Business model design roadmap using CANVAS and C-SOFT framework elements, synchronised with start-up growth phases

Management of Technology - Master Thesis Report

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Preface

Management of Technology at Technical university of Delft is a course designed to accommodate students with a technical background like myself. During the last two years I was able to have firsthand experience at business research and practices closely associated with technology. To add to the technical background obtained during my initial years of education, I was able to learn about incorporating corporate knowledge with technology for better implementation. This thesis marks the end of my Masters course in Management of technology after rigorous efforts for two years which turned out to be somewhat chaotic towards the end. But this experience has taught me the importance of prompt time management, smart decision making, and intuitive thinking.

This thesis was a lifetime experience for me and for that I would like to thank my supervisors at Technology, Policy and Management department for the patient guidance that they provided for last eight months. Without saying, I would like to thank SmarterBetterCities management team for the opportunity to observe and study a GIS start-up up close in the beautiful city of Zurich. I would also like to thank my friends and colleagues at Delft for the unconditional support and guidance they provided, especially when I was at my lowest. I also thank Climate KIC for the opportunities and options they provided me and also for inspiring me towards a climate sensitive technology as well as personal development. Last but definitely not least I would like to thank my family in India for the emotional as well as financial support they gave me for my studies in spite of being so far away from home.

Sujaya Shinde
Delft, October 2014
Executive Summary

The establishment of a start-up firm consists of a chain of activities; technical research, opportunity identification, resource acquisition to name a few. The business model (BM) for a start-up firm is also being developed (intrinsically or explicitly) along with these activities. This development of BM is gradual and continuous. Eventually when entrepreneurs claim to have defined the BM for their start-up, most of the time they have just identified the BM that is being intrinsically designed since the technology research stage. Entrepreneurs draft a business plan to authenticate the economic value of the technology at hand. This business plan represents a simple value creating and money earning logic. This logic is the first basic design of the start-up’s BM. Even though an initial draft of a BM is in place, actual maturity of each BM element happens in segments. This thesis tries to track the design of a BM in terms of BM elements, which form the start-up’s first efficient BM. To ensure a balanced growth, entrepreneurs should consider the designing of the BM synchronised with start-up development. Scholars have proposed many models for start-up growth, which don’t specifically focus on all BM elements but on overall start-up growth.

A roadmap of BM elements using CANVAS and C-SOFT frameworks, in sync with start-up growth is the deliverable of this thesis. This roadmap will assist entrepreneurs to identify which BM elements to develop during specific phases of start-up growth. This guidance is more valuable to an upcoming industry with a great potential for small scale service providing start-ups. Geographical Information System (GIS) service providing industry is embarking on such an opportunity with the rise of open sourced GIS platforms for integrating urban planning services to manage the rising trend of smart cities. Additionally, academia will acquire a new perspective in the upcoming field of BM roadmapping for designing business models from scratch for ICT start-ups in GIS industry. Business model frameworks have standardised definition and categorisation of business phenomenon. The use of BM frameworks will ease the process of identifying and defining BM elements to accommodate various activities undertaken during each growth phase. The intended roadmap will be designed by studying characteristics of each growth phase and associating them with various BM elements of CANVAS and C-SOFT frameworks. With help of this prototype roadmap, a GIS design case specific roadmap prototype will be developed.

Since the final deliverable is a roadmap design, design science research methodology will be implemented to structure this thesis. The thesis will be divided into six sections. First hunch; this section will elaborate the motivation of this thesis along with academic and industrial positioning of the study. The second section; theoretical background will review literature in the field of business models, BM design frameworks, start-up growth and roadmaps. The subsequent section requirements and specifications; will elaborate the functional and user requirements for the roadmap, followed by structural specification for the same. Theoretical prototype is the next section wherein a purely theory bases prototype of BM design roadmap ver. 0.1 will be drafted. In the next section a design case study will be conducted to refine the prototype based on practical implications; BM design roadmap ver. 0.2. Considering the scope of this thesis, a case study will be conducted at GIS service providing start-up; SmarterBetterCities. In the last section of the thesis, implications will be drawn based on the comparison between ver. 0.1 (theoretical) and ver. 0.2 (practical).
The use of two frameworks will result in two roadmaps (total 4 roadmaps CANVAS 0.1 & 0.2 and C-SOFT 0.1 & 0.2). In the last section, the use of these two frameworks will be compared to evaluate the usability of each for roadmapping BM design process for ICT start-ups. Based on the implications derived in the last section, future recommendations are made for further studies in the field of Business model design roadmaps for ICT based GIS start-ups.
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1. Introduction: First Hunch

1.1. Prologue

City planning is a complex process involving many stakeholders and tremendous amount of data analysis. The concept of smart cities was developed to consolidate the large scale of data analysis and stakeholder involvement in this process with the help of rising trends of internet of things and ICT advances. One of the basic building blocks of this approach is the Geographical information system (GIS) for large scale city wide implementation. This advances opened up prospects for varied application and services based on GIS technology. The smart city market is beginning to get tremendous attention in recent years (SmarterBetterCities, 2014). A recent survey of water utilities in UK concludes that $7.1 billion could be saved by introducing smart water solutions (Department for Business, 2013). A study estimates the global market for smart city solutions and the additional services required to deploy them to be $408 billion by 2020 (Department for Business, 2013).

Recent development in this field is the introduction of CityEngine by Esri Inc. Esri CityEngine is a three dimensional modelling software application developed by Esri R&D centre Zurich (formerly Procedural Inc.), and it supports generation of 3D urban environments. The easy availability of the CityEngine platform has unwrapped many small scale business opportunities to develop various urban planning software applications to work on the CityEngine platform. This new emerging business sector has caught the interest of many entrepreneurs and venture capitalists. The start-up SmarterBetterCities (SBC) is one of the pioneers in this business opportunity. Founded in 2012 SBC has been able to survive most of the initial hurdles that a start-ups faces to reach the sustainable stage in business. The SBC founders spotted the business opportunity as a result of their expertise in 3D modelling and urban planning combined with the CityEngine platform. Although the technology behind the idea is innovative, on its own the technology has very restricted application paradigm; the technology has to be incorporated in the already existing planning processes of various stakeholders involved. The real innovation ‘comes from enveloping the new technology in an appropriate, powerful business model’(Johnson, Christensen, & Kagermann, 2008). This gives us an opportunity to investigate the steps taken by this start-up in arriving at the current stage and give pointers for other upcoming start-ups in this
field. This thesis is a study of stepwise business model development of SBC in this new considerably business sector.

New business sectors present the opportunity of developing new business models (BM) that can be implemented. A new technology will yield less value to the Start-up unless a suitable Business model is found (Chesbrough, 2010). An appropriate BM can provide competitive advantage as well as maximum value to the customer and economic returns to the company. Such importance of a suitable BM makes it appealing for entrepreneurs to give the due attention to BM design along with product development.

Scholars and practitioners have given more importance to Business Model development, in recent years (Amit & Zott, 2010). Global CEOs, (in a study conducted by IBM), acknowledge the importance of an efficient business model to achieve competitive advantage and maximum value from the product (Amit & Zott, 2010). After being dormant for years since its conception in 1960, Business model as a concept has recently gained accelerated attention with the ascend of internet business era (Osterwalder, 2004). The importance of service design in e-business, has given considerable amount of importance to the study of business models specific to ICT domain. As opposed to the common misconception, business model design and implementation is a dynamic process which takes place in parallel with the company growth. For start-ups, it is necessary to understand this gradual process of defining a business model, to identify the timing for developing various BM elements, keeping in mind the limited resources at hand. This thesis aims to design an artefact that will guide ICT entrepreneurs (specifically in the GIS industry) to develop and implement their BM in parallel with the start-up growth.

1.1.1. Industrial positioning

Planning is an essential part of successful execution of any task. ‘Starting a new business involves managing change, and because the successful management of change is both difficult and often time-consuming, planning is crucial’ (Scott & Bruce, 1987). High mortality of start-ups can be reduced through better pre-start-up planning (Castrogiovanni, 1996). This significance of planning for start-up companies makes it appealing to have a BM design roadmap so as to plan and manage a balanced growth. It will enable the entrepreneurial management to envision future objectives and derive an action plan to achieve those objectives. ‘To see past the borders of what is and into the land of the new, companies need a roadmap’ (Johnson et al., 2008). The pressure of being at the right place at right time is more crucial for start-ups as they lack the economy of scale and scope that can leverage the risk of missing an opportunity. This makes it vital for start-ups to have an action plan with clear objectives. Roadmapping business model design process using BM frameworks can help start-ups to address the issue of time lining most of the activities while aiming at finding an appropriate business model. A roadmap for balanced (in terms of technology as well as business) growth of a start-up will be more helpful for an upcoming small scale industry. With introduction of CityEngine (Esri Inc.) as a platform to host and run GIS (Geographical Information System) applications, many aspiring entrepreneurs are ready to seize this opportunity. The market of smart cities that will be addressed by these applications is also growing rapidly and will require the proportionate rise in GIS service providers. A roadmap to develop the business model of such GIS service providing start-ups will provide useful insights and guidelines for the upcoming CityEngine based GIS business sector.

This thesis is aimed at consolidating the steps taken by SBC in reaching the current stage in business where the company is making its first leap towards a sustainable flow of revenue. The consolidation will be in form of a business model design roadmap drafted across the various
business model design roadmap using CANVAS and C-SOFT framework elements, synchronised with start-up growth phases

growth phases of a university spinoff (such as SBC). This roadmap will be developed following the standardised Design Science Research Methodology (DSRM), which can be generalised further to develop roadmaps for similar small scale start-ups in GIS industry. Also the study of the BM design of SBC wills revile some crucial strategic decisions that contributed to the current achievements of the company as a start-up in a new business sector. These strategic decisions and their timing can provide guidelines for other upcoming entrepreneurs in the GIS service providing industry encircling around the CityEngine platform.

To conclude: “GIS service provider Start-ups need a business model design roadmap to estimate the business elements that need to be developed during specific start-up growth phases, for deriving an appropriate business model. Also, this roadmap can be used for guiding the entrepreneurial management to plan and achieve desired future objectives of the start-up.”

1.1.2. Academic Positioning

CityEngine platform bases GIS service provider industry is an upcoming business sector. Every new market poses an opportunity to innovate and develop an appropriate business model for the particular business sector in a particular business network. Present thesis aims to explore this business sector to find an appropriate business model framework design that is able to address the high influence of technology (ICT) and the complexity of the network involved. Over the years of study in the field of business model it has been observed that business model design is most efficiently done in parallel with the product development. Business model is considered as a static entity at times unlike technology or organisational growth. Instead, it should be considered as a dynamic element which keeps on changing with the company growth (De Reuver, Bouwman, & MacInnes, 2009). Entrepreneurial literature should accommodate this changing nature of BM to devise ways for overall growth of a start-up company (Morris, Schindehutte, & Allen, 2005). For an ICT centric company business model development encircles around service design and development extensively. There is extensive importance of service (Kotler, 1984) design and its impact on value proposition in ICT domain. A same service concept with different service design can yield different outputs. Business modelling gives the desired scope for exploring various service designs (Bouwman, De Vos, & Haaker, 2008) around a constant service concept (Bouwman et al., 2008) and hence has a considerable impact on ICT companies. Consequently, it becomes more crucial for an ICT start-up to find an appropriate BM to capture maximum value and earn maximum returns. Keeping in mind the importance of business model design and development for ICT firms, a roadmap of business model development for the upcoming start-ups in the before mentioned GIS service provider industry will be valuable contribution to the entrepreneurial literature in this field.

With an objective to provide a new perspective on the entrepreneurial BM literature in GIS domain, this thesis aims to correlate the BM literature on its dynamic nature and start-up growth phasing models. The start-up growth phasing model used in this thesis is the Five Phase University spin-off growth model (Vohora, Wright, & Lockett, 2004). This model describes each phase with explicit details. Also the conceptualisation of this phasing model is based on nine field studies, which make it possible to correlate the phase description to practical scenarios. This helps to correlate BM element descriptions with each phase of the start-up growth, theoretically as well as practically.
Using the BM elements from pre-defined BM frameworks will ensure a common understanding of the elements. Business modelling frameworks contain a standardised categorisation of BM elements. These frameworks provide a well-defined outline structure which can be filled in with interrelated activities to design different business models. To develop a BM systematically various BM ontologies/frameworks can be used, but there is no consensus on a generic framework for business model design (Bouwman et al., 2008). This thesis tries to evaluate two different business model designing frameworks CANVAS and C-SOFT, for their applicability to develop the desired business model design roadmap.

To conclude: “The dynamic nature of business model can be correlated with entrepreneurial literature on growth phases of a start-up, to derive an artefact that can guide the business model development from the very beginning of the company development specifically for the GIS service provider start-ups.”

1.2. Research Objective

By consolidating the Industrial and academic problem positioning, a generic problem statement can be derived as follows.

Problem Statement: “A framework is needed to draft and track the design of business model of a GIS service providing start-up, which can help the entrepreneurial management to identify specific areas of the business model to focus upon with reference to the growth phase of the start-up.”

The industrial problem positioning revolves around the need of a roadmap for balanced (in terms of technology as well as business) growth of a start-up, while the academic positioning of this thesis aims at accommodating the dynamic nature of BM into the entrepreneurial literature on growth phases of start-up. Business model design roadmap in the present thesis refers to the tracking each step needed to come up with an appropriate business model for a start-up at the very start of the company. This research is undertaken with a Management of ICT approach with a specific focus on entrepreneurial GIS service providing start-ups. On the basis of academic and industrial positioning and the scope of this thesis, following Objective can be drawn.

Research Objective: “To design a business model design roadmap for university spinoffs in ICT industry using BM design frameworks, that will help to identify specific business model elements to be developed during various growth phases of a start-up, and will also help the GIS entrepreneurial management to roadmap activities for balanced growth of a start-up.”

1.3. Research Questions

For this thesis, the Objective and the problem statement co-define the main research question, whose solution will be the final deliverable of this thesis.

Research Question: How to trace the BM design in a growing start-up using BM design frameworks?

The research question can be broken down into six sub-questions that will serve as consecutive steps to reach the final objective of the research. The flow of these research questions is based on the research design of this thesis (Verschuren & Hartog, 2005), literature
available on business model roadmapping (De Reuver, Bouwman, & Haaker, 2013), and the practical design case study undertaken for this thesis. The sub-questions also define the outline of this thesis.

1.3.1. Sub Questions

Q1. What is the need for tracking BM design in a start-up (specifically in GIS service providing industry)?

As discussed in the industrial as well as academic positioning, the dynamic nature and impact of BMs on start-up's business (specially for an upcoming business sector like GIS service providers), makes it compelling to track its development. Tracking this development will also enable entrepreneurs to derive a roadmap to be used for guidelines in planning purposes of start-up growth in the GIS service providing industry.

Q2. How to design the tracking artefact (BM design roadmap)?

In order to ensure scientific relevance of the design process, a methodical research approach has to be undertaken. Since the objective of this thesis is to design a tracking artefact, Design Research Methodology (Hevner, 2007; Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Verschuren & Hartog, 2005) will be used to execute this thesis. This methodology will be adopted to accommodate the resource limitations and time constraints of this thesis and will include steps like First Hunch, Theoretical background, Requirements and Assumptions, Structural specifications, Prototype (Theoretical and Practical) and Implication.

Q3. What is the theoretical background for selecting specific theories to design the roadmap of BM development?

This thesis aims to correlate ‘BM design frameworks’ and ‘start-up growth’ via the technique of roadmapping. The theoretical background of BMs, BM frameworks, start-up growth and roadmapping has to be studied to understand fully and implement the theory to design a roadmap for BM development. Base on the theoretical background of Start-up growth, a Five Phase University spin-off growth model (Vohora et al., 2004) is selected. In addition, this thesis aims to design two roadmaps based on two BM frameworks. After contemplating on the relevance of the various BM frameworks and the time limitation of the thesis, two BM frameworks; CANVAS (Osterwalder & Pigneur, 2010) and C-SOFT(Heikkilä, Heikkilä, & Tinnilä, 2008) will be selected to draft the roadmaps.

Q4. What implications can be drawn from theory to draft a theoretical prototype roadmap ver. 0.1?

Functional and user Requirements will be drafted followed by structural specification to design a roadmap for BM design from existing literature (on BM, start-up growth and roadmaps). A BM design roadmap thus designed will be referred as the Roadmap ver. 0.1. This Roadmap ver. 0.1 will be designed by correlating various BM elements of CANVAS and C-SOFT BM design frameworks to each of the five phases (Vohora et al., 2004) of start-up growth. This correlation will be done by comparing the characteristics of each phase as defined in the literature (Vohora et al., 2004) to the characteristics of each of the BM element (e.g. Value proposition, Customer Relations, etc.) as defined in the literature (Heikkilä et al., 2008;
Osterwalder & Pigneur, 2010). This Roadmap ver. 0.1 is a theoretical prototype as it will be derived solely from existing literature about the kernel theories of 5 phase start-up growth model (Vohora et al., 2004), CANVAS (Osterwalder & Pigneur, 2010) and C-SOFT (Heikkilä et al., 2008).

Q5. How will the theoretical prototype be implemented in a practical scenario?

A design case of a University spinoff GIS service providing start-up; SmarterBetterCities (SBC) is selected to check the practical validity of the theoretical prototype designed as a result of sub-question 4. SmarterBetterCities’s background will be studied to understand the selection of this specific start-up for implementation. Interview with founder and secondary data from company’s archive documents and observations will be used to draft the BM design roadmap of SmarterBetterCities (Roadmap ver. 0.2). Interviews and workshops with employees will provide data to locate the current growth phase of SmarterBetterCities i.e. one of the five phases of start-up growth (Vohora et al., 2004) that resembles most with the current situation at SmarterBetterCities. Considering the fact that growth is a dynamic process, the current situation at SmarterBetterCities is changing every day. Keeping this in mind, a snapshot of current situation at the time of interview is used to compare and identify the current phase (out of the five phase model) at SmarterBetterCities. The Current phase will be studied in detail to check practical utility of the roadmap designed and also to illustrate the use of roadmap to plan for future growth.

Q6. What is the assessment after comparison of the roadmap (CANVAS and C-SOFT) ver. 0.1 and ver. 0.2?

Implications will be drawn based on the commonalities and discrepancies between the theoretically derived roadmap (ver. 0.1) and SmarterBetterCities roadmap (ver. 0.2). The commonalities will increase the validity of the design (within GIS service providing industry) while the discrepancies will encourage fine-tuning of the design and future recommendations. The usability of CANVAS and C-SOFT framework within the GIS service providing start-ups will also be compared to derive recommendation on usability of the methodology for designing a similar BM design roadmap.

In the final chapter of this thesis, the original objective will be revisited to check the relevance of the final deliverables to the main research question. The limitations and future recommendation of this thesis will also be discussed in the last chapter.

To conclude the thesis outline is drafted along the lines of research sub-questions and in accordance with the research methodology.

Table 1: Thesis Outline

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2. Research Design

Before initiating a research to design any artefact, it is essential to reflect upon scientific design methodology to conduct a creditable research in a structured manner. Research design helps to confide the research to a predefined set of actions. The research methodology used in this thesis includes; First Hunch, Topic background, Structural specifications, Prototype, Implementation and Evaluation. Present thesis is aimed at designing an artefact i.e. a Roadmap for BM development, and so can be termed as a design science research. The methodology used for this thesis is based on a combination of scientific Design Research Methodologies (Hevner, 2007; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007; Vaishnavi & Kuechler, 2004; Verschuren & Hartog, 2005). This chapter elaborates on design science inspired steps that will be followed in this thesis.

2.1. Research Methodology

A methodology can be defined as ‘a system of principles, practices, and procedures applied to a specific branch of knowledge’ (Peffers et al., 2007). Exploring the theory on research methodology enables a researcher to understand and implement appropriate research tactic for the intended research. As per literature ‘Research methodology’ in general is to motivate, develop, design, demonstrate, evaluate and communicate the developed artefact. These characteristics are also consistent with the Design Science Research Methodology (DSRM) (Peffers et al., 2007). The artefact that is to be created from this thesis is the design of Business model design roadmap. Since it is a design research thesis, DSRM is the most relevant research methodology to focus on. ‘Design deals with creating some new artefact that does not exist. If the knowledge required for creating such an artefact already exists then the design is routine; otherwise, it is innovative’ (Vaishnavi & Kuechler, 2004). The BM design roadmap (specifically for GIS service providing industry) will be designed by organising available data as well as observations from the design case study at SmarterBetterCities. Design science research is also termed as Improvement Research because it is generally conducted to solve a problem or enhance performance. The roadmap to be designed in this thesis is expected to improve the efficiency of BM design in ICT start-ups in general and specifically for GIS service providing start-ups. This roadmap is also aimed to help the entrepreneur to comprehend and plan for balanced (in terms of technology and other business aspects) start-up growth.

Nunamaker and Chen (Nunamaker Jr & Chen, 1990) proposed a 4 step system design, multi-methodological, high-level approach, which can be implemented in business research (Peffers et al., 2007). The four simplified steps of this approach are; 1) theory building, 2) systems development, 3) experimentation and 4) observations. This methodology was further developed into a design science process, extending it to six steps.

i. Problem identification and motivation
ii. Defining the objectives for problem solving
iii. Designing and Developing
iv. Demonstrating or implementing the design
v. Evaluation of the design after implementation
Communicating to relevant audiences, the Problem, its Solution, the solution Design and its Evaluation.

In the case of a design science research, step 3, 4 and 5 are repeated in the form of design iterations. “Progressive refinement in design involves putting a first version of a design into the world to see how it works. Then, the design is constantly revised based on experience, until all the bugs are worked out” (Collins, Joseph, & Bielaczyc, 2004). This is the reason for designing the two versions of roadmap prototype (two design iterations) in this thesis.

In an article by Verschuren and Hertog (Verschuren & Hartog, 2005), these six steps (mentioned above) are adopted to accommodate evaluation and research methodologies as systematic input of the designing process. Accordingly the six stages are; First Hunch, Requirement & Assumption, Structural specifications, Prototype, Implementation and Evaluation (Verschuren & Hartog, 2005). These stages can be regrouped into three phases namely; Plan (First Hunch, Requirement & Assumption, Structural specifications), Process (Prototype, Implementation), and Product (Evaluation). The last stage (Product) deals with actual evaluation of the designed artefact in the real world, which at times takes too long, especially when the artefact to be designed is a business process (Verschuren & Hartog, 2005). Business processes are difficult to design, implement and evaluate in a short time frame of 8 months (duration of this thesis; March 2014-October 2014). For the present thesis, the Product stage would consist of evaluating the use of the designed BM design roadmap (specifically ver. 0.2) to reach the final stage of Sustainable returns (last/fifth phase of start-up growth (Vohora et al., 2004)) for SmarterBetterCities. As per the observations made during the design case study at SmarterBetterCities, the company intends to reach this phase in year 2016 (SmarterBetterCities, 2014). But the theoretical roadmap (ver. 0.1) and the SmarterBetterCities roadmap (ver. 0.2) can be used as guidelines to develop similar roadmaps for other GIS service providing start-ups.

2.2. Thesis research design

The stages (First Hunch, Topic background, Requirement and Specifications, Prototype and Implications) that will be executed in this thesis are as follows.

Stage 1. First Hunch: The initial motivation for designing the artefact is also the stage where the final objectives of the design are set. In the present thesis, the final objective has been defined as “To design a business model design roadmap for university spinoffs in ICT industry using BM design frameworks, that will help to identify specific business model elements to be developed during various growth phases of a start-up, and will also help the GIS entrepreneurial management to roadmap activities for balanced growth of a start-up”. The motivation of this thesis is explained in the academic as well as industrial positioning of the study in the 1st chapter as, the need for providing guidelines for BM design in ICT start-ups, specifically for GIS service providing start-ups. The industrial and academic positioning is derived from desk research directed towards identifying the lack of available methodologies to address dynamic nature of BM design in entrepreneurial arena and the need of guidelines for best practices in the upcoming GIS service providing industry. The objective derived serves as the goal [G] (Verschuren & Hartog, 2005) to design the Requirements and Structural specification in the next stage of the thesis.

Stage 2. Topic Background: The theoretical background phase explores existing theories and literature in order to locate the kernel theories (Walls, Widermeyer, & El Sawy, 2004) used for designing the roadmap for BM design for a start-up. Reviewing the existing
literature is essential to gain understanding of the theoretical underpinning of the problem and develop an advanced design based on already validated knowledge (avoiding reinventing the wheel). During this stage literature on Business model, Business model design frameworks, CANVAS, C-SOFT, Start-up growth models and Roadmaps, and Business model roadmapping will be studied.

Stage 3. Requirement & Assumptions: Requirements for the artefact to be designed will be generic since the problem statement mentioned for this thesis did not originate as a demand from a specific organisation. The functional and user Requirement & Assumptions will be derived from the generic problem positioning coupled with the literature reviewed (specifically BM and Roadmapping literature) as follows. Functional Requirements will specify the functionalities that the roadmap should have. User Requirements will define the functionalities of the roadmap while interacting with the entrepreneurs. E.g. the roadmap should provide guidelines for growth planning a decision making in a ICT start-up. This stage will also outline the specific characteristics that define the boundary conditions for the implementation.

Stage 4. Structural specifications: The literature review in addition to the Requirements and Assumptions will define the structural specification of the roadmap to be designed. In this stage an outline structure of the roadmap to be designed will be formed. In case of the Business model roadmap to be designed this stage will define the basic structure of the roadmap i.e. 3 layered roadmap against a time line of start-up growth, and also the specifications of each layer; Objective Layer, Business model Element Layer and Action Layer.

Stage 5. Prototype: This stage is the actual implementation and construction of the desired artefact. A prototype embodies all the Requirements, Assumptions and Structural specifications identified in the previous stages. In case of this thesis the first prototype will be designed using the theoretical concepts studied in the literature survey. This will be termed as the Roadmap ver. 0.1. Further a practical design case study will be used to construct another BM design roadmap; Roadmap ver. 0.2. An important aspect of using a case study is development of an artifact in practical paradigm. This makes the understanding of a problem and its solution more realistic. A design case study is preferably used in this thesis because it provides an opportunity to observe and analyze a phenomenon/solution design in a practical context. The data collected from the design case in the forms of interviews and observations was validated with the secondary database from the other organizations involved in the foundation and growth of the company (ETH, Climate KIC & Esri Inc.) Semi structured interviews were conducted with the company’s decision making management (CEO, CIO) and other employees. Also participatory observations were also cataloged in form of meeting notes and used in the design of the Roadmap ver. 0.2.

Stage 6. Implications: The Business model design roadmap will be designed using two different methodologies; theoretical design and practical design, based on common structural specification. These two versions will be compared for commonalities and discrepancies to derive implication and recommendation. Also the requirements & assumptions enlisted in stage 4 will be revisited for checking if the designed artifact is able to meet the desired requirements and assumptions.
As per the research design the flow of research of the present thesis can be concluded in graphical format as follows.

![Diagram of research design](image_url)  

*Figure 2: Research Design*
3. Theoretical background

“There is nothing as practical as a good theory.” – (Lewin, 1951)

This section elaborates on the literature and kernel theories (Walls et al., 2004) used in conceptualising and executing the research in the present thesis. Since this thesis aims to develop a Business model design roadmap, the literature on BM definition will be studied. To design a BM various design frameworks can be used. Considering the abundance of BM design frameworks and specific strengths of each, tow design frameworks are chosen and studied - CANVAS and C-SOFT. Each of the BM design frameworks has a set of elements which correlate to build up the final business model. The start-up growth phasing literature is reviewed to understand the specific skill set, strengths and attention needed by various BM elements during specific phase of growth. A review on the roadmapping literature is conducted at the end of this chapter so as to design a roadmap to correlate the BM elements to start-up growth phases. Business Model has to be the first topic of investigation while building the theoretical background for creating an artefact to track BM development.

3.1. Business model definition

Business model as a concept appeared in 1960, in an accounting review (Jones, 1960; Osterwalder, 2004). Recently Business model came in the limelight as a crucial concept in the corporate world during rise of internet companies (since mid-1990) (Chesbrough & Rosenbloom, 2002; Osterwalder & Pigneur, 2010). Business model has been defined by many scholars differentiating around the rim with almost constant core concept of ‘Creating value and earning revenue in return’. Even though studies show that the academia is moving towards consolidation of a definition for BM in coming future (Zott, Amit, & Massa, 2011), there is no unified definition of BM currently available in literature as of today (Zott et al., 2011). In a study to consolidate Business model literature in year 2005, 30 BM definitions were examined to round up three general categories of definitions, based on their principal emphasis; economic, operational, and strategic (Morris et al., 2005). In 2011, 103 publications had to be studied to get an idea about the perception of different scholars on BM (academic as well as professionals)(Zott et al., 2011). Almost one fourth of all conceptual studies on BM, are related to e-business (Osterwalder & Pigneur, 2010). Most of the initial BM definitions were focused around internet business and few still are. E-business or ICT industry, mainly delivers service as a final product to the customer, unlike physical products from the manufacturing industry. Business model has the capacity to completely alter the value offering of a service keeping the central service concept constant. This could be the reason that e-business in specific and ICT industry in general are more focussed and alert about BMs as compare to other industries. This strong influence of Business model design on the growth of ICT organisations makes it more appealing to track the development of a start-up BM from scratch.

In order to arrive at a common working definition of BM for the context of this thesis, following BM definition were studied. The table also elaborates on the implication drawn from various BM definitions studied.
<table>
<thead>
<tr>
<th>Author</th>
<th>Business Model definition</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Timmers, 1998)</td>
<td>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</td>
<td>This definition gives an idea about business processes in e-business and the use of IT in an organisation. This complies with the focus of this thesis on ICT firms.</td>
</tr>
<tr>
<td>(Amit &amp; Zott, 2001)</td>
<td>The content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities</td>
<td>This notion of creating value via business opportunity identification is of interest for this thesis, considering its focus on growth phase’s start-ups, and one of the phase being opportunity framing.</td>
</tr>
<tr>
<td>(Chesbrough &amp; Rosenbloom, 2002)</td>
<td>The heuristic logic that connects technical potential with the realization of economic value</td>
<td>Considering the thesis focus on entrepreneurial firms the concept of creating economic returns from technology at hand will lead to a suitable definition of BM for start-ups.</td>
</tr>
<tr>
<td>(Magretta, 2002)</td>
<td>Business models are stories that explain how enterprises work. A good business model answers Peter Drucker’s (mission, customer, value, objective, plan (Drucker, 2011)) age-old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?</td>
<td>A definition with more practical hands on approach with a focus on value creation as well as revenue generation from the created value. This definition helps to identify the completion of a BM once all the questions are answered. These questions will be used in the implication chapter to evaluate the completion of a functional BM for SmarterBetterCities design case.</td>
</tr>
<tr>
<td>Reference</td>
<td>Definition</td>
<td>Notes</td>
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<td>(Johnson et al., 2008)</td>
<td>Business models consist of four interlocking elements (customer value proposition, profit formula, key resources, and key processes), that, taken together, create and deliver value</td>
<td>This is a simplified definition that gives an illusion of different elements/blocks of BMs that are defined in BM frameworks.</td>
</tr>
<tr>
<td>(Bouwman et al., 2008)</td>
<td>A business model is a blueprint for a service to be delivered, describing the service definition and the intended value for the target group, the sources of revenue, and providing an architecture for the service delivery, including a description of the resources required, and the organizational and financial arrangements between the involved business actors, including a description of their roles and the division of costs and revenues over the business actors</td>
<td>This is a definition conceptualised based on mobile service applications and so more closely applicable for ICT firms. It gives sufficient importance to the technology and platforms being used in business rather than just organizational aspects of the business. Also this definition of BM is the foundation of the C-SOFT (Heikkilä, Tyrväinen, &amp; Heikkilä, 2010) framework used in this thesis.</td>
</tr>
<tr>
<td>(Osterwalder &amp; Pigneur, 2010)</td>
<td>A business model describes the rationale of how an organization creates, delivers, and captures value. This definition was an extended version of the original definition; “a conceptual blueprint of the company's money earning logic”(Osterwalder, 2004)</td>
<td>A definition more understandable to practitioners who have limited knowledge of the BML (business modelling language). This definition of BM is the base line of the CANVAS framework that is to be used in this thesis.</td>
</tr>
</tbody>
</table>

For this thesis the definition of BM can be simplified as; ‘The content, structure, governance and service design of a start-up that enables it to exploit a business opportunity (Amit & Zott, 2001) using the technology at hand (Bouwman et al., 2008; Chesbrough & Rosenbloom, 2002) in such a manner that it delivers optimum value to the customers and equivalent economic value to the provider (Chesbrough & Rosenbloom, 2002).’

This should not be confused with a formal definition, but a working definition that will guide the roadmap of this thesis to arrive at the final BM. This definition is an implication of definitions studied in the above table (Table 1) and also in accordance with practical relevance of BM for ICT start-ups. As observed in few of the definitions above; BM consists of number of elements like customer value proposition, profit formula, key resources, key processes, service design, target group, revenue stream, etc. (Bouwman et al., 2008; Johnson et al., 2008; Osterwalder & Pigneur, 2010). Business model designing frameworks have a standardised
distribution of various elements that need to be defined and linked appropriately (balanced (Bouwman et al., 2008; Heikkilä et al., 2008)) to form a BM. This segmentation of BM elements makes it convenient to develop desired BM in a stepwise fashion. For this thesis using a BM design framework will be helpful to segregate various BM elements that are developed at various stages of a start-up’s growth.

3.2. Business modelling ontology

Business model design Ontologies/Frameworks are outline structures that help to build desired BMs. Business model designing frameworks are just means to reach the final goal of a BM design. The term BM design ontology and BM design framework will be used interchangeably in this thesis. ‘Ontology is an explicit simplified conceptualization of the objects, concepts, and other entities that are assumed to exist in some area of interest and the relationships that hold among them’ (Heikkilä et al., 2010). The current literature provides a range of BM design ontologies e.g. e-business model (Osterwalder & Pigneur, 2002) Entrepreneur’s Business Model(Morris et al., 2005), STOF (Bouwman et al., 2008), CANVAS (Osterwalder & Pigneur, 2010), C-SOFT (Heikkilä et al., 2010), VISOR (El Sawy & Pereira, 2013), etc. All of them are relevant for developing a service in ICT domain and each has a different set of strengths for specific business scenarios.

Today Lean CANVAS (Osterwalder & Pigneur, 2010) is the most commonly used BM design framework by start-ups (Osterwalder & Pigneur, 2010). Many start-up support organisations (incubators, Mentors, entrepreneurial training programs e.g. JA Start Up program in Finland (http://jastartup.com/), Climate KIC start-ups in Europe (http://www.climate-kic.org/)) guide new entrepreneurs to use CANVAS. CANVAS is widely used not only in the entrepreneurial field but also amongst well-established corporations like IBM, Ericsson, etc.(Osterwalder & Pigneur, 2010). ‘CANVAS format is easy to understand existing business model, even if the company does not know what their business model is’ (Johnson et al., 2008). This quality of CANVAS is a great add-on for identifying the BM elements of a start-up that has no formally specific BM design. Even though CANVAS is not specific for ICT start-ups, majority of entrepreneurs in all industries, use it as a starting point. This gives incentives to consider CANVAS for roadmapping BM design of a start-up from any industry. The simplified nature of CANVAS will make the roadmap using CANVAS more understandable to entrepreneurial managers.

Since the present thesis is targeted to design an artefact using a specific design case in GIS service providing industry, which can be categorized as a ICT service, it is logical to consider an ICT specific BM design framework. Another BM design framework being considered in this thesis is C-SOFT (Heikkilä et al., 2010) for its customer orientation and close relevance to ICT domain. C-SOFT was designed with focus on ICT businesses, as it is a derivation of STOF (Bouwman et al., 2008), which was conceptualised using mobile ICT services (Bouwman et al., 2008). The customer orientation of C-SOFT framework will give scope to specifically address the customer element of the BM definition used for this thesis. Using these two frameworks will give a chance to compare the advantages and disadvantages (if any) of using very specific or general BM design framework for roadmapping the BM design of a start-up. Below is a brief description of each of these two ontologies.
3.2.1. CANVAS

The BM CANVAS is an ideal brainstorming tool, which could be further subdivided into 4 main areas of a business processes. The 4 areas are: Customers, Offer, Infrastructure, and Financial Viability (Osterwalder & Pigneur, 2010). These 4 areas could be further subdivided into 9 building blocks and can be best used to describe how a firm intends to create value.

![CANVAS framework](image)

Figure 3: CANVAS framework (Osterwalder & Pigneur, 2010)

I. **Customer segments:** This section identifies the customer segments that the firm expects to create value for via their products and services. The customers can be group of individual people (business to consumer) or organization (business to business) that the company is targeting (Osterwalder & Pigneur, 2010).

II. **Value Propositions:** Value proposition is the real purpose that a product is bought by a customer. Value Proposition consists of a selected bundle of products and/or services that serves the **Requirements** of a specific Customer Segment (Osterwalder & Pigneur, 2010).

III. **Channels:** The product and value created by it, has to be delivered to the customers via some channel, be it direct or indirect. So the channels could be defined as the means to the customer’s value proposition (Osterwalder & Pigneur, 2010).

IV. **Customer Relationships:** Customer relationship can be defined as the types of relationships and commitments a company establishes with specific Customer Segments. This relationship can be **Personal, Dedicated, Self-Service, Automated or Co-creation** type (Osterwalder & Pigneur, 2010).

V. **Revenue Streams:** A revenue stream can be defined as the process of getting monitory returns for the service or product provided by the company. While designing the BM one must take care that the revenue stream provides sufficient cash flow so as to cover the cost paid by the company to make a service or product available to the customer (Osterwalder & Pigneur, 2010).

VI. **Key Resources:** Key resources are at the core of a BM. They are the most important assets required to make a BM work. These resources enable the company to conduct any activity, like marketing, delivering the value proposition, maintain customer relations, create and
offer the value proposition (Osterwalder & Pigneur, 2010). Resources can be of physical, intellectual, human or financial form.

VII. **Key Activities:** Activities carried out by the company to meet the client needs and deliver the product/service to the intended customers are termed as the key activities. Like Key Resources, they are required to create and offer the Value proposition, reach markets, maintain Customer Relationships, and earn revenues. Key activities can be related to production, organisational operations and maintenance (Osterwalder & Pigneur, 2010).

VIII. **Key Partnerships:** It is difficult to find a fully independent firm. Every company needs to have partners that help the company produce and deliver intended value to their customers. There can be different intentions of a company to tie up with a partner or supplier and there can be different ways to enter these partnerships (Osterwalder & Pigneur, 2010).

IX. **Cost Structure:** This element describes all the cost incurred while operating the BM to acquire the key resources and execute the key activities. (Osterwalder & Pigneur, 2010).

   Once all these elements are defined and developed they can be interlinked to form a BM. The key reason for considering CANVAS in this thesis is the simple definition of its elements which further simplifies its implementation to draft a roadmap. Having said that, one major disadvantage of CANVAS is the lack of consideration towards the dynamic nature of BMs.

3.2.2. **C-SOFT**

Business model keeps changing and evolving along with the organisation (De Reuver et al., 2009). C-SOFT BM designing procedure facilitates to iterate the resulting BM for future innovation as the company grows. This is one of the reasons for considering C-SOFT for roadmapping the BM design in this thesis. Most of the BMs are developed considering Organization (company) as a focal point. But if the definition of BM itself concentrates on creating value for Customer, so should a BM framework. Customer relationship is the focal point of the C-SOFT ontology (Heikkilä et al., 2010)(inspired from STOF (Bouwman et al., 2008)). Other elements of BM such as service, technology, organization and finance are designed around the customer segments in this ontology. C-SOFT conceptualization has used the same core definition of BM that was used for CANVAS; “conceptual blueprint of the company’s money earning logic” (Osterwalder, 2004). C-SOFT also takes inspiration from more detailed BM definition “A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities” (Amit & Zott, 2001). The close relevance and importance given to technology and explicit connection of customer segment specific service and technology in C-SOFT framework makes it easily adaptable for ICT start-ups. For any ICT company, technical architecture plays major role in service design and delivering the desired value proposition.

C-SOFT ontology has Customer as an element in addition to the Service, Technology, Organisation and Finance blocks/elements, that need to be defined before correlating them to form a BM (Heikkilä et al., 2008). Once all the elements are defined and balanced using customer segments as the central point, the final BM of a company can be depicted.
I. **Customer:** Various Customer segments to be addressed by a company are defined in this section, be it geographical segmentation, service based segmentation or utility based segmentation. This section also defines the relationship that a company will have with its customers, be it personal, indirect or mixed. Here the affiliation that a customer has with the company and the proprietorship of the company over that customer’s demand is defined. Different customer segments can be addressed with the same service with different value proposition for each. Using C-SOFT it is easy to add or exclude a particular customer segment without radically changing the complete BM. This could be contributed to the compatibility of C-SOFT with the dynamic nature of a BM. Also for a service industry Customer relationship is a major part of this BM element, including all the activities related to maintaining a smooth delivery and feedback channel between the customer and the service provider.

II. **Service:** The main intention of any service is to create value for the customer. Service design is a means to assure the maximum endowment of the intended value to the customer. The Service element helps to identify and design the intended value of a service, and how it is created and delivered (Heikkilä et al., 2010).

III. **Organization:** This element is dedicated to the organization/ network related activities that are carried out in order to deliver the intended service to the customers. All the involved stakeholders in the process of value creation and delivery are considered here. In addition the, distribution of resources and capabilities is defined and organised in this section. This section also deals with the roles, responsibilities and coordination between the involved partners on organisational level.

IV. **Finance:** This block deals with the money earning logic of a company. The entire network related affiliations that contribute to both cost and revenue stream of the company are depicted in this section. Along with cost and revenue sharing the risk sharing is also elaborated in this section.
V. **Technology**: It is essential to know the compatibility of a network with the technology, before innovating or modifying or designing a BM for a start-up around a new technology. This helps to design a BM that enables the company to deliver the created value to the customer segments without any incompatibility issues from the network. This section deals with the technology embedded in the service, the technology supporting the company operations and also the technology coordinating the network that the company is a part of.

### 3.2.3. BM Elements and Start-up

Each of the BM design frameworks has a set of elements which correlate to build up the final business model. The start-up growth phasing literature indicates specific skill sets, strengths and attention given to various BM elements during specific phase of growth. The above defined BM elements from CANVAS (nine explicit elements) and C-SOFT (five explicit elements) are developed over consecutive growth phases of a start-up. This thesis intends to develop a roadmap for BM design specifically for start-ups, to illustrate and guide analogous development of BM along with start-up growth. Scholars indicate that mortality of start-up (new/small businesses) can be reduced by conscious pre-start-up planning (Castrogiovanni, 1996). The artefact to be designed as a final goal of this thesis is designed with a view that the process of designing such a roadmap will provide guidelines for conscious pre-start-up planning. A Business model design roadmap coupled with start-up growth phases can be used by entrepreneurial management, as a reference point to plan and envision the activities needed for a sustainable start-up growth. Here sustainable growth refers to a market position of the company where it is out of the survival danger that most of the adolescent start-ups face and is has achieved a steady cash flow. To track these activities it is essential to zero in on a specific start-up growth model that can facilitate easy and comprehensible representation of a start-up growth. The selected growth model should also be applicable to the upcoming GIS service providing start-ups.

### 3.3. Start-up Growth

There is ample amount of literature available on how a start-up grows and what are the difficulties and phase that it goes through to finally become a sustainably growing business. Some start-ups survive all the stages, while others perish a premature death. Here are few start-up growth phases that have been identified by different scholars over the years.

In 1969, Steinmetz (Steinmetz, 1969) identified four phases of small business growth, namely Direct Supervision phase, Supervised Supervision phase, Indirect Control and finally Divisional Organizational phase. These phases were distributed over an S-shape growth curve as follows.
Phase I features limited rate of returns and higher dependency on personal skills and knowledge. Phase II is characterized with taking calculated risks instead of addressing the ad-hock customer demand. In Phase III, start-ups are in full exponential growth phase and arrive at an optimum combination of customers and service. Phase IV marks the maturity of a start-up, where the growth stabilizes and is reduced down to a steady minimal. This model offers understanding of fundamental concept of start-up growth by comparing it to a well established phenomenon of Technology growth S-curve. The only drawback is the explicit focus on financial (assets and earnings) and managerial (control of the company) aspect of the start-up growth. There is minimal consideration of the technological and organisational development of the start-up in this model.

Based on these 4 critical stages of small Business growth, Scott and Bruce (1987) suggested a modified growth model for start-ups with five stages.

This model was build with a point of view to help start-up managers to plan ahead proactively rather than just a model to track the growth of a start-up. Even though this model could not draft a strategy of the business instinctively, it could assist the management to make decisions along with empowering them with knowledge to make better judgement. This model considers the business as a whole where as the previous four phase model consider only the managerial part. This approach makes it more relevant to this thesis, which aims at considering
all the elements for business while encoding the growth stages for start-ups. It is this approach that makes it compelling to design the roadmap using BM as its foundation, as BMs covers all the managerial as well as functional aspects of business.

Recent studies show evolution of these models in more refined and specific formats. For instance a study in 2004 (Vohora et al., 2004) presented with five stages that a university spin-offs goes through to become a sustainable business. This particular start-up model is more relevant to this thesis as it gives very explicit description of each growth phase that can be correlated with specific BM elements. Also the GIS service providing industry focused in the present thesis is an upcoming industry, with new relatively technologies. Actual lifecycle of start-ups based on a new technology tend to start from a research stage, similar to the first phase of growth described in this model. Also this model has the facility to introduce the scenarios of surrogate entrepreneurs who take over, once a commercial opportunity has been identified after a pure scientific research (e.g. venture capitals, and others). Using this five phase growth model of university spin offs, enables the present thesis to keep the scope of application open for different types of start-ups in the GIS service providing industry.

Each growth phase of the five phase growth model of university spin off is defined with specific characteristics as follows.

I. **Research Phase**

Main focus of this phase is to ace the academic research at this time in the life cycle of a start-up. The commercial opportunity is yet to be identified. Valuable intellectual property is created which will be the core foundation of the start-up to come. During this phase most of the academic inventors involved in the start-up (in future) will most likely be at the forefront in their field of research (technology to be commercialised).

II. **Opportunity framing Phase**
This phase marks the identification of a commercial opportunity out of the academic research from Phase I, initiating the transition between opportunity identification and formative steps to establish a start-up (University Spin off). Here the identified opportunity is evaluated for its viability and commercial feasibility; “Screening”. This includes,

a. To evaluate if the technology actually works; proof of concept.
b. To evaluate the promise for application of research outside the laboratory; proof of market.

A variety of markets and customer segments are explored for practical implementation of the technology. The value and its delivery to the desired customer, is also defined. The accessibility of complementary resources that will be needed in the future is not yet estimated in this phase. Iterations of opportunity framing and reframing take place during this phase. Also this phase generally introduces the surrogate entrepreneurs if the researchers themselves are not willing compromise their academic career.

III. Pre-Organisation Phase

During this phase entrepreneurs make decisions regarding existing resources, capabilities, acquiring new resources and capabilities (‘Make & Buy’ decisions). This phase represents the steepest learning curve for academic entrepreneurs, as this is most likely the first time hands-on business experience for them. The actual set-up of a start-up takes place in this phase. This phase is aimed at providing a corporate identity/brand name/legal identification to the entrepreneurial idea initiated and developed in previous 2 phases.

IV. Re-Orientation Phase

By this phase the start-up has gained sufficient credibility to access and acquire resources and capabilities without much help from the support network (Universities, Incubators etc.). The start-up is attempting to generate returns by offering something of value to the customer and so is continuously identifying, acquiring and integrating resources and then subsequently re-configuring them. This is the phase where the entrepreneurs try to address the evident flaw (if any) in the BM design and accordingly plan to reconfigure. Realisation of the flaws is a result of information and knowledge acquired by the entrepreneurs from interactions with customers, competitors, suppliers, as well as potential investors in this short-term growth of the start-up. The transition from this phase to the next one is largely dependent on how well the preparatory work is done in previous phases by the founders and/or the technology transfer officers (TTO) and/or entrepreneurial coaches. If the foundation in the previous phases is insufficient and not able to build a strong BM then this phase will have to reconsider all the elements of the BM and so will stretch longer. If not, then this phase can address some minor reconfigurations and wrap up the phase in short time.

V. Sustainable returns Phase

A precise BM to give maximum returns from the technology is in place at this stage in development of a start-up. Many of the earlier uncertainties about various business elements (service, value, distribution channel, suppliers, etc.) are addressed by now. The focus of the company shifts from technological improvement to winning business, where technological development is one of the aspects but not the only focus. The start-up is able to generate a steady stream of economic returns. The spinoff has becomes an independent organisation with its individual existence outside the university.
The present thesis aims at designing a BM design roadmap for a GIS start-up so that similar GIS service providing start-ups can use this roadmap and the process implemented to develop it, to plan their own growth. GIS service providing start-ups are a sub-set of ICT start-ups. Another growth phasing model to address the growth of, not specifically a start-ups but new emerging ICT services has three prominent phases(Kijl et al., 2005). This phasing model has been developed with an intent to address the dynamic nature of BMs (De Reuver et al., 2009; Kijl et al., 2005).

I. Technology/ R&D phase

This phase is characterized with academic focus on developing the technology. It also includes business elements like developing the service concept and exploring investments. This is the emerging phase for the ICT service, where at times first pilots are materialised.

II. Implementation/ Roll-out Phase

During this phase the service prototype is ready for its first roll out (beta model). First ever introduction to market happens in this phase. Even though the elements like service, supporting technology, resources, etc are not optimally defined by this time, the service provider is exploring different options to find a specific combination of all the elements to form a precise BM.

III. Market Phase

This phase is characterised with commercial exploitation, since fine-tuning of various elements in previous phase has given indication about the exact commercial opportunity to be addressed. The focus gradually changes from capturing market to retaining the market share.

This thesis will use the five phase University spinoff growth model (Steinmetz, 1969) which correlates to the three phase new ICT service growth model (De Reuver et al., 2009; Kijl et al., 2005) to design the ICT industry specific BM design roadmap from the design case of an University spin-off. The technical focus of the Research Phase (Vohora et al., 2004) and the technology transfer characteristics of the Opportunity framing Phase (Vohora et al., 2004) can be correlated to the Technology/R&D phase (De Reuver et al., 2009). The start of Service delivery
by the start-up during the Pre-Organisation Phase (Vohora et al., 2004) and the BM refinement of the Re-Orientation Phase (Vohora et al., 2004) can be correlated to the Implementation/Roll-out phase (De Reuver et al., 2009). The characteristics of mass market exploitations and successful survival, which are observed during the Sustainable returns Phase (Vohora et al., 2004) can be correlated with the Market phase (De Reuver et al., 2009).

![Figure 9: University spin-off growth model & New ICT service growth model](image)

As a start-up grows from scratch over these five phases, so does the business model of that start-up. Such development of a start-up’s BM can be tracked and/or planned by identifying the specific elements being developed in each phase. A roadmap will facilitate the allocation of various BM elements to each phase and also assist to establish links between them to depict the transition from one phase to another.

### 3.4. Roadmapping

Technology Roadmapping is a well established method in research field, but BM roadmapping is a comparatively new field of study. This can be contributed to the fact that Business models are at times misinterpreted as a static entity. In recent times, case studies were conducted to propose a process to integrate BM designing and roadmapping methods for innovation support technology (IST) (Abe, Ashiki, Suzuki, Jinno, & Sakuma, 2009). Business models undergo innovation and incremental changes same as a technology undergoes innovation and incremental changes. Technology roadmaps help to trace the steps in this process of development, preferably along a time line. On similar lines a BM design roadmap could track development and changes in a BM. The main benefit of technology roadmapping is the information provided to make better technology investment decisions (Garcia & Bray, 1997). This information supplies guidelines to identify critical technologies, technology gaps and ways to leverage R&D investments (Garcia & Bray, 1997). Similarly BM roadmapping can provide information to make efficient business process investments and decisions by identifying critical activities and process timings. If technology is the means to develop a product, then BM is the means to deliver a service. The importance of Service and its strong association with BM in ICT industry makes it more appealing to develop a roadmap of Business model development as that of a technology. “Roadmaps explicitly show the time dimension, which is important both for ensuring that technological, product, service, business and market developments are synchronized effectively and for reflecting the dynamic, changing natures of technological and business environments” (Phaal, Farrukh, & Probert, 2004).

Reactive use of roadmapping in business strategies is done to respond to some stimulus such as a market failure or new competitive threat (Kappel, 2001). Strategic roadmapping (SRM) is a method that comprises a time-based, multi-layered chart, enabling various functions and perspectives to be aligned (Abe et al., 2009). In the light of recent studies and research in this field, Business model roadmapping is defined as “an approach to define the transition path from a current to a desired business model” (De Reuver et al., 2013). This definition was conceptualized by studying the BM literature along with the technology roadmapping literature. This thesis is an extension of the same approach in the entrepreneurial arena. The Business
Business model design roadmap using CANVAS and C-SOFT framework elements, synchronised with start-up growth phases

model roadmaps defined till date are to track changes in a BM and not development of a BM from scratch. Instead of designing a roadmap to track the transition of BMs, this thesis is aimed to design a roadmap for development of a BM from scratch for University spin-offs. The case survey for conceptualising the Business model roadmapping definition (De Reuver et al., 2013) illustrated a visual procedure of BM roadmapping so as to enable organizations to identify the overlapping paths, points of return, strategic tradeoffs and off course time-lining the activities in an organized manner for a successful BM implementation. The graphical representation of a roadmap is a powerful communication mechanism; it can present information in a highly synthesized and condensed form that can be quickly understood (Phaal et al., 2004). “Roadmaps are both forecasts of what is possible or likely to happen, as well as plans that articulate a course of action” (Kappel, 2001). Roadmapping has helped to identify right markets for right products at right time and improved cross-functional communication and processes for conceptualization of new products (Groenveld, 2007). Such roadmapping can prove advantageous especially for entrepreneurial managers who have limited resources and need to grow efficiently for survival as well as market exploration. Even though (80.8%) of graphical roadmap includes time as the horizontal axis (Phaal & Muller, 2009), the Business model design roadmaps designed in this thesis does not have an explicit time line attached to it. Instead the roadmap will be drawn along the 5 phase of University spin-off’s growth (Vohora et al., 2004) so that every start-up can adopt the timeline as per the pace of their growth.

3.5. Conclusion

The motivation for this thesis originated from literature review and not a specific company problem. The idea originated from observing correlativity between patterns of start-up growth and BM elements and the upcoming market trend of GI’s service providing applications. This is the key reason that the literature review for this thesis is not solely driven by a specific company but also by logical correlation of theories. An initiative to correlate BM’s gradual development and start-up growth via a roadmap motivated the critical review of the above literature. Available academic definitions of Business model were studied to derive a working definition of BM. This definition can be used to evaluate the final BM derived at end of the designed roadmap. In order to track development in terms of BM elements, two relevant BM frameworks were chosen. CANVAS was chosen and studied, for its ease of implementation and popularity with start-ups. C-SOFT was chosen and studied, for its close affinity to ICT service domain and consideration to changing nature of the BM. Once the BM frameworks were finalised, the focus shifted towards reviewing various phasing models that track a start-up growth. Entrepreneurial literature was reviewed to choose a phasing start-up growth model that could plot the growth of a University ICT spin-off; SmarterBetterCities design case. The correlation of BM design with start-up growth had to be plotted via a roadmap considering the sequential changes and interconnection between various BM elements within and across the growth phases. Roadmapping literature was reviewed to arrive at the structural specification and approach for a BM roadmap design. The next chapter will discuss these Requirements, Assumption and Structural specification for the roadmap design.
4. **Requirements, Assumption and Structural specifications**

As discussed in the research design of this thesis, the *requirements and assumptions* for designing the artefact, is the next step in the design cycle. The *requirement and assumption* for this thesis are to be derived from the literature review of the kernel theories, the specific theoretical models selected, the methodology of roadmapping and the industrial positioning of this study in ICT (specifically GIS service providing) industry.

### 4.1. Requirements and Assumptions for design

Using the industrial positioning of this thesis and the literature studied in previous chapters, two types of *Requirements* have been drafted for this thesis. *Requirements* are needed to confine the design within the frame that is defined by the goals and objectives (Verschuren & Hartog, 2005). The *functional Requirements* enlist the functionalities that the final artefact of this thesis is expected to have and are derived from the BM and roadmapping literature reviewed (chapter 3). The second type is the *user Requirements* is the purpose that needs to be fulfilled on behalf of the end-users of the artefact and is derived from the industrial positioning (chapter 1) of this thesis.

#### 4.1.1. Functional Requirements and Assumptions

The eventual goal of the roadmap to be designed is the delivery of an optimum BM. An optimum BM refers to a BM that enables the company to achieve maximum efficiency in terms of delivering value and earning revenue with the available resources and capabilities. Using the relevant BM definition studied in the previous chapter (table 2) following functional *Requirements and Assumptions* need to be considered while designing the roadmap for development of a BM for the present thesis.

1. Service design included in the roadmap: In the ICT industry, a service oriented industry, service design plays an important role in reaching an optimum Business model design. Service design (Bouwman et al., 2008) should be an integral part of developing the BM design roadmap. Also since the roadmap is aimed at ICT start-ups, it should include GIS technology specific activities as well.
2. Market exploitation: As the roadmap approaches the last phase (*sustainable returns or market phase*) (De Reuver et al., 2009; Vohora et al., 2004)), the start-up should be able to exploit the business opportunity initially identified. Exploiting the business opportunity will refer to mass marketing.
3. Only using Technology at hand: The roadmap should have activities that creates, delivers, and captures value created via the technology at hand (Osterwalder & Pigneur, 2010). Business opportunity being exploited at the end should be based on the technology being developed in the first *Research Phase* of the start-up (Amit & Zott, 2001; Chesbrough & Rosenbloom, 2002) This implies that the designed roadmap will not consider any influence of a radically disruptive technological intervention. This particular assumption can be wavered for the future research in the study of Business model design roadmap for GIS start-ups.
4. Optimum balance between value proposition and economic returns: The designed roadmap should be able to gradually develop a mechanism to deliver equivalent value proposition to the customer and economic value to provider. This delivered value should be compensated with the economic value created for the start-up, balancing the cost and revenue of the company. Balancing the customer value with appropriate cost (Magretta, 2002) delivers best possible service to customers. This will result in equivalent economic value (tangible or intangible) to the start-up and lead to a reliable revenue source at the end.

5. Answers to Duckers questions (Drucker, 2011; Magretta, 2002): While designing the roadmap following questions should be addressed and answered in order to eventually have a complete and optimum BM.
   a. How to make money? (Magretta, 2002)
   b. Who is the customer? (Magretta, 2002)
   c. What does the customer value? (Magretta, 2002)

6. All elements from the framework addressed: This artefact aims to identify individual elements of BMs that ultimately result into a complete BM. Since the Roadmap is aiming to use CANVAS and C-SOFT, it should develop all the nine blocks of CANVAS (Osterwalder & Pigneur, 2010) and/or five blocks of C-SOFT (Heikkilä et al., 2008) without any exception.

7. Continuity in the roadmap: The temporal roadmaps have a linear tendency (Phaal & Muller, 2009) and so are most useful for tracking and planning the changes in a BM for growth, which has a current state and is aiming to reach a desired future state linearly (De Reuver et al., 2013). Since it is a roadmap it should exhibit continuity and correlation between consecutive phases of growth.

4.1.2. **User Requirements and Assumption**

The intended end users of the roadmap designed in this thesis are GIS start-up managers. As a result User Requirements and Assumptions derived from the Industrial positioning of this thesis are as follows.

1. Starting point of this roadmap is null: The artefact is aimed at the start-ups that have to start building their BM from scratch (there is no ‘as is’ stage at the start of this roadmap, as there is no BM at the start). The resulting artefact might be less applicable for start-ups trying to reinvent a BM as compared to those with no defined BM in place yet.

2. Application scope: The artefact is designed using BMs from service industry and a design case from GIS industry. Therefore the resulting artefact will be more applicable for GIS service based start-ups. The start-up growth model used in this thesis is aimed at university spin-offs and so the resulting roadmap and will resemble to another GIS service providing university spin-offs.

3. Generalisable: The problem statement of this thesis is not specific to a singular organisation. The initiation of this thesis was a result of literature review and desk research. Thus there is no specific problem owner and so application should also be non-specific. The designed roadmap should be generalisable to other GIS start-ups in similar stages of growth.

4. As already discussed, majority of entrepreneurs are new to business modelling languages. To guide the entrepreneurs about the development of BM, the roadmap should address BM changes at high-level (single objective) as well as at detailed-level (explicit activities).
5. End point might not be the ultimate end: This thesis has a consideration for the continuously changing nature of BM, and so the roadmap designed should have scope for future changes. The underlying assumption of this aim is that there is no practical end to growth of a start-up or to the dynamic nature of a BM.

4.2. **Structural specifications**

Leveraging the concepts studied during the literature survey and the Requirements drawn; the Structural specifications can be drawn in this section. These specifications will define the framework of Business model design roadmap to be designed.

This section elaborates on how the various growth phases of start-ups can be mapped on a roadmap using BM elements as its building blocks. The main motivation for designing a BM design roadmap was the dynamic nature of the concept, BM. “Business model design choice once made during the conceptualisation of initial service concept and underlying technology typically change during subsequent stages of market rollout and commercial exploitation” (De Reuver et al., 2009). Studying the BM of an organisation at times serves a way to modify and improve the way a business is done (De Reuver et al., 2009). Business model is not a static phenomenon but a dynamic element that needs to be reinvented and modified from time to time to keep it in sync with the changing environment and the growing nature of its organisation (De Reuver et al., 2009). This exact notion allows a BM to develop and grow in parallel with the company from scratch.

To guide the entrepreneurs about the development of BM, the roadmap should address BM changes at high-level (single objective) as well as at detailed-level (explicit activities). A multilayer roadmap solves this problem of addressing the BM design at high and detailed level, by having the top most **Objective Layer** with macro focus on a complete phase, and the bottom **Action Layer** with detailed actions. Also one has to consider the key challenges of ‘keeping the roadmap alive’ (Phaal et al., 2004). This is why the roadmaps are to be kept open to new additions, so that they do not become obsolete with slight situational changes. Since BMs generally are dynamic in nature and a growth never stops the roadmap should be open ended, even after a complete BM is developed. Also a branched dynamic roadmap will be useful to incorporate more than one BM element being developed per growth phase (Abe et al., 2009).

Companies apply roadmapping primarily to determine future opportunities and changes, and to indicate actions that could be taken to succeed in such a future (Gindy, Morcos, Cerit, & Hodgson, 2008). So it should be ideal to have **Action** as one of the layers of the BM design roadmap. Business models are developed with an objective to structure the business processes and are innovated to organize any new developments easily. Having BM framework's structural elements in a roadmap will make it easier for an entrepreneur to understand the designed roadmap with their limited business management expertise and plan accordingly. This gives us an incentive to consider the BM elements/blocks as one of the layers above the **Action Layer**. Particular elements of BM will differ depending on the BM framework being used. For example **Service, Customer, Organization** etc. blocks will be plotted in the middle layer of C-SOFT roadmap and **Key resources, Delivery channels, Value proposition**, etc. blocks will be plotted in the middle layer of the CANVAS roadmap. **Business model Element layer** will make the
roadmap more generalisable, as well as assist in bundling activities under each phase per element for better organisation. Objectives for future are the starting point of planning at any organisation and start-ups are no exception. This gives us the third and topmost layer of the roadmap; Objective Layer.

The objectives for each layer will be drafted from various phases of growth in a start-up as both can be plotted on the timeline of start-ups growth. This integration will help to identify the current state of a start-up and the desired future state (phase). Each growth phases has peculiar characteristics, to design a roadmap these characteristics can be converted into condensed high-level objectives that the start-up is aiming to achieve. This will form the first layer; Objective Layer of the roadmap. The growth phases of start-ups if studied closely can present some peculiar characteristics which can be correlated to the various BM elements of the two selected BM frameworks (CANVAS and C-SOFT). The next layer; Business model Elements Layer will be formed using the specific BM elements in focus for that phase which will be used to achieve the objective of that phase. The various BM elements from each phase will be interconnected with each other as per the business process relations between them. In order to elaborate the business processes under each element as well those forming the relation between various BM elements will be listed as Activities in the last layer. The last Action Layer will be drafted only at high-level for the prototype design as it is expected to consist of individual start-up context specific activities.

4.3. Conclusion

The Structural specifications are derived from the Requirements and Assumptions and the Literature studied about Business model frameworks, Business model roadmapping, Start-up growth and Roadmapping approaches in Chapter 3. Using the same Structural specifications both versions of the Roadmaps will be designed. Using the same specification will facilitate an easy comparison of both the roadmaps. The Requirements and Assumptions defined in this chapter will assist the design of the Business model roadmap as well as the evaluation of the final roadmap design. The Assumptions also define the implementation and functional limitations of this thesis. All the Requirements and Assumptions will be reconsidered in the final stage of the design methodology (chapter 7). The Functional Requirements and Assumptions will be strictly followed in designing the Theoretical prototype i.e. Roadmap ver. 0.1 (chapter 5). Whereas few User Requirements and Assumptions will be addressed in the Practical prototype design i.e. Roadmap ver. 0.2 (chapter 6).
5. Theoretical Prototype ver. 0.1

As per the Structural specifications derived in previous chapter (chapter 4), the Business model design roadmap design is aimed to have three layers; Objective Layer, Business model Element Layer and Action Layer. These three layers will be stretched across a timeline synchronised with the five start-up growth phases; Research, Opportunity framing, Pre-Organisation, Re-Orientation and Sustainable returns. It was pointed out in the literature review that the BM designing process and the growth phases of start-up can be synchronised. This chapter is more detailed exploration on similar lines and deals with identifying correlations of the theoretical characteristics of each growth phase to the specific BM elements explicitly. A theoretical prototype roadmap will be designed by plotting various elements of CANVAS and C-SOFT in association with the objective of each phase. Furthermore, generic actions to be carried out as a part of developing each BM element are also enlisted under those elements in the Action Layer. The prototype developed in this chapter is solely based on theory and so will be referred as the Prototype ver. 0.1 or Theoretical prototype. The second version; Prototype ver. 0.2 or Practical prototype will be derived from a design case in the next chapter (chapter 6).

As mentioned this chapter is drafted to identify correlation chain between the start-up growth phases and the BM elements (of CANVAS and C-SOFT separately) and related generic actions. The final findings are to be consolidated in a roadmap structure defined in the previous chapter. The chapter is structured so as to identify the correlation chain for each growth phase one by one in the predefined three layered structure.

5.1. Research Phase

5.1.1. Objective Layer

Description derived from Five phase start-up growth model (Vohora et al., 2004): This phase is characterised with main focus being excellence in the academic research. The commercial opportunity is yet to be identified. Valuable intellectual property is created which will be the core foundation of the start-up to be established. During this phase most of the academic inventors involved in the start-up (in future) will be at the forefront in their field of research (technology to be commercialised).

This description can be consolidated in one objective with highlighted keywords selected or derived from the above description.

Obj1. \(\Rightarrow\) “Develop a novel intellectual property that is refined in all its technical aspects, with involvement of mainly academic/technical stakeholders”.

5.1.2. Business model Element Layer
This is the phase where the entrepreneurial idea is in its dormant stage. Most of the time this stage is more concentrated around the academic objectives and contribution to science with hardly any business perspective. The technology is being developed and fine-tuned to increase its efficiency for implementation not necessarily in commercial context but definitely in scientific research context. In this process the researchers identify crucial elements, means, tasks and activities in order to execute the research on the specific technology.

As discussed earlier the Business model Element Layer comprises of BM elements that would play key position in accomplishing objective of the particular growth phase and encompass all the related actions to achieve that objective. The coming sections are to identify the BM elements, being developed during the Research Phase along with the actions that are to be executed under each of the element.

- **CANVAS**: In CANVAS there is no specific block that deals with only the technology. However the Key Resources and Key Activities deal with the technology more than any other element of this framework. These two blocks are designed to consider the production line and related technical and network factors of a business. At this stage in a start-ups lifecycle there is no business perspective in existence, the entrepreneurs are involved in research and concentrated on identifying and developing Key Resources and Key Activities. Specifically for ICT start-ups the Key Activities and Key Resources are more closely related to the technology of the product/service. For example in case of a manufacturing start-up the key activities and resources will include physical asset collection for production. But in case of an ICT service the key activities will include developing (e.g. coding) the product/service, acquiring servers and database management capabilities even before the actual conceptualization of the entrepreneurial idea. All these activities are closely related to the initial research of the technology. Also the Key activities will include the accusation of Key resources, and so the Action Layer block for both the elements will be common, as the actions are interlinked.

![Figure 11: CANVAS Research Phase of ICT start-up](image)

- **C-SOFT**: The C-SOFT framework has a dedicated section to consider and contain the focus of the Research Phase. Technology is the main focus during this time while other elements of the C-SOFT framework and their links to the Technology are in the dormant state. This appropriate and specific match of the main activities of a growth phase and a BM element can be contributed to the fact that C-SOFT has been derived from the original STOF (Bouwman et al., 2008) BM framework which was conceptualised using for ICT
businesses cases. The Technology element deals with all the actions related to technical architecture for production, backbone infrastructure, platforms and servers.

![Figure 12: C-SOFT Research Phase of ICT start-up](image)

### 5.2. Opportunity framing Phase

#### 5.2.1. Objective Layer

Description derived from Five phase start-up growth model (Vohora et al., 2004): During this phase, the window of opportunity is identified and commercial validity is evaluated for the technology developed in the previous phase. Moreover formative steps for establishing a start-up are initiated, like exploring precise service concept, customer segments, investor market, commercial validity of the idea, etc. This phase includes the workshops/meetings that result in the initial draft of a business plan for the upcoming start-up. This first draft should not be misinterpreted as the final functioning BM of the start-up.

This description can be consolidated in one objective with highlighted keywords selected or derived from the above description.

Obj2. \(\rightarrow\) **“To draft a core business idea based on the technology at hand and explore the viability of business elements like service, customers, market, investments, etc.”**

#### 5.2.2. Business model Element Layer

This phase initiates at the *eureka moment* of the research when a researcher or an surrogate entrepreneur envisions the commercial potential of the research being conducted. During this phase, entrepreneurs identify the window of opportunity based on the research that has happened in previous phase. For a university spin off the researchers are academically involved with the university and so at times are unwilling to compromise their academic endeavours in exchange to becoming entrepreneurs. This gives rise to surrogate entrepreneurs that are ready to take up the corporate endeavours of starting up a new business and thus pick up where the researchers have left in the start-up lifecycle. Business viability and commercial demand of the technology is recognized in this phase. This includes identification of the opportunity and redefining or adaptation of the research for implementation according to the
market demand. This is the true technology transfer phase where an academic research transitions into a specific product/service concept. Identifying market demand for commercialization of the research is actually identifying the value proposition and the target market (e.g. customer) for that value. Sometimes an external interference is needed to identify the opportunity at hand (De Reuver et al., 2009). External elements such as interaction with a market/business oriented individual/organization also plays a major role in this transition (De Reuver et al., 2009). At times these associations stay with the start-up for the long run (e.g. strategic alliances) and at times they are short lived for a single phase. The opportunity framing also includes estimation of financial aspect for commercial production and running a business. But this is limited to just estimation and exploring for investments and not actual investment.

- CANVAS: This framework has most of the specific elements to address and accommodate the focus points of this phase. The actions needed to identifying the business opportunity can be explored in the Value Proposition block. Acknowledging the source of market demand for a product can be addressed in the Customer Segment block. The association with external organizations or individuals for commercializing the researched idea can be addressed under the Key Partners block. Also the funding arrangements can be drafted in this phase by defining the Cost Structure block of CANVAS. At times the investors also function as key partners, so the Action Layer block dealing with the investors should be linked to the Key partners as well as Cost structure.

- C-SOFT: The identification and framing of value proposition and commercial implementation of the research can be explored under the Service block. The Service block also covers the supply chain and distribution channel of a product, but these actions are not necessarily carried out in this phase. The Customer segment block can include all the actions related to target market identification. The Finance block includes every action from locating seed funding to estimating revenue and cost structure. Hence the cost estimation and related aspects of this phase can be considered under this block. The actions involved in technology transfer that are initiated by the internal or external agents can be addressed under Organisation element.
5.3. Pre-Organisation Phase

5.3.1. Objective Layer

Description derived from Five phase start-up growth model (Vohora et al., 2004): The start-up initiates the process to identify itself as a company (even if at very small scale) in this phase. The entrepreneurs/founders start to think in terms of business establishment, branding, and corporate identity along with the ‘Make & Buy’ decisions in addition to technological precision. This phase also includes directive steps towards purchasing required resources including hardware & software supplies, financial investments and official networking collaboration. For most of the University Spin-offs the founders are the researchers from the first phase. These Founders who are originally researchers, start acquiring the business management knowledge at a fast pace during this phase. Being involved in the day-to-day functioning of the start-up enables them to acquire knowhow of practical aspects of a business establishment. This phase is said to have the steepest learning curve for such entrepreneurs. During this phase the company also starts attracting its first early adopter customers. By the Pre-Organisation Phase the start-up has first draft of its BM in action. At times this BM implementation can be implicit and not official. The start of a business indicates that there is a functional money earning and value generating logic present, which can be called the first draft of BM of the company. This BM might not be the most efficient or optimum one. At times start-ups have an official draft of BM on paper by the end of this phase, if it is expected by the external agents like Investors, Incubators, Venture capitalists or other stakeholders.

This phase description can be consolidated in one objective with highlighted keywords selected or derived from the above description.

Obj3. → “Practical implementation of first iteration of the business model and start of the revenue earning channel of the company”

5.3.2. Business model Element Layer

Practical implementation of the business idea drafted/conceptualised in previous phase (Opportunity framing) is the main aim of this phase. Most of the conceptual elements of BM like value proposition, service design, identification of resources and capabilities have already been
focused in the previous phase. Now the focus shifts to other BM elements that are more concentrated on practical execution like revenue cycle setup, supply chain setup, strategic alliances, etc.

- CANVAS: The official set up of the network with strategic partnerships and alliances can be addressed in the Key Partners block in the CANVAS framework. Even though the external partner involvement for technology transfers has been addressed in the Opportunity framing phase, during this particular phase the Key Partners block deals with actions associated with officially signing the contracts and legal distribution of responsibilities and risks per partner. Also one of the crucial add-on of this phase is the start of Revenue Stream, giving a scope to focus on the pricing of the products. Other elements under focus are Distribution Channels, because it is not until this phase that the actual cash flow is in action. Also during this phase the company interacts with the first clients which give the opportunity to address all the related interactions under the Customer Relations block of the CANVAS framework. By now all the essential elements of BM have been established and so a BM can be designed by definition. But this BM is rarely the optimum BM that can provide efficient revenue to the company for its available capabilities and resources. The hands on learning’s that the entrepreneurs experience during the growth of the start-up will give more knowledge to fine tune the BM to achieve the appropriate efficiency. This fine tuning starts in the next phase of start-up growth.

- C-SOFT: The adoption of a functional revenue stream in the company can be addressed as a part of Finance element in the C-SOFT framework. C-SOFT framework has the facility to address these revenue streams on per customer segment basis. The introduction of strategic planning can be addressed in the Organisation domain of C-SOFT, on per-customer segment basis. By now all the essential elements of BM have been established and so during this phase the common elements of all domains in the C-SOFT framework are identified to design the first version of BM. Also the Service element can address the handling of early adopters and online or direct distribution setup.
5.4. Re-Orientation Phase

5.4.1. Objective Layer

Description derived from Five phase start-up growth model (Vohora et al., 2004): The main aim of this phase is to refine the first draft of BM for a start-up. This is the time to reassure and rethink the business plan once more to make sure that the initial strategies, drafted to achieve the desired vision of the company, are capable of meeting the expectations. The start-up is attempting to generate returns by offering something of value to the customer and so is continuously identifying acquiring and integrating resources and then subsequently re-configuring them. This is the phase where the entrepreneurs try to address the evident flaw (if any) in the BM design and accordingly plan to reconfigure. Realisation of the flaws is a result of information and knowledge acquired by the entrepreneurs from interactions with customers, competitors, suppliers, as well as potential investors in this short-term growth of the start-up. The transition from this phase to the next one is largely dependent on how well the preparatory work is done in previous phases by the founders and the technology transfer officers (TTO) or entrepreneurial coaches. If the foundation in the previous phases is insufficient and not able to build a strong business model then this phase will have to reconsider the responsible elements of the business model and so will stretch longer.

The above description can be consolidated in one objective with highlighted keywords selected or derived from the above description.

Obj4. → “Refine the business model while maintaining the current business”

This phase can also be compared to business model innovation where there is an ‘as is’ state of a BM and this BM is innovated to reach a desired ‘to be’ state to achieve some expected objectives. This phenomenon can be observed not only at start-ups but also at big corporations. Also this phenomenon of transitioning from a ‘as is’ to ‘to be’ stage of a BM will be observed at various occasions in the complete lifecycle of any company including a start-up. But for the purpose of this thesis this phase will be discussed only in context to initial growth stages of a start-up.
5.4.2. Business model Element Layer

This phase has one major objective; to refine the existing business decisions. But in ideal cases, where all initial decisions are giving expected results, the company might have to consider this phase as optional. Refining the original decisions can be anything from re-defining the value proposition to re-organising the resources and capabilities, or at times reconsidering or modifying a strategic alliance. Depending on various case studies discussed as a part of conceptualisation of the Five Phase University spin-off growth model (Vohora et al., 2004), three distinct patterns of reformation can be identified. These three types of refinements can be in terms of service, market segment and network refinement.

- CANVAS: The re-orientation can be categorised in following three types of refinements.
  - Service redesign: For this type the founders need to reconsider the Value Proposition, Customer Relations, Cost Structure and Key Activities used to define the Service provided by the start-up. Value proposition can be altered by changing some peripheral elements of the service provided so that new or existing customer segments can be explored by offering a different perceived value. This generally happens when the service delivered finds a better utility arena than the originally intended one. These changes influences the customer relations as well as the cost structure as the start-up might need to add or eliminate some service periferals. All the above changes if radical enough, will eventually result into changes in the key activities.

- Market Refinement: For this type of refinement, the market to be addressed needs refinement which implies that, the Customer Segment, Distribution Channels and Revenue Stream will be reconsidered and modified. At times the initially selected customer segments are not the appropriate ones and the service offered has much more demand in some other market segment. Changing the Customer segments implies changes in the distribution channel in most of the cases. Exceptions are only if the new customer segments can be approached and addressed using the same distribution channel. Also since the market is changed so will the revenue in accordance with the new perceived value by the new customer segments.
Network modification: For this type of modifications, the involvement of all stakeholders has to be reconsidered. External stakeholders, includes, suppliers, alliances, distributors, etc. These network elements can be re-drafted by reconsidering the blocks of Key Resource (all the shared resources and capabilities), Key Partners (involved stakeholders) and Distribution Channels (external partners involved in the distribution channel).

C-SOFT: The C-SOFT framework appears to have specific elements to address the refinement as compared to the CANVAS framework.

Service Redesign: C-SOFT has specific dedicated block to reconsider when it come to redesigning a Service. One major advantage of C-SOFT framework is, if the changes made in a specific customer segment’s Service element are similar to another existing customer segment’s service, then the overall BM does not need major modification.
Market Refinement: If the market needs refinement it implies that the Customer Segment has to be redefined. Since C-SOFT is completely Customer centric framework, all the elements addressing the changes in Customer segment have to be redefined accordingly for this type of refinement.

Network modification: The C-SOFT framework is known for its specialisation in businesses in a networked environment. The Organisation element for each Customer segment has to be redefined for any change in the stakeholder and alliance network. Only if the changes are in terms of external partners involved in the supply chain, then the refinement will be addressed in the Technology element; e.g. technical architecture changes.
5.5. **Sustainable returns Phase**

5.5.1. **Objective Layer**

Description derived from Five phase start-up growth model (Vohora et al., 2004): This is the final phase of growth for a start-up, since after this phase the company expands to a level where it is not a ‘start-up’ any longer. By this stage in growth, the start-up has also started to reduce its association with the initial strategic support alliances with other stakeholders like universities and research organisation. This phase mainly represents the highly sustainable market demand coupled with consistent revenue stream.

This description can be consolidated in one objective with highlighted keywords selected or derived from the above description.

Obj5. \(\Rightarrow\) “*Attain sustainability in the business with the existing product line along with organisational independence from the initial supporting alliances*”

5.5.2. **Business model Element Layer**

The main aim of this phase is to have a dependable revenue stream along with stability in other aspects of the company business. This necessarily does not mean that the start-up will not renovate or invest in R&D, the main focus or importance of this phase is that the start-up has reached a stage where it does not have to stress on survival any longer but look forward towards maintenance and growth. Sustainable growth is the assurance of a stable place and recognition in the industry for the start-up. This also implies the autonomy and self sufficiency of the company for survival.

- CANVAS: Since financial stability and reliable cash flow are the main objectives of this phase, the *Cost structure* and *Revenue stream* are the main focus. The self sufficiency is achieved by reconfiguring *Key Partners* in the BM of the start-up.
Delft University of Technology
Business model design roadmap using CANVAS and C-SOFT framework elements, synchronised with start-up growth phases

Figure 23: CANVAS Sustainable returns Phase of ICT start-up

- CSOFT: **Finance** is the prevailing element of this phase and action related to annual revenue, costs, financial turnover, capital etc take precedence. Other than this the self-sufficiency of the company is ensured under the **Organisation** element by modifying the actors, interactions and relations with those actors.

Figure 24: C-SOFT Sustainable returns Phase of ICT start-up

5.6. Conclusion

This chapter was dedicated to developing the first prototype Roadmap ver. 0.1. The consolidation of all the phases on a singular graph with all five growth phases on x-axis and the two top most layers of the roadmap on y-axis give the following roadmap.
It can be observed from both the roadmaps that all the elements of both frameworks were addressed at least once by the end of Pre-Organisation Phase. This is the time when the entrepreneurs undergo meetings and workshops to define the BM of the start-up. After the first draft of the BM is ready then it undergoes refinement in the Re-Orientation Phase as per the knowledge gathered by the entrepreneurs till this phase. The last phase is the actual launch of the fitting BM defined after refinement. Having a fitting BM delivering optimum value to customer and equivalent economic value to the start-up, might be the cause behind sustainable returns in the last phase. Many global CEOs (in a study conducted by IBM) have acknowledged the importance of an efficient BM to achieve competitive advantage and maximum value from the product (Amit & Zott, 2010).

The Roadmap ver. 0.1 does not take under consideration the practical implementation of the roadmap designed. Using this 0.1 prototype the prototype version 0.2 will be developed for the design case of SmarterBetterCities in the next chapter (chapter 6).
6. Design case: Prototype ver. 0.2

A design case study is preferably used in this thesis because it provides an opportunity to observe and analyze a phenomenon/solution design that few have considered before in a practical context. SmarterBetterCities design case study is used to improve the Business model design roadmap ver. 0.1, to the next Roadmap ver. 0.2 with more practical relevance. A case study is ‘A strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context’ (Saunders, Saunders, Lewis, & Thornhill, 2011). Inevitably, an important aspect of using a design case study is defining the actual implementation case. A start-up in the field of ICT is selected as a design case study to grasp and relate to the practicality of this thesis. The company is a GIS software development start-up; SmarterBetterCities (SBC) found in 2012 and is currently looking towards Market exploitation and thus mapping itself globally among leading GIS software service providers.

Market for ICT solutions provided by GIS services for smart cities is growing rapidly. Recent development in this field is the introduction of CityEngine by Esri Inc. Esri CityEngine is a three dimensional modelling software application developed by Esri R&D centre Zurich (formerly Procedural Inc.), and it supports generation of 3D urban environments. The open sourcing of the CityEngine platform (reference and date) has unwrapped many small scale business opportunities to develop various urban planning software applications to work on the CityEngine platform. This new emerging business sector has caught the interest of many entrepreneurs and venture capitalists. Esri CityEngine is also the platform that enables the services provided by SmarterBetterCities. ‘Service based on CityEngine’ is an upcoming industry, and so investigating into the development of one such company will provide some insight into probable do’s and don’ts of this industry. This roadmap will also be helpful for other upcoming start-ups in this industry as they can learn from the actions taken by SmarterBetterCities (SBC) in order to achieve the milestone that SBC has been able to achieve.

6.1. Data collection

SmarterBetterCities management and employees were interviewed to gather data about the company and activities related to the company growth (appendix 2-8). The higher management was interviewed to understand the steps taken in the growth of the company from an influential decision maker’s perspective (appendix 7). The company growth data obtained in the interview also matched the data collected from secondary sources/ websites of the supporting organisations (alliances) (appendix 2 and 3). Supporting data was also collected from the company business plans and archived documents (appendix 6). Since the roadmap to be designed also deal with the actions taken during specific phases of growth, it was important to understand the current action plan of SBC. This data was collected via participatory observations and meeting notes (appendix 8). The higher management of the company was interviewed for understanding the technological details of the current and future developments at SBC (appendix 8). This gave an insight in the future activities and objectives of the company for the next phase of growth (appendix 6 and 8). The data gathered from participatory observation and meeting notes was verified with the second official elaborate Business plan that was being drafted around the same time in the company. So to conclude a macro level of data that defined the growth till
date of SBC was collected and the second set was the micro level data collected from the current phase of growth and the immediate next phase objectives and action plans. After collecting the data the company was identified to be in the re-orientation phase and moving towards sustainable returns phase in its future agendas. This positioning of the company in the phase model gave an opportunity to derive the business model that the company expects to work on once the sustainable returns phase is achieved. The guidelines and expectations for the final BM were derived from a detailed discussion (workshop) with the decision making management of the company (CEO, CTO, and CIO) (appendix 7). Having the final business model specifications for reference and the supporting data from the day to day functioning of the company was helpful to trace back the action plan and objectives of the final phase of growth at SBC. Also to understand and incorporate the macro level activities related to the technology at SBC, a technology overview is presented below. A Literature review of the GIS service providing technology is also attached at the end of the thesis as appendix 4.

6.2. Overview of GIS service providing Technology

‘Current models of cities are often obtained from aerial images as demonstrated by Google Earth and Microsoft Virtual Earth 3D platforms. However, these methods cannot produce photo-realistic models at ground level.’(Xiao, Fang, Zhao, Lhuillier, & Quan, 2009). Today the conventional urban planning i.e. the creation of virtual 3D cities, its analytics and management is a time consuming, inflexible and expensive processes. The core market segments of Business and Government that require this planning tools, currently suffer from not having an integrated system for daily operation, also a simplified access to information and quick scenario analytics for decision-making. SmarterBetterCities (SBC) is a software company for holistic urban planning. The core technology is to consolidate and convert the 2D data related to urban planning into 3D interactive models, so as to provide an integrated system for quick decision-making. For instance, SCB can provide a software service that includes: 3D model of a building (existing or planned), with user interface for all the electrical connections and controls, water supply connections and controls, status report of heating system, cooling system, waste management, climate impact, zoning laws, etc. In addition the software can simulate few structural changes to the (planned) building itself. SBC provides status of all elements, required for managing an infrastructure on one simple user friendly interface. They deliver ICT solutions for transitioning and managing Smart Cities. SBC’s software products and services are exactly addressing the customer's needs by accelerating system integration, intuitive user frontends to show complex information and thus provide end users with novel interaction software that makes it easy to arrive at well-informed decisions. SBC builds information visualization products on established geo-spatial technologies and standards. The potential customer base includes cities, architectural corporations and construction material producer, municipalities and other urban planning authorities. “To these clients, SBC can provide interactive tools with 3D web-based technologies and touch-device-based assessment of urban climate, densification, construction materials and associated legal regulations”(SmarterBetterCities, 2014). SmarterBetterCities aims to create smarter planning platform by developing innovative and affordable web-solutions with help of 3D modelling and there by planning (SmarterBetterCities, 2014). The product and service portfolio at SBC allows the customers to digitally visualize simulate in 3D, to analyze their urban planning projects, helping them to better understand the consequences of their design decisions; saving time, money, and resources; to become more innovative.

The CEO of the company summarises the unique selling point of SBC as “Our service is added value for customers who don't want to create 3D web scenes on their own, or want special
customers are able to customize the viewer with their own branding and logos. They can embed their 3D content and have a really easy-to-use interface to discover the different floors of a building, for example, or visualize future scenarios of the city.”

6.3. Technology architecture

In order to draft a roadmap down to the individual activity level and indicate activities to carry out the desired transition, the technical architecture of SBC has to be understood first.

![Figure 27: Technology pipeline of SBC](image)

(SmarterBetterCities, 2013)

SBC develops urban planning software in order to facilitate consolidated representation of buildings and other infrastructure of a city in visual 3D format. The technical architecture of this software involves the components indicated in above figure. The geographical information and baseline are provided using the geo-spatial information available publically on various GIS databases. SBC engineers code building topologies over this platform using Computer-aided design (CAD) tools. These building topologies are coded with facility to manipulate various physical features such as texture or position at the front end as per the end users choice. The shape rules are incorporated, so that the 3D structures are real time representation of a physical structure. The shape rules are also called grammar rules and they defer as per the architectural genres eg. Grammar rules for Japanese's architecture cities will be different than that of a European architecture cities or Asian architecture cities. Project specific topologies also need to be coded individually eg. Custom designed Stadiums or Factory setups and installations. The placement of these coded structures has to be relevant to the real time geographical setup of the location. Thus the program code of the 3D structures has to be correlated with the existing GIS database and placed on a map like platform. For this Esri CityEngine is used. Esri CityEngine is a stand-alone software product that provides professional users in architecture, urban planning, entertainment and general 3D content production with a unique conceptual design and modelling solution for the efficient creation of 3D cities and buildings. More specifically it enables the creation of 3D cities and buildings based on the design code and grammar rules provided as input and correlate it to GIS data. If we talk in a basic software coding terms, CityEngine acts as a compiler and execution platform for the code/designs developed by the SBC programmers. The
clients receive a compiled version of the design on CityEngine. To compile a design code through CityEngine, one requires a developer license and access.

The CityEngine platform used in the pipeline of product delivery at SBC is a third party platform. SBC also uses other third party software and hardware to code the building topologies for their clients. SBC has bought licensed packages of all the software used to code the building topologies. The hardware used in the process includes the desktops from Dell and Apple for coding & designing. Also to test the products and to give demonstrations to the clients, tablets and touch screens from various providers are used.

6.4. *Foundation of SmarterBetterCities*

Today we are around 7 billion strong on this earth, out of which 50% live in cities and this percentage is to grow till 75% (*Geodesign-past-present-future*, 2013). It is estimated that at least 19 cities will have a population more than 20 million during this 21st century (*Geodesign-past-present-future*, 2013). This growing recognition of cities as the centre of the human world was further highlighted when The City 2.0; a smart city built using the simulations on CityEngine was awarded the 2012 TED Prize (a 1 Million $ award given annually to exceptional individuals with creative and bold vision to spark global change). It was the first time in the history, that an Idea was awarded and not a person. As per the TED committee, ‘it was an idea upon which our planet's future depends’ (*Geodesign-past-present-future*, 2013).

This gives us an impression about the need for efficient urban planning softwares. The solution to facilitate this change should be a GIS (geographical information system) based software that incorporates a holistic system to consider element of urban planning. Urban planning process itself has many stakeholders involved, e.g. municipality, electricity providers, water supply providers, waste management, etc. A common integrated platform is required, that can be understood and is usable to all those involved in the network of urban planning. This was the motivation and window of opportunity that initiated the foundation of SmarterBetterCities.

This opportunity was identified by few researchers studying in the field of GIS 3D modelling technology, 3D city modelling & associated legal implications and web technology and human-computer interaction technology inspired. Most of these researchers were associated with ETH University (Swiss Federal Institute of Technology: Eidgenössische Technische
Hochschule) which provided them a common platform to network with each other and then correlate their research topics. The foundation of SmarterBetterCities was supported by the ETH spin-off (an initiative for university entrepreneurial projects) and Climate KIC (Europe’s largest public-private partnership focused on climate change to support and enhance the development of climate sensitive projects). In addition to these circumstances “a research on alliances and networks has stressed the value of inter-organizational relationships for accessing resources and creating competitive advantage” (Baum, Calabrese, & Silverman, 2000). In addition to the financial and mentoring support from the ETH University and Climate KIC, SmarterBetterCities also has close affiliation with Esri R&D in Zurich. This affiliation was a result of the extensive network connections developed by the founders with their long term involvement in the GIS field. “Alliances have also been postulated to provide access to complementary assets (Pisano, 1990) as well as access to external legitimacy and status similar to that provided by legitimating institutions” (Baum et al., 2000). The support from ETH University and Climate KIC, technical compatibility with ESRI coupled with the entrepreneurial zest of the founders were crucial elements for the foundation of SmarterBetterCities and also helped in its brand building since 2012 (foundation year).

### 6.5. Growth of SBC

SmarterBetterCities has covered some major milestones over its journey as a start-up since 2012 and before. Even though the company was found officially in December 2012, the foundation was being developed since the research on 3D GIS, started at the ETH Zurich University in 2006.

![Figure 29: SBC growth roadmap](image)

The growth of SmarterBetterCities can be associated with *Five Phase University spin-off growth model* (Vohora et al., 2004). While studying the growth phases at SmarterBetterCities, specific BM elements and the associated actions can also be identified. The Objectives defined for each phase in the Roadmap ver. 0.1 were used in the interviews with the founders to define the scope of each phase of SBC. This is the reason that the Objective layer is unaltered, while the Business model Element Layer and the Action Layer are described below for each growth phase.
6.5.1. Research Phase

This is the time when technical research takes place for considerable amount of time within academic frameworks (Vohora et al., 2004). The Research Phase for SBC started with current CEO, CIT and CTO working as researchers at the Value Lab of ETH University, Zurich. During this phase most of them had only academic perspective towards their individual projects. This particular timeframe was characterised with each of the founders focussing solely on their research without much commercial outlook. The intellectual property of 3D GIS modelling developed during this time, formed the core technical speciality of SmarterBetterCities in future. Each of the founders was working on cutting edge technology as a researcher in their respective fields. The current CEO of SBC was at the time working on ‘Collaboration of urban planning platforms’ for sustainable urban development with the current CTO and others. At the same time the CIO of SBC was working on ‘Human computer interaction multi-camera systems, Segmentations, 3D recognition, Posture recognition and Virtual reality’ with the focus on real time application. All these technologies formed the building pillars of SmarterBetterCities in future and gave the first movers advantage to SmarterBetterCities. During this phase few mock-ups were developed to have the proof of concept for each research projects. These mock-ups resulted into the first prototype with the potential to provide a consolidated platform for well informed decision making of urban planners. These mock-ups attracted a major government project, which turned out to be one of the major clients for SBC in future. The Research Phase lasted from October 2006 to June 2011.

- CANVAS: In case of SmarterBetterCities the core technology as discussed earlier was ‘Urban planning using 3D modelling’. Thus the technical Key Activities included, coding the urban structures, linking (as previously discussed in the technology overview) these structures with urban planning platforms like Esri CityEngine, virtual 3D representation of the urban structures on City Engines. In order to execute these activities the Key Resources like, Esri CityEngine, CAD were identified and approached/acquired in this phase.

- CSOFT: Technology was the main focus during this time as no formal business proposition was conceptualized yet. The technology of ‘Urban planning using 3D modelling’ was being developed during this phase. This technology was developed within academic context with focus on ‘developing a cutting edge technology for consolidated urban planning’. It was only around 2011, when the business opportunity was given attention.
During this phase all the links to other BM elements from the Technology were dormant for most of the time.

6.5.2. Opportunity framing Phase

This phase is characterised with formal opportunity identification and then formative steps to create a new start-up venture mainly focusing on technology transfer (Vohora et al., 2004). During the time from June 2011 to September 2012, founders of SBC got involved in Climate-KIC (more in appendix 2) innovation project "SUA–Smart Urban Adapt" (more in appendix 2). During the Research Phase the government organisation had already shown interest in this technology. This interest coupled with commercial importance of SAU project, motivated the academic perspective of the founders to envision the commercialization opportunities of their research. This opportunity identification combined with the confidence in the research and its usability, inspired the researchers to become entrepreneurs. Early performance of a start-up can be enhanced by associating with efficient networks alliances that provide access to diverse information and capabilities with minimum cost of redundancy, conflict and complexity (Baum et al., 2000). Association with Climate KIC, an external organization closer to the market, provided SBC with a wide range of stakeholders and network connections within relevant industries. SBC also collaborated with Esri for its technical resource; Esri CityEngine. This association happened due to technical dependency of SBC technology on CityEngine and strong professional connections of the founders with the original developer company of CityEngine; Procedural Inc. later taken over by Esri R&D Zurich. These associations also helped in brand recognition once the start-up was formed. SBC acquired a proof of Market when interest of other companies and Industries spiked towards SBC products, partly due to exposure through Climate KIC’s SUA project. The exposure gained via networking with Climate KIC and Esri provided required initiation to locate prospective customer segments. Around the same time another ETH spin-off, Procedural Inc., with its flagship product CityEngine, was being acquired by ESRI Inc. CityEngine is GIS visualization software used in the pipeline of SBC product delivery. This way ESRI, a global leader in GIS solutions, silently approved the technical viability of the 3D GIS modelling solution, making the opportunity for SmarterBetterCities more promising. The successful interface with CityEngine and a working prototype developed during the Research Phase gave required proof of concept. This two aspects helped SBC to crossover the below mentioned critical juncture (Vohora et al., 2004).

“Universities have lots of well-developed technologies but with little proof of concept, no proof of market, and no commercial management. In general there isn’t the commercial
expertise or resources within universities to overcome these deficiencies and develop an opportunity that is fundable” (Vohora et al., 2004). To overcome this well-known hurdle in the second phase of start-up growth and to make the transition easier, the technology transfer initiatives at ETH University (ETH spin-off program) and Climate KIC (“Climate KIC Accelerator” start up support program) helped SmarterBetterCities’s founders at financial, organizational and motivational level. The BM elements in focus during this phase are as follows.

- **CANVAS:** The **Key Partners** like Climate KIC and Esri R&D Zurich were identified and incorporated in the business alliances during this phase. This phase also included efforts to estimate the financial aspect of the business to be developed. Funding arrangements were being figured out in this phase by taking into consideration the tentative **Cost Structure** based on the **Key resources** and **Key activities** identified in the previous phase. Association with Climate KIC assisted the founders to precisely identify the **Value Proposition** of SBC products and services. The identified value proposition was ‘Visual 3D modelling for unified urban planning information’. It also helped to identify prospective **Customer Segments** as a result of the exposure to various industries and companies. The identified segments were; Business (including Architecture, Engineering and Construction (“AEC”), Media and Press, Real Estate and Retail) and Government (Economic Development, Facilities, Federal, State, Local, Urban and Regional Planning)

- **C-SOFT:** SBC founders identified the commercial opportunity of their technology in this phase. They also identified the two **Customer Segments;** Business and Government. The **3D modelling Service** to be offered was designed in this phase since the value to be offered was clearly identified. SBC also applied for seed funding from Climate KIC, required for product/service production. The monetary activities related to this are addressed under the **Finance** element of C-SOFT.
6.5.3. Pre-organization phase

As proposed in the Roadmap ver. 0.1 (Chapter 5), SmarterBetterCities also had the basic business plan ready by the end of the 2nd growth phase i.e. around September 2012. The Pre-Organisation Phase included taking decisions about what existing resources and capabilities need to develop, as well as when & where to access them. Decisions were also made regarding what resources and knowledge needs to be acquired at the moment and in the future at SBC. From September 2012 to December 2012 the founders were busy organizing all the required resources for establishing an independent company outside the research labs of ETH University. These activities included acquiring office space, hiring technical experts and full time employees for assistance in product development and research. In order to enhance the employees entrepreneurial and organisational skills, One of the founders participated in a start-up-training program from Venturelab (launched in 2004 as a national training program for innovative high-tech start-ups("venturelab - fast track for startups!," 2004)) and another founder participated in the Climate KIC start-up-training program (Climate KIC, Appendix 2).

“The funding for Climate KIC came in at the right time and was supplemented by revenue from first major client orders like” as mentioned by the CEO in the interview. This coincidence of Climate KIC funding timing and also all other contribution for building up the corporate identity of SBC in relevant network of stakeholders was possible only because of the strong association of SBC with Climate KIC, ESRI R&D, various Academic and Professional mentors (more on SBC network appendix 2). This strong network enabled SmarterBetterCities with a quick company setup and so a quick Pre-Organisation Phase. As correctly stated by Baum “establishment of an alliance network at the time of founding will significantly reduce the hazards faced by a start-up, resulting in differential initial performance and growth” (Baum et al., 2000).

By December 2012 SmarterBetterCities was engaged in commercial production and working towards delivery of two initial client projects. This marked the start of next phase of growth for SmarterBetterCities. The BM elements in focus during this phase were as follows.

- CANVAS: SmarterBetterCities’s first clients were addressed in this phase and so the Revenue Stream was established along with pricing. Since the sales were aimed to be on personal basis no special setup was required for Distribution channel. Also since SBC dealt with their first projects during these phase the element of Customer Relation was also
developed during this phase. The element of Key Resources was also addressed by setting up an office, hiring employees and acquiring office space, etc. All 9 elements of CANVAS were addressed at least once in the growth phase up till now.

C-SOFT: This phase was the initiation of Organizational framing of SBC in terms of setting up an office, hiring employees and acquiring office space. Also the Financial cost and revenue cycle officially started in this phase with the first client orders. The Service element was also touched upon while the face to face consultancy with the first two clients. All 5 elements of C-SOFT were addressed at least once in the growth phase up till now.

6.5.4. Re-orientation stage

SmarterBetterCities is identified to be currently in this phase as per the interviews and observations made at the company. The data thus gathered reveals the intent of the company to modify current product line by making it more modular. Modular refers to making the products in form of pre-defined set of building topologies unlike the previous service concept of including the customised set of building topologies in the packages delivered per customer project. Also company engineers are observed to be working on adapting SBC products to a cloud platform in
order to keep the company at technical forefront. After careful analysis of the current activities and short term goals (gathered from interviews, meeting notes, and business plan) at SmarterBetterCities, following objective of the current stage is drafted.

‘To redefine current product line along with launching it on web-shop and develop all the capabilities and competencies for launching all SBC products on Cloud platform, while maintaining the current customer base’.

This objective can be divided in three distinct focus areas as follows.

1. 3D Libraries: Product modularity

These three focus areas have different priority based on observations made on the completion status and resources allocated to each of them. As its first priority, SBC is concentrating on developing modular product line that can be delivered via web-shop in pre-defined package format. The Modular Product sets are called 3D Libraries (e.g. 3D library set for school infrastructure, residential infrastructure, office infrastructure, industrial infrastructure, etc.) and henceforth 3D Libraries and modular products will be used interchangeably. Even though the core technology of ‘3D modelling for unified information on urban planning’ will remain constant, the service content and the associated value will change. The original service design is not completely discarded, but the new design will be implemented in parallel. “The aim is to have maximum market coverage with the modular product packages, and gradually reduce the custom made packages” (quote from interview – more information in appendix 7). As a result of this change SBC currently has two types of services. Original service design; on demand, custom designed urban planning tools and/or virtual 3D structures (appendix 4) for dedicated client projects. New Service design: Pre defined set of functionalities and/or virtual 3D structures available in packages, ready to use (drag and drop on the map) for any generic customer. Since the technology is not changing much and the value proposition is also being altered but not changed radically, the customer segment is also expected to retain the original customers with addition of more customers with wide range of implementation. Modular products will ensure less time and resources invested in consulting with each client and also reduce the ratio of production time and resources required per client. As also mentioned in the three phase service design model (De Reuver et al., 2009); during the last growth phase Market plays major influential role for changing the BM. This supports the strategic decision of SBC to focus market penetration during the Re-Orientation Phase (Vohora et al., 2004), which partly resembles the Market phase of the three phase new ICT service design model (Kijl et al., 2005).

2. Web-shop : Online sales via SBC website adapting a intuitive distribution channel

Second priority for SBC is a Web-shop that will enable online one stop distribution channel for all products, via SBC website shop. This objective is also aimed at reducing the amount of resources utilised in handling each of the customer orders on personal basis. This reformation can also be categorised into a service refinement (as discussed in the Roadmap ver. 0.1).

3. CloudCities (Cloud Based product line - more information in appendix 5): Technological adaptation.

“CloudCities is still in beta testing phase; we aim to launch the modular Libraries first. We would like to introduce CloudCities in Specific technical conferences like ‘Esri International User Conference in San Diego, California, from July 14-18, 2014’ where the audience is ready for advance technical endeavours in GIS field” (quote from interview – more information in appendix 7). Adapting the product line of SBC as per growing market adoption of cloud
computing is also coupled with similar changes in the alliance network of SBC. Esri has already rolled out the Cloud based platform for hosting various GIS applications called ‘ArcGIS’. Esri’s ArcGIS Online map and GIS services provide immediate access to cartographically designed, seamless base maps to which SBC clients can easily add their own data in form of virtual 3D structures (Kouyoumjian, 2010). Esri uses Amazon's EC2 and S3 compute and storage services that allow Esri to host the content and provide access 24/7 (Kouyoumjian, 2010). SBC can leverage Esri’s PaaS (Platform as a Service) offerings via ArcGIS and enable its SaaS (Software as Service) to the SBC clients. SBC technical experts are currently working towards refining the CloudCities beta model. This new venture at SBC will address much wider market as the requirement for software installation capacity at the client end will reduce down to minimum. The client will essentially need just a compatible web browser to use SBC products.

- **CANVAS:** First objective of the current phase at SBC can be addressed in the **Key Activities** element of CANVAS, as the production process is undergoing alteration and so are the activities related to that. The **Value Proposition** is changing, so that the clients with generic demand without any need for consultancy can also find SBC products valuable. The reduced ratio of production resources and capabilities per client, resulted changes in the **Cost structure**. For the second part of the objective, the web shop is also helping to increase the value proposition for the above mentioned client types. The Web-shop is also modifying the **Distribution channel** and **Customer Relations** radically in this phase. For the third part of the objective; CloudCities is almost a new product in spite of having same core technology. Thus SBC will be addressing the CloudCities project only at technical level in this phase, which will imply changes in **Key Activities** and **Key Resources** as of now.

- **C-SOFT:** For this framework the service redesigning for 3D libraries and web-shop can be covered under a singular element of the BM. The web-shop being developed at SBC will also be included in the **Technology** block as it is a technological change in the interaction within the involved network of SBC. Even though new services are introduced for the same customer segments, the original service design is not yet completely discarded. But in case of C-SOFT framework, the new service can be defined as second part of the **Service** for the original **Customer segments**. While other elements like **Organisation**, **Finance** and **Technology** will remain unchanged. For the CloudCities, the activities

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**Figure 36: CANVAS Re-Orientation Phase - Service Redesign of SBC**
undertaken to develop a new Cloud based services at SmarterBetterCities can be addressed under the Technology element for each of the customer segments of the BM.

![Diagram of Business Model Design Roadmap using CANVAS and C-SOFT Framework elements, synchronised with start-up growth phases](image)

**Figure 37: C-SOFT Re-Orientation Phase - Service Redesign of SBC**

### 6.5.5. Sustainable returns

The main objective of this phase is expected to be - achieving a predetermined amount of financial turnover (SmarterBetterCities, 2014). Along with attaining a stable state in the Swiss market the company also envisions to grow globally and will leverage its sustainable revenue for this geographical expansion (SmarterBetterCities, 2014). But in this specific design case, the second objective of this phase is identified as the successful mass market rollout of CloudCities (appendix 4, 7 & 8). SmarterBetterCities aims at; achieving per-set financial turnover per year leading to geographical expansion of the company and mass market rollout of CloudCities. This objective supports the fact that ICT industry grows in terms of technology quite rapidly and so they have to frequently adapt and change their strategies and technologies in order to survive for long term.

The technical feasibility of CloudCities is expected to be checked in Re-Orientation Phase itself. Also as discussed in the previous phase; CloudCities can be termed as new product line, which will use the same core technology that is the foundation of SBC. **Sustainable returns Phase** is expected to include the market roll out of CloudCities and its consequent BM refinements. During this phase, all other SBC products with probable exception of CloudCities would have been well established in the market with a reliable demand. This will give SmarterBetterCities a leverage of economy of scale to explore its economy of scope.

- **CANVAS**: More than the cost structure, the revenue stream will play a major role during this phase. Like any other organisation SmarterBetterCities will try to achieve the economy of scale and reduce the production cost per product, while maintaining the revenue from each product, eventually raising the profits earned. The geographical expansion will have massive impact on the distribution channel but other aspects of the business will not be affected in equal proportion. For the CloudCities the market rollout will compel SBC to readdress most of the CANVAS BM elements (except Key Activities & Key Resources as they are addressed in the Re-Orientation Phase). But for the purpose of this thesis, in order to investigate only the technology at hand during the Research phase the CloudCities related endeavours are not further investigated.
C-SOFT: Finance element will be the main focus of this phase. The geographical expansion will require Organisational setup at new locations. For the second part of the objective where a Cloud technology is to be adopted by the existing customer segments, the focus will be on all but Technology (as it is already addressed in the Re-Orientation Phase), elements of the BM. This marks a start of new BM iteration. But for the purpose of this thesis, in order to investigate only the technology at hand during the Research phase (Requirements and Assumptions) the CloudCities related endeavours are not further investigated. As discussed in the Requirements and Assumptions this roadmap will be open ended.

6.6. Conclusion
SmarterBetterCities is a start-up in its prime growth phase and looking forward to step into the Sustainable returns Phase in coming future. This case is ideal to design the roadmap for the BM changes required at the organization for their future sustainable growth. Being involved in the company closely gave a greater insight to study these factors and use them in designing the roadmap. Since SmarterBetterCities does not have rigid BM ontology adopted, it facilitates to draft their BM using two ontologies determined earlier: CANVAS and C-SOFT. Also due to the small structure of the organization, it is easy to get the overall picture. The network structure of SBC also facilitates us to implement to C-SOFT ontology and the simple entrepreneurial nature of the BM facilitates to implement the CANVAS ontology. As the end of the roadmap a stable BM is developed for SmarterBetterCities including all the guidelines provided in during the meetings and discussions at SBC (appendix 6). But since this thesis is aimed at developing a roadmap, the BM thus developed is added in appendix 6.

Objectives of each layer guide the BM elements and the elements of each layer ultimately fulfil the objectives. Objectives have a sequential order, and the last objective block is to address the start of new iteration of Business model development for CloudCities.

![Figure 40: CANVAS Business model elements development Roadmap ver. 0.2](image)

![Figure 41: C-SOFT BM elements development Roadmap ver. 0.2](image)

This is the Roadmap ver. 0.2, which will be compared with the Roadmap ver. 0.1 as a final stage of this thesis in the next chapter.
7. Evaluation

7.1. Evaluation process

“Progressive refinement in design involves putting a first version of a design into the world to see how it works. Then, the design is constantly revised based on experience, until all the bugs are worked out” (Collins et al., 2004). This is the reason for designing the two versions of prototype Roadmaps in this thesis. First a theoretical version was designed and the second design iteration was conducted with help of a design case; SmarterBetterCities. Qualitative and participatory research method is used in this thesis, where Systematic observations, interviews, company documents were used to design the Business model design roadmap of SBC. These 2 Roadmaps designed, are compared in this chapter to identify commonalities and discrepancies, based on which implication of this thesis will be drawn and future recommendations will be made in next chapter. The comparison is not just between ver. 01 and ver. 0.2, but also between use of CANVAS and C-SOFT for roadmapping the BM development. Furthermore the Requirements and Assumptions drafted in chapter 4 will be referred back to evaluate their fulfilment.

7.2. Implications from designing a BM design roadmap

7.2.1. Design Modification/Recommendations

After practical comparing Roadmap ver. 01 and ver. 0.2 few differences have been observed, those will be enlisted below. Also since it was possible to study the transition of phase 4 to 5 from Re-Orientation to Sustainable-returns, in details, there are more recommendations for this particular transition.

1. The BM elements associated with the Research and the Opportunity framing Phase remained constant for both versions, validating the following arguments
   a. During Research Phase the Technology aspects of the BM should be focused, acquiring all possible Key resources and defining all Key activities related to the technology.
   b. During the Opportunity framing Phase all the BM elements, which are associated with identifying the customer segments, are focused. This phase should also be used to develop the financial and stakeholder (network/partner) aspect of the BM. It was observed that for the SmarterBetterCities case, this phase introduced all the important Key Partners, which proved helpful for consistent growth in the future.
2. A discrepancy was observed between the Pre-Organisation Phase of Roadmap ver. 01 and ver. 0.2. While studying the SBC case, it was observed that the company had focused on the Key partners during the Opportunity framing Phase as most of the Partners played a key role in indentifying the opportunity. Since the Key partner element is also focused in the previous phase as well, this BM element focus can be placed at the transition of these two phases (Opportunity framing Phase and Per-Organisation).
3. Re-Orientation Phase is mainly responsible for rethinking the BM designed thus far at the start-up. This is most important phase considering the fact that getting the BM and product matched perfectly in the first try is a very unlikely coincidence. The importance of this phase also validates the selection of SmarterBetterCities as a design case for this thesis.
Since SmarterBetterCities is in this phase of growth currently, it was possible to study the previous comparatively less complicated phases via interviews and documents, while practical observations were available to study this phase in details. Along with refinement of the existing BM this phase also serves as the incubator for future growth strategies of the company. The Service redesign category identified in the Roadmap ver. 0.1 was also observed and verified at SBC for the particular BM elements to be developed during this phase. Coincidently the future strategy of SBC also aligned to this particular category.

4. **Sustainable returns Phase** in the Roadmap ver. 0.1 was identified to focus solely on financial sustainability and organisational independency. The first half of the objective at SmarterBetterCities aligns with the objectives identified during the Prototype Roadmap ver. 0.1. But it was observed that this phase should also include considerable dedication towards rethinking and adopting new technology as per the fast growing nature of ICT. The Financial sustainability should be leveraged to develop and adopt the company according to the rapidly innovating ICT. This could be contributed to the fact that changes in ICT will affect not only the production but distribution (e.g. new technology for online product distribution) and organisational aspects (e.g. new technology for virtual team formation) of the BM, making the adoption of new technology a prominent part of the sustainable phase.

### 7.2.2. CANVAS Vs C-SOFT

Estimating a BM framework that is more suitable for roadmapping the BM designing of an ICT, and specifically GIS service providing start-up was also a secondary objective for this thesis. Following observations were made during the design and implementation of the prototype roadmap in the design case.

<table>
<thead>
<tr>
<th>Criteria for comparison</th>
<th>CANVAS</th>
<th>C-SOFT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ease of execution</strong></td>
<td>Since the BM elements are more specific and modular, it is easier to execute such a roadmap which provides very specific focus points.</td>
<td>The elements have a larger scope and so are very broad for the entrepreneurs to comprehend the scope of these elements.</td>
</tr>
<tr>
<td></td>
<td>■ This characteristic of CANVAS made it easy to identify the elements for activities already performed in the first three growth phases at SBC.</td>
<td></td>
</tr>
<tr>
<td><strong>Complexity of end results</strong></td>
<td>CANVAS model has many elements this might make the process of implementing the roadmap for deriving the complete BM a bit overwhelming.</td>
<td>The complete scope of BM elements makes it easier to link them at the end to derive the complete BM.</td>
</tr>
<tr>
<td></td>
<td>■ This characteristic of C-SOFT</td>
<td></td>
</tr>
</tbody>
</table>
Specificity to ICT start-ups

The comparison does not give prominent justification for considering a particular framework advantageous or disadvantageous. But it is clear from the comparisons that CANVAS has the capability of giving a detailed view of BM design, where as C-SOFT has the capability to form a BM roadmap with elements that can be linked (balanced) much faster to form a complete BM at any given time and equally easy to innovate that BM. Designing the roadmap with the CANVAS elements was easier, since each of the BM element in CANVAS has very basic definition, making it easy to convey it to the practitioners while conducting interviews and workshops. But when the C-SOFT model was explained, it was observed to be more suitable of adapting to the new upcoming changes and product lines at SBC. It is more suitable for SBC to have dedicated BM elements for each customer segments, as the company is aiming to expand its economy of scope. These observations indicate that the CANVAS framework is suitable for GIS service providing start-ups till the first draft of BM at the end of the pre-organisation phase. After this phase the management can shift to C-SOFT framework to accommodate future reformations in the GIS service providing start-ups.

7.3. Evaluating Requirements and Assumptions

The requirements and assumptions defined in chapter 4 are to be evaluated for complication to check if the designed roadmap has systematically achieved the objectives of this thesis. Below is a table with the requirements and assumptions in the first column and the steps that were taken to address, in the second column. Most of the functional requirements and assumptions were addressed in the designing of Roadmap ver. 0.1, whereas most of the user requirements and assumptions were addressed in the design case study.

<table>
<thead>
<tr>
<th>Requirements and Assumptions</th>
<th>Implementation in the Roadmap design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market exploitation: As the roadmap approaches the last phase (sustainable returns or market phase (De Reuver et al., 2009; Vohora et al., 2004)), the start-up should be able to exploit the business opportunity initially identified.</td>
<td>Sustainable returns Phase is aimed at stable revenue coupled with mass marketing and thus market exploitation of the business opportunity identified in the Opportunity framing Phase.</td>
</tr>
</tbody>
</table>
**Only using Technology at hand:** The roadmap should have activities that creates, delivers, and captures value created via the technology at hand (Osterwalder & Pigneur, 2010). Business opportunity being exploited at the end should be based on the technology being developed in the first *Research Phase* of the start-up (Amit & Zott, 2001; Chesbrough & Rosenbloom, 2002) This implies that the designed roadmap will not consider any influence of a radically disruptive technological intervention. This particular assumption can be wavered for the future research in the study of Business model design roadmap for ICT start-ups.

Since this was one of the criteria for this thesis the CloudCities agenda of SBC was not mapped in details and also the roadmap was left open ended.

**Optimum balance between value proposition and economic returns:** The designed roadmap should be able to gradually develop a mechanism to deliver a value proposition to the customer and economic value to provider. This delivered value should be compensated with the economic value created for the start-up, balancing the cost and revenue of the company. Balancing the customer value and appropriate cost (Magretta, 2002) delivers best possible value to customer. This will result in equivalent economic value (tangible or intangible) to the start-up and lead to a reliable revenue source at the end.

The last phase is the actual launch of the most favorable BM defined after refinement. Having an apt BM delivering optimum value to customer and equivalent economic value to the start-up, might be the cause behind sustainable returns in the last phase. Many global CEOs,(in a study conducted by IBM), have acknowledged the importance of an efficient BM to achieve competitive advantage and maximum value from the product (Amit & Zott, 2010).

**Answers to Duckers questions (Drucker, 2011; Magretta, 2002):** While designing the roadmap following questions should be addressed and answered in order to eventually have a complete and optimum BM.

a. How to make money? (Magretta, 2002)
b. Who is the customer? (Magretta, 2002)
c. What does the customer value? (Magretta, 2002)

The money earning logic of SBC was defined and redefined as the sales of modular product with fixed cost. The final customer segments were same as the ones identified in the start ‘Business and Government’ with slightly modified value proposition.

**All elements from the framework addressed:** This artifact aims to identify individual elements of BMs that ultimately result into a complete BM. Since the Roadmap is aiming to use CANVAS and C-SOFT, it should develop all the nine blocks of CANVAS (Osterwalder & Pigneur, 2010) and/or five blocks of C-SOFT (Heikkilä et al., 2008) without any exception.

All elements of CANVAS and C-SOFT were addressed by the end of *Pre-Organisation Phase* and there after *Re-Orientation Phase* refined it for optimal BM design for stable revenue in *Sustainable returns Phase*.

**Continuity in the roadmap:** The temporal roadmaps have a linear tendency (Phaal & Muller, 2009) and so are most useful for tracking and planning the changes in a BM for growth, which has a current state and is aiming to reach a desired future state linearly (De Reuver et al., 2013). Since it is a roadmap it should exhibit continuity and correlation

The *Objective Layer* is designed with consecutive and continuing objectives.
between consecutive phases of growth.

| Starting point of this roadmap is null: The artifact is aimed at the start-ups that have to start building their BM from scratch. The resulting artifact might be less applicable for start-ups trying to reinvent a BM as compared to those with no defined BM in place yet. | The roadmap is designed from the very beginning of Research Phase, at which point of time the entrepreneurs have no commercial influence. |
| Application scope: The artifact is designed using BMs from service industry and a design case from ICT industry. Therefore the resulting artifact will be more applicable for ICT service based start-ups. The start-up growth model used in this thesis is aimed at university spin-offs and so the resulting artifact and recommendation will be more applicable to university spin-offs. | Even though most of BM element of Roadmap ver. 0.1 and 0.2 match, it cannot be assured to be generalisable without more number of case studies. |
| Generalisable: The problem statement of this thesis is not specific to a singular organization. The initiation of this thesis was a result of literature review and desk research. Thus there is no specific problem owner and so application should also be non-specific. The designed roadmap should be generalisable to other ICT start-ups in similar stages of growth. | Even though most of BM element of Roadmap ver. 0.1 and 0.2 match, it cannot be assured to be generalisable without more number of case studies. |
| Macro and micro level: Majority of entrepreneurs are new to business modeling languages. To guide the entrepreneurs about the development of BM, the roadmap should address BM changes at high-level (single objective) as well as at detailed-level (explicit activities). | Roadmap designed with three levels where Objective Layer is macro and Activity Layer is micro. |

### 7.4. Design Limitations

The Sustainable returns Phase is yet to be executed at SmarterBetterCities and so the analysis is based on the future strategies and vision of the company. In reality when SBC will actually step into this phase the scenario might change. But it also has to be kept in mind that this roadmapping is aimed to guide the planning and decision making for transitioning from one phase to another.

Second limitation of the roadmap developed in this thesis is, it is being developed using the start-up growth phase model which is derived from series of case studies explicitly University spin off. This might restrict the designed roadmap to limit its scope of vision to university spin off and imply less applicability to other capital ventures which do not originate in an academic framework.
8. Conclusion

This last chapter is dedicated to provide concluding remarks on the thesis conducted with an aim to design a roadmap of BM design at ICT start-ups. The main objective of the thesis will be referred back in this chapter to check if the thesis has reached the set goals. This chapter will also involve the final recommendations and reflection based on the execution and implication of this thesis.

8.1. Evaluating the research objectives

The research objective of the present thesis was drafted as follows.

“To design a business model design roadmap for university spinoffs in ICT industry using BM design frameworks, that will help to identify specific business model elements to be developed during various growth phases of a start-up, and will also help the GIS entrepreneurial management to roadmap activities for balanced growth of a start-up.”

By adopting a research design that facilitated the design of a prototype based on theoretical concepts as well as practical design case study, the objective of this thesis was fulfilled. The Literature survey provided with first draft of Roadmap ver. 0.1. This survey also provided selection of two BM design frameworks (CANVAS and C-SOFT) to design two different prototypes as follows.

![Figure 42: CANVAS BM design roadmap ver. 0.1](image-url)
The Design case study at SmarterBetterCities resulted in a second iteration of the BM design roadmap ver. 0.2. Which were then compared to find discrepancies and recommendation for further studies in the field of BM designing roadmaps got GIS service providing ICT startups. Also each of the versions had two roadmaps each based on the design frameworks used; CANVAS and C-SOFT. In case of the practical implementation it was observed that the BM design roadmap should be open ended to accommodate the future reformations in the company especially technical adaptation for ICT based companies. The importance of network positioning and early identification and association with well established partner was highlighted in the Roadmap ver. 0.2.

Figure 43: C-SOFT BM design roadmap ver. 0.1

Figure 44: CANVAS BM design roadmap ver. 0.2
The two frameworks were also compared so as to estimate the usability of each for BM design in GIS service providing ICT start-ups. It was observed that the CANVAS framework is useful for primitive BM designing till the pre-organisation phase, but later on C-SOFT is more appropriate for the GIS start-ups that have to keep pace with the evolving ICT. All these activities were performed in order to answer the research questions drafted at the start of the thesis. The coming section looks back on all the sub questions and enlists the actions taken in the present thesis to address each of them.

8.1.1. **Research Questions**

The research questions were drafted from the research objective to ensure stepwise execution of the study leading to the research objective.

Q1. What is the need for tracking BM design in a start-up?

The first hunch of the thesis elaborated on the industrial as well as academic positioning of the thesis. These positioning indicated the need for BM design roadmap for start-ups as follows.

**Industrial problem framing:** “GIS service provider Start-ups need a business model design roadmap to estimate the business elements that need to be developed during specific start-up growth phases, for deriving an appropriate business model. Also, this roadmap can be used for guiding the entrepreneurial management to plan and achieve desired future objectives of the start-up”.

**Academic problem framing:** “The dynamic nature of business model can be correlated with entrepreneurial literature on growth phases of a start-up, to derive an artefact that can guide the business model design from the very beginning of the company development specifically for the GIS service provider start-ups.”

Q2. How to design the tracking artefact (business model design roadmap)?

The **Requirements & Assumptions** derived from the literature and the industrial positioning provided the scope and a checklist for designing the desired roadmaps. The **Structural specifications** gave a framework on which both the versions (ver. 0.1 and ver. 0.2) of the roadmaps were built on in further chapters.
Q3. What is the theoretical background for selecting specific theories to design the roadmap of BM design?

For designing a BM design roadmap, a common understanding about the concepts was established. The concepts such as Business model, Business modelling frameworks, Start-up growth models, roadmapping and Business model roadmapping were studied. These concepts provided the structural specification for designing a roadmap that fulfilled most of the Requirements of the research problem and also considered all the Assumptions based on scope and limitations of the Business model design frameworks and start-up growth phase model used.

Q4. What implications can be drawn from theory to draft a theoretical prototype roadmap ver. 0.1?

Using the Literature derived Requirements, Assumptions and Structural specification, first version of the Roadmap was designed. This roadmap had a three layered structure that spans across the 5 phase start-up growth model. The 5 phase growth model used consists of ‘Research, Opportunity framing, Pre-Organisation, Re-Orientiation and Sustainable returns’. Two prototypes of Roadmaps were designed by correlating the BM elements of each CANVAS and C-SOFT BM design frameworks to the characteristics of each phase of the 5 phase start-up growth model.

Q5. How can be the theoretical prototype implemented in a practical scenario?

The Structural specification of three layered structure spanning over the 5 phase of the start-up growth model was used to build a BM design roadmap at SmarterBetterCities. The design case was relevant to this thesis due to the fact that the growth phases executed at the company resembled the 5 phase growth model and the company BM could be easily represented using C-SOFT as well as CANVAS. Association of various BM elements with the growth phases of SmarterBetterCities resulted into similar roadmaps that of the prototype design, with few discrepancies. Also the detailed actions could be observed to roadmap the transition of current phase (Re-Orientiation) of SBC to the future phase (Sustainable returns) gave an insight on the practical utility of the BM design roadmap.

Q6. What is the assessment after comparison of the roadmap (CANVAS and C-SOFT) ver. 0.1 and ver. 0.2?

The comparison between the theoretical prototype and the design case roadmap indicated few discrepancies but the overall roadmap remained constant. The major implication of this comparison was the addition of Future technical growth agenda and start of next BM design iteration in the objectives of the Sustainable returns Phase. The ‘Future technical growth agenda’ in the last phase implication can be contributed to the ICT industry scope of the design case. Also the roadmap was open ended in the practical scenarios which goes on to support the fact that BM is a dynamic entity and keeps on changing as the company grows. Also the CANVAS framework was found to be useful only till the pre-organisation phase and the C-SOFT framework was found more useful after that phase to accommodate the refinements and innovations needed in the BM as the company grows.
8.2. Reflection

Business model is not a static phenomena and so designing a BM is also a gradual process as developing the business (De Reuver et al., 2009; Kijl et al., 2005). Various elements of BM develop during various phase of start-up growth. Unlike a business plan BM cannot be drafted in one go, it evolves over a period of time in parallel with the growth of a company. The association of particular BM elements with specific start up growth phases and also the start of next iteration of BM design in the last phase of the roadmap designed goes on to support the fact that entrepreneurs should pay equal attention to the development of Business model along with the development of technology for achieving the Sustainable returns Phase.

Suggestion for Practitioners ➔ For entrepreneurs: Business model is dynamic, so it is not ideal to draft a BM model once and use it further without change. Adapt it according to the company growth

This thesis is specifically focused on ICT start-ups. The BM roadmap is an iterative process especially for ICT industry with rapidly advancing technology, and compulsory adoption for survival. As per the design case studied in this thesis the next iteration starts during second last phase of the first round making it chain iteration. CloudCities project is an indication that GIS service providing start-ups might reach the sustainable stage, but with a new incumbent product can also be a part of this phase. Unlike manufacturing industry, ICT industry changes rapidly and so any start-up aiming to reach the Sustainable returns Phase will have to keep a close eye on the technical advances in the industry and be ready to adopt quickly to survive for long term. The Last stage for GIS service providing start-up should not be only about stable financial returns but it should also include new technical adaptations for strong future. This at time might imply that the Re-Orientation Phase will mark the first Research Phase of modified if not new product line.

This thesis was aimed at designing a roadmap for the technology in hand at the time of completing the Research Phase. But in the field of ICT, adapting to new technology like Cloud computing can be considered as a very important aspect of growth. Keeping in mind the Moore's law, ICT start-ups, and so GIS service providing start-ups as well need to have enough flexibility and capability to evaluate and adapt to new and improved technologies at a higher frequency as compared to other industries. The resulting roadmap is to help managers of ICT start-ups for growth of their company from one phase to next progressive phase, with new or existing product/service/technology.

Suggestion for Practitioners (for ICT entrepreneurs) ➔ The technical architecture of the company has to be kept flexible to adopt the to the ever steep development curve of the IT industry.

It was also observed during the design case study that if the goals and objectives are well defined then it is easy to achieve them as compared to having generic growth objectives. It was easier for SBC to plan the activities and develop the capabilities in time to achieve the next phase of growth since they had a clear vision of what they aim to achieve, in form of a well defined product, selection of appropriate partners and exact track of the GIS technology development.

Suggestion for Practitioners ➔ For entrepreneurial management: Clearly define the future goals in most current premise of technology, network and market demand.
8.2.1. Design Case specific reflection

The GIS industry is commencing upon a wide range of business opportunities based on ESRI’s CityEngine and ArcGIS platforms (Ball, 2012; Kouyoumjian, 2010; SmarterBetterCities, 2014). SmarterBetterCities is one such pioneer in this ICT industry. As a result of the specific design case study, present thesis provides a preview of a BM that can be implemented by the upcoming GIS service providing start-up companies. The five phase growth model (Vohora et al., 2004) describes few critical junctures in the development of university high-tech spinout companies. In case of SmarterBetterCities most of these critical junctures were overcome with the support from strong network alliance that had been an intrinsic part of SBC from the start. The first critical juncture of Opportunity recognition (Vohora et al., 2004) was overcome with the help of Climate KIC’s Smart Urban Adapt project that presented with practical evidence of the window of opportunity as well as provided the seed funding for this opportunity. The second critical juncture of entrepreneurial commitment (Vohora et al., 2004) was overcome by the support provided by ETH university spin-off program for establishment as well as management of SBC. Being a part of this program the founders could manage the start-up company and also hold their academic position at the ETH University, without making them choose between two. The third critical juncture in the development of a high tech university spinout company is threshold of credibility (Vohora et al., 2004). SBC had a strong alliance with Esri Inc. Zurich R&D team and so was able to place its brand image very close to that of Esri Inc. This association was also highlighted by sharing booth space with ESRI in various tech conferences (Esri GIS User Conferences http://www.esri.com/events, National Planning Conference in Atlanta http://www.planning.org/conference, Esri Federal GIS Conference, GeoDesign Summit 2014, http://www.smarterbettercities.ch/geodesign-summit-2014, etc) and trade shows (ICSC RECon Las Vegas The Global Retail Real Estate Convention http://www.icsc.org/2014RECON/, Resilient Cities 2014 http://resilient-cities.iclei.org/bonn2014/resilient-cities-2014-home/, etc.). This strong network positioning of SBC in the GIS and urban planning field could be contributed to the smart decision making of the founders to associate with right partners at the right time. This strategy of SBC should be included as one of the best practices for the upcoming GIS industry.

Suggestion for Practitioners ➔ For GIS entrepreneurs: Target a strong network position and develop strategic alliances that can enhance the capabilities, resources and brand recognition of the company.

On similar lines the BM design roadmap ver. 0.2 developed in this thesis can be used for guidelines by any upcoming GIS based start-up company. Another best practice that can be identified at SBC is the vision to continue product or service enhancement. This vision has provided additional strength to their future associations with Climate KCI (innovation oriented organisation) and ESRI (a technology leader in the GIS industry). Due to confidentiality issues it is difficult to specifically mention the future product/service roadmap of SBC. This roadmap consists of 7 innovative product lines based on the GIS 3D modelling technology- out of which three are mentioned in appendix 4.

Suggestion for Practitioners ➔ For GIS entrepreneurs: Keep the technological capabilities flexible and up-to-date to respond to the steep growing curve of the GIS industry even after the business has been established and a sustainable revenue targets are achieved.
The reflections provide suggestions for the practitioners whereas the future recommendations provide suggestions for further academic endeavours in the field of BM design roadmapping.

### 8.2.2. Future recommendations

When the roadmaps designed are look at in a broader perspective, the process of product/service renovation/enhancement can be represented as follows.

In case of SBC, the company developed its first service design in research and opportunity framing phase as - custom made 3D modelling packages for client requested urban planning information. This service was launched in the pre-organisation phase. The pre-organisation phase and the re-orientation phase enabled the management to learn from experience and adapt the service to modular products such as 3D libraries (appendix 4). During the re-orientation these learning’s were used to modify the service provided by SBC and the last sustainable returns phase will include launch of this modified service. This appears to be a cyclic process, but further detailed study can confirm this. This study can be conducted by observing a similar ICT company (or SBC itself) for a considerably longer period of time that will give a chance to observe more than just 1.5 run of this cyclic process.

The second recommendation derived from this thesis is for a quantitative study of the elements discussed in the roadmaps developed. A quantitative data collection of amount of resource and time required for developing each of the BM elements can result in a graphical representation of the roadmap as shown in the figure 43 and 44. Please note that these graphs are not drawn to the exact quantitative measure of the elements being developed. These graphs are drawn just to indicate the development of specific element during specific growth phase.
The third recommendation is for future continuation of designing roadmap ver. 0.3 to n.n. These roadmaps should be designed using similar ICT start-ups so as to derive more generalisable roadmap that can be used by entrepreneurs in the future. The future study can also be done specific to the GIS service providing ICT industry, resulting in identification of key elements for survival and sustainable growth of start-ups in this industry.

The last obvious recommendation of this thesis is the caution to consider the developed roadmap as guiding tool and not an enabling tool. The BM design roadmap ver. 0.2 was designed in parallel with the company growth and so the actual final BM is not verifiable for this thesis. Further study can be done to evaluate if the roadmap developed was able to reach the desired final BM. It might also happen that the final BM that will be implemented at SBC in the sustainable returns phase in 2016 will have some differences than the one desired by the management right now. Also this roadmap of BM element development can be verified for its applicability at large corporations for addition of new product lines.
Delft University of Technology

Business model design roadmap using CANVAS and C-SOFT framework elements, synchronised with start-up growth phases

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Definition Appendix 1

1. 3D web scenes - CityEngine Web Scene is a custom, web-optimized format that can be viewed with CityEngine Web Viewer and shared on ArcGIS online for simple sharing.

2. Balance growth of start-ups - Overall growth with optimum development of each aspect of the company from product development to company development.

3. Bundling - A marketing strategy that joins products or services together in order to sell them as a single combined unit. Bundling allows the convenient purchase of several products and/or services from one company. The products and services are usually related, but they can also consist of dissimilar products which appeal to one group of customers.

4. Business model element - Business model contains a set of elements with interconnected relationships that allows to express the business logic of a specific firm (Slywotzky, 1996)

5. Cartography - Cartography is the study and practice of making maps.

6. CityEngine - Esri CityEngine is a three-dimensional (3D) modeling software application developed by Esri R&D Center Zurich (formerly Procedural Inc.) and is specialized in the generation of 3D urban environments.

7. Compiler - A compiler is a computer program (or set of programs) that transforms source code written in a programming language (the source language) into another computer language (the target language, often having a binary form known as object code).

8. Computer-aided design tools - Computer-aided design (CAD) is the use of computer systems to assist in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing.

9. Early Adopters - An early adopter or Lighthouse Customer is an early customer of a given company, product, or technology (Rogers, 2010).

10. Economy of scale and scope - Economies of scale for a firm primarily refers to reductions in the average cost (cost per unit) associated with increasing the scale of production for a single product type. An economy of scope refers to lowering the average cost for a firm in producing two or more products.

11. ETH University - ETH Zurich is one of the leading international universities for technology and the natural sciences. It is well known for its excellent education, ground-breaking fundamental research and for implementing its results directly into practice.

13. Execution platform - A framework on which applications may be run.

14. First-mover advantage - In business, economics, or marketing, first-mover advantage, or FMA, is the advantage gained by the initial ("first-moving") significant occupant of a market segment. It may be also referred to as Technological Leadership.

15. Geo-spatial - Of or pertaining to a geographic location, especially data. Describing the combination of spatial software and geographic data.

16. GIS - A geographic information system (GIS) is a computer system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

17. ICT - Information Communication Technology

18. Seamless base maps - A unique, updated base map with best currently-available global vector base map

19. Semantics - The branch of linguistics and logic concerned with meaning.

20. Service concept - The service concept defines the how and the what of service design, and helps mediate between customer needs and an organization’s strategic intent (Goldstein, Johnston, Duffy, & Rao, 2002)

21. Service design - The development of blueprints for the service output and process (Bouwman et al., 2008).

22. Service - A service is an act of performance that one party can offer too another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product (Kotler, 1984)

23. Shape rules - A shape rule defines how an existing (part of a) shape can be transformed. A shape rule consists of two parts separated by an arrow pointing from left to right. The part left of the arrow is termed the Left-Hand Side (LHS). It depicts a condition in terms of a shape and a marker. The part right of the arrow is termed the Right-Hand Side (RHS). It depicts how the LHS shape should be transformed and where the marker is positioned. The marker helps to locate and orient the new shape.


25. Topologies - Typology (in urban planning and architecture) is the taxonomic classification of (usually physical) characteristics commonly found in buildings and urban places, according to their association with different categories, such as intensity of development (from natural or rural to highly urban), degrees of formality, and school of thought (for example, modernist or traditional). Individual characteristics form patterns. Patterns relate elements hierarchically across physical scales (from small details to large systems).

26. ventureLAB™ - ventureLAB™ is where entrepreneurs get help bringing their innovations to market. ventureLAB™ apply a unique combination of mentoring, partnering, and
connecting to help pioneering entrepreneurs turn their great ideas into globally competitive businesses with successful start-up business training.
Appendix 2: Network element of SBC

Data collected via SBC documents, SBC business plan, participatory observations and meeting notes and online material available on the technology and relevant organisations.

**Climate KIC ("About Climate-KIC," 2010)**

Climate KIC is Europe's largest public-private innovation partnership focused on climate change, consisting of dynamic companies, the best academic institutions and public sector ("About Climate-KIC," 2010). Along with inspiring climate sensitive business ideas, Climate KIC also provides support (in form of mentoring, financing, networking, etc) to the entrepreneurs to commercialise these ideas. The activities at Climate KIC are driven by eight climate change themes and one of them is ‘Sustainable cities’ ("About Climate-KIC," 2010). Under this theme the involved parties faced the problem of unavailability of a common platform that integrates all city planning applications and services. This conceptualized the idea of the ‘Smart Urban Adapt’ project to develop a tool/platform to integrate available data and models with visualization facility and an interactive front end to provide a user-friendly software to city planners and public authorities ("Smart Urban Adapt," 2012).

Developing such a platform requires multidisciplinary interaction, including architects, urban planners, mobility & traffic managers, ICT experts, energy & water managers, health specialists, climate & environmental scientists, sociologists, economists and policy makers ("Smart Urban Adapt," 2012). The Climate-KIC project ‘Smart Urban Adapt’ was designed to integrate this know-how into one piece of software. Mr. Jan Halatsch (currently CTO at SBC) and his team (included current CEO and CIO of SBC) from ETH Zurich and Imperial College London, as well as experts from IBM and ESRI were involved to integrate all available data and software and build a user-friendly system. In his own research, Halatsch focused on this interface between user and software and developed interactive tools to merge visualization and simulation. This is the exact expertise of graphical applications of all sorts of geographical information, which he brought along at SmarterBetterCities as a co-founder.

**ETH Spin-off ("ETH Zurich: Spin-offs," 2010)**

Since the 1990s, ETH Zurich has been supporting the foundation of companies based on its research achievements("ETH Zurich: Spin-offs," 2010). Their objective is to turn such research results into marketable products and to create qualified jobs. This encouraging department boosted the commercialization of the research on virtual 3D GIS representation technology.

Being an ETH Zurich spin-off, SmarterBetterCities was supported with following activities during their incorporation and the initial years after incorporation:

- **Consulting and advice:** ETH provided advice about the first steps in founding SmarterBetterCities("ETH Zurich: Spin-offs," 2010).
- **Infrastructure:** During the first two years, SmarterBetterCities could hire premises or equipment from ETH Zurich for shared use where capacity is available("ETH Zurich:
Spin-offs," 2010). In addition to ETH’s own premises, support was also provided to the hire of office space in Zurich’s Technopark at discounted rates("ETH Zurich: Spin-offs," 2010).

- **Contacts:** Advices and support were also provided to set up contacts in the fields of financing, taxes, law, consulting services, etc("ETH Zurich: Spin-offs," 2010).

**ESRI (Esri, 2014)**

Esri is a Geographic information system company. Esri is an international supplier of Geographic Information System software, web GIS and geodatabase management applications. The company is headquartered in Redlands, California. Esri CityEngine is a three-dimensional (3D) modelling software application developed by Esri R&D Center Zurich (formerly Procedural Inc.) and is specialized in the generation of 3D urban environments. With the procedural modelling approach, CityEngine enables the efficient creation of detailed large-scale 3D city models with merely a few clicks of the mouse instead of the time-exhaustive and work-intensive method of object creation and manual placement. CityEngine was developed at ETH Zurich by the original author Pascal Mueller, co-founder and CEO of Procedural Inc. During his PhD research at ETH Computer Vision Lab. Procedural Inc. was acquired by Esri in the summer of 2011.

**Advisory Board**

Extract’s from Business plan (SmarterBetterCities, 2014)

**Peter Jager, CEO, Esri Switzerland**

Mr. Jager is an expert in business model creation in the software industry. He has been CEO of Esri Switzerland since 3 years and has a track record of being a successful entrepreneur by being the co-founder and CEO of several start-up companies in the field of GIS. Since 1995 he has worked for Esri and Esri partners. Mr. Jager is constantly reviewing and advising SBC business operation. Further he co-develops business models with SBC management team to make the transition from license based software retail to subscription services in the field of 3D Web GIS successful.

**Luc Van Gool, Professor, KU Leuven and ETH Zurich**

Luc Van Gool is a professor at the Katholieke Universiteit Leuven in Belgium and the ETH Zurich. He leads the computer vision research groups at both universities and is a co-founder of the company Eyetronics. He also held minor stakes in multiple start-ups. Professor Van Gool has been a program committee member of several major vision conferences and has been involved in many European, Swiss and Belgian projects. Professor Van Gool regularly advises SBC in future technology trends and supports the company with enthusiastic interns, master students and prospective team members.
Scientific Board

Extract’s from Business plan (SmarterBetterCities, 2014)

Pascal Muller, Director, Esri R&D Zurich

Dr. Muller is the Director of the Esri R&D Centre Zurich and former CEO of the preceding company Procedural Inc. He pioneered novel methods for the procedural modelling of buildings, which are now the core of Esri’s ArcGIS 3D platform. Dr. Muller advises SBC in novel 3D city modelling trends and shares interests for urban planning, architecture and generative design.

Gert Van Maren, Esri PM Lead for 3D

Mr. Van Maren is currently the Esri Product Management Lead for 3D at Esri R&D Zurich. He is one of the leading 3D GIS capacities and has a special emphasis on 3D GIS and virtual reality software development, 3D GIS analysis and 3D product management. Mr. Van Maren supports SBC with novel insights in ArcGIS 3D platform technology for SBC' CloudCities service and by connecting SBC to regional Esri offices, international Esri distributors, and Esri business partners.
Appendix 3: Organisational structure of SBC

The founders of SBC are experts in the field of computer graphics, urban planning, geospatial information systems, software engineering and computer vision (Antje, Jan, Michael, & Jeremy, 2014). This section is an extract from the business plan of SBC, and the LinkedIn profile of the employees. The organizational team structure can be represented as follows.

Antje Kunze, President and Chief Executive Officer: since 2012

She has co-authored many technical publications in the field of GIS 3D modelling technology. Her domain expertise and end-user oriented approach was the inspiration for commercializing the ‘3D modelling for urban planning’ technology in form of SmarterBetterCities. Special contribution: Applying and acquiring funding and grants and developing the technology with end user perspective.

Jan Halatsch, Chief Technology Officer: since 2012

On account of his expertise in the field for a decade, he has developed an extensive network in the GIS, AEC and 3D modelling industries. Along with being the CTO at SmarterBetterCities, Mr. Halatsch also concentrates in his PhD research on 3D city modelling with a focus on legal applications, keeping the company on the leading edge of latest research in the field. Special contribution to the start-up: Applying and acquiring funding and grants and developing the technology with end user perspective. A Strong network connection due to his involvement with Procedural Inc. (now Esri R&D Switzerland) as a former employee and Climate KIC.
Michael Van den Bergh: Chief Innovation Officer: since 2013

His field of expertise in the field of web technology and human-computer interaction technology inspired his association with SmarterBetterCities in 2013. He joined in as a co-founder and brought along his extensive knowledge in novel web technologies. Special contribution to the start-up: Applying and acquiring funding and enhancing the web based technology applications.

Jeremy Pflaum: Director of Marketing and Sales: since 2014

His proximity and vast experience in the US real estate market inspired his association with SmarterBetterCities. Also his experience and familiarity with the US market makes him the best candidate for leading the upcoming US subsidiary of SmarterBetterCities in Santa Monica. Special contribution to the start-up: Business growth, Marketing strategies, market expansion and exploration in US.

Sandro Martis, Software Engineer: since 2014

Mr. Martis completed his Master Thesis at SBC and has been developing an Interactive User Interface for mobile tablets. He is responsible for the CloudCities front-end implementation and the web-based 3D modelling services. He holds a Master’s degree in Electrical Engineering from ETH Zurich and is highly interested in information technology topics such as computer vision and interactive mobile applications. He also has experience in energy related fields involving photovoltaic and smart building technologies.

Grete Soosalu, 3D Product Engineer: since 2012

Mrs. Soosalu has been on board with SBC as 3D product engineer from the very beginning. She is responsible for 3D modelling and visualization. Mrs. Soosalu holds a Master degree in architecture and city planning, and a Master of Advanced Studies degree in Computer Aided Architectural Design. Grete has studied planning and building processes in Switzerland and Estonia and is passionate in searching ways to explicate that in visual forms.

Somil Miglani, Energy Solution Intern: since 2013

Mr. Miglani joined the SBC an energy solution intern. His work focuses on enhancement of the CloudCities interface and development of cloud-based tools to visualize the energy related aspects of buildings. He holds a Bachelor degree in Mechanical Engineering from India and is currently pursuing a Master’s degree in Energy Science and Technology at ETH Zurich. He is an enthusiastic capacity in GIS-based planning processes.

Future Employees

With future funding SBC will hire two software engineers at the office in Zurich. In addition, SBC will also hire a US Director of Marketing and Sales and an assistant that will be based at the new US subsidiary office located in Santa Monica, CA.
Appendix 4: GIS technology

Geographic Information Systems (GIS) involve capturing, storing, manipulating, analyzing, managing and visualizing all types of geographical data. This technology has been in use for more than 2 decades now (Dangermond, 2012). The process of geo-design has been simplified with use of GIS technology to expand the traditional methods of manual geo-designing to a level that includes everything. Traditionally the urban infrastructure planning was done based on the data collected periodically and depending on that the simulations of this data, urban planning was done. With the advancement of real-time data capturing and sophisticated geo-design software platforms like procedural modelling tool: CityEngine, it has become easy to do urban planning simulations on real-time infrastructure models. Watson B. and others (Watson et al., 2008) further defend the importance of these tools by stating the fact that cities are huge, richly detailed and modelling them with non procedural tools can take hundreds man years. The recent developments in this field include the virtual 3D representation of the infrastructure in real-time.

CityEngine (ESRI Inc. product) is one of the most advanced and mature procedural modelling tools available today. The CityEngine provides the Virtual platform of the city and the planers/users can build various infrastructural elements on it. These elements can have variety of shape, structure, texture, and forms. For urban planning it is important that these kind of applications can give an simulated effect of those structure on surroundings by simulating wind directions, shadows and sun light patterns, pollutions patterns and also weathering and wearing on the infrastructure itself (Watson et al., 2008). Recent GIS application developers are simplifying this work. Applications are being developed, that can construct the required infrastructure with all the structural rules (architectural grammar rules: term used in the procedural modelling) and the users work is being simplified. The users just have to insert the libraries (set of code to insert the required structure in the city model on CityEngine like platforms). Also this library structures can be adjusted using user-friendly interface, which can be understood by any person unaware of any grammar rules (Jan, Antje, & Gerhard, 2008). In order to understand the technology at SBC we need to understand all the involved components of this technology.

CityEngine: CityEngine evolved into a framework, which enables users to reconstruct architectural designs and archaeological scenarios with shape grammar rules as given inputs. The CGA (computer graphic architecture) shape grammar (architectural rules) had been implemented in C++ and integrated in the CityEngine framework. It can process urban environments of any size i.e. ranging from a single plot up to a whole city. The input data is represented in a GIS format and consists of different regions like streets, parcels, building footprints, patios etc and is supported by importing bitmap data or geographic vector data like Google Earth’s KML format, which can be used for building mass models (Jan et al., 2008). A region (usually a polygon) is fed as initial shape into the grammar engine, which derives it into an elaborate design by applying the selected rules. The resulting model can then be previewed in the OpenGL viewer of the CityEngine or photo-realistically visualized in a 3D application like Autodesk’s Maya (Jan et al., 2008).
Grammar rules: The notation of the grammar and general rules to add, scale, translates, and rotate shapes are extended for the modelling of architecture (Jan et al., 2008). The CGA Shape framework consists of the shape definition, the production process, the rule notation with shape operations, and an element repository (Jan et al., 2008).

Element repository: The library of 3D models consists mainly of basic primitives, elementary architectural objects (e.g. iconic capital building structures) and plant models (Jan et al., 2008).

Procedural modelling is finally going mainstream (Watson et al., 2008). Till now it was a boutique solution, used only when no other options existed. Now procedural modelling is often the cost-effective solution, used because the alternatives are too expensive (Watson et al., 2008). In film, games, and other applications, consumers expect richer, higher quality digital content (Watson et al., 2008). Because budgets won’t allow content producers to increase cost significantly, they have only one choice: they must improve their tools. Procedural modelling is the primary ingredient in these tools. One of the main drivers of these trends is urban content. Cities are huge, richly detailed artefacts often required in digital productions. Modelling them with existing, nonprocedural tools can take hundreds of man-years. Several researchers are creating procedural techniques specifically for automating city modelling (Watson et al., 2008).

Manual tasks are difficult to handle in large-scale landscape and urban planning projects especially when it includes large scale of interdisciplinary expert knowledge. It takes lot of man-hours, to ensure the dependability and fineness of the plans with detailed 3D landscape and cityscape models. But if this task is simplified using computer analytics and graphics, it could dramatically raise design quality through (1) the added predictability of the aimed urban design, (2) the possibility to simulate certain key measures for the city’s planning, like enhanced airflow through skillfully placed city layouts along with flow optimized building facades, and (3) the opportunity to re-design large drafted urban models within seconds (Jan et al., 2008). In addition to the normal functionalities, more sustainable designs can be achieved if associated attributes like CO2 emission per zone and energy consumption per structure are included in such models. SBC solutions offer the possibilities to keep things simple for the non-experts and to keep things open for users that want to get deep into the urban designing.

SmarterBetterCities is a State-of-the-art 3D web technology Software Company with clear commitment to sustainable urban planning (Antje et al., 2014). They had an innovative idea about commercializing the technology of providing 3D representation of 2D GIS data for ease of urban planning decision-making. The product thus designed can be simplified as follows.
GeoDesign: Geodesign provides a design framework and supporting technology for professionals to leverage geographic information, resulting in designs that more closely follow natural systems.

GIS: A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information("SmarterBetterCities technology presentation ", 2013). GIS facilitates to, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts("SmarterBetterCities technology presentation ", 2013). GIS technology can be integrated into any enterprise information system framework.

City modelling: Designing and coding the city infrastructure is city modeling. This includes coding and designing the buildings, roads, parks, railway lines, tramlines, pavements, streets, avenues, vegetation water bodies etc.

3D web: A viewer to view the finished 3D design. It is the front-end representation of all the information in user understandable format.
Appendix 5: SBC Products

The company had targeted business-to-business solutions from start and had the vision of making the process of urban planning decision making easier as they progress in the market. SBC planned to develop business-to-business solutions for decision makers, urban planners, municipalities, local governments, consultants, architect offices, real estate agencies, construction companies and more. Their product ideas were softwares designed to assist in urban planning decision making, to make urban evaluation more affordable and accessible to non-experts, but also to get people to participate with urban design, and to advertise products in a dynamic and interactive way. SBC currently has developed a small range of prototype software application that can suffice different functionalities and have different value propositions for different customer segments. The current range of products is discussed below. This information has been extracted from the business plan (SmarterBetterCities, 2014) and observation notes.

SmarterBetterCities is focused on two targets: easy conversion from 2D to 3D, and easy sharing of the resulting 3D models with corresponding analytics. The first target is approached with 3D Cities Libraries. SmarterBetterCities is the first company to commercialize CityEngine rule packages as libraries and sell them online. The rule package workflow also makes it easy to generate semantics and analytics automatically with the model generation. The resulting smart 3D models can be published using the CloudCities product, a cloud-based platform for sharing 3D city models, together with analytics and maps. Smart 3D models can be embedded anywhere on the internet and viewed on mobile devices and tablets. Sharing is as easy as posting a link to YouTube or Vimeo.

**3D Libraries**: It consists of ready to use visual 3D models of typical urban elements (parks, bridges, subway lines, etc.) and a vast collection of contemporary building typologies. Clients can adjust building types and parks without coding the visual 3D model from scratch.

3D Cities Libraries contain a collection of smart building grammars for Esri CityEngine and ArcGIS Pro. These grammars enable fast conversion from 2D plans to smart, semantic 3D models. The resulting workflow can be up to ten times faster than traditional CAD workflows. Unlike CAD, the models generated from SBC libraries contain semantics, which opens the door to a host of analytics that can be generated on the fly. SmarterBetterCities is the first company to provide such libraries on a commercial basis. The libraries contain various building typologies and typical urban elements.

Creating city-scale 3D models for visualization and analytics is a very expensive and time consuming for individuals in real estate, retail, media, urban planning and AEC industries. Esri CityEngine and Esri ArcGIS are the leading desktop platforms for automated 3D cities content creation. These platforms are difficult to learn and expensive due to manual programming of 3D city models. The 3D Cities Libraries accelerates the 3D cities creation process and the 3D analytics process for Esri CityEngine and Esri ArcGIS users by 10 times compared to traditional CAD applications. Users can simply connect their 2D map data with the 3D Cities Libraries and ArcGIS Desktop Apps inside Esri CityEngine and Esri ArcGIS and instantly generate stunning 3D city model with precise reporting with the push of a button.
Benefits

- Easy 2D to 3D. Convert any 2D city maps into 3D cities and 3D GIS visualizations without programming inside the desktop versions of Esri ArcGIS, Esri CityEngine. Use our 3D Cities Libraries with ArcGIS GP tools or with Esri CityEngine to convert any 2D map data (points, lines, shapes) into feature rich 3D models (landscapes, streets, building types, vegetation etc.) without programming. Implement ready-to-use smart 3D city models and create template-based reports for whole cities, or individual structures (e.g. energy, land coverage etc.). Save money on 3D creation process and pay minimal project fees for use of the tools.

- Content for Esri 3D Professionals – faster, smarter and better. Esri 3D technology enables professionals to effectively create 3D cities contents. SmarterBetterCities’ 3D Cities libraries design, modelling and evaluation process is quick and efficient.

- Create rich 3D Scenes. Esri’s 3D tools are amazing. However, 3D content is limited to user capabilities. Time, programming experience and design aesthetics are required for creating amazing 3D content. Our intuitive 3D Cities Libraries enables users with less experience to create intelligent, attractive and feature rich 3D city content inside ArcGIS Desktop and Esri CityEngine.

- 3D Model Retrofit. Users can take their existing 3D city models and increase the geometric quality e.g. by adding easily new façade details or building details.

- Draw Scenarios with Smart 3D. 3D City Libraries include smart functionalities. Plans can be created that follow exact constrains (max. floor area or setbacks) or react on GIS data attributes and features (Automatically create residential buildings where land use is ‘residential’) without leaving ArcGIS Desktop and CityEngine.

- New content. 3D Cities Libraries content is updated regularly each month.

- Design any urban 3D content. Users can design at any scale because landscape, city size, buildings and interiors are all supported. 3D Cities Libraries features high quality 3D content for landscape design, buildings and special land uses, infrastructure, street profile designs, urban furniture, garden works, and general 3D content including people, vehicles and vegetation.

- Library Collections. The 3D Cities Libraries comes as individual collections of architectural styles and design schemes. They feature vernacular buildings and special land use types specific to a collection region. Selected signature series highlight special designs and construction technologies.

- Support for Green districts and buildings. The 3D Cities Libraries includes smart district information such as achieved ‘Leeds district certification level’ and much more on green district and building standards.

- Visualization Styles. The libraries feature level-of-detail management and come with a large preset of color palettes, realistic materials and local color toning. The 3D Cities Libraries can be used for 3D cartography creation and realistic or special information visualizations.

- Urban Performance Visualization. The 3D Cities Libraries comes with various contextual 3D Urban Performance visualization capabilities. Solar impact, microclimate impact, flood capacity, energy and water demands can be visually integrated within the 3D urban model and be used for rich analysis presentation and scenario comparison.

- Rich Reports. Users can analyze the performances of their created designs. Are they inside the fiscal impact boundaries? How many jobs will be created? How much energy can be generated for heating or electricity on site? The reports of the 3D Cities Libraries offer very detailed reporting on various market dimensions.
Includes free CloudCities voucher. Each 3D Cities Library comes with a free CloudCities voucher for a limited trial use of CloudCities.

*ArcGIS APPs*: Smart 3D Analytics are apps that take advantage of the semantic nature of the 3D Cities Libraries, and provide a host of analytics that are automatically generated together with the city models. Some examples that are already implemented by SBC are SmartInvest, EnergyCount and SmartZoning. The results can be visualized inside CloudCities, either as visual overlays in the form of 3D layers, or as numbers and charts on a dashboard. These analytics apps are a collection of visualization and analysis tools for governmental planners, utility managers and real estate professionals. For example, zoning allowance can be visualized in exact geometric envelopes (SmartZoning). Users can detect and show existing investment opportunities or overuse of resources coupled with fiscal and energy impacts.

*EnergyCount*: This APP provides planners with assessment of per building energy use on city-scale.

*SmartZoning*: This is a novel APP for zone plans. Legal regulations can be easily visualized and assessed in 3D. It is completely driven by zoning constraints. It shows only building footprints, floor areas and roof shape that are allowed to be built.

*SmartInvest*: With SmartInvest clients can easily visualize in 3D, the various investment opportunities within cities.

Benefits

- Evaluate Zoning Laws in 3D. Zoning is complex and requires strong competence of linking textual with abstract mapping information. Smart3D allows users to simplify the numeric and regulatory complexities by focusing on the urban 3D canopy to help drive their decision making.
- Translate zoning maps into development potentials. Using Smart3D users can load 2D GIS information such as zoning maps, parcel plans into Esri ArcDesktop or Esri CityEngine and populate the parcel plans with the maximum amount of buildings allowed by law. Comparisons with the existing state of the land development can be evaluated and pre-design visions can be assessed in minutes.
- Evaluate Urban Resources. Urban forms affect available urban resources. Smart3D indicates green area ratios, zoning constrained solar potential, energy standards, flooding potentials and reports fiscal effects.
- Investment Strategy Assessment. Users can use Smart3D to detect expansion potentials in existing buildings. Users receive interactive 3D models and numeric Excel reports on obtained area per use and fiscal return of investment. Therefore users can leverage existing 3D city models or 2D to 3D converted models using our 3D Cities Libraries.
- Urban Retrofit Cost Assessment. Smart3D has the capacity to evaluate the performance and the costs of the existing built environment. Infrastructure and building (e.g. façade or roof insulation standards) renewal costs can be calculated in high detail using presets and...
cost factors (purchase, renewal intervals, resources saved, etc.). Different retrofit scenarios can be quickly created and evaluated.

- Each Smart3D for ArcGIS comes with a free CloudCities voucher. CloudCities lets users share and visualize their smart 3D city models online. Various internal and external data sources can be integrated into the visualizations. These can either be visual overlays in the form of 3D layers, or graphically visualized in a dashboard. The software architecture allows embedding in third party products and can be seen as an advanced YouTube for smart 3D city models.

**CloudCities:** CloudCities is a cloud-based platform for hosting, sharing and visualizing smart 3D city models. CloudCities lets users share and visualize their smart 3D cities online. Various internal and external data sources can be integrated into the visualizations. These can either be visual overlays in the form of 3D layers, or graphically visualized in a dashboard. The software architecture allows embedding in third party products and can be seen as an advanced YouTube for smart 3D city models.

With the recent surge in Big Data and Smart City Information Communication Technology (ICT) solutions planning and managing urban assets such as individual buildings or even cities is expensive and is increasingly difficult to handle. Intuitive ICT access to and of these urban assets is needed for a multitude of market segments. The existing software requires training, has high upfront costs and is disintegrated and not web-based. The CloudCities product line allows low-cost planning and management of urban assets from city to individual buildings. By just using a web browser users can create, explore, analyze and share urban assets in an effective, integrated, intuitive and enjoyable 3D web environment. No deployment costs or training is necessary.

**Benefits**

- Convert existing 2D Data into stunning 3D Cities, 3D Landscape, 3D Buildings and 3D Interiors. Existing 2D maps, GIS data, CAD data and line art can be added to CloudCities cloud services and converted into amazing and highly detailed 3D models with no additional software needed. All major data input formats are supported. Input data can be uploaded, linked to existing cloud storage (Dropbox, Google Drive, Amazon S3) or directly synched with Esri’s cloud mapping service ArcGIS Online. Adding 3D to the design process has never been easier.
- Use your 2D Data for context. Users often like to show more information on the context next to the 3D. CloudCities conveniently displays 2D data featuring maps, technical drawings, and images next to the 3D viewer. Users can simply use rich content from ArcGIS Online or even connect their ArcGIS Online contents to CloudCities.
- Embed Real-time Data into 3D. Real-time data from sensors, smart phones or other networked devices can be directly integrated and values visualized in 3D (e.g. utilities capacity, air quality, occupancy tracing).
- Professional Graphics Design. Help promote your products or plans with stunning functional design. Streamlined and fully customizable frontend design, now more intuitive than ever.
- Publish and Share 3D content on the web. CloudCities comes as a 3D sharing service. Insert CloudCities 3D contents on any web page as easy as embedding YouTube videos. No additional software installation is required. Additionally, users can integrate their existing ArcGIS 3D web scenes that they already have on Esri’s ArcGIS Online into CloudCities. CloudCities Viewer is a secure platform freeing you from the hassle of installing third-party plug-ins. CloudCities also runs
  - on local installations.
- Understand in 3D and on the web. Our world is in 3D. People want to solve real world 3D problems in 3D and not on abstract 2D lists and maps. With CloudCities users can check their world in 3D without training and without installing software. Users can create beautiful information visualizations for explaining the facts behind the 3D. Intuitive dashboard visualizations complement the user experience.
- Support for B2B and Gamification. CloudCities can be fully customized and adapted to specific corporate identities. Our CloudCities technology is available for any application that requires a 3D viewing context or quick 3D content creation. Imagine locating faulting devices inside a facility with the support of 3D or being a game publisher with complete control of your game contents (levels or assets) and model performance via the web.
- CloudCities runs within any web page on any device. Accessing your city models can be as easy as sharing a URL and opening it in Firefox, Chrome or Safari. CloudCities builds on HTML 5 and WebGL standards and its 3D contents run on Windows, Mac, Linux, Android, iOS and Blackberry. No plug-ins are required and it is also compatible on iPhone, iPad and Android. Because of this over 64% of all web users worldwide can already use CloudCities. This percentage is growing daily.
- Plan, manage, and show any part of your city infrastructure(s) or single buildings.
- Pay-as-you-go per project on monthly subscription and usage flat rates.
- Create, use and change intuitive 3D models without installation and training.
- Save money on 3D creation process, linking and integrating existing content.
- Share models, analytics, live data or any other contextual information.
- Intuitive access to complex information using novel 3D web technology.
Appendix 6: SmarterBetterCities Business model

There were two business model extracted from the interviews and SBC company specific documents. The first business model is the one used for the initial few project sales, in other words the business model screenshot of SBC at the moment (re-orientation phase). The second business model is the one that is expected to be set in motion as the company achieves its current vision, in other terms reaches the sustainable returns phase.

The current snapshot of the business model was derived from company documents and unstructured interviews with the CEO of the company to fill in the information gaps of the data extracted from the documents.

CANVAS

Customer segments:

SBC was developing products for the segments, Business (including Architecture, Engineering and Construction (“AEC”), Media and Press, Real Estate and Retail) and Government (Economic Development, Facilities, Federal, State, Local, Urban and Regional Planning). But the firm had to make a conscious decision to target particular customer segments that could be addressed initial available resources and capabilities (the architectural specialization capabilities and knowledge pool of the team, limited exposure to market and new brand image). So the SBC management decided to address the customer segment that consisted of following types of customers.

1. 3D city model providers for local markets.
2. Construction companies.
3. Municipalities GIS (geographical information system) centres.

The consisted of only one customer segment which was addressed with the same service for all three types of clients.

Future:

Larger organizations: with volume licenses, usage flat rates, on premise installation and OEM solutions. These types of customers are especially interested in customized 3D City solutions and corporate branded business intelligence of SBC products: CloudCities, Smart3D for ArcGIS and 3D Cities Libraries. Significant shares of these types of customers are interested in including our products as a component to their own specific software solutions. These customers can be attractive to create large transaction revenues through few sales but bear the risk of market instabilities and increased efforts for customer relationship. Typically, SmarterBetterCities only offers volume licensing to large-scale partners or customers where SmarterBetterCities’ software needs to be accounted as purchased equipment (e.g., institutions with government background).

Smaller organizations and businesses: with project licenses, pay-as-you-go, cloud-based services. Subscription-based created revenues are preferred by SmarterBetterCities. In this
scheme customers can book subscription costs for SmarterBetterCities' products as operational costs. Payment and usage processes are well defined for customers and do result in low customer-care costs for SmarterBetterCities. We always try to develop very intuitive and process oriented products that do not need training, maintenance or deployment on customers’ side.

**Value Propositions:**

The core value proposition of SBC has remained constant from the start (i.e. Opportunity framing phase): ‘visual 3D modelling for unified urban planning’. Their vision is to help people create smarter and better places by developing innovative and affordable web-solutions. The value proposition is collective representation of the benefits of all the services provided by SBC. Till date (May 2014), SBC was addressing individual clients on ad-hock basis. But the basic value proposition remained the same with addition of customised solutions as per the client’s needs. Also customization to cater specific customer needs, cost reduction, convenience and usability can be enlisted as the secondary type of values offered (Osterwalder, A., & Pigneur, Y., 2010).

**Future:**

SBC is looking forward to designing modular products unlike custom made solutions for each client. The modular product wills all a generaliasibility to the SBC product range and increase the market reach. This transition will result in a slightly modified value proposition; ‘visual 3D modelling for pre-defined set of urban planning information’. The individual products have following benefits that will act as supplements to the main value proposition of SBC

- The products are intuitive to use, zero deployment cost, usage-based costs, and instant return on investments.
- The Cloud-Cities enable users to share their smart 3D cities online featuring various data feeds including real-time data.
- The software architecture can be easily extended and, or integrated with, within third party products and adapted to new verticals.
- The products are built on industry leading geo-spatial platforms provided by ESRI Inc.
- A novel 3D technology and the unique product line up allow the customers to break down industry and disciplinary boundaries. By providing the customer, a capability to simulated design models without having any knowhow about the backend coding in 3D modelling.
- All products at SBC are developed to provide the customers with;
  - to reduce processing costs.
  - to bundle information resources.
  - to develop attractive and efficient solutions.
  - to transport and to share their ideas to their end customers.

**Distribution Channels:**
SBC started with a strong network position which provided them with an opportunity to showcases itself in many tech shows and other conferences. Most of the initial clients were acquired via this alliance network. The product delivery for customers was on demand and customer specific. Each client was provided with consultation to draft the specification of the building topologies and functionalities provided in the package delivered to them. The billing was also direct without any mediator.

**Future:**

Currently SBC building up the online sales channel to reach their customers. Product delivery is on demand and instant, through and customer specific. SmarterBetterCities is setting up a web shop currently to feature more products that are in the last phase of prototyping. Once the potential customers arrives at SBC's website they can try the online demo applications and then sign up for their own online project or purchase a desktop version of 3D Cities Library or ArcGIS Desktop Apps.

SBC has a great partner relationship with Esri Inc. for product development and marketing. SBC is building its products on rock solid and future proof Esri technology. SBC is currently building its own base of customers that will benefit from the direct access to the following distribution channels:

- Esri distributor network: SBC is in close exchange with key local and global Esri distributors around the world. Esri distributors understand the local market demands and support SBC to create sales for all products of SmarterBetterCities. Within the distributor network SBC especially focus on typical GIS users in: Urban Planning, Real Estate, Government, Defence and Mapping.
- Esri US: SBC is working closely with Esri Inc. to address customer needs for 3D Cities in the US.
- Esri EMEA: SBC is working with the major Esri distributors (Germany, Netherlands, U.K., and France) and applying a similar strategy to the Esri US.
- US Real Estate Market: Jeremy Pflaum, sales director of SBC, has 16+ years of experience in the US Real Estate Market and a vivid customer base and network that SBC can directly build on.
- US Retail Real Estate Market: This customer base is shared with Esri, which has a strong interest in creating indoor navigation solutions.
- Media & Press: Customer attraction and promotion is mainly performed through SEO, Twitter and LinkedIn.

All the channels discussed above are still in the awareness and evaluation stage. These channels are still to explore the full potential of the purchase, delivery and after sales stage (Osterwalder & Pigneur, 2010).

**Customer Relationships:**

SBC had an approach of addressing individual customer face-face. So the customer could contact SBC management any time via e-mail, phone call or face-to face meetings. Also all the issues regarding delivery, installation and maintenance of the service were handled at a personal level for each client at SBC. All the current products are of this type and so customer relationship is a crucial part of delivering the intended value of the product. Currently the customer relationships can be categorized as 'dedicated personal assistance' type (Osterwalder A.,...
The ‘SBC blog’ served as a good community for customers, technology champions and other related stakeholders to voice and share their opinions.

**Future:**

Going forward these type of personal customer relationships will be provided for few products only and other intuitive products like 3D libraries could be delivered with just customer support on demand. SCB is moving towards developing 'Automated service' type of customer relations (Osterwalder A. & Pigneur Y., 2010). The customers will be catered via the web-shop. Which will enable the customer to download the software packages and the installation and maintenance manual videos will provide on the SBC web-site. The e-mail and on call support channels will still be active.

**Revenue Streams:**

Till date SBC has been very effective with direct sales large volume custom made projects. Clients were charged for projects delivered, consultancy provided for requirement gathering, implementation, and maintenance of these projects. The project delivered cost included the cost of number of man-hours invested to develop the intended product package, the divided cost of all the resources utilized during the development and organizational activities involved in the production. The pricing was of dynamic nature for the initial few projects

**Future:**

As the company is aiming to make more generalisable products the pricing per product will be fixed depending on the volume of building topologies and functionalities provided in the package. The prices of same volume packages are going to reduce as there will be less need of personal assistance for each customer. Also since the 3D libraries packages or ArcGIS apps will be pre defined, the cost of production per customer will reduce considerably. This will result in higher price to cost ratio. The introduction of web-shop will introduce third party service providers like VISA, MasterCard, PayPal, etc. in the revenue channel.

For the ArcGIS apps, prices are fixed but 3D libraries and CloudCities products the prices are volume dependent as per the geographical area for which the product is developed and the functionalities bundled in the delivered software.

**Key Resources**

Resources at SBC include the hardware and programming software available for developing the software packages. SmarterBetterCities started with the intellectual/human resources of a leading edge team of experts in the field of computer graphics, urban planning, geo-spatial information systems, software engineering, and computer vision, finance, marketing and business development. Most of the members present a long track record of successful projects and publications in their respective fields. Technical resources of the company include the technologies and software provided by the partners like IBM, Microsoft and Esri Inc. (international supplier of Geographic Information System (GIS) software), ETH university
Zurich (engineering and science university) and Climate KIC. The financial resources of the company include the funding from Climate KIC (Europe's largest public-private innovation partnership focused on mitigating and adapting to climate change.), Autodesk (Software Company for 3D design, engineering and entertainment software services) and Zurich Kantonal Bank (Financial service company).

**Future:**

SBC has recently acquired the second round of funding, for the launch of promising products like CloudCities and 3D Libraries. The initiation of CloudCities required expertise in the web technology interface that was already available at SBC in for of Mr. Bergh's and Mr. Martis's strong academic background in the same field. Also SBC will be able to leverage the cloud servers used by Esri Inc. More on the Cloud Cities in Appendix 7.

**Key Activities**

The key activities at SmarterBetterCities currently involve the software development, client management, market expansion and retention. Also attending various conferences and tech shows all around Europe and USA, for expanding the exposure of SBC to potential customers is a key activity at SBC in this growth period of the start-up.

**Future:**

SBC aim to create and maintain each customer profiles once CloudCities is launched in the market. Also the web-shop being developed will require maintenance, up-gradation and customer support. Setting up the US office and the relevant network and distribution channel dedicated for the US branch will also be a task at hand. Hiring new employees and maintenance of the current employees is a part of SBC future agendas. Defining the 3D libraries and ArcGIS apps contents and coding the same is currently in progress at SBC.

**Key Partnerships**

In addition to the competitive advantages of a new technology SBC also gains from the strategic alliance with the world’s leading geo-spatial software company Esri Inc., renowned 3D designing company Autodesk, Climate KIC start-ups in the field of enabling smart cities and ETH university with state of the art urban planning technology researchers. These partnerships increase SBC's range to a large global network of distributors, resellers, third-party developers, customers, educational institutions, which is another key competitive advantage. This network of relationships will enable SBC to build a broad and deep reach into volume markets around the world first in B2B then in B2C. The company also has partnerships with software resource providers like IBM, Microsoft and Esri Inc. The partnerships at SBC can be distinguished in following types (Osterwalder, A., & Pigneur, Y., 2010) The following alliance landscape is an extract from the business plan of SBC(SmarterBetterCities, 2014).
Future:

SBC does not have any major alliance related changes planned in the recent future. The only addition to the partner's list will be that of the capital venturing bank providing the second round of funding for SBC, and the partnerships (retailers, office space building contracts, etc.) needed to set up the office in Santa Monica.

Cost Structure

The costs incurred by the SBC are mostly resource related. The costs include licensing fees for the software used to develop the product, employee salaries, marketing expenses (including the conferences and tech shows). Also with the growth of company new hardware are needed and office space will also increase adding to the cost in future from time to time. Till 2013 SCB had funding seed from Climate KIC. By end of 2014 SBC aims to have acquired funding capital from a capital ventures bank. In order to maintain the confidentiality of explicit financial details of SBC, the cost structure cannot be discussed in depth here.

Implication

Even though there was no formal business model at SmarterBetterCities till recent times. But the basic framework of business was build using CANVAS model from the very start. CANVAS being a good brainstorming too, helped the entrepreneurs of SBC to commercialize their research studies into a business. Since the foundation of business was build on CANVAS most of the elements described above were well defined in process rather than on paper at SBC. CANVAS is an ideal brainstorming tool for lean start-ups. But the only disadvantage is that technology and its implication on the network is not investigated in details in this model. Technology is considered as a black box. For ICT firms, technology is a major part of their business model. To draft a roadmap it will be easier if the technology pipeline is also described in the business model. This is facilitated the managers to identify micro level technical activities and seek for optimizing opportunities with the fast developing ICT technology. CANVAS business modelling framework does not have any facility to integrate the company's future vision and aspiration in the model and so integration of this framework with a roadmap will provide that facility.
C-SOFT

In case of SmarterBetterCities the first draft of business model was based on CANVAS. But considering the different types of service provided for the upcoming 3 different customer segments C-SOFT seem to be more apt for defining the final business model. Below is the final business model that SBC is aiming to achieve once they reach the sustainable returns phase.

In order to analyze a business idea using the C-SOFT ontology we will use the following 2 steps (Heikkila J., Tyrvainen P. & Heikkila M. (2010).

Step 1. Defining the strategic objective of the business model (Heikkila J., Tyrvainen P. & Heikkila M., 2010): Finding a business model to commercialize a technology of converting 2D data into 3D visual models for better decision making of urban infrastructure planners. Also explore different markets to find a perfect match to prioritize the focus of SmarterBetterCities. Smart decisions for good and sustainable cityscapes are hard to be made. SmarterBetterCities aims to provide smart software solutions for integrated planning and better management of cities. Also to support customers to easily turn 2D map data into meaningful 3D cities and information visualizations.

Step 2. Identifying customer segments and defining all five C-SOFT blocks for each customer segments (Heikkila, J., Tyrvainen, P., & Heikkila, M., 2010).

**Customer relationship**

SBC customers come from a varied field of industries and so do the partners. This whole set of stakeholders makes up the network that SmarterBetterCities is a centre of. SmarterBetterCities has partners that have the exposure to the current and potential customer segments and so can be helpful in addressing the market launch or adaptation of SBC in the respective segments. The company has five customer verticals, which are currently addressed by three main service segments (customer segments). The verticals identified are as below, which can be used as a guideline to identify future objectives in terms of customer segment exploration and exploitation.

1. Architecture, Engineering and Construction (AEC)
2. Urban planning
3. Real Estate
4. Media & Press
5. Facility Management

To study the customer distribution of the current business model at SBC we could use the number of products provided as the baseline and formulate the three customer segments. Each of the customer segments comprises a combination of different verticals. Below are the three customer segments and their composition.
1. **Mobile/desktop app segment:** This is the segment of customers that do not have the need to design a GIS model but only need the functionality based on the GIS data. This segment also does not necessarily have the capability and need to understand the back-end coding of the GIS data and so can be served with just easy user interface front end. The verticals included in this segment are Architecture Engineering and Construction, Urban planning and Real estate. The specific customers of this segment can be divided as per the products provided by SmarterBetterCities.
   a. **SmartZoning**
   b. **SmartInvest**
   c. **EnergyCount app**

2. **3D Library segment:** This segment of customers is generally capable to understand and design a 3D model but needs a tool to make the modelling process easy and fast. 3D libraries are a set of pre-coded 3D building and infrastructure elements (railways, roads, tunnels, etc.) that the clients can just drag and drop in their geo data visual platforms. Customers can choose the desired structure from vast collection in 3D building/structures and also adjust building types and parks without coding inside geo data platform. Potential clients from this segment are Architectural firms, Construction companies, Marketing firms, Video gaming companies and visual entertainment companies, etc.

3. **CloudCities segment:** This segment has the needs similar to previous two segments but does not have the capability to host all the setups on their systems. Also this is the segment that has the technological compatibility to use cloud-hosted services and enjoys higher level of mutual trust to share data and application. This segment does not need to host the backend setup of all/any the SmarterBetterCities products and so are satisfied with all the front-end functionalities performed on a web browser. Potential clients from this segment are Architectural firms, Construction companies, marketing firms, video gaming companies, visual entertainment companies, town planning departments, investment firms, insurance companies, financial institutions, real estate firms, energy distributors, real estate firms, clean tech institutions, municipalities, and individual end users, etc.

**Service**

The service component block helps to identify and design the intended value of a service, and how it is created and delivered (Heikkila, J., Tyrvainen, P., & Heikkila, M. (2010). Here each of the segments will be studied for the design of service answering the questions like 'What are the service components for the customer segment?' (Heikkila, J., Tyrvainen, P., & Heikkila, M. (2010). Below is the service description for each of the customer segments at SBC.

1. **Mobile/desktop app segment:** A service to convert 2D data in 3D at efficient price and at faster speed with precise reporting.
   a. **SmartZoning:** A service to estimate and visualize the zoning constraints. A service to show building footprints, floor areas and roof shape that are legally allowed to build.
   b. **SmartInvest:** A service to visualize in 3D and estimate the existing and future city infrastructure. A service to identify the infrastructure investment opportunities in a city...
c. EnergyCount: A service to visualize and assess the building energy use in a city. Also capabilities to estimate current and future energy demands. Functionality to be linked with CO2 emission and consumed resources, such as oil, gas, district heating and clean energy.

2. 3D Library segment: A service to intuitively design 3D city infrastructure models without actually coding inside a geo design platforms like ‘CityEngine’. Faster and cheaper way of converting 2D data in 3D format for precise reporting. Eliminating the need of subscription and designing knowledge of geo design platforms like CityEngine. This service can be divided into two types as follows.
   a. Fixed packages: This service provides the clients with a fixed set of pre coded buildings ready to use e.g. 3D residential Libraries, 3D school library, 3D hospital Library, 3D Zurich Library, etc.
   b. Customizable packages: This service provides the client with capability to dictate the number and types of buildings included in the customized Library package.

3. CloudCities segment: A service that hosts all the SBC 3D applications and products on cloud. Faster and cheaper way of converting 2D data in 3D format for precise reporting. Eliminating the need of subscription and designing knowledge of geo design platforms like CityEngine. Like 3D library segment the cloud cities segment services can also be divided in two types.
   a. Fixed packages: This service provides the clients with a fixed set of pre coded buildings or apps ready to use e.g. 3D residential Libraries, 3D school library, 3D hospital Library, 3D Zurich Library, EnergyCount, SmartInvest, SmartZoning etc.
   b. Customizable packages: This service provides the client with capability to dictate the number and types of buildings included in the customized Library or app functionality packages, e.g. combination package of customized 3D buildings and dedicated SmartZoning and EnergyCount app.

**Organisation**

The organization block identifies all resources and partners involved in delivering the intended value to each segment. This block only considers partners and activities that are involved in the delivery of the value proposition offered by SmarterBetterCities to the intended customer segments. The partners that are involved for the resources need to develop the value to be delivered are considered in the technology block.

1. Mobile/desktop app segment: A sales network is need online for marketing and a place for the clients to download the apps.
   a. Web Shop: The web shop currently with SmarterBetterCities is built using website templates bought from WordPress (web software to create websites/blogs/web shops). The web shop is accessible to public on Internet globally.
   b. Marketing Partners: ArcGIS Marketplace (‘ArcGIS Marketplace’ open only to Esri customers), Esri Partner network, Google and Social media adds (SBC promotion on other websites), Social media groups (LinkedIn Twitter, Facebook, etc.) AEC related Conferences and tech shows, etc.
2. 3D Library segment: This segment needs assistance at times to purchasing a product and so the channel for this segment consists of both automated online channel and one coupled with individual consultancy to match the SCB product to the customer specific needs. Depending on the two types of service provided for this segment the channels have slightly different combination of partners involved in the respective channels.
   a. Fixed packages: Web shop, ArcGIS Marketplace, Esri Partner network, Google and Social media adds (SBC promotion on other websites), Social media groups (LinkedIn Twitter, Facebook, etc.) AEC related Conferences and tech shows, etc.
   b. Customizable packages: Personal consultancy at SmarterBetterCities, Esri Partner network, Google and Social media adds (SBC promotion on other websites), Social media groups (LinkedIn Twitter, Facebook, etc.) AEC related Conferences and tech shows, etc.

3. Cloud cities segment (Future segment): The main partner for this segment is the Cloud host server provider. Also on the basis of the two types of service described in the service block of the SBC business model previously we have two sets of partners/activities.
   a. Fixed packages: Web shop, ArcGIS Marketplace, Esri Partner network, Google and Social media adds (SBC promotion on other websites), Social media groups (LinkedIn Twitter, Facebook, etc.) AEC related Conferences and tech shows, etc.
   b. Customizable packages: Personal consultancy at SmarterBetterCities, Esri Partner network, Google and Social media adds (SBC promotion on other websites), Social media groups (LinkedIn Twitter, Facebook, etc.) AEC related Conferences and tech shows, etc.

**Finance**

Here we identify the money earning logic of SBC in return to the value provided for all three segments.

1. Mobile/desktop app segment: The prices of products provided for this segment are fixed. The customers have to purchase an app with pre defined set of functionalities, and if need arises for more functionality the customer can purchase them at a fixed cost again.

2. 3D Library segment: This segment has to pay a fixed price for the initial setup needed for all the 3D library products.
   a. Fixed packages: The pricing is volume base but fixed as per the number of buildings/functionalities in a package
   b. Customizable packages: The pricing is volume based and also dynamic, as it has to be calculated separately for each customized package.

3. CloudCities segment: This segment has to pay a fixed price for the initial setup needed for all the Cloud cities products. Also a usage cost of the server is added to this segment as a fixed cost.
   a. Fixed packages: The pricing is volume base but fixed as per the number of buildings/functionalities in a package
   b. Customizable packages: The pricing is volume based and also dynamic, as it has to be calculated separately for each customized package.
**Technology**

Web-based 3D visualization software from SBC is available for Windows, Mac, iOS, Android and supported on touch devices as well. In this segment we define the technology needed to address each of the three segments in the process of developing the intended value. Since SBC needs information/Knowledge as essentially as a technology to develop the products, we have considered knowledge as one of the resource needed.

1. Mobile/desktop app segment:
   a. At customer side: A web browser is essential for a customer to have to access the products of this segment. Recent version of Chrome, Safari, Firefox or Internet Explorer and without plug-ins, also windows users have to enable the WebGL (a JavaScript API for rendering interactive 3D graphics and 2D graphics within any compatible web browser without the use of plug-ins).
   b. At Company side: Capability to correlate the 2D energy data to the 3D geographical data (CAD software. Software to code the applications – Esri CityEngine, Esri ArcGIS Desktop). Subscription to ArcGIS Marketplace (to address Esri ArcGIS online account). Software and hardware to code the 3D models: Esri CityEngine, Esri ArcGIS Desktop, AEC software, Dell PC solutions, Apple (PC’s and tablets), HP, Samsung (tablets).

2. 3D Library segment:
   a. At Customer side: A web browser is not an essential capability for this segment. This customer segment has access to other geo-design visualization platforms to utilize the SmarterBetterCities application.
   b. At company side: Software for testing the compatibility of the models developed with different geo-design visual platforms (Esri CityEngine, Esri ArcGIS Desktop, AEC software, Autodesk 3DStudio, Autodesk AutoCAD, Autodesk Maya, Autodesk Revit, AutoCAD Civil 3D, MicroStation - Bentley, Nemetschek Vectorworks, Inc., Nemetschek Allplan, ArchiCAD – Graphisoft. Software and hardware to code the 3D models: Esri CityEngine, Esri ArcGIS Desktop, AEC software, Dell PC solutions, Apple (PC’s and tablets), HP, Samsung (tablets).

3. CloudCities segment:
   a. At Customer side: A web browser is essential for a customer to have to access the products of this segment. Recent version of Chrome, Safari, Firefox or Internet Explorer and without plug-ins, also windows users have to enable the WebGL (a JavaScript API for rendering interactive 3D graphics and 2D graphics within any compatible web browser without the use of plug-ins).
   b. At company side: Software for testing the compatibility of the models developed with different geo-design visual platforms (Esri CityEngine, Esri ArcGIS Desktop, AEC software, Autodesk 3DStudio, Autodesk AutoCAD, Autodesk Maya, Autodesk Revit, AutoCAD Civil 3D, MicroStation - Bentley, Nemetschek Vectorworks, Inc., Nemetschek Allplan, ArchiCAD – Graphisoft. Software and hardware to code the 3D models: Esri CityEngine, Esri ArcGIS Desktop, AEC software, Dell PC solutions, Apple (PC’s and tablets), HP, Samsung (tablets).
Appendix 7: Interviews

CEO interview
Interviewee: Antje Kunze (CEO of SmarterBetterCities)
Interviewer: Sujaya Shinde
Place: Zurich, SmarterBetterCities office. June 2014
Organization: SmarterBetterCities

1. How did it all start?
   The research at ETH started in 2006. Back then the only focus we had was academic achievement; reaching the academic goals of the research. My research position was to look at the usability and ease of usability of the complex GIS information and the 3D computer interface of the technology. This gave me a user perspective of the research and I could visualize the opportunity of this research being used by non-technical people. In addition climate KIC came in picture and fuelled the idea by presenting the opportunity to use this technology in a much bigger project and scale. The application and perfect fit of our research to the ‘Smart Urban Adapt’ project was the kick that pushed us further to explore our entrepreneurial capabilities.

2. What resources were available at start and what you had to acquire intentionally?
   We had the technology and our expertise. Developing a product so closely related to the research and also having the support from ETH University to start our own company, made it easy to start development even before we had individual office space. This helped us in long run as by the time we were out of ETH we already had clients and revenue stream from them. In addition to this our association with climate KIC made seed funding more accessible. Since this association had started in April 2012, by the time we needed a cash flow for setting up independent business out of ETH, we had the funding. “The funding for Climate KIC came in at the right time and was supplemented by revenue from first client orders like ‘city of Zurich’ and ‘Sika Smart City’ project (Sika Services AG: a global construction chemicals company).” Other than technology we needed additional technical assistance, as the product development was not a small job. We hired Grete as a full time employee as Mr. Halatsch and I were still employed at ETH at that time. For initial six months the office had Grete working fulltime and me and Jan working part-time at SmarterBetterCities and dedicated the remaining time to ETH university research responsibilities. To get into entrepreneurial shoes me and Jan enrolled for various start up tanning programs. This included Venturelab (launched in 2004 as a national training program for innovative high-tech start-ups("venturelab - fast track for startups!," 2004)), and Climate KIC start-up training program("Climate-KIC Accelerato," 2014).

3. What was the investment scenario of SBC at start?
   At the start SmarterBetterCities was developing dedicated products only. Also having had the proof of concept ready in the Research Phase at ETH labs, had provided us with client from very beginning. Also when the time came for larger investments like office space and having fulltime employees other than the co founders we had the funding from Climate KIC and also a small stream of revenue from the clients. But now that we are...
proceeding towards more modular products we need additional funding and so we are applying for investment loans from ZKB bank and other investors.

4. What was the motivation to start a company?

My involvement in the research projects with an end user perspective enabled me to see the probability of commercialising the research. At the same time Jan was also getting involved with the Climate KIC 'Smart and Urban Adapt' project. Our technology was majorly based on the CityEngine and the commercial importance of CityEngine was evident to us. Specially when the original company of CityEngine was bought by the global leader in GIS field. Also at ETH university a special importance is given to implementing a research to satisfy market need and thus commercialisation of technology at hand while creating new jobs.

5. What were the major problems faced at what stage?

Currently facing the problem managing the partnership commitment in parallel to new strategic changes and new product developments at SmarterBetterCities.

6. How is the company planning to grow? In terms of finance?

Funding from ZKB and continuous revenue from modular products. This stream can be small at the start but will grow in future this is the reason that we have considered best case as well as worst case scenarios while future planning.

“Lots of customers want to offer added value to their GIS data and also in 3D. We can see that there is a market and we could bring added value to CityEngine and other Esri products. They will get a starting package from us with very fast 3D models, so that they don’t have to program in CityEngine their libraries themselves or get customized web viewer. I think there's also a growing market for these apps and 3D libraries.” - Antje Kunze CEO SmarterBetterCities (Eric, 2014)

Employee interview

Interviewee: Sandro Martis, Software Engineer
Interviewer: Sujaya Shinde
Place: Zurich, SmarterBetterCities office. June 2014
Organization: SmarterBetterCities

1. What was your motivation to join SBC?
   - Being an electrical engineering student with interest in 3D technology derived me to look for related topics for master thesis. I did not know anyone from the SBC team before this project. I contacted Michael via the ETH University portal when I looked up his expertise in my field of interest.
   - Even though I had very little background in architectural design, I had explored CityEngine earlier. Including 3D models in this technology was an interesting and understandable topic for me.

2. What is your exact contribution to the Company?
   - On basis of master thesis I was able to develop the 3D modelling and physical detection technology further to support the existing work at SBC. Before the web scenes were able to construct the scene based on the coded buildings, with my work it was possible to develop a web scene using touch recognition on a touch screen by using physical 3D models of buildings.
Employee interview

Interviewee: Grete Soosalu, 3D Product Engineer
Interviewer: Sujaya Shinde
Place: Zurich, SmarterBetterCities office. June 2014
Organization: SmarterBetterCities

1. What was your motivation to join SBC?
   - I joined the company in 2012, initially I was asked to help with the production of the first deliverable of the start-up at ETH University. I have the required skill set and architectural programming background for development. The recommendation to work for SBC came to me from the network of professors I had at ETH University during my Masters.
   - I was inspired by the work ethics of the team (Antje, Jan and Michael) and also by the opportunity to work in the field of my interest and explore new emerging technology in my field of studies.

2. What is your exact contribution to the Company?
   - Initially I worked on superficial periphery of the core technology as being an architectural student I was able to understand the overall picture of the project quickly.
   - As my involvement increased I had to learn coding in 3D as it was new to me. I worked on the project parallel while learning the coding from scratch.
   - Currently I work on product development and other organizational stuff, like maintaining the office repository and documentations. Also I represent SBC and make presentation for the potential client of SBC at various trade conferences in US and Europe. I travel almost every two months for this purposes.
Appendix 8: Meeting notes

Action plan to meet future objectives

Following micro transition activities were identified via daily observations and conversations with the SBC employees. As explained in the conclusion of chapter 5, Action Layer can be more detailed if designed for a specific start-up. Since SBC is currently in this transition phase these activities can be observed first hand and so are explained in more details.

- Identifying what type of set might be in demand so that the customer can achieve maximum utilisation of the Library. Identifying the types of Libraries such as 3D Urban Office Library, 3D School Library, 3D City Library, 3D Residential Library, etc.
- Identifying the generic set of structures to group together and define the modular set of all the 3D Libraries. Eg. Identifying all the types of Office buildings to be included in the Urban Office Library.
- Considering a limited work force (6 full time employees), SBC had to identify the resources in terms of technical experts working on the production of 3D Libraries. This resulted in Mr. Jan and Miss. Greta mainly working on the actual production of the 3D Libraries.
- SBC also had to carry out the activities of designing and en-coding the web shop.
- Setting up a web-shop with new modular products also included the cost allocation to each product on the web shop. The company had to investigate the cost distribution for each of the new 3D Libraries, according to the resources invested and the value offered.
- The web-shop aimed at reduction of customer interaction at SBC, but a customer support system had to be set up to address some essential amount of customer relations, as customer service. This was done via providing the contact details like address, e-mail and phone number on the web-site.
- Since the customer contact is reducing, demo videos and instruction documents are being made for easy use of the product by self service to the customer.
- The Web-shop will expose SBC to global platform and so SBC is aiming towards global expansion starting with first branch out in USA in near future. This includes finding office space in the new country and establishing the internal network of workforce and external network for market placement.
- Since the new product to be launched is a cloud technology base SaaS products. The SaaS (Software as service) architecture implies that the application will run on the cloud server without the obligation of installing the application on client platform (Marston et al., 2011). SmarterBetterCities will need to acquire servers to host the processing platforms where the actual GIS virtual 3D models will be developed and then displayed at the client systems on simple web browsers.
- Using ArcGIS support, CloudCities is en-coded till its prototype stage. This included allocating human as well as technical resources dedicated to the task.
- This type of system will include changes in not only the technical capabilities and resources but also organisational networks, with introduction of stakeholders like Owners of the Cloud host servers, internet connectivity providers, etc. Cloud computing includes compulsorily includes a set of stakeholders; Consumer, Provider, Enabler and Regulator(Marston et al., 2011).
- Customer service for the CloudCities customers.
- Sales of CloudCities via Web Shop and also on Esri Marketplace (online shop for ArcGIS bases products, governed by Esri) As of now the company is focusing on hosting the service on the ArcGIS online cloud servers provided by Esri Inc.
- Establishment and maintenance of Client accounts to access the SBC CloudCities via their web browsers.