BM change is fundamental to business success,*' they concluded. For well-established businesses, recognizing and managing this kind of radical change could be critical to their long term survival, whereas for start-ups, such change may be advantageous. With that said, although present-day changes in customer behavior, globalization and technological innovation have left the door wide open for the advent of new BMs (Schiavi & Behr, 2018), one must realize that not all BMI efforts are alike (—see Figure 33 for an illustration of the various approaches to BMI).

[76]Amazon.com, 2018, Harvard Business Review Case Collection, August. Available from: https://www.hbs.edu/faculty/Pages/item.aspx?num=49324 (The webpage was last visited on 3-13-2020)

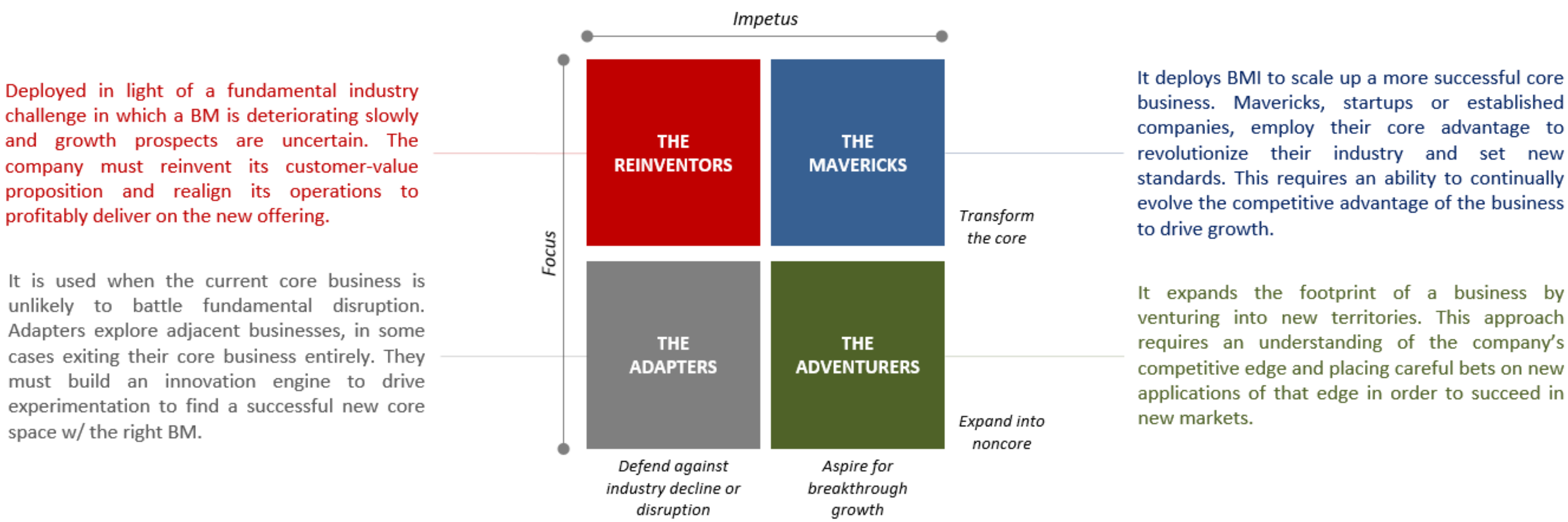


Figure 33. The four approaches to business model innovation
Source: Inspired and adapted from Deimler and Kachaner (2020)

2.5.1. *DEFINITIONS*

To date, the BM concept has been embarked upon in the fields of *innovation* and *technology management*, with two chief ideas typifying the academic research pertaining to it: (1) companies promote original ideas and technologies via their BMs, and (2) BM is a new substance of innovation by itself. Chesbrough and Rosenbloom (2002) advanced the case of *Xerox* to pinpoint the ability of a BM to unlock the value potential embedded in new technologies and convert it into a concrete outcome. From their side, Calia et al. (2007) affirmed that BMs not only could they entail consequences for technological innovations —but could also be shaped by them. Moreover, as put by Johnson and Suskewicz (2009), BMs play a vital role in the commercialization of technologies at two levels, that of an individual company —and of an entire industry. In large, in infrastructural change, the authors argued, the key intent is to shift the focus from developing distinct technologies to creating completely new systems. The BM in such a case is introduced as part of an all-inclusive framework for thinking about systemic change. Though BM looks like a terrific thing, we recap, studies on BM, innovation, and technology management have shown that technology might not be enough by itself to guarantee business success (Doganova & Eyquem-Renault, 2009) —for it lacks inherent value (Chesbrough, 2007).

Apart from embedding technology in outstanding products or services, Mitchell and Coles (2003) said, a company should design a unique BM to be able to fully grasp its operating potential. Indeed, as per the authors, companies are possibly to view the BM itself as a substance of innovation —hence, the notion of *open innovation* introduced by Chesbrough (2003). In the main, *open innovation* — being a mode of innovation in which companies look outside their boundaries in order to leverage internal and external sources of ideas — entails the espousal of new BMs designed for sharing or licensing technologies (Chesbrough, 2010). Today, there is a swelling agreement that BMI is decisive of business performance (Foss & Saebi, 2017) —and the number of scholars investigating BMI as a means for corporate conversion and rejuvenation is on the rise (Johnson et al. 2008; Demil & Lecocq, 2010).

At this point, now that we have concisely presented the concept of BMI, it seems opportune to define it. Overall, we proclaim, the definitions that one could come across while reviewing the academic literature on BMI diverge greatly, thus revealing some deep vagueness with regards to what the latter really is (Foss & Saebi, 2017).

For some scholars, BMI is a *process* —while for some others, it is more of an *outcome*. Such variances, we proclaim, are expected to have significant implications for subsequent research on BMI. Indeed, studies that perceive BMI as a *process* often take a dynamic approach and look into the managerial physiognomies that facilitate or hinder the process of BMI (Demil & Lecocq, 2010; Doz & Kosonen, 2010), whereas studies focusing on the *outcome* tend to be more descriptive and identify the content of the BMI ex post (Bucherer et al. 2012; Günzel & Holm, 2013). As put by Foss and Saebi (2017), even though both types of studies have their merits, they however deal with distinct phenomena, each requiring a different empirical approach to be scrutinized. Same as for BM, the definitions suggested for BMI are numerous (—see Table 25), yet they in majority lack specificity. This, again, infers that there is no clarity in the literature about the nature of a BMI.

Definitions	***Author/s***
BMI means BM replacements that provide product or service offerings to customers and end-users that were not previously available. The process of developing these novel replacements is also referred to as BMI	*Mitchell & Coles (2004)*
BMI is the discovery of a fundamentally different BM in an existing business	*Markides (2006)*
BMI is a reconfiguration of activities in the existing BM of a company that is new to the product service market in which it competes	*Santos et al. (2009)*
Initiatives to create novel value by challenging existing industry specific BMs, roles and relations in certain geographical market areas	*Aspara et al. (2010)*
BMI occurs when a company adopts a novel approach to commercializing its underlying assets	*Gambardella & McGahan (2010)*

(Cont.)	
BMI is about generating new sources of profit by finding novel value proposition/value constellation combinations	*Yunus et al. (2010)*
Innovate BM by redefining: content (adding new activities), structure (linking activities differently), and governance (changing parties that do the activities)	*Zott & Amit (2010)*
BMI is the process that deliberately changes the core elements of a company and its business logic	*Bucherer et al. (2012)*
A BMI happens when the company modifies or improves at least one of the value dimensions	*Abdelkafi et al. (2013)*
Corporate BM transformation is defined as a change in the perceived logic of how value is created by the company, when it comes to the value-creating links among the company's portfolio of businesses, from one point of time to another	*Aspara et al. (2013)*
A BMI could be thought of as the introduction of a new BM aimed to create commercial value	*Berglund & Sandström (2013)*
BMI refers to the search for new logics of the company and new ways to create and capture value for its stakeholders; it focuses primarily on finding new ways to generate revenues and define value propositions for customers, suppliers, and partners	*Casadesus-Masanell & Zhu (2013)*
BMI refers to (a) the design of novel BMs for newly formed companies (i.e. the activity of creating, implementing and validating a BM), or (b) the reconfiguration of existing BMs for established companies (the phenomenon by which executives reconfigure organizational resources and acquires new ones). Both phenomena are change phenomena and could lead to BMI	*Massa & Tucci (2014)*
BMI activities could range from incremental changes in individual components of BMs, extension of the existing BM, introduction of parallel BMs, right through to disruption of the BM, which may potentially entail replacing the existing model with a fundamentally different one	*Khanagha et al. (2014)*

Table 25. Definitions of BMI
Source: Adapted from Foss and Saebi (2017)

For the purpose of our research, we adopt the definition suggested by Pavie et al. (2013) for BMI. According to the authors, BMI is the art of enhancing advantage and value creation by making simultaneous, mutually supportive changes both to a company's CVP —as well as to its underlying operating model. *At the value proposition level*, the authors affirmed, these changes could address the choice of the target segment, product and service offering, and revenue model. While, *at the operating model level*, they added, the focus is more on how to drive profitability, competitive advantage, and value creation. Put differently, BMI describes a fundamental change (technology-driven or not) in how a company delivers value to its customers.

The next subsection exposes the four main streams of research on BMI.

2.5.2. *STREAMS OF RESEARCH ON BMI*

Although there is today a noteworthy number of studies that revise the existing literature on BMI (Zott et al. 2011, Lambert & Davidson, 2013; Wirtz et al. 2015; Foss & Saebi, 2017), there is only one, we believe, to be complete and exhaustive —explicitly, that written by Schneider and Spieth (2013), which appraises over thirty scientific papers on BMI. Foss and Saebi (2017), too, did a great job gathering and summarizing data linking to BMI research. Specifically, they reviewed nearly 150 publications in terms of their conceptual, theoretical, and empirical developments and contributions (Table 26) — and distinguished four fairly overlapping streams of BMI research (Table 27). Those streams, the authors added, embody weighty evolutions —as well as limitations in the arena of BMI research in general. They are discussed below:

Streams	***I***	***II***		***III***	***IV***
Focus	***Conceptualization of BMI:*** *case examples*	***BMI as an organizational process:*** *case examples*	*Case studies:*	***BMI as an outcome:*** *case studies*	***BMI and managerial consequences:*** *survey data*
Author/s	• Markides (2006) • Johnson et al. (2008) • Santos et al. (2009) • Koen et al. (2011) • Sorescu et al. (2011) • Amit & Zott (2012)	• de Reuver et al. (2009) • Deshler & Smith (2011) • Berglund & Sandstroem (2013) • Evans & Johnson (2013) • Cavalcante (2014) • Girotra & Netessine (2014)	• Demil & Lecocq (2010) • Deshler & Smith (2011) • Pynnonen et al. (2012) • Enkel & Mezger (2013) • Aspara et al. (2013) • Frankenberger et al. (2013) • Dmitriev et al. (2014) • Khanaga et al. (2014) • Mezger (2014)	• Anderson & Kupp (2008) • Gambardella & McGahan (2010) • Sánchez & Ricart (2010) • Yunus et al. (2010) • Wirtz et al. (2010) • Berman (2012) • Holm et al. (2013) • Richter (2013)	• Pohle & Chapman (2006) • Zott & Amit (2007) • Aspara et al. (2010) • Bock et al. (2012) • Huang et al. (2013) • Denicolai et al. (2014) • Wei et al. (2014) • Velu & Jacob (2014) • Kim & Min (2015)

Table 26. Streams of BMI Research
Source: Adapted from Foss and Saebi (2017)

Author/s	***George & Bock (2011)***	***Zott et al. (2011)***	***Lambert & Davidson (2013)***	***Wirtz et al. (2015)***	***Schneider & Spieth (2013)***
Findings	***Use of BMs:*** • Organizational design • Resource-based view • Narrative and sense making • Nature of innovation • Transactive structure • Opportunity facilitator	***3 themes of BM literature:*** • E-business • BMs and strategy • Innovation and technology management	***3 themes of BM literature:*** • BM as basis for enterprise classification • BMs and enterprise performance • BMI	***4 research foci:*** • Innovation • Change and evolution • Performance and controlling • Design	***3 streams of BMI research:*** • Prerequisites of conducting BMI • Process and elements of BMI • Effects achieved through BMI

Table 27. Research on BM and BMI
Source: *ibid*

The first stream, *conceptualizing BMI*, centers on the phenomenon of BMI itself, suggesting definitions and conceptualizations of BMI (e.g. Amit & Zott, 2012; Teece, 2010). It also focuses on issues such as the least significant definition of BMI —and the dimensions along which companies could innovate their BMs (e.g. Santos et al. 2009). At this level, the purpose seems to revolve around the development of definitive, pictorial schemes; nevertheless, as formerly noted, most definitions available, though abundant, vary strikingly and are often unclear. When it comes to the second stream, *BMI as an organizational change process*, innovation is said to strongly defy prevalent managerial structures (Damanpour, 1996). In contrast to the first stream, the second one goes farther by underscoring the competences, governance, and scholastic systems required for prolific BMI. Indeed, studies carried out within the second stream define BMI as a vigorous process by: (1) recognizing the various stages of the BMI process (e.g. Gassman et al. 2014), (2) categorizing the different administrative know-hows and procedures needed to support such a change process (e.g. Demil & Lecocq, 2010), (3) revealing the significance of research and knowledge (e.g. Andries & Debackere, 2013), and (4) putting practical tools forward for the implementation of the process (e.g. Evans & Johnson, 2013).

Moving forward, the third stream, *BMI as an outcome*, embarks upon the yield of the second stream. Commonly, it addresses the advent of new BMs in a specific sector or industry (e.g. Schneider & Spieth, 2013; Souto, 2015). Also, some studies within this stream concentrate on scrutinizing a precise type of a new BM — one that is conceived for low-income markets for instance (e.g. Sánchez & Ricart, 2010). Other publications within this stream (e.g. Matzler et al. 2013); we assert, tend to be descriptive rather than exploratory, limiting their contributions to commentaries on the creativity of some prominent companies' BMs (e.g. Nestlé's Nespresso). For some reason (one or more), the third stream does not build on the first one, yet, instead, the emphasis is put on unfolding one specific type of change in BM —often said to be of a new kind. This stream is limited though in the fact that it does not provide any discussion of the standards based on which the proper BM change could be seen as new.

Lastly, the fourth stream, *the managerial consequences of BMI*, tackles the managerial performance repercussions of BMI. In this stream, one could distinguish between studies that link the BMI process —to outcome implications (e.g. Cucculelli & Bettinelli, 2015) —and those that inspect the influence of various types of BMs on company performance (e.g. Zott & Amit, 2008). In the first case, studies assume a process view and investigate whether an innovative change in the existing BM leads to larger performance outcomes (Giesen et al. 2007; Aspara et al. 2010; Cucculelli & Bettinelli, 2015). In the second case however, studies do not directly link BMI to performance outcomes, but instead, they test, following an empirical approach, the impact of various BM designs on innovation performance (Zott & Amit, 2008; Wei et al. 2014).

To say the least, the BMI literature has so far yielded several key insights —allowing for a better understanding of the nature of BMI in general. One central contribution of BMI research links to the capacity of companies to incorporate change in the design and architecture of their BMs as a strategic vehicle for the creation of both value and competitive advantage (Massa & Tucci, 2014). Within the scope of our investigation, two lines of argumentation seem to be obvious; academic researches either follow a dynamic view of BMI or conceptualize it as a managerial change process (*first stream*) —or view BMI as a new type of innovative schemes (*third stream*) that could ultimately influence business performance (*fourth stream*). We conclude by pointing out that the literature on BMI lacks academic works that plainly deal with the antecedents of BMI — yet, we note that the four research streams discussed earlier have largely evolved over time, perhaps disconnectedly, because no direct correlation could be spotted among them (Foss & Saebi, 2017).

In connection with the present subsection, the next one demarcates the gaps in the academic literature on BMI.

2.5.3. *GAPS & CHALLENGES*

According to Foss and Saebi (2017), the existing literature on BMI is highly fragmented, and the gaps in the studies carried out over the years to investigate it are copious. For simplicity reasons, the identified gaps are categorized under specific headers (themes), in the number of six, namely: (1) *definitions*, (2) *dimensions*, (3) *antecedents*, (4) *outcomes*, (5) *variables*, and (6) *boundaries* (—see Table 28). They are clarified hereunder:

Definitions — up until now, we have plainly exposed the various inconsistencies in the definitions suggested for BMI — pointing altogether to a lack of clarity and specificity in the literature stream regarding the nature of BMI. Though this might not unavoidably be a bad thing, a characteristic of a nascent research field that has not formed yet, such conjectural heterogeneity, we believe, may be challenging on the long run since research efforts would end up branching off in various, random directions[77].

Dimensions — advances in research frequently occur when constructs are clearly dimensionalized —that is, when scholars succeed to capture the heterogeneity of a construct in terms of its key components that have relevant inferences for outcomes. Our review of the literature suggests that BMIs differ in terms of at least two dimensions: *scope* and *novelty*. The degree of novelty of BMI relates to whether BMIs are seen as novel at company or industry level (e.g. Johnson et al. 2008; Santos et al. 2009). As for its scope, reflecting how much a BM is reflected by BMI, it could start small (BMI influencing only one component of a BM) (e.g. Amit & Zott, 2012; Schneider & Spieth, 2013) —yet grow larger and larger over time (BMI influencing two components, three, four, or even all components of a BM —plus the architecture connecting them) (e.g. Yunus et al. 2010).

Antecedents — to our knowledge, there is little or no publications that theorize the antecedents of BMI. Actually, most of the studies that we bumped into while inspecting the matter seemed to tackle the BMI concept from varied slants. Doz and Kosonen (2010) for instance — acknowledged that BMI is a compulsory retort to strategic incoherence and disorders, convergence and strong global competition. In contrast, Johnson et al.

[77]ibid

(2008) stated that a company should opt for BMI whenever it is facing competitive pressure or an unstable base of rivalry. Voelpel et al. (2004) rather talked about the prominence of BMI whenever chief and erratic changes in the business context have emerged. Some other studies (—see Tables 26 and 27), we add, described BMI an endeavor, a strategy often used by companies, to grasp new opportunities announced by the advent of new technologies. Also, a few others focused on assessing the impact of new BMs on business performance in the context of e-business (Pateli & Giaglis, 2005; Sabatier et al. 2012). The list of scholars attempting, say, to identify the use-value of BMI in the corporate world stretches endlessly, yet, what is worth mentioning at this point is that most of the relevant academic works carried out on this basis have been, as put by Foss and Saebi (2017), backdated and inductive —rather than deductive and hypothetical.

Outcomes — our investigations led us to recognize that the influence of BMI on business performance is likely to vary based on the improvements or strategies that companies choose to adopt in order to innovate their BMs (e.g. cost cutting, process optimization, launching new products). Generally, there are only few articles that clearly explicate how BMI boosts profitability (e.g. Aspara et al. 2010; Wei et al. 2014). One reason for that lies in the intricacy of linking BMI and performance. This is genuine because, often, there might be numerous composite links between BMI and performance, links that play out differently across time with the possibility of being entangled. Thus, it seems impractical for scholars to empirically account in their studies for all the inherent mechanisms governing the relation between BMI and corporate performance (Foss & Saebi, 2017).

Definitions	*Dimensions*	*Antecedents*	*Outcomes*	*Variables*	*Boundaries*
• Concept • Construct	• Scope • Novelty	• BMI Precursors	• Causality Relationship: BMI, Business Performance	• Capabilities, Leadership • Learning, Experimentation • Cognition • Organizational Structure Design	• Current Market Standing: Statu Quo • Adaptability: Market Changes, Requirements
• BMI: Construct of BM • BM: Architecture for Value Creation, Capture, Delivery • Complex Systems: Functional Relations, Underlying Activities	BMI Typology: • Evolutionary BMI • Focused BMI • Adaptive BMI • Complex BMI	• Internal Environment • External Environment	• Business Model • Governance Structure • Value Chain • Revenue Model • Imitability, Complexity	• Moderating Factors	• Entrepreneurship • Open Innovation • Servitization • Sustainability

Table 28. Gaps in BMI research
Source: Created by the author - Inspired from Foss and Saebi (2017)

Variables — while revising the literature on BMI, we have found numerous studies that point towards the crucial roles that *managerial capabilities*, *leadership skills*, and *educational processes* could play in provoking BMI; also, we have recognized that some other, equally important, managerial variables were, regardless of the reason, only meagerly addressed. To start with, Demil and Lecocq (2010) stressed on the importance of building *dynamic consistency*, which, the authors, described as the ability of a company to prompting and sustaining business performance while varying its BM. Similarly, Doz and Kosonen (2010) focused on the capacity of companies to achieve *strategic agility* for hastening BM renewal.

Going forward, other scholars (e.g. Andries & Debackere, 2013) have shed light in their works on the vitality of *experimentation* and *education* as sources of BMI. Indeed, they suggested that companies could innovate their BMs via either incremental or radical experimentation modes —meaning that innovation is not inevitably, always stirred by radical change, and that, in specific cases, small changes may be satisfactory to induce the required change. *Cognition*, too, seems to be playing an important role in instigating BMI. For Doz and Kosonen (2010), BMs stand as cognitive structures providing a scheme of how to set boundaries to the company, how to create value, and how to shape its internal structure. Besides the aforesaid, other managerial factors at play in the management of both BMs and BMIs have been also mentioned and described in the literature in recent times (Markides, 2013; Schneider & Spieth, 2013), explicitly: *strategic flexibility* and *culture*. However, some other, equally important, contingency variables, were neglected or less tackled in the literature, the most important one, we proclaim, being *organization structure design*. Indeed, as put by Foss and Saebi (2017), the extent to which managerial design and control procedures need to be changed to support BMI —and the extent to which a BMI necessitates a new managerial design are subject matters that must be tackled by scholars in way more depth.

Boundaries — the literature on BMI does not openly contend with the issue of boundary conditions; however, these are significant, as companies may diverge with regards to the antecedents and magnitudes of BMI, based on whether they are entrepreneurial or incumbent, high-tech or traditional, start-up or established, and single industry or diversified. For instance, as previously evoked, while startups may have the suppleness required to engage in BMI, the performance repercussions of BMI may be much more evident in well-established companies (e.g. Zott & Amit, 2008). As well, while research recognized that BMI is a vital vehicle for managerial makeover and renewal among incumbent companies (e.g. Demil & Lecocq, 2010; Doz & Kosonen, 2010), only a few studies have thus far compared BMI between incumbent and entrepreneurial companies. On the other hand, concerning sustainability issues in BMI in particular, it is only recently that these have started to gain momentum. As a result, a snowballing number of studies have suggested that sustainability objectives may call for BMI —and several scholars have started investigating the factors and-or BM designs that may possibly help companies to achieve triple-bottom-line goals: *social*, *environmental*, and *financial* (Bocken, 2015).

The next subsection, preceding the conclusion, is added for the only purpose to provide some real world, empirical insights into BMI. Complementing our theoretical research, it offers some straightforward examples of how BMI is (should be) used in practice.

2.5.4. *SOME PRACTICAL INSIGHTS INTO BMI*

BMI is among the most operative ways for companies to set themselves apart from the crowd —and so, protect the existence of their businesses (Casadesus-Masanell & Ricart, 2010; 2011). Precisely, it is a question of thin slicing a company into its building blocks, scrutinizing and valuing them, re-inventing them —and, in mixture with other, new building blocks, to collate them scientifically[78]. At its meekest, BMI requires neither new tools nor the formation of new markets; it is simply about manufacturing existing products using existing technologies, and delivering them to existing marketplaces through existing channels (Chesbrough, 2010). And because it frequently includes changes that are imperceptible to the outside world, it could convey hard-to-copy advantages. The issue, to be clear, is to determine, with some accuracy, what BMI really entails. In the absence of a frame of reference for detecting opportunities, it would be uneasy to be methodical about the process, which expounds why it is commonly done on a case-by-case basis.

Additionally, given the fact that any BM is basically an assortment of key decisions that jointly define how a business generates its profits, incurs its costs, and mitigate its risks, we perceive innovations to the BM as changes to those decisions: *what* mix of products and services should be offered, *when* should key decisions be made, *who* are the best decision makers, what they actually do, how to choose them —and *why* (Betz, 2002; Carassus, 2004; Baden-Fuller & Morgan, 2010). Resourceful changes along these dimensions, we believe, would unquestionably boost a company's blend of financial aspects. We hereunder list some practical (international) insights into BMI that is, how innovative BMs are commonly built ―and based on what rationality. These insights are crucial as some of them would directly inform the BMI we are proposing at the level of the French construction industry, namely: *the engagement of a maven decision maker* ―which, in our case, is the GC.

[78]Four Paths to Business Model Innovation, Harvard Business Review. Available from: https://hbr.org/2014/07/four-paths-to-business-model-innovation (The webpage was last visited on 2-5-2020)

WHAT MIX OF PRODUCTS OR SERVICES SHOULD BE OFFERED?

Uncertainty, especially if linked to demand, is a serious operational impediment that all companies face —and is generally their primary source of risk. One way, among others of course, to significantly mitigate that risk is to alter the company's mix of products or services. Indeed, companies seeking to adjust their offering mix have three options to play on and choose from. They are listed below:

- *LOOK FOR COHESIONS ACROSS OFFERINGS*

The triumph of *VW* (Volkswagen) is chiefly due to its competent business strategy through which the existing commonalities between its various car models. Even if *VW*'s strategy does not necessarily protect it from broad demand swipes, it cuts demand unpredictability for singular components, because shared components make it stress-free for the company, whenever needed, to shift production at its plants from one model to another. Cohesions (or similarities) are not simply shared components among different products —as they could also be, under specific scenarios, the skills required to serve several products, customers, and customer segments. In the late 1990s, for instance, *Amazon* stretched its business from books —into music, video, and games—all of which necessitated the same logistics abilities that books did[79]. This has enabled *Amazon* to conceal the risk of failing to procure sufficient share in either of these categories with possibly larger shares in the other ones.

- *BUILD A HEDGED PORTFOLIO*

Alike banks, companies could choose assortment sets of products or markets to shrink the general hazardousness of their BMs. Chile's *LATAM* airlines, previously known as *LAN* airlines, opted for a somewhat similar approach[80]. Unlike the majority of US carriers, major ones included, which stem less than one-tenth of their financial returns from cargo, *LATAM* decided to use its planes, hovering international routes, to transport not only passengers,

[79] Amazon.com, 2018, Harvard Business Review Case Collection, August. Available from: https://www.hbs.edu/faculty/Pages/item.aspx?num=49324 (The webpage was last visited on 3-13-2020)
[80] LATAM Business Strategy. Available from: http://memoria2012.marketinglan.com/ingles/estrategia_y_negocios.html (The webpage was last visited on 3-13-2020)

but cargo too. With almost all travels from the Americas to Europe taking place on overnight flights, passenger-only airlines tend to keep their planes on the ground for long periods of time, an opportunity cost that *LATAM* decided to avoid by operating its planes at full capacity whereby using the downtime to carry cargo. In fact, this approach diminished the risks related to *LATAM*'s capacity decisions. Generally, airlines make such decisions occasionally —by ordering new airplanes —a request that is hardly achievable, thus leaving them exposed to phases of over or underutilized capacity, with some negative repercussions on revenue. And so, to hedge passengers with cargo could alleviate this risk since their respective demand curves hardly ever rise or fall in concert. Furthermore, to carry cargo could allow for the airline to fly cost-effectively with less passengers onboard and to serve terminuses that other airlines have a tendency to escape.

WHEN SHOULD KEY DECISIONS BE MADE?

Frequently, decisions should be made ex ante a given company compiles sufficient data to make them with certainty. There are three strategies, we would say, that, based on prevailing settings, could mend a BM by shifting the timing of decisions:

- *DELAY DECISION-MAKING*

In lots of industries, companies tend to decide on pricing even before they start selling any of their products and-or services. This, surely, repeatedly exposes them to high risks. For instance, it seems dicey to price airplane seats prematurely simply because demand in this case is likely to vary based on prevailing economic and other conditions —and so, would unquestionable change over time.

Back in 1980, *American Airlines*[81] deciphered this issue by using the booking system, *SABRE (*Semi-Automated Business Research Environment*)*, which makes it fairly easy to adjust prices swiftly by considering up-to-the minute data. Indeed, the capacity of airlines to price dynamically, in real-time has transformed the industry forever. Oh, yeah, just recently, *Uber*[82], an e-business that ties customers who need car rides with automobiles for

[81]American Airlines (Business Model Navigator). Available from: https://businessmodelnavigator.com/case-firm?id=9 (The webpage was last visited on 3-14-2020)
[82]How Uber Works: Insights into the Business & Revenue Model. Available from: https://jungleworks.com/uber-business-model-revenue-insights/ (The webpage was last visited on 3-14-2020)

hire, loaned out the same business logic that is, in high-demand days, the company gears surge pricing, whereby prices for rides increase, thus plummeting demand while boosting supply.

- *CHANGE THE ORDER OF DECISIONS*

Not all companies have the privilege to alter the timeline within which they operate; instead, they could jostle the order in which decisions are usually made to adjourn investment obligations until relevant information is identified. Most product development, for instance, starts with suggesting a technology (solution) for a customer need. If, ex post primary investments, the technology shows to be unsuccessful, then it would be brought back to the drawing table (a vicious, feeble operative circle!). Yet some ICT companies, *InnoCentive* and *Hypios*, have recognized that if the sequence is switched to performance first —and investment second, the risk associated with R&D could be as a result pointedly mitigated (Marjavonic et al. 2012).

A comparable variation in sequence enlightens the triumph of *LiveOps*[83], a company in the call center industry. Typically, conventional call centers make forthright investments in facilities and hard set-up before making any call and ex ante the signature of a single contract. They also choose the number of agents to be hired, the levels of talent and expertise needed, and to whom training should be provided. Afterwards, they sign up clients whose requirements match the competences they gathered. Lastly, they come up with daily and weekly recruitment schemes to guarantee that sufficient operators with the fitting talents would be open to take calls. *LiveOps*, on the contrary, hires operators as the calls come in. Its operators work freely from home, and signal *LiveOps* whenever they are set to take calls. Their pay is determined based on their performance (skill at meeting callers' needs), as well as on the duration of the call (―this is made possible because all calls are recorded and scored by *LiveOps*). Subsequently, the said company's smart software transfers callers to the most competent operators available —conferring to the nature of the call, so that capability and recruitment are regularly attuned to meet actual needs.

[83]LiveOps: The Contact Centre Reinvented. Available from: https://publishing.insead.edu/case/liveops (The webpage was last visited on 3-14-2020)

- *THIN-SLICE KEY DECISIONS*

It has been a few years now since the corporate innovation and start-up worlds were taken by storm by a slightly new movement, *the lean start-up movement*[84]. At the core of the movement is a novel tactic for executives who have to make decisions about their businesses. Formerly, instigating a risky new venture entailed assembling a comprehensive business plan that covers all vital elements of the BM —and then performing according to plan. Basically, all key decisions used to be made promptly and candidly, all at once, prior to the initiation of business activities. In contrast, the lean start-up method consists of slicing up key decisions, as follows: a venture commences with comparatively vague and imperfect assumptions about where an opening may be found; numerous stages of data collection and information gathering follow, as the BM is brushed up to reach its final, authenticated form. Characteristically, the concerned executives would have a tendency to drastically modify their initial assumptions as the venture develops and new business ideas are brought to the table.

WHO ARE THE BEST DECISION MAKERS?

It is said that companies believe that decision making in the value chain could be profoundly enriched if the people who usually make the final calls are changed. Pragmatically, concerned companies could do the following:

- *ENGAGE A MAVEN DECISION MAKER*

The entire idea revolves around the idea of endowing the right, most informed persons (one or more) with the right and power to make the calls. *Google*'s engineers, for instance, are given the liberty to choose which development projects the company should undertake, just because the said company trusts they are better versed in technologies and current market needs than their counterparts, first-rank executives are.

[84]Why the Lean Start-Up Changes Everything, Harvard Business Review. Available from: https://hbr.org/2013/05/why-the-lean-start-up-changes-everything (The webpage was last visited on 2-5-2020)

Adding that maven people are not necessarily part of the concerned company's own workforce. *Walmart*, for example, about 30 years ago, decided to reassign some decision rights about stocking its store shelves to *P&G*, believing that the latter had, at the time, the right mixture of data and incentives to optimize its delivery and production schedules — and keep its shelves fittingly stocked around the clock. This has indeed converted into a trend that one could see more in some industries relative to others. Moreover, with technological advances, some companies have been delegating their decision-making processes to algorithms. Such trends could be seen in the restauration business.

Raising the case of the restaurant chain *Not Your Average Joe's*: — the latter uses *Muse* for the management of its daily operations, an analytic tool developed by *Objective Logistics*. Basically, *Muse* tracks servers' performance over time based on strategic metrics such as: sales per customer and customer satisfaction. Indeed, this enabled the chain to come up with a productivity-based ranking system whereby staff (waiters) have the possibility to choose both their schedules and the tables they wish to serve. However the rewards of making better-informed decisions are evident, empowering personnel, suppliers, or customers— and amassing extensive information frequently involve outlays and complications. In this context, it worth noting the case of *Amazon* owing its early success to its drop-shipping model, which enabled it to offer over one million books while stocking an insignificant less-than-1% share of the bestselling titles. For the remainder, the company dispatched orders to book wholesalers and publishers, who subsequently proceeded by shipping them straightforwardly to customers. In this state-of-the-art model, *Amazon*'s network of partners was held responsible for the management of inventories. Adding that, they, the partners, not *Amazon*, had to assume the risk of carrying books without having any prior bits and pieces of the probable demand for them. Yet because the risk was extensively allocated, all entities involved in the process succeeded to manage their own share of the risk with quite some comfort.

- *CHOOSE THE DECISION MAKER WITH THE MOST TO GAIN*

In several BMs, strategic decisions are often made by those with less to gain than others in the value chain. A company's customer, for instance, over and over again, feels he gains less when he purchases a company's product than the company does. That was an issue fronting *NETAFIM*, a global leader in drip irrigation solutions for sustainable agriculture. By definition, smart drip and micro-irrigation is the watering technique of choice for individual farmers in tropical countries[85]. The said company created a technology that tweaks water applications based on the soil's water content, salinity, and fertilization — and according to climatological facts. *NETAFIM* exhibited to farmers that its technology could grow crop yields by 50% —and decrease water consumption by 40%, thus making it a hypothetically worthwhile investment[86].

Originally, the technology was unpopular at first, a tough sell indeed. Absolutely, individual farmers were hesitant to accept the new, sophisticated technology and pay a price for it. They felt lots of risks would be eventually put on their shoulders if they decide to espouse it. *NETAFIM* overcame this problem by providing them with a free-of-charge, all-integrated package, including maintenance services. Reimbursement came from a share of each farmer's improved agricultural output. In other terms, the company in question decided to take on all the risks of the decision, and farmers just had to respond by *yes-or-no* to an opportunity, with no possible downsides, to make extra money. The said company succeeded its mission because it understood that it had the most to gain from the acceptance of its technology. The risks bore by the company were a lot tinier than what they could have been if the small farmers were to assume them singlehanded. Also, even when the system botched at some farms, the company was able to make up for it elsewhere. And as individual farmers accomplished larger successes, through word-of-mouth, *NETAFIM* increased its sales figures and achieved economies of scale.

[85]Drip Irrigation Changes the Face of Agriculture. Available from: https://www.netafim.com/en/drip-irrigation/ (The webpage was last visited on 2-5-2020)
[86]NETAFIM ESG Case Study. Available from: https://www.permira.com/about/investing-responsibly/esg-case-studies/netafim/ (The webpage was last visited on 2-5-2020)

<u>WHAT DO KEY DECISION MAKERS DO?</u>

Whenever decision makers work together to create value, they should be able to fulfill their personal goals, while ensuring that the value chain would not be damaged in any way. There are four distinct ways to do this:

- *VARY REVENUE STREAMS*

Customarily, whenever the US DoD (Department of Defense) buys a jet, it would settle to a time-and-materials agreement, under which contractors charge a certain amount of money for labor and resources exhausted in due course of every maintenance event (similar to what mechanics do in car repairs!). Inopportunely, this BM did not endow contractors with client-friendly incentives. From their standpoint, the more the client faces difficulties, the better it is. Exactly so, it has been projected that for every USD1 the US DoD spends to buy a new jet, it spends an extra USD7 over the aircraft's lifespan. Until, that is, the US DoD gave contractors a motive to care more about engine performance. In 2003, facing pressure to lessen costs and progress achievement, it embraced the so-called performance-based contracting, which transformed the revenue model for contractors[87]. Under this BM, contractors would be rewarded for the amount of time the jet is actually (or remains) in service. And so, the longer a jet performed without necessitating to be taken out of service for whatever reason, the more the contractors earned.

- *ORCHESTRATE TIME HORIZONS*

Usually, sourcing depended upon competitive-bidding schemes that guaranteed truncated prices and judicious, but satisfactory quality services. The selected supplier won the business for a relatively short period of time, after which the bidding process was reinitiated. But as foreign sourcing amplified, the BM in force started to demonstrate some significant flaws. Distant suppliers began to cut corners on quality control and materials trustworthiness. Even worse, disclosures of offensive labor practices, product diversions, and the forging of goods materialized. And because most sourcing transactions consisted

[87] Four Paths to Business Model Innovation, Harvard Business Review. Available from: https://hbr.org/2014/07/four-paths-to-business-model-innovation (The webpage was last visited on 2-5-2020)

of on-off deals, careless suppliers remained unpunished —until, certainly, some multinationals started feeling the destructive impact of recurrent performance snags on the profitability of their brands.

Li & Fung, a Hong Kong–based logistics, commerce and distribution company, altered the world of outsourcing through the creation of a new BM based on uniting the suppleness of sustainable sourcing with the sureness of durable rapports. It chooses, authenticates, and accepts suppliers and allots their businesses between its manufacturing clients —and it manages each client's relationship with each supplier —counting productivity, acquiescence, and creating incentives for suppliers to invest in staff and resources. Given the prospective for a long-lasting rapport with *Li & Fung*, suppliers worldwide were stirred to create longstanding value for manufacturing associates[88]. Yet, today, companies such as *Li & Fung* are rare —and to carry out sourcing transactions in sectors or industries where there is significant lack of trusted intermediaries could be problematic for companies as they would be obliged to manage such rapports all by themselves, directly.

- *PARTNER WITHIN AN ECOSYSTEM OF CROSS-INDUSTY ACTORS*

At present, prominent companies across industries have resolved that they could no more play it solo, contemplating ways for their businesses to magnify, transform —or just compete. Specifically, for companies to be able to craft new opportunities or overthrow challenges, they need to build sustainable partnerships within an ecosystem of cross-industry players and work with partners to outline, shape and implement customer solutions.

In fact, executives across industries seem to be more and more interested about ecosystem-based BMs[89]. The ICT sector is among the earliest adopters of such systems. Indeed, tech giants were the first to acknowledge the opportunity that could ensue from binging together application developers for the joint benefit of their platforms and

[88]Here is How Li & Fung Plans to Create the Supply Chain of the Future. Available from: https://sourcingjournal.com/topics/business-news/heres-li-fung-plans-create-supply-chain-future-64351/ (The webpage was last visited on 2-7-2020)
[89]An ecosystem playbook for agility and growth. Available from: https://www.accenture.com/us-en/insights/strategy/ecosystem-playbook-agility-growth (The webpage was last visited on 2-5-2020)

customers. A brief overview of how this sector has leveraged ecosystems over time, we believe, would possibly help companies in other industries to efficaciously steer their own ecosystem strategies.

Customarily, technology players used to build ecosystems within their own industry galaxy by merging the competences and resources of other technology partners. Yet, they progressively stretched outside their core business by developing new businesses via the combination of skills and value conveyed by other industry expert partners. For instance, key ICT vendors, whose specialty was to develop products and sell them to infrastructure customers, ended up reaching out to services companies to cultivate and incorporate bespoke technology solutions for their new customers in the banking, health or public service sectors (among others). In this context, a recent study published by *Accenture*[90] showed that there is a substantial number of businesses around the globe (over 40%) that chose to construct their ecosystems outside of their own industry, wishing to explore new markets and serve new customers[2].

Put simply, joining an ecosystem is likely to provide businesses with an exclusive opportunity to drive innovation and lead disruption. Today, there is an enormous need to progress collective partnerships beyond customary associations and channel rapports. Thus, building an ecosystem, we proclaim, is a great move towards fostering disruption or, at least, responding to unwanted disruption. For example, in China, given that the app market for smart phones in the country is extremely fragmented, this opening has led to innovation intended to disrupt incumbent players. As a result, mini-programs were developed via a new ecosystem. Widely held by customers, they could be easily integrated into the instant messaging app and used effortlessly, without having to download them. And the payout? The disruptor gains insight into customer behavior that could finally be used to create added value and fortify the rapport with existing consumers. Besides, to preserve (or strengthen) their current positions in their core markets and sustain competitiveness, It is compulsory for businesses to stay attentive and keep on exploring (new) ways to work in collaboration with their partners. Actually, one

[90]Accenture Strategy 2018 Report: *Ecosystems: The cornerstone of future growth.* Available from: https://www.accenture.com/us-en/insights/strategy/cornerstone-future-growth-ecosystems (The webpage was last visited on 2-2-2020)

of the prime threats dreaded by businesses today comes from new rivals outside of their industry[91]. Adding that the latter would become lethal if businesses refrain from acting proactively and preventively.

On another note, *Accenture*'s research indicated that about 50% of management teams, although in favor of ecosystem strategies, frequently see a risk in swapping information with fellow associates. To be fruitful, the rules of engagement among partners should be plainly voiced so that to curtail risk as much as possible and make sure each ecosystem partner contributes a unique role while upholding a basic level of control.

Ultimately, it is a trade-off, a give-and-take process between two companies, discerning the willingness of a company to share individual value versus the willingness of another company to gain joint value. For example, in the software application development market, tech giants swiftly figured out how to strike the right balance. They principally remunerated developers for their creations, their ability to build a critical store size, but also profited from any in-store purchase transactions since they offered the general applications hosting the platform. And so, as revealed by technology tycoons, businesses should not, in any case, shy away from investing in —and adapting their business models to reflect the sole needs of an ecosystem-based business strategy. This is genuine because innovation, we affirm, could ensue in the creation of new markets, services and solutions—that could benefit quite a few companies, small and big, operating in various business sectors.

[91]ibid

2.6. FROM THE MANAGERIAL QUESTION TO THE RESEARCH QUESTIONS

Now that we have embarked upon the bulk of notions and concepts that are straightforwardly linked to our research topic —going from *connectivity* and *urbanization*, to *smart cities* and *smart constructions*, to *innovation in construction* and *construction project management processes,* and *value chains*, to finally reaching *BM theories* and *BMI* (Figure 34) — we proceed in Chapter 3 by explaining the various business modelling tools and research techniques exploited for the successful achievement of our empirical research. Concisely, we recap, our envisioned BM is solution-based and human-centric. As for the changes it is likely to bring to the table, those will be incremental rather than radical, of a managerial rather than technological nature. Moving forward, in Chapters 4 and 5, we effort to suggest relevant answers to some interconnected managerial questions (and sub-questions) —some of which are documented below:

- How the design of a new general contractor BM would eventually help resolve the so many issues construction companies are encountering in the management and overseeing of large, smart developments?
- How could such a BM help construction companies to better orchestrate the design, construction and delivery processes of smart city projects?
- How it will be designed —based on which process —and what form will it eventually take? How many service layers will it comprise?
- What will be the role of the *general contractor* in particular —in comparison to other key construction players? What about end-users and ICT companies?

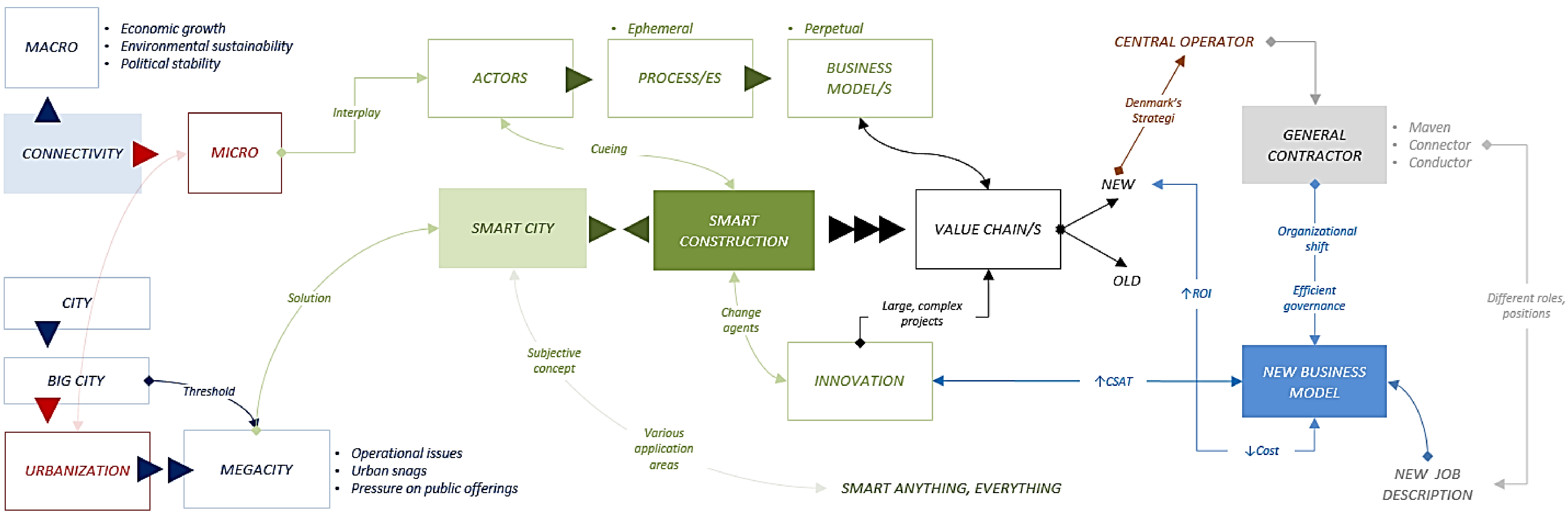


Figure 34. Conceptual framework
Source: Created by the author

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CHAPTER III. METHODOLOGY

Chapter 3 discusses the methodology chosen for answering our predefined research questions —and so, for the successful achievement of our empirical study. Indeed, the latter sheds light on the research methods and techniques used to gather and analyze data. Succinctly, the *qualitative research approach* was, as a starter, used to define the main research questions to be addressed. And then, it was opted for to, all other things held constant, test the validity and sustainability of the BM built. Concerning the BM per se, it was conceived using a mixture of strategic tools expounded below. A meticulous description of the entire BM design process is available in Chapter 4.

Simply put, Chapter 3 is structured as follows:

A. The research design process is first described; followed by
B. An explanation of both the data collection techniques and data analysis methods used; to finally
C. Embark upon the key strategic tools exploited for the formation of both our construction process map (piloting tool) and envisioned BM.

3.1. THE RESEARCH DESIGN PROCESS

The process steps that we followed for the conception and design of our new BM are those governing DSR (Design Science Research) —which is a relatively new approach to research (Da Rocha et al. 2012).

As put by Iivari (2007), the main objective of DSR is to construct a new reality — e.g. *solving problems* — rather than elucidate and make a better sense of an existing one. The core of this approach, the authors said, is a problem-solving process used to either build a new artifact or recover an existing one by enhancing its operability. In our verses, artifacts refer to business models. And the operability of BMs, we proclaim, is indispensable for business success. And so, companies, at least in our eyes, must regularly review the operability of their BMs in an astute attempt to recognize whether they are running out of gas (or not)—and in view of that demarcate the compulsory measures that should be assumed to revive them. This comes hand in hand with the rationale behind our envisioned BM by which we isolate the weaknesses associated with the old construction value chain —and suggest solutions to inform the architecture of the new one.

Reverting back to DSR, as per Lukka (2003), the latter is a method for producing innovative constructions, intended to solve real-world problems and, by that means, to make a contribution to the theory of the discipline in which it is applied. In the main, DSR consists of two basic activities: *build* and *evaluate* (March et al. 1995) —where *building* denotes the process of constructing an artifact for a precise purpose and *evaluating* designates the process of determining how well the artifact works.

(—see Figure 35 shown below for an overview of DSR's main constructs)

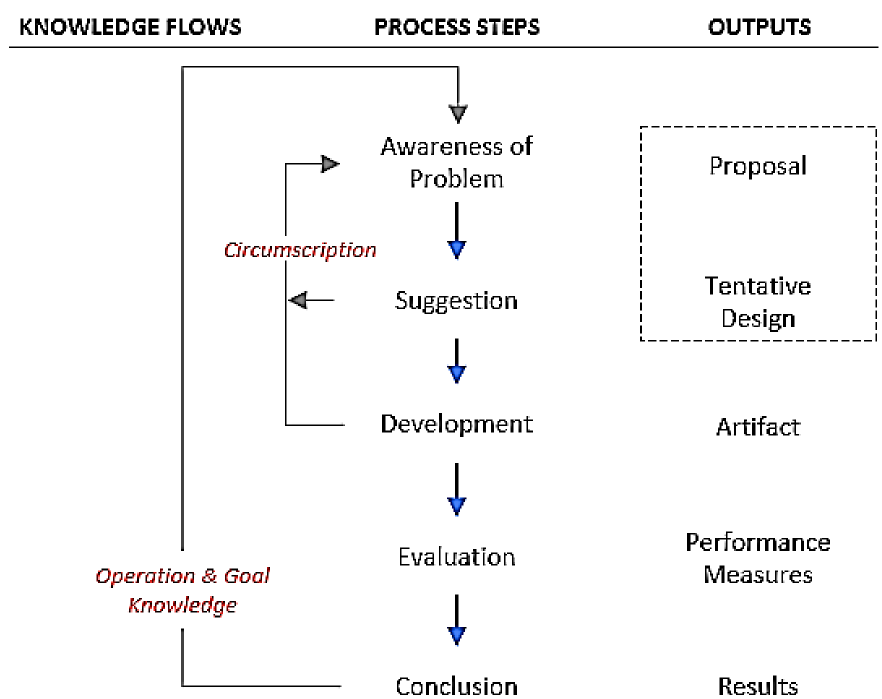

Figure 35. Design science research
Source: Adapted from Kuechler and Vaishnavi (2008)

Our choice of DSR is justified by the fact that our study seeks primarily to develop and evaluate the performance of a (designed) artifact. Also because DSR involves the development of a solution that has practical and theoretical relevance.

Before we carry on with our discussions, we pause for a moment to talk a little bit about DSR, mainly what it stands for and how it originated. According to Pfeffers et al. (2007), the introduction of computers into large companies over fifty years ago has had a weighty impact on the global business environment ―and the lavish flow of information that was enabled at the time by technology has finally led to the upsurge of a new field of study: MIS (Management Information Systems)[92]. Concerning design, although the latter has always been a key constituent of MIS, neither business experts nor scholars considered it, at least at first, to be a relevant topic of study for MIS. This however noticeably changed in the late 1980s. Actually, Weber (1987) — after dropping the M from MIS — made a call for the creation of an exemplary base for IS (Information Systems) research in the study of discrete, perpetual artifacts. The author then defined the concept of *design research* as a thought-provoking artifact that is worth weighing independently — unrelatedly to its probable influence on management. Moreover, to further legitimize artifact-based research, Nunamaker et al. (1990) normalized a design research method, *the engineering approach*, which theorizes an upgrading to a system — or a correction to a system flaw. The said approach was a few years later embraced by the majority of design researchers in IS around the world ―and while it was given so many appellations throughout the years, including improvement and constructivist research, the engineering approach per se has been subsequently broadly termed DSR. Koskela (1992) and Pekuri et al. (2012) are among the scholars who used the DSR methodology to discuss the application of the new production philosophy to construction.

Now that we have succinctly explained the DSR approach, it seems opportune to carry on by describing the latter's constructs and how they could serve the purpose of our research study. As put by Kuechler and Vaishnavi (2008), DSR is a looping process (also known as *circumscriptions*) that involves gaining a deep understanding about a set of problems that is only achieved via the precise act of building an artifact. It is a *learning-by-doing* process, the authors said, where circumscriptions are expected to occur at either

[92]MIS is an *information system* used for decision-making, and for the coordination, control, analysis, and visualization of information in a company. It is a collection of systems, hardware, procedures and people that all work together to process, store, and produce information. Available from: http://www.businessdictionary.com/definition/management-information-system-MIS.html (the webpage was last visited on 2-11-2020)

the *building* or *evaluating* step of the artifact (BM) ―and, afterwards, lead to a reconsideration of the problem awareness. On the evaluation front, things are carried out internally and externally. Internally, the researcher carries out a self-assessment of the performance of the artifact and reflects about the plausible solutions that could be suggested to address the identified problems. At this point, the viability of the whole artifact (BM) is put to the question as the researcher must ensure the innovation is sellable (Lukka, 2003). Externally, the evaluation is done by third parties (industry experts), a crucial step, we trust, that enables the researcher to get pertinent feedback about the artifact and make necessary amendments to improve both its operability and viability.

Moving forward, our envisioned BM, we say, aiming at smoothing out construction processes in general, is built based on the five-step process depicted in Figure 35, as follows:

- *Awareness of the problem*: At first, we outline all the problems (economic, social, environmental, and technical) that France-based construction companies, large ones in particular, have been facing in recent years when handling large and complex developments —and remain unsolved to date;

- *Suggestion*: The inventory of problems and suggested solutions is made per construction stage. This is vital because the construction industry per se is intricate, multi-layered, and project-based —involving a horde of stakeholders who repeatedly step in and out at different points along the value chain to ensure deliverables are completed according to contract terms;

- *Development*: A portrayal of our BM is suggested in Chapter 4. Specifically, we describe how our new idea of a GC BM nurtured over time to reach its final state.

- *Evaluation*: The consequential preliminary BM is an artifact that requires further tweaking to reach its final state. The latter's validity is consequently evaluated qualitatively via a sequence of interviews conducted with industry experts who are asked to share their opinions vis-à-vis the design of the new BM as well as its content (—referring to the variables used to building it); and

- *Conclusion:* Finally, based on amassed data and provided commentaries, our new BM (in its draft form still) is once again honed —so it henceforth reaches its absolute form.

3.2. DATA COLLECTION

Now that we have clearly emphasized that the design of our envisioned BM is based on the DSR methodology, we proceed in the following subsections by discussing the research methods used to amass relevant (primary and secondary) data on the topic understudy (—relating to the need for a new BM in the French construction industry today and the validity of the designed BM per se).

3.2.1. *GREY LITERATURE*

The subject matter of our study, we affirm, has been diligently and thoroughly looked at, not only by digging into academic writings and publications —but into grey literature too (e.g. governmental reports, policy statements, industry reports —and specialized magazines and websites). In the rear, by doing so, we have gained access to a wide range of relevant, global, business facts, and information —and we were able to consolidate theory and practice —also, to dot some of the main problems that construction companies, whether in France or elsewhere in the world, are conceivably to encounter when running and managing smart developments.

Hereunder is a selective list of the nonacademic resources that we inspected for the drafting of our empirical research (In total, about forty nonacademic resources were checked and examined to ensure the accomplishment of our empirical study). Our search criteria consisted of using specific keywords to refine search results. Among the keywords (and key phrases) used, we cite a few: smart city management, smart construction, general contractor, innovation management, managerial practices in construction industry, business model innovation, managerial problems in construction industry, and others.

- Construction Tech: https://constructech.com/news-brief/

This magazine, comprising twelve search categories and over thirty news briefs per search category, kept us up-to-date with strategies to implement new technology. It simply helped us to converge construction and technology.

- The Constructor Magazine: https://www.constructormagazine.com/

Issued by the AGCA (Association of General Contractors of America), this specialized magazine embarks upon the most trending and debatable topics in construction (contracts and law, risk management, technology, project delivery, etc.). It was useful in the fact that it provided us with some relevant insights (qualitative, infographics, etc.) into the roles and duties of GCs in particular.

- The Global Construction Review: http://www.globalconstructionreview.com/

This publication discusses international construction matters and provides a listing of big construction projects executed around the globe. Some detailed examples of big construction projects, smart or not, are also available. Articles are issued on a daily basis and the emphasis is mostly put on innovation and market perspectives.

- Architecture Mouvement Continuité: https://www.archires.archi.fr/en/catalogue/90

This specialized magazine sheds light on influential architecture trends and discusses trending architecture topics in France. It a periodical publication that could be found online or in university libraries (ENSA de Toulouse, ENSAP de Lille, and others)

- The Demolition & Recycling International:

https://www.khl.com/magazines/demolition-and-recycling-international/interviews

It is one of the most leading suppliers of international construction information in the world. KHL Group is member of several professional associations, among which we cite: Construction Equipment Association, Association of Equipment Manufacturers, and European Demolition Association. Issued bimonthly, the magazine offers practical insights gathered from interviews carried out with leading industry specialists (e.g. Joe Brinkmann, Tony Kiesel, Hrvoje Merki, and others).

- Acronyms used in Construction (Dictionary):
  https://www.allacronyms.com/BM/construction

It is an evolving database open for public access. It comprises over four million acronyms and abbreviations. It is extensive, user-driven and topic-oriented.

- Facts & Fact Sheets: https://construction.laws.com/general-contractor

These websites delve into rules and regulations governing the construction sector and provides some real-life facts and figures about the construction industry. Among the emphasized topics, we cite: construction contracts and costs, and construction project management. These websites comprise hundreds of articles and consultancy reports.

- Urban Innovation & Smart City Management: https://www.constructionglobal.com/infrastructure/smart-cities-need-smarter-project-management — https://publications.iadb.org/en/road-toward-smart-cities-migrating-traditional-city-management-smart-city

Some non-academic (yet invaluable) publications could be found on these websites (that of the Inter-American Development Bank for instance); most of them pertaining to trending topics in the construction industry, such as innovation in construction, smart city management, and urban planning. One of the most pertinent publications that we bumped into is that of Bouskela et al. (2016), entitled '*The Road toward Smart Cities: Migrating from Traditional City Management to the Smart City*' —downloaded nearly twenty thousand times since it was first published.

Apart from the worthwhile secondary data that we were able to amass on the topics of general contractors, smart city management and others by digging into some nonacademic resources available on the internet (—refer to previous paragraphs), our empirical research, we note, has been invigorated by some primary data that we amassed ourselves. The data collection process is explained below:

3.2.2. *IN-DEPTH INTERVIEWS*

As put by Bogdan and Biklen (2006), an in-depth interview is a qualitative data collection technique that allows the interviewer to center the interviewee's speech on a predefined set of topics that are recorded in a discussion guide.

More specifically, an IDI does not enclose the interviewee's speech — but, on the contrary, it allows him to share his personal views and thoughts vis-à-vis matters addressed in the guide. This type of interviewing, we say, enables interviewees to express themselves freely within the framework of a central topic defined a priori. The importance of IDIs lies in the capacity of the interviewer to manage the flow of insights passed on by the interviewee while, at the same time, granting him all the autonomy, time and space needed to respond objectively and openly to all the questions asked. (Table 29 shows the main pros and cons associated with IDIs)

ADVANTAGES	***DISADVANTAGES***
• It enables the interviewer to build a rapport with the interviewee and to run behavioral and-or body language analyses if necessary • The interviewer could collect detailed information about the values shared by and the attitudes of the interviewee	• The results found could not be generalized in any way • The suitability of the data collected depends upon the intuitions of the interviewee and his willingness to frankly respond to the questions asked

Table 29. Advantages and disadvantages of IDIs
Source: Adapted from Bogdan and Biklen (2006)

For our study, the use of the qualitative research method has enabled us to gather descriptive, narrative and macro insights into the topic at hand ―and to build some concrete knowledge of a practical, hands-on system, explicitly: the building and managing of smart cities and the roles that GCs could play in this regard.

Overall, 17 interviewees were targeted and interviewed. While the recruitment of participants was mostly done via telephone — in some other cases, prospective respondents were approached through written communication (i.e. e-mails). Partakers (e.g. industry experts, scholars, and others) were very receptive and responsive; they showed lots of interest in the study, and enthusiasm and willingness to participate in it; they openly shared their lifelong knowledge vis-à-vis various topics of interest. The refusal rate was trivial — equal to 20% (rounded) — that is, out of ten invitations sent, only two invitees refused to take part. On average, each interview lasted for about ninety minutes. The IDIs were carried out face-to-face — via Pen and Paper Interviewing ― based on prescheduled appointments and using a specialized discussion guide. On another note, at the request of interviewees, their identities have been kept confidential[93] throughout the whole text ―thus, for discourse analysis purposes, we refer to them by their respective initials (―or last names) rather than full names (Table 30).

	Initital	***Job Role Title — (Entity)***	***Contribution***
1	B-G	• Business Development Manager —(*Bouygues*)	▶ Full IDI[94], completed after three visits
2	C-R	• University Professor, Retired — (*Université de Versailles*)	▶ Full IDI, completed after four visits
3		• Co-director of an Executive E-DBA thesis — (*Université Paris Dauphine*)	▶ Talk over validity and sustainability of suggested BM
4	D-B	• Director General — (*Caisse de garantie du logement locative social*)	▶ Full interview, completed after four visits
5	F-C	• University Professor, Researcher, Sociologist, and Urbanist — (*Université Paris Dauphine*)	▶ Full IDI
6			▶ Talk over validity and sustainability of suggested BM
7	E-N	• Development Director — (*ESITC Paris*)	▶ Full IDI, completed after two visits
8	P-P	• Ex Director General — (*Bouygues Construction*)	▶ Full IDI
9			▶ Talk over validity and sustainability of suggested BM
10	D-T	• Economist — (*Institut Paris Région*)	▶ Full IDI
11	S-P et al.	• Chief Operating Officer — (*SORGEM*)	▶ Full IDI, completed after three visits and one conference call
12	P-B	• Strategic Consultant — (*Independent*) • Instructor, Researcher — (*Université Paris XII*)	▶ Full IDI, completed after three visits
13	O-A	• Development Director — (*n/s*)	▶ Full IDI
14	AF-H & B-S	• Innovation Director — (*Artelia*)	▶ Full IDI, completed after one visit and one conference call
15	J-N	• Operations Director— (*Architecture, Économie et Ingénierie* ; *Alliance Économie 75*)	▶ Full IDI
16	A-T et al.	• Operational Director General (*SCOOPING*)	▶ Full IDI
17	V-B	• Executive co-director, Master's Program: Social Housing (*Université Paris Dauphine*) • Secretary General (Groupe FIMINCO; Association FIDJI)	▶ Full IDI

Table 30. Complete list of interviewees

[93]This is done for ethical reasons, not out of obligation —as no consent forms were signed at kick-off
[94]Including discussions about the legitimacy of a new GC BM for the construction industry, crafted specifically for the management of smart constructions

Finally, we note, the discussion guide (—see bordered box below), encompassing a blend of open-ended questions, used to carry out the IDIs was carefully drafted —based on the scope of the research and the objectives assigned to it. It permitted the prioritization of questions asked (and subjects tackled) — while handling the interlocutor's speech in a stretchy way. With regards to the guide's content, it was inspired by extensive academic readings (Flyvbjerg & Holm, 2002; Flyvbjerg et al. 2003; Giffinger et al. 2007; Cohen, 2012; Flyvbjerg, 2014; Simard, 2015) —and prescribed following the funnel technique structure — general questions come first, specific ones follow — which helped us to uphold a certain level of coherence in the interviewer-interviewee discourse.

The questions (Q1, Q2, etc.) listed below are only *headlines* that were used to direct the *interviewer-interviewee* discourse. The exchanges we had with interviewees were very broad, covering copious matters that are in direct or indirect association with our managerial questions and research topic.
All or most IDIs were conducted in French.

On the need for and design of a new BM:

- **Q1:** Concerning the management process of construction projects in general, what are the principal, most frequent flaws that construction companies should pay attention to the most in their day-to-day activities?
- **Q2:** What are the recurrent issues you used to face on a daily basis (whether it is your companies or other companies you used WO work with)? What return on experience could you draw?
- **Q3:** What kind of improvements would you suggest, technological or managerial? What about the tools you are using? What are your suggestions for companies to be able to overcome these flaws and bridge prevailing resources gap?
- **Q4:** Would the design of a new BM (reshaped, reinvented, or simply adjusted) help companies to solve these problems? If not, what other options do we have?
- How do the old and future value chains in construction compare? Where do the deviations (improvements) lie?
- **Q5:** Construction projects are intricate, with lots of information flowing and being exchanged among players during conception and execution: what do you think would be the best means to manage such tremendous data flows? Please explain
- **Q6:** What do you think of smart cities? How would you define a smart city? Is it a real opportunity that construction companies should seize (in partnership with other entities)?
- **Q7:** What is the best way (blend of strategies and tactics) for companies to step into the smart city market? What does it entail? What are the best practices in this domain?
- **Q8:** With their current operating models (or business models), would French construction companies be able to embed and compete in the emerging smart city market? If not, what changes are required? Please elaborate
- **Q9:** Do you believe operational and other benefits could be drawn from GCs handling (or leading) smart construction projects, from start to finish? Please specify. What would be the roles of other stakeholders? Under similar settings, how would the construction process run?

On the legitimacy, validity and sustainability of our envisioned BM:

- **Q1:** What do you think of our BM (design and content wise)? How does it compare to other original BMs you are familiar with?
- **Q2:** What perfections or improvements do you propose (if any)?
- **Q3:** Is there any nuances that you would like to shed light on and that we might have neglected during the BM process design?

3.2.3. *OWN EXPERIENCE & MOTIVATION*

My interest in smart cities and BMs is a direct resultant of my day-to-day work in the construction field. The last few years were hectic, I assert, as I had lots of projects to complete. Not only had my business grown over time, but my network of connections too — which opened the door for more opportunities and more business.

Long story short, my work in the construction sector in France has opened my eyes on a few ideas, which, I trust, were to some extent overlooked (and remain so, to a certain extent, today!). One of those ideas relate to the hidden potential of the smart city market, an area that remains barely addressed by both industry experts and academics in France. Given my personal acquaintance with the topic and the numerous readings that I did, I now dare to admit that the smart city market is on the rise —exhibiting some serious financial potential — a great opportunity, I believe, that construction companies must seize at the earliest opportunity.

At the time, out of inquisitiveness and in an endeavor to build some sort of a solid scientific background on the matter, I have started scrutinizing the literature on smart city development and management. What I have learned is that the challenges (—budget and time overrun, low quality deliverables and unsatisfied end-users) that construction actors often encounter when dealing with such projects has nothing to do with the lack of resources or knowhow at industry level, but with the absence of a central entity that could oversee the resourceful execution of such projects. Comparable inferences could be found in Flyvbjerg et al. (2003). Indeed, the problem lied in the number of actors involved in the execution of complex projects and the absence of a strategi — a leader — who is able to administer them competently. Thus, a clue as to how to palliate these issues sprang to mind; the latter revolved around a single concept: *business model innovation*. By itself, this clue was not really new as lots of companies in France, big ones mainly —such as *Bouygues*— have been for quite some time now putting lots of effort and time to reinvent their existing BMs so they could better design, coordinate and execute smart city projects.

I, myself, had a personal experience in this regard when I first launched my company. As a starter, I embraced the industry's classical way of doing things (the industry's orthodox BM), but the market, I later on recognized, was too fragmented and the laws in force were relatively tough. The constant market dynamics and technological advances, I would say, accentuated things further by forcing construction companies to continuously innovate their BMs. These realities, to say the least, have attracted my attention and pushed me to rethink my own company's moneymaking logic. To my knowledge and that of others, the

French construction market is currently in need of a different offering, something relevant that would enable construction companies, small and big, to better deal with the challenges imposed by complex, smart developments. Yet, to figure out what that (different, relevant) offering might be, I had to acquire sufficient scientific knowledge on the matter first (the reason why I chose to undertake Paris Dauphine's E-DBA program), something to build on to be able to commercialize my now-clear proposition and set it on tough grounds.

> *My proposition spins around the idea of designing a GC solution-based BM. My envisioned BM is inspired by Copenhagen's experience in the domains of smart city and innovation management, thus explicitly reflecting the need to engage a strategi for the administration of smart developments. Though the advocated BM accounts for the specificities of the French construction industry, I believe the latter to be lithe and adaptable, and so—through extrapolation, could outfit other construction industries elsewhere in the world. In finale, we also note that the new BM could be also regarded as multi-sided because the GC is expectedly to play the role of an intermediary, standing in between the project owner from one side of the value chain and the end-user from the other side.*

3.3. DATA ANALYSIS & REPORTING

Completed IDIs were recorded by permission of the interviewees, transcribed, pooled together, and added to the research findings. The audio recordings were then used for quality control purposes. The transcribing task, we add, was done in MS Excel and the raw data at hand (—i.e. the verbatim transcripts) was categorized under specific headers to render the tasks of data analysis and reporting easier. As shown in Figure 36 below, a fourfold methodical approach is adopted for the analysis and reporting of the data. Also, we reiterate by asserting that the data gathered — whether primary, secondary or based on own experience (see previous subsections) — has helped us to inform the design of our envisioned BM —as well as to test its validity.

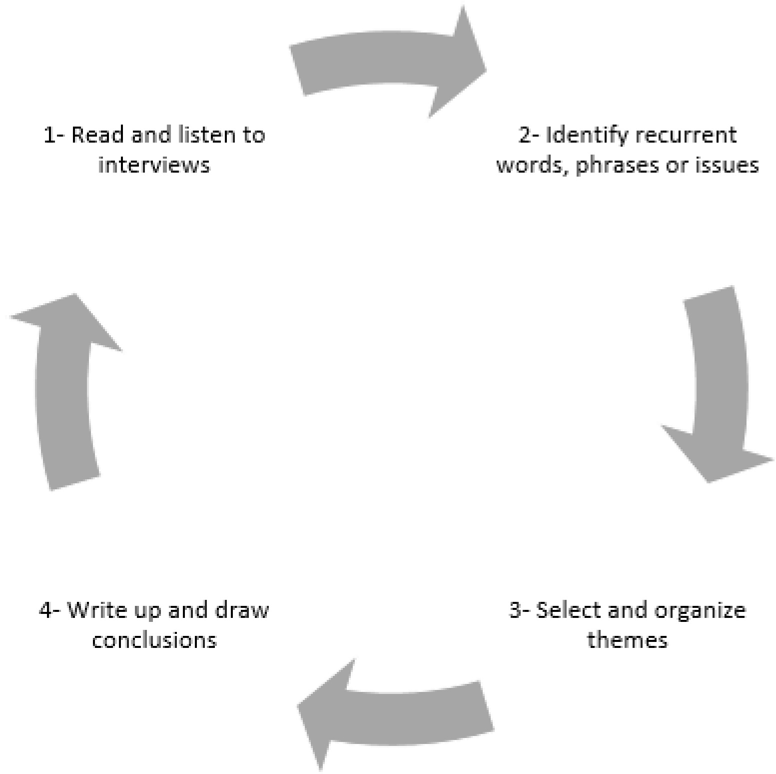

Figure 36. Four stages in qualitative reporting
Source: Adapted from Bogdan and Biklen (2006)

In the next subsections, we briefly expose and justify our choice of the business-modelling tool espoused for the design of our new BM.

3.3.1. *THE TRIPLE LAYERED BUSINESS MODEL CANVAS*

Construction companies, alike other commercial entities, are first concerned about the size of the net profits that could be cashed out from the marketable investments they routinely make. Seeking heightened economic returns is a rational thing indeed — however, the problem nowadays lies in the fact that economic performance is often achieved at the expense of other, equally important, attributes of construction projects. Moreover, given the new realities (connectivity, urbanization, innovation, smart construction, human centricity, and others) that arose in recent years and changed the rules of the game in the construction industry, it seems apparent that construction companies are nowadays sort of obliged to redesign, adapt, or at least rethink their prevailing BMs —so that to remain competitive, survive rivalry, and keep track of constant market changes —else they would suffer from hefty consequences.

To our knowledge, the need for a new BM lies in the fact that construction companies' current-state BMs are indisputably to fail. And for them to be able to favorably bend their accounts, a new something is undoubtedly required. Exactly so, instead of solely concentrating on boosting the economics of construction projects —construction companies should start worrying less about their profit margins and more about the social and environmental outcomes that might ensue from their circadian activities. A more fitting BM, we avow, is one that ensures some sort of an equilibrium or evenness between all traits of construction projects (economic, social, and environmental). With that said —and since we intend to design not just a new BM —but a sustainable one too, we use Pigneur et al.'s (2015) all-embracing TLBMC for that purpose. The latter, we say ― accounting for all the aspects (*economic*, *social* and *environmental*) that are pivotal for a company's business success ― constitutes the basis of our envisioned BM.

Figure 37 shown below presents some brief descriptions of the twenty-seven building blocks constituting the TLBMC. Though there are some obvious inter-associations among the BM canvas' building blocks, the inherent linkages between them remain to a certain extent omitted. Also, we aver that the existing multicollinearity between building blocks renders the depiction of the content of each one of them a hard task to fulfill. The most direct correlation is that existing between *costs* and *revenues*. Commonly, lower costs imply higher revenues, and lower revenues lay emphasis on increased costs. By knowing one, inferences could be *ipso facto* made to evaluate the other. Thus, such constructs could be easily merged, we say, into a single one: *profits*, for instance ― hence reducing the overall number of the economic layer's building blocks to eight. The same logic could be applied to the other two layers in an effort to shrink their sizes too.

Other confusions may rise whenever trying to distinguish between impacts and benefits ―as impacts could be either positive or negative ―and so, whenever they are positive, *would not they then be regarded as benefits*?

ECONOMIC LAYER				
Partners — an entity (person or company) with which another entity has some form of a business alliance, temporary or perpetual	**Activities** — the action of making, providing, purchasing, or selling products or services **Resources (Human and Nonhuman)** — the factors used in producing products or providing services	**Value Proposition** — an offering, innovation, service, or feature intended to make a company or product attractive to customers	**Customer Relationship** — the development of an ongoing connection between a company and its customers **Channels** — a chain of businesses or intermediaries via which a product or service passes until it reaches the final customer	**Customer Segments** — the process of dividing customers into groups based on common traits so that companies could market to each group effectively and aptly
Costs — the amount of money to be spent for one to obtain or produce something			**Revenues** — the income generated from normal business operations or activities	
ENVIRONMENT LAYER				
Supplies & Outsourcing — the use of the services of an external specialized supplier to complete a given task and achieve as a result green goals. It could also relate to the provision of sustainable products or services.	**Production** — is concerned with the (sustainable) process of transforming a range of inputs into those outputs that are required by the market **Materials** — the various resources, sustainable or not, used in construction or production processes	**Functional Value** — the solution an offer provides to the customer	**End-of-life** — it denotes the end of a product's useful life; it is when the producer decides to stop marketing, selling, or rework sustaining it **Distribution** — it is concerned with the strategies to be adopted by a company to sustain the delivery process of outputs to markets (finding best ranges, using eco tires, etc.)	**Use Phase** — The impact that may ensue throughout a product lifecycle, principally when the customer is using the purchased product or service. Recently, the expression 'UX, User Experience' has become a trend
Environmental Impacts — any change to the environment, adverse or beneficial, resulting from a company's activities			**Environmental Benefits** —generating power using renewable energy technologies is an example of an environmental benefit leading to, say: improved air quality, reduced noise pollution and reduced consumption of fossil fuel energy sources	
SOCIAL LAYER				
Local Communities — those people living in a given locality irrespective of their origin and may be sharing or having some common interests in the area	**Governance** — the set of socially conscious standards based on which a company manages its rapports with staff, customers, partners, and the communities where it operates **Employees** — a person working for another person or a company for pay	**Social Value** — the quantification of the relative importance that people place on the changes they experience in their lives	**Societal Culture** — the commonly held beliefs or values that exist and are agreed upon in a given population **Scale of Outreach** — capacity of a company to reach out to people to promote its propositions through word-of-mouth	**End-User** – the final customer, consumer, or client. The term end-user is normally used in IT to denote the person that a software program or hardware device is designed for
Social Impacts — how companies or individuals' actions affect surrounding communities			**Social Benefits** — literally, they denote transfers received by households intended to provide for the needs that arise from certain events or circumstances. In construction, it has to do with improved living standards, greener neighborhoods, etc.	

Figure 37. Definition of the TLBMC building blocks
Source: Created by the author

Additionally, when it comes to smart city projects in particular, *end-users* ―though having their own building block within the social layer of the BM canvas ― are regarded as both sources of data and creators of innovation ―thus, as project *partners* (part of the model's economic layer). This suggests a direct connection between the two layers in question.

With that being said ―and despite the so many limitations of the TLBMC (part from the ones already cited, the list goes on and on) ―the main reasons that eventually pushed us to choosing it as a base for our new BM are in the number of three ―listed below:

A. The fact that *sustainability* (―a as a concept) has gained noteworthy momentum over time;
B. The advent of additive technologies, which changed the rules of the game for construction companies. Precisely, the emphasis which was once put on lessening negative externalities is now budging towards boosting positive ones in an attempt to create social and environmental benefits for all; and
C. The very obvious similarities or common ground between the components of a smart city (―the topic understudy) and the layers (and building blocks) of the TLBMC.

Our envisioned BM, scripted based on the rationale behind the TLBMC, is conceived based on an exhaustive assessment (per construction stage) of problems faced by —and solutions available for— companies operating in the construction industry. By using the TLBMC tool, we were able to exploit sustainability-oriented BMI and represent (design) our new BM in a more holistic way ―as a complete system or platform ― by exposing and clarifying all prevalent linkages among our BM's layers and building blocks.

Lastly, we note, the validity of our new BM was evaluated via qualitative interviews carried out with third parties: industry experts and scholars (―see Table 30).

3.3.2. *A BUSINESS MODEL WITHIN A PILOTING TOOL: A COLLAGE OF STRATA*

As recurrently evoked, our prime aim throughout this study is to build a practical, all-inclusive BM that construction companies could eventually use to calibrate their business plans —and better their project-based construction processes. The ingenuity of our envisioned BM, we proclaim, lies in the fact that it is stage- and solution-based (as well as multi-sided); also in the fact that it is part of a broader, interactive, and practical piloting tool[95]. The piloting tool —and the envisioned BM, we affirm, are part of the same construct and are somewhat inseparable. On a separate note, to circumvent redundancy in the wording used in the text, our BM's variables are referred to as *strata*.

Overall, our piloting tool (—*construction process map*) accounts for a total of six strata (*1 thru 6*) (—see Figure 38 below). The strata *4 thru 6* establish the grounds for our new BM —with the TLBMC's layers on one side (*stratum 4*), its building blocks on the other (—*stratum 6*), and the smart city components in between (*stratum 5*). With regards to strata *1 thru 3*, they are specific to the piloting tool per se, used for simulative purposes —so that the output generated by our BM would end up being stage-based (—referring to our *pivotal stratum*, *stratum 1*). This is central because any construction process is normally to go through several junctures before completion. Besides, knowing that BMI is often triggered by *technology*, we have chosen to add *stratum 2* to our tool, trusting that innovation in construction is untraceable unless closely monitored. Moreover, to be able to trace construction works performed at every stage of the construction process, we have also included *stratum 3* —as a means to defining '*who does what and when?*'

Long story short, our suggested *business-modeling tool* generates five propositions —five successive BM versions, one for each construction stage. This implies that key points of failure are recognized per construction stage —and fundamental problems and complex systems around those problems are identified and solved. Lastly, we add, visual

[95]An interactive platform, a construction process map, scripted in Angular 2+

aids (*dependency graphs*) are created for a better depiction and visualization of the problems reported at both layer and building-block levels.

Now that all the puzzle pieces are plainly documented, the next step consists of putting them together. Two questions spring to mind at this level: *would the different puzzle pieces fit together?* If so, *how would the final BM picture look like?* From this point onwards, we take on an original style to drafting the empirical research of our study. We do so by trying to conclude how the theoretical frameworks discussed throughout Chapters 1 and 2 could be genuinely applied in practice. Hence, our purpose, we proclaim, is to link theory to practice or — said otherwise — to bridge the existing gap between construction project management fundamentals and practices.

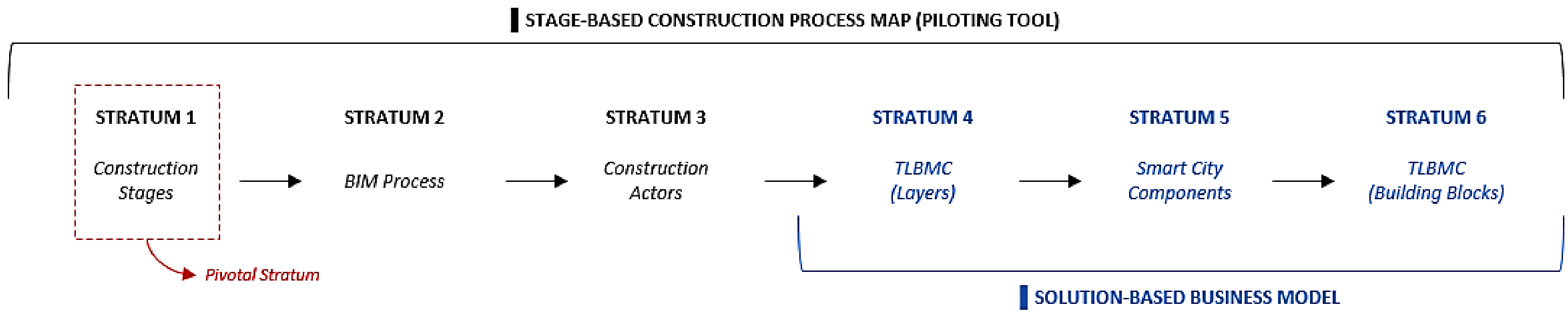

Figure 38. A business model within a piloting tool
Source: Create by the author

CHAPTER IV. THE DESIGN PROCESS OF THE GENERAL CONTRACTOR BUSINESS MODEL

Nowadays, cities around the globe are being put under increased pressure to host more and more inhabitants. The influx of people towards big cities has indeed become a trend for people are ever more looking for better opportunities and enhanced connectivity. And it is the attractiveness of cities, their economic power and influence that would depict whether they would eventually be regarded as hotspots or not. Urbanization has actually set the new rules of the game —and cities were as a result put to the test. Essentially, there are two plausible paths that cities could undertake: either adapt to the new realities and flourish —or fail to do so and lag behind. Apart from urbanization, technological developments have also led the world, including the ways we live, communicate with each other and do business, to evolve constantly — at an accelerated pace. Since the internet bubble in 2001, the world seems to be in a race against itself. And companies are persistently searching to exploit the best technologies available to gain in competitiveness and productivity —as a means to sustain their businesses and secure a competitive edge over their rivals.

Alike companies, cities — too, are currently seeking to strengthen their respective market standings. Their overall appeal is at stake. And so, they are presently in a race to attract more resources, talents and investments. And the only means for them to win the race is by becoming smart. Hence, we proclaim, cities, mostly big ones, are destined to become smart in order to survive the so many urban challenges they are facing today. Thus far, it is apparent that some cities have done a better job in this respect than others. While Barcelona, London, and Copenhagen are now alleged to be smart —France, for instance, seems to be still figuring out how to catch up with its neighboring metropolises. In the other part of the world, in Southeast Asia in specific, Singapore constitutes a great example of a city that failed at first to keep pace with development, but eventually succeeded to progress and take lead. We hence look back at a question that has been raised in earlier chapters of the study, namely: *are all cities vowed to be smart?*

> As put by Mr. Rochet, '*Lee Kuan Yew, the founder of Singapore, succeeded to build the city of tomorrow by simply copying other successful smart city models. While imitation was the primary component of his strategy, he however made sure to integrate the state's own ideologies and values into it.*' '*The whole system he created,*' Mr. Rochet added, '*was founded on Singapore's own cultural tradition.*'

This puts emphasis on the fact that a smart city should not be conceived disjointedly of the values and cultures of the territory on which it is sited —but on the contrary; it should be a direct reflection of them.

> According to Mr. Rochet, '*the French model is fairly comparable to the one in Russia*.' '*In Russia,*' he specified, '*the problem lies in the cultural framework of the country that is, the prevalence of monocities, a legacy of a top-down (Soviet) conception of power and development.*'

Under the Soviet governance model, we proclaim, it is the government's role to bring happiness to the people —with the people having no clear role in this respect. Indeed, the social structure of the country is problematic, being a source of both corruption and bureaucracy, especially that the government often seeks its own interests and tends to sink its nose in every aspect of people's lives —which means that people have no other choice but to bargain with it in order to get what they need.

Following the same reasoning, Mr. Biou affirmed that '*people are often inclined to crowd into cities.*' To further elucidate his viewpoint on the matter, he advanced the case of Chinese cities, being centralized administrative economies including hundreds of millions of residents.

> Consequently, Mr. Biou asserted that '*smart city initiatives are more likely to succeed in China than anywhere else in the world because the recipe of success is time and again set by a single central entity*'. '*In Anglo-Saxon democracies,*' he closed, *'decentralized decision-making schemes are privileged and the masses are often consigned to choose, which is not a bad thing per se —but how could we eject all the paradigms that may arise from the fact that we do not have centrally planned economies, but rather plentiful agents who operate based on short-term-yield business logics?*'

It is within this rationality that the idea of a GC BM for the building of smart cities sprang to mind. We herein explicate how the latter materialized and nurtured over time. Also how it gradually — little by little, transformed into a tangible artefact that, we hope, could serve construction companies in the execution and management of their future smart city projects. The four-phase process based on which this new BM idea developed is illustrated in Figure 39 below. As for the main data sources used per phase, they are listed in Table 31.

PHASE 1. RISE	***PHASE 2. SHOWCASE***	***PHASE 3. MATURITY***	***PHASE 4. EVALUATION***
• *own professional experience*	• *own professional experience*	• *meeting with prominent industry players*	• *meeting with prominent industry players*
• *brushing up academic literature*	• *revising and examining construction industry publications*	• *partaking in collaborative research efforts on smart city topic*	• *meeting with scholars and academics*
• *meeting with prominent industry players*	• *meeting with scholars and academics*		
• *attending smart city conferences and exhibitions*	• *meeting with prominent industry players*		

Figure 39. The development process of a GC BM for the building of smart cities
Source: Created by the author

PHASE 1. RISE	*PHASE 2. SHOWCASE*	*PHASE 3. MATURITY*	*PHASE 4. EVALUATION*
Main Readings: • *Flyvbjerg (2014)* • *Virtanen et al. (2014)* ***Conferences & Exhibitions:*** • *The smart city and smart grids exhibition, October 4-5, 2017 (Paris porte de Versailles)* • *Forum Smart City Du Grand Paris 2017 – La Tribune (Vivre Ensemble) - November, 2017 - Hôtel de ville de Paris*	***Main Readings:*** • *Flyvbjerg and Holm (2002)* • *Flyvbjerg et al. (2003)* • *Le Moniteur (Batiactu)* • *Industry Consultancy Reports (Bouygues, Vinci, and others)* ***Conferences & Exhibitions:*** • *The smart city and smart grids exhibition, October, 2018 (Paris porte de Versailles)* • *Forum Smart City Du Grand Paris 2018 – La Tribune (Vivre Ensemble) - November, 2018 - Hôtel de ville de Paris*	***Main Readings:*** • *Industry reports (Eiffage, Bouygues, Vinci, and others)* ***Conferences & Exhibitions:*** • *Conference by Architect Youssef Tohmé at École Nationale d'Architecture Paris-Val de Seine (ENSAPVS)* • *The smart city and smart grids exhibition, October, 2019 (Paris porte de Versailles)*	*Not Applicable. The validity of our business model was conversed and evaluated by prominent industry players and academics.*

Table 31. Data sources used in the business model design process
Source: Created by the author

Within each phase of the process, problems were identified and solutions were suggested for their resolve. A thorough explanation of problems and solutions is available in Chapter 5.

4.1. PHASE 1: RISE

Over the course of my professional career as a construction expert who has been working in the French construction industry for over ten years now, I have had the chance to accumulate sufficient knowledge about construction practices and procedures exactly as operated in France. Everything held constant ― or better say, for an external observer ― the construction industry in France seems to be functioning just fine (which is true in general!), yet when it comes to smart constructions in specific, it really is not.

Just a few years back, the smart city concept has started to grow in popularity and gain ground. It eventually turned into a global trend. Consequently, I, myself, being passionate about the topic, thought of creating a research-and-development department within the general contracting company I own to better understand the question of smart cities. Truthfully, it is not just the smart city concept that drew my attention, but also the current structure of the construction industry's value chain. Indeed, my aim was to figure out whether the latter is resourcefully designed to allow for companies to undertake smart construction projects and ensure their success in the long run. While being acquainted with the construction industry in Anglo-Saxon economies, I even questioned whether a construction company like the one I am heading could be integrated into the chain and be part of the solution to the various problems France based construction companies are currently facing.

In France, the construction industry is highly fragmented and state-controlled, and to suggest something new and incite construction actors to espouse it would not be an easy task to fulfill. I am fully aware of that, nonetheless the idea that I had in mind was vital —and so, I assumed is worth the effort.

At start, I believed the main problem, which was holding the construction industry from flourishing was the existing mismatch between supply and demand. And the solution, I alleged, may simply take the form of a more adequate offering that could better fit the real needs and aspirations of end-users. Though my allegation was to some extent legitimate, I suspected that a more detailed investigation of the topic would be necessary so that I may possibly come up with a global solution that could benefit not just my own company —but the entire construction industry. For that reason, I took the decision to enroll in Paris Dauphine's E-DBA program in an endeavor to investigate the smart city concept further and endow my research with some scientific credibility. To say the least, the decision I made enabled me to focus my efforts and works on the topic in question and come up with a proposition that holds value among its layers.

Indeed, my research aimed at identifying problems hindering the functioning of the French construction industry and suggesting plausible solutions that could set it back on the right path for growth. As previously noted, urbanization is putting intense pressure on cities to innovate and magnify their appeal. The same goes for construction companies who are obliged to rethink their offerings so they better match with current market requirements. In France, at least to date, things do not appear to be rolling in the right direction. Being inadequate, the BM based on which the French construction industry is now operating has been significantly affecting the latter's performance and productivity. Put differently, this implies that a change must be brought to the industry's current value chain so it could better cope with shifting market realities and redress its economic figures. The suggested BMI revolves around a GC to be integrated into the industry's value chain in an endeavor to abridge the various gaps found along it, down to upstream.

Interviewees (e.g. Architecture cabinets, multidisciplinary design offices, smart city experts, public developers, and others) whom I interviewed to gather practical insights into topics discussed openly espoused the innovation I am proposing. Nevertheless, before I reached the interviews part, I first did some exploratory research on the topics of smart cities, BMs, and GCs, to be able to draft a discussion guide based on which my discourses with interviewees would be structured. The several readings I did, referring to both academic and nonacademic publications, somewhat confirmed my suspicions that the industry's BM is dysfunctional and that, consequently, some incremental rather radical change should be brought to it. Moreover, they actually helped me draft a review of the literature on topics in question. Whether based on personal intuitions or insights gathered through interviews, all data pointed towards one thing: the need for a new entity to be consigned for the running and management of large construction projects, from initiation to closure.

My idea of a new GC BM was originally inspired by Flyvbjerg (2014) who put emphasis on the need for a new entrepreneurial entity to conduct lengthy megaprojects. For the authors, instead of thin slicing projects into numerous subprojects and executing them as part of disconnected arrangements, they should be bundled into one contract where a private sector entity would be commissioned to oversee and ensure the management of all works required. Furthermore, as put by Virtanen et al. (2014), introducing a central operator into the old construction value chain would result in improved control over the entire construction process in terms of both scheduling and price determination. Additionally, the authors avowed, the amount of logistics and pieces held in storage would be condensed and subordinate quantities of resources tied in the process freed. For end-users, they said, the amount of customizability would be significantly amplified.

On the interviews front, an architect (whose identity remains concealed) who works in a well renowned, award winning, Île-de-France based architecture cabinet affirmed that the French construction sector, apart from being fragmented, has now reached a certain level of maturity, where most CVP made are monotonous and outdated. '*Innovation is thus required,*' he said, '*not essentially technical or technological, but organizational.*'

In the context of smart city development, France is still trailing behind and a new something is needed for it to be able to catch up. The smart city market's potential, we proclaim, is huge and France should attune its ways of doing so it could successfully secure its share of it. Largely, the interviewee showed lots of interest in the idea of developing a GC BM for the creation of smart cities. This has comforted me in the sense that the solution that I am trying to craft would crack an issue that several construction actors believe it exists – not only myself. Another interview I conducted with the COO of a Multidisciplinary Design Office based in Île-de-France revealed fairly similar conclusions. Precisely, it has been agreed that though the smart city concept is vague and not very well defined in France such an innovation, at least for the time being, is interesting for it constitutes an actionable solution to the daily issues faced by the industry's stakeholders.

> For the COO, '*though interesting and worth testing, it is hard to believe that such a role would be able to solve all problems encountered in the construction industry today.*' '*Such an innovation,*' he settled, '*could however be part of a bigger, all-inclusive solution.*'

Some other industry experts who were approached and shared their viewpoints vis-à-vis my BMI proposition comprised a large public developer who has been in charge of implementing several large construction projects in the Île-de-France area. The latter specialized in the development of eco-quartiers, eco-friendly constructions that are not necessarily smart. After discussing the foundations of his company and the mix of construction processes he usually adopts for the implementation of large projects, he openly asserted that there is a tendency today among public developers to delegate the ownership of their projects to some private entities who have the required knowledge and expertise in handling and managing smart developments. This is, we proclaim, a change that pubic developers are in due course of bringing to their BMs.

As reported, though large projects are being successfully built and delivered, they often fall short in terms of meeting end-users' expectations. Indeed, there is a huge gap between what is being offered today and what end-users are actually expecting to get. This problem, we proclaim, has nothing to do with companies' construction processes but rather their BMs. Time and again, end-users are dissatisfied with the quality of construction works and complain about the state of the final product received. This situation is further aggravated by responsibility diffusion, where, post-delivery of final product, all stakeholders claim not to be liable for final-product state and end-users see themselves struggling to find the entity who is (should be!) in charge of maintenance or after-sale works (e.g. insurance companies, property manager, etc.).

> For the interviewee, '*these problems could not be solved unless potential end-users and local communities become partakers in large construction projects.*' '*We are now trying to change our BM so that we do not operate in a pure economic-logic anymore*' he added.

Indeed, we say, the spectrum of construction projects has been recently changing, widening to cover the social and the environmental ―as much as the economic.

> '*Construction companies today,*' the interviewee said, '*should worry less about the economics of their projects and more about the well-being of citizens.*' To this end, he said: '*we are nowadays investing both time and effort to revise and widen the scope of our BMs so that we could adjust our value propositions to the satisfaction of end-users.*' '*If we cannot keep the promise we make to end-users at start of the project, then there is definitely something wrong in the BM based on which we are operating,'* he concluded.

Often, value created at the very early stages of the production chain is lost in later ―more advanced ― stages. This difficulty, we aver, could be resolved once a specialized entity has been consigned to oversee and keep track of all works performed at each construction stage. In finale, the smart city conferences and exhibitions I attended ― mainly the Smart City & Smart Grids Exhibition and the Forum Smart City du Grand Paris ― were useful in the fact that they have given further meaning to my BM proposition. Indeed, they clarified the nuance that smart city projects should not in any way solely revolve around the technical and the technological. As communicated, gadgetizing our cities would not inevitably make them more attractive to people ―but on the contrary, we risk of making them less humane. We intend to make our cities smarter by reinventing them, and reinventing them is not a simple question of installing smart grids (among others) at city level, but to allow all builds of a city to create a coherent and resilient system where data could freely flow from one build to another. The twenty first century challenges (e.g. climate change, energy efficiency, reduced carbon footprint, etc.) are numerous and our cities need to constantly evolve to be able to cope with them.

> And so, as put by one moderator, '*reinvesting Paris means summoning all the creative forces to continue to imagine a city moving ahead in its metropolitan constructions; it is to give our city an original urban radiance so it remains an international attraction; also, it is about imagining new ways for the city to create more wealth and jobs, and encourage data sharing and knowledge exchange among its constituents.*'

Table 32 shown below exhibits the main problems identified in phase one ―as well as the solutions suggested for their resolve. Accordingly, a first draft version of our new BM has been envisioned (―see Figure 40). It accounts for four variables, explicitly: smart city components, construction stages, construction actors, and dimensions of a construction project. The color codes were carefully chosen to show inherent similarities between the dimensions of a construction project on one hand ―and the components of a smart city on the other hand. Moreover, our choice of variables ensued from our understanding that construction projects are stage-based and that construction works evolve every time we move from one stage to the other. In parallel, we presume, construction actors intervening along the process would change with one stepping in and another stepping out at each construction stage. Therefore, we say, the execution of construction projects follows a systematic course where the relay, stage after stage, is passed on from one stakeholder to another ―and it is their collective effort that would finally result in the building of smart constructions. The dynamics behind our suggested BM are shown in Chapter 5 using a specialized software that was developed to this particular end.

<table>
<tr><th>IDENTIFIED PROBLEMS</th><th>SUGGESTED SOLUTIONS</th></tr>
<tr><td>• Urbanization</td><td>(Convert big city into smart city)
• Improve attractivity and absorption capacity of city</td></tr>
<tr><td>• Failing BM leading to abridged growth prospects at industry level</td><td rowspan="2">• Rely on organizational change to drive industry growth</td></tr>
<tr><td>• Project process confused for business model</td></tr>
<tr><td>• Outdated CVP</td><td>• Adjust offerings to the exact needs and requirements of end-users
• Allow for customizability (portfolio diversification)</td></tr>
<tr><td>• Constricted approach to value creation</td><td>• Ensure final product has a use-value and that utility may be extracted from it</td></tr>
<tr><td>• Misconception of smart city notion</td><td>• Partner with local communities for the conception and building of smart developments</td></tr>
<tr><td>• Smart city projects as disconnected micro projects</td><td rowspan="5">• Rely on organizational change to drive industry growth</td></tr>
<tr><td>• Fragmented projects</td></tr>
<tr><td>• Too much weight put on technology in the building of smart cities</td></tr>
<tr><td>• Smart constructions as pure technology demonstrators</td></tr>
<tr><td>• Overlooked organizational innovation</td></tr>
<tr><td>• Large amount of logistics, pieces, and other resources tied in the process</td><td>• Abridge logistics and procurement costs
• Assign central operator to oversee execution works</td></tr>
<tr><td>• Loss of control over quality of works</td><td>• Assign central operator to oversee execution
• Set cohesive plan for the execution and tracking of construction works</td></tr>
<tr><td>• Mismatch between promised and delivered final product</td><td rowspan="2">• Partner with local communities for the conception and building of smart developments
• Organize hearing sessions for all people affected by the project
• Assign central operator to oversee execution works
• Assign specialized entity to handle after-sales services and maintenance works</td></tr>
<tr><td>• Criticism of final product by end-users</td></tr>
</table>

Table 32. Problems versus Solutions (Phase 1)
Source: Created by the author

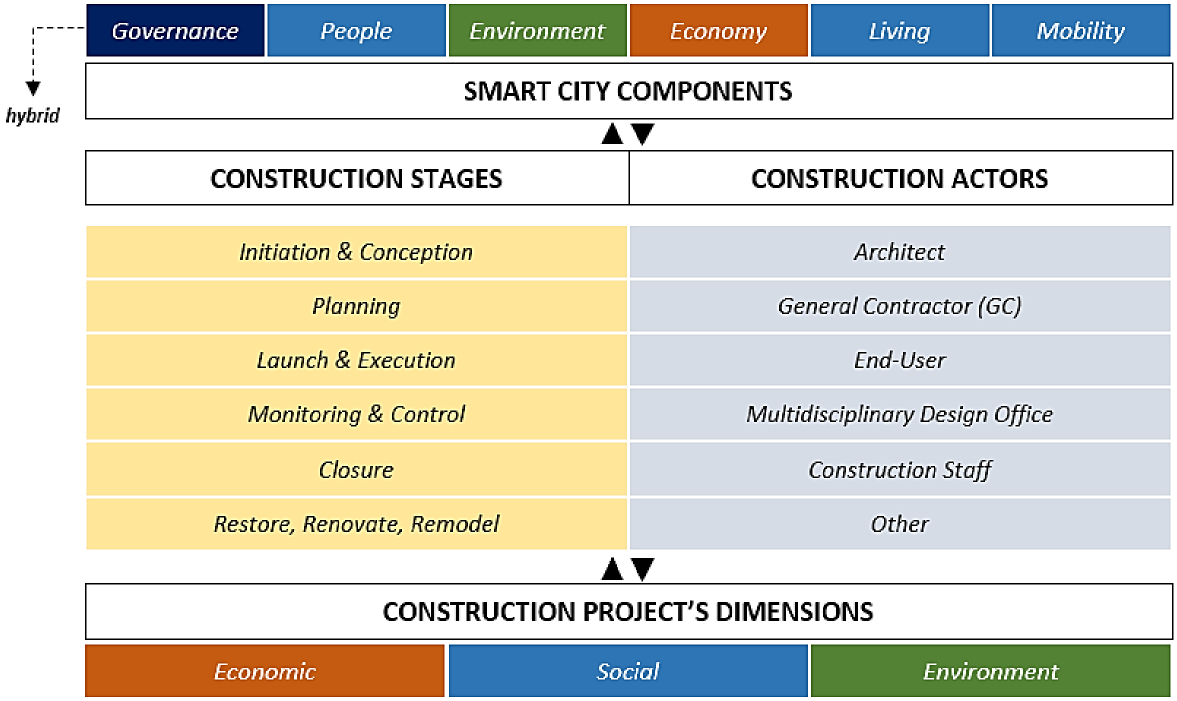

Figure 40. Version 1 of GC BM
Source: Created by the author

4.2. PHASE 2: SHOWCASE

In phase 2, after capitalizing on the findings of phase 1, we made a step forward in the direction of building a more comprehensible GC BM for the creation of smart cities. Affirmatively, the exploratory research we did and the findings we gathered gradually nurtured — phase after phase. Adding that further problems were identified and plausible solutions were suggested during this phase.

After brushing up the industry's most relevant publications, we noticed that among the various challenges to which construction companies are now exposed lay state-imposed construction standards and codes. Those are being repeatedly revised —at an accelerated pace[96]. For construction companies, such tweaks in regulations often ensue in *delays in project execution*, as on-going projects must be stopped and necessary changes made

[96]Juridique Les contrats globaux de construction en Europe. Available from: https://www.lemoniteur.fr/article/juridique-les-contrats-globaux-de-construction-en-europe.45309 (The webpage was last visited on 5-4-2020)

before construction works could be resumed. Apparently, today, neither construction companies nor the people are being able to keep track of those supervisory innovations.

Within this setting, we add, some recent texts of construction law (e.g. Élan Law, article 18, relating to Design-Build contracts)[97] seem to come in favor of some specific stakeholders and in disfavor of others. Largely, some construction actors, mainly architects, are now feeling threatened by such regulatory innovations as the odds of their roles being marginalized are high[98]. Following the Élan Law, we say, the project owner has gotten the freedom to deviate from the principle of state law stating that the tasks of the PM and the GC are necessarily distinct. Thus, both tasks could be (alternatively) assigned to a single entity who could concomitantly play both roles. In other words, the project owner may currently override the process of awarding two separate contracts and entrust the design and the execution of a project either to a group of operators (the so-called in French '*ensemblier*') —or to a single private entity via a Design-Build contract. Some exceptions apply though. Those are available in the original text of law, the so-called MOP Law, dating back to 1985. Concisely, such a contract could not be awarded unless two conditions are fulfilled[99]: 1) construction works present a particular technicality — and 2) the structure built is subject to a contractual commitment requiring energy efficiency improvement[100].

Ensuing from the above mentioned, it is obvious that Design-Build contracts are now being more and more endorsed and facilitated by public authorities, which sets the ground for an innovation like the one we are suggesting in the present study. Moreover, we say, it is practically conceivable to expect the management and execution of large construction projects to change (to the better) in the near future. Within the realm of contracts, we carry on by stating, big operators such as Bouygues and Eiffage have recently used global

[97]CONSTRUIRE EN CONTRAT GLOBAL. Available from: http://boutique.lemoniteur.fr/construire-en-contrat-global.html#caracteristiques_produit (The webpage was last visited on 5-4-2020)
[98]Les contrats globaux, seul moyen de construire les bâtiments de demain. Available from: https://www.batiactu.com/edito/ontrats-globaux-55693.php?MD5email=3bda47a71aa107686b2e568cde6824a1&utm_source=news_actu&utm_medium=edito&utm_content=article (The webpage was last visited on 5-4-2020)
[99]Juridique Les contrats globaux de construction en Europe. Available from: https://www.lemoniteur.fr/article/juridique-les-contrats-globaux-de-construction-en-europe.45309 (The webpage was last visited on 5-4-2020)
[100]Associated with the Grenelle II law of 2010

contracts to their own benefits. Actually, whenever a large construction project is commissioned, big operators tend to subcontract, through passive bidding processes[101], some or all of the works required to third parties. Subcontractors selected for the job are often vulnerable and set to work at near-zero margins. Said otherwise, big operators frequently outsource construction works to the lowest bidders so they could keep high margins for themselves. This constricted approach to value creation is one of the main problems the construction industry is currently facing. At times, big operators may possibly stop the project without even paying the subcontractors. They tend to do so whenever the project is thought to be economically unfeasible which supervenes in operational issues that accumulate throughout the process to finally reach the end-user. This could partly explain why end-users are often dissatisfied with the final products they get —often being of mediocre quality, unlike the one promised at start. And so, we state, big operators tend to, over and over again, neglect the well-being of end-users in a short-vision attempt to maximize their own profits.

Following a meeting I had with the Chief of Innovation Services at a Multidisciplinary Design Office based in Paris, we altogether agreed that there is an actual need for an innovation at industry level, and that the institution of a new organizational structure for the management of large complex projects is highly recommended.

> As put by the claimant, '*as customers' needs and are constantly changing, so should our offerings, else our company would lag behind and see its customer base shrinking.*'

Though most companies would find it difficult to rethink their BMs, they must come up with an innovative strategy that would enable them to redress their market standing and remain competitive in the marketplace.

> '*Our construction processes are impeccable,*' he added, '*yet what is outdated is our customer value propositions.*'

By focusing on the economics of construction projects, we often neglect the social and the environmental. The economics of a project are only worthwhile for construction

[101]This sheds light on the fact that operational problems encountered during the conception and execution of smart developments originate even before the kickoff of construction projects — in the course of bidding processes.

companies, but worthless for customers. What customers really care about is the social and environmental aspects of projects, which are every so often ignored.

> According to a Business Development Manager who works at a Multidisciplinary Design Office in Paris, '*a smart city does not exist in France — not yet at least — adding that it is the prevalence of short-term financial goals among construction companies that renders our constructions rigid and inefficient.*' '*Big operators care about themselves only, their own profits, and do not care about the impact of their projects on people and the environment*' he concluded.

Another architect — specialized in the construction of smart residential structures for the elderly — with whom I had the chance to meet and speak, shared the same viewpoint in this respect, stating that such an innovation (i.e. a GC BM for the building of smart cities) is definitely required — first to palliate the different problems construction companies are currently facing at present — second to allow France to step into the international (huge) smart city market — and third to ensure that what we are delivering to end-users goes beyond simple walls and roads.

> '*Apparently,*' the architect said, '*today, construction companies, big ones in particular, are working on hedging their portfolios by rethinking their own BMs — or say, by extending their scope of work so they could better satisfy all market needs and requirements.*'

Indeed, some France based construction companies are currently seeking to espouse the role of an integrator by trying to extend their business activities in an endeavor to cover the entire value chain, down to upstream[102]. For these companies, any attempt to conceive the city of tomorrow without the help of local communities would be destined to fail. Thus, we affirm, a smart city cannot be built but through a successful collaboration between all stakeholders immersed in the project, among which end-users.

Hence, under this vision, end-users should become active construction actors who co-conceive and co-design smart projects along with construction companies. To this end, organizing public hearing sessions (concessions) with local communities and potential end-users is a stepping-stone to allow end-users to start playing a more active role in the

[102]To my surprise, during my investigations, I found out that insurance companies in France, some of them at least (AXA), have a general contractor agreement that allows a construction company to expand its business activities downstream the value chain. However, under such a contract, a general contracting company, though overseeing and controlling the entire construction process, is bounded to outsourcing all trades required to third parties — not permitted to accomplish any construction works by itself.

conception and building of smart cities and boost social acceptability for smart structures built. Shockingly, it is only until recently that big operators become aware that conceiving smart cities following a top-down approach would fail. They saw their financial earns drop and their stocks of unsold units grow. And so, they realized that smart cities cannot be built but in cooperation with end-users, following a bottom-up approach.

Within this framework — and as reported by the General Manager of a financial company whose activities are focused on social housing, the GC role may only be consigned by the project owner (or big private operators). A maven in construction, he would play the role of a delegated project owner, replacing the often-deemed-incompetent original project owner throughout the entire project lifecycle and be held responsible for the success or failure of the project. He would oversee all construction works carried out and synchronize the tasks of different actors involved in the process.

The diversity of stakeholders (e.g. architects, engineers, urban planners, contractors, subcontractors, etc.) involved in construction projects is not a problem per se — the interviewee signposted — but on the contrary, it is a healthy thing, yet what is needed today is someone, an entity that could orchestrate and direct their works, so that to ensure they are being achieved harmoniously rather than separately, and ensure the delivery of project on time and within budget. This is important as faulty estimates are often seen as a key characteristic of large construction projects — a problem that often leads to budget overruns, thus pushing construction companies to adopt cost-cutting measures in an endeavor to fit their spending into the project's budget envelope. Such measures, we proclaim, habitually influence the social and environmental rather than economic aspects of the project. This is true as construction companies are less inclined to sacrifice part of their economic returns to uphold the agreed upon social-and-environmental specificities of the project.

Moving forward, during my chitchat with Mr. Biou, a program director at Paris Dauphine, the topic of social housing was raised. In social housing (relative to private housing), citizens are at the core of the BM.

> In Mr. Biou's languages, '*the viability of the social housing model is greater than that of private housing because the former is maintained and preserved via public governance schemes by which the life span of properties could be distended.*' '*The social housing model,'* he attested, *'reinforced by a smart governance structure within which citizens are key actors, may be adopted for the conception and building of smart cities.*' '*Such a model would ensure co-conceived constructions are accessible and affordable for all*' he concluded.

For construction companies, private ones mainly, social housing remains an underserved market ― an opportunity they should seize in their furious attempt to building smart cities. In conclusion, a University professor specialized in issues of socioeconomic and territorial changes whom I met during the Smart City's Exhibition held in Paris, insisted on the fact that the successful building and running of smart cities is primarily a question of governance and financing, hence the need for both central operators who could bring all the constituents of a smart city together ―and investors who could procure the monetary funds required for the building of the city.

> '*Unless there is a certain form of interoperability between the different components of a city,*' he asserted, '*the latter would not in any way be deemed smart*.'

Per se, a smart city is a platform or an ecosystem where all its builds communicate with one another. Communication, he added, is often facilitated through technology. Additionally, by allowing the free flow of data within the city, people would use it to come up with innovative ideas that could be eventually exploited to further enhance the performance and attractivity of the city. Therefore, we affirm, building a smart city is an ongoing process that is subject to continuous improvements. Thus, a BM that is specifically catered for smart cities should be flexible and adaptable in the sense that it should fit in to any improvements made.

Table 33 shown below exhibits the main problems identified in phase 2 and the solutions suggested for their resolve. Once again, we recite, the listed problems and solutions are only headlines, to be further elucidated in Chapter 5. Accordingly, a second draft version of the BM has been envisioned (see Figure 41).

IDENTIFIED PROBLEMS	*SUGGESTED SOLUTIONS*
• *Passive bidding processes* • *Legal and institutional barriers* • *Constantly changing construction standards* • *Financing*	***External (uncontrollable) factors***
• *Failing BM leading to abridged growth prospects at industry level*	• *Identify and target underserved market segments* • *Allow for customizability (portfolio diversification)* • *Adjust offerings to exact needs and requirements of end-users* • *Ensure final product has a use-value and that utility may be extracted from it*
• *Big companies' resistance to change*	• *Rely on organizational change to drive industry growth*
• *Top-down managerial approach*	• *Administer smart developments following a bottom-up managerial approach*
• *Banishment of any collaborative urban governance scheme*	• *Rely on collective thinking and intelligence to conceive and execute smart developments* • *Promote collaborative urban governance schemes (social constructivism)* • *Partner with local communities for the conception and building of smart developments* • *Create value in networks - profit sharing logic* • *Rely on services of external partners to achieve specialized tasks (outsourcing)* • *Build mutually beneficial rapports with stakeholders*
• *End-users not being co-creators of value*	• *Promote social engagement of end-users in construction projects* • *Co-create value by co-conceiving construction projects* • *Ensure involvement of end-users in all stages of construction process*
• *End-users not involved in the early stages of construction*	• *Organize hearing sessions for all people affected by the project* • *Recognize end-users as both data sources and innovation creators*
• *Faulty estimates leading to recurrent budget overruns* • *Scheduled timelines left in tatters*	• *Set cohesive plan for the execution and tracking of construction works* • *Set efficient budgeting systems and flexible timelines*
• *High number of stakeholders with overlapping roles and responsibilities*	• *Espouse a centralized decision making process* • *Manage stakeholders involved in the process and clear up roles and responsibilities*
• *Discoordination between construction actors*	• *Assign central operator to oversee execution works* • *Set up effective stakeholder management strategies*

IDENTIFIED PROBLEMS	*SUGGESTED SOLUTIONS*
• *Decentralized decision-making*	• *Ensure apposite cueing and synchronization among construction actors* • *Set up effective stakeholder management strategies* • *Build a lengthy network of industry partners*
• *Absence of an entity that could orchestrate time horizons and handle maintenance works*	• *Assign specialized entity to handle maintenance works* • *Responsabilize stakeholders* • *Assign central operator to oversee execution works*
• *Lack of understanding of smart construction process*	• *Promote social engagement of end-users in construction projects* • *Administer smart developments following a bottom-up managerial approach*
• *Risk of technological obsolescence upon delivery of project*	• *Set cohesive plan for the execution and tracking of construction works* • *Better innovation management practices* • *Lower risk of premature technology obsolescence* • *Improve work quality and curb maintenance costs*
• *Additional costs incurred to integrate new technology and upgrade asset*	
• *Innovation mismanagement*	

Table 33. Problems versus Solutions (Phase 2)
Source: Created by the author

As one would probably notice, some significant improvements have been brought to the first version of our envisioned BM —with some variables added and others replaced in version two:

- The TLBMC, being a strategic management tool, has been opted for so we could better reflect the various dimensions of a construction project, namely: economic, social and environmental. In the TLBMC, dimensions (—version 1 of BM) are rather connoted layers (—version 2 of BM). And within each layer, corresponding building blocks were added. The TLBMC allowed us to narrow down our problem-solution analysis —and served as a scheme for the portrayal of our GC BM. Said differently, the various problems identified and solutions suggested at each phase of the BM design process would ultimately be allotted across the numerous builds of the TLBMC;
- Besides, given that innovation is often enabled by technology, we chose to add the BIM (Building Information Modelling) Process into our BM, a tool that GCs, in partnership with other key stakeholders, could use to better plan, design, build, and manage large construction projects; and

- Finally, we drew the boundaries of our GC BM for the creation of smart cities. Indeed, four variables were identified, explicitly: 1) legal and institutional aspects, 2) construction standards and codes, 3) financing, and 4) social acceptability. Indeed, we say, any construction project, smart or not, cannot be executed unless it complies with state-imposed rules and regulations — including construction codes and standards; it could not be built unless the required funds were secured first; and, finally, could not be sold unless requested and accepted by end-users.

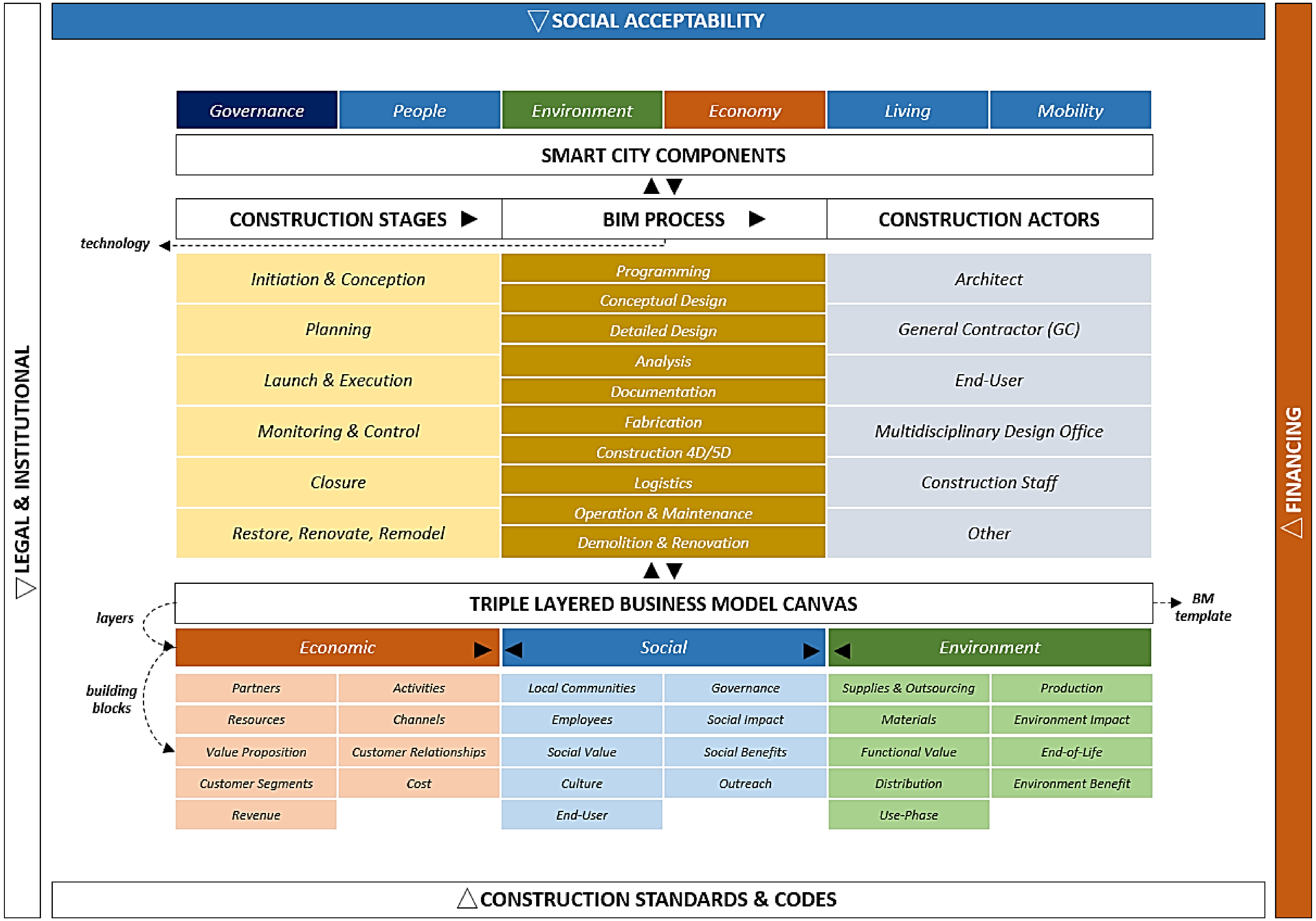

Figure 41. Version 2 of GC BM
Source: Created by the author

4.3. PHASE 3: MATURITY

In phase 3, we affirm, our envisioned GC BM has reached a certain level of maturity and became somehow complete. We are not proclaiming that our GC BM is perfect, not at all. It is simply a serious attempt in the direction of creating an artefact that construction companies in France (or anywhere in the world) could use to better tackle the question of smart cities.

Ensuing from our findings in phase 2, I carried on in my investigations by doing some further dig ins and outs to fine-tune the second version of the GC BM. Based on a meeting I had with the Business Development Manager at a large construction corporation, I was able to gather some invaluable insights about customers' real needs, mainly what they want and what they aspire to get. Requoting the interviewee, '*a sociologist once said, what people actually want is to permanently feel on vacation.*' Though they live in the city, the village must be brought to them — hence the importance of encouraging smart initiatives like the Chinese made urban-village. Besides walls and roads, construction companies must look at construction from a different perspective so that to include green spaces, entertainment zones, parks, benches, and others in their offerings.

For the interviewee, people are not seeking complexity, but simplicity. It is the most basic which in their eyes has the most value. Construction companies should as a result widen their scope of how the city of tomorrow should be built and look like, otherwise they would fail to deliver and eventually be evicted from the market. Customers care about the little details and appreciate eco-friendly construction practices. Therefore, everything that generates less pollution and allows for energy consumption reduction is often admired by customers. Besides, construction companies should not pretend to know what people actually want, because they do not. Customers should be part of the process and it is only when companies and communities cooperate together that large construction projects would be destined to succeed. At building level, the interviewee affirmed, it is important for companies to keep a close eye on the design and modules of the ground floor. In his viewpoint, it is this part of the building that would eventually decide whether the latter would sell or not — whether a neighborhood is livable or not — whether a city is appealing or not. The ground floors of buildings indicts the dynamics of a city. Smart cities, once built, are likely to be job creators; indeed, a community or a property manager must be hired to ensure that all components of the city are interrelated and all systems are working as intended (e.g. waste collection, grid management, energy consumption, space management, and others).

Technically speaking, whenever an idea of a large project springs to mind, the execution of that project follows a sequential process that extends from the day the company meets with the public landlord and makes him a proposition about the envisioned project, to getting state permits and permissions, to finally settling through concessions with local communities on a clear exposé of what the city would entail and resemble.

In our envisioned BM, integrating the GC as a construction maven in the value chain does not mean that he would have the exclusiveness of fulfilling all works required in the project. His role is mainly managerial, to oversee and ensure the provision of all necessary trades for the accomplishment of the project. Under the GC BM, as under any other BM, groundworks may possibly be outsourced to third parties who would operate under the supervision of the GC. Also, we note that, nowadays, in France, the world smartness, often misplaced, is being used by construction companies as a mere marketing tool that allows them to sell their final products faster and more expensive. Until construction companies are held accountable or responsabilized for their behavior, the interviewee declared, companies would continue labeling and selling their products as being eco-friendly and smart, while in reality they are not. Corporate social responsibility is a key topic that should be seriously considered in the realm of smart cities, especially for construction companies. Also, given that decision-making is often decentralized in the construction industry, the likelihood of mix ups in conception and execution plans occurring is high.

> '*This,*' the interviewee said, '*gives further credibility to your proposition as once decision-making is centralized in the hands of one entity such flaws would be dodged.*' '*The maladministration of documentations, often resulting from records dispersed in the hands of numerous stakeholders, would also be escaped*' he added.

Under the GC BM, we assert, the GC — along with other stakeholders among which end-users — would take part in both the conception and execution of the project. Smart cities cannot be built but through team effort, collaboratively rather than individually. Hence, it is a process of value creation (for all) through value networking (by all). Whenever we work individually (without supervision), each one of us would seek his own interest, yet under the GC BM, the odds the collective interest would end up being served are higher. This is crucial as most of propositions made to customers today lack value. Smart cities are never about the technology nor the structure, but about the humane and the livable. Smart cities are mainly a question of smart governance and smart people. All other components come second. They are an assortment of different things among which the environment therefore, the latter should be given further attention by construction companies. By using both smart technologies or systems and sustainable construction materials the yield that we would expect to get at the end of the process would inevitably be eco-friendly, sustainable, and smart. And so, smart cities are complete packages including different components that should be considered and thought of pre kick-off of project. Under our GC BM, GCs could be defined as the entities who are in charge of bringing all city components together — a reasoning that aligns with the experience of Copenhagen, Denmark in the domain of smart cities.

The GC BM, we found, is a necessity today in the construction market in France since most of the companies operating in the market are small-sized each specialized in a definite field. The problems listed thus far seem to be common to almost all construction companies operating in France. The innovation we are suggesting is correctional rather than being disruptive. And, we presume, it would be beneficial for all: for project owners because they would have to sign one agreement with only one entity instead of several ones who would handle all the risks associated with the project; also, for small-sized construction companies who often handle micro-scale construction projects, having only one correspondent to talk to throughout the entire construction process is regarded as an invaluable innovation. And so, we conclude, if such an innovation is required for micro-scale projects, what would it be for macro-scale ones? To conclude my investigations regarding smart cities, I held several meetings with Mr. Rochet, a professor at Paris Dauphine, where we both agreed on the fact that the right departure point for any future research on smart cities would consist of deciphering the notion of smart cities, first by embarking upon all academic research on the topic, then by attempting to make an innovative, and scientifically-proved proposition in this field. Within this context, I, together with Mr. Rochet and a few other scholars, proceeded by creating a committee of researchers (including Ph.D. students and university professors) to conduct further research on the question of smart cities and smart territories, a work that, we hope, would eventually lead to the creation of a research center (Symbioter —as we thought of naming it) that would be specialized in the study of the circular economy, territorial development, and human-centric smart cities.

Table 34 shown below exhibits the main problems identified in phase 3 and the solutions suggested for their resolve. Accordingly, a third and final version of the BM has been envisioned — illustrated in Figure 42. We reiterate, color codes were meticulously chosen to reflect potential dependencies between the BM’s sequentially-ordered six constructs: construction stage, BIM process, construction actors, TLBM layers, smart city components, and TLBMC building blocks. As you would notice, a technical layer has been added to the TLBMC. It was added to fit in all technical aspects of construction projects; also to account for all aspects that could not fit in other layers. Besides, the BM’s boundaries were colored based on their prospective links with both smart city components and TLBMC layers: financing revolves around the economic, social acceptability around the social, and construction standards and codes — and legal and institutional requirements around the technical. Governance with smart city components has a unique color as governance could have different forms: social, economic, technical, and others.

IDENTIFIED PROBLEMS	***SUGGESTED SOLUTIONS***
• *Governments’ reticence to openly share data*	***External (uncontrollable) factors***
• *Lack of smart city initiatives and urbanization efforts*	• *Encourage smart and eco-friendly initiatives (urban-village)*
• *Non-sustainable construction*	• *Use of innovative, eco-friendly, cost-effective construction materials* • *Use additive or other technologies and systems to boost energy efficiency*
• *Broad concerns apropos the livability of assets*	• *Build eco-friendly living environments* • *Enhance end-users' wellbeing and quality of life* • *Ensure final product has a use-value and that utility may be extracted from it*
• *CSR-related topics occasionally conversed for mere marketing purposes*	

Table 34. Problems versus Solutions (Phase 3)
Source. Created by the author

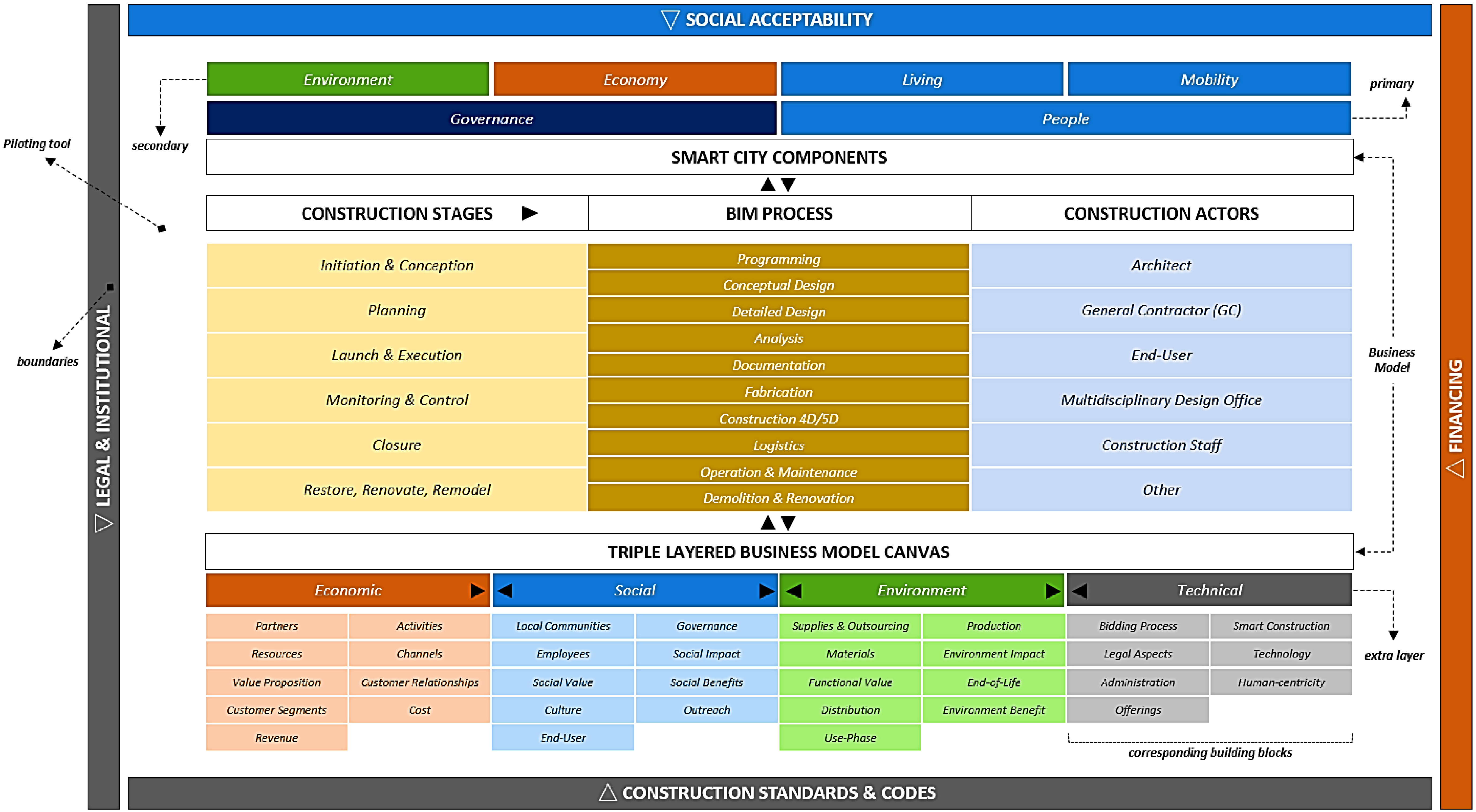

Figure 42. Version 3 of GC BM
Source: Created by the author

4.3.1. *THE SIX-STRATUM BUSINESS MODEL*

In the next subsections, we briefly explain each of the six strata (variables) forming our envisioned GC BM for the building of smart cities. Following a sequential order, we first embark upon the model's pivotal (first) stratum which is construction stage, going through BIM process, construction actors, TLBMC layers, and smart city components, all the way to TLBMC buildings blocks, being the model's final stratum. The latter would help us portray problems identified and solutions suggested earlier across four dimensions of construction projects: economic, social, environmental, and technical.

4.3.1.1. *<u>CONSTRUCTION STAGES</u>*

Every stakeholder involved in the process of planning, designing, constructing and operating physical facilities related to the (smart) project under consideration, gain different viewpoints on project management for construction. The contribution of proficient knowledge could be very helpful, mainly when it comes to large and complicated projects, since stakeholders in various specialties could offer valuable services. On the other hand, it is very essential and advantageous to understand how the different parts of the process match together. As previously evoked, the poor coordination and communication among stakeholders may eventually lead to excessive costs and delays. Hence, it is chiefly the requirement of the (delegated) project owner that is, in our case, the GC, to assure that such flaws do not take place. And it owes all stakeholders involved in the project to regard the interests of project owners — represented by GCs throughout the entire project process — as at the end — it is them who would provide the resources and make the decisions.

The implementation of the GC's viewpoint would help stakeholders to focus on the completion of the project by having proper attention in the process of project management for constructed facilities. This, we proclaim, would curtail the old concept of bringing decisions based on the historical roles of stakeholders involved in the project, namely: multidisciplinary design offices, urban planners, architects, engineering, construction staff, material suppliers, ICT companies, and end-users (among others). There is no doubt that each stakeholder individually would have a lot of contribution to the advances of construction projects[103] — yet, we trust, the understanding of the entire process of project management would make them respond more effectively to the GC's requirements. Consequently, they could contribute their proficiency through opinions in improving the productivity and quality of their work. The enhancement of project management boosts the construction industry which in turn facilitates the development of regional and national economy (—thus, cultivates the allure of the city). To have significant improvements, one should be familiar with the construction industry, its working environment and the legal and institutional constraints that are likely to influence its activities and the nature of project management.

Generally, a standard construction project is split into six major lifecycle phases (—see Chapter 2 for more details in this regard) — enumerated and described below:

- *INITIATION & CONCEPTION*

Alike any construction project, at the beginning of the project, we should create and evaluate the project in order to determine whether it is feasible and whether it should be undertaken. Here the project objectives or needs are acknowledged; this could be a business problem or opportunity. A suitable response to the needs is documented in a business case with recommended solution options. Some preliminary feasibility studies are then conducted to examine whether each option clearly identifies the project objectives and a final recommended solution is dogged.

Many questions related to the issues of feasibility, for instance — could and should we do the project? — are mentioned and faced during this phase. When a solution is approved, a project is initiated to implement the accepted solution. At this stage, the main deliverables and stakeholders that would partake in the process are identified. This is the time when the project team begins to take shape. Approval is then required by the GC to

[103]Construction Project Life Cycle – Phases in Life Cycle of a Construction Project https://theconstructor.org/construction/construction-project-life-cycle-phases/14283/

move onto the detailed planning phase. GCs, architectures, ICT companies, and end-users play key roles during this phase of the construction process.

- *PLANNING*

The planning phase involves further development of the project in detail to meet the project's objectives. The GC identifies all of the work to be achieved. The project's tasks and resource requirements are identified, along with the strategy for producing them. In a broader sense identification of each activity as well as their resource allocation is also carried out. A project plan outlining the activities, tasks, dependencies, and timeframes is created.

The GC — in association with other key stakeholders, mainly: architects, engineers and ICT companies — is the one who would handle scope management that is, coordinate the preparation of a project budget by providing cost estimates for the labor, equipment, and materials costs. The budget of the project already estimated is then used to monitor and control cost expenditures during project implementation. Finally, the GC prepares a few documents that show the quality plan, providing quality targets, assurance, and control measures — as well as the acceptance plan, listing the criteria to be met to gain customer acceptance. At this point, the project would have been planned in detail and is ready for launch and execution.

- *LAUNCH & EXECUTION*

During this stage, the project plan is put into motion and the work of the project is performed practically on site. The GC would spend lots of time handling this step of the process. Throughout the project implementation, different stakeholders carry out a blend of tasks, and progress information would be reported via regular project team meetings.

- *MONITORING & CONTROL*

The GC would use all information identified in the previous stage to preserve control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities. If any deviation is noticed from the already defined plan corrective measures are made. The first option of action should always be to bring the project back to the original plan. Nevertheless, if impossible to do, the GC might proceed by recording deviations from the original plan and records and publishes adjustments brought to the plan. All through this step, investors (sponsors) and other key stakeholders (—among which the original project owner) are kept informed about the project's status. Generally, status reports must always highlight the probable end point in terms of cost, schedule, and quality of deliverables. Also, each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. When deliverables have been produced and the customer has agreed on the final solution, the project is said to be ready for closure.

- *CLOSURE*

During closure, the importance is on providing the final deliverables to end-users that is, handing over project documentation to the project organization, terminating supplier contracts, releasing project resources, communicating the closure of the project to all stakeholders, and conducting lessons-learned studies.

- *RESTORE, RENOVATE, REMODEL*

A few years after closure, there is a chance that the project delivered might require maintenance, thus it is up for the GC (or assigned specialized entity) to decide whether the property should be restored, renovated, or remodeled. In a nutshell, restoration is the process in which the building would be returned to its original condition. It includes simple repairs to be brought to the property. Renovation on the other hand is the process of renewing a building or structure by fixing what is already present and in some cases adding new components. Often renovations are done in conjunction with restorations as one could decide to restore a given property and modernize it at the same time. Lastly, remodeling involves changing the entire structure of a given property or structure. Relative to restoration and renovation, remodeling is much more labor-intensive and costly.

4.3.1.2. *BIM PROCESS*

The BIM Process founds the stratum 2 of our GC BM. It is directly linked to stratum 1 that is — construction stage. By combining the two, we allowed for a supplementary breakdown of construction stages —and so, a better trailing of construction works carried out at each stage. The tie between the two strata is shown in Figure 43.

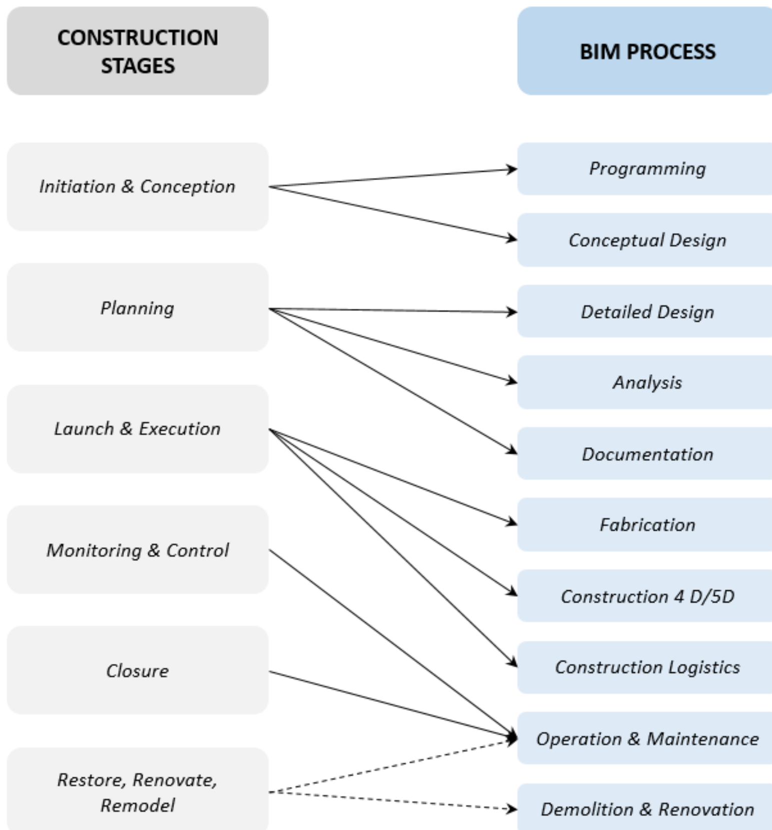

Figure 43. Association between construction stage and BIM process
Source: Created by the author

Given the broadness and immensity of the BIM process (—comprising ten phases), it is fundamental for one to be able to locate himself in it[104]. Today, France based construction companies, mainly those using BIM to keep track of their construction project processes, do not develop BIM building models, but rather the BIM models that define and specify the building or structure to be built. Precisely, they do not model the construction site and do not consider details and phases of the building systems that would be used to build the building or structure. Put differently, they model the structure to be built, not the process of building that structure. Hence, we affirm, BIM is often misconstrued and its potential not fully exploited by construction companies. This is factual since the software could be

[104]What is BIM? Available from: https://bimmda.com/en/what-is-bim (The webpage was last visited on 5-6-2020)

used not only to develop a BIM model that considers the various stages of a construction site, but the construction processes that are intended to be used in construction too (—see Figure 44). Hence, we avow, BIM is a set of policies, processes and technologies that, together, generate a methodology for the process of designing smart constructions, testing their performance, and managing their information and data using digital platforms.

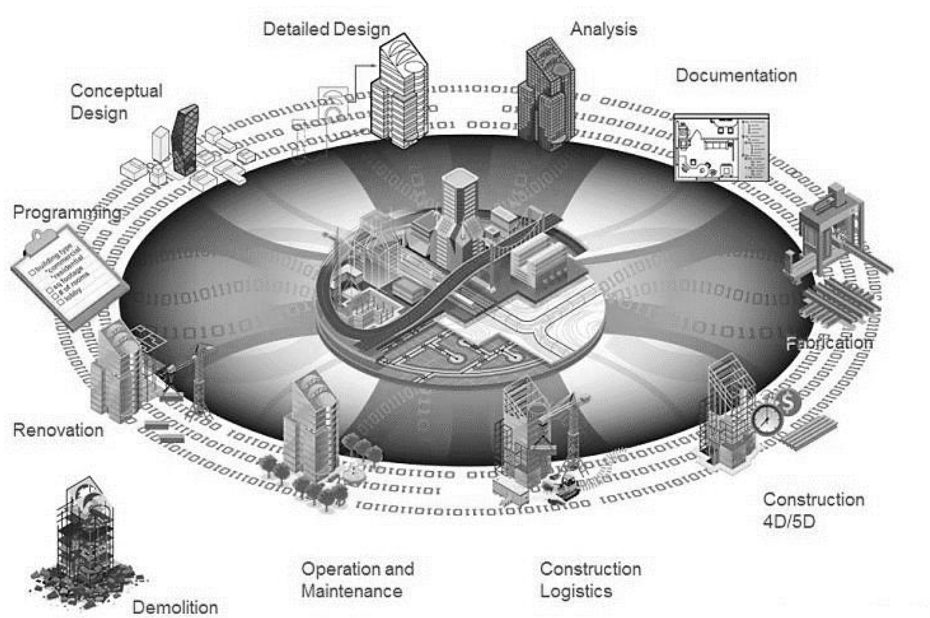

Figure 44. BIM Process[105]

Besides, BIM is applicable to the entire lifecycle of a construction project, from the conception and creation of a construction project idea, through project development and construction; until after the works are completed, and the final product is delivered and occupied —the reason why we chose to integrate it into our GC BM. Also, based on the scope and objectives of the construction project, BIM may possibly be used to build various models at different stages of a construction project's lifecycle, while considering the consolidation of data resulting from the evolution of the project and the process of defining constructive solutions and specifications. BIM models, we add, may be even used for occupancy management and maintenance. And so, in finale, we trust that by

[105]Building Information Modeling Process. Available from: https://www.realityimt.com/as-built-bim/ (The webpage was last visited on 5-8-2020)

integrating BIM into our GC BM, we would be disposed to resourcefully manage smart developments, by avoiding maladministration of project documentations, reducing paper work, keeping track of all details going on throughout the lifecycle of a construction project, curbing needless operational costs, and helping ensure accurate synchronization and cueing of tasks to be fulfilled by stakeholders involved in the project.

4.3.1.3. *CONSTRUCTION ACTORS*

In construction, numerous stakeholders (or construction actors ― being the third stratum of our GC BM) join forces throughout the lifecycle of a construction project to build the intended structure and deliver it on time and within the boundaries of the budget set. Besides the common roles played by architects, engineers, construction staff, multidisciplinary design offices, and others ― in our GC BM, we rather focus on that of a GC for the building of smart cities. A GC is an entity or a person, hired by the project owner (client) to carry out the work that is required for the completion of a project. Nevertheless, GCs do not always have the expertise or the trades that are needed for completing all construction work by themselves. Thus, they time and again appoint subcontractors to complete parts of the work. It goes without saying that the role of GCs has many different levels as they are responsible for a wide range of tasks and people. Finding the right people to get the job done and taking care of materials, equipment, and any other services required for the smooth development of the project are parts of their work. This is also where subcontractors could provide valuable help, as in most cases, GCs have their own networks of subcontractors which could support the progress of the project, and allow for the delivery of project, perhaps, in relatively shorter timeframes.

The most common project aspects that a GC could be responsible for include ―but are not limited to: 1) building permits application, 2) ensure property security, 3) providing temporary facilities on site, 4) taking care of generated waste, 5) on-site personnel management ―comprising the implementation of safety and security measurements, 6) site surveying, 7) site engineering, 8) schedule and progress monitoring, 9) modifying, and updating the programme of the project based on most recent changes and received feedback, and 10) collaborating with contractors and subcontractors (―see Table 35).

Based on the aforesaid, it seems obvious that a GC would also be accountable for the quality of the works delivered to end-users. Under the GC BM, the GC is a direct contractor, an entity who contracts with and is hired directly by the project owner. In such a case, the relationship of a project owner with a GC takes the form of a long-term commitment, which may sometimes include one or more future projects. Under the GC BM, GCs are also entrusted to help architects plan and design the project, ensure all works done in a project complies with the construction standards and codes (environment related, social related, safety and health related etc.), and stay on top of the work done on site. Also, GCs are expected to act like design and build contractors who would be involved in almost every step of the project, and whose job may extend to post-delivery phase, even after the project has been completed and delivered, by, for instance, ensuring the maintenance of the structure built. Hence, under the GC BM, GCs are consigned to concurrently act as CMs and PMs.

Summing up, it is evident that providing a specific definition for the role and the responsibilities of GCs could be harder than it might look due to the multi-purposed services that they provide in the course of a construction project. However, we proclaim, the advent of technology in combination with the various challenges that the French construction industry is currently facing has paved the way for a new approach in the roles and responsibilities of GCs. Adding finally that a GC job description may alter on a project basis ― based on whether he is assigned to just provide management of a project or also to participate in construction.

Manage daily operations	A GC's main job is to manage the day-to-day operations at the construction site. Also, to focus on keeping all tradespeople on-task and the work site safe and clean.
Provide all construction materials and equipment	A GC is responsible for providing all of the construction materials and equipment needed for the project. He ensures that the best quality materials are used, while keeping the client's budget in mind. He also makes sure that all materials show up on time and in great condition.
Coordinate contractors, subcontractors, and architects	A GC hires specialized subcontractors to work on portions of the project (e.g. plumbers, painters, and others). On the work site, he is responsible for coordinating all of the subcontractors to keep them on task. He also relays important information from the project owner to the subcontractors. Additionally, he is responsible for the timeline, budget, and quality of work — and makes weekly check-ins to make sure that all aspects of the project are running smoothly during the entire duration of the build.
Main contact to the client	A GC acts as the primary contact to the project owner, ensuring the latter is kept updated with the progress of the project. From the initial consultation and onward, a GC works with the project owner to guide the project to completion.
Collaboration across the supply chain	A GC works on improving communication and collaboration among stakeholders involved in the construction process which, we trust, could make the whole difference between the success and failure of a project.
Managing the team on site	A GC uses digital tools such as BIM to establish a strong connection between the site and the office. BIM is quite useful as it enables GCs to competently handle and manage several projects at a time.
Task delegation	A GC uses interactive systems to establish connections between office and site, delegate tasks, and keep all stakeholders in harmony.
Documentation	Documentation is one of the biggest challenges for every PM. The amount of captured data in the course of a construction project is humongous and with this in mind, it becomes clear that the transition to digital is of paramount importance today. Hence, the invaluable role of our *stratum 2* (—*BIM Process*) in this respect.
Learning from past projects	A GC efficiently handles data collected throughout the lifecycle of a project and uses it as a basis for improving efficiency and reducing rework rates in future projects.

Table 35. General Contractor's main duties
Source: Created by the author

4.3.1.4. *TLBMC LAYERS*

As previously discussed in former chapters of the present study, the TLBMC is a new strategic management tool that was developed by Pigneur et al. (2015) with the aim to explore sustainability-centered BMI. The TLBMC, built upon the foundation of Osterwalder (2004), adds two new layers to the traditional BMC: environmental and social. This new BMC, we proclaim, moves a company away from the one-dimensional perspective of the old-style BMC by incorporating the three-legged approach, allowing for a more holistic BM to be achieved.

In our GC BM however, we have added a fourth (technical) layer to the new BMC, thus making it four-legged (—stratum 4 of our GC BM). Overall, the new version of the TLBMC enabled us to map, understand, evaluate, design, implement, operate and control four key layers instead of three (— and thirty four building business blocks instead of twenty seven). The problems identified during the course of the BM design process are allotted across the TLBMC four layers so we could see within which layers most problems lay — and, consequently, suggest plausible solutions for their resolve.

On a separate note, the innovation we are trying to bring to the construction industry's value chain suits Hart and Milstein's (2003) greening concept, which in the authors words, is a process whereby a company attempts to harness sustainability through incremental rather than radical innovation. Within this context, we make clear that the TLBMC allowed us to analyze and conceptualize the dynamics and coherence of our BMI; first, vertically, by comprehending how value is created across all three-plus-one layers, and then, horizontally, by exploring and understanding new ways of creating economic, environmental, social, and technical value — individually — via the interaction of the building blocks within each layer. Lastly, we say, the TLBMC permitted us to make a significant first step forward towards transforming the old construction industry's BM into a sustainable one.

4.3.1.5. *SMART CITY COMPONENTS*

Smart city is a new concept that is based on and enabled by technology. As previously evoked, the rapid increase in population and urbanization worldwide have increased the basic ways to manage urbanization, with maximum impact on the environment and lifestyle of inhabitants. The prior integration of new ICT into urban operations has promoted the concepts of digital cities. And the design of the IoT for smart cities resulted in ensuring smart cities' goals with minimum human interactions. With technology playing an increased role in the building of smart cities, cities eventually converted into technology demonstrators and lost their social appeal. To settle on what a smart city really means is not easy since there is no universally accepted definition of it.

To my knowledge and based on the extensive readings I did on the topic, I could openly affirm that a smart city is expected to mean different things to different people. The conceptualization of a smart city, I add, is likely to change from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. Indeed, a smart city would have a different connotation in India than, say, Europe. Some definitional boundaries are required to guide cities in this mission. This is true, as in the imagination of a smart city the wish list of infrastructure and services required is possibly to vary among cities and nations. Nowadays, in an attempt to provide for the aspirations and needs of the people, urban planners are seeking to develop entire urban eco-systems, which are represented by the four pillars of comprehensive development-institutional, physical, social and economic infrastructure. This could be a long-term goal and cities could work towards developing such comprehensive infrastructure, incrementally, by adding some layers of smartness to their existing BMs. (―see Chapter 1 for more details regarding smart cities)

For the purpose of this research, we assume two primary components of smart cities: governance and people ―and four secondary ones: economy, environment, livability, and mobility (―altogether forming stratum 5 of our GC BM). Some classic features of comprehensive development in smart cities are listed below[106]:

1. Housing and inclusiveness (i.e. expand housing opportunities for all);
2. Create walkable localities (e.g. reduce congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security, etc.);
3. Preserve and develop open spaces (e.g. parks, playgrounds, and recreational spaces in order to enhance the quality of life of citizens, and others);
4. Promote a variety of transport options (e.g. public transport and last mile para-transport connectivity);
5. Make governance citizen-friendly and cost effective (e.g. rely on online services to bring about accountability and transparency; form e-groups to listen to people and obtain feedback, etc.);
6. Apply smart solutions to infrastructure and services in area-based development in order to make them better and more resilient (e.g. make areas less vulnerable to disasters, use fewer resources, provide cheaper services, etc.).

4.3.1.6. *TLBMC BUILDING BLOCKS*

The TLBMC building blocks constitute the sixth and last stratum of our GC BM. Overall, after adding the technical layer to the BMC, the total number of building blocks rose from 27 to 34, hence allowing for a larger breakdown of problems identified and solutions suggested. The economic layer of the BMC accounts for nine key building blocks causally interacting with one another. At this level, the focus is on the economic sphere ― that is, the economic profitability of construction projects. The environmental layer on the other hand focuses on the life-cycle assessment, measuring the environmental impact of a structure throughout all stages of its life. At his point, companies should concentrate on identifying material environmental issues through tools such as, energy and water use, waste generation, resource depletion, ecosystems destruction, and negative effects on public health and life. Once a critical material environmental issue has been identified,

[106]Smart City Features: http://smartcities.gov.in/content/innerpage/smart-city-features.php (The webpage was last visited on 5-8-2020)

construction companies should come up with solutions aimed at resolving it. On the social front, the focus is put on the construction company's social impact. By incorporating a stakeholder perspective, construction companies would be better suited to balance the different interests of their key stakeholders. This layer, we avow, is broad and flexible in use. Lastly, the newly added technical layer accounts for the technicalities of projects, mainly technical issues faced which, if remained unsolved, may possibly have some serious repercussions on the other layers and buildings blocks of the BMC.

For the successful achievement of our empirical research, we sought to identify, map, and evaluate all economic, social, environmental, and technical issues encountered during the building process of smart cities in general and constructions in particular. Subsequently, once issues have been identified and mapped out, we used the TLBMC to explore new ways (solutions) to transform the BM through innovations aiming at creating, delivering and capturing superior value.

Before discussing the fourth phase of the design process (—evaluation), I close the present subsection by affirming that the idea I first had of the new GC BM was somewhat complex (—see Figure 45). As a matter a fact, I faced some serious troubles portraying it visually, the reason why we finally resorted to a specialized IT developer who helped me arrange both my ideas about —and vision of the new BM. Consequently, we were able to conceive and build a business model simulator following the design process phases listed and described earlier.

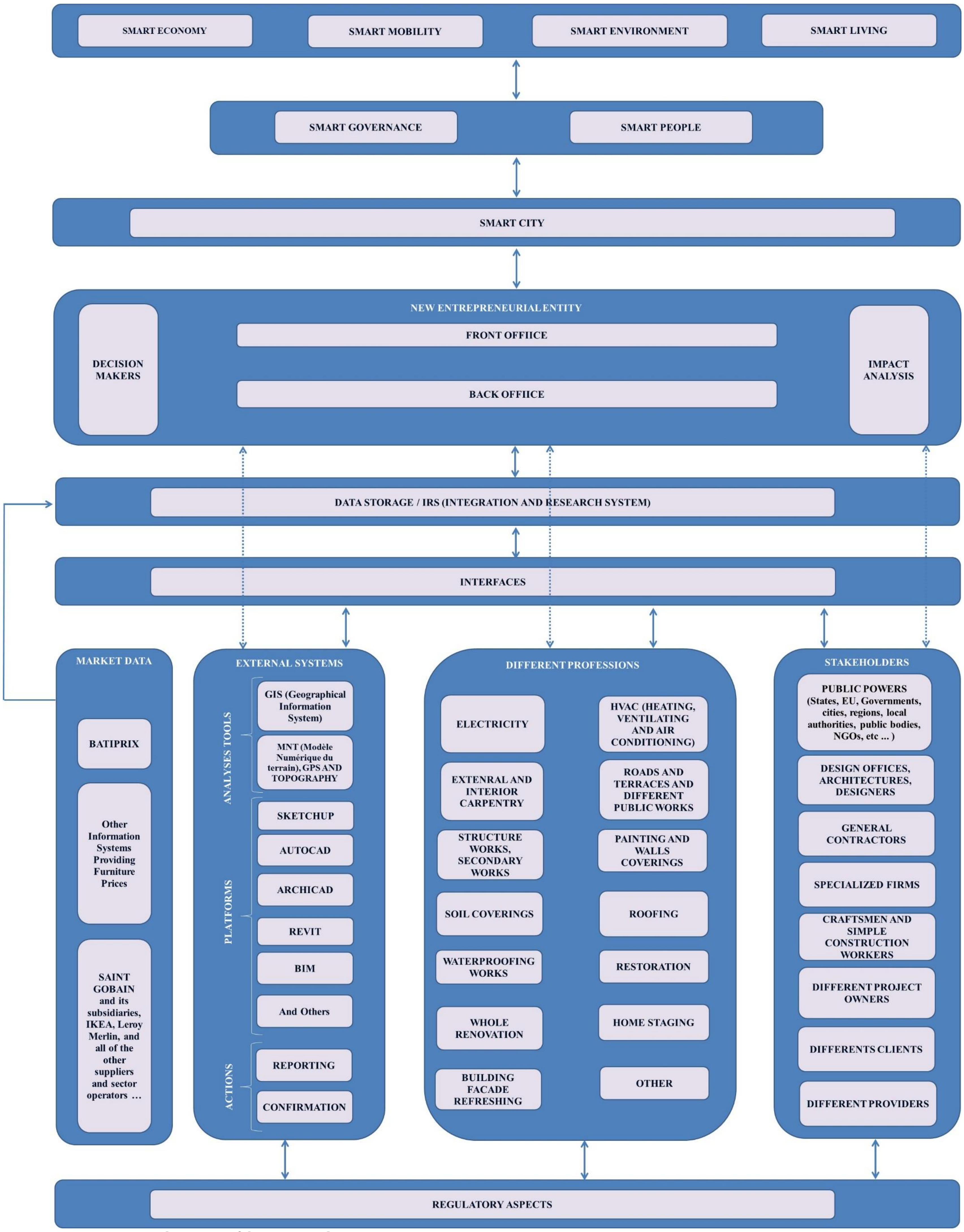

Figure 45. An early version of the envisioned GC BM
Source: Created by the author

4.4. PHASE 4: EVALUATION

A total of four interviewees were carried out with university professors and industry experts to gather their viewpoints vis-à-vis the *validity* and *sustainability* of the GC BM built. Overall, all four interviewees have *valued* my research work and avowed that the suggested BMI is original and thought provoking. Precisely, as put by Mr. Gérardin, '*the smart city BM you have built is extensive and all-inclusive — accounting for BIM technology, too — which is great*.' One limitation was nevertheless mentioned by Mr. Gérardin — relating to the fact that the economic analysis pertaining to smart cities was insufficient and should have been extended further. This is understandable — we say — given that our research efforts were not solely focused on the economics of smart cities. The economics of smart cities is an interesting topic that I believe would unquestionably embark upon in my future research endeavors.

> For Mr. Gérardin, '*the GC BM is inventive in the sense that it accounted for all dimensions of a construction project, irrespective of whether the latter is smart or not.*' '*The integration of the GC role as a central operator within the construction industry's value chain is ahead of the functioning of our organizations,*' he said, '*who are still a bit orthodox in their ways of thinking.*'

Also, he well-regarded the business model simulator (—software scripted in Agular 2+) which, in his views, could be used along with other available technologies to ensure the resourceful planning, execution, and management of future smart city projects.

> '*This study is a robust starting point that France based construction companies may eventually rely on to improve their construction practices and contribute to the emergence of a real smart city market in the country*' he concluded.

In the same manner, Mr. Youssef avowed that the suggested GC BM is very interesting, especially that — in France, it is uncommon to find someone who is capable of looking at things from a changed angle.

> In his languages, '*though the GC concept is practical and viable, the risk market players would refute it is high; the market itself does not allow for such innovations — which is unfortunate.*'

Even if the GC concept exists (it actually does exist!), he would be forced to outsource construction works ―and so his job would be limited to control and management.

> '*The fact that you added the BIM into your BM is a smart move,*' Mr. Youssef asserted, '*also the ability of the business model simulator to generate changed BMs, showing possible interactions among stakeholders, is remarkable as problems and solutions could be then mapped stage by stage.*'

He finally suggested testing the GC BM in real-life and see how it works and whether or not further improvements should be brought to it. Similarly, Mr. Petitprez affirmed that he has never seen such a tool before (―referring to the business model simulator), insisting that the suggested GC BM brings some real and useful change to the industry's old BM.

> In his languages, '*the construction sector is never focused on improving its ways of doing which partly explains why we are still committing the same mistakes we used to do fifty years ago*.'

Moving forward, Mr. Rochet avowed that the research I carried out is perfectly structured, including my choice of the business-modeling tool.

> In his eyes, '*the TLMBC is a somewhat perfect tool that one could use to map problems faced at industry level today and suggest solutions for their resolve.*' Also, '*by adding end-users as construction actors,*' he affirmed, '*you have respected the human-centricity approach to building smart cities where people partake in the process as both data sources and innovation creators.*'
>
> He closed by saying: '*the TLBMC per se responds to all aspects of a construction project, smart or not, and the technical layer, I admit, is a beautiful addition to your BM or, better called, piloting tool.'*

In Chapter 5, we discuss and map the main problems in construction as well as the solutions suggested for their resolve. We also clarify and graphically illustrate the existing dependencies among the BM's layers and between its building blocks.

CHAPTER V. RESEARCH FINDINGS

The present chapter identifies the main problems encountered in construction today and suggests plausible solutions for their resolves.

5.1. PROBLEMS

We herein present an inventory of the main problems encountered by construction companies today. We use the TLBMC's four layers — *economic*, *environment*, *social*, and *technical* — to map and explicate them. As you would notice throughout the text, the problems identified are also split into two categories: *controllable* and *uncontrollable*. In our views, *controllable problems* simply denote project management problems that could be addressed and solved by construction companies once the appropriate measures have been implemented. Whereas, *uncontrollable ones* — which we label O-B (Off-Balance) — are those construction companies have zero control on, yet could markedly impact their capacities planning in project management and put their project management structures to the question. Urbanization, financing, legal and institutional barriers, and state-imposed construction codes and standards are examples of uncontrollable, off-balance problems. This distinction between controllable and uncontrollable problems is vital in the sense that it permits construction companies to separate operational problems from institutional and other macro ones. Noting that problems in construction repeatedly ensue from institutional problems —being out of construction companies' control. Over time, those problems, we believe, are undoubtedly to magnify and create other, operational, problems such as budget overruns and delays in deliveries.

In the following subsections, we group the various problems identified under specific headers: economic, social, environmental, and technical —and thoroughly clarify them

5.1.1. *ECONOMIC*

We herein list and explicate the economic problems in construction. First, we tackle off-balance or uncontrollable problems —and then embark upon controllable ones.

Financing (O-B). Financing plays a vital role in the building of smart cities. David Harvey, a neo-Marxist-inspired author who took a keen interest in the study of urbanization of capital, agreeably spoke about this[107]. When it comes to France in particular, the process of founding new cities went through diverse phases over time. At first, there was the Fordist-cycle where the state played a chief role in the implementation of urban policies and regional plans. Then, in the 70s, public finance and rivalry between territories rose as topics of interest for every person. Subsequently, in the late 80s, came the so-called urban entrepreneurship dogma where rivalry started shifting from territory to city level. French authorities strained year-over-year to institute some developmental balance between the country's different territories —but somehow failed to do so.

They were unsuccessful because their strategy consisted in undressing Paris in an endeavor to dress up other declining cities. Looking at the experience of the US, the UK, or other countries in this domain — one could realize that smart city markets in Anglo-Saxon economies are governed by market-oriented policies, where urban governance is often ensured by means of operative private-public partnerships (which is not quite the case in France!). In France, we expect big operators such as Altarea Cogedim, Unibail-Rodamco and ICade, being all listed in the stock market as real estate investment companies, to drive urban growth at country level in the near future.

> '*By setting appropriate financing schemes for the national real estate market, we would be able to come up with a novel production system that would help our declining or marginalized cities to revive and flourish*' Mr. Cusin avowed.

We need to invest to generate more money —and with more money, we would be able to invest more; it is a looping process where more investments lead to more value creation. Today, lots of construction companies are building residential units, but are not making any successful pitches, does this means that their construction processes are unproductive? Not really. More likely, their BMs are running out of gas.

> For Mr. Natchitz, '*the act of creating smart cities through the implementation of a revised BM is indeed an innovative idea, however to be able to properly*

[107]The Application of Harvey's Theories into China's Urbanization of Capital. Available from: http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8979923&fileOId=8979940 (The webpage was last visited on 5-10-2020). Other useful insights could be found on the following address: http://www.globalconstructionreview.com/

implement it, one key factor (among others) should be always considered: financing.'

Failing BM leading to abridged growth prospects at industry level. Generally, urban developments are not smart unless they match people's changing lifestyles. Whether in Paris or in any other city in France — a smart city should be instituted on modular artifacts that could be adjusted over time. Without a question, the European architecture is one of reference[108] —and the architects and engineers who built our capitals and towns were visionaries. Customarily, architects were able to conceive cities based on laid-back urban plans following the instructions of just one entity, an elected official who decreed the structure of the entire conurbation. At present, we should operate in a comparable way: first, by stopping to sell end-users empty ideas and promises —and second, by reviewing our offerings in an effort to bridge existing supply-demand gap.

According to Mr. Biou, '*there is no perfect smart city model as there would always be curbs to what we conceive no matter how smart it is*.'

Today, what is holding France back from building its own smart cities is the widespread fallacy among industry experts of what a smart city really is. Structure wise, we proclaim, horizontal constructions are far from being green or smart — and in France, it would be more conceivable to opt for vertical constructions[109] whenever a plan is set to kick-off the smart city business.

In addition, urban variations such as the ones we could find in China (e.g. Shenzhen, Guangzhou) and the rest of Asia — referring to urban-villages[110] — should be indorsed in France, as, end of day, smart cities are mere incarnations of the humane and the livable. If we appositely construct a forty-storey building that includes small-sized residential units — that is located in proximity to bus and train stations, and grocery stores — and that grants residents access to green spaces and shared entertainment areas, we would be

[108]The Complete Guide to European Architecture. Available from: https://www.rolcruise.co.uk/blog/the-complete-guide-to-european-architecture (The webpage was last visited on 5-13-2020)
[109]Vertical City Concept: How to Live a Sustainable Life. Available from: https://www.smartcitiesdive.com/ex/sustainablecitiescollective/vertical-city-concept-how-live-sustainable-life/1163942/ (The webpage was last visited on 5-10-2020). Other relevant publications could be found here: https://publications.iadb.org/en/road-toward-smart-cities-migrating-traditional-city-management-smart-city
[110]China's mass urbanization projects mean the end for Guangzhou's 800-year-old urban villages. Available from: https://www.scmp.com/economy/china-economy/article/3006303/chinas-mass-urbanisation-projects-mean-end-guangzhous-1000 (The webpage was last visited on 5-10-2020)

then on the right track to converting our existing cities into smart ones. Smart cities is for and foremost a question of urban governance that should be addressed more seriously by public authorities. If we were to compare the two cities of Lyon and Marseille, though they are of nearly equal sizes, they however do not share the same urban histories. Neither the same architecture structure types nor economic trajectories. While Lyon may have a well-structured urban governance scheme, this is not quite the case in Marseille. Largely, all French cities are currently vying to boost their lure by attracting direct investments towards their own territories. The Bilbao effect[111], a phenomenon whereby cultural investment plus showy architecture are supposed to equal economic uplift for cities down on their luck, is thought to be the direct (and only) solution to the issues we are currently encountering in France (which is not quite accurate!). Nevertheless, to trust that via the implementation of megaprojects, declining cities would be able to recover their positions is a huge mistake that local public authorities often commit.

> For Mr. Cusin, '*what people really want and what local authorities actually assume they want are totally two different things. Assuming equality between the two is a gaffe that should be avoided at all costs.*'

The inadequacy of prevailing governance schemes used in France for the handling of large construction projects is among the key issues that are holding the industry back from striving. Indeed, we say, what works for a specific project does not necessarily work for another dissimilar project. Though this is largely factual, in France, project owners, being public utility companies, often opt for a single managerial approach for the running of all construction projects irrespective of their types and sizes.

Lack of understanding of smart construction process. The smart city concept is vague. Often, smart cities give the impression that what is being conversed is something very complicated. In France, as elsewhere in the world, we came up with ample sets of environmental rules and regulations (e.g. carbon emissions, energy consumption per building, etc.), business ethics guidelines —and systems values that we could use to competently govern the operational activities of construction companies and become hypercompetitive in the smart city market. In addition, we have satisfactory technological

[111]The Bilbao Effect: is 'starchitecture' all it is cracked up to be? Available from: https://www.theguardian.com/cities/2015/apr/30/bilbao-effect-gehry-guggenheim-history-cities-50-buildings (The webpage was last visited on 5-10-2020)

tools that we could use to establish a healthier environment, make cohabitation easier, encourage social housing initiatives, and make buildings more pleasant dwellings. We pretty much have everything, and we know how to do almost everything; we have the required knowledge and technology to build smart cities, yet what we do not have is a clear-cut definition of what a smart city really is and what it entails.

> '*A city is cognitive, smart, intelligent, etc. —a list of echoing yet empty words'* Mr. Natchitz professed.

The city is a blend of two very basic concepts: the people who design it —and the people who live in it. Which is best, the city that was built three hundred years ago or the one of today? Frankly, no one cares about the construction as such. What is significant is the impact and the grip that remains once the construction works are completed.

> For Mr. Natchitz, '*the Romans are the ones who built our cities, and, we, ourselves, did not do but refurbish them.*'

A smart city is not factually smart, but rather nice and livable. Once we understand this genuineness and considers it, we would be then able to create a humane smart city and regulate its parameters to the satisfaction and fulfillment of its inhabitants. We also add that people repeatedly confuse wants and needs. Thus, we say, the problem we are encountering today does not solely relate to the ability of construction companies to adapt their offerings to people's real needs since, people, time and again, get attached to stuff they do not really need —but have been told they cannot live without. What people really want is to have two trashcans around the school. With no intricacy involved whatsoever, the smart city notion revolves around such rudimentary themes.

Fragmented projects. By comparing old Parisian buildings to new ones, one could plainly see that the way construction works are achieved has pointedly altered over time, often to the worse — quality wise. Today, the interest of public authorities is shifting towards construction projects that could be delivered in relatively shorter timeframes. As for long-term smart city projects, their budding effect on the attractiveness of cities and the well-being of citizens is thought to be huge which justifies public authorities' snowballing interest in them. To render our cities smart does not imply that we have to demolish and rebuild them from the ground up. It is rather a question of creating ties between the various components of a city so that to build a coherent system that people could extract real value from.

> As put Mr. Burckel, '*smartness has to do with cultivating people's quality of life and well-being, and its constructs are those that bring use, functional and social value to the people.*'

The design of the smart city should be carried out in the early stages of the construction process —while financial obligations should be delayed — settled a year or two after the project is finalized. Moreover, in a smart city project, one should discern how to integrate externalities and set an optimal cost-sharing scheme among all stakeholders involved. When a smart building is set up, the cost of the property must include all the operational costs incurred by the project — or else there would be nothing smart about it. Therefore, construction companies must operate based on a total-cost logic —as a smart city is nothing but a series of ecosystems, a platform that creates wealth, including interlocked components that roll harmoniously[112]. What is more, the platform built should be neutralizing by nature —meaning that its components must be conceived so they counteract the prospective (negative) effects of one another.

> '*A smart city is not an architectural model, but a set of criteria that perfectly fit together.*' *Île-de-France (Paris Region) is an example of a region that is smartly governed — but that is not smart per se*' Mr. Thépin acknowledged. '*The key problem we are facing today relates to the fact that most structures in the Paris Region are conceived in silo, not as part of a bigger something. We build, but fail to sell — what is the point then?*' he concluded.

Constricted approach to value creation. It would be hard to fully grasp the smart city concept — in the French context — unless one has a thorough understanding of how the country's construction market is structured and regulated. If we were to make a comparison between Germany and France — being the two largest economies in the European Union now that the United Kingdom is out of the league, we could straightforwardly assert that, in Germany, real estate represents 20% of a household's monthly budget (on average) —while this figure may go up to 30% in France. Property prices are higher in France because the sector is highly subsidized.

[112]The making of a smart city: best practices across Europe. Available from: https://smartcities-infosystem.eu/sites/default/files/document/the_making_of_a_smart_city_-_best_practices_across_europe.pdf (The webpage was last visited on 5-12-2020)

> For Mr. Biou, '*the more subsidies the sector gets — the higher property prices would be.*'

In Europe, the more you move towards the South, the more likely it would for residents to be homeowners (e.g. France), whilst in norther countries; residents are most likely to be tenants (e.g. Germany). This is quite reasonable because real estate is not as profitable in Germany as it is in France. In contrast to Germany, France, we avow, is an individualist[113] — a southerner — and an owner.

> As put by Mr. Biou '*in France, not only construction companies are blinded by the short term, but customers, too — often buying properties for speculative rather than housing purposes.*'

In Germany, real estate is a common good — a commodity that people do not venture on. In France, however, people operate based on a pure economic logic that often disregards the social and the environmental. The short rather than the long run[114] fascinates them —which, to a certain extent, refutes the basic principles that characterize smart cities.

> '*Taxing speculative behavior in land and real estate markets may be a practical approach for local authorities to gain a certain control over the situation*' Mr. Biou advised.

The smart city concept, we finally proclaim, relates to the social as much as it does to the economic, environmental and technical. In fact, smartness is associated with the social well-being of people. Today, construction companies endeavor to enhance people's social well-beings through value propositions they believe would meet their needs, yet it is unsurprising that their forecasts end up being off beam — not corresponding to people's real aspirations.

> In Mr. Bruckel's expressions, '*the smart city notion is highly subjective as different individuals could have different discernments of what it may connote.*' '*For developers, smart cities could signify one thing, whereas for end-users, smartness could entail totally different things*' he closed.

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[113]Comparison France-Germany with Hofstede. Available from: http://carnets.parisdescartes.fr/blog/view/325598/comparison-francegermany-with-hofstede (The webpage was last visited on 5-12-2020)

[114]Building the smart cities of the future: Think long-term and local. Available from: https://www.smartcitiesworld.net/opinions/opinions/building-the-smart-cities-of-the-future-think-long-term-and-local (The webpage was last visited on 5-12-2020)

Project process confused for business model. In France, construction processes are often complicated and unnecessarily arduous. Explicitly, the current construction value chain is dysfunctional in that value creation is repeatedly mislaid. Hence, the problem is institutional by nature. To say that any loss at any level of the value chain would eventually translate into a loss for the entire chain. This is genuine as the construction value chain is (or at least should be!) a sequence of interlocked phases where various stakeholders intervene at different levels of the process to fulfill assigned tasks for the delivery of a flawless artifact at the end of the process. Today, the productivity and efficiency of the entire construction value chain is at stake —especially that smart developments are every so often misconceived and misinterpreted.

> '*In France,*' as per Mrs. Tiscornia, '*construction actors recognize smart constructions as complex rather than simple projects — though, in reality, most smart city projects, at least the ones we see today and are labeled as such, are very primitive.*'

Moving on, there is a tendency today among French based construction companies to confuse construction processes for business models. The former is intermittent whereas the latter is perpetual; also, construction processes could vary on a project-by-project basis depending on the specificities of each project, which is not the case for business models.

> As put by Mrs. Nabih, '*business models are supposedly to change every three to five years — based on market circumstances.*' '*The life span of a business model is shorter than that of technology —and surely of that of a smart construction project, therefore, whenever crafting a new business model, we must ensure the final artefact is malleable and adjustable*' she concluded.

Top-down managerial approach. In France, the term GC exists for specific construction branches — mainly in industrial buildings but, overall, the GC role per se does not exist in the construction sector. In the US and other Anglo-Saxon countries however, the GC role is popular. Largely, in these countries, GCs have some sort of influence over the entire construction process, or even the construction value chain. Specifically, they control budgets and handle the sequence of activities in construction projects — from design, thru development and construction, to promotion.

> For Mr. Gérardin, '*to introduce such a role into the French construction market is an innovation by itself.*' '*At Linkcity,*' he added, '*we have been more and more operating based on smart-city-concept logic — working on building smart eco-districts and neighborhoods — thus, for us, such an innovation is concurrently relevant and pertinent.*'

In our eyes, inept public governance is the main problem causing the quaking of the French construction industry today[115]. Though the city of Paris has a powerful standing, it is often administered based on an unbending governance model[116]. To say that based on where one would like to build his structures, he might have to deal with three to six different public departments to get the required approvals. Consequently, between the metropolis of Greater Paris and the public authorities concerned, there are over a hundred executives to be approached — thus, we wonder, *how one could make everyone agree on a given project*?

> In Mr. Bordeaux's languages, '*a consensus must be put in place describing how the resources we have must be used for the building of the city of tomorrow.*' '*A smart city,*' he declared, '*is a vision of how we, as a society, want our cities to look like in the future —and based on this vision, we need to join forces to overcome all barriers that are holding us back from building it.*'

On the project-management front, managing construction projects is not an easy thing to do[117]. There are many junctures (e.g. conception, execution, monitoring, marketing, etc.) that construction projects go through before closure. Not to mention the so many state-imposed rules and regulations (relating to the environment, energy production procedures, infrastructural design, and others) that construction companies should comply with at all times. Once a company secures a concession contract, there would be many works (project diagnostics) to be accomplished pre construction phase — principally feasibility and other preliminary market studies (in cooperation with elected officials and citizens) — in order to meticulously assess the conditions and settings of the construction project.

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[115] Smart cities towards a French strategy. Available from: https://inspire.ec.europa.eu/sites/default/files/presentations/377_pdf_copy_of_presentation.pdf (The webpage was last visited on 5-13-2020)

[116] Top-down vs bottom-up planning: Which one is better? Available from: https://www.letsbuild.com/blog/top-down-vs-bottom-up-planning (The webpage was last visited on 5-9-2020)

[117] A solution to handle large and complex construction projects: Interface Management. Available from: https://www.designingbuildings.co.uk/wiki/A_solution_to_handle_large_and_complex_construction_projects:_Interface_Management (The webpage was last visited on 5-8-2020)

> ‘*Consulting with public authorities, especially local ones, is a critical matter that should be fulfilled before initiating any construction work*’ Mrs. Panzani avowed. ‘*This is how we, at SORGEM, conceive and execute complex construction projects (e.g. ZAC Clause-Bois Badeau, ZAC des Belles-Vues, and ZAC Val Vert-Croix Blanche) — collaboratively, with the assistance of local communities, developers and departments*’ she concluded.

Furthermore, what is specious today is that construction companies tend to make baseless abstractions by imagining that end-users would eventually be acquainted with the final product delivered —and that use and intended value would eventually intersect. Buying a house is not the same as buying a car. Generally, a person buys a car without taking part in the manufacturing process of the car (he has no say in this respect!). Of the cars available for sale, he simply chooses the one that best fits his palate and budget. He seems to trust the oligarchy of companies that manufacture cars. This is not exactly how things work in the construction sector though.

> According to Mr. Biou, ‘*buying a property, in comparison to a car, is a life-time investment; also, the offerings in the construction sector are not as varied as in the automotive sector.*’ ‘*Hence, alike the automotive sector,*’ he alleged, ‘*the construction sector should allow for further diversification and customization in its offerings so it better succeeds to catch growth opportunities in the market.*’

Indeed, not all people have the same aspirations and tastes, with some of them finding happiness residing in big cities while some others preferring to live in rather quiet and less-populated areas. The main idea here is of a cultural nature — revolving around what people really aim for.

> ‘*Human-centricity is a primary component of smart cities*’ Mr. Auffret alleged. In the same manner, for Mr. Bodreaux, ‘*social acceptability is a prerequisite for the successful building of smart cities.*’

Though we have the ability to make our offerings more appealing to people, we are currently lagging in a state of imbalance —and to introduce a central entity into the scene that could ensure a fair interplay among stakeholders and enrich the sector’s value propositions, we trust, may perhaps be sufficient to help us improve the existing construction value chain.

> For Mr. Bordeaux ‘*under the GC BM, a bigger role should be reserved for end-users; it is a question of setting up the appropriate steering systems and settling on how information could be centralized and efficiently communicated to customers.*’

Therefore, what France needs today is a framework by which it could improve communication channels in and outside its cities and inspire value networking by boosting long-term partnerships between stakeholders ―among which end-users.

> In Mrs. Panzani's expressions, '*smart cities could not be built unless all its elements are aggregated together.*'

Big companies' resistance to change. Well-established companies are not necessarily the ones that should handle and manage smart developments as they often take conservative stands vis-à-vis innovation. Relative to small-sized companies, large ones are less innovation-friendly. This is true because any change initiative, once applied, is probably to tremble their stranded moneymaking BMs. Indeed, we proclaim, risk aversion is a barrier to innovation[118]. Moreover, in comparison to small-sized companies, large-sized ones have inflexible governance structures as well as slighter maneuvering abilities to espouse incipient innovations smoothly. Not to mention their complex corporate structures which boost their odds of facing exceptional business management problems. Bouygues, we trust, constitutes a great example of a France-based conglomerate ― a combination of multiple business entities operating in entirely different industries (e.g. telecom, construction, and others) under one corporate group ―with each entity having its own management structure, business operations and goals.

> According to Mr. Gérardin, '*Bouygues is currently facing some serious issues controlling the works of its subsidiaries which partially enlightens its climbing reliance in recent days on external outsourcing.*' '*A GC BM for the building of smart cities is sort of a new-fangled offer of urban services*' he added.

Decentralized decision-making (*in the management of smart construction projects*). Today, France is still marching against the stream. Indeed, the country has left the collective world and is now opting for an individualist vision. Put differently, we are showing partiality towards individualism, an ideology that reigned in the 80s, whereas ― today, the world is rather privileging collectivism – referring to collaborative thinking and intelligence.

[118]Overcoming the aversion to risk key to innovation in construction. Available from: https://canada.constructconnect.com/dcn/news/associations/2018/09/overcoming-aversion-risk-key-innovation-construction (The webpage was last visited on 5-14-2020)

> For Mr. Biou '*to bring change to the existing business model and enhance partnership among stakeholders would undoubtedly do us good*' he affirmed. '*We surely need an entity today that could control and oversee construction works*' he avowed.

Adding that public developers are often incompetent in France. They often bite each other's books and make copies of them ―as if all construction projects were the same, involving the same specs ―delivered to the same clients. The same applies for engineers who turned into creators of problems rather than solutions.

> As put Mr. Natchitz, '*there is a missing link at the level of the construction value chain today.*' In his views, '*what is missing is a centralized decision-making model where a maven central operator may be consigned to take the lead and ensure a fair interplay among all construction actors involved in the process.*'

Today, the existing construction value chain is wrecked in the sense that no continuity exists in the works fulfilled by the various stakeholders, as each one of them tends to operate independently from the other. In addition, knowing that the construction industry is very fragmented and project-based, the odds that value-creation would be lost through construction processes are high. Moreover, value networking is restrained because, for each project commissioned, construction companies tend to bring new construction staff to handle the execution of on-site works. This frequently translates into broken learning and feedback loops among staff, high turnover rates, and diseconomies of scale.

> In Mr. Auffret's languages, '*public developers, being incompetent in general, opt for external outsourcing for the achievement and management of large construction projects.*' '*Usually,*' he avowed, '*large construction works are entrusted to three or more companies rather than one ― the so-called, in French 'ensemblier'.*' '*The GC role you are suggesting in the present study would play a somehow similar role to that of an 'ensemblier' ― by synchronizing the works of stakeholders and handling cueing throughout the entire project lifecycle*' he concluded.

High number of stakeholders with overlapping roles and responsibilities. On-site construction works are often handled by several stakeholders all seeking to partake in the management of projects. Often, instead of having one decision maker who could synchronize and competently manage construction works, we often end up with several ones; each with divergent interests and visions around the project ―which is problematic per se. The problem does not directly relate to the count of stakeholders involved in the process, but to the fact that stakeholders tend to work disjointedly from one another. Such behavior often translates into some serious operational and financial challenges (e.g. delayed deliveries, wrong procedures, extra costs, and others)[119].

> According to Mr. Panzani, '*we often see incompetent projects managers, mainly architects, assigned to oversee construction works and manage the project in its entirety.*' '*As architects,*' she precised, '*they do the necessary drawings at the very early stages of the construction process, yet they show lots of inexperience and unskillfulness in all stages that come after.*'

Moreover, based on my professional experience, I could easily assert that the larger the number of construction actors involved in the construction process gets, the higher the odds of overlapping roles and responsibilities would be.

> '*Whenever the count of partakers in the construction process exceeds a certain threshold, every sense of professional responsibility would be lost among them— and diffusion of responsibility would consequently ensue*' Mrs. Panzani concluded.

Discoordination between construction actors. Building a smart city is an iterative process where different stakeholders synchronically interact with one another. Lots of dig out and fill in are to be made prior to building large structures. Generally, a construction project is never finished until the moment project owners or whoever is handling the project hand the keys over to end-users. Smart projects — often long-term constructions — may prolong over a fifteen-year period or even more. Hence, such projects require meticulous consultation and deliberation among stakeholders — including customers and local public authorities — so that to ensure the envisioned artifact ends up being fitting. Generally, the conception-and-initiation phase starts with an idea and grows to become an iterative process where the first idea shared is repetitively revised and changed. The final framework of the project is expectedly to take several years to be tied up as it often accounts for continual technical and legal makeovers levied by local authorities.

> For Mr. Biou, '*construction companies should beware to consult with local public authorities on the specificities of projects before groundworks kick-off.*' Likewise, for Mrs. Panzani, '*besides the economic viability of a project, social and political acceptability are two key metrics decisive of its success or failure.*'

[119]Centrally located: rebranding a decentralized organization with a centralized project structure. Available from: https://brandactive.com/rebranding-project-management-decentralized-organizations/ (The webpage was last visited on 5-14-2020)

Loss of control over quality of works. One of the main issues in the French construction sector today is the lack of human control over construction procedures. To say the least, the smart city concept, at least as perceived in the country, remains distanced from people's real aspirations.

> As put by Mr. Natchitz, '*the output of construction works we undertake today would not materialize before a 30-year period.*' '*And it is only within this time length that we would be able to settle whether the structures built have been relevant to people's real aspirations or not*' he added.

With several stakeholders stepping in and out the value chain at different times and stages, it is often hard to trace the quality of works achieved by every intervenor, hence the importance of integrating quality control in the management of construction work processes.

> As per Mr. Thépin, '*the absence of a central operator who could foresee construction works is indeed a problematic matter in France, thus the importance of the GC role who may possibly fulfill such a task.*'

Innovation mismanagement. Construction actors operate either down or upstream the value chain — not both. Hence, when a construction actor operating downstream makes a promise that the product delivered at the end of the process would have certain value qualities, he often fail to keep his promise, as his contribution at the advanced stages of the process is very limited. At advanced stages of the process, actors operating downstream lose control over the quality of the final product delivered. The same applies to construction actors working upstream the chain who cannot guarantee the quality of the works performed at the very early stages of the process.

> '*Today,*' Mr. Gérardin stated, '*some big operators such as Bouygues, with the help of their subsidiaries, are seeking to overcome this particular problem by positioning themselves at different stages of the value chain, down to upstream.*'

Mismatch between promised and delivered final product. Today, end-users are often dissatisfied with the quality of the final product they get. Often, they end up paying money in return for a low-quality output that is different than the one promised at start.

> In Mr. Biou's expressions, '*end-users are positioned at the end of the value chain and what they eventually get is nearly 90% of what they initially paid for (i.e. the*

building and the roads), however what they do not get is a sustainable high-quality final product.'

Anyhow, we proclaim, developers and subcontractors are not the only ones to be blamed for such defects as end-users should be held accountable, too. What is astonishing is that people frequently choose their properties much faster than they choose their cars. Indeed, home buying is done passively rather than actively, fairly quickly relative to the budget paid.

> '*For one to buy a TV, he visits different stores, compare prices, and check reviews to be able to make the right call – yet, surprisingly, this is not how things happen in construction'* Mr. Biou attested.

Absence of an entity that could orchestrate time horizons and handle maintenance works[120]. Often, construction companies operate in a pure moneymaking logic. Precisely, developers often hire low-skilled, economically fragile actors to handle large developments.

> For Mr. Biou, '*it is a political game that involves the most and least fragile.*'

After kick off, if the project is estimated to fail, the developers (—being the least fragile) may proceed by cancelling it, sometimes without even paying the subcontractors (—being the most fragile). Whenever such a scenario concretizes, subcontractors respond by providing poor on-site workmanship. Moreover, in some specific cases, they would even bring damages to the property built, hence rendering it unsaleable. If, subsequently, they were paid, they would make the necessary repairs — otherwise; end-users would suffer the consequences (e.g. delayed deliveries, damaged final product, and others) —as no other construction actor would claim responsibility for such flaws.

Faulty estimates leading to recurrent budget overruns. Budgeting is another key topic that should be raised whenever attempting to build a smart city[121].

[120]Though this specific problem could have been merged with another one — we chose not to do so in an effort to shed light on the importance of having a specialized entity in large construction projects who could handle follow-up with end-users and maintenance works post-delivery of final product. We finally note that maintenance works may possibly be handled by the GC himself, or another specialized subcontractor.
[121]Six strategies to keep your project on budget. Available from: https://www.bdcnetwork.com/blog/6-strategies-keep-your-project-budget (The webpage was last visited on 5-14-2020)

> ‘*In France,*’ as put by Mr. Cusin, ‘*the idea of budgeting remains very vague, whereas, in Anglo-Saxon economies, it is a present-day topic befalling at each and every stage of a construction process.*’

Macro-level budgeting is often misrepresentative, especially in the construction sector, leading to unwanted project budget and time overruns. Alternatively, properly-done micro-level budgeting should embark upon the tiniest details of a construction project (i.e. negotiations, profit margins, social impacts, environment impacts, etc.). The use of technology in this respect — such as the BIM for instance — we trust to endow budget estimates with a certain level of accuracy.

> In Mr. Cusin languages, ‘*the building of smart cities in France follows a somewhat conservative approach that is driven and controlled by state authorities —which is not quite the case in Anglo-Saxon economies.*’

Indeed, French based construction companies are currently operating based on a public business model that is indicted by public authorities —and framed by texts of public laws. In construction, we specify, there are two types of stakeholders that should be considered: those who invest —and those who do not. Those who invest are those would contribute money, are business savvy, think in financial terms, and seek to minimize costs and maximize profits. Whereas non-investors are those who contribute labor or technology.

> For Mr. Bordeaux, ‘*the GC BM you are suggesting for the building of smart cities would eventually lead to the rejection of existing industry-level business model since the latter does not account for the main components of smart cities.*’

The construction of a smart city, we avow, follows a sequential process and is founded on meticulous programming activities. Budget wise, we avow, it is practically impossible for one to predict the exact budget of a new construction project in absolute terms, especially large ones. As a rule, the provisional budget estimates that PMs or whoever else is handling the project make pre kickoff of construction projects are usually uncertain and erroneous (—underestimated). Anyhow, this does not constitute a problem by itself because, in the special case of state-financed projects, there would always be a minority of people who would benefit from such flawed estimates for personal gain. Again, the political comes at play at this level.

> ‘*For Grand Paris express for instance,*’ Mr. Biou alleged, ‘*though nobody knew the exact budget that would be allotted for the project, the latter was commissioned anyways because it was politically legit.*’

Putting state-financed projects aside, faulty budget estimates ordinarily lead to the rebuff of construction projects. Indeed, though construction companies usually have a certain maneuvering margin to calibrate their spending so it fits into the budget's envelope, such calibrations would not remain possible beyond a given budget-spending limit. The Sydney Opera House is a great example of a chaotic construction project where the budget estimated equaled one-tenth the budget actually spent.

> '*Within the same framework,*' Mrs. Nabih affirmed, '*it is practically impossible for a construction company not to deviate from original budget whenever handling a complex construction project.*'

Several constraints make it difficult for construction companies to stick to budget over the lifecycle of a project —one of which relates to the fact that project specs are not always fully detailed and explicitly itemized pre kickoff. Usually, there is an original construction plan and a budget estimate that are settled upon pre-launch of groundworks. Often, these estimates end up being wrong, hence adjustments are made to restore the initial figures, usually through budget cuts —or changes in project specs — or both. In due course, adjustment over adjustment, the final output delivered would be finally changed, not resembling the one promised at start.

> As put by Mrs. Nabih, '*end-users could not be more careless about the construction process per se for what they really care about is the final output to meet their expectations.*' '*Such challenges could not be resolved,*' she added, '*until end-users become an integral part of the construction value chain.*' '*And so, for the final output to appeal to end-users, they have to become part of the entire process, co-designers of projects and co-creators of value*' she concluded.

Scheduled timelines left in tatters. Besides budgeting, time is a metric that is worth considering in large construction projects. The construction process is a broken chain where construction works follow a cyclical curve: we work, we stop, we resume work, and then for some reason we stop, etc. Often, construction calendars are underestimated because, for instance, they do not account for changes in state-imposed construction standards and codes, which may occur during the lifecycle of a project.

> According to Mrs. Panzani, '*we often spend lots of time revising the specificities of our projects to ensure they comply with newly-imposed construction standards.*' '*Construction calendars do not account for such niceties,*' she added, '*which is problematic for construction companies*.' '*Theoretically, yes, we could stick to*

> *timelines set, yet, in practice; some unforeseen events may arise over time and sway the timelines of our projects*' she concluded.

Additional costs incurred to integrate new technology and upgrade asset. If real estate developers fail to customize their offerings so they meet end-users' real aspirations, they would sooner or later reach a critical point where there would be no more demand for their propositions. Should real estate developers keep their production systems rolling as usual, no successful pitches would be expectedly made —and stocks of unsold units would most likely get larger over time. Besides, end-users' who thought they bought properties in smart cities, but were in reality deceived, would soon enough find themselves paying extra money to upgrade their assets and integrate new technology into their homes.

5.1.2. *SOCIAL*

We herein list and explicate the social problems in construction. First, we tackle off-balance or uncontrollable problems —and then embark upon controllable ones.

Governments' reticence to share data (O-B). Big data is compulsory for a country like France to be able to go farther than building eco-districts to connecting neighborhoods and cities. Once we have such sizable data at hand, we would be then able to do ample things with it (e.g. create apps, analyze data and create simulators and others). Actually, immense use-value could be extracted from such data.

> As put Mrs. Tiscornia, '*in France, we are still lacking big data at the level of the construction industry.*' '*By, for instance, gathering energy consumption information written on electricity bills and entering them into a unified database and then proceed by technically analyzing it, we might find practical ways to enhance the energy consumption and efficiency of our buildings'* she added.

Indeed, in the realm of smart cities, data is of a grand importance, and, we say, sizeable data could not be secured unless it was exchanged among actors, mainly: public authorities and city residents. Through back-and-forth exchanges, data would eventually, via snowball effect, grow in size. So would the value that may be pulled out from it.

> '*What is inopportune today,*' Mrs. Tiscornia declared, '*is the reticence of some governments around the world to share data with the public which holds them back*

> *from building their own smart cities.*' '*Such problems are less frequent in democracies in contrast to other political (non-democratic) systems*' she specified.

Misconception of smart city notion. There is no common definition for smart cities and lots of misconception is still spinning around the expression today[122]. At present, the subject is very fashionable and professionals all around the world seem to have adopted it, each in his own senses and adapted it to his own work field. Nevertheless, the topic remains very indefinite for that we do not have a shared vision of it.

> As highlighted by Mr. Thépin, '*whenever one talks about smart cities, he directly thinks of collective well-being — as the two are strongly connected.*'

In urban terms, we avow, the smart city concept means nothing, especially in France.

> '*There is nothing smart about the constructions and structures we see walking down the streets of our cities today, though they are often labeled as such*' Mr. Thépin attested.

Though a smart city is nothing but a structuring axis of development, the main issue with it lies in its longevity. For construction actors, it is often hard to keep a promise that we make today ten or fifteen years later.

> '*Mobility and livability,*' Mr. Cusin proclaimed, '*might be the main components of smart cities today, but this might not hold true tomorrow.*'

Therefore, we proclaim, smart city is an expression, a unifying term that we often use to embody places where people could assemble and live together. End of day, the city is a human construction rather than an architectural or urban one. Thus far, we cannot conclude that smart cities have failed in France —as some promising signs of urban developments are waving in the horizon. However, we assert that what is missing today is clearly the human factor. Thus, by integrating residents into construction processes, future smart city initiatives would have better chances of being successful.

Nowadays, construction companies are focused on the building: they design, build, promote and sell. What is being sold is the performance and the quality of the building. Yet, whenever one tackles the smart city concept, things alter a bit. If we think on a wider scale, say, for instance, on the scale of a district, or that of a neighborhood or a city, then

[122]Smarter City myths and misconceptions. Available from: https://theurbantechnologist.com/2013/07/14/smarter-city-myths-and-misconceptions/ (The webpage was last visited on 5-14-2020)

what would be built and sold goes beyond mere constructions to reach social connectedness and well-being. As previously noted, there is a growing tendency among construction companies today to label smart any project that includes some form of technology.

> '*Actually,*' for Mr. Gérardin, '*smartness has become a mere marketing tool that holds no meaning within that companies habitually use to sell their merchandises faster and for a higher price.*'

Outdated Customer Value Proposition. People's interests are often very divergent —and their preferences might change depending on several factors (e.g. professional occupation, social standing, education, etc.), thus the need for construction companies to diversify their offerings so they could fulfill various market demands.

> For Mr. Natchitz, '*to draw all end-users together and put them into one category as if their needs were similar is a mistake that construction companies often commit.*'

For that reasons, it is vital for construction companies today to ask themselves: who their customers are: merchants, residents, tourists, small businesses, or large businesses? This is crucial as construction is not solely focused on the residential, but extends to the commercial, too. Anyhow, we ask: would a city be deemed smart or attractive if it does not attract residents, tourists, businesses, commuters, and others?

> '*For a city to flourish,*' Mr. Natchitz declared, '*it has to become an attractive destination for all customer segments, not just one.*'

The 4 Quai de la Seine in Paris would have had zero value, if it did not have the ability to attract tourists, capture investments, and strengthen the economic engine.

> In Mr. Natchitz's own expressions, '*smart cities are conglomerations that entice everyone; a smart city should be human-centric, built for and to the people.*'

Consequently, people should partake in the construction process of smart cities, not in the sense that they would participate in the construction works, but in the co-creation of value at city level. Moreover, construction companies have to come up with new offerings as people are fed up with staying hours on the roads to get home or to work. Therefore, we trust urban planners to have a crucial role to play in this respect, mainly by working on adapting urban spaces to people's exact needs.

> For Mr. Auffret, '*it is for and foremost a question of making better use of spaces.*'

Whether in France or elsewhere in the world, the influx of people towards cities has been pointedly increasing over time. In China for instance, Shanghai has been a migratory soil hosting over a million new inhabitants every week.

> '*People get richer by being in cities*' Mr. Bruckel declared. '*Though smart often denotes what is chic and new, it should not be distanced from the social —as the social is an integral part of the smart*' he added.

Often, construction companies tend to mistakenly misjudge people's real needs; they offer the most complex and intricate, whereas people are often on the lookout for the simplest and the most basic.

> '*Smartness is not about complexity but about simplicity; it is about what people want, their well-being, and finding ways to improve the quality of their lives*' Mr. Bruckel concluded.

Banishment of any collaborative urban governance scheme. Smart cities, we assert, cannot be built but through collective thinking and intelligence[123]. End of day, smart cities is the resultant of collective rather than individual effort. Indeed, it is not about Bouygues or any other big operator —it is not even about the GC or the architect — but it is about an amalgam of construction actors who should synchronize their works and collaborate with one another to create the city of tomorrow. A smart city is thus a platform where value creation is function of value networking.

> According to Mr. Rochet, '*a new GC BM for the building of smart cities is definitely an interesting idea, especially for large companies as they are the ones that could espouse it and market it.*' '*It is an investment that SMEs cannot afford*' he added.
>
> For Mrs. Tiscornia, '*almost 95% of construction companies operating in France are SMEs with the bulk of them lacking the required means and knowledge for the construction of smart cities.*' '*They are not literally unknowledgeable,*' she said, '*it is just that the world is evolving at a very fast pace —and if these companies were not given sort of a grace period to be able to catch up that is, adapt and enhance their skillsets, all smart initiatives they undertake would most likely be destined to fail.*'

[123]EFFECTS OF COLLABORATION IN PROJECTS ON CONSTRUCTION PROJECT PERFORMANCE. Available from: https://www.diva-portal.org/smash/get/diva2:1008892/FULLTEXT01.pdf (The webpage was last visited on 5-10-2020)

> Similarly, In Mr. Gérardin's views, '*in France, collectivism is almost non-existent.*' '*This is forthright as people are often inclined to work individually —and whenever they work in teams or as part of a group, say, in an endeavor to achieve a common something, they often come to disagreements, they face problems, they fight, they fail*' he concluded.

End-users not involved in the early stages of construction. Almost ten years now, Hermitage Construction, a Russian based company, was commissioned to plan and build two tours each of an altitude of 320 meters in La-Defense — next to a housing complex that dates back to the 70s. Once the project kicked-off, hundreds of inhabitants living in the project's environs left their homes. The project has been going on for eight years —and now it seems on the verge of being annulled. Though elected officials as well as other public authorities have concerted with local communities over the project, it looks clear that the concertation held were not genuine. This is to say that construction companies cannot presume they know what people really want because they simply do not. Today, besides consulting with potential clients, construction companies must work on diversifying their offerings so that what is being offered, a variety of propositions rather than one, acting as a net, ends up enticing to the largest number of customers possible.

> According to Mr. Gérardin, '*by contemplating the newly built structures in the city of Paris, one could clearly see that the output being delivered is far from being smart.*' '*In smart projects,*' he added, '*it is not a building or an asset that we are selling but a lifestyle, a wellbeing, and a quality of life.*' '*Your GC BM proposal is very interesting especially that construction companies are now invited to revise their somewhat outdated value propositions*' he concluded.

Today, real estate developers seem to be unaware or disconnected of the real world, of people's real needs. In the smart city arena, France is lagging behind relative to its neighbors, mainly Spain and England —and some serious efforts must be deployed for the country to be able to restore its position in this sphere.

> '*When the project is not co-conceived and co-designed with local communities (potential end-users), the odds that conflicts would arise once the project has taken off are expected to be high*' Mr. Cusin avowed. In his words, '*it is an inherent risk to large-sized construction projects, a risk that is often underestimated by both public authorities and industry actors.*'

End-users not being co-creators of value. Smart cities is mainly a question of finding ways to keep information circulating and alive. This is crucial, we proclaim, as information tends to get diluted over time. The longevity of smart developments poses some serious problems for construction actors, the reason why finding resourceful communication canals or a system where data could flow freely and openly, and be archived seems highly necessary. Despite that one may communicate loads and loads of information to people about the project understudy, the odds they would forget most of this information are high. And so, to keep end-users involved throughout the entire construction process irrespective of its length is a crucial thing for the success of smart developments, a means for boosting social acceptability.

> According to Mrs. Panzani, '*by allowing end-users to act as construction partners, the risk of end-users complaining about the project upon delivery could be significantly reduced.*'

Criticism of final product by end-users. Often, end-users are less concerned about the technicalities of construction projects and more concerned about the quality of the final product they would be getting[124]. As formerly noted, France based construction companies are facing loads of challenges operating, executing and managing large construction projects. Among those, we cite a few: budget and time overruns, mismatches between promised and delivered products, absence of after-sale services, tech-intensive constructions, poor urban design, and others. All of these challenges combined would eventually be indirectly passed on to the end-user whose journey would be negatively impacted. He would be dissatisfied with the product purchased and have lots of complaints about and concerns regarding it. In some cases, end-users take necessary legal action against developers from which they purchased the property.

Broad concerns apropos the livability of assets[125]. Once the final product has been delivered, should end-users' assets require maintenance works, they would most likely

[124]Construction Firms: Seven Essential Tips for Client Communication. Available from: https://www.workflowmax.com/blog/construction-firms-7-essential-tips-for-client-communication (The webpage was last visited on 5-29-2020)
[125]Spotlight on livable cities, Part III: Responding to the challenge of livability. Available from: https://www.urbanet.info/livable-cities-challenge-of-livability/ (The webpage was last visited on 5-29-2020)

find themselves alone, as no construction actor would plead guilty —and accept to assume the costs that could ensue from such low-quality works. End of day, end-users would be totally discontented. And their indisposition to recommending the services they got to others would ultimately (negatively) influence the business activities of concerned construction companies. For those companies, the impact of a low NPS (Net Promoter Score) would not be felt but after a while —in the mid to long run.

5.1.3. *ENVIRONMENT*

We herein list and explicate the environmental problems in construction. First, we tackle off-balance or uncontrollable problems —and then embark upon controllable ones.

Urbanization (O-B). The need to adapt knowledge and skills was only felt recently, after the global surge of the smart city concept. The rise of smart cities, we proclaim, is the direct resultant of urbanization, which has lately become a trending phenomenon.

> According to Mrs. Tiscornia, '*the existing know-how among construction actors in the French construction industry is somewhat old and requires substantial improvement.*' '*Urbanization is a function of technology and society, and the processes of technological and social changes are functions of urbanization*' she added.

Though most people cannot see but the negative effects of urbanization (e.g. overloaded infrastructure, destruction of habitats, overcrowding, pressure on ecosystem, etc.) — it is worth noting that some noteworthy benefits could also ensue from it, with the most obvious ones being: economic growth and development, and the swelling need to innovate and improve existing production systems.

Constantly changing construction codes and standards (O-B). The constant changes to state-imposed construction codes and standards are going much faster than what construction actors could possibly accept. In France, there is a very high turnover in terms of standards enforced. Indeed, I say, construction standards are often experimental with a life span that does not exceed two years.

> As put by Mrs. Tiscornia, '*a project is launched in the morning according to specific standards, yet, in the evening, new ones emerge, meaning that we have to*

> *redo everything from start.*' '*The rhythm based on which construction standards are changing is very fast*' she added.

This is quite challenging for construction companies. Though these recurrently changing standards may be imposed to protect people's interests and serve their needs (which they might!), I trust that people care less about the standards and more about the quality of the final output and the amenities accompanying it. People seek comfort above all and amenities play an important role in offering quality living.

> In Mrs. Tiscornia's expressions, '*the reference frame of state-imposed construction standards is often detached from people's day-to-day needs.*'

Energy performance is among the key topics that springs to one's mind when thinking of environment-related construction standards. To my knowledge, energy performance, say at building level, could be achieved in so many ways and using different technologies and systems. In fact, I could openly assert that solar water heating systems is the main technology (to my knowledge at least!) being used by construction actors today to enhance the energy efficiency of their buildings. The said system is relatively cheap and its use-value could be easily grasped —and so, people are often willing to pay for it. Yet, when it comes to other more advanced technologies and systems, people seem to be out of tune.

> '*There is a huge gap between construction standards and people's preferences, with the former changing at a much higher speed than the latter*' Mrs. Tiscornia concluded.

Lack of smart city initiatives and urbanization efforts. Moving on, I, as a an expert in the French construction industry, could openly avow that what people are actually looking for does not really come hand in hand with what is being offered. A new concept that I think is worth putting emphasis on is that of urban villages. In China, urban villages, though overcrowded, are among the country's liveliest areas, notable for affording economic opportunity to newcomers. They constitute a unique phenomenon that formed part of China's urbanization efforts. This is to say that, today, in France, some similar initiatives must be implemented for us to be able to bring transformative change to our cities. Though the number of national programmes in favor of smart city initiatives being ran by different bodies of government has been on the rise in recent years[126], lots of work remains to be done for the country to become a leader in the smart city market.

> For Mr. Bordeaux, '*in France, initiatives such as building eco-districts are good, yet insufficient —as those account for merely 5% of the country's total urban structures built.*' '*Today,*' he declared, '*we are still figuring out how to build the new city over the old one.*'

CSR-related topics occasionally conversed for mere marketing purposes. Corporate responsibility strategies have been gaining increased momentum and attention from experts operating in the construction industry in recent years as questions of sustainability and green agendas have come to permeate business the world over. Construction companies may not like to openly disclose it, but CSR (Corporate Social Responsibility) is indeed part of their marketing strategies to build a positive brand image among customers.

Indeed, I believe that customers are more prone to deal with construction companies that have good reputation in the marketplace. Concisely, CSR provides construction companies with the opportunity to identify and address the harms they are contributing through commercial activities to society. By identifying the right social cause and addressing it, construction companies would be able to identify themselves as responsible and trustable. However, the problem today lies in the fact that most French construction companies still do not understand the most effective ways to designing and implementing sustainability programs, which explicates their incapacity to fully capitalize on its potential for the creation of business value. Time and over again, construction companies use CSR as a mere marketing tool, an ornate paper they use to wrap their outputs so they could be commercialized in the marketplace with no trouble.

Precisely, to date, they have mostly focused their attention on direct routes to extracting business value from CSR. They are pursuing easy-win strategies that have direct commercial benefits, such as computing and dipping their corporate carbon footprints. Though such strategies are deemed useful, they often fall far short of the mark. In fact, for construction companies to be able to fully benefit from CSR, they must wake up to

[126]The French Tech project, the Eco-quartier Label project, and the Investment for the Future project ─ to cite a few.

the fact that they need to take a more indirect route to creating value with it. Practically, this involves moving away from top-down managerial logics in direction of richer bottom-up ones where value could be co-created in partnership with other stakeholders. Indeed, we ask: should construction companies sacrifice the environment or their profit margins? Honestly, there is no forthright answer to this question. To date, we say, construction companies are still focused on achieving short-term financial goals that is, maximizing revenues and minimizing costs. In their belief, if effectively applied, CSR would end up being high-priced and could possibly plummet their financial proceedings. Today, construction companies are invited to find a certain balance between the economic and the environment aspects of their projects (a vital matter in the context of smart cities!).

> In Mr. Cusin' expressions, '*The environment is always regarded as an optional aspect that would be honored if and only if the project's budget permits it —else, whenever cost cuts are necessary, it is frequent that the environment would be sacrificed so that the economic aspect could be preserved.*'

Non-sustainable construction. In France, buildings are responsible for the bulk of energy consumption and GHG emissions[127]. Indeed, residential buildings, constituting about 75% of the total floor area in majority occupied by single-dwelling buildings, dominate France's metropolitan building stock[128]. However population and floor area are expected to grow in the near future, final energy demand for heating, hot water, and ventilation (among others) is estimated to drop by a few points. This is mainly the resultant of the newly imposed building codes requirements. On the supply side, though key stakeholders trust the use of RES (Renewable Energy Systems) and in-site productions could play a vital role in boosting the energy performance of buildings, we, openly assert that the use of RES on a national scale is currently impossible, especially with the present energy prices, making RES an investment hard to pay off.

> As put by Mrs. Panzani, '*whenever building smart, the structures themselves should be smart and eco-friendly, built using sustainable materials.*' '*However,*' she said, '*such materials are often expensive which could pointedly impact construction companies' profit margins.*' '*Often, companies refrain from building sustainable constructions for pure economic reasons; and constructions would*

[127]Building Market Brief (France). Available from: http://cuesanalytics.eu/wp-content/uploads/2018/10/181023-CK-BMB-BMB_FRANCE-DEF-CIE-Edition.pdf. Also, see: https://www.archires.archi.fr/en/catalogue/90
[128]ibid

> *remain non-sustainable in France until they become economically sustainable first*' she concluded.

Large amount of logistics, pieces and other resources tied in the process. Usually, construction projects go through different stages from initiation to closure. Concerning lengthy smart developments, their execution require great amounts of logistics, which makes them creators of negative externalities.

> For Mrs. Panzani, '*the orthodox procedures based on which construction companies are operating these days may be improved by bringing some humble yet valuable variations to the existing value chain.*'

Today, the focus of France based construction companies is on the building of eco-districts ―which we believe to be sustainable rather than smart constructions. Though this might still read well, these eco-districts are not always built following eco-friendly procedures. Complying with state-imposed environment-related standards and codes is certainly to sink the financial returns that one could expect to get from a project. Thus, construction companies often make concessions at the expense of the environment in an attempt to preserve a decent profit margin at the end of the construction process.

> '*Often, the economic prevails over the social and the environmental*' Mrs. Panzani concluded.

5.1.4. *TECHNICAL*

We herein list and explicate the technical problems in construction. First, we tackle off-balance or uncontrollable problems ―and then embark upon controllable ones.

Passive bidding processes (O-B). Large construction projects are often the chattels of public authorities who carry out passive bidding processes for the assignment of such projects. It is the lowest bidder that is frequently selected for the job. Generally, a truncated price is a sufficient criterion for a company to win the project, regardless of the technicalities of the project and whether the selected company has a pertinent history in the handling of such projects (or not).

> As put by Mr. Gérardin, '*in France, construction standards are often set in favor of specific construction actors who seem to be always protected by the law.*' '*In addition, when it comes to public procurement procedures (―tenders), it is evident*

that big operators such as Bouygues,' he avowed, '*having armadas of lawyers and, as a result, developed bargaining abilities, are better positioned than their smaller counterparts to win such bids.*'

'*Within this framework,*' Mrs. Panzani admitted, '*public tenders issued, often miswritten and lacking key criteria that bidders should account for in their proposals (but do not!) ensue, once the project is commissioned, in ample operational issues.*'

Overruns are not serious issues per se, as the specs of the project could always be revised so they fit the project's budget envelope. Indeed, serious issues are only felt when erroneous estimates are significantly large so that no adjustments could be made to correct them. Henceforth, any potential tune-ups in such a case would be made at the detriment of other project specs.

In Mrs. Panzani's expressions, '*construction companies draft their technical and financial proposals based on the specificities of the project, exactly as mentioned in the terms of reference.*' '*They have a whole series of solutions to opt for whenever operational difficulties are faced, yet no miracles could be expected when the project owner himself is unknowledgeable of the most basic components of smart developments*' she concluded.

Legal and institutional barriers (O-B). The absence of a national policy and a dedicated smart city programme for the promotion of multi-dimensional urban development are the main reasons that have been pushing French cities, alone or in clusters (OASC France)[129], in partnership with private technology providers (EDF, Veolia, SNCF, and others)[130], to become proactive and undertake personal initiatives for the smartization of their territories.

As put by Mr. Burckel, '*the recently imposed Élan law failed to solve the numerous urban governance issues encountered today in the French construction industry.*' '*It is the French authorities' conservative standing vis-à-vis innovative initiatives in construction that is holding the entire industry back from innovation*' he specified.

[129]OASC France (Open & Agile Smart Cities France) initiative is a city-driven non-profit organization with the aim to create a Smart City market. OASC France was initiated in 2015 by four French cities in the north of France (Communauté d'Agglomeration de Saint-Quentin, Valenciennes Métropole, Amiens Métropole, Ville d'Arras).
[130]Smart eco-cities in France: Trends and city profiles 2017. Available from: http://www.smart-eco-cities.org/wp-content/uploads/2018/07/Smart-Eco-Cities-France-2017.pdf (The webpage was last visited on 5-10-2020). More details on construction laws could be found on the following address: https://construction.laws.com/general-contractor

Another issue that is worth noting at this level relates to the fact that smart city projects are often badly conceived, handled by inept stakeholders who fail to manage them properly.

> As per Mr. Natchitz, '*city mayors are part of the problem.*' '*Though they are unskilled in construction with the texts of law, absurdly, not requiring them to be,*' he attested, '*they often decide on the designs and shapes of the structures to be built.*' '*What we need today is an innovative urban governance model for the building of coherent and resilient smart cities*' he finished.

Smart city projects as disconnected micro projects. In France, policy makers should trust in competition as a means to enhancing quality and sinking prices. Ten years ago, the works of real estate developers revolved around public developments; they had a wider vision of the city (—as an urban agglomeration); they used to think of the city as a platform that should be built harmoniously; nonetheless, today, they are inclined to operate on a project-by-project basis, with projects built disjointedly from one another.

> For Mr. Gérardin, '*a smart city is a platform where different smart projects are built and put in connection with one another.' 'It is the connectivity of all projects within a city,'* he added, *'that makes a city smart.*'

Too much weight put on technology in the building of smart cities. The banal conception of smart cities is among the key problems that the construction industry is facing today. This is accurate, as big operators, repeatedly; tend to abridge smart cities to the simple act of installing small electric meters (for instance) at building level. As we see it, a smart city is a destination rather than a means.

> In Mr. Natchitz languages, '*it is the incompetent processes being used nowadays by construction companies rather than state-imposed legislations that are putting brakes to the development process of smart cities in France.*'

Thus far, industry actors are still misconstruing smart constructions for technology-intensive ones[131]. In the context of human-centric smart cities, this is exactly where the problem lies.

[131]When to Launch Technology and How to Stick the Landing. Available from: https://www.constructormagazine.com/virtual-design-and-construction/ (The webpage was last visited on 5-29-2020). Other useful insights on the matter could be found on the following address: https://constructech.com/news-brief/

'*Technology is a means rather than an end; it is a tool that should be resourcefully used to connect all constructs of a smart city while ensuring resource optimization*' Mr. Bordeaux acknowledged.

Ideally, smart cities are built following a pragmatic managerial approach where available tools, resources and skills are intelligently exploited to crack the challenges faced in construction today. We close by affirming that smart cities cannot be constructed but through trial-and-error, by crafting apposite urban governance and resource management schemes, ensuring interoperability between stakeholders, and enabling technological innovation and systemization.

Overlooked organizational innovation. The global success of the US is mainly driven by entrepreneurial initiatives, the creation of start-ups, and technology which is often put at the service of both businesses and people. Singapore, we say, is a good example of a country that succeeded to build its own economic model by copying other developed countries' models —while adapting them so they fit its own skins. Indeed, by espousing innovative production systems, Singapore was able to improve the urban design of its cities. As formerly evoked, there is no perfect business model for the building of smart cities, as the meaning of smart cities is conceivably to change across countries and cities, so would the BM crafted for their building. In France, we say, the construction industry seems to have failed where the aeronautics and automotive industries thrived.

According to Mr. Rochet, '*we succeeded to fly planes with pieces manufactured in the four corners of the world without reporting any problem throughout the process – however, now, in the construction industry, we seem to be encountering copious challenges building a simple structure around a street corner.*'

While Paris is still lagging behind today, other nearby cities, Barcelona for instance, are really ahead of the curve. Spain, being innovative in construction, has succeeded to turn Barcelona into a smart metropolis following a people-centered governance model within which technology (BIM) played a vital role[132].

In Mr. Natchitz's languages, '*there is no magic wand for the building of smart cities.*' '*A smart city could not be built but through trial-and-error, a recurrent process,*' he specified, '*where we build, we adjust, we rebuild, we upgrade, so on*

[132]Information on global smart city constructions —and management practices are available at: https://www.constructionglobal.com/infrastructure/smart-cities-need-smarter-project-management

> *and so forth, until we reach a situation where the final output has been sufficiently upgraded and improved to be then labeled smart.*' '*Les-Bricolos-du-Dimanche,*' he concluded, '*is a garage-based small trade whose owner never imagined that one day he would become a pioneer in a craft that was initially inexistent.*'

Today, lots of flaws and brakes should be tackled at the level of the construction industry. Adding that a ready-to-use solution is simply unavailable. Moreover, despite the so many talks about the Parisian smart city, no serious measures have been implemented in this regard ―which explains why the city remains inexistent to date. As previously noted, what is missing today is neither the technology nor the knowhow but a fitting governance model that would allow for the resourceful building and management of smart cities. Hence, we say, the problem is chiefly organizational, not technical nor technological.

> In Mr. Natchitz's words, '*smart cities are coherent ecosystems that should be built and managed by maven entities.*' '*Construction,*' he avowed, '*is never always about the technical and the technological, but about the organizational, too.*' '*Innovation in construction should not always be radical as mere and incremental changes brought to the value chain could time and again be sufficient to resolve arising problems and restore the chain's ability to create value for all*' he concluded.

Smart constructions as pure technology demonstrators. The smart city concept has nothing to do with creating green buildings, but with crafting something that could fit into a global ecosystem[133]. In France, public developers presume they know how to build smart cities. They build structures and invite people to come settle in them. This does not seem like a bad idea, however the main challenge lies in their capacity to convince people to come and invest in those projects. It is a question of social acceptability, creating a rapport between people and structures built. If such a rapport is impossible to create, then structures or cities built would end up being empty.

> According to Mr. Rochet '*the city per se is nothing; it is just a bunch of walls and streets.*' '*Smart cities,*' he declared, '*must be friendly, digitized, and agricultural; they should also appeal to people ―be human-centric ― account for urban mobility, etc. ― otherwise, they would not be smart.*'

[133]Check the following address: https://constructech.com/news-brief/ ― for more details on the matter.

Though smart cities are often built using technology (―referring to digital infrastructures)[134], technology per se should only be regarded as a mere tool, a means used for a specific purpose that is, the building of smart cities.

> '*To get Rue-de-l'Avenir association there,*' Mr. Natchitz said, '*a pedestrian has to cross four lanes, two for buses and two for cars.*' '*Similar urban snags could be bumped into in Tour-de-Montparnasse as well as on the T3a-T3b junction at the Porte-de-Vincennes*' he added. For Mr. Natchitz, '*such urban planning is neither intelligible nor intuitive*' '*We have been told that our cities are smart,*' he declared, '*yet in reality, there is nothing smart about them.*' '*Sometimes, our cities are not even humane*' he concluded.

> For Mr. Bruckel on the other hand, '*mismatches between conception and execution plans ―and the absence of a strategi that could oversee the execution of large projects are possibly the two main causes of such urban design flaws.*'

> Within this context, Mr. Natchitz wondered, '*how romans, roughly five thousand years ago, succeeded to design aqueducts and other complex structures without the use of technology?*' '*What is astonishing,*' he assumed, '*is that the romans made the trajectories of tunnels through alignment with the reflection of light, and they arrived to achieve their woks flawlessly, from start to finish, without any technological assistance.*' '*Also,*' he added, '*to make the first Airbuses, we had one part manufactured in Germany, a second one in France, and a third one in London ―and finally, all parts were put together in the US using made-in-China machineries.*' '*Again,*' he reiterated, '*we used to fly planes with materials manufactured by people who neither spoke the same language nor had the same cultural backgrounds, and all of this was done faultlessly ― whereas, in our time, with all the technology we have got, we face lots of problems building a few houses around street corners.*' '*The problems faced today,*' Mr. Natchitz concluded, *'are thus governance-, not technology-related*.'

Risk of technological obsolescence upon delivery of project. The lifecycle of a smart construction is relatively longer than that of a technology. Therefore, whenever a smart construction project is initiated ―and by the time construction works are complete, and the final product is ready for delivery, the odds the technology implemented is obsolete are high.

> In Mr. Biou's expressions, '*all people who thought they bought smart homes five years ago are finding themselves today paying significant amounts of money to upgrade their properties.*' '*We build over a 24-month period but, over that period, we are at risk of overlooking two generations of technology products which makes our construction archaic at delivery.*' '*Besides, once a technology has been implemented at the very early stages of the construction process, it would not be*

[134]ibid.

> *feasible, cost wise, to simply confiscate it and implement a new one*' he finally advised.

Table 36 shown below summarizes all problems discussed throughout the present subsection. They are tabulated based on *stratum one and four* of our GC BM —by construction stage and dispatched across the TLBMC's four layers.

(—The next subsection embarks upon the plausible solutions for the resolve of the problems identified except for those designated off-balance)

CONSTRUCTION STAGE	PROBLEMS			
	ECONOMIC	ENVIRONMENTAL	SOCIAL	TECHNICAL
INITIATION & CONCEPTION	• Failing BM leading to abridged growth prospects at industry level • Lack of understanding of smart construction process • Top-down managerial approach • Big companies' resistance to change • Financing (O-B)	• Urbanization (O-B)	• Misconception of smart city notion • Banishment of any collaborative urban governance scheme • Governments' reticence to share data (O-B)	• Passive bidding processes (O-B) • Legal and institutional barriers (O-B) • Smart city projects as disconnected micro projects
	• Constricted approach to value creation	• Lack of smart city initiatives and urban efforts • Constantly changing construction codes and standards (O-B)	• End-users not involved in the early stages of construction	
PLANNING	• Project process confused for business model		• End-users not being co-creators of value • Outdated CVP	
	• Faulty estimates leading to recurrent budget overruns			• Too much weight put on technology in the building of smart cities • Overlooked organizational innovation
	• High number of stakeholders with overlapping roles and responsibilities	• CSR-related topics occasionally conversed for mere marketing purposes		
LAUNCH & EXECUTION	• Decentralized decision-making • Discoordination between construction actors	• Non-sustainable construction		
	• Innovation mismanagement			• Smart constructions as pure technology demonstrators
	• Fragmented projects	• Large amount of logistics, pieces, and other resources tied in the process		
MONITORING & CONTROL	• Loss of control over quality of works			
CLOSURE	• Mismatch between promised and delivered final product • Scheduled timelines left in tatters • Absence of an entity that could orchestrate time horizons and handle maintenance works		• Criticism of final product by end-users • Broad concerns apropos the livability of assets	• Risk of technological obsolescence upon delivery of project
RESTORE, RENOVATE, REMODEL	• Additional costs incurred to integrate new technology and upgrade asset			

Table 36. Key problems in construction (France)

Source: Created by the author

5.2. SOLUTIONS

Up until now, we have made clear that the French construction industry is currently facing countless difficulties handling and managing smart developments. Besides, we have put emphasis on the fact that the construction industry has been for a few years now operating based on a failing BM, which, apparently, has been slowly but surely plummeting its performance and productivity. We have also showed that, not only in France, but around the globe, too — there is absenteeism of a straightforward and precise definition of smart cities. Indeed, we said, the smart city concept is highly subjective and may possibly hold distinctive meanings among its layers. In fact, smart could mean anything, as anything could be smart: smart grids, smart constructions, and smart buildings — just to cite a few. In France, there is still confusion today among stakeholders about what smart cities entail and what they should consist of.

> For my part, '*a smart city is a city that is conceived, developed and ran by the government and the people, both being smart, for the sake of promoting citizens' well-being and ensuring a better quality of life for all.*'

Though this definition might read good, it does not really help, practically at least, in deciphering the key constructs of a smart city, how the latter should be built, what it should resemble, or even what it should encompass. The smart city concept is multifaceted and extends to reach anything and everything, the economic as much as the social, the environmental, the technical, and even the political. This last sentence may sound a bit philosophical, yet, based on the extensive readings I did in this regard, this is what smart cities really are. Here and now, what we know for sure is that there is currently no one perfect, all-inclusive smart city model because, as reported earlier, smart cities are function of several, country-specific, builds. In other terms, smartness is likely to change meanings based on one's geographic location — that is, based on where he stands. Smartness may denote the simplest of things, as it may also refer to the most complex. With that said, a smart city is never associated with only one construct, but several interrelated ones, which, once pooled together, would found a coherent system that is smart itself. Moving on, we have also affirmed that lots of money should be invested for the conversion of a big city into a smart one. It is a long-standing, capital-intensive investment.

> Our reasoning comes hand in hand with the declarations of Mr. Natchitz who specified that '*a smart city is a combination of two elements: financing —and a clear vision of what a smart city should consist of and what its purpose should be.*' '*A city would not be deemed smart,*' he added, '*unless the services it offers come in line with people's exact needs and aspirations.*'

Often, construction companies misapprehend the real needs of people. They presume to know what people really want — but, in reality, they do not. This is true as, sometimes, what we, construction companies, believe is bad ends up working just fine, while what we trust to be fine turns out to be bad. Building a smart city, we acknowledge, is principally a question of abridging the growing market gap between supply and demand. In the present study, we focus on a specific construct of smart cities: smart constructions, being structures and buildings linked together through technology and data. In smart cities overall, technology is a means rather than end. It is a tool used to facilitate communication and data exchange among the various elements of a city.

> In Mr. Thépin's own expressions, '*smartness is never solely bounded to technology; it extends to cover the social, the environmental, the livable, and the humane within a city.*' '*Today,*' he added, '*French based companies are operating based on a pure money-making logic, an inhumane business model.*'

At present, we do not actually have to rebuild the entire world, as it already exists; all we have to do is to improve it by bringing some worthwhile change to it.

> '*Smartness,*' Mr. Thépin said, '*should not be mistaken for the complex and the compound, as it frequently relates to the simplest and the most obvious (e.g. create a parking App that people could use to find variants of parking spots, boost buildings' energy performance, implement urban security measures, enhance urban mobility, and others).*' '*The buildings we see nowadays walking down the streets of our historical cities are not smart, but are labeled as such anyhow*' he avowed.

For construction companies, projects labeled smart are thought to sell better and quicker in comparison to the ones that are not. This nevertheless creates misconception among citizens leading them to think of smart cities as unsympathetic and unlivable places. We regularly tend to complicate things in a misled endeavor to make them smart.

In the following sub-sections, we refrain from embarking upon off-balance problems as they are out of our reach and control. Accordingly, we solely focus on discussing project management problems and suggesting plausible solutions for their resolve.

5.2.1. *ECONOMIC*

We herein list and explicate the solutions suggested for the resolve of the formerly listed economic (—and other) problems.

Espouse a centralized decision making process. Despite the many innovative initiatives implemented at country level today[135], France is still lagging behind in the field of smart city development. This is mainly because large construction projects are often owned and ran by incompetent project owners. Being inept in construction, they often outsource, through passive bidding processes, the execution and administration of such projects to external entities, regularly to the lowest bidders. Regardless of the quality and content of technical proposals, bidders who submit the lowest financial proposals are the ones with the highest chances to secure the job. This is problem-zero —from which ensue a series of other problems that would accrue over time and lead to the failure or annulment of construction projects.

> In Mrs. Hayman languages, '*large construction projects, smart ones in specific, are hard to manage; they are tricky and lengthy, and the BM based on which construction companies are operating nowadays does not seem to comply with the requirements of a smart city.*' '*Today,*' she continued, '*there is definitely need for a maven contractor who could step into the scene and use both his knowledge and savoir-faire to successfully pilot and manage construction works carried out in the context of smart developments.*'
>
> Similarly, Mrs. Tiscornia stated, '*for smart developments to succeed, construction works should flow smoothly down and up-stream the value chain, and construction actors should be able to flawlessly synchronize their works throughout the entire process, from start to end.*' '*Multi-level interoperability must be ensured at all times*' she said. '*For this to be possible however, we need a central operator,*' she detailed, '*an integrator, someone with adequate expertise in construction to make the right decisions at the right times.*'

Within the value chain, each specialization has its own *raison d'être*; however a central operator is needed in order to bring all stakeholders together, thus ensuring interoperability between them. Put differently, the central operator would tie the entire value chain together, ensure a fair interplay between stakeholders, and oversee all tasks carried out from initiation to closure. Besides being a decision maker, the central operator (—which in our case is a GC —consigned by the project owner to replace him— acting as a delegated project owner), would be given control over the entire construction process. As an intermediary between stakeholders

[135]SBA (Smart Building Alliance) is association with offices in Lyon launched to bring change the field of construction. It brings scholars and industry experts together to discuss and rethink both smart city and smart building notions.

positioned down and upstream the value chain, he would ensure end-to-end data delivery, from the project owner, on one end — to the end-user, on the other end.

Improve attractivity and absorption capacity of city. There are precise (inflexible) procedures that France based construction companies must abide by at all times for the achievement of their projects. Thus, to simply change how things works and jump from the orthodox to the unorthodox would be without a question challenging. Under a smart city business model, resources should be exploited — and services delivered — in a sustainable way. In France, we are not quite there yet. Also, with the rise of the smart city concept in recent years, several key elements that were previously overlooked came to play (—open data, IoT), and new actors were brought to the scene (ICT companies). The world is evolving and change is part of it. If we fail to adapt, we would eventually lose in business.

> For Mr. Bruckel, '*sooner or later, public governance schemes would change, hence setting the ground for further innovations like the one you are suggesting in this study*.' '*Unfortunately,*' he said, '*there is no magic wand that we could use to overcome problems faced in construction today: to fix things, we need to innovate.*' '*The city of tomorrow cannot be built but through trial-and-error, an ongoing process where mistakes are made and necessary adjustments follow*' he specified.

Today, all cities around the globe are aiming at becoming smart. Smartness is a means that enable cities to boost their allure and gain economic power by attracting capital in destination of their soils. Today, the main challenge consists of finding the perfect recipe for the creation of smart cities, as smart cities may include too little or too much. Generally, smart city projects should be catered based on the exact requirements and hopes of end-users. They should also account for the specificities of the cities or territories on which they are sited. If, for instance, we had to build the same project in Lyon and in Montpelier, we could not expect a comparable success rate in both regions if no adaptations where brought to it a priori to reflect the uniqueness of each territory. People in Montpelier are likely to have different tastes that those in Lyon; also, Lyon, as a city, has distinctive traits that differentiate it from Montpelier. Once construction project is on the go, it should account for all of these minutiae – otherwise it would not be smart.

> In Mr. Gérardin's expressions, '*friendly, people-centered, technology-based, data-driven, livable — are key adjectives that one could use to define smart cities.*' *The desirability of a city,*' he opined, '*ensues from the shape and looks of the lodging first, then comes the nicety of the street shop next door, the view, the amenities and services offered, and finally the greenery available in the vicinities.*' '*This is what creates real-estate value and gives a city its real appeal*' he concluded.

Ensure final product has a use-value and that utility may be extracted from it. No construction actor has control over the entire value chain, which implies that no one could guarantee the quality or state of final product since, throughout construction processes, the relay is regularly passed on from one stakeholder to another. Based on where a construction actor is located along the chain, his control over the quality or state of the final product is expectedly to diminish or grow the more we move down or upstream.

> According to Mr. Gérardin**,** ‘*the prevalent Design-Build-Operate model must be improved so it becomes something like Design-Integrate-Build-Operate*’. ‘*As construction companies,*’ he explained, ‘*we are not being able to keep our promises in terms of delivering a high-quality output at the end of the process simply because we do not intervene at all stages of the value chain.*’ ‘*Hence,*’ he indicated, ‘*the need today for a specialized entity who could control construction works done and guarantee that value created throughout the process would not be lost.*’

End of day, in the context of smart cities, construction companies need to ensure what is being sold is more than simple structures. In collaboration with architects, urban planners, and other stakeholders, we trust, the GC would be able to deliver upstream what has been promised downstream. Moreover, construction companies must ensure the final output delivered is useful and utilizable. Precisely, end-users must be able to extract use-value from spaces built —else they would be dissatisfied. It is mainly a question of space management (use, eco-friendliness, and others) —as well as of urban design.

> For Mr. Gérardin, ‘*end-users should be all set to use their homes in a convenient and handy manner.*’

Allow for customizability (portfolio diversification). The rapport between architecture and housing has traditionally been an uneasy one. After a period of flagging interest from the 70s into the 90s, design interest in housing is again on the rise, predominantly in terms of innovative materials and production systems, green building, and an activist interest in providing for a broader spectrum of people. The production of housing today ranges from the hyper-customized singular house for a distinct user to completely mass-produced manufactured housing and repetitive builder models. Recently, mass customization has become a term used to describe housing production that falls between these extremes. This term suggests a production system that has the stability of quantity and the flexibility of custom design. To be applied effectively in architectural work, mass customization must be understood as a system approach that includes not only design, production, and construction —but also communication and economics.

> As Masa Noguchi explained, '*today's homebuilders are encountering a production gap between the need for product standardization that helps reduce construction costs and the need for product customizability that satisfies diverse demands of contemporary consumers*[136].'

In other words, construction actors are trying to mass-produce housing in order to create stability and mitigate risk. Simultaneously, more types of consumers are entering the market and more consumers of all types want to have a larger voice in the design of their homes. Bridging this gap, we proclaim, requires a system that is familiar and standardized enough to allow the construction industry to embrace it —while also malleable enough to respond to the diverse needs of end-users at all positions in the economic and cultural spectrum. Architects and producers of mass-customized housing are today attempting to create just such a system in which affordability and quality-diversity-sustainability are not mutually exclusive. This kind of systems take available off-the-shelf components and use them to create modular building and furnishing elements that could be assembled in a variety of configurations. In fact, this suggests something more egalitarian, available to more people.

> According to Kieran Timberlake's website, '*customized housing is a bottom-up approach that comes from the assembly system itself rather than a top-down approach used in more conventional prefab construction*[137].'

Nowadays, the increasing competitive pressure on construction companies requires the revision of existing corporate structures[138]. Accordingly, extending product ranges seems to be one plausible way that construction companies could opt for to secure their market positions in the long term. Another possibility is to strengthen the core business. This ensures the function as price or quality leader. Due to the lack financing, the realization of new (large) construction projects has become more difficult today. The lending of many banks has become more stringent, and many companies are pushing their construction projects to procrastinate. To compensate for the prevalent unstable situation, a trend towards diversification has been recently apparent and the decline in sales was somewhat offset in this way. Additionally, the possibility to operate in different segments of the construction industry compensates for the risk of cyclical fluctuations. Large, international corporations, in particular, are active in activities along the value chain. One of the advantages is that even large projects could be managed almost entirely from a single source. Generally, there are two possibilities for diversification: vertical (—the inclusion of upstream or downstream construction services in

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[136] Mass-Customization in Housing: Designing Systems Rather than Objects. Available from: https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1094&context=arch_conf (The webpage was last visited on 4-15-2020)
[137] Website: https://kierantimberlake.com/
[138] Market positioning through diversification. Available from: https://buildingradar.com/construction-blog/diversification-construction-industry/ (The webpage was last visited on 4-15-2020)

the product range) and horizontal (—the expansion of the product range to include services or products, which are closely related to the current performance spectrum) —and it is up to each company to choose which of the said possibilities suits it best.

Identify and target underserved market segments. There are various ways to determine if a company is innovative or not. For some, innovative companies could be new entrants that serve previously unmet needs. For others, they are those that introduce groundbreaking solutions to relevant issues. They could also be businesses who use strategic armaments such as technology, design or sustainability to create an impact. These are all in various lists of top innovative companies that aim to help underserved niche markets (e.g. Nespresso). As mentioned, most corporate innovations focus on markets with certain similarities. First, there are minimal logistical challenges. Then there are consistent BMs in the same competitive sphere. Lastly, they return a timely profit greater or equal to other investments. Meanwhile, underserved markets present greater challenges. Consumers in such markets face often overlooked issues. Resources are insufficient and outcomes are not always predictable. For some innovative companies in this space, these challenges represent unseized opportunities. Indeed, their measures for success deviate from usual practices. In France in specific, social housing for instance, represents an opportunity for construction companies seeking to diversify their offerings and enlarge their customer bases. A book called —The Fortune at the Bottom of the Pyramid— proposed that four billion people earning less than US$1,500 a year represented a US$5 trillion global market. While individual incomes in underserved markets are low, the aggregate buying power of communities remains huge[139].

Adjust offerings to exact needs and requirements of end-users. Construction companies are invited today to offer tailor-made solutions to their customers. This is genuine as not all people have the same tastes and preferences. While some might prefer the old and the traditional, some others would be more fascinated by the innovative and the new. This solution is directly linked to the ones mentioned above, primarily: customizability and portfolio diversification.

Ensure involvement of end-users in all stages of construction process. Nowadays, at the very early stages of construction processes, construction companies tend to make concessions with customers to ensure their expectations and needs are imprinted in the projects. Though

[139]Top innovative companies that target underserved markets. Available from: https://www.boldbusiness.com/society/underserved-markets-get-help-through-innovation/ (The webpage was last visited on 4-15-2020)

this might not be a common attitude among all construction companies, things seem to be gradually shifting this way.

> For Mr. Bodreaux, '*concessions are not always serious and real, sometimes arranged because they are simply part of the process.*' '*Passive concessions made at the beginning of the process,*' he avowed, '*would eventually ensue in serious clashes with customers at the end, upon delivery of final product.*'

This is to say that value propositions made irrespectively of people's real needs and aspirations would be destined to fail. Even though such propositions were successfully commercialized once, deceived end-users would make sure, through negative word-of-mouth, that such an eventuality would not occur again.

> As per Mr. Cusin, '*urban design has a substantial impact on people's daily lives and so, construction projects should not in any case be conceived and built without consulting with potential customers first.*' '*The final output delivered,*' he detailed, '*should be tailor-made to their exact needs and construction procedures should be adapted so that such offerings could be made.*'

Between yesterday and today, client integration has made the entire difference. End-users have become (or are on the way to!) co-conceivers of construction projects and co-creators of value. Indeed, construction companies are not conceiving any solutions anymore for their clients, but instead they are collaborating with them in this respect. In addition, they are connecting with one another to collaboratively identify problems and suggest reasonable solutions for their resolve. Previously, clients were neither involved in the conception of projects nor the creation of value. Yet, nowadays, construction companies seem to be increasingly espousing collaborative governance models so they could serve their customers better. Through communication, construction companies are hoping to better apprehend the real needs and hopes of their customers.

> '*In construction,*' Mr. Gérardin indicated, '*we cannot create a product and then, consult with customers to adjust it based on their needs and preferences.*' '*This is simply unachievable in construction*' he said. '*What should be done,*' he carried on, '*is to immerse end-users in construction projects, from the very start till the very end.*' As per Mr. Gérardin, '*this is a precondition for the successful creation of smart cities.*'

Recognize end-users as both data sources and innovation creators. As formerly noted, a smart project generally goes through various junctures and stages before completion, and for construction companies to be able to safeguard its smart character, they should ensure end-users are actively involved in the construction process.

> In Mrs. Panzani's terms, '*end-users would become partners to construction companies, acting as sources of data and co-creators of innovation.*'

Smart cities are humane cities — cities that are livable and dynamic. They are dynamic in the sense that their design allow for the effortless end-to-end flow of data. Indeed, data plays a crucial role in both the creation and administration of smart cities. Normally, data is gathered by public authorities and shared with everyone, especially young developers who could use it to create inventive things, practical solutions that may improve the standing of the city and boost its attractivity overall. Moreover, given the longevity of smart city projects, it would be a good idea for construction companies to create user manuals for housing and-or equipment in an effort to mitigate the risk of project-related data going down the drain over time.

Co-create value by co-conceiving construction projects. Data is today's new fuel oil — and effective data management practices constitute a solid foundation for the creation of smart cities. Regarding technology, it is a tool that is often used to manipulate and analyze data —so that plausible solutions could be figured out for the resolve of urban snags encountered.

> For Mr. Gérardin, '*people are the source of data*.' '*And for data to be worthwhile,*' he added, '*it should be exploited well; else it would turn out useless.*'

Additionally, one should beware not to confuse smartness for the technology-intensive —as people remain at the heart of smart cities. Indeed, smart cities are people-oriented —and so, to be successful, they should preserve their human skins.

> As put by Mr. Gérardin, '*by rendering data available for all, tech-savvy people would use it for innovative purposes.*' 'For that reason, *not people only are sources of data,*' he admitted, '*but value-creators, too.*'

Around the world, one could come across various models of smart cities, ones that are mere technology-demonstrators (Songdo, South Kora) —and others that are rather focused on relationships and people (Copenhagen, Denmark). However, practical evidence has shown that technology-intensive cities were not as prosperous as expected; they failed to become smart and attract people; they remained inhabited and empty.

Manage stakeholders involved in the process and clear up roles and responsibilities. Often, there is more than one major stakeholder in construction projects, especially large ones. A boost in the number of stakeholders (—being often decision makers, too), I would say, adds stress to the project and increases the project's complexity level. The ability of stakeholders to influence the project outcomes or execution approach would also affect the stakeholder complexity of the project. In addition to the count of stakeholders, the degree to which the project stakeholders agree or disagree on strategic matters relating to the project is likely to sway the project's complexity overall. A large construction project would typically involve numerous stakeholders. All the building permitting agencies, environmental agencies, and labour and safety agencies (among others) have an interest in the project and could influence the execution plan of the project. The neighbors would have an interest in the architectural appeal, the noise, and the purpose of the building. Based on the project, construction companies should conduct a stakeholder analysis, or an assessment of a project's key participants to determine how the project would affect their problems and needs; also, identify their individual characteristics and interests, find out what motivates them, as well as what provokes them. In the GC BM, the GC should clearly define roles and level of participation, and decide whether there are conflicts of interest among different groups of stakeholders. The new BM is an abridged version of the old BM, involving lesser stakeholders who fulfill specific tasks and intervene at specific stages of the project lifecycle. In addition, by centralizing the decision-making process, we trust the project's complexing level would be pointedly reduced.

Ensure apposite cueing and synchronization among construction actors. Putting the conductor-contractor analogy aside (—see Chapter 2), we herein avow that a GC somehow resembles a cook. The cooking process, similarly to the construction process, rolls as follows: we cook, we taste, we rectify, we taste; if the final output tastes good, we deliver — else, we rectify again, we taste, so on and so forth. Building, just like cooking, is an ongoing process. The only difference between the two is that in construction adjustments are only possible at the very early stages of the process. By having an executive chef on premises, the time that would elapse before delivering the final output would be abridged —for the most part, because the latter would be practically flawless requiring minor or even no tunings.

> '*In the restaurant business,*' Mr. Rochet affirmed, '*cooking follows an agile methodology where tasks are broken down into small pieces and assigned to different team members.*' '*The final output would then be created once all pieces have been put together where each member would have contributed a piece to the final output*' he added. '*Could you imagine a big restaurant's kitchen being ran without an executive chef where each team member works individually, not as part of a team? The situation would undoubtedly be chaotic*' Mr. Rochet concluded.

This comparison puts emphasis on the importance of having a central operator in the construction industry who, alike executive chefs, could synchronize construction works by cueing who does what and when.

Rely on services of external partners to achieve specialized tasks (outsourcing). Today, for the efficient execution of smart constructions, big operators such as Bouygues feel the need to get involved, along with end-users and other key stakeholders, in the works carried out at the very early stages of construction processes, downstream the value chain. By focusing on the Design-Build phases, they would be able to control the quality of works performed downstream, and then ensure —in the Operate phase— that innovative value propositions would be eventually delivered to end-users positioned upstream the chain.

> In Mr. Gérardin's expressions, '*though Bouygues, with the help of its subsidiaries, could cover the entire chain and handle construction works required all by itself, it, frequently, for economic or other reasons, outsources part of the job to external entities.*'

Nowadays, there are neither common guidelines nor plans apropos how smart cities should be built. It is something that companies decide on according to the particularities of every project. Usually, project owners resort to subcontracting for the accomplishment of specific tasks, explicitly: structure and digital infrastructure design, management, execution, and promotion. Per se, subcontracting is good as subcontractors often bring expertise, cost-efficiency and increased productivity to large projects. However, the problem lies in the fact that project owners do not hold trusting rapports with subcontractors. Generally, with no long term commitments involved and assigned to realize very particular tasks, subcontractors tend to work disjointedly from one another, which supervenes in incoherent, low-quality outputs.

> As reported by Mr. Rochet, '*today, there is a need for a prime contractor who could oversee the works carried out by subcontractors given that project owners are habitually incompetent in construction.*' '*The prime contractor, or the so-called GC, could fulfill such a task*' he added. '*Smart constructions are like puzzles,*' Mr. Rochet detailed, '*where different pieces should be brought together to create a perfect final output.*'

Hence, the GC's role would be to find the optimal combination of input during a given construction process from which would ensue a high-quality output. The GC would outline work standards to be adopted for the execution of construction works, manage staff and oversee their works, and handle disputes. Indeed, we assert, the GC BM, though based on a centralized managerial, is a collaborative solution that involves all construction actors, including both end-users and ICT companies. Alike end-users, ICT companies (e.g. Schneider, Siemens, Orange, etc.) play a central role in the building of smart cities and could not be circumvented from the process, mainly because their contribution falls within the peripheral framework of the smart city.

> In Mr. Bordeaux's languages, '*habitually, public developers subcontract the digital infrastructural design of their projects to ICT companies.*' '*Through technology implemented,*' he added, '*the project built would end up being sustainable in the sense that resources could be allotted optimally, and operational expenditures end energy consumption cut in half.*'

Build a lengthy network of industry partners. In France, large construction projects are often administered and executed by the so-called '*ensemblier*' —a group of companies (two or more) that partner together for the achievement of such projects. In the case of an '*ensemblier*' however, there are two or three decision makers instead of one, meaning that conflict of interest is still abound to happen at any point of long-lasting construction processes.

> For Mr. Bordeaux, '*the task of smart city management should be carried out by a single entity — in partnership with other stakeholders — local communities to ensure there is social acceptability for the project — public authorities to ensure political acceptability, and —investors to ensure economic feasibility.' 'In the realm of smart cities, value is often created in networks rather than individually, hence the importance of the GC role*' he signposted.

Achieving a large construction project's goals takes a focused, well-organized person (or entity) who could engage with a committed team and gain the support of all stakeholders involved in the process. Building strong, trusting rapports with interested parties from start could make the difference between project success and failure. Communication, being a key piece of stakeholder management efforts, should be preserved at all times. For construction companies, developing a communications plan that secures stakeholders' support is highly recommended. When it comes to GCs, they often have their own networks of subcontractors with whom they have been working for years and hold a rapport of trust and loyalty. The GC BM would hence allow for reduced turnover rates, abridged broken knowledge loops, and increased stakeholders' engagement.

Abridge logistics and procurement costs. The construction industry is normally regarded as one of the oldest project-based industries. Indeed, the project-based managerial structure has remained intact for centuries in construction. Although being one of the oldest industries, construction is still an unsustainable one in terms of the triple-bottom of sustainability, encompassing: economic, environmental —as well as social aspects. Focusing on economic means, construction is characterized by time- and cost-intensive production processes, which makes it prone to project risks and failure, in terms of time and budget.

In practice, this signifies that the performance of construction projects is usually low. Precisely, construction projects are regularly delayed and over budget. This is not just due to problems faced during project scheduling, but also during related processes such as material procurement and material management. For many decades, methods such as the critical path method (CPM), the programme evaluation and review technique (PERT), and Gantt charts have been applied in construction and have maintained their role for construction project planning. Though widely popular, these techniques do not pay sufficient respect to the complex planning environment in construction and are solely suitable for the determination of time windows for project activities. Generally, construction companies – whether in France or elsewhere in the world — use such tools to plan their projects, however over and time again they diverge from them, thus making them useless. The orchestration of time horizons in construction, we trust, should be made from within, though value chain planning. Specifically, the GC, by aptly synchronizing works, cueing intervention times, and controlling the entire construction process (down and upstream the value chain), would guarantee the timely delivery of final outputs.

Lower risk of premature technology obsolescence. Today, the bulk of businesses whether in construction or any other sector, are technology-intensive —and so, highly reliant on the adeptness of existent digital infrastructure at city or country level. Normally, the lifecycle of a smart project is five years upstream, five years downstream — ten years in total, whereas that of technology is significantly shorter. This gap in life span between technology and construction project, we presume, is likely to have a substantial impact on the economics of (smart) construction projects.

> In Mr. Gérardin's expressions, '*there is a need today to shorten construction processes, mainly those specific to smart city projects, so they could mature after five years.*' '*And this could not be attained but through the creation and adoption of innovative project management processes*' he advised. For Mr. Rochet — on the other hand, '*delivery schemes would be more productive once digital technology (BIM) has been efficiently exploited in the design of construction projects, as this would enable the adoption of smarter manufacturing and construction techniques that speed delivery, minimize disruption, and maximize efficiency.*'

Improve work quality and curb maintenance costs. The construction sector is considered to be a basic industry on which the development of the city (country) depends to a great extent. In addition, the growth of construction companies is generally determined by their capabilities to innovate and espouse cost-efficient production processes. In construction, we proclaim, purchasing is a strategic function that could be used to control and reduce bottom line costs. Practically, this could be achieved by, among others: running value analyses (identification of hidden, unnecessary costs) — making bulk purchases (specific for big operators) — setting tough quality control procedures — dealing with suppliers located in vicinity of construction sites (reduced logistics costs) — partnering with major suppliers (sustainable construction materials).

Normally, quality management consists of two types of activities: quality assurance and quality control. Quality assurance relates to activities designed to ensure that quality is built into the process, whereas quality control is rather focused on activities designed to ensure that desired quality levels are actually achieved by the process. In construction, quality management is frequently achieved through quality control. Hence, we say, by regularly controlling the quality of works achieved throughout a construction process — cost reduction, productivity improvement, customer satisfaction, defect reduction and morale could be ensured. We finally note that quality control works best in settings where it is strongly supported by management, implemented by employee teams, and there is a continual focus on process improvement that prevents errors from occurring. Under the GC BM, the GC would be in charge of controlling all works achieved throughout the lifecycle of a given smart construction project.

5.2.2. *SOCIAL*

We herein list and explicate the solutions suggested for the resolve of the formerly listed social (—and other) problems.

Promote collaborative urban governance schemes (social constructivism[140]). In France, big market operators such as Bouygues are currently putting much effort to position themselves as leaders in the smart city field. Bouygues for instance has been recently promoting a culture of integration by strengthening the rapports it holds with stakeholders situated at varied levels of the construction value chain. Though the said company seems to be currently facing some issues controlling the works of its own subsidiaries, it is actually doing a great job promoting collaborative urban governance schemes for the building of smart cities. The collaborative approach being indorsed today would end up being beneficial for everyone, as all parties involved would profit from the exchange of knowledge and skills on smart city topic.

> '*The city of tomorrow,*' Mr. Gérardin acknowledged, '*should be built collaboratively rather than individually — where every stakeholder contributes work and expertise to the equation, thus leading to the execution of high-quality construction works — and subsequently, the creation of an effective smart city.*'
>
> Similarly, according to Mr. Biou '*the building of a smart city is mainly a question of urban governance.*' '*In opposition to Adam Smith's instructs,*' he advised, '*the sum of individual interests would not ensue in the fulfillment of the collective interest — unless individual works were properly controlled.*'

[140]Social constructivism. Like social constructionism, social constructivism states that people work together to construct artifacts.

Collaboration (—referring to collective thinking and intelligence—that is smart governance), we proclaim, is hence indispensable for the success of large construction projects. Actually, project participants have nowadays realized that knowledge and information sharing is one of the key elements of a successful contractual relationship. As far as we are concerned, three factors are possibly to boost the odds of construction actors working together i.e. enriched data sharing, improved quality and timely project completion, and enhanced product and service quality.

> For Mrs. Tiscornia, '*there is no clear guide today on the process of collaboration between stakeholders, therefore making it time and again difficult to effectively interact and achieve common project goals within the bounds of cost, quality and time —thus the importance of your GC BM at this level.*'

Partner with local communities for the conception and building of smart developments. Today, local communities are making their voices heard when it comes to how they imagine the looks and feels of the city of tomorrow to be. In contrast to yesterday, they are currently more inclined to express themselves on topics —such as their preferred living locations, types of residences they would like to live in, and others. In fact, just recently, local communities turned into key industry players who have a say in the design and conception of construction projects. Actually, they became decision makers who participate in the running of the city.

> '*For construction companies,*' Mr. Gérardin affirmed, '*it is crucial to integrate end-users in the construction process as of the very early stages of the process.*'

By collaborating with local communities, we believe, the cities of tomorrow would be managed more efficiently.

> In Mr. Gérardin's expressions, '*end-users do not interfere in the technicalities of projects; they are incompetent in this area —which is normal.' 'They would not take the pencil and start drawing the city — but instead, they would contribute ideas; ideas that would help shape the looks of smart cities*' he added.

Therefore, construction companies should listen to customers and jot down their comments. Ultimately, they are the ones who would potentially purchase the final product —and for them to be inclined to do so they should be satisfied with it in the first place. Communication channels between construction companies and local communities should remain open throughout the entire project process.

> As put by Mr. Gérardin, '*the partnership between the two is an ongoing process, a long-term relationship that could only be broken upon mutual agreement.*'

In the realm of smart cities, it is the tiniest details that count the most: would I build a bakery or a library at the street corner? Though the question may sound silly, such an information, we declare, makes the whole difference in the success or failure of a construction project.

> '*By partnering with local communities,*' Mr. Gérardin closed, '*construction companies would be able to build not only walls and roads, but the spirit and soul of cities.*'

Rely on collective thinking and intelligence to conceive and execute smart developments. The problems encountered today at the level of the French construction industry, we proclaim, could be solved by encouraging both collective planning and collective thinking.

> As per Mr. Bruckel, '*the solution lies in centrally planned collective housing to be ensured via resourceful public private partnerships schemes where the public sector governs and the private sector builds.*' '*Besides,*' he added, '*given that public authorities are often incompetent in construction, the governance of large projects would end up being delegated to a maven private entity.*'

Consequently, the private sector would be in charge of running the projects, ensuring both governance and execution of operations.

> According to Mr. Biou, '*in France, one in four homes are centrally planned and follow a style of collective housing.*' '*Social housing is the type of housing that honors its social heritage the most*' he declared.

Within this setting, the GC role would be invaluable in the fact that it may promote this type of centrally planned, social housing construction.

Create value in networks — profit sharing logic. As previously stated, the governance of smart cities is better ensured by a GC — not alone, but in partnership with end-users. In our eyes, smart cities is primarily a question of smart governance and smart people —and it is their smart collaboration that would safeguard the smart character of cities.

> According to Mr. Bruckel, '*end-users should assist GCs in the managing of smart cities.*' '*Together,*' he detailed, '*they form an ensemblier— who would run smart projects based on a DBO (Design-Build-Operate) model.*'

We close by pointing out that the success of smart projects relies on the ability of construction companies to build and manage them following a people-oriented economic model —and based on a bottom-up managerial approach (—thus, the solution suggested next!).

Administer smart developments following a bottom-up managerial approach. Créa'City[141] constitutes a good example of a smart initiative (program) that encourages partnership between local communities and construction companies —and supports personal

[141] Website: https://www.creacity.be/

(innovative) initiatives. Créa'City is kind of a brainstorming session where different people sit together to discuss the fundamentals of sustainable life (—reacting to questions, such as—what the city of tomorrow should look like?). Undeniably, the involvement of end-users in the very early stages of large construction project processes is a prerequisite for their success.

> As put by Mr. Gérardin, '*often, people are right —and construction companies are wrong; the assumptions companies tend to make about people's needs are time and over erroneous.*' '*We converse, we make adjustments, we fix things, and then we converse again*' he said. '*Smart projects are subject to constant adjustments until the point construction works have been initiated*' he concluded.
>
> Similarly, for Mr. Natchitz, '*it not up to big operators such as Bouygues to decide what people's real needs and aspirations are, as citizens are the only ones who are entitled to speak for themselves.*'

Set up effective stakeholder management strategies. In the realm of smart cities, construction companies must work on enhancing cross-functional collaboration across value chain and building long-lasting rapports with stakeholders. As formerly evoked, construction projects have a lot of fuss and they could easily get off track if the various stakeholders are not working together efficiently. The importance of collaboration for more effective construction projects is increasingly recognized across the construction industry. Indeed, improved collaboration is expected to reduce risk on construction projects and boost the sense of engagement and responsibility among stakeholders. Big operators often use tools such as the BIM[142] to improve multi-stakeholder, real-time communication. When it comes to France, despite the widespread agreement about the value of increased collaboration, the country's construction industry is still struggling today to be collaborative and create sustainable value networks.

In order to run a successful construction project, it would be central for a construction company to address the needs of the project's stakeholders, effectively predicting how the project would affect them and how they would affect the project. Ineffective stakeholder management practices could eventually result in dissatisfaction with the final output and negative impacts on the project's budget and schedule. During the development stages of a construction project, we proclaim, a clear and detailed stakeholder management strategy should be established. While it may be hard to satisfy all stakeholders on every project, effective stakeholder management must aim to satisfy as many as possible, which would often involve strategic

[142]BIM stands for Building Information Modeling. BIM refers to a collaborative method of working which is based on the generation and exchange of data and information between the various project parties. Based on this information the full cycle of a building, from conception to completion, could be managed.

prioritization of different stakeholders needs. In our views, an effective stakeholder management strategy could take the following form: Inform-Consult-Involve-Collaborate. The first category (—inform) includes those stakeholders who require minimal effort. Stakeholders with lower power but higher legitimacy need to be kept informed of decisions taken that may affect them directly. The second category (—consult) covers stakeholders who require more than just being informed about the project. Those have higher power but lower legitimacy; they should be kept onboard and consulted in order to seek their opinions and input for key decisions that directly or indirectly affect them (usually, companies are unlikely to change their strategies based on the results of such consultations but may adjust their tactics to maintain high levels of commitments). Last but not least, the third category (—involve) comprises stakeholders with high power levels, even if with low legitimacy. Those need to be involved in all project activities according to their interest since they have the power to make decisions that impact on the project. Finally, the fourth category (—collaborate or —partner) involves primary stakeholders who have high levels of legitimacy and power to affect project success —and as such, they should be treated as partners to increase their engagement and commitment. This is often achieved (whenever necessary) by revising and tailoring project strategies, objectives, and outcomes[143].

Enhance end users' wellbeing and quality of life. In France, large construction projects often fail to sell because they greatly diverge from people's exact needs and aspirations. We, as construction companies, promise end-users one thing at start, and then deliver a different thing at the end. We simply fail to keep our promises.

> Within this context, Mr. Gérardin avowed, '*it would be beneficial to delegate the management of smart constructions to a maven GC who may ensure the promises made downstream the chain would hold true upstream.*'

Precisely, the GC would have a certain control over the value chain and ensure the final product meets people's real aspirations and hopes.

> '*A smart construction,*' Mr. Gérardin said, '*is part of a smart city —and so, construction companies would eventually fail to create smart cities unless they ensure their constructions are smart; a smart city is a chain of smart projects.*'

[143] Stakeholder management for building design and construction. Available from: https://www.designingbuildings.co.uk/wiki/Stakeholder_management_for_building_design_and_construction#Stakeholder_management (The web link was last visited on 4-27-2020)

It is a solution that construction companies offer, value propositions that goes beyond the simple act of selling mere structures. Indeed, smart cities must mirror people's real needs and territories' embedded values.

> For Mr. Natchitz, '*To enhance the attractivity of cities, construction companies must step aside and its inhabitants must take over.*' '*Construction companies,*' he mentioned, '*must connect with citizens by raising their awareness about the fact that it is the little actions they undertake that would influence the future looks and shapes of their cities.*'

We accept as true that smart cities cannot be built but through trial-and-error: we try, we fall, we get up, and then we try again. Hence, by collaborating with other stakeholders, we would be able to identify the real problems that are holding our cities back and come up with solutions that could allow us to move ahead.

> '*Today,*' Mr. Rochet said, '*there is a shift from the technical to the methodical.*' '*Indeed,*' he said, '*people are less concerned today with the performance of technical services provided; what is instrumental form them is rather the performance of the social service that accompanies the technical.*'

This is practically accurate as construction companies are now delivering, not just technical performance but social one, too. Social performance, we say, relates to the well-being and quality of life of people. Adding that people's well-being is not preserved through the provision of, for instance, well-connected accommodation or cutting-edge heating systems, but lodgings that are located in pleasant sports, in a nice neighborhood, alongside charming street corner bistros. Hence, we acknowledge, the performance of a smart project is both financial and social.

> In Mr. Gérardin's expressions, '*people would be willing to pay more to live in an enjoyable neighborhood.*'

Normally, it takes time to build smart cities. They are often built successively, piece after piece, year-over-year. Indeed, over time, the raw idea that we had would materialize to convert into something tangible. Moreover, smart cities are collaborative systems where stakeholders join forces to put together the different pieces of the puzzle. If properly conceived and built, smart cities would be beneficial for all.

> For Mr. Gérardin, '*developers should be ready to make some sacrifices — say, allotting a 500 m^2 area (—equivalent to one million euros) for the building of green spaces, gyms, yoga spots, and kids zones (among others) — to boost the well-being of local communities.*' '*Even if such offerings are not always sufficiently payable,*' he expounded, '*they create sympathy and enhance the saleability of the final product.*' '*Enhancing social well-being,*' he closed, '*implies adding value to the property, thus making it understandably more expensive.*'

Moving on, in the wider property, the key focus of sustainability has been and still is to a greater extent, on environmental impacts (e.g. global warming and resource depletion). These are undeniably crucial but in our enthusiasm to tackle one problem we ignored another, equally important, one that is, the impact of buildings on people and especially the impacts from interior spaces that is where they spend most of their times. We know that sustainable buildings ought to support and help people live better, healthier and more productive lives but this metric has been marginalized or been seen in some cases as irrelevant up until now. People live indoor most of time. Buildings directly influence occupants' health and productivity. The effect of indoor environmental quality in buildings on occupants' health, well-being, and productivity is an important topic in occupational health and public health. To my knowledge, buildings, which are facilitated by green features, provide clean and more comfortable environment for their dwellers. Also, better ventilation, higher indoor air quality, environmentally friendly materials and optimized lightening are green building features that may positively influence people's well-being and health. Hence, smart constructions — as part of smart cities — are expectedly to bring well-being to people today while preparing the future for all.

5.2.3. *ENVIRONMENT*

We herein list and explicate the solutions suggested for the resolve of the formerly listed environmental (—and other) problems.

Organize hearing sessions for all people affected by the project. A smart project is often lengthy —and take years to be completed, which signifies that its impact on the environment —and so, on local communities living in its vicinities — could be sizeable, especially if no counteractive measures were clearly defined at start. In fact, whenever a company is handling a smart construction project, it has to think of the budding environmental impacts that could ensue from it. In addition, local communities living in the environs of the project should be kept informed about the works to be undertaken as well as of the benefits and costs that could result from it as those may influence them, their lives and well-being.

> As per Mr. Gérardin, '*construction companies must organize hearing sessions for all people who might directly or indirectly get affected by the project.*' '*Moreover,*' he revealed, '*in some specific cases, people should be entitled for financial compensations for the damages experienced during the course of the project.*'

Favor ecofriendly constructions. In our views, eco-friendly construction begins with a smart design. By thinking strategically and opting for the right materials and technology early, construction companies may contribute to saving the environment while cutting on project costs. Smart design means making the best use of space possible. It is a motive for developers to start thinking ingeniously about space — and the future of infrastructure. Something as simple as the placement of windows could make a whole great deal of difference to the atmosphere of a room. Innovative technology for construction companies assist in identifying the most strategic window positions to take advantage of sunlight and natural breezes. Insulation is another thing to consider when building eco-friendly properties. On a separate note, we avow that the life expectancy in architecture and construction is currently growing in importance. And that sustainable construction materials (e.g. brick, stone, and concrete) have a longer lifetime and are more eco-friendly during the demolition and disposal phase. Extensions, renovations, and refurbishments, we trust, are probably to stretch the life of a building, specifically when it is constructed using sustainable materials.

Use additive or other technologies and systems to boost energy efficiency. One of the early signs that additive manufacturing had made it in architecture was the shift from its use by designers solely as a tool for prototyping —to one that could be used to fabricate finished objects. Although slower than many mass-production processes, the increased design control and scalable customization afforded by the new technology through processes — such as 3D printing — has propelled its rapid growth within many industries[144]. Thanks to newfound capabilities, particularly relevant to architecture, additive manufacturing is taking another step forward: printing buildings in situ.

This capacity is possible mainly because of advances in concrete fabrication technologies. Chinese construction company, WinSun, for example, made headlines when it constructed ten single-room houses in Shanghai from 3D-printed modules in less than twenty-four hours. Although these were built from components that had been fabricated offsite, the company now is planning to produce entire structures —including bridges and tall office buildings— onsite. WinSun's material feedstock is a combination of cement, steel, glass fiber, and recycled construction debris. The use of waste materials is a clever strategy to diminish the carbon footprint of concrete —and the printing process ensures that construction workers are less likely to be exposed to potentially hazardous ingredients.

[144]Using Additive Manufacturing to Build With Materials Sourced From the Jobsite. Available from: https://www.architectmagazine.com/technology/using-additive-manufacturing-to-build-with-materials-sourced-from-the-jobsite_o (The webpage was last visited on 4-26-2020)

> According to Ronald Rael, '*nearly one-third of the global population currently lives in earthen buildings. The clear environmental and economic benefits of this construction method has inspired the recent development of novel strategies that combine onsite earthen construction with additive manufacturing techniques*' (a passage extracted from Earth Architecture, Princeton Architectural Press, 2009).

Moving forward, we affirm that construction companies should start integrating the environment into their construction processes. They should also provide end-users with service solutions, a set of smart things that could be implemented at city level in an attempt to boost its attractivity and livability. In reality, this, we say, could be achieved by focusing on two areas: 1) the improvement of waste management processes —and 2) the extensive use of RES[145]. Monaco is a good example of a smart, self-sufficient city-state that has very efficient waste management systems. In Monaco, waste rather than data is today's fuel oil. Indeed, through waste-to-energy technology, Monaco has now the capacity to process eighty thousand tonnes of waste per annum with energy recovery.

Concerning RES in particular, those could be used to promote sustainable constructions. For instance, a geothermal system harnesses temperatures below ground to warm residential homes or businesses. Pipes, led to a heat pump, either warm or cool buildings. Solar power converts the sun's radiation into energy. Installing solar panels may be expensive today, but in the long run saves a lot of money and energy consumption. The carbon footprint of these technology-led developments was reported to be significantly lower than traditional constructions, as well as being cheaper to run, and producing less waste[146].

In finale, we highlight that the development and deployment of digital technologies and processes — value chain digitalization — is central to the required transformation of the construction industry. Innovations of this kind, we proclaim, would unquestionably enable new functionalities along the entire value chain, from the early design phase to the very end of an asset's lifecycle at the demolition phase. According to a recent study[147], full-scale digitalization (—the use of big data and analytics, as well as new simulation and virtual reality methods) in nonresidential constructions would be, within ten years, capable of producing annual global cost and resource savings of nearly one trillion dollars on engineering and construction. Indeed,

[145]Technical terms and acronyms in construction could be found here: https://www.allacronyms.com/BM/construction
[146]Scientists are taking concrete steps towards reducing cement's massive carbon footprint. Available from: https://qz.com/1748561/%E2%80%A8reducing-cements-carbon-footprint-is-critical-to-climate-fight/ (The webpage was last visited on 4-27-2020)
[147]Shaping the future of construction: A breakthrough in mindset and technology. Available from: (http://www3.weforum.org/docs/WEF_Shaping_the_Future_of_Construction_full_report__.pdf) (The web link was last visited on 4-27-2020)

by exploiting mobile connectivity and augmented reality, construction companies would be entitled to progress the performance of their production processes by engaging in real-time communication and by providing stakeholders with additional on-site data.

Use of innovative, ecofriendly, cost-effective construction materials. Just as the definition declares, sustainability is meant to make something last. The main idea of using sustainable building materials is to construct homes that last —and longer lasting homes mean lower maintenance costs and less up-keeps. A cost reduction and extended life span are two remarkable benefits that could draw construction companies' attention. Apart from economic benefits, other, nonfinancial incentives may also push construction companies to use sustainable construction materials — explicitly: decreased carbon footprint, increased home resale value, shorter on-market periods (among others).

> To my knowledge — and based on previous chitchats with peers, '*a home that employs third-party certifications for sustainability may on average sell for 10-15% more than a similar non-certified home.*'

Encourage smart and ecofriendly initiatives (urban-village). Whenever creating a smart city, environmental issues should be prioritized —and be seriously addressed (e.g. energy efficiency, carbon footprint, building energy performance, etc.). In Paris, the building of eco-districts is on the go now. Though these constructions are not smart per se, they are sustainable and eco-friendly. In the realm of smart cities, construction companies' priorities must shift from the pure economic to the environmental —and the social (not necessarily in that order!). Indeed, in their projects, they must ensure some sort of evenness between all three dimensions. Today, if one asks a client, where do you prefer to live or what amenities do you seek most. His answers would mostly relate to the environment. This partially explains the growing interest among companies for the environment —and why the spectrum of construction projects is lengthening beyond the structures built per se, to cover their surroundings — and sometimes the entire neighborhoods in which they are sited.

Generally, people choose where to live based on two factors: the atmosphere of the area (livability and mobility), and the living environment (cleanliness, open spaces, natural sights, greenery, and others). This is, we proclaim, what smart cities are all about — the sum of its components — among which the environment.

> For Mr. Gérardin, '*construction companies are nowadays building milieus rather than mere constructions; places where people would be willing to live and social collective welfare could be upheld.*' '*Eco-friendly, smart initiatives,*' he said, '*are*

> *much needed today in France —something like the Chinese urban-village concept; they should be encouraged, indorsed, or even sponsored.*'
>
> In Mr. Natchitz's arguments, '*Butte-aux-Cailles is a great example of a French urban-village.*'

5.2.4. *TECHNICAL*

We herein list and explicate the solutions suggested for the resolve of the formerly listed technical (—and other) problems.

Assign central operator to oversee execution works. Today, we do not actually have to reinvent the wheel, as many available tools could be used to restore the construction industry's situation. Generally, the management of big projects is a complex affair, thus the importance of relying on specialized technologies, such as BIM to ensure construction projects are managed efficiently, all stakeholders have access to the same data, and work progress is trailed on a regular basis. In addition, there is a need to centralize decision-making, where authority and control are placed in the hands of a maven entity that could push construction works forward and safeguard the quality of the product throughout the entire construction process. This is in fact what the suggested GC BM is all about. Under the said model, we clarify; the GC would be in charge of all construction works, from initiation to closure. He would also assume the entire risks associated with the project. As for the project owner, he could partake in the very early programming stages (e.g. deadlines, validations, documentations, etc.) of the project —and then withdraws, giving the relay to the GC who would take over and act as a delegated project owner

> In Mrs. Tiscornia's languages, '*the suggested GC BM, resembling a bit to a concession model*[148]*, may indeed serve as a solution for the various challenges encountered at the industry level today.*' '*The project owner would subcontract a GC,*' she clarified, '*who has sufficient knowledge and expertise in construction for the handling and managing of smart constructions.*' '*Under the GC BM*,' she concluded, '*the centralized entity in charge of the entire construction process — that is, the GC —would be ultimately held responsible for the success or failure of the project.*'
>
> As for Mrs. Nabih, '*a conductor or an integrator role in definitely necessary in the construction sphere today, pointing out that, though such a role could be efficiently played by a GC, it could also be apportioned to several entities rather than just one.*' '*The main concern at this level,*' she clarified, '*lies in the fact that large projects are the proprietorship of public entities who, routinely, through passive bidding processes, commission them to the cheapest, often incompetent bidders.*'

[148]The concession model involves a designated space in a department store that operates somewhat autonomously — with its own signage, walls, furniture and displays; it provides its own staff, and has more control over distribution by moving away from the wholesale model and selling products direct to consumers.

> ‘*This puts a question mark on the ability of project owners to delegate their roles to the right entities*’ she concluded.

Rely on organizational change to drive industry growth. Given that large construction projects are often state-controlled, we believe the GC (—being the delegated project owner) would have a somewhat limited supervisory rather decision-maker or conductor role.

> For Mrs. Hayman, ‘*large construction projects are often lengthy and associated with a bunch of operational issues.*’ ‘*And so,*’ she elucidated, ‘*if a GC or any other competent entity comes to the replace the incompetent project owner, this would unquestionably mark the debut of a period where the role of public authorities in the construction sector has started to fade.*’ ‘*The GC would play a crucial role by bringing all stakeholders together —and the change he would bring must focus on the downstream that is, the very early stages of a construction process*’ she added. ‘*The rest,’* she closed, *‘would automatically take care of itself.*’

In our eyes, the GC BM we are proposing is comparable to the Design-Build delivery system where the project owner contracts construction works to only one entity. Under the Design-Build delivery system, the owner only communicates with one entity whose responsibilities and liabilities are clearly defined. Cost and time savings could be realized as stakeholders would work in tandem, synchronically.

Likewise, we trust the GC BM to overlaps a bit with another well-known construction project delivery system, which is based on the engagement of a CM who provides professional construction management services (— including construction costs, scheduling safety procedures, and others) at the early stages of construction processes. Under the GC BM, the GC would be handling such tasks.

Moreover, resemblances could be dotted with the PM delivery system, where the owner hires an independent PM to manage the entire project on his behalf. The underlying assumption at this point is the outsourcing of the responsibility for the entire project to a separate entity on behalf of the owner. This might be the case if in-house experience is insufficient to undertake a construction project and impermanent professionals are required to arrange and control the planning, the design and the construction process. We lastly shed light on the fact that the GC BM is also comparable to the Build-Own-Operate-Transfer system in the sense that, in both systems, the owner contracts solely with a single turnkey contractor. Under the GC BM, based on the project scope and the objectives assigned to it, the GC is expectedly to play several roles, that of a CM —of a PM —as well as of a turnkey contractor (—refer to Chapter 1 for more details in this regard).

(—see Figure 45 shown below for a simple illustration of the GC BM)

According to Mrs. Tiscornia, '*what the construction industry needs today is an organizational change, a new project management model, that construction companies could opt for to competently oversee and manage large construction projects.*' '*Under the GC BM,*' she expounded, '*the GC would ensure the delivery of the project on time and within budget; decide of the workflow (what to do, when and where, and by whom?); synchronize construction works; and signal opportune intervention moments for stakeholders.*'

Perceiving things from a slightly different angle, for Mr. Gérardin, '*innovation in construction should now focus on the resourceful design and management of ground floors.*' In his views, '*apposite urban governance requires the ground floors of buildings to work symbiotically with the surrounding sidewalks and public spaces.*' '*Together,*' he added, '*they provide a continuous network of pathways and experiences that are active, safe, comfortable and engaging.*' '*Innovation,*' he finally clarified, '*often ensues from the little things we do, the incremental improvements we bring to our business models, to our constructions.*'

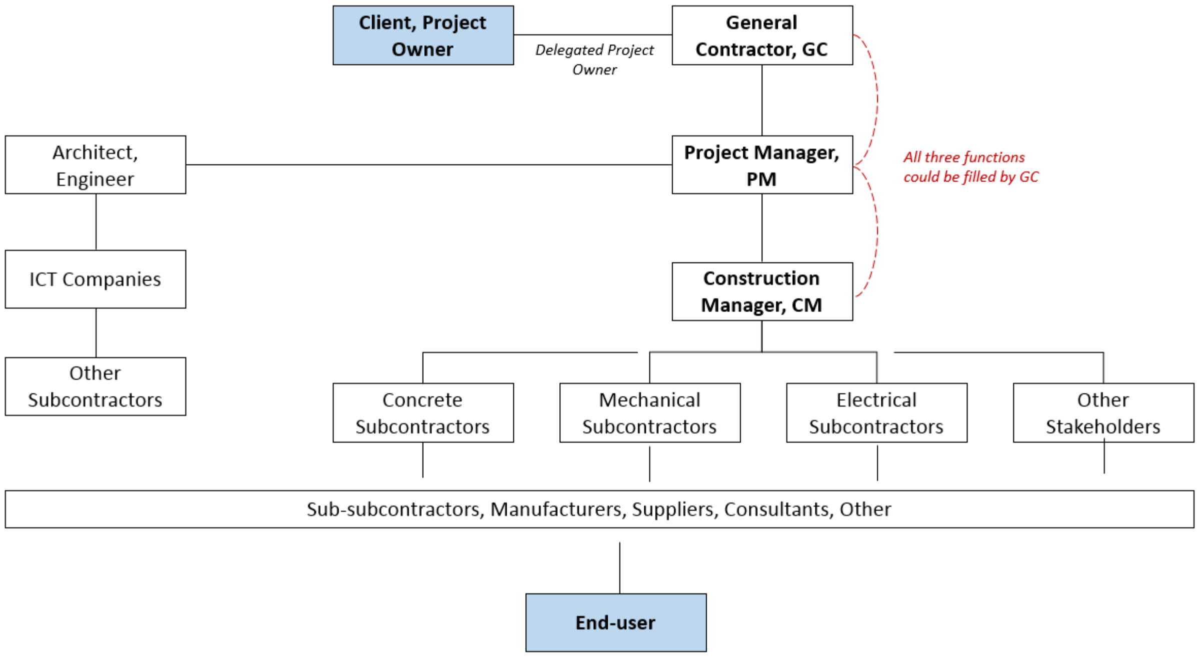


Figure 46. Simple graphical illustration of the GC BM
Source: Created by the author

Set cohesive plan for the execution and tracking of construction works. A smart city is a blend of different components that are linked together, thus forming a coherent system where people could work, live and prosper. The cities we live in today were built hundreds of years ago and the changes we bring to them are often done gradually. What we are doing today is adapting our cities so they could become smarter. Moving on, it is worth mentioning that smart constructions are complex; they go through various stages with lots of intervenors stepping in and out at each stage. Deciphering the boundaries of smart cities and matching our offerings with customers' needs are surely important, yet what is really needed today is a cohesive plan for the execution and tracking of large construction works.

For Mr. Bruckel, '*there is definitely need today for a managerial innovation that would help construction companies to execute large construction projects skillfully — and to create healthy ties with stakeholders operating down and upstream the value chain.*' Similarly, in Mr. Gérardin's expressions, '*whenever we think about smart cities, it is the governance component that we should focus on and improve.*'

This does not relate to the technicalities of projects but rather to the way projects are being executed and managed. The central idea here revolves around the ability of construction companies to efficiently manage their day-to-day operations (e.g. define clear objectives and work plans, set precise timelines and budgets for the execution of projects, and others).

'*Under the GC BM, the GC would be consigned by the project owner to ensure the smooth running of large construction projects*' Mr. Bruckel concluded.

Better innovation management practices. The construction industry in France (and around the world) has long been urged to innovate, but innovation has been elusive because of the inherent social and organizational complexity of construction. Focusing on the practice of innovating requires exploring the enabling capability of solutions for practitioners to establish novel ways of doing things for improvement, referred to as —innovative capability. BIM has been promoted as an enabler of innovation in construction design because of its data management capabilities and the opportunities for interdisciplinary work based on them. Today, the construction industry seems to be underperforming and failing to deliver optimum value and the lack of communication and coordination among various stakeholders has been seen as a major reason of this. Consequently, the need for innovation to improve communication and coordination has been a recurrent theme. Nevertheless, the construction industry and its projects exhibit social and organizational complexity, which makes innovation difficult to define, implement, and use. This suggests that practice is the locus of innovation in construction. Therefore, developing an insight into the practice of innovating is necessary in order to produce knowledge on innovation that has practical application. Indeed, what France based construction companies must do today to improve their innovation management practices and succeed their smart city projects is to find a median-solution, an alternative to two extreme approaches, the technology-centered and the human-centered.

Set efficient budgeting systems and flexible timelines. A budget is a statement of the amount of money that is available to spend over a period of time, or on a specific thing. It may comprise an outline plan for how that money would be spent, and a breakdown of the items it would be spent on. Overall, budgets for construction projects help determine what is affordable —and should be set as early as possible. It is central for a project budgets to be based on evidence and realistic. A project budget could be established through the assessment of projected income and expenses through the lifecycle of the project, comparison with similar projects, and pre-design analysis of requirements (among others). Usually, the project budget is set by the project owner and is distinct from cost plans prepared by a construction company which are likely to solely focus on construction costs. In large construction projects, it is common that the budget and the brief diverge over time and it is for this reason that careful cost control is important (—task handled by the GC, under the GC BM). It is also important that the project owner makes clear what costs should be monitored by the construction company and what would remain within his control. Architects often design in a vacuum. Cost and budget are key constraints that should always be identified and considered when designing a construction project, even when the provision of cost advice is expressly excluded from the architect's obligations. Alike construction budgets, construction timelines should be realistic and flexible, accounting for unforeseen events that may occur during the lifecycle of a project and may delay its execution. A proper construction timeline is one that allows adequate time for the delivery of supplies as well as time for unfortunate and unforeseen hassles like order mix-ups, construction snags or inclement weather —just to cite a few. In Anglo-Saxon countries, successful projects often start with a maven GC — an experienced GC who has ample savoir-faire in the execution of construction projects in general brings so much to the table when it comes to thorough construction management.

> In Mr. Gérardin's languages, '*even though hiring an expert GC could be sometimes costly, the connections and resources he is likely to bring with him would be beneficial for the client and the project in the long run.*'

Assign specialized entity to handle after-sales services and maintenance works. In construction, maintenance is the process of ensuring that buildings and other assets retain a good appearance and operate at optimum efficiency. Inadequate maintenance could result in decay, degradation and reduced performance and could affect heath and threaten the safety of users, occupants and others in the vicinity. Depending on its design, quality of materials and workmanship, function and location, buildings deteriorate at different rates and require different levels of attention. Though no building would ever be maintenance-free, the quality of the design and workmanship could sustain the final output by minimizing the level of maintenance it requires. Under the GC BM, the role of the GC would extend to post delivery of final product, to handling after-sales and maintenance services. This is a service solution — in response to inadequate maintenance and responsibility diffusion problems encountered in projects built and delivered under the old construction industry's BM — by which the GC guarantees assets would retain a good appearance and operate at optimum efficiency over time.

Table 37 shown below summarizes suggested solutions for problems encountered in French context.

CONSTRUCTION STAGE	BIM-PROCESS	SOLUTIONS			
		ECONOMIC	ENVIRONMENTAL	SOCIAL	TECHNICAL
INITIATION & CONCEPTION	PROGRAMMING	• Espouse a centralized decision making process • Ensure final product has a use-value and that utility may be extracted from it • Adjust offerings to exact needs and requirements of end-users	• Favor eco-friendly constructions	• Promote collaborative urban governance schemes (social constructivism) • Partner with local communities for the conception and building of smart developments • Administer smart developments following a bottom-up managerial approach	• Assign central operator to oversee execution works • Rely on organizational change to drive industry growth • Set efficient budgeting systems and flexible timelines
	CONCEPTUAL DESIGN	• Ensure involvement of end-users in all stages of construction process	• Organize hearing sessions for all people affected by the project		
PLANNING	DETAILED DESIGN	• Recognize end-users as both data sources and innovation creators • Co-create value by co-conceiving construction projects • Allow for customizability (portfolio diversification)		• Rely on collective thinking and intelligence to conceive and execute smart developments	
	ANALYSIS	• Identify and target underserved market segments	• Encourage smart and eco-friendly initiatives (urban-village)		
	DOCUMENTATION				• Set cohesive plan for the execution and tracking of construction works
LAUNCH & EXECUTION	FABRICATION	• Rely on services of external partners to achieve specialized tasks (outsourcing) • Manage stakeholders involved in the process and clear up roles and responsibilities • Ensure apposite cueing and synchronization among construction actors • Build a lengthy network of industry partners	• Use of innovative, eco-friendly, cost-effective construction materials • Use additive or other technologies and systems to boost energy efficiency	• Set up effective stakeholder management strategies	
	CONSTRUCTION 4D/5D	• Lower risk of premature technology obsolescence		• Create value in networks: profit sharing logic	• Better innovation management practices
	LOGISTICS	• Abridge logistics and procurement costs • Improve work quality and curb maintenance costs			
MONITORING & CONTROL	OPERATION & MAINTENANCE	• Improve attractivity and absorption capacity of city			
CLOSURE	OPERATION & MAINTENANCE			• Enhance end-users' wellbeing and quality of lives	• Assign specialized entity to handle after-sales services and maintenance works
RESTORE, RENOVATE, REMODEL	DEMOLITION & RENOVATION				

Table 37. Key solutions in construction (France)
Source: Created by the author

5.3. THE GENERAL CONTRACTOR BUSINESS MODEL

Frankly, it is the existence of various problems in construction, which remain unsolved to date, that stirred me to think of a GC BM for the building of smart cities in the first place. Using the GC BM, problems identified and solutions suggested for their resolve were mapped across different dimensions of construction projects. For this, we used the TLBMC, being part of our GC BM, to which we added a fourth layer: technical (―stratum 4). This addition was compulsory, as we were not able to fit all problems identified into the envelopes of existing layers: economic, social, or environmental. In our views, some problems are rather technical, relating to the technicalities of projects, with the ability to sway the productivity of construction projects, among which passive bidding processes and legal and institutional barriers. Therefore, by adding an extra layer, we have widened the spectrum of the TLBMC. In addition, as you would have noticed by now, some of the identified problems were labeled off-balance. Those are problems that we, as construction companies, have zero control on, yet could pointedly sway our planning and project management capabilities. As exemplified in Chapter 4, some of those problems found the boundaries of our GC BM.

The GC BM, as its name suggests it, revolves around a central operator ― a general contractor, consigned to manage and oversee groundworks in large and complex construction projects. He oversees the whole construction process, from initiation to closure. As a delegated or acting project owner, he replaces the project owner throughout the entire construction project lifecycle. Endowed with necessary power and authority, the GC, a maven decision-maker, is entrusted to make the right decisions at the right times. He assumes all risks associated with the project and is accountable for its success or failure. Ensuring interoperability between stakeholders involved in the process is among his key tasks. For the most part, his role consists in synchronizing construction works and cueing intervention moments. As discussed throughout the present study, the GC resembles a music conductor (―and a cook) whose primary obligation is to create coherent arrangements permitting the production of quality outputs. The GC’s role is managerial by nature. He ensures control over the quality of construction works and keep communication channels open between all stakeholders involved in the construction process.

Putting the GC role aside, under the GC BM, end-users become part of construction processes, construction actors who partake in the process from the very early stages of initiation until the very late stages of closure and delivery. Indeed, they act as co-creators of value and innovation.

Overall, the GC BM is a collaborative governance model where all stakeholders work together, each contributing a piece to the final output, among others: architects handle drawings, ICT companies work on the digital infrastructure design of the project, and construction staff ensure construction works are delivered on time. It is through collaborative work and effort that smart cities are constructed.

As previously evoked, the GC BM is made of six connected strata (—see Chapter 4 for further insights into this). The pivotal one is stratum 1: construction stage. This is factual in the sense that construction projects are stage-based and that problems faced in construction are likely to vary on a stage basis. Moving on, given that innovation is technology-enabled, we chose to add stratum 2 to our GC BM: BIM process. BIM benefits are numerous, including four main efficiency factors: improved collaboration, reduced costs, time saving, and increased sustainability[149]. However the practicality of BIM technology, the latter remains misused by France based construction companies today. Stratum 2 has been integrated into the model in such a way it was imbedded into stratum 1. This enabled us to split construction stages into smaller pieces so that the tracking and management of construction works could be performed at a more micro level. Construction actors denote stratum 3 of our GC BM. As recurrently evoked, there are numerous stakeholders involved in a construction process, stepping in and out the value chain during life span of a construction project. They are likely to change each time we move through the stages of a project. Thus by manipulating stratum 1, and accordingly stratum 2, we could have a visual of who does what (stratum 3), and at which stage (strata 1 and 2).

Regarding stratum 4, it represents the different dimensions of a construction project. Those are symbolized by the TLBMC layers, in the number of four: economic, social, environmental and technical. Besides, given that our BM is catered for the building of smart cities, it seems obvious that smart city components should be part of it, stratum 5. Moving on, we explain, instead of directly linking the TLBMC layers to their corresponding building blocks, we have included a control variable in between the two: smart city components. This stratum allows for companies to track construction activities while ensuring the different constituents of a smart city are accounted for in their projects. Finally, stratum 6 represents the TLBMC building blocks. By varying inputs at level of stratum 4, the ensuing output at the level of strata 5 and 6 would automatically change. In our GC BM, there are three strata that could be used for

[149]Four BIM Cost Savings and Efficiency Factor. Available from: https://www.kreo.net/blog/bim-cost-savings-and-efficiency-factors (The webpage was last visited on 5-14-2020).

simulative purposes: one, two and four. We note at this point that a business model simulator, scripted in Angular 2+, was created for the running of real-time simulations. Constructed using the funnel technique — going from the most general to the most specific, our GC BM is original in the fact that it is a BM as much as it is a piloting tool — precisely, a dual-use BM. Strata 1 thru 6 form the piloting tool, whereas strata 4 thru 6 form the business model. At last, it is worth noting that our GC BM is both solution-based and multi-sided. Solution-based because we use it to map problems faced at each stage of the construction process; also, by categorizing them based on their types. And multi-sided because the GC plays the role of a connector, ensuring works performed throughout the lifecycle of the project roll harmoniously and synchronically; he also acts as an intermediary who transmits data along the value chain, end-to-end, from project owners, downstream —all the way up to end-users, upstream.

5.3.1. *BREAKDOWN OF PROBLEMS*

The breakdown of problems identified in earlier subsections was done using the GC BM, minus two strata: stratum 2 (BIM process) and stratum 5 (smart city components). Indeed, we use a less extensive version of the GC BM, a four- rather than six-stratum BM, for the reporting of problems faced in construction today. We do so for one forthright reason that is, under current circumstances, BIM technology and smart city components are not integral parts of the prevalent construction industry's value chain in France. (—see Table 38 shown below for a sneak peek into the breakdown of problems in construction across the TLBMC's layers and building blocks[150]) In the next subsection, we present a breakdown of problems faced in construction today and explain existing dependencies among them. The problems identified are dispensed across the various buildings blocks of the GC BM —in the number of 34. For the explanation of dependencies, we select a few problems and explain them using texts and graphs. Adding that no dependencies graphs were generated for O-B problems, though some of them are mentioned in the text. The graphs used show two visuals, one for construction process map and another one for dependencies. Construction process maps reveal the whole BM picture for each identified problem, by displaying the linkages between its four strata —whereas dependency graphs indicate how problems are disseminated across layers and how they link up with one another.

[150]Not showing O-B problems.

ECONOMIC		
PARTNERS • *High number of stakeholders with overlapping roles and responsibilities* • *Discoordination between construction actors*	**ACTIVITIES** • *Project process confused for business model* • *Decentralized decision-making* • *Innovation mismanagement* • *Absence of an entity that could orchestrate time horizons and handle maintenance works*	**RESOURCES** • *Fragmented projects*
CUSTOMER SEGMENTS	**CUSTOMER RELATIONSHIP** • *Top-down managerial approach*	**CHANNELS**
VALUE PROPOSITION • *Failing BM leading to abridged growth prospects at industry level* • *Lack of understanding of smart construction process* • *Big companies' resistance to change* • *Constricted approach to value creation* • *Loss of control over quality of works* • *Mismatch between promised and delivered final product*	**COSTS** • *Faulty estimates leading to recurrent budget overruns* • *Scheduled timelines left in tatters* • *Additional costs incurred to integrate new technology and upgrade asset*	**REVENUES**
SOCIAL		
LOCAL COMMUNITIES	**GOVERNANCE** • *Banishment of any collaborative urban governance scheme*	**EMPLOYEES**
SOCIAL VALUE • *Outdated CVP* • *Broad concerns apropos the livability of assets*	**SOCIETAL CULTURE** • *Misconception of smart city notion*	**SCALE OF OUTREACH**
END-USER • *End-users not involved in the early stages of construction* • *End-users not being co-creators of value*	**SOCIAL IMPACTS** • *Criticism of final product by end-users*	**SOCIAL BENEFITS**
ENVIRONMENTAL		
SUPPLIES & OUTSOURCING	**PRODUCTION**	**MATERIALS** • *Non-sustainable construction*
FUNCTIONAL VALUE • *Lack of smart city initiatives and urban efforts* • *CSR-related topics occasionally conversed for mere marketing purposes*	**END OF LIFE**	**DISTRIBUTION** • *Large amount of logistics, pieces, and other resources tied in the process*
USE PHASE	**ENVIRONMENTAL IMPACTS**	**ENVIRONMENTAL BENEFITS**
TECHNICAL		
BIDDING PROCESS	**SMART CONSTRUCTION** • *Smart city projects as disconnected micro projects*	**LEGAL ASPECTS**
TECHNOLOGY • *Too much weight put on technology in the building of smart cities*	**ADMINISTRATION** • *Overlooked organizational innovation*	**HUMAN CENTRICITY** • *Smart constructions as pure technology demonstrators*
OFFERINGS • *Risk of technological obsolescence upon delivery of project*		

Table 38. Breakdown of problems: a sneak peek
Source: Created by the author

5.3.1.1. *DEPENDENCIES*

We use the TLBMC for the mapping of problems. In our views, problems should not be contemplated in silo, as, say, one economic problem could have repercussions, direct or indirect, on other noneconomic layers of the model. Indeed, problem dependencies could be dotted between layers and among building blocks. The same problems could even sometimes affect several building blocks within the same layer.

The **construction industry's failing BM** for instance falls within the model's economic layer, part of the **value proposition** building block. Indeed, a failing BM could lead to worsening offerings that do not match people's real needs and aspirations. This would over time influence other building blocks within the economic layer, **revenue** for instance. This is viable as inadequate value propositions would eventually lead to reduced sales and amplified stocks of unsold units, hence plummeting construction companies' financial returns. Other corollaries could be spotted at the level of other layers too. In fact, a **failing BM** may signpost the existence of a **weakening governance model**, thus affecting the **social layer** of the model, precisely its **governance** building block. Likewise, there might also be causality between a **failing BM** and a **deteriorating production system**, a system that does not for instance, encourage sustainable construction practices, which implies that the impact of the first economic problem may prolong to reach the model's **environment layer**, its **production** building block in particular.

This analysis suggests that problems in construction today do not only affect one specific model's component ― but on the contrary, their impact may extend to reach other components within. Thus, social, environmental and technical repercussions may perhaps supervene from economic problems – and vice versa. **Constricted approach to value creation** is another problem faced in construction today whose dependencies are similar to the ones formerly described. The same analysis could be used for the explanation of other problems, mainly: **lack of understanding of smart construction process** and **big companies' resistance to change** (―see Figure 47 shown below ―as you would notice; in this case, end-users are not part of process and do not partake in the conception of the project).

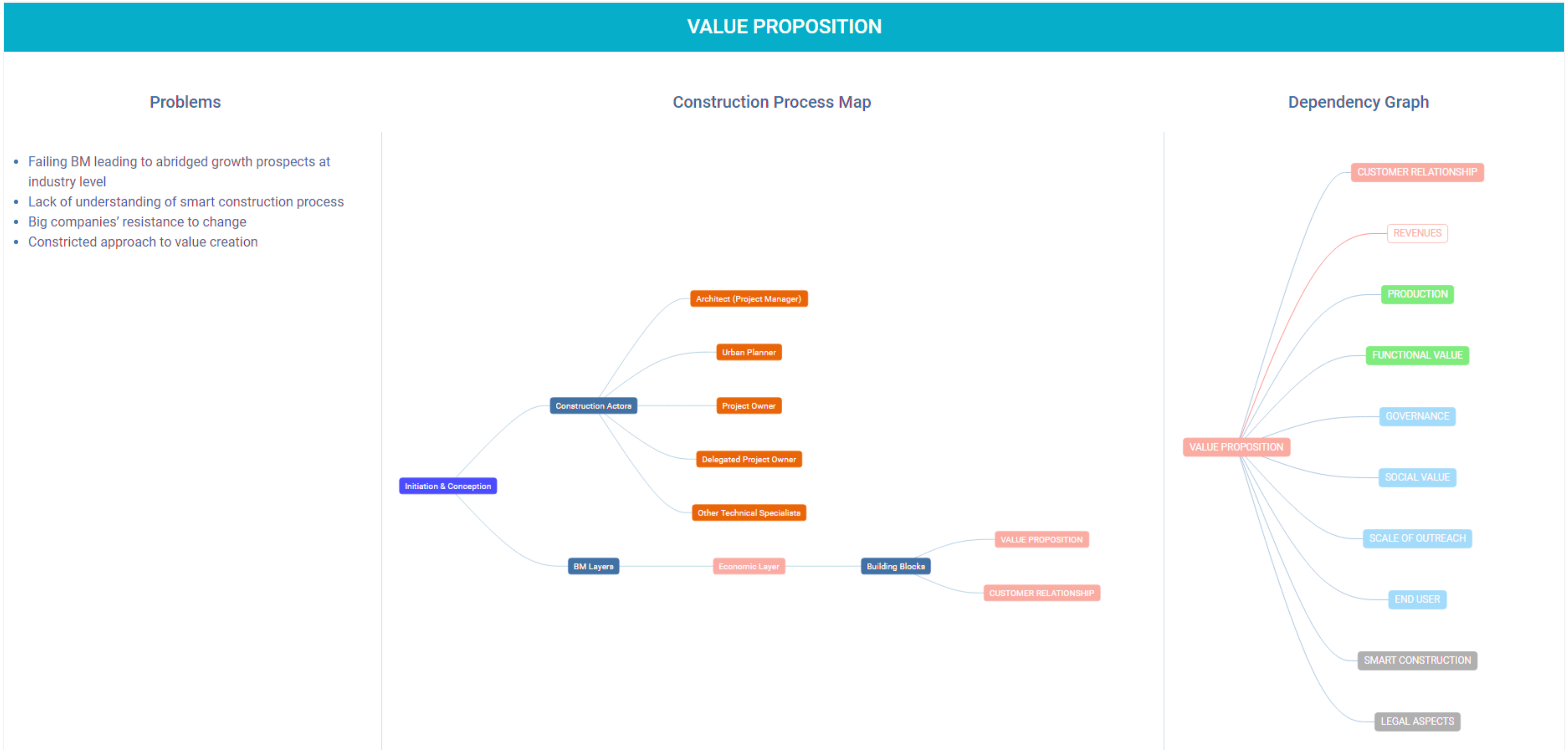


Figure 47. Dependency graph (Failing Business Model)

If we consider another problem, say **faulty estimates in construction —** for instance. The latter obviously falls within the economic layer of the model, within the **building block entitled costs**. As formerly evoked, faulty estimates are often the resultant of misinformed or incompetent project managers (architects) who make budget previsions that end up being erroneous. Though this problem is economic, it is also of a technical nature, linking to the technicalities of the project and triggering another problem, which is the **maladministration of large construction projects** in general. With that said, faulty estimates are thus to have an impact on the **technical layer** of the model, mainly its **administration building block**. If we were to extend our analysis further, we could say that significant faulty estimates could even lead in certain cases to the annulment of construction projects, thus affecting the **blocks activities and partners** within the model's economic layer. Simply because construction activities would be permanently stopped and money paid by partners, including investors, gone in the drain. This is an extreme scenario though. If we were to consider another, more conservative one where the budget, though underestimated, remains adjustable, we could assert that, construction companies, seeking to preserve their profit margins, would tend to correct their spending so they fit into the budget's envelope. Often, budget cuts are made at the detriment of the environment and social aspects of projects, which means that potential repercussions on the model's social and environmental layers could be expected too, possibly: **non-sustainable construction (—production block)** and **dissatisfied staff (—employees block).**

Our scrutiny could extend even farther to cover the very little ramifications that may potentially ensue from a given problem; however, the GC BM created for the purpose of this study only highlights some of the most-obvious dependencies between layers and building blocks. (—see Figure 48 shown below for a complete view of both the construction process and problem dependencies).

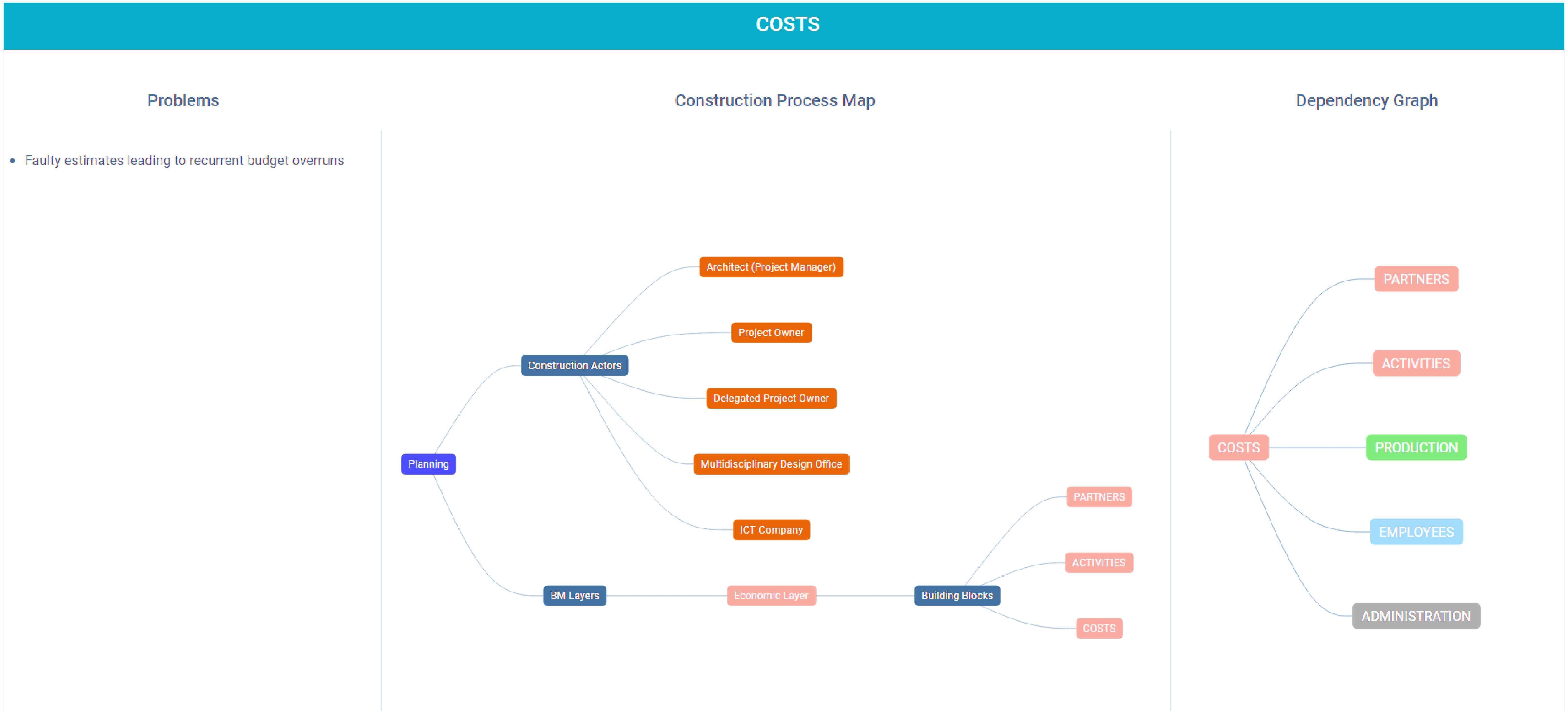


Figure 48. Dependency Graph (Faulty Estimates)

Moving forward, the **absence of an entity that could orchestrate time horizons and handle maintenance works** is another problem whose repercussions touch three building blocks within the economic layer, activities, value proposition, and costs. Often, delayed project deliveries are not exactly happily welcomed by end-users, which is possibly to (negatively) influence the company's relationship with its customers. Also, to incur extra unforeseen costs to be paid by companies for the restoration of structures (costs block within the model's economic layer). Such snags are often the resultant of mismanaged construction activities where the discoordination between stakeholders involved in the process would lead to time overruns and low-quality works that would necessitate huge maintenance works only a short while post-delivery. In the mid-to-long run, such a problem is likely to put companies' value propositions to the question. Consequently, the impact of the said problem extends from the economic to the social layer, trembling its end-user, social value, and social impacts building blocks (Figure 49).

By the same token, the **mismatch between promised and delivered final product** is another problem that finds its origins in the model's economic layer, at the level of its value proposition building block, yet extends to touch another block within the same layer, customer segments. As detailed in earlier subsections, construction actors make promises at the early stages of the construction process but fail to deliver at the end. This is factual as no construction company has control over the entire chain. With the relay passed on from one stakeholder to another throughout the construction project lifecycle, the promised product is likely to change stage after stage especially that no entity is overseeing the process, down to upstream (―affecting the model's activities block). Frequently, end-users get a final product different from the one expected, leading to their discontent (―relating to the customer relationship block). As for construction companies, they time-and-again mistakenly presume to know what their customers' needs really are. They deliver walls and roads, whereas end-users are looking for something different. Not all customers are the same, nor they have the same preferences and tastes. This is a vital piece of information that is often disregarded by construction companies. Hence, what construction companies end up proposing would be lacking the looked-for value. This suggests the problem identified has an influence that goes beyond the economic to reach the social, chiefly its end-user, social value, and social impacts blocks (Figure 50).

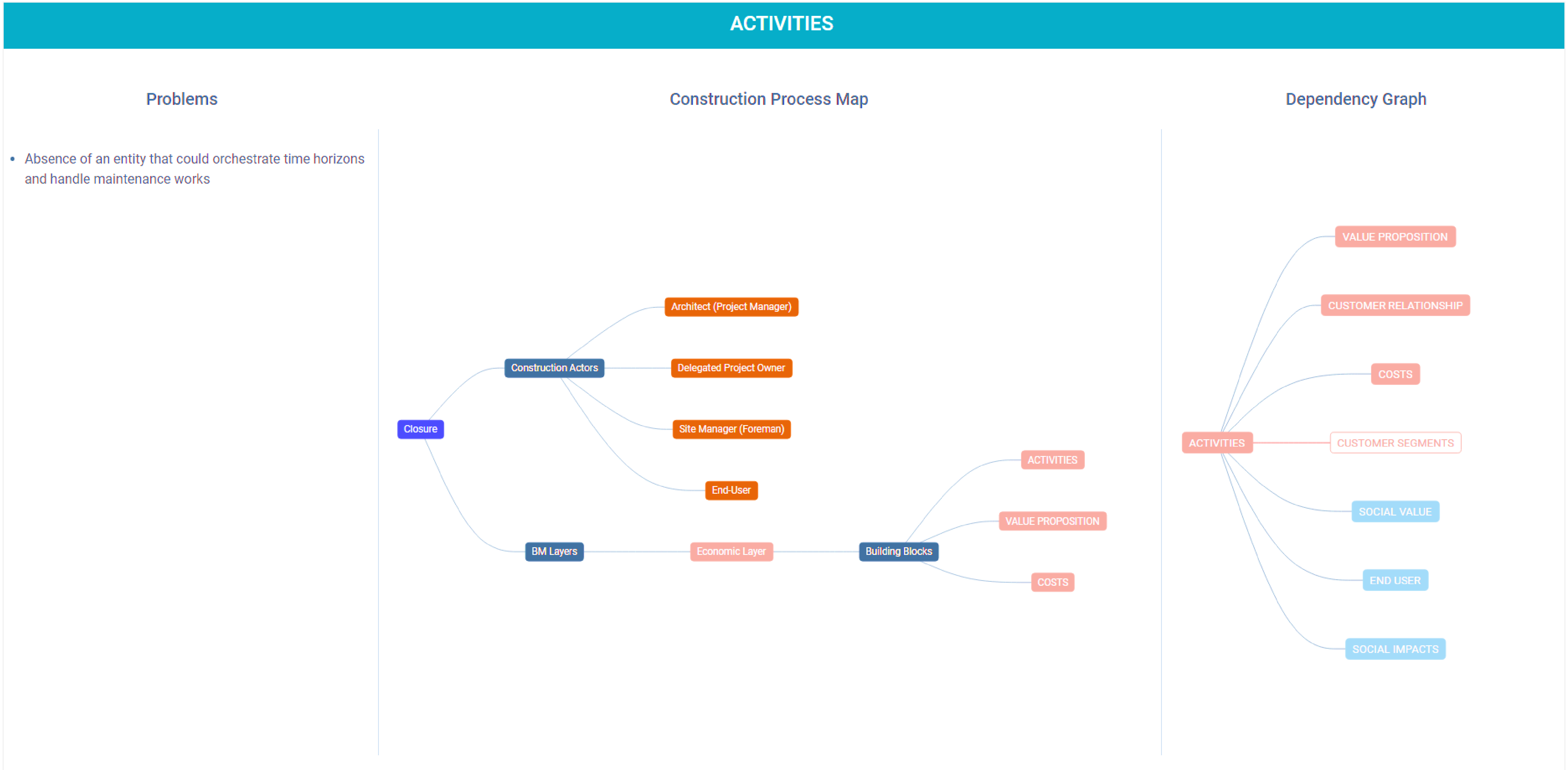


Figure 49. Dependency graph (Absence of an entity that could orchestrate time horizons and handle maintenance works)

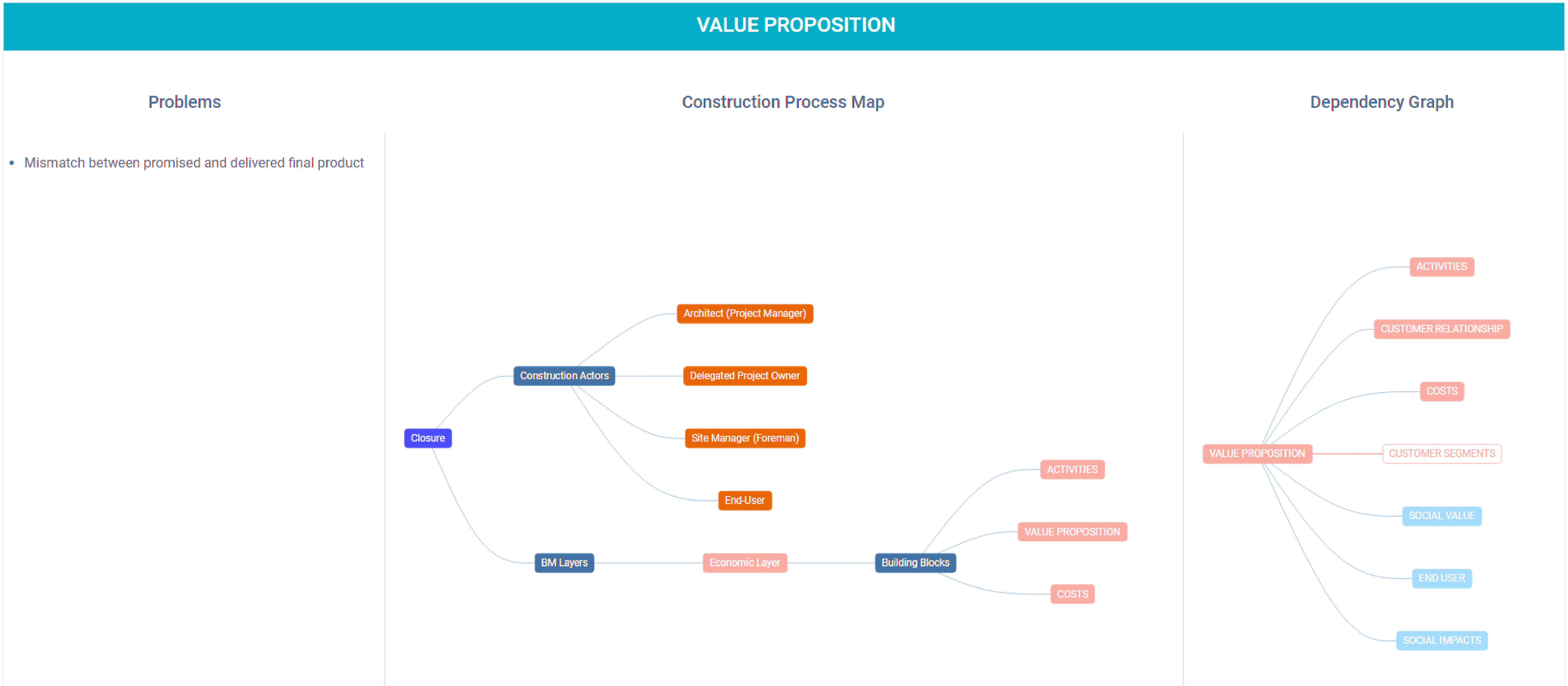


Figure 50. Dependency graph (Mismatch between promised and delivered product)

Additional costs incurred to integrate new technology and upgrade assets is a problem whose impact extends to cover almost all model's layers. At its name reveals it, it is part of the economic layer — the building block entitled cost. Ipso facto, we say, as costs rise, revenues would drop which means that the revenue building block would be also indirectly affected. To integrate new technology and upgrade assets, we assert, some serious renovation and restoration works would be required[151]; residents would have to evacuate their homes and people living near the project would have to suffer the consequences, loud noises and smashed environs. This implies potential repercussions on both social and environment layers, respectively their environment impacts and social impacts building blocks. Contemplating things from a different angle, we affirm that other aftermaths could be also marked at the level of those layers, especially that, in such settings, the expected life span of the property would be reduced (use-phase block), and end-users' would be frustrated as they have failed to extract any social value from the property purchased (social value block) (Figure 51).

Now let us take an example of an O-B problem that falls within the model's environment layer, its environment impact building block in specific: urbanization. Thus far, we have clearly explained that urbanization has now become a trend. Indeed, with the massive influx of people towards cities, increased pressure has been put on public good and services offered at city level. All held constant, urbanization could have some serious impacts on the well-being of local communities: poor living conditions, high unemployment and crime rates, and others. Unless big cities turn their territories into smart ones, urbanization would unquestionably have some adverse effects on its inhabitants. Thus, urbanization, which is initially an economic problem, a phenomenon where people flee their homes in destination of metropolises in pursuit of more and better opportunities, is likely to affect the model's social layer, mainly its local-communities building block. Capitalizing on what has been said, the lack of smart initiatives and urbanization efforts is a problem that could have some serious influence on a city's attractiveness and absorption capacity. The latter falls within the model's environment layer, its functional-value building block. However, such smart initiatives are part of companies' value propositions, therefore this infers that companies' offerings are to a certain extent outdated and distanced from people's requirements. Which in turn translate into lack of social value in the offerings made to end-users. With that said, the environment problem in question

[151]Some useful insights into the matter could be found at: https://www.khl.com/demolition-and-recycling-international/jacqueline-o-donovan-inside-looking-out-/127864.article (Interviews with Jacqueline O' Donovan and other industry experts)

is thus possibly to influence all model's layers, the economic through value propositions, the social through social value, and the technical through offerings.

On a separate note, under the old BM, we said, the **amount of logistics and other resources tied in the process of building smart cities** is large. This problem falls within the model's environment layer and directly touches its distribution building block. Nevertheless, it has also an indirect influence on another building block within the same layer: environment impact. This is genuine as the higher the amount of logistics and resources held in storage in the process, the higher the environment impact would be. Looking at things from a slightly different perspective, it would then be clearly noticeable that this problem relates to the model's economic layer as well, in the sense that the logistics of the project could also sway its economics. Precisely, depending on the project location for instance —and the channels used for the delivery of resources and materials, distribution costs may significantly rise or fall. Within this setting, the model's channels building block would be affected by the project logistics. The more we extend in our investigations, the more dependencies we would be able to spot. This reveals the dynamism of problems faced in construction today —thus the urgent need to find plausible solutions for their resolve (—Figure 52).

For now, it is conceivable that problems even if befalling within a specific layer, their impacts could extend to reach —or even instigate other problems in— other layers. This is mainly the case of **outdated CVP**, a problem that fall within the model's social layer, at the level of both its social value and end-user building blocks (—Figure 53). Outdated CVP relates to inadequate offerings (building block within technical layer) that do not align with people's real aspirations. A value proposition (—building block within economic layer) that does not hold use-value among its layers in the eyes of end-users (—relating to the use-phase building block within the environment layer). The said problem also sheds light on the fact that construction companies may be using their resources (—block within economic layer), financial and nonfinancial, inefficiently for the production of undesirable artefacts. Other dependencies may also apply, however those are indirect.

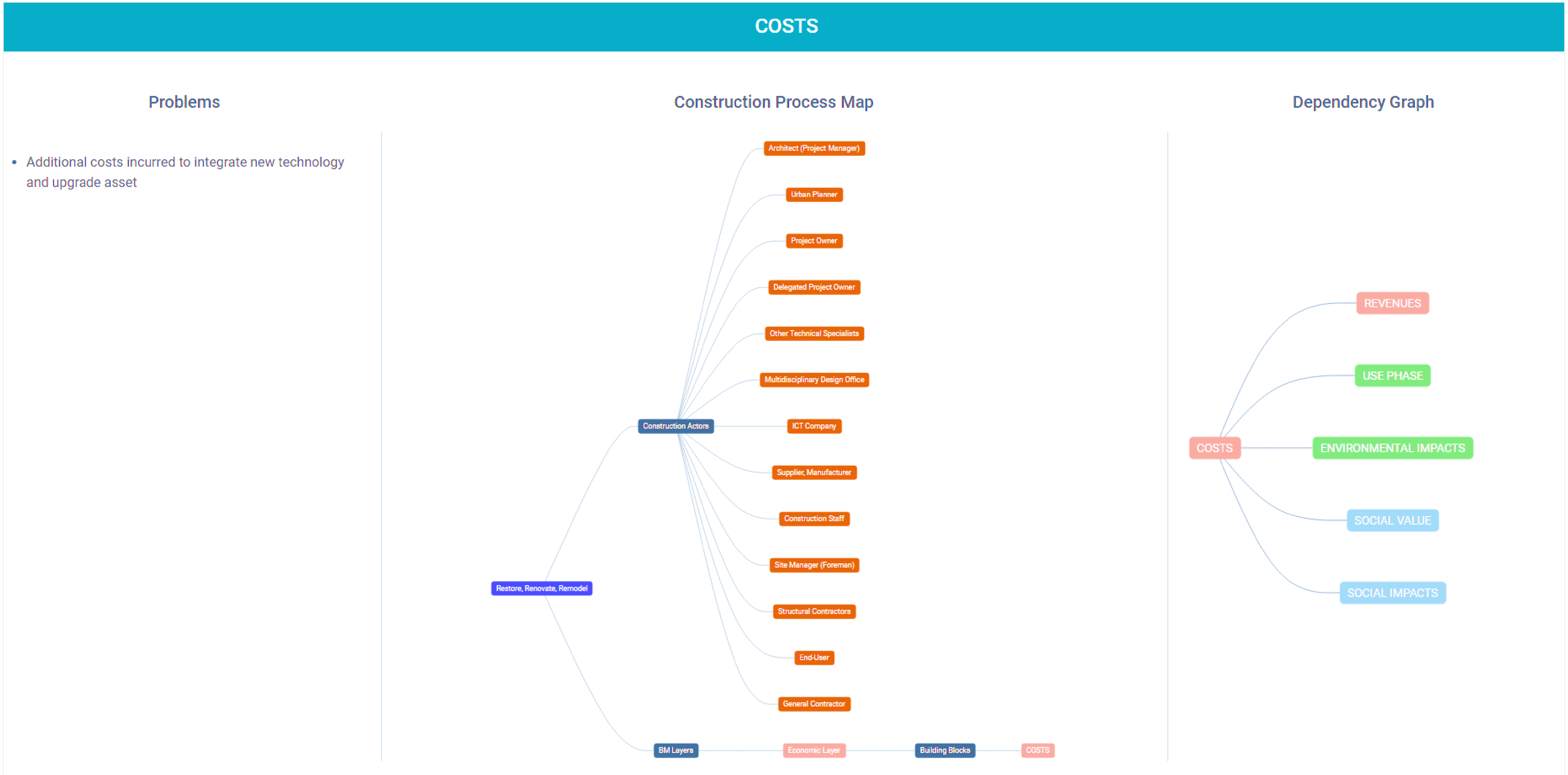


Figure 51. Dependency graph (Additional costs incurred to integrate new technology and upgrade asset)

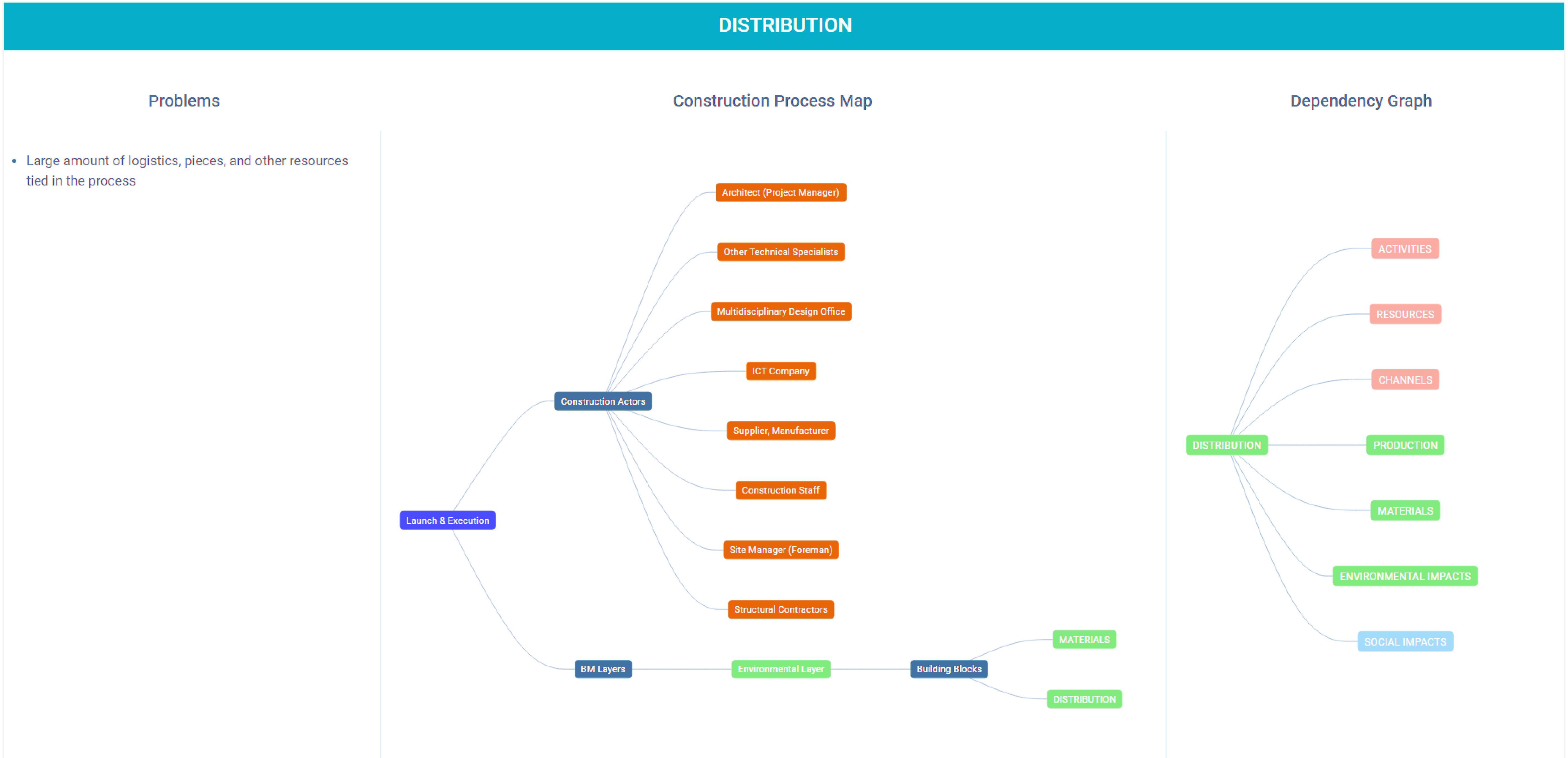


Figure 52. Dependency graph (Large amount of logistics, pieces, and other resources tied in the process)

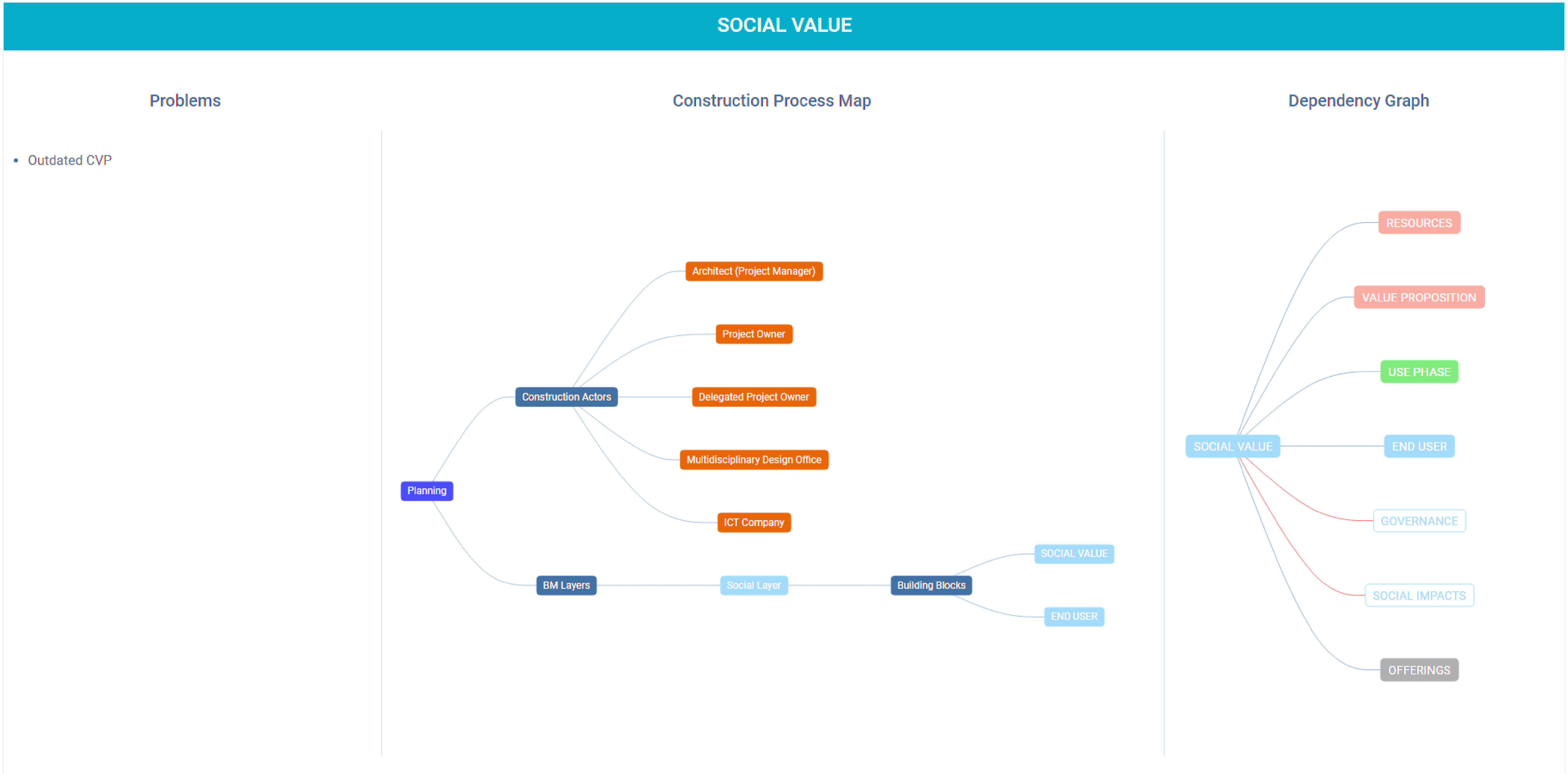


Figure 53. Dependency graph (Outdated CVP)

About **misconception of smart city notion**, this problem relates to the social as much as it does to the economic, environment and technical (—Figure 54). As reported throughout the present chapter, a smart city is a question of culture and governance —being the two affected building blocks within the social layer. On the economic and environment fronts, the dependency is straightforward, a smart city is a proposition which if it does not hold use and functional value among its layers would undoubtedly be destined to fail. Finally, a smart city is a blend of whole bunch of smart things, among which smart constructions befalling within the model's technical layer. We tackle one more social problem before discussing one technical problem and then closing this subsection: **end-users not being co-creators of value**. This problem falls within the model's social layer (—Figure 55); obviously, its end-users building block. As discussed, in the realm of smart cities, end-users are not only sources of data but creators of innovation too. Therefore, end-users are resources (or should be regarded as such!) that would help in the building process of smart cities. If not involved in the construction process, the odds offerings made by construction companies would be inadequate and lack value are high. Indeed, the life expectancy of final product would be shorter and the utility that end-users would extract from it would be trivial. Ultimately, the said problem would impact the entire customer journey.

Within the same rationality, we assert that, in smart city projects, the **risk of technological obsolescence upon delivery of final output** is normally high; especially that technology life span is shorter than that of a smart city project. Though such technical nuances are important with the possibility to sway the allure of construction companies' offerings and the economics of their projects, they repeatedly ignore them. This problem falls within the model's technical layer, its offerings building block — and within the economic layer, relating to value proposition. Given the massive gap between the life span of technology and that of a smart city project, whenever a technology becomes obsolete, some serious restoration works must be done to integrate new one and upgrade asset, thus affecting the model's environment layer, its end-of-life building block in specific (—Figure 56).

Now that the logic behind problem dependencies has been thoroughly explained, we carry on next by exhibiting and commentating the GC BM stage-based construction maps, showing plausible solutions to problems discussed in earlier subsections.

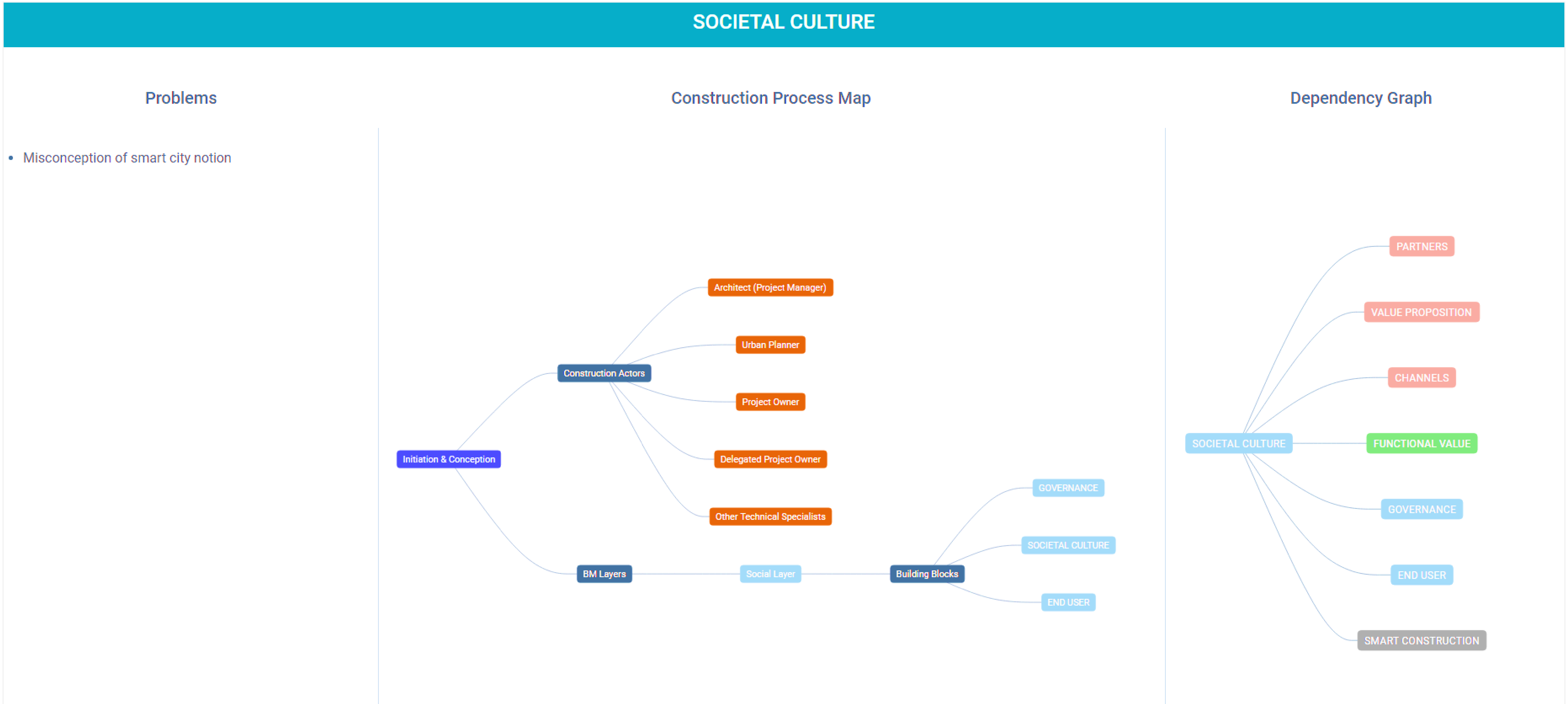


Figure 54. Dependency graph (Misconception of smart city notion)

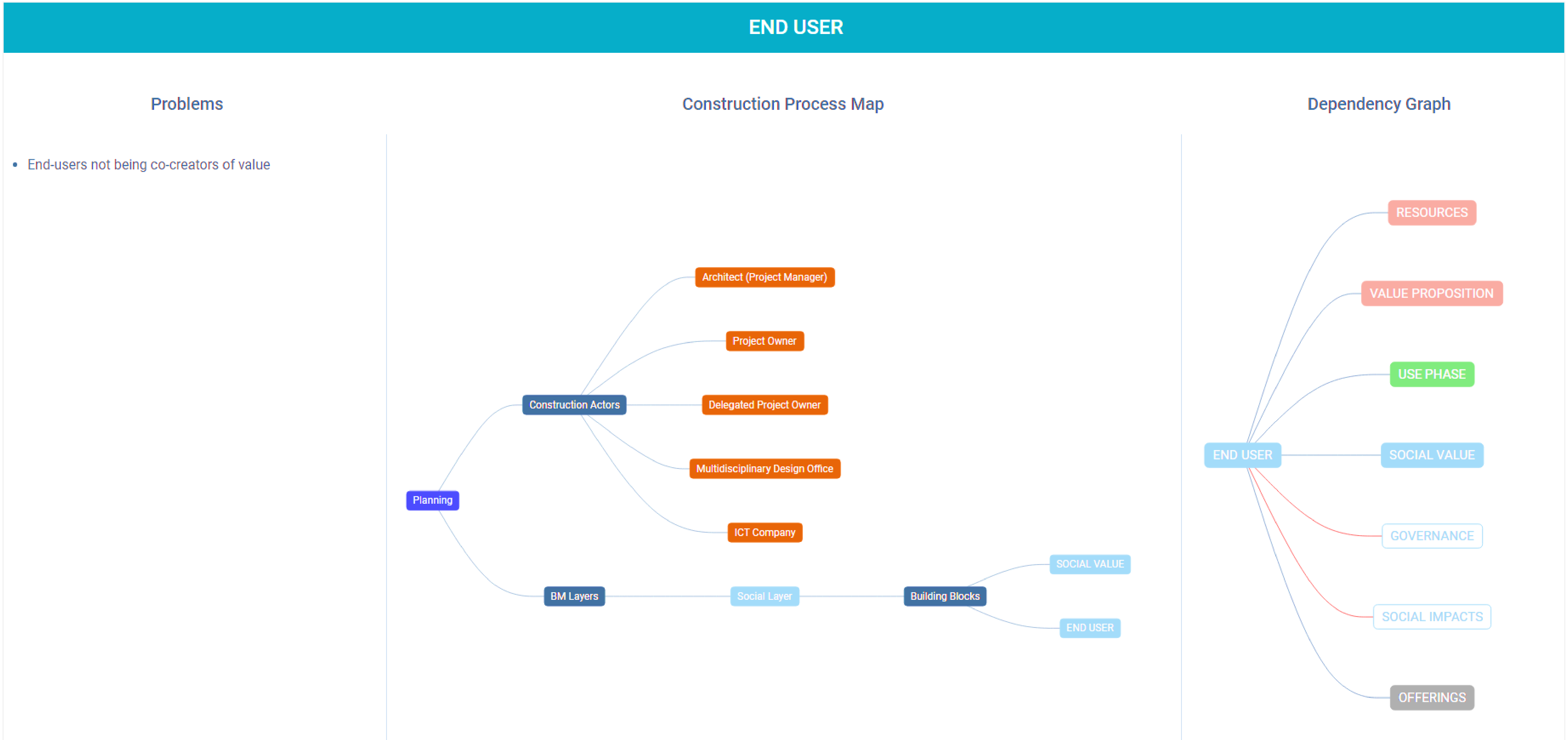


Figure 55. Dependency graph (End-users not being co-creators of value)

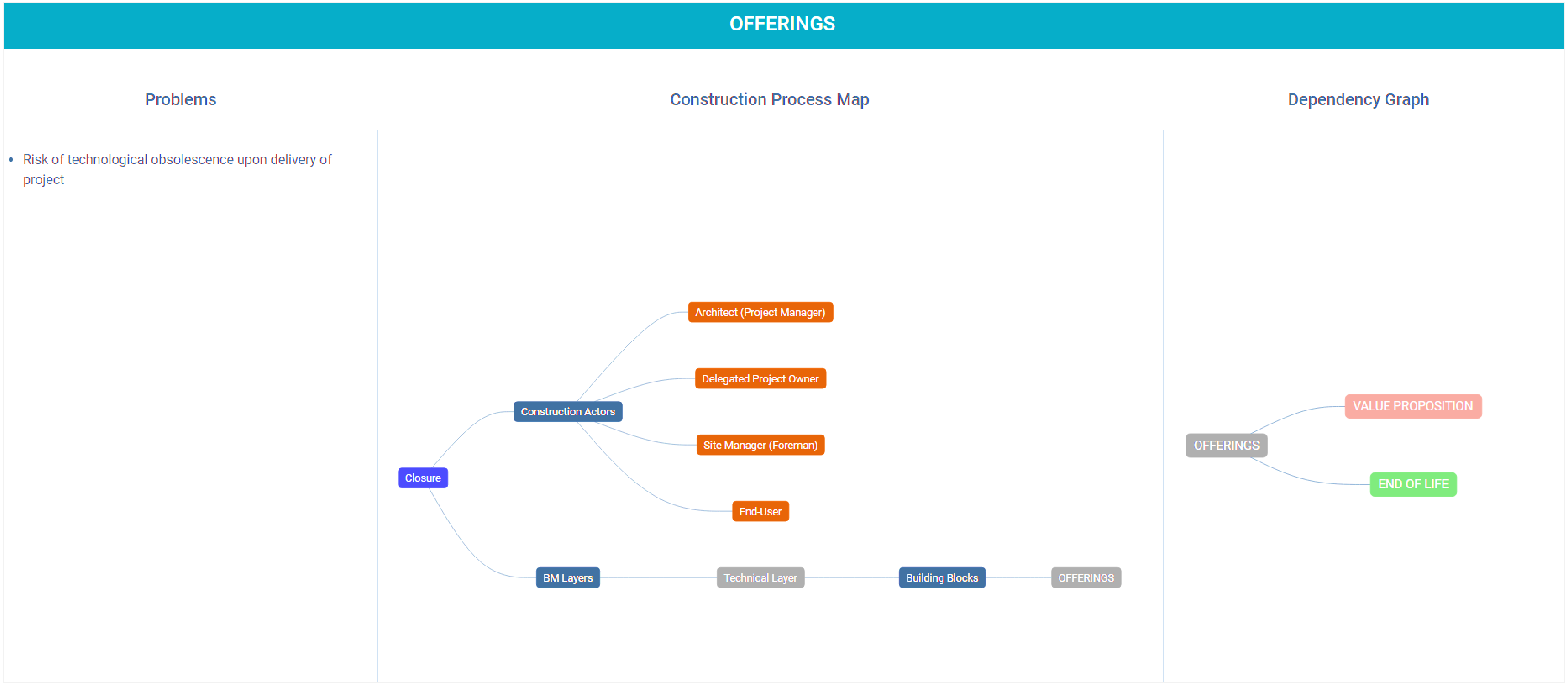


Figure 56. Dependency graph (Risk of technological obsolescence upon delivery of project)

5.3.2. *BREAKDOWN OF SOLUTIONS*

In the present subsection, we spread the solutions suggested over the GC BM layers and building blocks. Now that we are talking about solutions, we use the GC BM in its complete form, accounting for six rather than four strata. Before we deep dive into the narratives and graphical illustrations of construction process maps, we first indicate that solutions were not suggested so they match every problem identified, in the sense that there is no solution for every problem. In our reasoning, a suggested solution may apply for more than just one problem. For instance, if we were from the very start of a construction process to assign a central operator to manage the entire process and oversee construction works from start to finish, the bulk of problems that usually arise in later stages of the project process, with the possibility of affecting one or more of its dimensions, would then be dodged. This also explains why no dependency graphs were generated for solutions (in contrast to problems).

Moving on, given that the business model simulator that we created for the purpose of this research is capable of generating tenths of graphical illustrations, we go on by choosing only some of the solutions suggested, and displaying and commentating their respective construction process maps.

Knowing that our GC BM is a stage-based BM, we run our analysis sequentially by, as a starter, inspecting two solutions suggested for the proper initiation and conception of large construction processes: adjust offerings to exact needs and requirements of end-users (within the model's economic layer) ―and administer smart developments following a bottom-up managerial approach (within its social layer).

Markedly, the construction process maps shown below display inherent linkages between the BM's various strata, going from stratum 1 to 6. Looking at Figure 57, one could see that end-users have become an integral part of the process, co-conceiving and co-creating large constructions along with the GC and other key stakeholders (stratum 3). The initiation and conception stage (stratum 1) is connected to programming in the BIM process (stratum 2). Moreover, the solution suggested would supposedly have an impact on three of the model's building blocks, all falling within its economic layer: activities, value proposition and customer segments. Regarding stratum 5, smart city components, a control variable, such a solution, we consent, would account for four of its components, two primary (governance and economy) and two secondary (people and mobility). Indeed, by adjusting their offerings, construction companies would be able to secure higher return on investments, as they would be eventually able to sell their products. Moreover, given that end-users partake in the conception process of the process, this signpost that companies are following a resourceful governance model for the building and management of smart constructions. Following the same reasoning, the conception and building of smart cities following a bottom-up approach (Figure 58), encouraging the involvement of end-users throughout the entire process, would have some positive impacts on the project's social value. In addition, through real concessions and hearing sessions for instance, social acceptability for the project would heighten and local communities (referring to potential buyers) would be happy to go invest and settle in it. In such a case, the living component of a smart city (among others) would be ensured.

Hence, we elucidate, in construction projects, most operational problems occur at the very early stages of the construction processes and snowball over time to create other problems affecting some or all of the project's dimensions. Thus, by using an adequate governance model from the beginning, much of the problems that often arise during more advanced stages of the process would probably evade. To say that most of the incremental changes suggested by the GC BM concern the very early stages of construction processes.

Moving on, while sticking to the initiation and conception phase, we briefly discuss another solution that falls within the GC BM's economic layer, its customer relationship building block in specific: ensure involvement of end-users in all stages of construction processes. As shown in Figure 59, now being at the conceptual design level of the BIM process, architects would handle the project's drawings, ICT companies the design of its digital infrastructure, and multidisciplinary offices the approval of project specs. Adding that under the GC BM, each stakeholder would have his own raison d'être — and large construction projects would be conceived and built collaboratively rather than individually. Moreover, under the GC BM, we advocate that large construction projects are better off ran, with higher success chances, by a central entrepreneurial entity. We carry on by stating that the solution suggested in this case would primarily touch two smart city components: governance and economy. As previously evoked, by espousing a governance model that encourages the involvement of end-users in construction processes, the project economics would be expected to improve, so would the project's estimated financial returns.

CUSTOMER SEGMENTS

Solutions

- Adjust offerings to exact needs and requirements of end-users

Construction Process Map

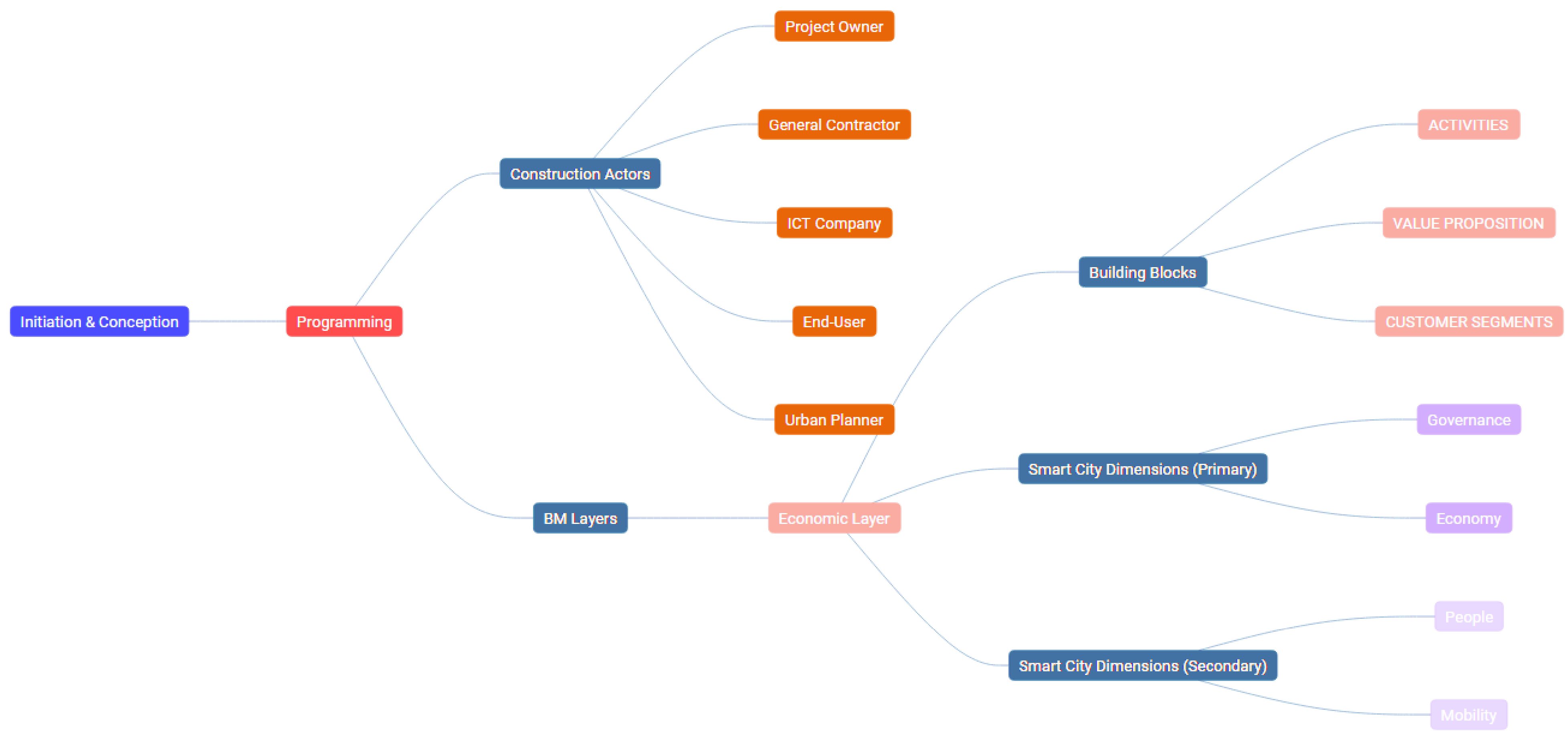


Figure 57. Construction process map (Adjust offerings to exact needs and requirements of end-users)

GOVERNANCE

Solutions

- Administer smart developments following a bottom-up managerial approach

Construction Process Map

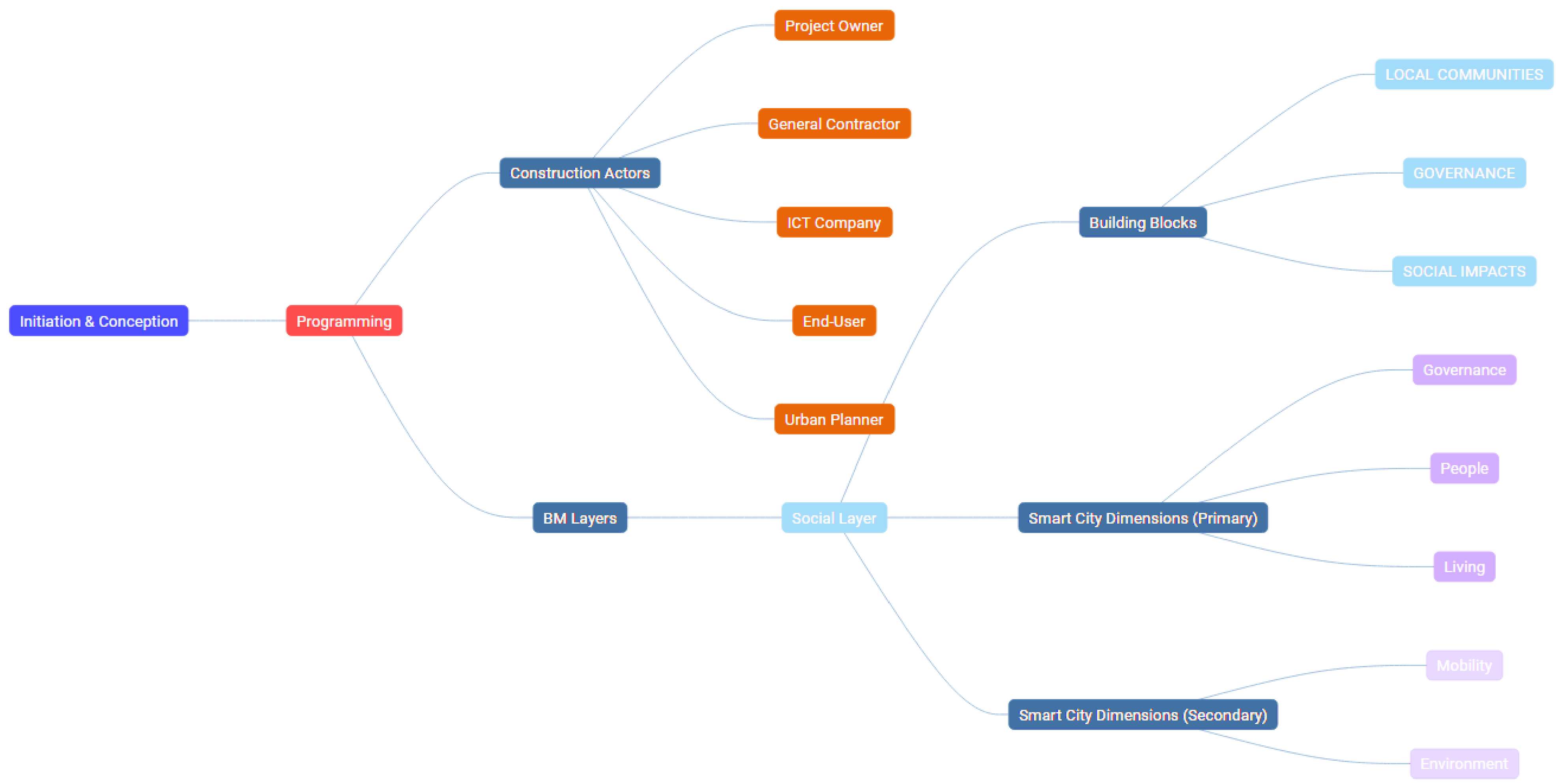


Figure 58. Construction process map (Administer smart developments follow a bottom-up managerial approach)

CUSTOMER RELATIONSHIP

Solutions

- Ensure involvement of end-users in all stages of construction process

Construction Process Map

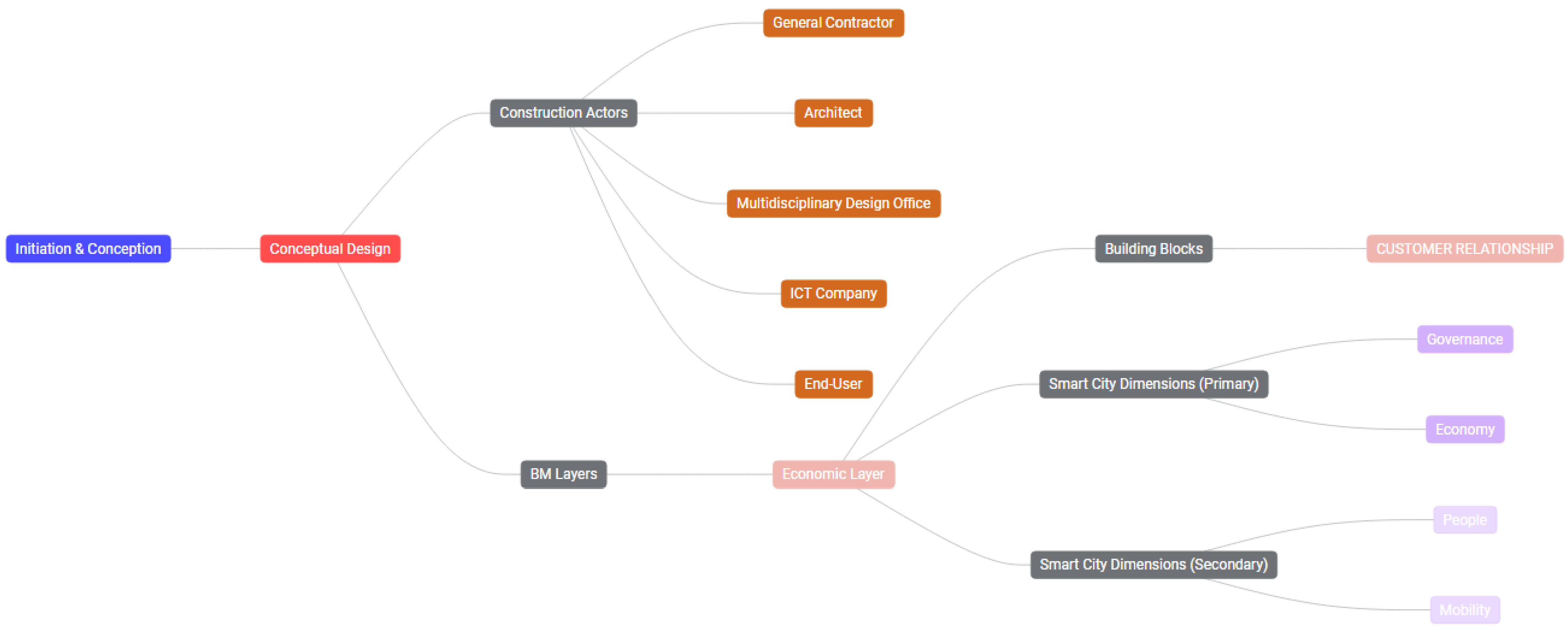


Figure 59. Construction process map (Ensure involvement of end-users in all stages of construction process)

Skipping to the planning stage, at the detailed-design level of the BIM process, we tackle another suggested solution for the resourceful building of smart cities: allow for customizability (portfolio diversification).

Following the same reasoning as above, the appropriate construction actors intervene in this stage, directed by the GC, in the presence of end-users to settle upon the detailed design of the smart city. This solution falls within the GC BM’s economic layer, its partners and customer segments building blocks in particular. This is straightforward, as under our envisioned BM, end-users are active partners who partake in the entire construction process. Besides, construction companies, seeking to enhance the size of their respective market shares, would positively opt for customization. This is a reasonable corporate tactic —as not all customers have the same needs and wants. Thus, through portfolio diversification, construction companies would be better positioned to expand their business activities and serve a larger portion of the market. Looking at our control variable, we could openly avow that the solution in question is possibly to have a marked influence on a smart city’s governance and economy components (primary) —and, on other ones too, people and mobility (secondary) — to a lesser extent (Figure 60).

Now that we have commentated some of the solutions suggested for the resolve of problems faced in construction today, we close this subsection at this level, simply because the same reasoning as described above applies to the remainder of solutions. (—see earlier sections for a detailed discussion of solutions suggested)

CUSTOMER SEGMENTS

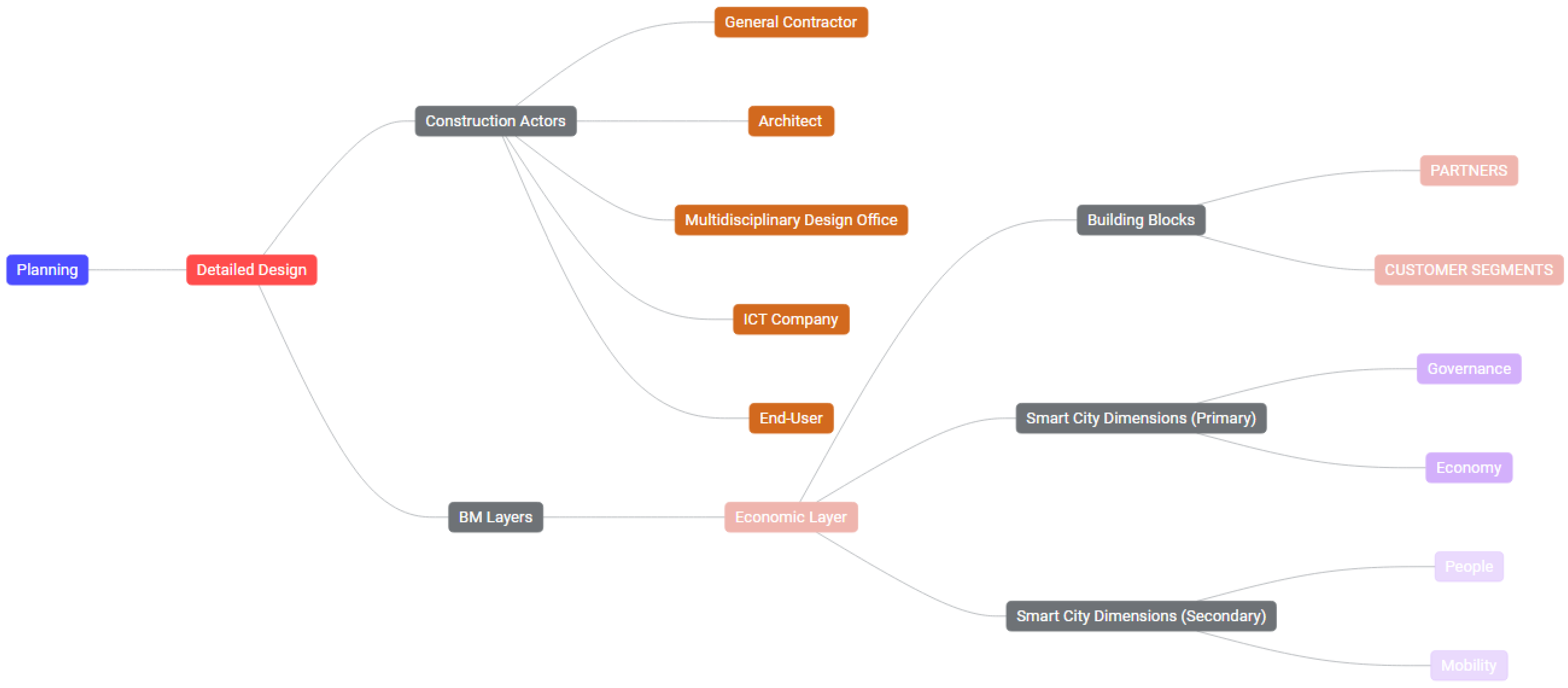
Solutions	Construction Process Map
• Allow for customizability (portfolio diversification)	

Figure 60. Construction process map (Allow for customizability)

5.4. CONCLUSION

Throughout the present chapter, we plainly identified and discussed the dynamics of problems faced today in construction —and suggested reasonable solutions for their resolve. Though the recommended improvements are specific to large or smart construction projects, we say, they could also apply to other projects of relatively smaller sizes.

For the building of smart cities, we opined, the long rather than short run — collectivism rather than individualism — bottom-up rather than top-down managerial approaches — centralized rather decentralized decision-making processes (among others) should be indorsed —otherwise, any attempt to convert our cities into smarter ones would be destined to fail. Such improvements, we showed, are made possible through the GC BM. The GC, a key role in our model, acts an integrator who would bring all builds of the city together, thus creating a coherent system that would enhance both its attractivity and economic power. Keeping in mind the GC role is relatively new in France; the espousal of our innovation would not happen right away, overnight, as some further real-world tests should be performed so that to confirm its validity and sustainability. As we see it, the GC BM is a step forward towards building a made-in-France smart city business model.

CHAPTER VI. DISCUSSIONS

Our thesis is entitled '*designing a GC BM for smart cities*'. Hence, the subject themes, which we attacked throughout this study, are three, namely: smart cities, general contractors and business models. In the following subsections, we clarify our contributions to the academic literature available on these subject themes.

6.1. THEORETICAL & METHODOLOGICAL CONTRIBUTIONS

We first list our contributions on the topic of smart cities, followed by that of general contractors, and finally of business models.

6.1.1. *ON SMART CITIES*

Definition of smart cities. Today, the definitions for smart cities are numerous and variable (Cohen, 2012; Kitchin, 2014; Simard, 2015; De Jong et al. 2015; Eremia et al. 2017); also, often divergent and lacking meaning. For some, smart cities are places where higher quality of life is secured. For others however, smart cities are eco-friendly places, focusing on a city's ecological perforce, assessing and dipping pollution and GHG emissions —as well as energy and water consumption. Other opinions relate to the fact that social equity, together with a greener living environment should be considered for the development of smart cities. In recent developments, new thoughts have arisen, where the smart city concept was defined as a blend of people, activities, and environment. Places where a dynamic balance among economic, environmental and socio-cultural development objectives could be achieved —outlined by a local governance system characterized by heightened citizen contribution.

Today, the smart city concept has become a catchword —drawing increased attention among research agencies, universities, governments, officials, and specialized companies. All over the world, there has been hasty proliferation and promotion of smart city programs —and the market potential for smart city solutions has been dogged to be substantial. As recurrently reported throughout this project, smart is a word that is used by construction for companies to be able to sell their products faster and more expensive, which often creates misconception about smart cities among end-users —and sometimes even among industry experts. Today, though the rise in popularity of the smart city is sturdy, the dissemination of initiatives in countries with poles apart needs makes it problematic to find shared definitions and common trends at the global scale. To say that there is no clear-cut definition of the term smart city, nor a general agreement on what its inherent features are. Definitely, we expounded, while smart city projects in Latin America tend to be strappingly focused on the improvement of security, local government management, and mobility — in Asia, the emphasis is rather put on the improvement of infrastructure and mobility —and, in Europe, the concentration is on boosting the efficiency of public offerings, building a socially-inclusive culture, and enhancing citizens' well-being.

Our contribution in this regard may be written as follows — a comprehensive definition for smart cities: 'a *smart city is a city that is conceived, developed and ran by the government and the people, both being smart, for the sake of promoting citizens' well-being and ensuring a better quality of life for all.'* Clearly, our definition omit the GC, as the latter, we trust, would act as an out-of-sight middleman, standing between pubic developers who have the ownership of large construction projects, on one hand—and people who would eventually invest their money to buy properties in those projects, on the other hand. Frankly, it is neither the government nor the people who would build smart cities, but construction companies. However, for this to be conceivable, a centralized-decision making process should be espoused —and communication channels should remain open at all times between all stakeholders located at the extremes of the construction value chain. In our views, by defending the interests of all stakeholders involved in construction projects and creating bridges among them, maven GCs —as central operators, would be able to ensure the successful execution and delivery of smart projects in general.

Smart city components. The smartness of a city is pronounced by the set of physical and legislation infrastructures that support economic development, ensure social inclusion, and allow environment protection. The smart city models — that of Giffinger et al. (2007) in specific is said to be the most illustrative as to its capacity to demonstrate and exhibit the strategic components of a smart city. Nevertheless, since these components were established roughly ten years' ago, numerous authors have referred to them year-over-year to develop more elaborate frameworks and strategies, namely Cohen's (2012) Smart City Wheel. For us personally, a synthesis of the works of Giffinger et al. (2007), Cohen (2012), and Simard (2015) allowed for a better understanding of the relevance of smart city components. Indeed, in our study, we proclaimed that, though all smart city components are important, some of them are more important than others — the reason why we chose to split them into primary and secondary components. Depending on the type and scale of the construction project, some components seem to have more weight in comparison to others. Overall, at least in our views, governance and people are the key components of smart cities.

Moving on, we avow, our contribution to the literature on smart cities went beyond the theoretical to reach the practical. Actually, we have resorted to some real-life smart city examples to better elucidate our standpoint. Songdo (South Korea) was advanced as an example of a failing smart city model — while Copenhagen (Denmark) as an efficacious one. While the former focused on technology for the building of the city, the latter rather concentrated on human-related aspects. Within this framework, we carried on by affirming that a smart city is a bunch of smart things: governance, energy, infrastructure, transportation, healthcare, building, etc. Looking at the world's experience in this domain, one could clearly notice that some components are nowadays being prioritized relative to others.

Here and now, the components that are drawing most attention globally are governance, energy and infrastructure. Nevertheless, what our research findings showed is that '*people'* is the key factor to the successful building of smart cities —and that it is only by guaranteeing a certain evenness between the various dimensions of construction projects that those projects would end up being smart. This is only possible, we said, through smart governance, the assignment of a central operator who, in collaboration with other stakeholders (including end-users), would efficaciously oversee and manage smart construction projects. In finale, we have showed that the building of a smart city is a dynamic and evolving process in the sense that what is thought to be central today could lose ground over time. Year-over-year, new components step in — other ones step out. Precisely, though the environment or mobility (for instance) is not currently a primary component of smart cities, we expect it to become so in the near future. In addition, while mobility, for instance, may possibly rank first in Copenhagen, this would not necessarily be the case in London, Amsterdam, or even Paris.

In our GC BM for smart cities, '*smart city components*' was used as a control variable to ensure solutions suggested account for the requirements of smart cities. For the dissemination of problems identified —faced today in construction, the latter was not part of the four-stratum BM used to this end. Alternatively, problems were spread over the TLBMC's layers (economic, social, environmental, and technical), which anyhow enabled us to grasp how and why construction activities today do not align with smart city requirements. As recurrently evoked, our choice of the TLBMC was influenced by the inherent resemblances between its layers and the components of smart cities —as depicted by Cohen (2012). For the most part, problems identified related to two components of smart cities: governance and people. The reason why, narratives such as '*smart cities is a question or urban governance that should be built following a human-centric approach*' could be abundantly found throughout the entire text. Even by looking into the global smart city market and how it is segmented across various categories of smart things, one could plainly see that smart cities is primarily a question of governance and people. Whenever these two (primary) components are safeguarded, the remainder of (secondary) components would automatically follow. In France, we finally recommended, the focus should be now on working out public-private partnerships to encourage smart city initiatives on national level —and encouraging the immersion of end-users in large construction processes, from initiation to closure.

***Are all cities vowed to be smart*?** The smart city notion is a subjective one. Indeed, we avowed, there are no right and wrong smart city models, as the connotation of a smart city is likely to change from one place to another — across cities and countries — based on their cultures and traditions. For that reason, we acknowledged that by competently using their own resources and endowments — refining communication infrastructure and web-based services — allotting ample financial resources and adopting appropriate funding schemes — and creating apposite value chains that ensures a fair interplay between stakeholders — all cities around the world could become smart — at skewed rates perhaps, each in its own skin.

6.1.2. *ON GENERAL CONTRACTORS*

General contractors, central operators in new construction value chain. There is a budding shift today from an old to a new value chain in construction where a central operator would be entrusted to handle the management and running of large projects, from start to end. Nonetheless, in the literature, there is no mention of who could play this particular role. To our knowledge, today, in France at least, (incompetent) public developers or assigned architects are fulfilling this role. Yet, things do not seem to be rolling in the right direction, as the count of problems faced in construction seems to be on the rise. For that reason, we thought of endorsing a GC for this vacant position. Through a basic analogy, a central operator is the equivalent of a strategi under Copenhagen's smart city model.

By definition, a GC is a stakeholder —an entity or a person— who supervises daily activities at the construction sites and ensures all construction works are carried out properly. Moreover, a GC supplies the labor, building materials, machinery, raw materials —and all the other kits needed for the successful completion of construction works in general. In our eyes, GCs are mavens in construction —and so, qualified to handle the management of smart developments. As its name suggests, a central operator is a machinist who, if endowed with the required power and authority, has the ability to competently oversee construction works and manage teams involved in the process. Yet, '*central*' refers to the centralization of decision-making, meaning that the GC would have the final say in project-related matters. In Anglo-Saxon economies, the GC is frequently regarded as central operator who proposes made-to-measure solutions to clients, and expertly manages worksites, tradespeople, deadlines and budgets. Moreover, we explained, given that GCs do not always have the required expertise for completing all construction works by themselves, they tend to maintain a network of specialized subcontractors who would help them achieve their works. Moreover, the GC role is interesting in the sense that he upholds, being one of many responsibilities, direct and regular contact with clients to keep them instructed on work progress —as well as with other construction actors throughout the whole construction project lifecycle. With that said, we believe GCs to have the perfect profile to fill this vacant central operator role —especially in large construction projects.

Rogue analogies. A rogue analogy was made to better exemplify the role of GCs (as central operators) within the new construction value chain. GCs were compared to music conductors; we also showed how astonishing is the resemblance between the two. Also, we asked some curious questions: why orchestras are structured the way they are? Why do not the oboes and tubas sit in the front? Why do not flutes and violins swap positions? Why do not trombones and French horns sit right up front with the music conductor? In fact, we affirmed, there is pretty much of a good reason for why everything we experience in life is the way it is, and the orchestra's seating arrangements are no exception. To better elucidate our idea, we referred to big orchestral arrangements (—denoting large construction projects). Until the twentieth century, the violins, first and second, were seated opposite each other. However, a few years later, the conductor Leopold Stokowski tried something new, seating the orchestra in every conceivable way in an effort to find the perfect amalgam of resonances. He eventually came up with a new, better seating arrangement. At first, his suggestion did not stick — yet, couple of years later; the so-called Stokowski shift gained serious momentum and became popular around the world. In our views, this is in fact the onus of the central operator —who, alike music conductors— efforts to bring all construction actors together in order to create beautiful melodies rather than mishmashes of conflicting sounds.

The GC role (—alike the Stokowski shift!) in France is new or even inexistent —and current market players, we assume, would not very much like such a proposition despite being reasonable. Thus, our BMI suggestion is possibly not to stick today, hoping it would in the near future. In our views, the GC BM is inventive in the fact that it identifies problems faced in construction today and suggests pertinent solutions for their resolve. Problems are marked per construction stage and split into four different categories. Hence, through the GC BM, which allows for the dissection of problems in construction, companies would be able to circumvent all types of snags that are conceivably to hinder their business performance in the mid to long run. Within this context ―and under the GC BM for the building of smart cities, our contribution lies in the endorsement of the GC role, which is practically inexistent in France. GCs are popular in Anglo-Saxon economies ― not quite in Europe. As explained earlier, the GC, we trust, is perfectly equipped to fill the central operator role in the new construction value chain, the one suggested by Vrijhoef and Koskela (2000). Being a maven in construction, he has sufficient knowledge and savoir-faire to handle and manage large construction projects. Moreover, we avowed, GCs, along with end-users, are at the heart of the solutions suggested for the resolve of problems faced in construction today. Again, we corroborate, smart city projects are best managed by one entity, a maven decision maker or a strategi, based on a centralized governance scheme. Copenhagen's experience in this domain is a real-life proof that such a governance model is possibly to make it if well implemented. However, for this do be viable, GCs must first have the legitimacy to play this role. Smart cities are connected chains and any damage or flaw at any part of the chain would undoubtedly affect the entire chain. Hence, GCs would play the role of connectors, bringing all stakeholders involved in the process and so, linking the entire construction value chain, down to upstream.

What is more, the '*ensemblie*r' concept, which already exists in France, is not the right solution for the various problems encountered in construction today. Let us take the case of Bouygues for instance, a big market operator with lots of subsidiaries whose activities cover almost the entire construction value chain. Bouygues is facing many challenges handling and managing the works of its own subsidiaries nowadays, as all of them have the legitimacy to make key decisions that often ensue in snags and hitches. Why. Simply because, within a project, if several rather than one decision maker exists, the odds of operational problems occurring are high. This reflects the absence of centralized decision-making ―in line with Flyvbjerg's (2014) findings attesting that, in the case of large and lengthy construction projects, decision-making should be put in the hands of one entity and the management of smart developments preserved throughout the entire construction project lifecycle. With that said, the GC BM we are proposing constitutes a plausible solution to such problems. Indeed, in our time, big operators like Bouygues are very well equipped to indorse this new GC role for the running of smart developments. Furthermore, we close, for GCs to fulfill their roles fruitfully ― they first must be given the required authority and power to do so. Accordingly, they should act as co-owners of construction projects rather than mere stakeholders.

6.1.3. *ON BUSINESS MODELS*

Definition of business model. In spite of the recent deluge in the literature on BMs, we affirmed, a definitional clarity on BMs is still nonexistent today (Chesbrough & Rosenbloom, 2002; Afuah, 2004; Casadesus-Masanell & Zhu, 2013; Massa & Tucci, 2014; Baden-Fuller et al. 2017; Foss & Saebi, 2017). While for some authors, BM constitutes a key vehicle for innovation at corporate level others see it as a representation of how a company generates, conveys and captures value. From our side, we have contributed a supplementary definition to the existing literature on business model. It pours as follows: *'a BM is an architecture of the product, service and information flows, including a description of the various business actors and their roles* ― *a description of the potential benefits for the various business actors* ― *a description of the sources of revenues.'*

A business model for the building of smart cities. Moreover, we have showed that BMs could be designated *stractics*, an assortment of corporate strategies and tactics. The rationale behind our last definition of BM is quite straightforward; normally, companies start by choosing a logic of (strategy for) value creation and value capture, which would be reflected in their BMs. Then, they make tactical choices driven by their intents to maximize stakeholder value. Therefore, sequentially, strategy comes first and tactic follows; and BM falls in between the two. With that said, we simply used the expression *stractics* to denote BMs, being concurrently —a reflection of a company's sets of strategies —and an influencer of its sets of tactics. Within this setting, we have also emphasized, though circuitously, that generic BMs does not fit the construction industry very well, as productive ones, we believe, must be thin sliced into strata to allow construction companies to keep track of works performed at every stage of the process. Therefore, the practicality of generic BMs in the construction industry is put to the question. About our GC BM, it is multifaceted in the sense that it is both solution-based and multisided. It is also of a dual-use because it consists of a BM within a piloting tool. Additionally, it shows which construction actor intervenes and at what time. In the realm of smart cities, it allows for the deciphering of problems in construction and the suggestion of plausible solutions for their resolve. The GC BM is a corporate BM that construction companies may use, along with other technologies available in the market, to better track and manage their construction projects. Using six different strata, it could help construction companies track problems as they arise, per construction stage. It shows the dynamics of problems in construction based on their type — economic, social, environmental or technical — and display linkages among them. Being operational, the GC BM could be used for simulative purposes, too. Using the business model simulator that we have created with the help of a developer using a specialized IT software (Angular 2+), dependency graphs (among problems) and construction maps (for both problems and solutions) could be generated. The GC BM is hence innovative in the fact that it allows for the drawing of linkages between the various layers and building block of the TLBMC —something that remains extensively untackled to date.

CONCLUSION

Throughout this thesis, we have shown that connectivity is key —and that functional geography has taken over. This new reality has reshaped and wired connections between countries. It also helped ease political tensions, mitigate environmental risks, and uphold economic growth. Additionally, we have indicated that people tend to migrate to big cities in search for more connectivity and opportunities. Indeed, we said, urbanization has become a trend, transforming big cities into megacities — and megacities into smart cities. Long story short — '*smart cities*' is a combination of smart governments and smart citizens, tied together using smart technologies. Literally, today, big cities are being revamped to resemble smart villages. For the construction of smart cities, we asserted, there would be need for more adaptability and flexibility. Through the implementation of a new business model, a fair interplay among construction actors could be assured. Their works would be synchronized and their interventions perfectly cued. However, for this to be achievable, a central operator is required. Raising Copenhagen's case at this point, this operator, a person or an entity, is supposedly to be a strategi who could expertly orchestrate complex smart city projects.

Moving on with our investigations, we have shown how the construction value chain has evolved over time with the upsurge of innovation in construction, paving the way for the intercession of a new actor — the so-called *central operator*. The latter would act as a music conductor, harmonizing the performance of all industry players so that large-scale, smart developments end up being impeccably built. He would synchronize construction works and ensure cueing, who does what and when. We have also established that a single value chain is unimaginably to fit all types of projects, hence the need to conceive new ones. Equally, we have evidenced that business models, being more perpetual than construction project processes, are grandly decisive of companies' long-term business success. As well, we have ascertained that GCs are both mavens in the field of construction —and connectors, possessing their own networks of backers. Pretty much like music conductors, GCs are frontrunners with the ability to play various roles and hold different positions athwart the construction industry's value chain. All other things held constant, GCs are best equipped to play the role of central operators. Hence, it is within this setting that we thought of designing a new business model for the building of smart cities, a BM where decision-making is centralized in the hands of a maven GC.

Our suggested GC BM is solution-based and human-centric. Human-centric because the end-user is at the heart of it and solution-based because it suggests plausible solutions for operational problems encountered in construction today. It is also multisided because the GC intermediates between two stakeholders: project owners, located downstream the chain —and end-users, upstream. As for the changes our GC BM is likely to bring to the table, those are likely to be incremental rather than radical, of a managerial rather than technological nature. Per se, the GC BM built was the resultant of an extensive research carried out on three subject themes: smart cities, general contractors and business models —also, of an extensive problem-solution analysis carried out to assess the current state of the French construction industry's value chain — mainly the ability of construction companies to successfully build and manage smart city projects. Though the GC BM was tailor-made to the exact specificities of the French construction industry, it is adaptable so that other industries and companies elsewhere in the world may also benefit from it.

Little by little, we succeeded to put all the puzzle pieces together. The GC BM was created through trial-and-error. First, we had a raw idea that materialized over the years and led to something tangible. The GC BM is labeled six-stratum business model for it accounts for six builds. It is a BM within a piloting tool. Through a series of research methodologies, we were able to identify problems faced in construction today and suggest solutions for their resolve. For the mapping of those, we used the well-known strategic business-modelling tool: the TLBMC — to which we added an extra (technical) layer. Eventually, data gathered was disseminated across the various dimensions of a construction project. This was made possible using the business model simulator scripted in Angular 2+. In our analysis, we have reported that most operational problems arise at the very early stages of construction processes and snowball over time to create supplementary problems. Indeed, say, a technical problem occurring in the early stages of the process, if left unsolved, could materialize year-over-year to create a pool of other problems of different types (social, economic, and environmental) in advanced stages of the process. Hence, we advised, to address and solve those problems, the focus should be on the downstream rather than the upstream of the value chain, the stages where construction projects are programmed ―and designed. The dynamics of problems in construction were plainly discussed throughout our research, so were the solutions suggested for their resolve.

Though the recommended improvements are specific to large or smart construction projects, they could also apply to other projects of relatively smaller sizes. For the building of smart cities, we opined, the long rather than short run — collectivism rather than individualism — bottom-up rather than top-down managerial approaches — centralized rather decentralized decision-making processes should be indorsed —otherwise, all attempts to convert our cities into smarter ones would be destined to fail. Such improvements, we showed, are made possible through the GC BM. The GC, a key role in the model, acts as an integrator who brings all builds of the city together, thus creating a coherent system that enhances both its allure and influence. Keeping in mind the GC role is relatively new in France; the espousal of the GC BM by construction companies, we presume, would not happen right away — overnight. Truthfully, as we see it, our suggested BMI is nothing but a step forward towards building a made-in-France smart city business model ― one step in a thousand-step journey.

7.1. RESEARCH LIMITATIONS

Though reported by interviewees to be innovative and original, our suggested GC BM remains incomplete in so many ways. First, time and budget constraints. Of course, we would have been able to do a better job if we had all the time in the world to complete the study ―yet this is never the case. As anything in life, there are time boundaries that we should abide by, while endeavoring to deliver the best output possible. On another note, given current circumstances around the world, my E-DBA is an investment that I wanted to pay in the shortest delays possible. Due to the ongoing covid-19 crisis and lockdown measures implemented everywhere in the world, I have been stuck in Lebanon since February-20, jobless, with no clear prospect of my return date in France. Moving forward, among other limitations, we cite those that are research-related ― linking to the TLBMC, the business-modelling tool that we used for the successful achievement of our thesis. Precisely, the large number of building blocks associated with each of its layers. The interconnectedness of buildings blocks, we attest, made the task of dispersing problems and solutions across them complex, which led to some needless redundancies in the analysis. A better way would have been to take the TLBMC and try to shrink the count of its inherent buildings blocks so that each layer contains no more than five blocks. Moreover, the size equality of building blocks among layers is a bit doubtful. If we had nine building blocks within the economic layer, is it compulsory to have nines within the other layers too? Hence, we admit, a reduced-size version of the TLBMC would have permitted a more straightforward spreading of problems and solutions. (In statistics, data would make no or less sense if distributed across too many categories, thus the need to find the perfect number of building blocks within each layer — how many is too many building blocks?). On a side note, on the analysis front, a comprehensive economic examination of smart city components, we proclaim, would have brought extra benefit to our research. Also, by, for instance, marking the economic losses in monetary value that could be expected from every problem faced in construction today our research may have had a higher impact factor.

In finale, we trust, a problem-solution matching exercise could have been done —and consequently, dependency graphs generated for solutions — same as we did for problems. This may have given added meaning to our research. By doing so, we would have made construction companies' lives easier, in the sense that every time they encounter a problem they could straightforwardly look for the adequate solution (one or more). In our case, the GC BM in its present form, they would have to search for it — to choose among several options.

7.2. RESEARCH AVENUES & NEXT STEPS

Among the research avenues that we would aspire to embark upon in the near future, we thought of the following: come up with clear-cut definitions (one or more) of smart cities in France —definitions that account for the specificities of territories within cities. By finding a common definition, some sort of benchmarking between smart cities around the world could be then performed. Conducting market studies on the subject of smart cities to assess customers' needs, decipher misconceptions, and identify existing market gaps seem like a valuable thing nowadays as people have positioned themselves at the heart of smart cities and so, it would be very useful to dig in and better familiarize ourselves, as construction companies, with their needs and requirements.

Another interesting point is to carry out a detailed investigation of the roles and responsibilities of GCs in the suggested BM as well as in the French construction industry overall. This, we believe, would grant our suggested BM further exposure and validity in the marketplace. Other research avenues include investigating the relationship (if any) between social and smart housing. This is important as a significant share of the construction market in France is reserved for social housing. Should any connection exist between the two, this would open additional doors for the commercialization of the smart city notion. Finally, we also believe that it would be curious to find some common grounds between the private and public sectors so they could collaborate for the building of France based smart cities. As recurrently evoked, smart cities is nothing but the resultant of collaborative thinking and intelligence.

Lastly, concerning the GC BM, the next steps I would take include using the GC BM in the real world to check and appraise its real use-value. Also, to test its validity and sustainability. Indeed, we avow, the GC BM must go through a practical trial phase ―and its performance be improved along the way. Once proven valid and sustainable, some marketing works should be performed to commercialize it and encourage its adoption by construction companies. Besides, still an idea now, I am thinking of approaching BIM to present my GC BM to them, and see whether it is possible to integrate it into their technology ―thus becoming part of it.

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