
General Contractor Business Model for Smart Cities

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Color Section

SUSTAINABLE CITY			
Social Development	Economic Development	Environmental Management	Urban Governance
<ul style="list-style-type: none"> • Education and Health • Food and Nutrition • Green Housing and Buildings • Water and Sanitation • Green Public Transportation • Green Energy Access • Recreation Areas and Community Support 	<ul style="list-style-type: none"> • Green Productive Growth • Creation of Decent Employment • Production and Distribution of Renewable Energy • Technology and Innovation 	<ul style="list-style-type: none"> • Forest and Soil Management • Waste and Recycling Management • Air Quality Conservation • Adaption to and Mitigation of Climate Change 	<ul style="list-style-type: none"> • Planning and Decentralization • Reduction of Inequities • Strengthening of Civil and Political Rights • Support of Local, National, Regional, and Global Links

Figure 1.1. *The four dimensions of a sustainable city (source: adapted from UN (2013))*

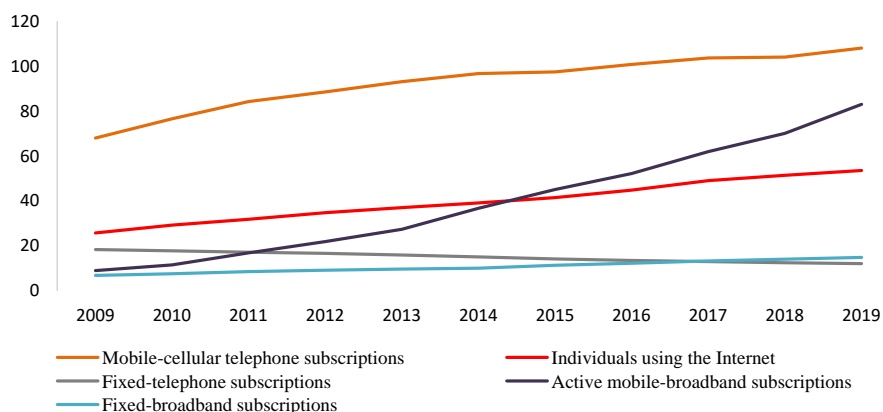


Figure 1.3. *Global ICT developments, Y2009-19 (source: adapted from ITU (2019))*

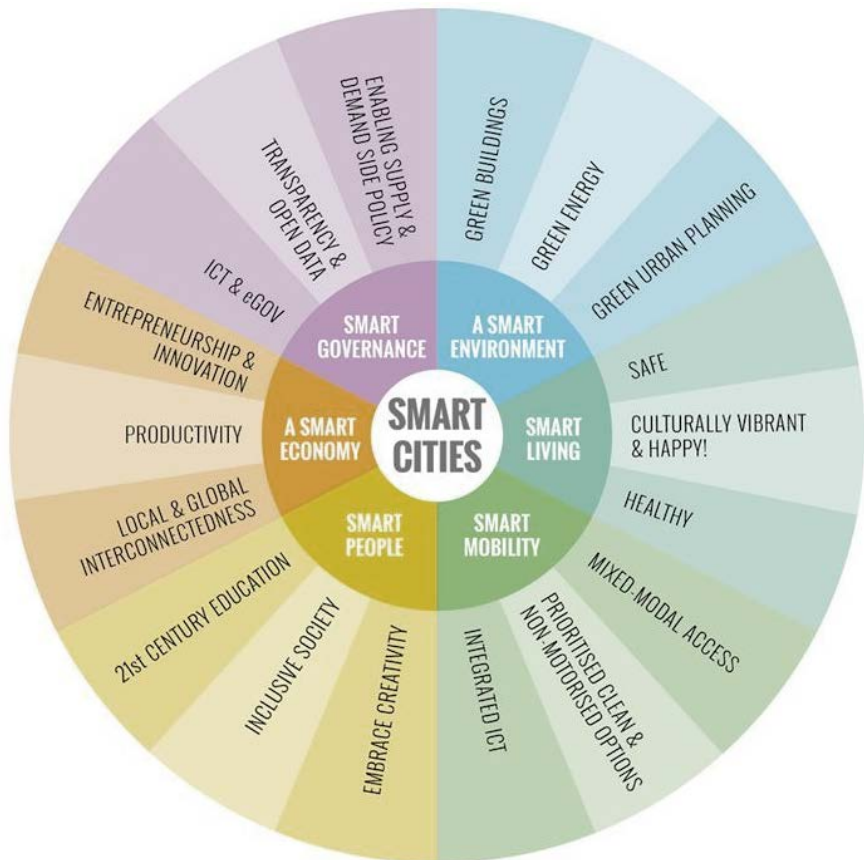


Figure 1.6. Smart City Wheel (source: Cohen (2012))

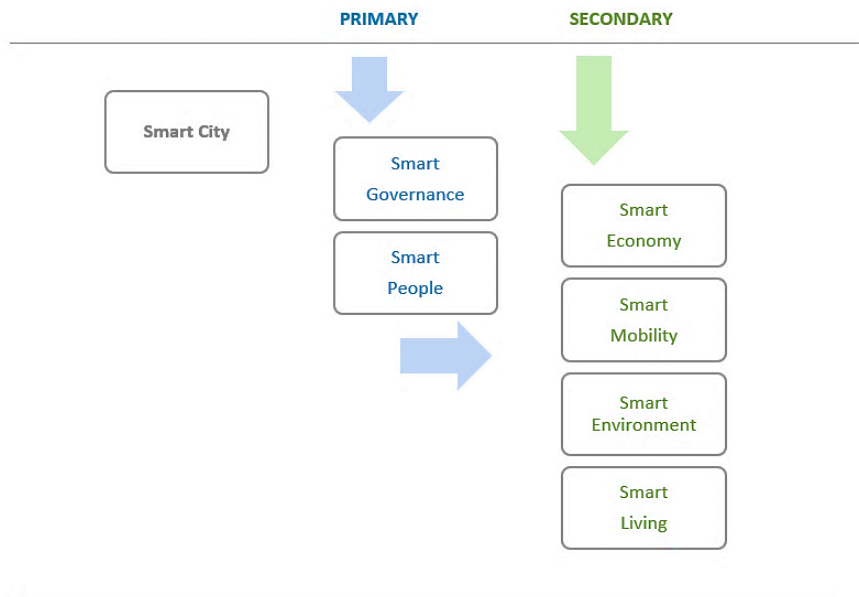


Figure 1.7. *Giffinger et al.'s (2007) work revisited (source: created by the author – inspired by Simard (2015))*

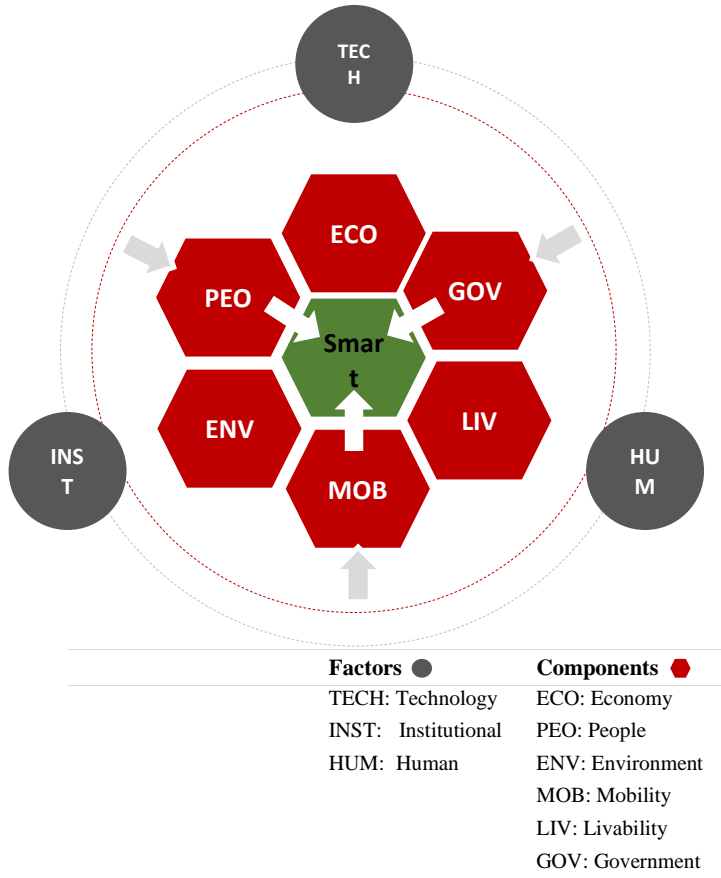


Figure 1.8. *Smart city: factors versus components (source: adapted from Tobergate and Curtis (2014))*

1	<u>Strong governance:</u> <ul style="list-style-type: none"> • The backing of the political establishment is critical! 	2	<u>Proof-of-concept projects:</u> <ul style="list-style-type: none"> • Pilot projects are key! • Data matter, whether big or small.
3	<u>Human-centric approach:</u> <ul style="list-style-type: none"> • Listen to citizens' needs and propose suitable solutions. 	4	<u>Create a pool of talents:</u> <ul style="list-style-type: none"> • Attract and retain talented people. • Develop university programs dedicated to smart cities.
5	<u>Build strategic alliances:</u> <ul style="list-style-type: none"> • Work with partners, inside the city government and outside. 		

Table 1.7. *The five strengths of Amsterdam's smart city (source: Ernst and Young)*

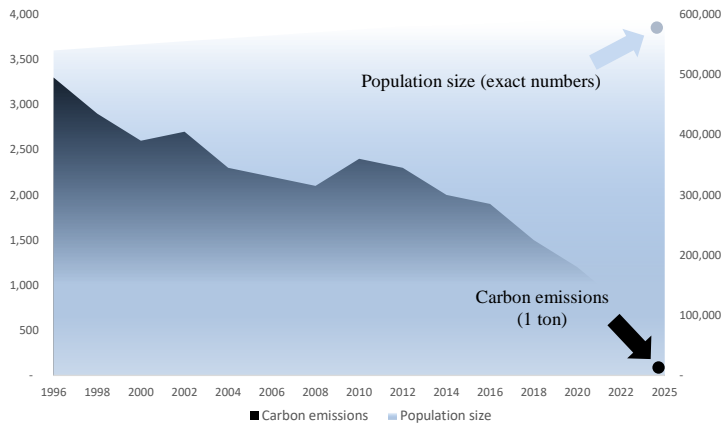


Figure 1.9. *Copenhagen: carbon emission versus population size (source: compiled from various sources)*

Smart Projects:	Smart City Initiatives:
<p>Work with:</p> <ul style="list-style-type: none"> — 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 	<ul style="list-style-type: none"> • Cooperation across administrations • Project coordination board ► One “<i>strategi</i>” for smart city • Focus on lighthouse projects: <ul style="list-style-type: none"> — Open city data platform — City map — Big data platform with partners — City solution lab • Mobility projects and ITS (Intelligent Transport Systems) • Digital infrastructure

Table 1.9. *Copenhagen: smart projects and initiatives (source: compiled from various sources)*

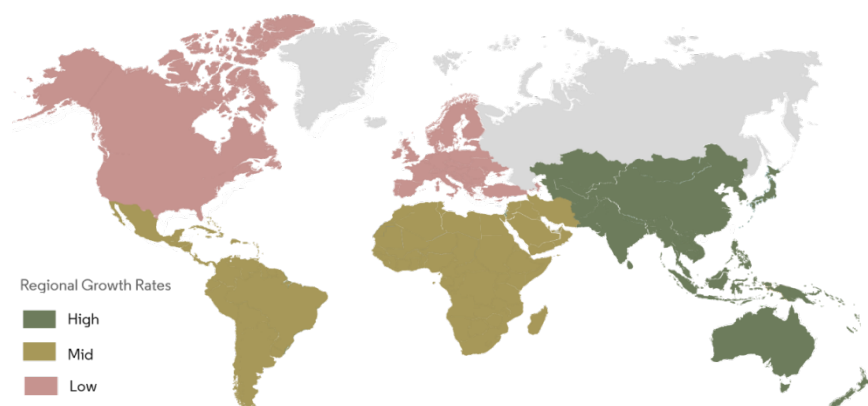


Figure 1.12. *Smart city market: growth rate by region, 2019–2024 (source: Mordor Intelligence)*

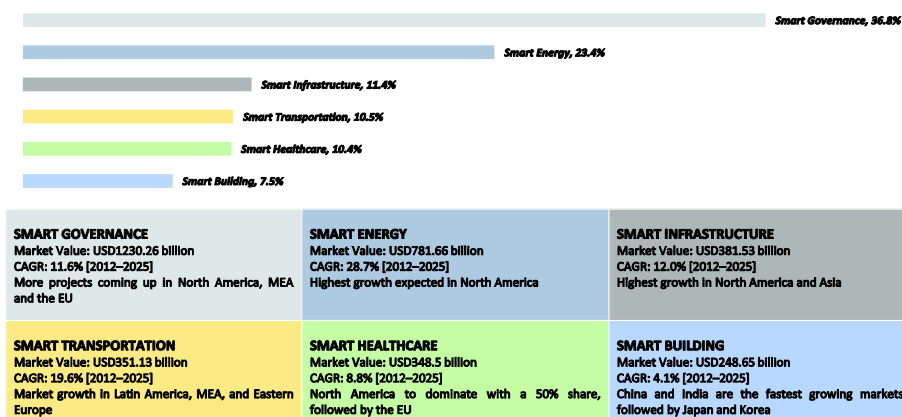


Figure 1.13. *Global smart city market, by segments: 2016 (source: Frost and Sullivan Analysis)*

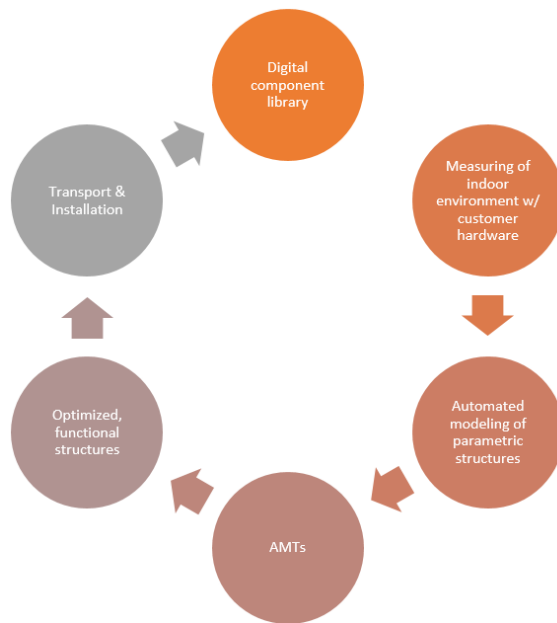


Figure 2.3. *The future of construction process (source: adapted from Virtanen et al. (2014))*

Families of actors	Design stages	Construction steps
Project Owner	Programming & Preliminary Studies	Roads & Networks
Project Manager	Competition or Sketch	Structural Works
Clients	Pre-project Summary	Clients
Institutions & Administrations	Detailed Pre-project	The Cover
Site Steering Group	Building Permit	The Technique
Various Construction Companies	Project & Companies Consultation File	Finishings

Figure 2.5. *The building blocks of a construction project process (source: adapted from Direction des Immobilisations and Cloutier (2005))*

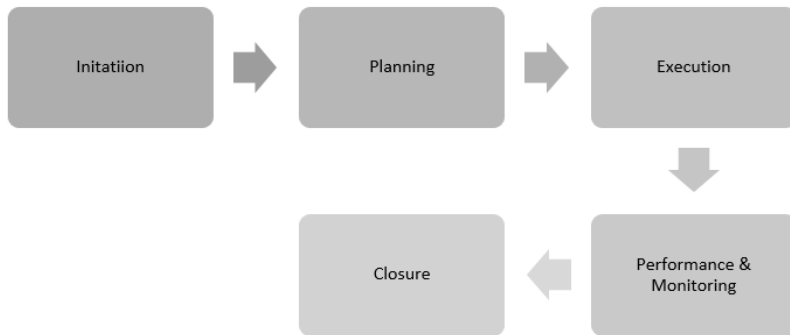


Figure 2.6. Major CPLC phases (a) (source: compiled by the author)

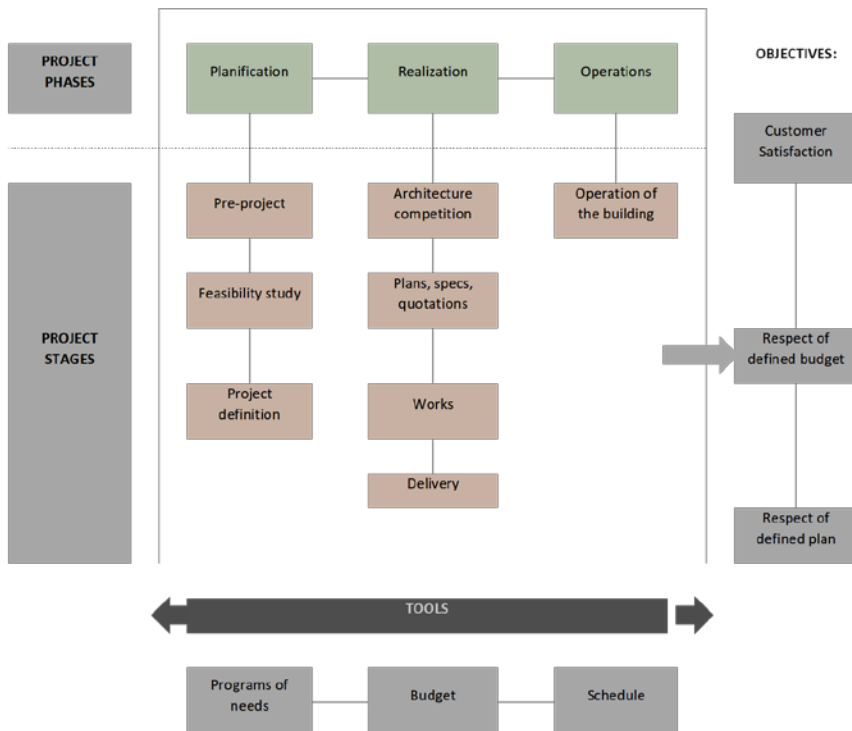


Figure 2.7. The construction project management process (source: created by the author)

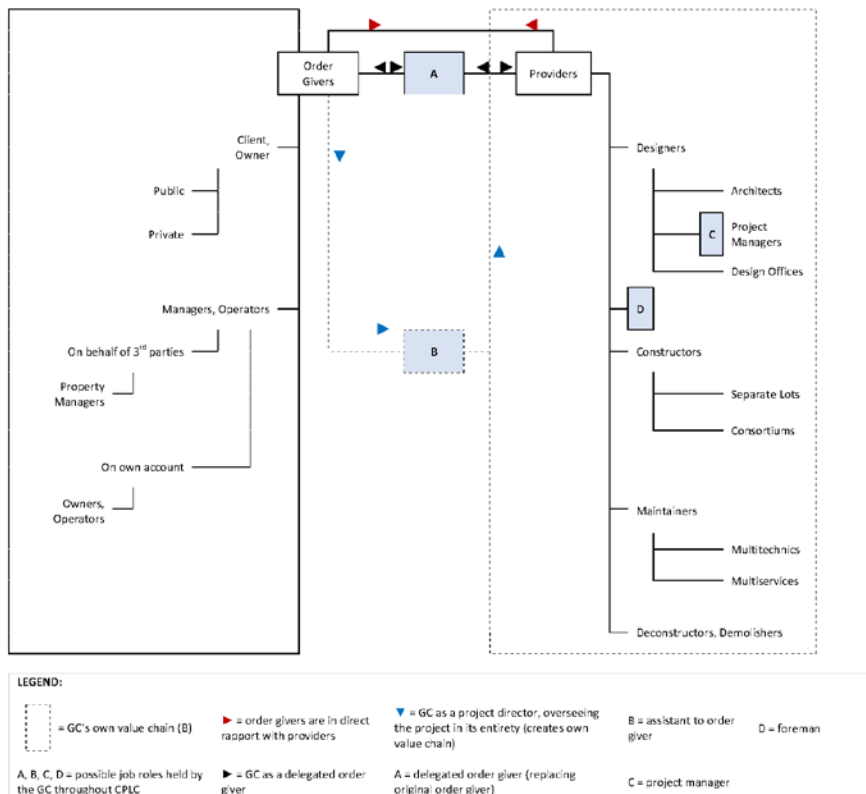


Figure 2.8. Construction sector organigram (source: created by the author)

SCENARIO:	A		B		C	D
Job role:	Delegated Project Owner		Assistant to Project Owner		Project Manager	Foreman
Involvement:	More		←		→	Less
Intervention:	Early stages of value chain		←		→	Later stages of value chain
	Such roles are now being endorsed by France-based construction operators (specifically sizeable general enterprises) due to the copious operational and managerial issues they are facing while executing full-scale, smart developments.				As conveyed earlier, GCs play several roles and hold different positions along the construction value chain.	
	This is indeed the case for Bouygues Construction and Vinci Construction.				Such roles could be performed by GCs at any time and in any project, regardless of its type or size.	
Added value ² :	Very High		High		Mid-to-High	Low
Level of challenges encountered:	Nil		Insignificant		Moderate	Extraordinary
Selective list of challenges encountered:	None		Trivial operational issues		<p>One or more of the challenges listed below could be encountered under scenarios C & D:</p> <ul style="list-style-type: none"> ▪ 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 for what ▪ Criticism of final product (by clients) ▪ Customer dissatisfaction 	

Table 2.4. General contractors' roles (source: created by the author)

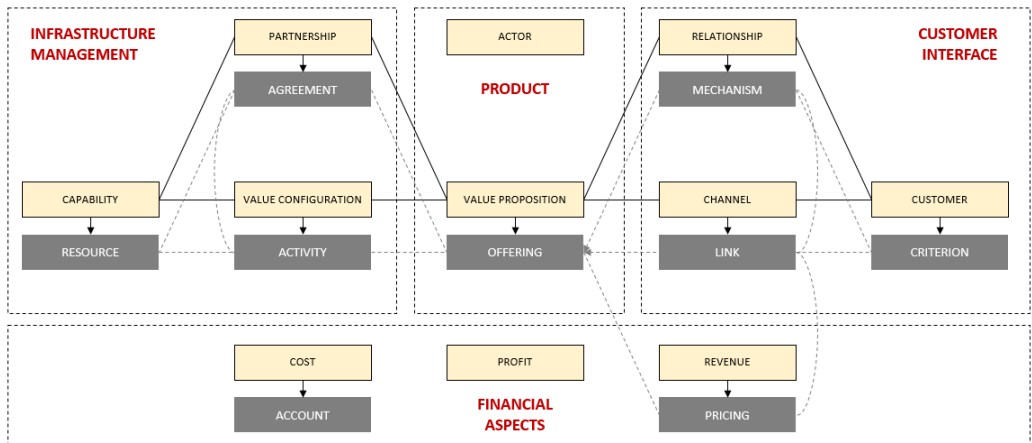


Figure 3.2. Osterwalder's business model ontology (source: adapted from Osterwalder (2004) and Osterwalder et al. (2005))

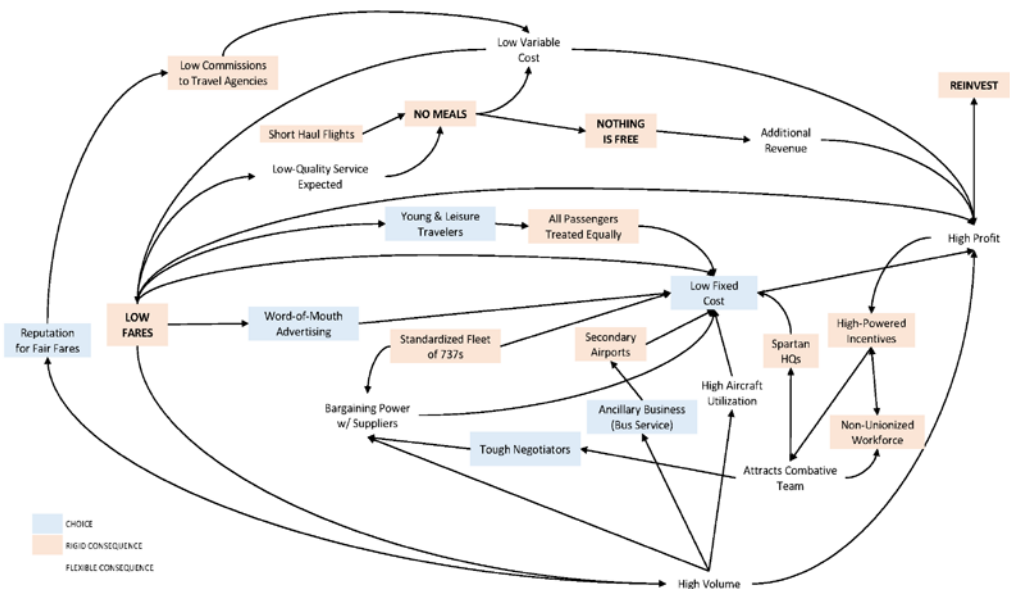


Figure 3.4. Ryanair's (low-cost strategy) business model (source: adapted from Casadesus-Masanell and Ricart (2011))

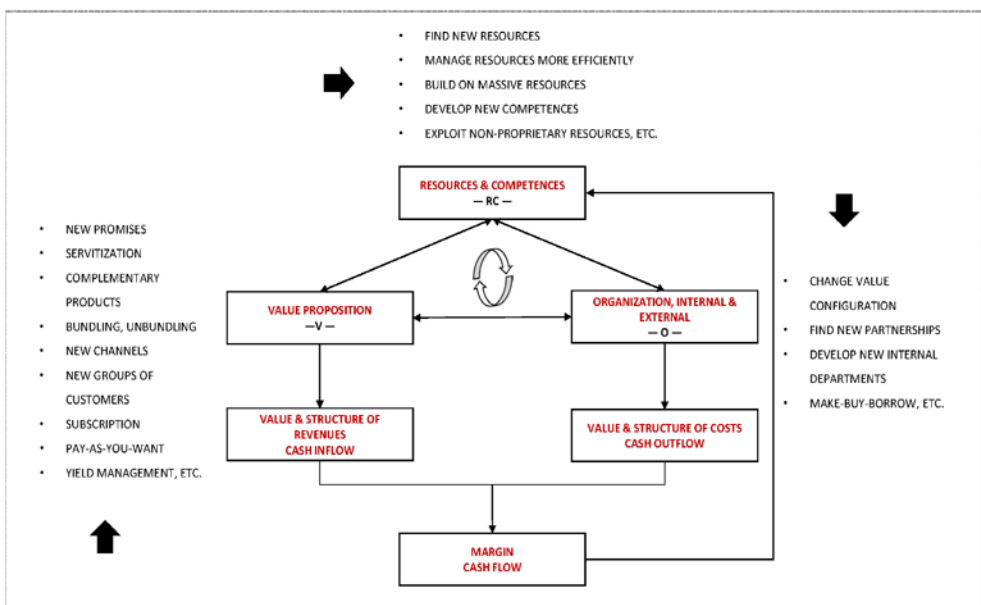


Figure 3.5. RCOV framework (source: adapted from Demil and Lecocq (2010))

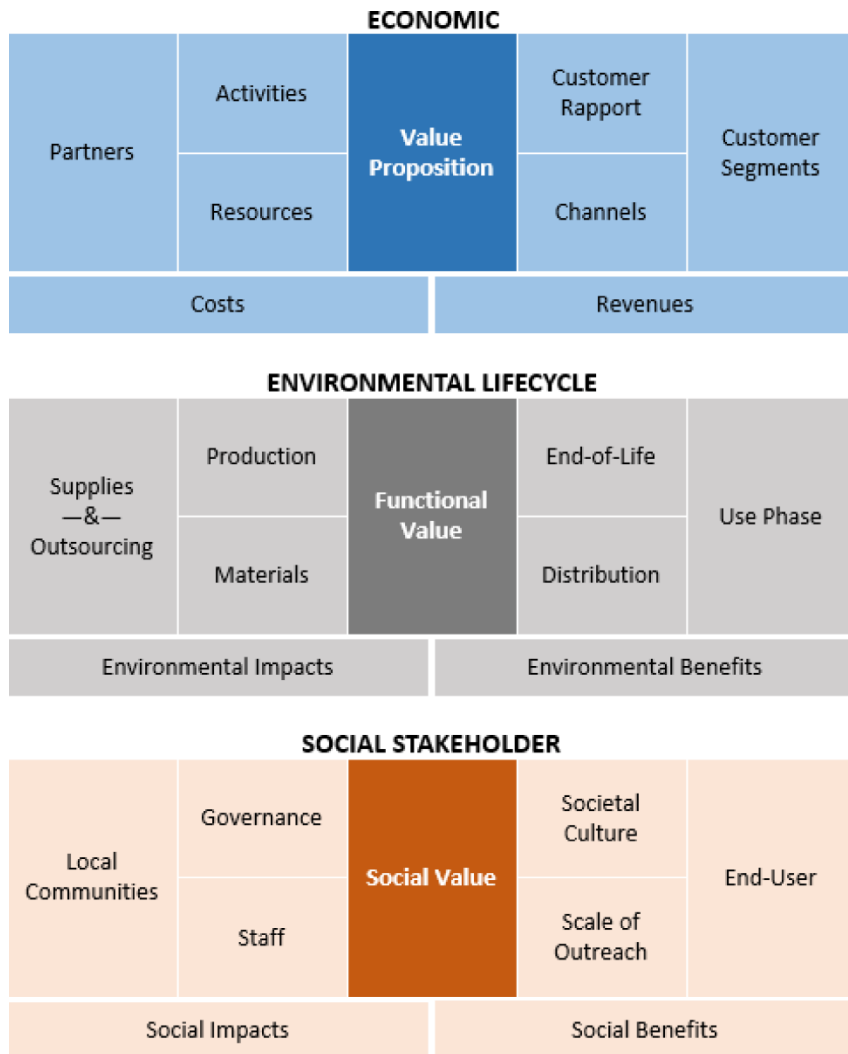


Figure 3.6. *The triple layered business model canvas (source: adapted from Pigneur et al. (2015))*

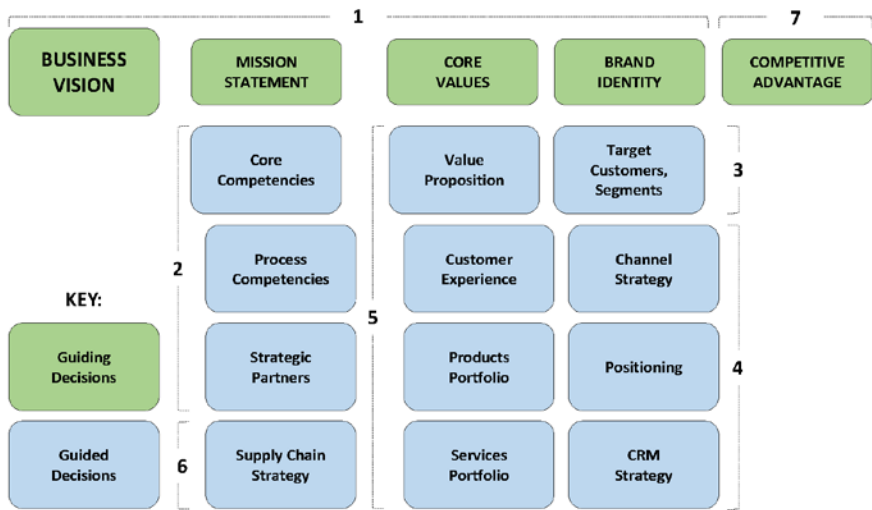


Figure 3.7. The decision-making model (source: created by the author – inspired by Lee and Stinson (2014))

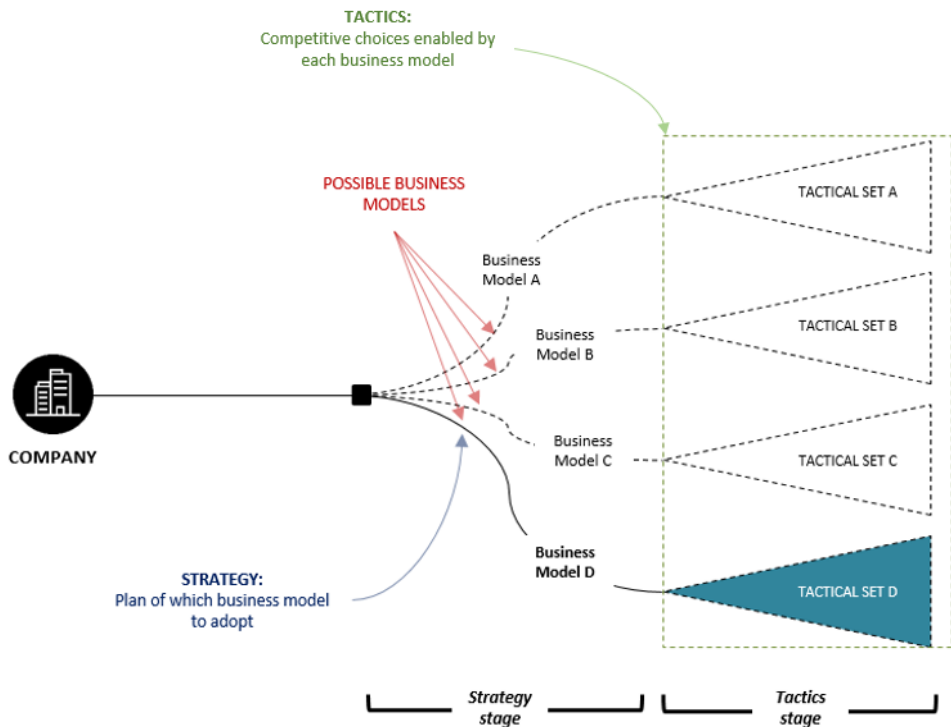


Figure 3.9. Strategy, business model and tactics (source: adapted from Casadesus-Masanell and Ricart (2010))

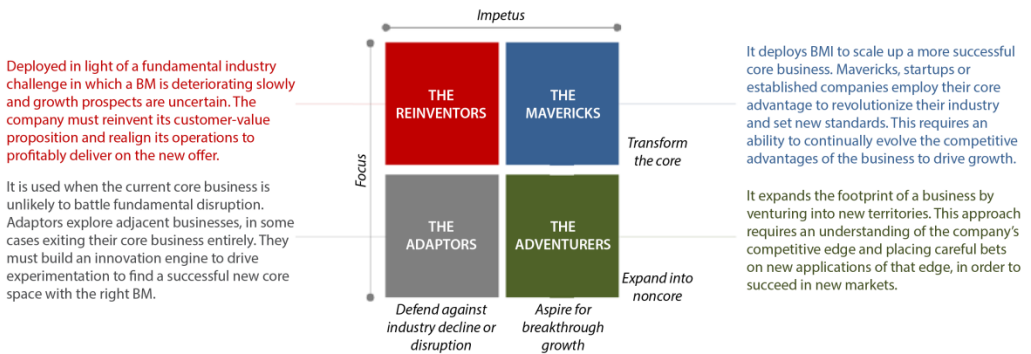


Figure 3.11. The four approaches to business model innovation (source: inspired and adapted from Deimler and Kachaner (2020))

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	<ul style="list-style-type: none">Markides (2006)Johnson et al. (2008)Santos et al. (2009)Koen et al. (2011)Sorescu et al. (2011)Amit & Zott (2012)	<ul style="list-style-type: none">de Reuver et al. (2009)Deshler & Smith (2011)Berglund & Sandstroem (2013)Evans & Johnson (2013)Cavalcante (2014)Giotra & Netessine (2014)	<ul style="list-style-type: none">Demil & Lecocq (2010)Deshler & Smith (2011)Pynnönen et al. (2012)Enkel & Mezger (2013)Aspara et al. (2013)Frankenberger et al. (2013)Dmitriev et al. (2014)Khanaga et al. (2014)Mezger (2014)	<ul style="list-style-type: none">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)	<ul style="list-style-type: none">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 3.8. Streams of BMI research (source: adapted from Foss and Saebi (2017))

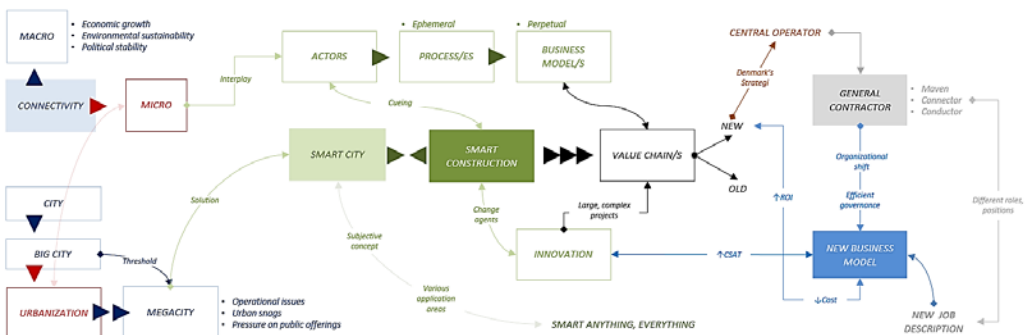


Figure 3.12. Conceptual framework (source: created by the author)

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 upon academic literature	– Revising and examining construction industry publications	– Partaking in collaborative research efforts on the 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 4.1. 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: – Conferences given by Architects 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 4.1. Data sources used in the business model design process (source: created by the author)

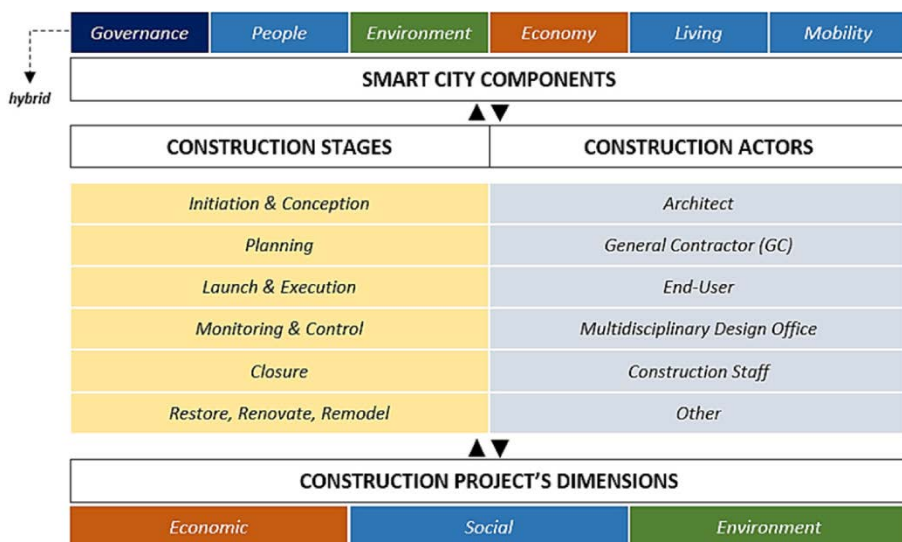


Figure 4.2. Version 1 of GC BM (source: created by the author)

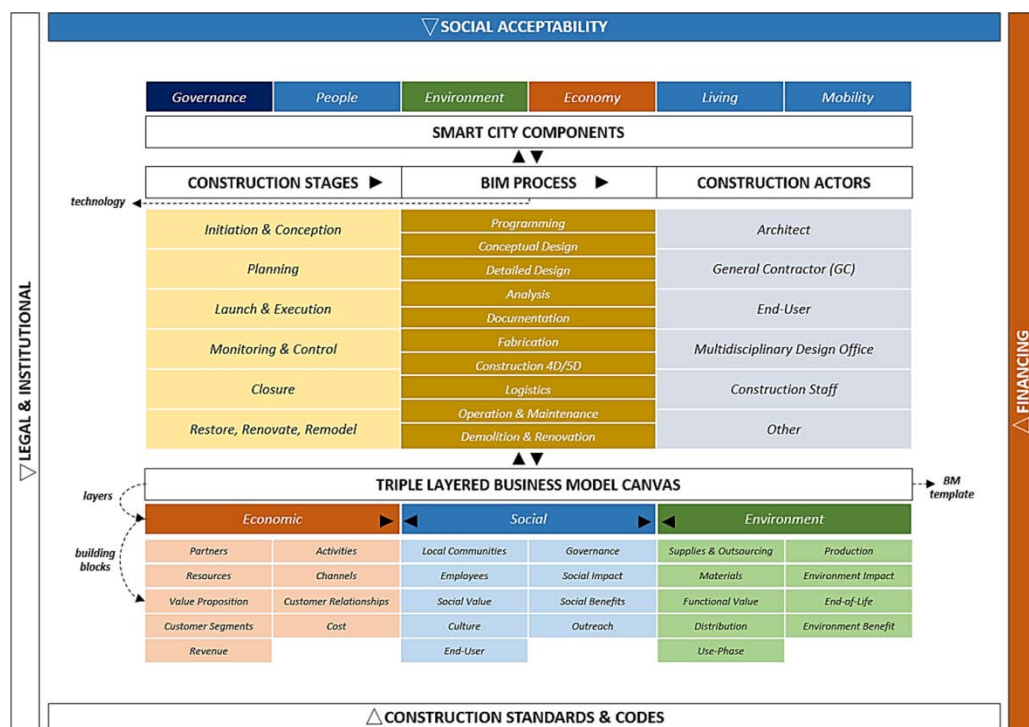


Figure 4.3. Version 2 of GC BM (source: created by the author)

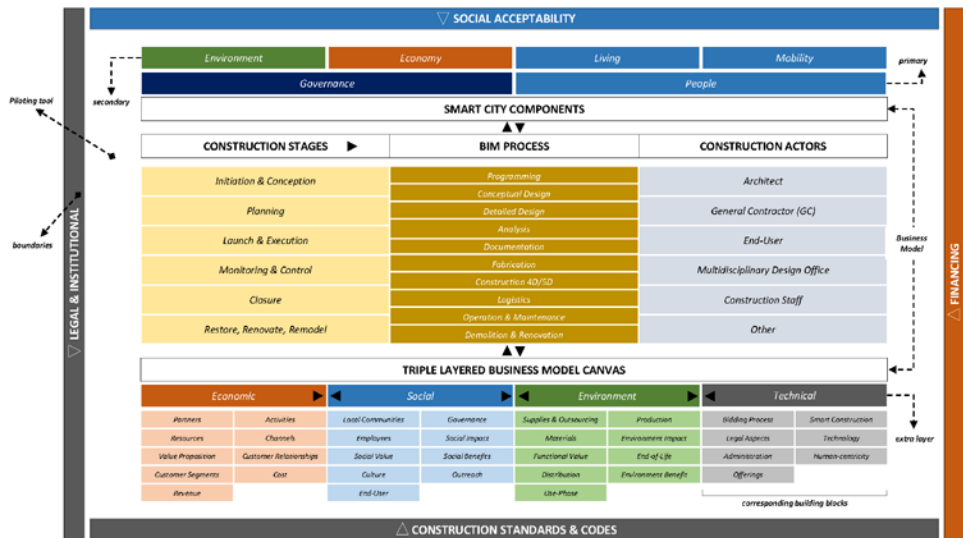


Figure 4.4. Version 3 of GC BM (source: created by the author)

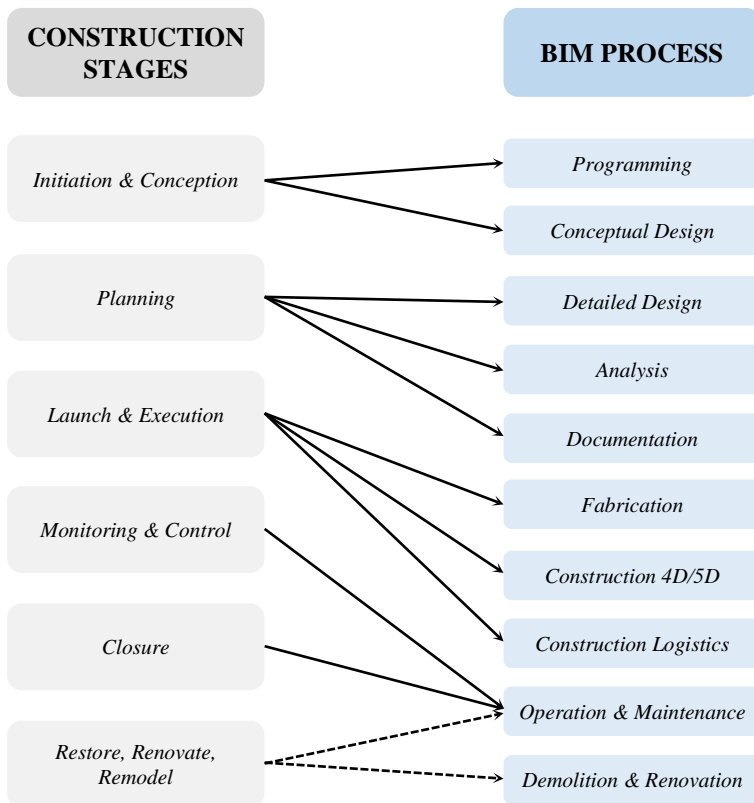


Figure 4.5. Association between construction stage and BIM process (source: created by the author)

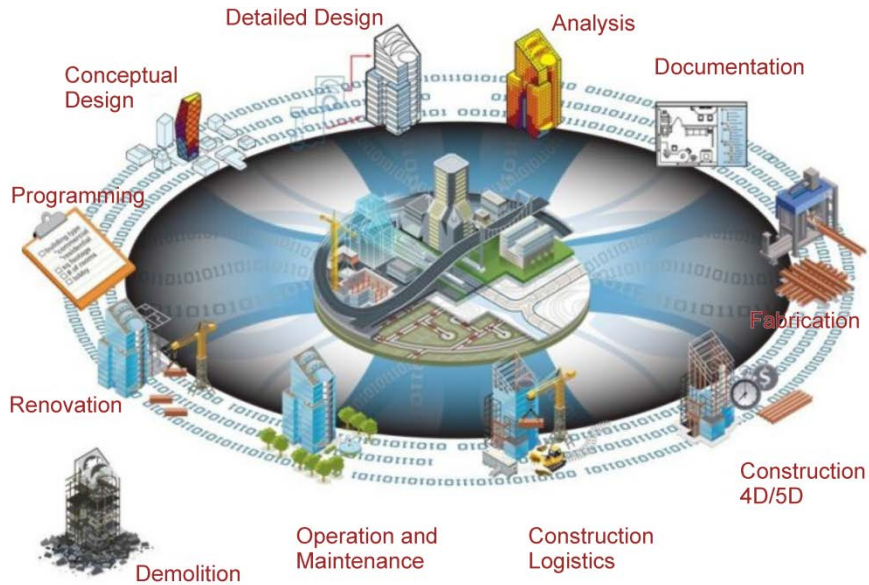


Figure 4.6. BIM process

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	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	Customer Segments — the process of dividing customers into groups based on common traits so that companies could market to each group effectively and apply
	Resources (Human and Nonhuman) — the factors used in producing products or providing services		Channels — a chain of businesses or intermediaries that a product or service passes through until it reaches the final customer	
Costs — the amount of money to be spent 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 green goals as a result. 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	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	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
	Materials — the various resources, sustainable or not, used in construction or production processes		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.)	
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 have some common interests in the area	Governance — the set of socially conscious standards on which a company manages its rapports with staff, customers, partners, and the communities where it operates	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	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
	Employees — a person working for another person or a company for pay		Scale of Outreach — capacity of a company to reach out to people to promote its propositions through word-of-mouth	
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 concerns improved living standards, greener neighborhoods, etc.		

Table 4.6. Definition of the TLBMC building blocks (source: created by the author)

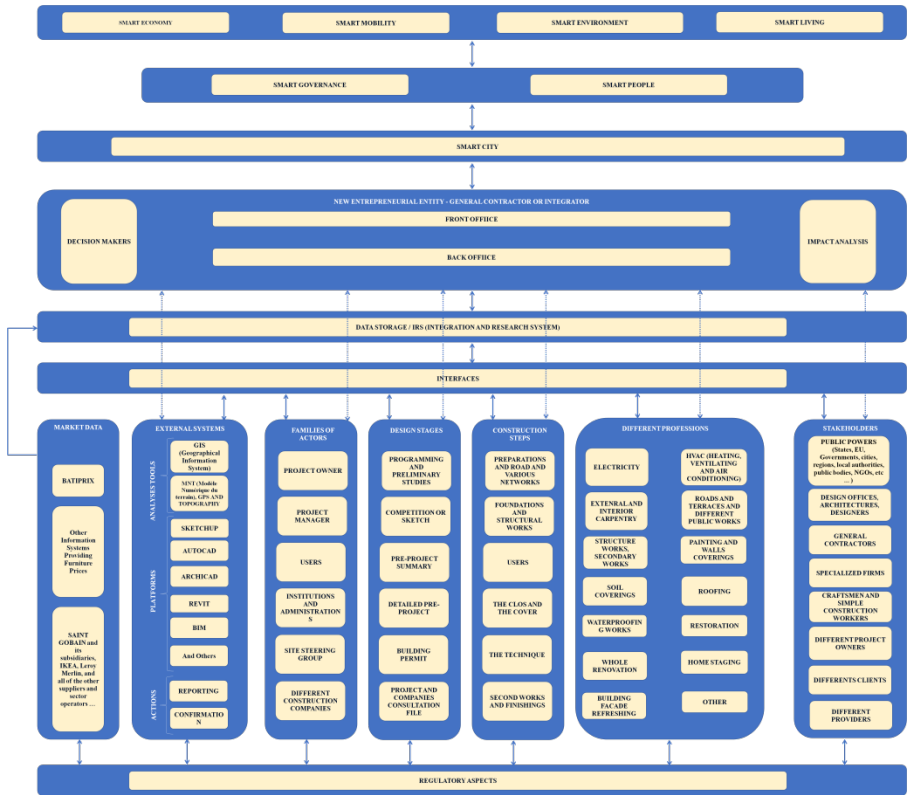


Figure 4.7. An early version of the envisioned GC BM (source: created by the author)

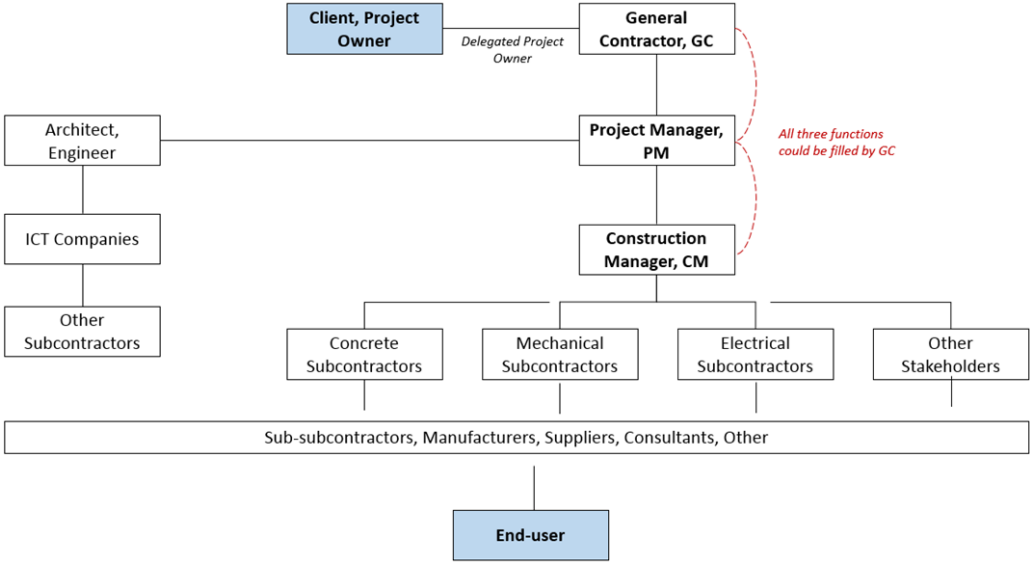


Figure 5.1. Simple graphical illustration of the GC BM (source: created by the author)

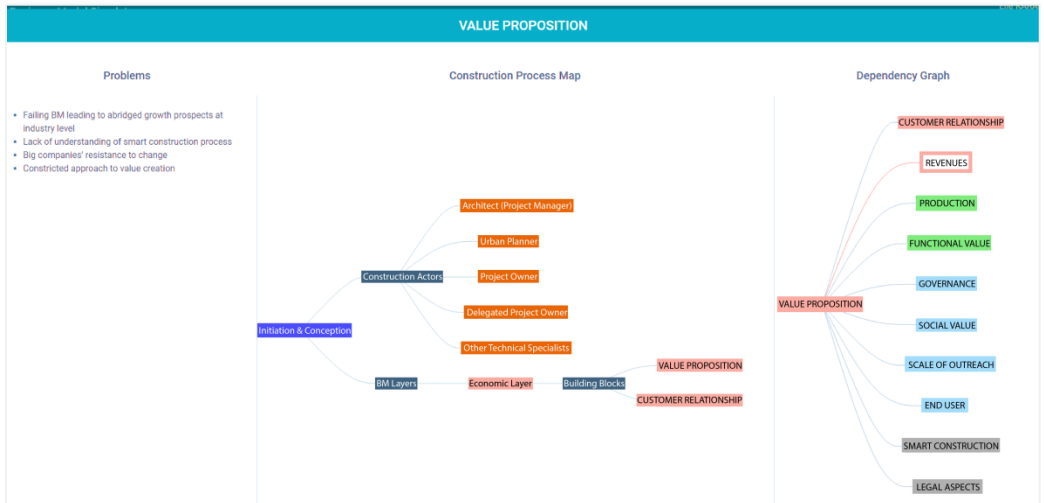


Figure 5.2. *Dependency graph (Failing Business Model)*

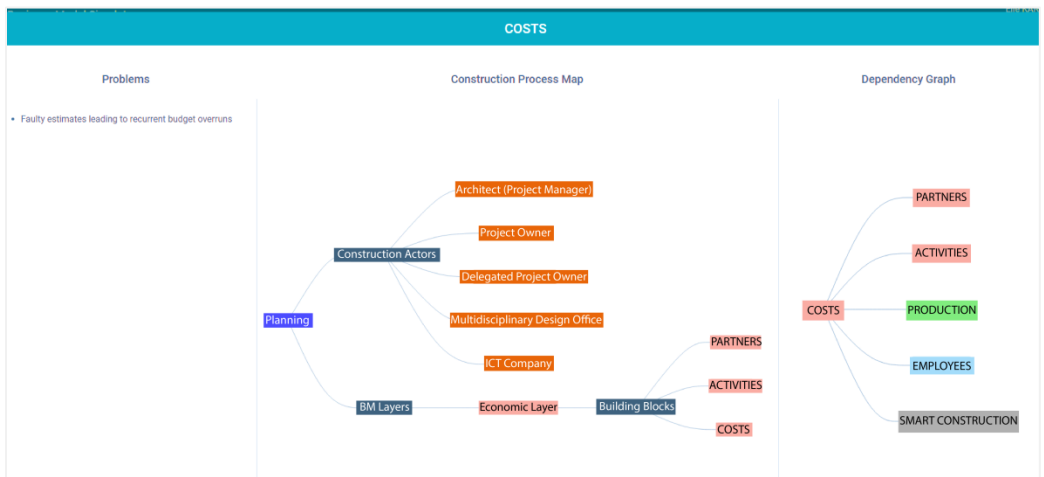


Figure 5.3. *Dependency graph (faulty estimates)*

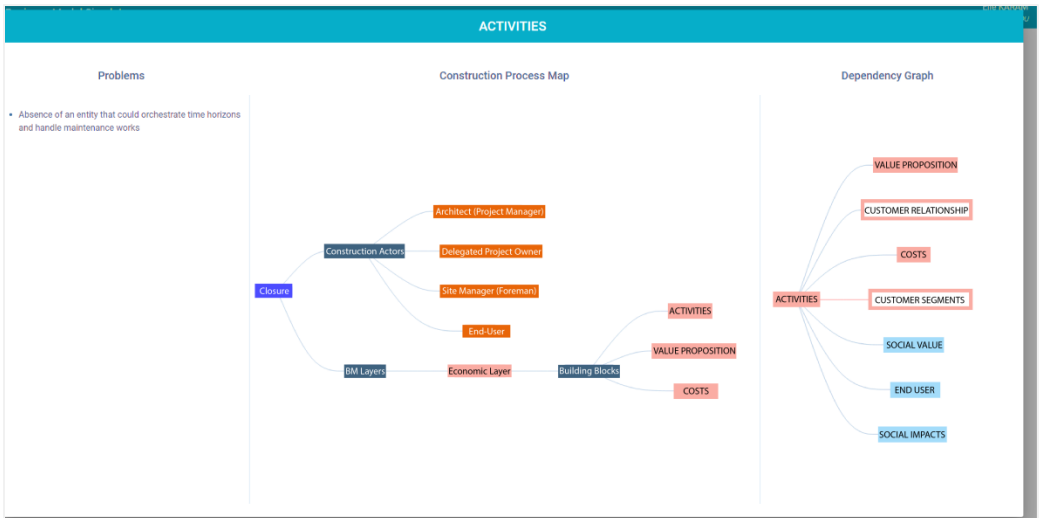


Figure 5.4. *Dependency graph (absence of an entity that could orchestrate time horizons and handle maintenance works)*

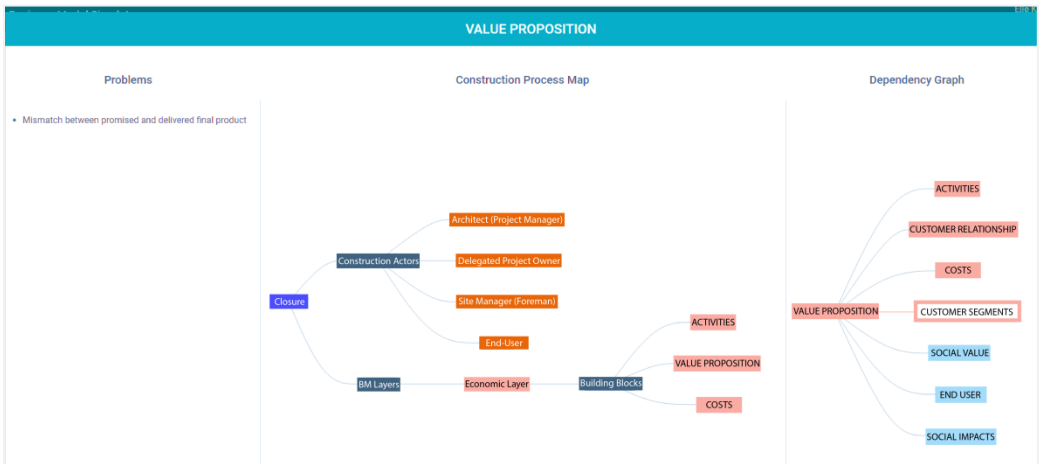


Figure 5.5. *Dependency graph (mismatch between promised and delivered product)*

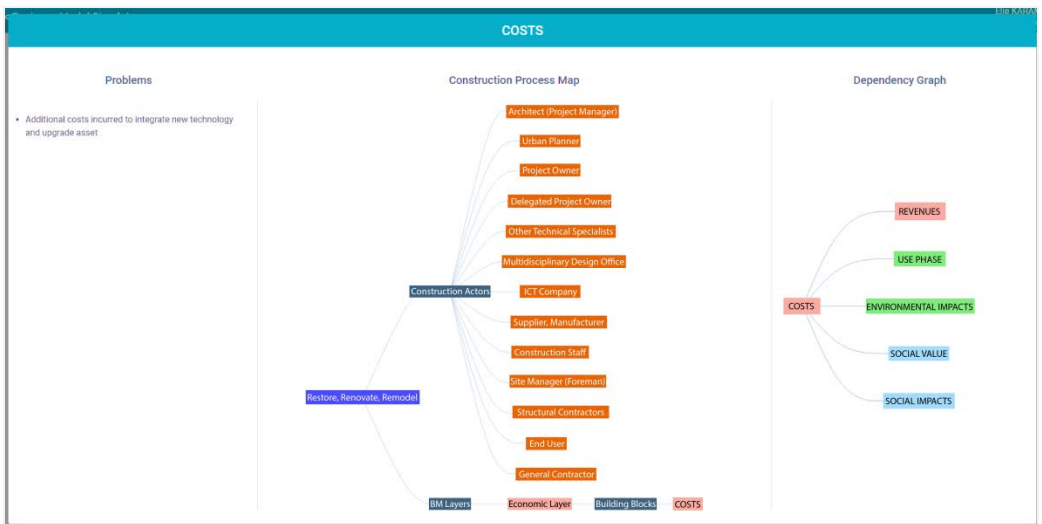


Figure 5.6. *Dependency graph (additional costs incurred to integrate new technology and upgrade asset)*

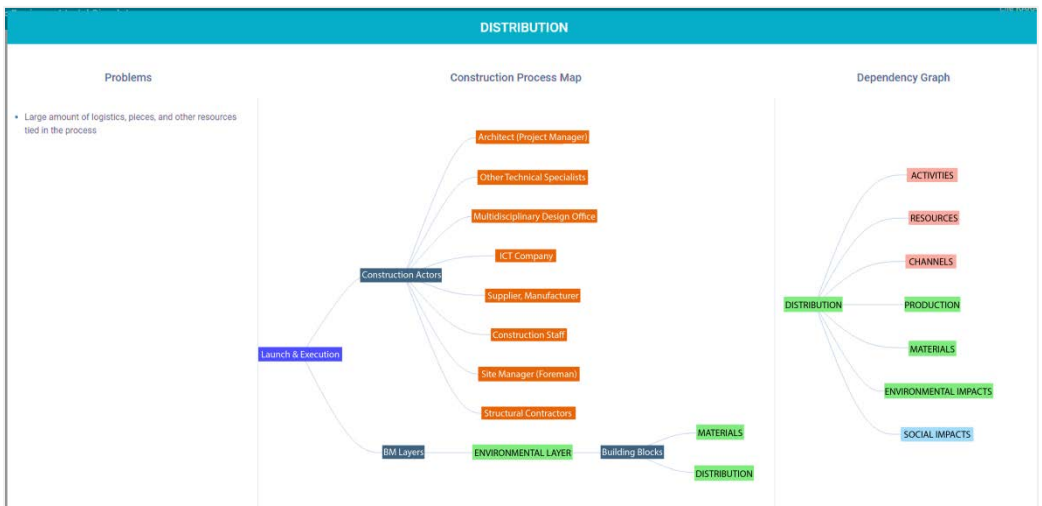


Figure 5.7. *Dependency graph (large amount of logistics, pieces and other resources tied in the process)*

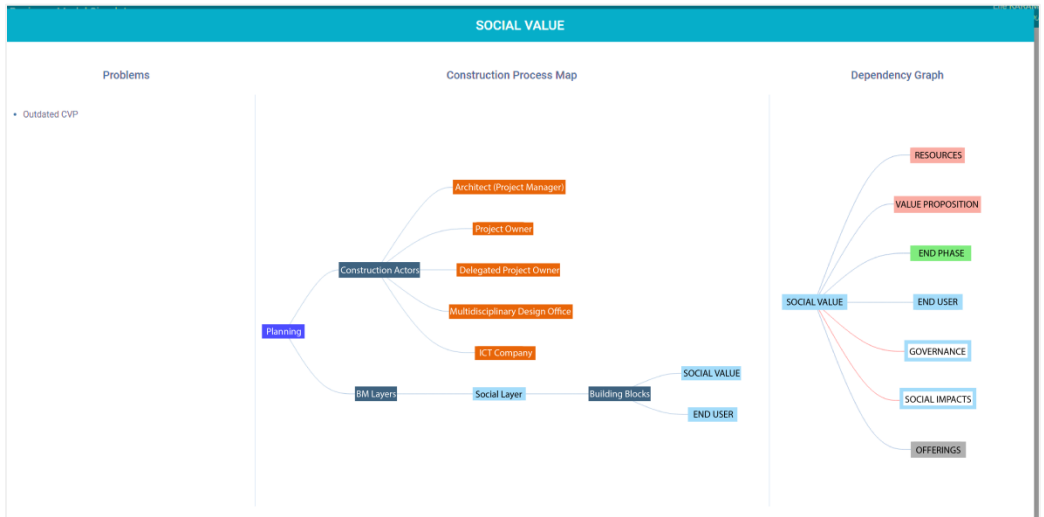


Figure 5.8. *Dependency graph (outdated CVP)*

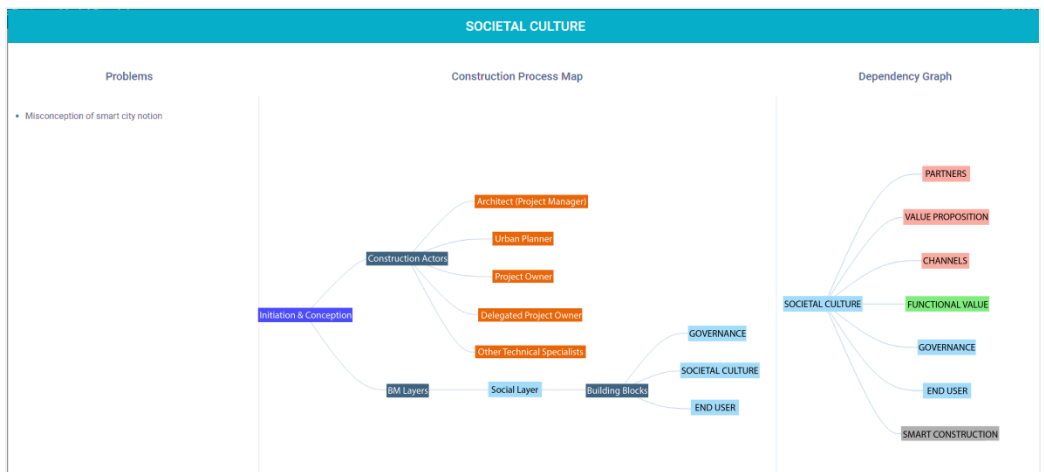


Figure 5.9. *Dependency graph (misconception of smart city notion)*

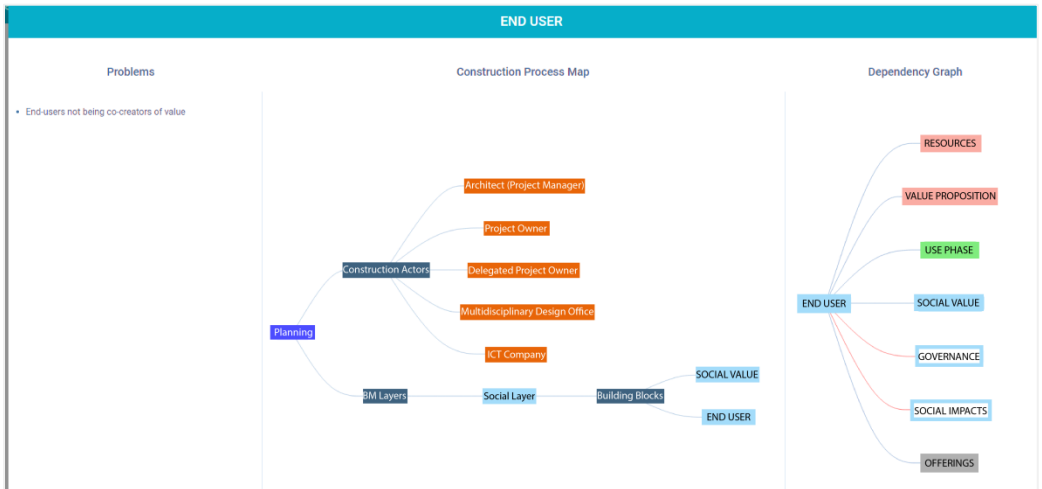


Figure 5.10. *Dependency graph (end-users not being co-creators of value)*

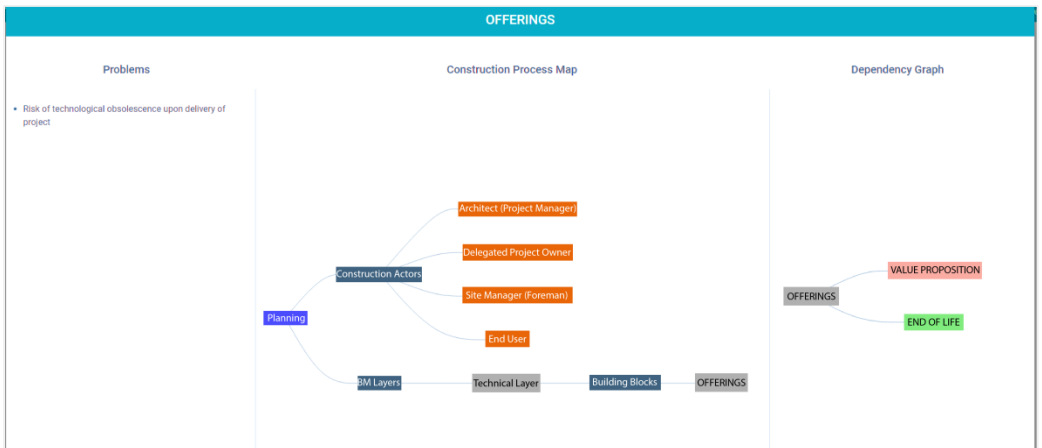


Figure 5.11. *Dependency graph (risk of technological obsolescence upon delivery of project)*

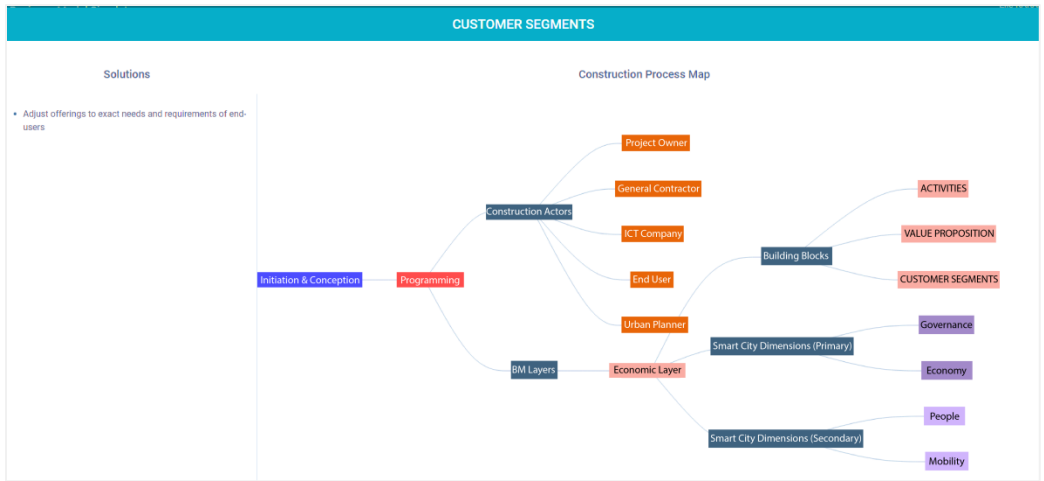


Figure 5.12. *Construction process map (adjust offerings to exact needs and requirements of end-users)*

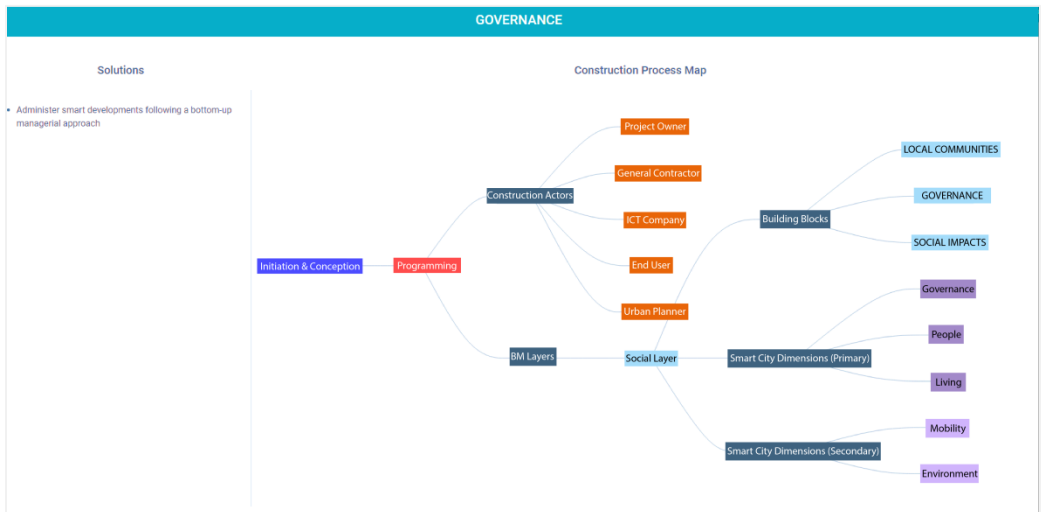


Figure 5.13. *Construction process map (administer smart developments follow a bottom-up managerial approach)*

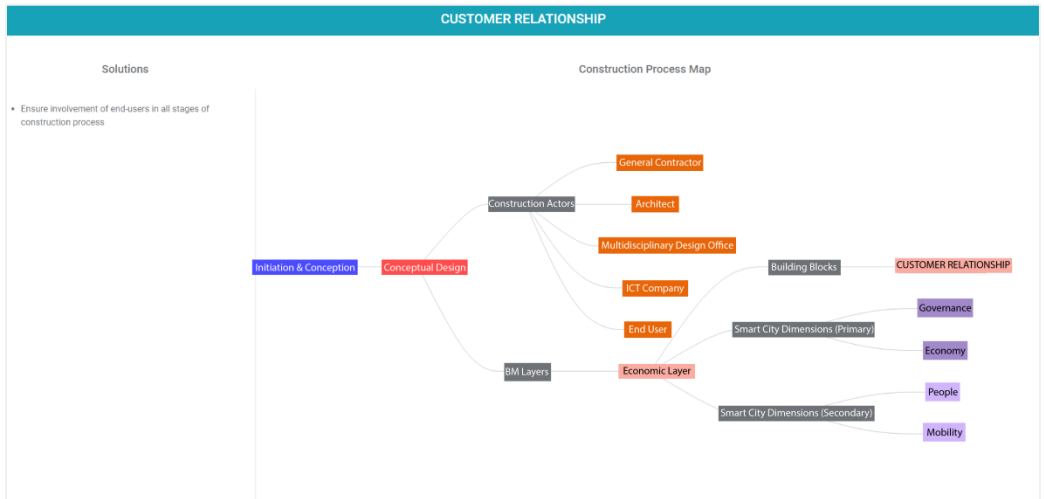


Figure 5.14. Construction process map (ensure involvement of end-users in all stages of construction process)

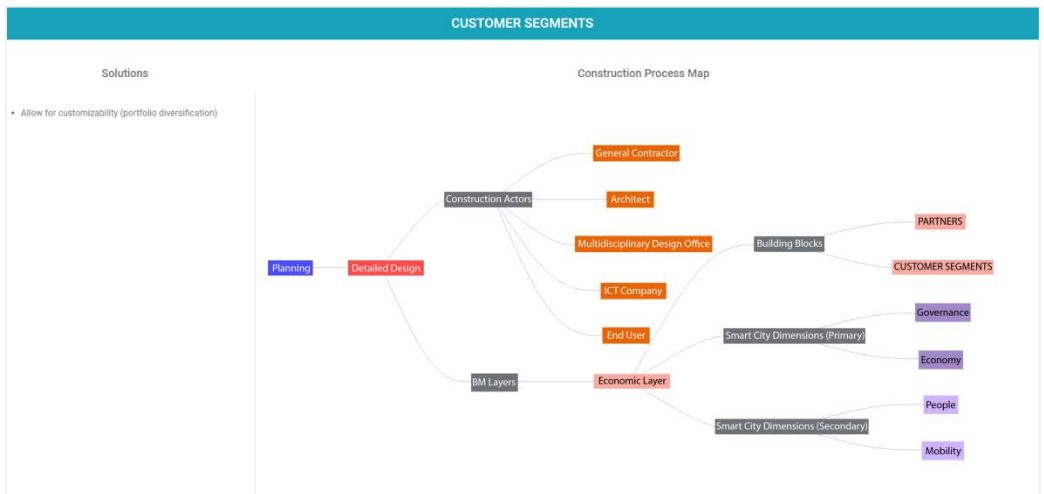


Figure 5.15. Construction process map (allow for customizability)