ARCADA

Value Co-Creating Decision Support Services from Iceye's SAR Satellite Data

Sam J. Björklund

MBA Master's Thesis
International Business Management
2018

DEGREE THESIS	
Arcada University of Applied Sciences	
Degree Programme:	MBA International Business Management
Identification number:	
Author:	Sam J. Björklund
Title:	Value Co-Creating Decision Support Services from Iceye's SAR Satellite Data
Supervisor (Arcada):	Carl-Johan Rosenbröijer
Commissioned by:	Iceye Oy (Ltd.)

Abstract:
The aim of the research was to explore future usage of Iceye's SAR data, and analyse what implications this potential usage should have on Iceye's operations and business today. And, investigate how Iceye could develop services with potential customers. The research was carried out in the form of an Innovation Boot Camp, following Futurice: Lean Service Creation method (LSC). The material gathered during the Innovation Boot Camp presented themes, topics and answers in correlation to the stated research questions: 1. *What kind of decision support services could be developed from Iceye's SAR data?* 2. *In what way could Iceye value co-create services with potential customers? 3. Does Iceye's SAR data influence their business network?* The research results functioned as the base for the thematic analysis, that branched off to answer the three research questions. The research questions were divided into three separate themes: big data & analytics, value co-creation and business networks. The main findings were, that the kind of decision support services most likely to be developed from Iceye's SAR data, are services that merge data. By using a method like the LSC, new service concepts can be developed through a value co-creation process. This process takes place in a joint value co-creation sphere, where the provider and the customer can through interaction create value prepositions. The data Iceye's systems gather and process influences their business network, by having certain technological requirements. The data also impacts the business network with its unique content, which is a unique resource for the whole network.

Keywords:	Satellite SAR data, big data, analytics 3.0, Lean Service Creation LSC, value co-creation, Actors Resources Activities (ARA model), Minimum Viable Product (MVP), Iceye
Number of pages:	69
Language:	English
Date of acceptance:	2.10.2018

CONTENTS

Figures

Tables

1 INTRODUCTION

The 12th of January 2018, the Finnish space industry company **Iceye Ltd.** launched its first satellite into orbit. ICEYE-X1, is space history's first synthetic aperture radar (SAR) satellite weighting under 100kg. Two more satellites are planned to follow their initial proof of concept, later in 2018. The launch was a big milestone for the startup and their founders, that initially came out of the Finnish Aalto University and its startup accelerator. According to the Finnish Business Information System, Iceye Ltd. was founded 16th of September 2014. This means they managed to plan, finance, build and launch a working proof of concept in less than five years. The company's plan is to maintain a swarm of approximately 20 satellites from 2020.

The satellites will have the ability to send images in a near real-time flow. Applications based on this SAR data could be able to track ships, icebergs and analyse floods or forest damages. These planned applications are mainly intended for large organizations and governments. But, by harnessing the innovation potential of startups, other applications could be developed.

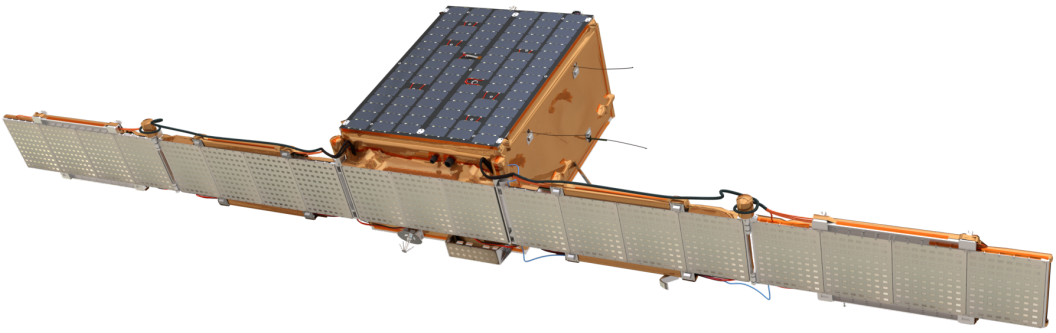


Figure 1. ICEYE-X1 SAR Satellite (Iceye Oy, 2018).

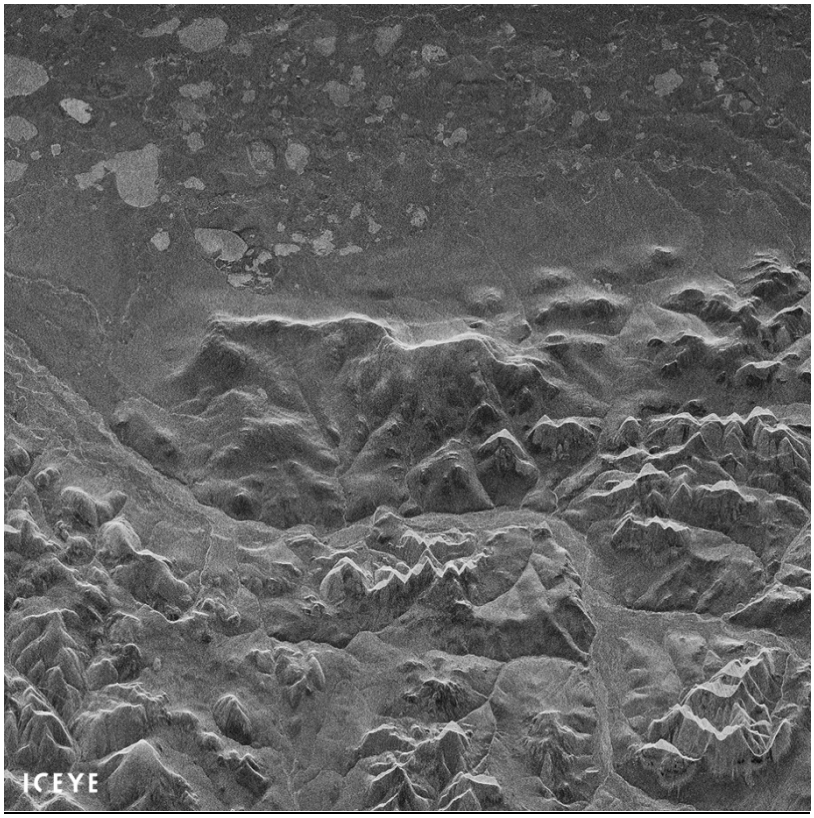


Figure 2. ICEYE-X1, SAR image of the Noatak National Preserve, Alaska. Image taken 17.1.2018 during a 10 second pass-over at an altitude of 500km. The Image spans roughly 80 x 40 km on the ground (Iceye Oy, 2018).

1.1 Statement of Iceye's Problem

Iceye's challenge is to foresee, plan and fulfil the needs of future customers. This is a challenge due to several reasons. **One,** not knowing who their future customers are and what their needs might be. **Two,** the rapid development of technology is constantly shifting what is economically feasible or technically even possible. **Three,** emerging projects and startups interested in innovating new applications from SAR data, must be found and taught the technical capabilities and limitations of Iceye's satellite missions. The lifespan of Iceye's satellites are estimated to 4 years. After which a replacing satellite must be launched. This has its up and down sides. A downside being very dependent on affordable launch vehicles and their weather sensitive timetables, a service which for instance Elon Musk's SpaceX is trying to solve with reusable and self-landing rocket boosters. One upside with having a short satellite lifecycle is that it makes it possible for

Iceye to develop and upgrade the swarm with new sensors and technology every five years or so. Opening up for different joint operations with customers willing to cooperate on different levels. In a sense the satellites can be seen as an infrastructure or platform for future customer's sensors, financing their development and overhead costs with SAR data.

1.2 Background and Iceye's Need

The space industry has for a long time maintained a high facade and only been reachable for large players with deep pockets. With the new affordable technology and the ever-evolving digitalization, space is no longer out of reach for startups. Also, spinoffs of bigger projects like ICEYE might emerge. Being a forerunner in small SAR satellites Iceye needs customer and partners that can validate their intended services. Iterate the services with these partners, while constructing a supportive service infrastructure that is cost-effective, dynamic and reliable. At the same time develop and build for the future. Iceye is in the business of selling data or images. Big money is in the services based on the SAR data, so Iceye must work together with their customers in order to get a larger piece of the cake.

The thesis focuses on the conceptual innovation work needed to be done in order to produce a minimum viable product (MVP). Iceye's next generation satellites, may contain a different set of sensors, proven necessary by customers trials. Or, invented through the innovation work done by third-party companies. Companies interested in developing products from the Iceye's satellites data, are forced to comply with certain technical, rights and business realities. A part of this thesis, is to explore some of these traits and discuss the possibilities and limitations of the applications that can be innovated and developed from the Iceye's SAR data.

1.3 Purpose and Research Questions

The purpose of this study is to explore future usage of Iceye's SAR data, and analyse what implications this potential usage should have on Iceye's operations and business today. To reach this purpose I have formed three critical research questions:

1. What kind of decision support services could be developed from Iceye's SAR data?

2. In what way could Iceye value co-create services with potential customers?

3. Does Iceye's SAR data influence their business network?

1.4 Significance to The Space Industry

The significance of this work is marginal to the space industry at large, but can at its best inspire Iceye to reflect on their business and operations from new angles. And potentially assist Iceye to predict future managerial, operational and financial needs. External partners interested in working with Iceye could benefit from getting a quick summary of central concepts, challenges and possibilities Iceye's operations provide. Publishing the thesis in October 2018, ten months after ICEYE-X1 was launched, provides the involved parties time to: learn, validate and develop their services from a pool of new insights which this work aims to contribute too.

1.5 Limitations of the Thesis Work

The work is limited to study certain aspects of Iceye's operations, business and relations, framed by the research questions. Being a five-year-old startup with its first proof of concept in orbit, much may change as part of validating their product with real customers. The work is therefore limited to 17.1.2018, when the image of Alaska was received as a proof of a working system from the ICEYE-X1 SAR Satellite.

1.6 Ethical Considerations

This work imposes no ethical challenges, since all gathered information has been collected either from open sources like articles, books and websites or through personal interviews. Involved informants have prior to their participation in interviews and workshops given their full consent to participate with their own name and company name in the final report. Further, all persons involved has also been informed of the general aspects of the work and none has objected in any way. The work doesn't take into ethical consideration the potential business models of Iceye Ltd.

2 LITERATURE REVIEW

This chapter consists of three main parts. First, we will have a look at *Big Data* and *Analytics.* Second, we will examine *Value Co-creation*. Third, we will go through the *Actors, Resources and Activities Model* (ARA). The contemporary terms of big data and analytics can be derived from the post-World War II era. At that time corporations started to gather data for analytical purposes and for instance UPS started an analytics group in 1954. As seen in the table below, the terminology for analysing data has evolved several times the last decades, with analytics and big data as the two most recent (Davenport, 2014, p.10).

Table 1. Terminology for using and analysing data, with the addition of Analytics 3.0. (Davenport, 2014, pp. 10, 197)

Term	**Time Frame**	**Specific meaning**
Decision support	1970 - 1985	Use of data analysis to support decision making
Executive support	1980 - 1990	Focus on data analysis for decisions by senior executives
Online analytical processing (OLAP)	1990 - 2000	Software for analysing multidimensional data tables
Business intelligence	1989 - 2005	Tools to support data driven decisions, with emphasis on reporting
Analytics 1.0	2005 - 2010	Focus on statistical and mathematical analysis for decisions
Big data	2010 - present	Focus on very large unstructured, fast moving data
Analytics 3.0	2013 - present	Blend with big data, bringing insights and offerings with speed

2.1 Decision Support Systems

As seen in the table below the difference between analytics 1.0 and big data is in the nature of the data that is being analysed. Analytics has traditionally been implemented on fixed data sets, where big data on the other hand focuses on very large unstructured, fast-moving data (Davenport, 2014).

Table 2. Big data and traditional analytics (Davenport, 2014, p. 4)

	Big data	**Traditional Analytics 1.0**
Type of data	Unstructured formats	Formatted in rows and columns
Volume of data	100 terabytes to petabytes	Tens of terabytes or less
Flow of data	Constant flow of data	Static pool of data
Analysis methods	Machine learning	Hypothesis-based
Primary purpose	Data-based products	Internal decision support and services

Defining Big data

Grasping and defining the elusive term big data is somewhat challenging. Researchers have though agreed on three general characteristics that in their opinion make up big data. One of them is the American research and advisory firms Gartner, who defines big data in the following way:

> Big data is high **Volume**, high **Velocity**, and/or high **Variety** information assets that require new forms of processing to enable enhanced decision making, insight discovery and process optimization (Gartner, 2012).

The information technology firm IBM has added to their definition a fourth V: **Veracity**, claiming that big data might also be the source of more accurate information, through a larger volume of data, provided at a higher speed and with a broader variety of input sources.

> "Big data gives you the ability to achieve superior value from analytics on data at higher volumes, velocities, varieties or veracities. With higher data volumes, you can take a more holistic view of your subject's past, present and likely future. At higher data velocities, you can ground your decisions in continuously updated, real-time data. With broader varieties of data, you can have a more nuanced view of the matter at hand. And as data veracity improves, you can be confident that you're working with the truest, cleanest, most consistent data." (IBM, 2016)

Volume, the share volume of the big data is not that interesting, in comparison to what it may be used for. The large amount of unstructured data can contain different data sets that must be identified, structured and data harvested in order to be useful. This can be compared to crude oil where different carbon chains make up certain end products within the oil, but must be fractioned and refined in order to separate the nail polish from the heavier components like diesel fuel. **Velocity,** another characterizing aspect of big data is the velocity or constant flow of data. In the past or pre-big data era, fixed sets of data were gathered and analysed. Now companies have the possibility to analyse data in motion giving indications of direction and even prediction. **Variety,** it is argued that variety might be one of the most important factors of big data. By combining external data sources companies can see new trends which the homogeneous data from within a company was not able to predict or understand before. Here lies the key to new decision supporting systems. It is argued that adding new data streams is more beneficial then refining the analyse model itself, compare (Davenport, 2014, p. 22). **Veracity,** derived from the first three V's. By having access to a large amount of up-to-date data combined from many different sources portrays a more accurate image of the situation at hand.

The four V's of big data define what big data is, but there is much more to it. In order for companies to fully embrace big data they must embrace constant change. By data sourcing and automating data analysing processes companies van find totally new data driven products and business opportunities. Shifting from having data as a supportive business function to hire data scientists, and go data first, brings value. "There are three classes of value: cost reductions, decision improvements, and improvements in production services" (Davenport, 2014, p.22).

In the following matrix, the three V's by Gartner have been combined with the three value creating properties presented by Davenport in order to visualize the added value big data brings. And make the fourth definition added by IBM; *Veracity* (truth or reliability) more visible.

Table. 3. Matrix of the three V's defining big data and the added value big data brings. The matrix was compiled by the author (Björklund, 2018).

	Volume	**Velocity**	**Variety**
Cost Reduction	More information can save money	Real-time data save money	Insight discovery save money
Decision Improvement	Larger data samples improve accuracy	Real-time tools improve decisions	Multi streams, combining data
Improve. in production services	New datasets found within big data	Predictive to prescriptive services	More options from different data sets

2.1.1 The Big Data Stack

Big data and analytics have not emerged in a vacuum, but are causal results from the technical development and lowered prices of data storage and computational power in the big data stack of "data smart" companies and their system or service providers. (Davenport, 2014, chap. 4). The data stack figure presented below is to be read from the bottom up, with each layer of technology supporting or hampering the next. In the following chapter, we will have a look at these technical aspects and the implications they impose on the usage of big data.

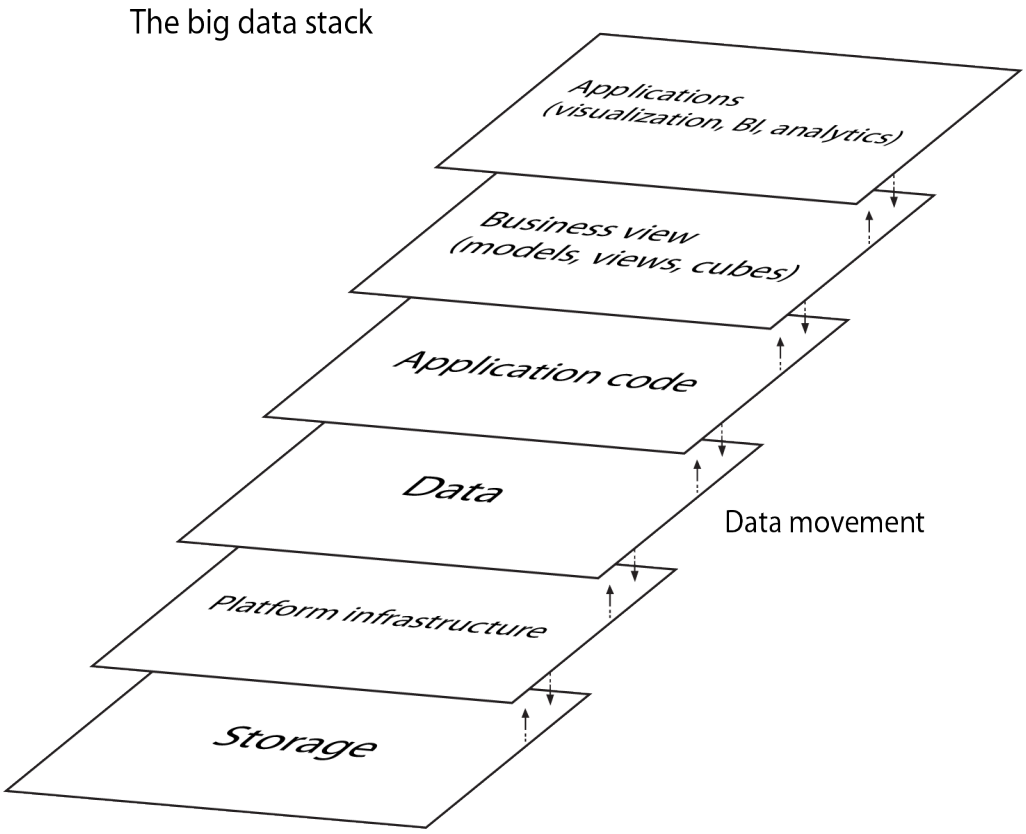


Figure 3. The big data stack (Davenport, 2014, p. 119)

Developing a company's IT department toward big data and taking all the different aspects in consideration is a work of its own. It must be scalable, robust, and have a server architecture that is optimized for the intended workload. For this there are many local service providers and naturally also the global giants like Amazon and Google.

2.1.2 Analytics 3.0

With analytics 1.0 as the forerunner to big data, it would be logical to first present analytics and then segue over to big data. But, analytics has evolved dramatically over the past 10 years, so that the newest form of analytics, named analytics 3.0, might arguably lead the way together with big data toward whatever new term that might come next. The table below shows how analytics has evolved since 2005. It is worth mentioning that even if analytics 3.0 was coined in 2013, it is still not the common way for corporations to lead their businesses but something many works towards under the title digitalization and automatization of business processes.

Table 4. Three eras of analytics (Davenport, 2014, p. 194)

	Analytics 1.0	**Analytics 2.0**	**Analytics 3.0**
Types of companies	Large enterprises	Online and start-ups	All-"data economy"
Analytics objective	Internal decisions	New products	Decisions and products
Data type	Small, structured	Large, unstructured	All types combined
Creation approach	Long-cycle batch	Short-cycle agile	Short-cycle agile
Primary technology	Software packages	Open source	Broad portfolio
Primary analytics type	Descriptive	Descriptive, predictive	Prescriptive
Business relationship	Back office	"On the bridge"	Collaborative

Table 4. shows the development of analytics. To the left we have the old world with cumbersome, slow and fixed data sets. In the middle, we have analytics 2.0 or AKA big data. Contemporary companies with digital systems giving them close to real time data. To the right, we can see analytics 3.0, the future, where data has moved beyond predicting to prescriptive analysis, solving future challenges in advance. This can for instance translate into automatic decision support systems for the maritime business. With instant analysis of big data, a system in the realm of analytics 3.0, could in advance suggest a new route for an autonomous ship in order to save energy and time, due to a developing wind system, local wave pattern or change in sea current.

According to Davenport, it is important for companies of any size to develop their businesses from analytics 1.0 toward analytics 3.0. Big data is an important step on the way, bridging this paradigm shift, but not the final destination. In order to maintain the competitive edge companies must rethink how they create value for themselves and their customers by analysing data (Davenport, 2013).

2.1.3 Service-Oriented Decision Support Systems

Companies naturally collect data about their internal operations, but can also provide data, information and analytics as services. Following the development of big data and analytics, service-oriented decision support systems (cloud based DSS) has emerged, assisting companies to become more agile and able to respond faster to market changes. In the following chapter, we will have a look at these systems and how they relate to each other.

The word service has two meanings in this chapter. It stands for some provision provided to a customer as a service, but also stands for cloud services. This has its origin in paradigm shifts like software-as-a-service (SaaS), infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS). Shortly put, using services for building services.

As part of the big data definition brought forward earlier in chapter 2.1.1 by (Gartner, 2012), big data calls for: *"new forms of processing to enable decision making",* but also *"insight discovery and process optimization"*. The key technologies enabling these processes are: cloud storage and computing, machine learning, mobile technology and artificial intelligence. These technologies make it possible to process big data and cater to the exploratory side of big data while making it at the same time broadly available through mobile applications. This also makes way for the development of new services and products for customers (Davenport, 2014, p. 23). One of the key concepts of service-oriented systems, is that data, either stored in the cloud or on a desktop computer can be accessed from anywhere. This enables the building of a service-oriented architecture (SOA). This architectural structure gives developers the possibility to configure complex systems like building blocks. Data, models' and user interfaces can be integrated to the system and scaled according to storage, computation or bandwidth needs (Delen & Demirkan, 2012a).

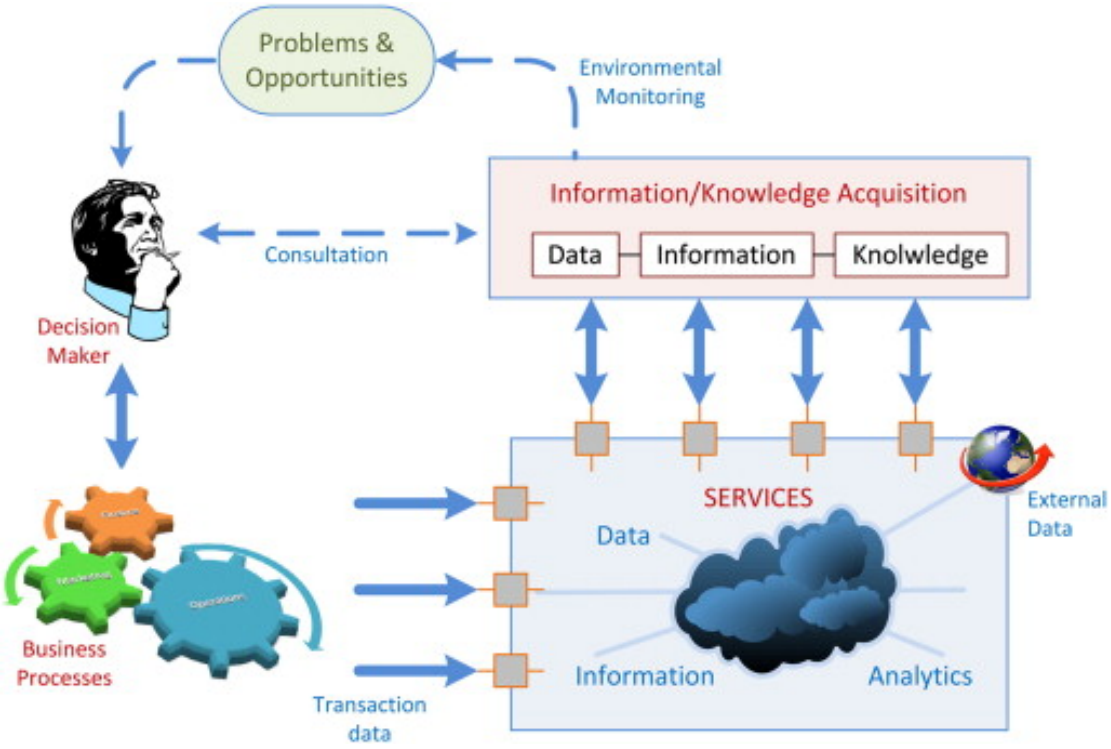


Figure 4. A conceptual framework for service-oriented decision support systems (Delen & Demirkan, 2012a).

As the ever more integrated world becomes increasingly complex, so does the work of decision-making managers. With the right kind of data, computational power and analytics new supportive systems and tools can be developed to aid managers.

Figure 4. above, could for instance depict a service-oriented decision support system aiding the pilot of a remote-controlled cargo ship. The Business processes would represent the ship making its way on the ocean, while sending its transaction data like speed, bearing and engine status to the decision support system. Also, fed by external data from weather stations and satellites. Analysed against models from different scenarios and data the pilot is given options if speed is more important than fuel consumption or if maintaining a particular direction is more important than avoiding strong currents and winds. These parameters and rules could naturally be pre-fed to the system which would automatically know what to prioritize and with the help of AI and machine learning learn from its mistakes.

The concept of SOA is developing and fusing with cloud computing. Delen and Demirkan, argue that their conceptual SOA framework, presented in figure 4. can be used to manage any type of distributed competence. May this be technical, human or organizational.

> "Service oriented architecture is constructed on a type of architectural framework that supports the design, development, identification and consumption of loosely coupled, discoverable, reusable, interoperable services across the enterprises. These services can be executed based on need" (Demirkan & Delen, 2012b).

In the following table 3. the differences between *descriptive*, *predictive* and *prescriptive* analytics are explained. The author has taken the liberty of adding the three words analytics 1.0-3.0 to the table, and would also argue that the concept of big data well fits the middle column named predictive.

Table 5. A simple taxonomy of business analytics (Delen & Demirkan, 2012a)

Business Analytics			
	Descriptive (Analytics 1.0)	**Predictive** (Analytics 2.0)	**Prescriptive** (Analytics 3.0)
Questions	What happened? What is happening?	What will happen? Why will it happen	What should I do? Why should I do it?
Enablers	• Business reporting • Dashboards • Scorecards • Data warehousing	• Data Mining • Text mining • Web mining • Media mining • Forecasting	• Optimization • Simulation • Decision modelling • Expert systems
Outcomes	Well defined business problems and opportunities	Accurate projections of the future states and conditions	Best possible business decisions and transactions

2.1.4 Continuous Analytics as a Service (CAaaS)

In the same way, as big data and analytics is a continuance of the technological development, the different service structures are part of that development and architecture. The technology for different levels of data or analytics as a service, (DaaS & AaaS) is already widely developed and adopted. The following step of data development can be considered that of continuous analytics as a service (CAaaS).

> "Today's cloud supported analytic solutions should be able to produce continuous analytics results of real time events, for monitoring oil & gas production, watching traffic status and detecting accident" (Demirkan & Delen, 2012b).

But in order for CAaaS to function properly the architecture must be stable, scalable and have resilient properties in order to minimize operational downtime of the service. And is the provided service a constant ongoing decision support system, could a system crash lead to a real crash of an autonomous vehicle or system error in an autonomous surgical robot. "These solutions come with many challenges, such as security, service level, data governance. Research is still limited in this area" (Demirkan & Delen, 2012b).

It is out of the scope of this work to discuss artificial intelligence (AI) and how analytics is being developed in that field. But it is obvious that having an adaptive or even learning system, like Google Cloud ML Engine or TensorFlow, that can process structured and unstructured data, in different combinations with continuous and fixed data sets, is the future. Also, Iceye is at the moment developing different algorithms for object recognition and tracking within their own material in order to provide customers with not only satellite images but also selected and analysed data sets.

2.2 Value Co-Creation

Value, *value creation* and *value co-creation* has been analysed from different angles by many researchers, leaving behind a variety of interpretations and definitions. Much of that thinking has been grounded in industrial economic models, emphasizing a product-oriented manufacturing logic or the old enterprise logic. "The focus should be on reinventing value in terms of the value-creating system itself where different actors – suppliers, business partners, allies, and customers – work together to co-produce value" (Saarijärvi, et al., 2013, pp. 6-7). Many researchers though agree that value is ill-defined (Grönroos & Voima, 2012, p. 134) and some researchers even argue the concept has been elaborated too far in order to serve both scholars and practitioners (Saarijärvi, et al., 2013, p. 7)

The main approaches to value co-creation can never the less be divided into the following categories: The *Service Dominant Logic* (SDL), *Service science approach*, *Service Logic* (SL) and other approaches to value co-creation like *many-to-many marketing* and instead of value-in-use the concept of *value-in-social-context* (Saarijärvi, et al., 2013, pp. 8-9). But there is also the *Customer-Dominant Logic* (CDL), which is included in this chapter for its managerial perspective on marketing and business, and paradigm shift from company to customer viewpoint cf. (Heinonen & Strandvik, 2015, pp. 472, 475).

This thesis emphasizes the Nordic school of research tradition within value co-creation, with a focus on SL, since it resonates to the interactive aspects of value co-creation cf. (Grönroos, 2011, p. 289), which is arguably an important aspect of the *actors, resources and activities model* (ARA), presented in the next chapter 2.3. The service logic viewpoint is balanced with aspects presented by the Customer-Dominant Logic. A thought supported by researchers of SL:

> "Analysing value creation and co-creation from the customer perspective thus might support a systematic, analytical definition of the scope, locus, and nature of value and its creation and co-creation" (Grönroos & Voima, 2012, p. 133).

2.2.1 Service Logic Definition of Value and Value Creation

In the SL approach to value creation, value is not created by the company but rather emerges from a self-service or full-service process by the customer. The company's processes develop potential value for the customer which then can become value-in-use for the customer or be destroyed in the process.

> "Value creation refers to customers' creation of value-in-use; co-creation is a function of interaction. Both the firm's and the customer's actions can be categorized by spheres (provider, joint, customer), and their interactions are either direct or indirect, leading to different forms of value creation and co-creation" (Grönroos & Voima, 2012, p. 133).

When describing the elusive concepts of value and value creation, a higher level of abstraction in the form of spheres has been used. This is to avoid unnecessary complexity which company operations would bring to the schematics.

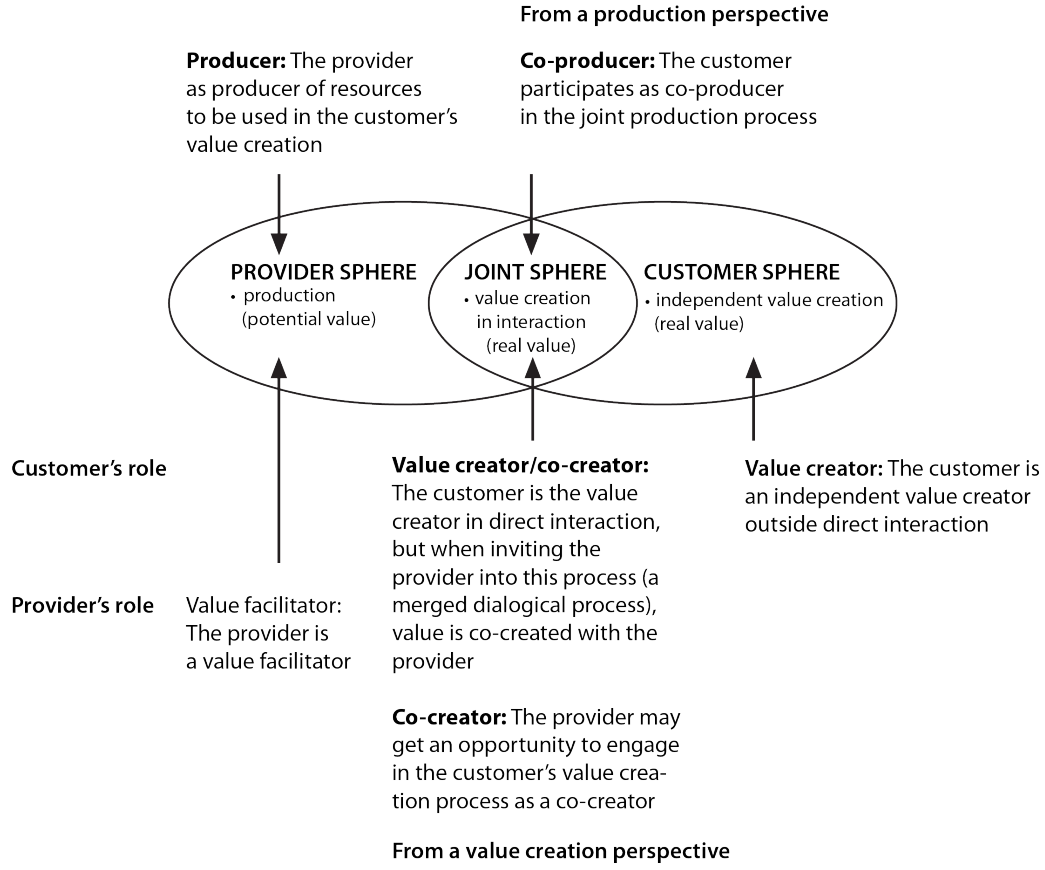


Figure 5. Value creation spheres (Grönroos & Voima, 2012, p. 141).

Grönroos car example, sheds some light on the different angles the discussion of value creation can take.

> "Understanding when value for a customer occurs is also an elusive issue, perceived in an individualistic way. For someone, driving a certain car may mean value, whereas for someone else value relates to having an opportunity to meet friends enabled by the drive made possible by this car (physical use). Yet another person may find value already in the process of considering buying a special car (mental use) or making the actual purchase. For someone, the mere possession of, for example, a luxurious sports car may create value (possession)" (Grönroos, 2011, p. 282).

2.2.2 Service Logic Approach to Value Co-Creation

The service logic approach to value co-creation is part of the research which is carried out in the field of service marketing. The approach focuses on defining value creation and setting the locus for where value is created, but also, defining value.
This could be interpreted through the example of a key. A locksmith makes a key which carries the potential value of opening a door, if the customer opens the door with the key value emerges. But is the key not properly made, then the value of the key is destroyed in the process of trying to open the door. (The authors example)
This is an example of value-in-use, which is not the same as value co-creation. In order for value co-creation to emerge, according to the service logic approach, interaction between the company and the customer must take place. This is the only way a company can create real value by interacting with the customer during the service process.
Through the evolving digitalization and the development of networked business interdependencies these interactions become ever more intertwined.

> "Technology is often seen as facilitating the emergence of different types of mechanisms by enabling the transfer of new resources effectively and efficiently for the use of other actors. It is important to identify and understand the wide variety of 'co-processes' through which various resources can be engaged in one another's value creation" (Saarijärvi, et al., 2013, p. 12).

Companies doesn't create value for their customers but through production generate potential value, whereas usage is generating real value (Grönroos, 2011, p. 283).

2.2.3 Clarifying the Conceptual Complexity of Value Co-Creation

What is value co-creation, and what is it used for? According to Saarijärvi & al. value co-creation is defined as following:

> "The question of what value co-creation is fundamentally about and how it can serve business purposes remains largely unanswered. The relevance of the concept in theory is poles apart from its practical relevance" (Saarijärvi, et al., 2013, p. 7).

One way to clarify the conceptually complex term of value co-creation is to explore the different interpretations of the term's separate parts, which is the cause to the complex range of definitions. By assigning questions to the separate parts of the term: "value", "co-" and "creation" (Saarijärvi et al., 2013) has tried to clarify the concepts in the table below.

Table 6. Analytical framework for practitioners (Saarijärvi, et al., 2013, p. 12)

	Value	**Co-**	**Creation**
	What kind of value for whom	By what kind of resources?	Through what kind of mechanism
Customer	What is the customer benefit? How is the customer's value creation supported?	What firm resources are integrated into the customer's value-creating processes?	What is the mechanism through which firm resources are integrated into the customer's processes?
Firm	What is the firm benefit? How is the firm's value creation supported?	What customer resources are integrated into the firm's value-creation processes?	What is the mechanism through which customer resources are integrated into the firm's processes?

> "Customers are increasingly seen as a critically important operant resource for firms – not only as the ultimate determent of customer value – but as a source of creative knowledge, and motivated resources that can be harnessed to work with the firm in co-creation. However, customers input cannot be taken for granted or go unrewarded – engaging them in the firm's activities must be done in a way that is enticing and beneficial for both parties" (Saarijärvi, et al., 2013, p. 16).

2.2.4 Customer-Dominant Logic of Service

By placing the customer in focus, the perspective can be shifted from how providers involve customers to how customers can engage different types of providers in their ecosystems (Heinonen & Strandvik, 2015, p. 472).

> "The starting point for innovating offerings is the outcome customers envision in a specific context, rather than what providers themselves see as an offering that could provide value" (Heinonen & Strandvik, 2015, p. 478).

This means that instead of providing "blind" value propositions for customers, the value formation is shifted closer to the customer by involving and envisioning what customers need. Competing for the customers attention and increased competition might cause service providers to imitate each other instead of going their own way by figuring out how customers are behaving in the evolving marketplace. For companies this will mean that they must develop these customer insights into action, innovating new offerings with the customers' needs in focus cf. (Heinonen & Strandvik, 2015, pp. 481-482).

2.2.5 Chapter Summary of Value Co-Creation

The author has chosen to present the selected research of value, value creation and value co-creation, with the intention to show how it integrates with the concepts of big data, analytics 3.0, business models and service networks. The old product-oriented manufacturing logic is here giving way for digital products, which value emerges through customers interaction with networked services and companies.

2.3 Business Networks

This chapter presents the *actors*, *resource*s and *activities model* (ARA). The model, was first formed by Håkansson & Johanson in 1992, and was further elaborated in the form of a book titled: "Developing Relationships in Business Networks", edited by Håkansson & Snehota in 1995. The ARA model was formed in a pursuit to define and analyse relationships and interdependencies in business networks, by presenting a network approach. In order to do so a conceptual framework was formed for the analysis of business relationships.

2.3.1 Actor Bonds, Resources Ties and Activity Links

The model is made up of three dimensions, closely connected but not separate: Activity links, Resource ties and Actor bonds. Changes in these relations naturally effect the other layers. In some company relationships the links, ties or bonds might not be fully developed due to the nature of the current business, or to the neglect of seeing the possibilities these could bring (Håkansson & Snehota, 1995, p. 34).

> "Every business enterprise is deeply rooted in its specific context. Specific conditions and circumstances (technical, economic and social) make a business enterprise possible at the same time as they constrain its possibilities. Every company connects different people, various activities and miscellaneous resources with varying degrees of mutual fit. Regardless of the type of industry, a company always operates within a texture of interdependencies that effects its development. We shall be dealing here with a few that are repeatedly encountered in various business relationships:
>
> - technology
> - knowledge
> - social relations
> - administrative routines and systems
> - legal ties" (Håkansson & Snehota, 1995).

Table 7. The relationship between two companies has a profile in terms of activity links, resource ties and actor bonds (Håkansson & Snehota, 1995, p. 26)

Actor bonds connect actors and influence how the two actors perceive each other and from their identities in relation to each other. Bonds become established in interaction and reflect the interaction process.
Resource ties connect various resource elements (technological, material knowledge resources and other intangibles) of two companies. Resource ties result from how the relationship has developed and represents in itself a resource for a company.
Activity links regard technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company as a relationship develops.

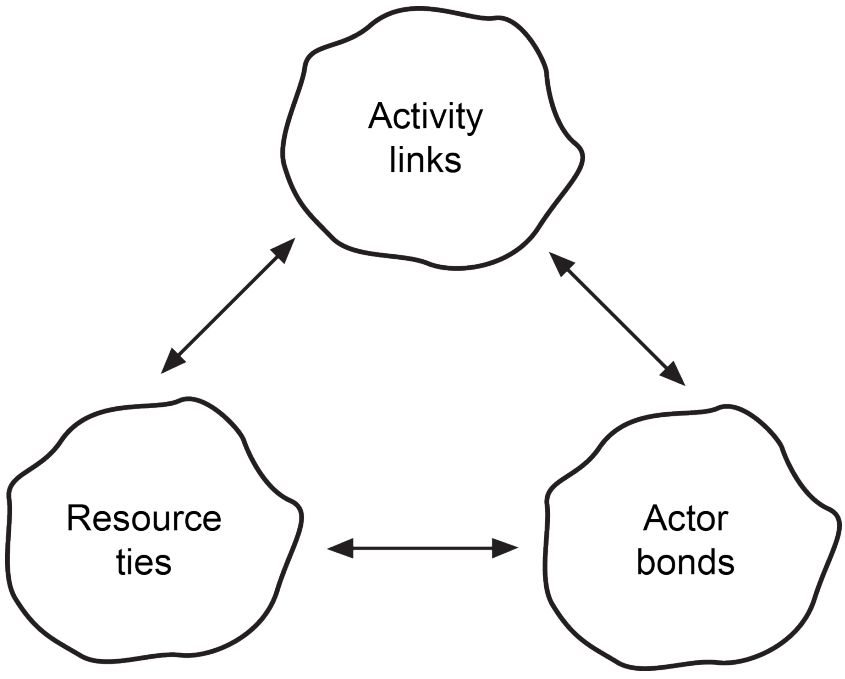


Figure 6. Interplay of the three substance layers of business relationships (Håkansson & Snehota, 1995, p. 35)

As companies develop their relationships in the different ARA layers, they will become intertwined. If the relationships are fruitful, they will make up a quasi-organization, which sum is greater than the organizations separate elements. This comes from the possibility to perform activities and summon resources which they could not perform or benefit from on their own. What they can achieve depends ultimately on how their relationship unfolds. The potential of this dyad, is not a given but must be explored through mutual trials and errors. Invested team efforts and the development of the relationships in the ARA layers determines the quality of the outcome. When two companies get involved in this way it doesn't only affect the involved parties but may also change their relationships to other companies (Håkansson & Snehota, 1995, pp. 36-39).

> "The innovation is typically positioned within some partly visible, partly invisible business landscape where it needs (1) to activate and stabilize a complex set of relationships between activities, resources and actors, (2) to systematically handle reactions to friction forces across these entities, and (3) to maintain and advance the necessary framing needed to coordinate interactions across all the involved and affected business resources, activities and actors" (Håkansson & Olsen, 2012).

2.3.2 Chapter Summary of The ARA Model

The main layout of the ARA model may be considered simple and therein lies its strength and weakness. Boiled down one could describe the model as people doing something with something. But, at the same time it raises many valid points on interaction, relationships and intensity of different activities. A certain degree of holism hovers over the model, where quality and connectiveness in networked businesses are more than the sum of their separate parts. The ARA model was chosen to support this thesis research due to Iceye's network of support services that make up their product. And, since none of Iceye's future data services can be purchased or obtained without being a part of this chain of sensors, antennas, and servers.

2.4 Chapter Summary of The Literature Review

The literature selected for this work, was chosen to underline a particular development of thought or paradigm shift, which has for decades been the prevailing direction of business and technology development. It is that of agile, networked, de-centralized, fast moving and real time services. Big data, analytics, value co-production, customer dominant logic and the ARA model, all speak of mutual efforts to develop something new and useful. By seeing beyond the traditional roles of companies and customers, and boldly mix and match new ways working together.

The way the models, theories and logics was brought forward in the chapter doesn't give full credit to the lifelong research some of the literature represent. This was partly due to the intricate nature of the models presented in the selected literature, often presented as an elusive patchwork of academic insight. And many papers, mostly in the chapter of Value Co-Creation, ended with the slightly annoying notion that more research should be done in order to make sense of it all in practical terms. This said, the material presented here is sufficient for the discussion and research. In an effort to bridge the selected literature with the empirical research presented in the next chapter, a simple table is presented below.

Table 8. The main topics presented by the selected literature

Chapter	Findings	Research
Big data	The future is data driven	We must mix data streams
Analytics	Ever evolving clever systems	We must be cutting edge
Decision Support Sys.	The apex is Continual AaaS	Prescriptive real time services
Value Co-Creation	Value emerges from insight	Together we can find value
ARA Model	We must work together	Business network thinking

3 RESEARCH METHODOLOGY

This chapter presents the empirical research carried out in this qualitative study. The research material is gathered during an Innovation Boot Camp following the **Lean Service Creation** method. The purpose of the research is to study the phenomenon of SAR data. Innovate and create a new service concept based on Iceye's future SAR data and analyse what implications this service might impose on Iceye's operations and business today. By foreseeing future needs, Iceye can set the right business and operational foundation, supporting a dynamic development of new SAR based applications and services.

3.1 Introduction to The Research

Researching potential thesis topics in 2016, Iceye was mentioned in an article about Finland's first satellites that where scheduled for launch in 2017, during the country's centennial independence anniversary. These two micro satellites Aalto 1 & 2, were being built at the Aalto University, the alma mater of Iceye's founders. The launch timetable of Iceye's larger satellite ICEYE-X1, was set to late fall 2017.

Intrigued by the Finnish satellite projects and further inspired by the space scene at the startup convention SLUSH in Helsinki, November 30.11-1.12.2016, arrangements were made and the first meeting with Iceye's representative: Operations and Business Development Manager Kenneth Lampinen was held 12.12.2016 in Otaniemi, Espoo.

Working with startups at the time, it felt natural to include an entrepreneurial angle to the thesis work. Iceye being a startup company itself had many questions still open in 2016. They had no proof of concept and little knowledge on how to attract startups or larger companies to innovate new applications from their future SAR data. Iceye formulated their request as following:

> "Think about how we can work with external partners, interested in innovating new applications from our data. Try also to foresee what implications this might have on Iceye's operations and business." – Kenneth Lampinen 2016

A research plan was formed based on this information, and 28.12.2016 Iceye approved the research plan. During the first months of academic background research the learning curve was very steep, but the researched topics on technology, space industry and business development where kept wide. The initial emphasis on startup companies was toned down since many of Iceye's initial key customers would be operational if not even global companies. The topics and articles where gradually narrowed down during spring 2017, and three research questions where formed:

RQ 1. What kind of decision support services could be developed from Iceye's SAR data?

RQ 2. In what way could Iceye value co-create services with potential customers?

RQ 3. Does Iceye's SAR data influence their business network?

3.2 The Innovation Boot Camp

It is common in research to join forces and work together in different teams. By doing so a larger pool of knowledge and funding can be utilized. This has often been the case in IT and the startup scene, where there is a tradition of organizing joined software development events called hackathons. There are different schools regarding how to arrange a hackathon, and if coding must be part of the activities or not. The stricter view demands coding to take place in order to rightfully be called a Hackathon.

In order to simulate the innovative powers of a joint venture, where different companies' individuals could in a controlled environment represent Iceye and their future customers, a Hackathon stood out as a potent research method. With time, arranging a several days long hackathon where actual coding would take place proved to be too ambitious. Many Hackathons are prepared a long time in advance with external sponsors, funding and prices. It stood clear that without the right funding the event would not be able to attract the right kind of developers and teams. The challenge finally found its solution in the form of an Innovation Boot Camp and the Lean Service Creation method.

The 19th of April 2017, an Innovation Boot Camp will be held at Arcada – university of applied sciences in Helsinki, Finland. The event will take place in the class room E377 between 12:00-16:30. The participants, listed in the table below, where all selected for the event according to their background and special skill-sets. Unfortunately, all participants selected to participate where male and representatives of the same age group (30-40 years). The participants are representing themselves with their own name and expertise.

Table 9. The Innovation Boot Camp participants: Name, special skill-set, company.

Ville Eloranta	IT researcher	Aalto University
Thomas Fredriksson	Sales & service developer	Mesensei
Touko Haunia	Iceye AIT engineer	Iceye
Erik Hausen	Software developer	Cre8
Kim Salmi	Startup entrepreneur, developer	Sanoma Pro

The workshop, which was arranged and facilitated by the author had received 200€ in funding by Iceye. The funds were used for printing the Lean Service Creation Canvases in size A1 (594x841mm). Catering and office material like post-it-notes and pencils where also purchased. The workspace was provided free of charge, by Arcada, the room was arranged with a large cluster of tables in the middle, like a board room table with chairs around it. In the middle of the table the LSC canvases was placed in a pile with the first canvas facing down.

3.3 Lean Service Creation by Futurice

I first came in contact with Lean Service Creation (LSC), participating in a Lean Service Creation Crash Course held at the Finlandia Hall in Helsinki, 31.1.2017. The event named Ahto17, was arranged by Tekes (since 2018 Business Finland) and the software agency Futurice. The event was coordinated by Management Events. During the course

of the day, about 500 people sat down around 100 tables and practiced the method, by creating 100 new service concepts. The group I participated in, created an autonomous post truck with built in delivery drones, as a solution for the Finnish post offices delivery challenges.

The Lean Service Creation method and canvases represents a continuation and development of the *Business Model Canvas, originally* proposed by the Swiss business theorist Alexander Osterwalder in 2008. Since then, different methods and canvases has been developed for different purposes. The selection of canvases used in this study was developed by Risto Sarvas, Hanno Nevanlinna and Juha Pesonen from the Finnish software agency Futurice. Their version of the canvases where released to the public 1.10.2016, under the title: The Handbook for LSC canvases (ver 1.7). The LSC canvases used at the Innovation Boot Camp, where downloaded from Futurice's website and had been updated to the beta version 1.72. The material has since been moved from www.futurice.com/LSC to the website: www.leanservicecreation.com.

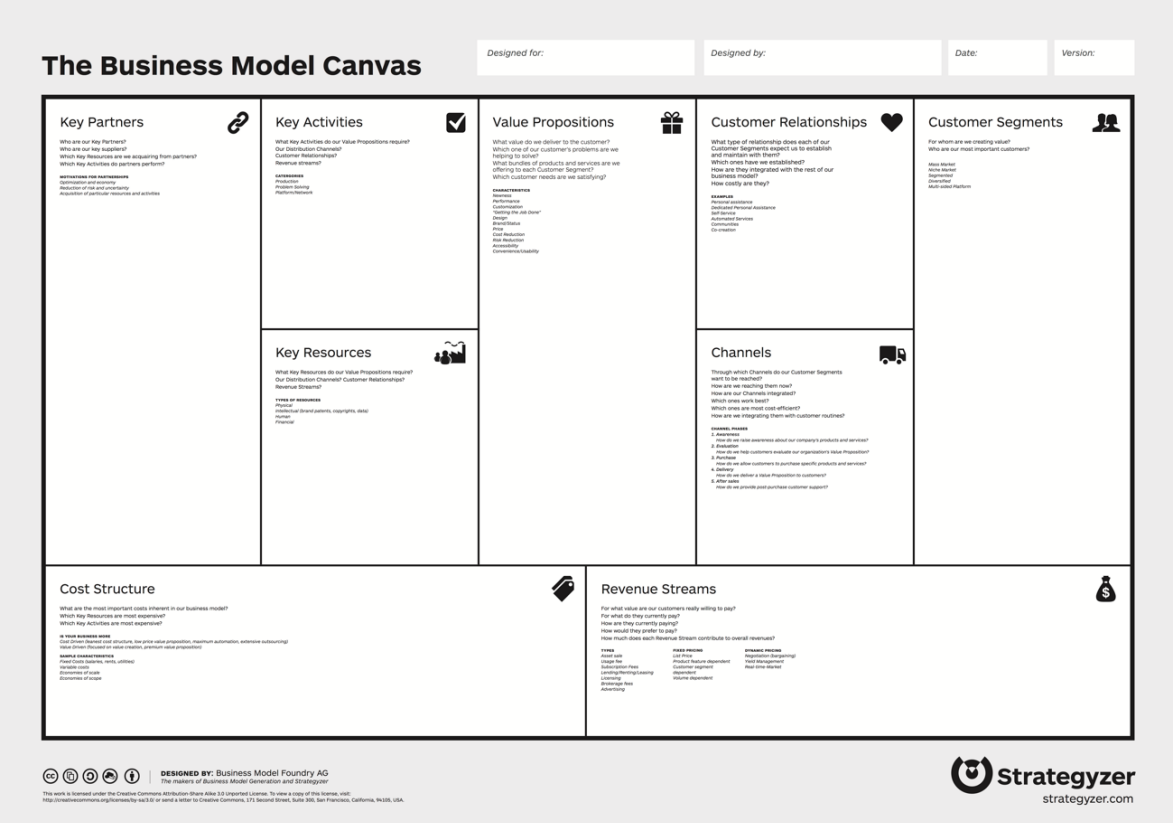


Figure 7. Example of a Business Model Canvas, created by Strategyzer.

3.3.1 The LSC Methodology

The Lean Service Creation method can be divided into two parts, one being the LSC methodology itself and the other part being the LSC canvases. The methodology of creating service concepts in a lean way, has its roots in the history of lean and its development from Henry Ford in the 1930-ties to the Japanese, *Kanban* in the 1950-ties. Futurice emphasizes in their version of the method, a three-step cycle of continuous improvement: *Learn, Build, Measure*.

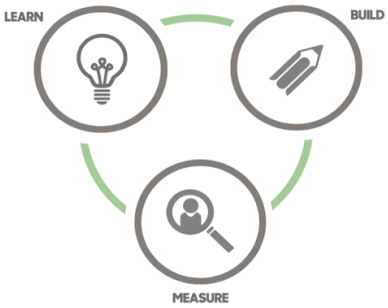


Figure 8. The Lean Service Creation Iteration Cycle. Learn, Build and Measure (Sarvas, et al., 2016).

The Lean Service Creation starts with setting goals and defining when the process has succeeded. A business problem worth solving is then formed as a question, to which the participants will try to find an answer to during the process. Information and ideas are gathered, and through the iterations of the process some are abandoned others improved. The goal of the process is to create a first commercial version of the service or product in the form of a minimum viable product MVP.

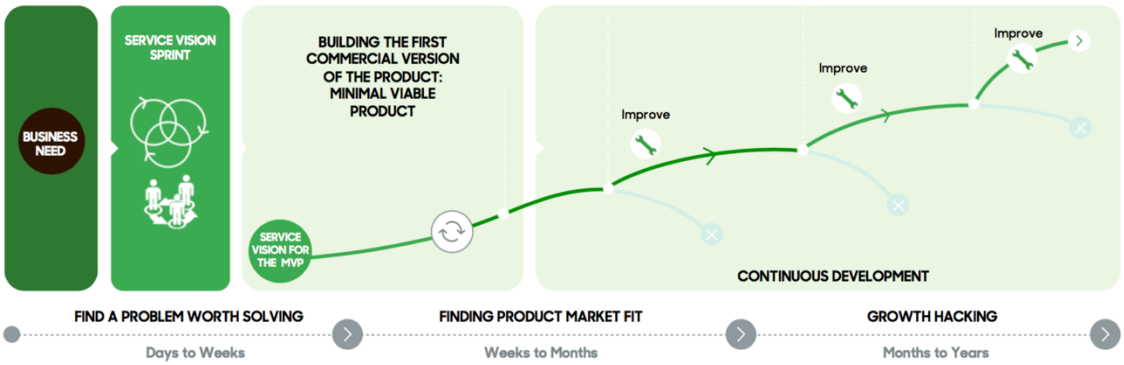


Figure 9. Lean Service Creation Methodology Chart (Sarvas, et al., 2016).

3.3.2 The LSC Canvases

In order to facilitate and structure the work with the LSC methodology, different canvases have been developed. The canvases can be modified according to special needs, but is not altered for the Innovation Boot Camp. Instead the canvases are carefully selected from the 18 canvases provided by Futurice in their handbook, and some are left unused. Choosing to leave out some canvases are mainly due to time limitations and in order to maintain focus in the workgroup. There are also a number of canvases that must be used in order for the process to move forward.

The ten LSC canvases selected for the Innovation Boot Camp are the following:

1. Business Goals and Limitations
2. Immersion – To know where you are and build on top of others work.
3. Data – Know your numbers and facts.
4. Segmentation – Choose who you aim to serve.
5. Ideation
6. Concept and Value Proposition
7. Profiling the Concept – It's time to face the wet blanket
8. Customer Engagement – How do we make people advocate the service
9. Business Model & Market Size – Making sure there is the business
10. Minimum Viable Product – nothing but the essential

It is not certain that the workgroup is able to go through all the canvases during the given time. In that case, some or all of the last canvases 7-9 must be skipped. The success of the workgroup is there for pending on the workgroups capability to follow the given instructions and keep the strict timelines of the process.

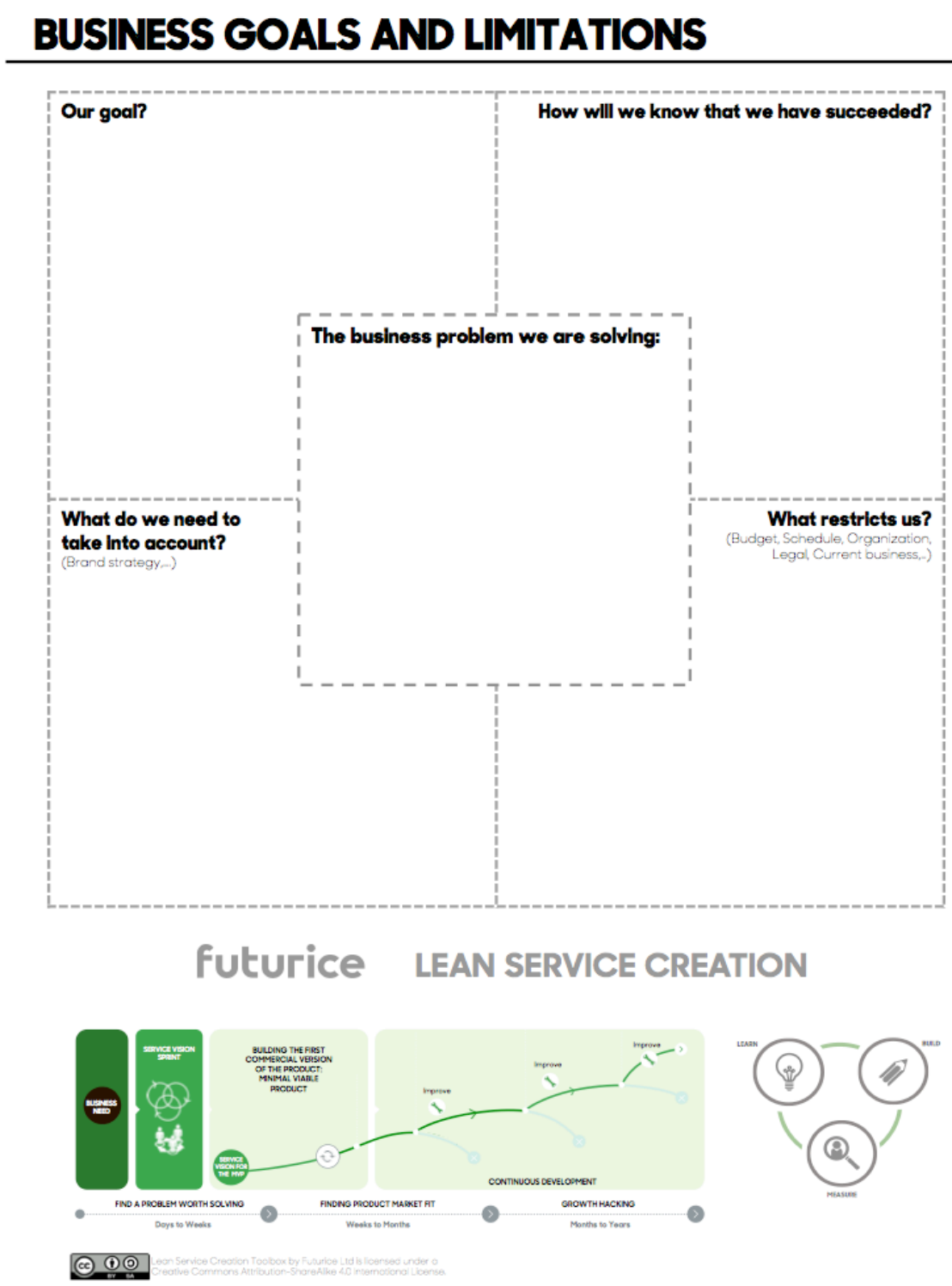


Figure 10. The Business Goals and Limitations Canvas. The first canvas in the methods process, asking for the business problem to be solved.

3.3.3 The LSC Procedure

The Lean Service Creation process follows some predefined procedures. These procedures are facilitated by a person making sure the group stays on track, follows the set time limitations and doesn't stray of and get stuck by the questions stated on the different LSC canvases. The facilitator may also assist the group in interpreting the meaning of the canvas's questions.

In the beginning the LSC canvases are placed on top of each other on the table. The participants are asked to sit around the canvases without looking at them before they are given permission by the facilitator. At first the facilitator welcomes everyone to the event and lets the participants introduce themselves. Then the procedure of the process is presented by the facilitator. The main rule is having one silent minute before discussing the content of each LSC canvas. This minute is measured with an hourglass, which makes the minute visual for the participants. During the quiet minute the participants may look and read the canvas and make their own hand-written notes on sticky notes. When the minute is up the group can begin to discuss the canvas and address the questions it asks.

During the Innovation Boot Camp, each canvas is given 12 minutes of working time. This is timed by a mobile phone on the table or projected on a screen in the room. When the time is up the facilitator takes the canvas and fixes it with some tape to the wall, for everyone to se. And the next silent minute commences. This way the process is carried out and the canvases begin to direct the work and thoughts of the participants.

The method and the procedure are intertwined by the work with the LCS canvases. A positive and open mind set must be stressed and no mobile phones are suggested to be used. Different coloured sticky notes and markers can come to represent different individuals or different thought patterns. There are no rules how the work is done during the given 12 minutes as long as the process continues to flow and the questions get answered.

3.4 Data Analysis

The research material, qualitative to its nature, is gathered during the Innovation Boot Camp in two different ways. **The first,** being in the form of the LSC canvases filled out by the participants. **The second way,** is by recording the discussions carried out by the participants during the whole process. The material will not be processed or altered in any way, but function as a analyse ready research material in its original, unaltered form. After the Innovation Boot Camp, the canvases will be photographed and together with the sound recording of the event be copied to a cloud service, for security and easy access.

The research material will be analysed by **thematic content analysis,** with the goal to discover common patterns across the research material. The process of the analyse will take the following order:

- Getting to know the material by studying it and listening to the recording
- Labelling the material according to relevant canvases and questions
- Searching for themes and broader patterns of meaning in the material
- Reviewing themes to make sure they fit the material
- Defining the themes and insights
- Report the findings with quotes

Since the LSC method is deductive to its nature, funnelling ideas into a single service concept, it might be argued that a separate analysis of this deductive process could find alternating final outcomes. It can also be argued that the path and the discussions leading to the final service concept is equally as important as the final outcome itself. One of the reasons for selecting the LSC method was the convenience of having a well-structured material produced by the informants themselves. The recording brings depth and context to the written material.

3.5 Discussion of The Method

The reliability, credibility and study limitations of the research is pending on several challenges with: time, little back ground knowledge of the participants, the facilitators inexperience with the method and the fact that the research is conducted in a simulated environment and not with real customer. These challenges and in part also opportunities will be tackled prior to the Innovation Boot Camp, but might never the less arise questions of the research credibility.

Time is a limiting factor for the workgroup's success. According to the LSC method a complete process with several iteration cycles could take from days to years. This means that the half day long innovation boot camp might not fulfil the minimum requirements for creating a service concept with the LSC method. There is tough a smaller entity called a ***Service Vision Sprint,*** which is consistent with the half day of joint innovation work the group was able to come together. So, in order to fully develop the created service several of these Service Vision Sprints would be needed to take place.

The workgroup not having enough background information about Iceye's operations and systems can be tackled by having a presentation about Iceye prior to starting the work with the LSC canvases. Here it would be beneficial if Iceye's own AIT engineer would give his input. The facilitators little experience and training with the method might impose several challenges with keeping time, staying objective still maintaining the focus of the group and simply not understanding what parts of the process is the most vital for the process. This will be compensated by carefully following the Futurice LSC canvas Handbook with instructions and trusting the process of the LSC canvases. In the end it is the workgroup that is doing the actual innovation and service creation work. It is hard to predict the dedication and dynamics of the group, but the gender and age composition might be too homogeneous. This might have some positive sides, having the same language and references for discussion, but having women and representatives of older age groups would most likely bring the groups work closer to the level of a real business engagement situation?

4 THE RESULTS OF THE INNOVATION BOOT CAMP

The results of the research, conducted in the form of an Innovation Boot Camp, following the Lean Service Creation method are here presented. The primary result is the actual service concept created through the Lean Service Creation method, together with the questions and answers leading up to the final service concept. This data was gathered on the LSC canvases. The secondary results consist of the insights and discussions related to the work with the LSC canvases. Explanatory comments, arguments and other findings the group members expressed verbally during their groupwork. This data was gathered by recording the entire Innovation Boot Camp.

These LSC canvases were used at the Innovation Boot Camp:

1. Business Goals and Limitations Canvas
2. Immersion – To know where you are and build on top of others work.
3. Data – Know your numbers and facts.
4. Segmentation – Choose who you aim to serve.
5. Ideation Canvas
6. Concept and Value Proposition Canvas
7. Profiling the Concept – It's time to face the wet blanket
8. Minimum Viable Product – nothing but the essential

During the process two canvases where skipped, when time was running out. These where the: **The Customer Engagement Canvas** and **The Business Model & Market Size** canvas. Skipping the Customer Engagement Canvas, asking how do we make people advocate the service, did arguably not affect the final outcome of the service creation process, but would have been beneficial to iterate from a marketing point of view. The same goes for the skipped Business Model & Market Size canvas, covering overhead costs and earnings before interests and taxes. The data needed for the canvas was not available, and the canvas had more of a limiting role than an innovating function. Hence it can arguably be stated that skipping these two canvases didn't affect the creative or innovative work of the service creation process.

4.1 Results

Here follows the presentation of the results and the abbreviated renderings of the gathered material. Each Lean Service Creation canvas, used during the Innovation Boot Camp, is presented with its corresponding main questions and the groups answers. Further depth and context are added to the answers, extracted from the group's discussions captured on the audio recording.

The Innovation Boot Camp started with a presentation of Iceye and the capabilities of the planned SAR satellite swarm. This was done in order to speed up the innovation process and even out the know-how gaps within the group. The main points of the presentation, was that the company has planned to launch 21 satellites in the near future and that they would have the capability to capture the whole world every second hour. They have the capability to see through clouds and in total darkness, but with the proposed resolution of 3 meters, objects smaller than a car would most likely not be seen.

4.1.1 Business Goals and Limitations Canvas

Following the Lean Service Creation method, the group started their work by formulating a business problem they would need to solve during the process. The problem was written down in the form of a question: ***"What business problems can we solve with Iceye's data?"*** This initial question, open to its nature, gave a certain direction to the groups work from the beginning and guided the work throughout the different iterations with the LSC canvases.

Supporting questions stated on the canvas included: "Our goal?" and "How will we know that we have succeeded?". **Regarding the goal**, the group answered: *"Solve one problem that will benefit/impact one or several stakeholders, which can be translated in to a business plan."* and *"Provide easily accessible data and/or information to encourage experimentation (and serendipity)"* and also *"Finding companies that needs data/processed data"*.

Regarding, how we will know that we have succeeded the group answered: *"First point of success is validation of solution"* and *"We are known throughout our potential stakeholders"* and *"Top 3 organic publicity in tech blogs/publications. Thought leader"* and also *"API/SDK popularity in selection in similar services/offerings"*. API, stands for application programming interface and SDK stands for Software Development Kit.

The canvas also raised two restricting questions. "What do we need to take into account?" and "What restricts us?". To these questions the group answered, *"Availability of the data"* and *"Multihoming, re-participation to tech / logistics platforms (Risk management)"*. Multihoming is a term for connecting a network to several networks. The group also answered that, *"Legal issues related to critical use cases"*, *"Financials"*, *"Technology, we can't measure everything that would be interesting"*. The Business Goals and Limitations Canvas also spurred discussions about succeeding in general.

4.1.2 Immersion Canvas

The second canvas facilitates the group to think of where they stand, and also tries to help the group to build on top of others work. The canvas begins with the question, "Your best guess of the customers problem", to which the group answered: *"My best guess is that the customer doesn't know the problem yet", "Outdated data", "Low cost of providing explorative stuff" and "Maritime safety and security"*.

Asked to state the hottest start-ups the group listed: "*Planet, Terra Bella and Orbital Insights"*. Asked how current business could be disrupted, the group answered: *Drones, New Technology, Commercialization of military resources, Airline operators, worsening geopolitical situation lessens the desire to use open systems.* Additional questions asked on the canvas was: Inspiring services & products, to which the group answered, *"Google Maps" and* public debate around the topic, was answered shortly*: "privacy"*.

At this stage we can clearly see the group has focused their thinking to explore the phenomenon of SAR data, and recall what they know about satellites, data and different applications thereof. Also, the fact that most Finnish men attend the defence forces and

no women was present in the room, led to army related answers which potentially could have been broadened to other applications with female participants.

4.1.3 Data Canvas

The third canvas, asking for numbers and facts, consisted of six fields with questions. For convenience the groups answers have been placed in the table below. At this point critical voices where raised toward the method. Some in the group felt there wasn't a tangible problem to solve or the business problem was to wide. This might under the circumstances be considered a natural reaction to the ambiguity of the process, and the participants not having the ready answers, but being forced to guess, improvise and discuss.

What data do we need? • Number of companies currently utilizing satellite data • Governmental legal or other restrictions or regulations • Customers • Market potential	**List the relevant data sources:** • Automated data analysis / target acquisition • Marine shipping industry • Meteorological institutes
Key findings of users from DATA. • What kind of specific problems do end users have • Average size of organizations using satellite data would be (good) to know.	**Key opportunity related to the users:** • Get the data market concept to finally working
Key findings of our and others business based on the DATA. • No answer was provided by the group	**Key opportunity related to the business/ competitors:** • Fastest adaptability / pivoting • Lobbying in the EU, open/closed data due to the privacy issues • Space traffic management

Overcoming the negative thoughts and dealing with the vagueness, segued the group into a discussion about selling data. Having open API tiers, and the difficulty of building working market places for selling data. The discussion also led to talks about the

difference between distinct data-sets. For instance, selling the satellite image of a harbour or giving the number of ships currently in the harbour. The group emphasized that providing an open API playground with historical data, could lead to serendipity and the accidental discovering of new services.

4.1.4 Segmentation Canvas

Segmentation – Choose who you aim to serve.
The group found a rage of different segments or potential users of the proposed SAR data. They also identified some common issues shared by all the user segments. These were: "*Lack of understanding of the uses of the data. The reluctance to share own data assets (especially incumbents) and the need to plan with the data"*.

The segments identified listed: *tsunami warning, sea level height monitoring, earth quake prediction geology, infrastructure, logistics, mining industry, intelligence spying, rogue states, environmental organizations, insurance companies, academia, surfers, meteorology, space industry and traffic surveillance*.

According to the process the last step of the canvas would have been be to interview a person representing one of the identified segments. This step was skipped due to time limitations and the feeling of not having a natural or real representative in the room.

4.1.5 Ideation Canvas

Following the LSC process the group was asked to first fill out the internal sphere, shown in figure 11, and then brainstorm to find large and small ideas. The process asks for insights from the segment interviews, but since the group did not carry out any interviews the material for this canvas came from the groups other discussions carried out during the process.

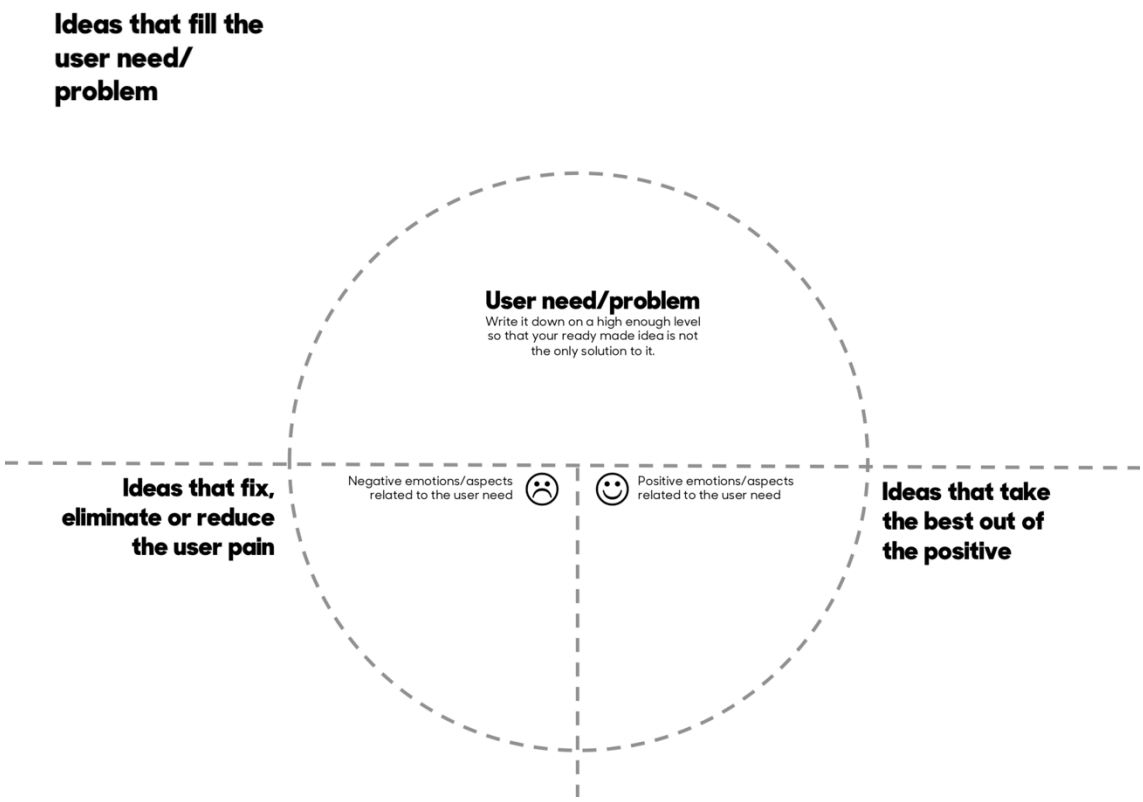


Figure 11. Part of The Ideation Canvas, showing the layout of the central questions.

The group continued to struggle with the ambiguity of the process. Asking themselves who they are and represent. And also wondering what the user needs or problem is. *"What business problem can we solve with Iceye's data",* was the initial business problem the group set out to solve. But working with the LSC canvases the group felt the problem started to have the characteristics of an opportunity rather than a problem.

This led to a critical analysis of the method by the group, saying that the method is good for a linear development of toothpaste or ball bearings, where the problem is tangible. But not so useful for platform or opportunity-based service creation. One group member expressed this in the following way:

> "I am starting to understand what there is to be fixed in this Futurice (LSC) model. This is created for solution creation. And a platform is not a solution, it is a solution platform where other people create solutions." – group member

Despite the groups, at this point, low energy level and the expressed criticism toward the process, the group continued to write down their answers and came to the following ideas and features. The main field, the top of the canvas inner circle, *User need/problem,* was left un answered by the group. This proves to show how difficult it was for the group to define the problem they were trying to solve. And how important it would have been to interview representatives of different customer segments, to find their needs and problems.

The group finally came to recall the examples of potential usage, provided by Iceye on their website: *monitoring illegal fishing, oil spills, storm damage, forest growth, monitor crops growth, storm damage, pest movements, assisting efficient harvesting, monitoring ports.* And the features of the satellites themselves: *can see in darkness, can see through clouds, has a fast refresh rate and makes accurate altitude measurements.* Repeating these potential use cases, encouraged the group to continue with their work on the selected path.

Again, military applications came to discussion. Monitoring "silent" aircrafts and strategic area surveillance was written down. Ukraine farmers Tweeting about tanks in their fields and people sharing information about ships passing the Bosporus. Crowd surveillance and crowd intelligence, was discussed in the context of a missile launcher driving on small roads in Ukraine, was mentioned:

> "If nobody has enough data in order to form a situational picture. But, if you have several people that can access different data sources, and then you can combine. And you know who to trust. Then you can create a pretty good situational picture of what is going on in a battlefield. Whether that is a business battlefield or an actual battlefield." – Innovation Boot Camp participant

Table 10. Lower Part of The Ideation Canvas.

<table>
<tr><td colspan="2">Ideas that fill the user need / problem
Increased accuracy of topography maps
Strategic area surveillance (military)
Spying on your competition
Making it easy to combine data
Integration to AR systems (e.g. shipping & ice)
Monitoring “silent” aircrafts?</td></tr>
<tr><td>Ideas that fix eliminate or reduce the user pain
Fast & inexpensive playground (SDK/API)
Co-operation with data cleanrooms</td><td>Ideas that take the best out of the positive
Cases demonstrating social value
Case gallery
Im amount of possibilities to collaborate with other firms</td></tr>
<tr><td>☹ Negative emotions/aspects related to the user need
Lack of knowledge / people to prototype new solutions
Loss of privacy
Loss of data control</td><td>☺ Positive emotions/aspects related to the user need.
Feeling of knowing more</td></tr>
</table>

Some of the answers that stood out from the material was the comment to make it easy to combine data and providing fast & inexpensive playground for developers with SDK and API.

4.1.6 Concept and Value Proposition Canvas

The concept canvas led to a lengthy discussion about block chain and crowd funding the satellites and their data. It was suggested the SAR data could be sold on a marketplace based on block chain technology and additionally controlled by bitcoin (DAO).

Table 11. The Concept and Value Preposition Canvas Q&A

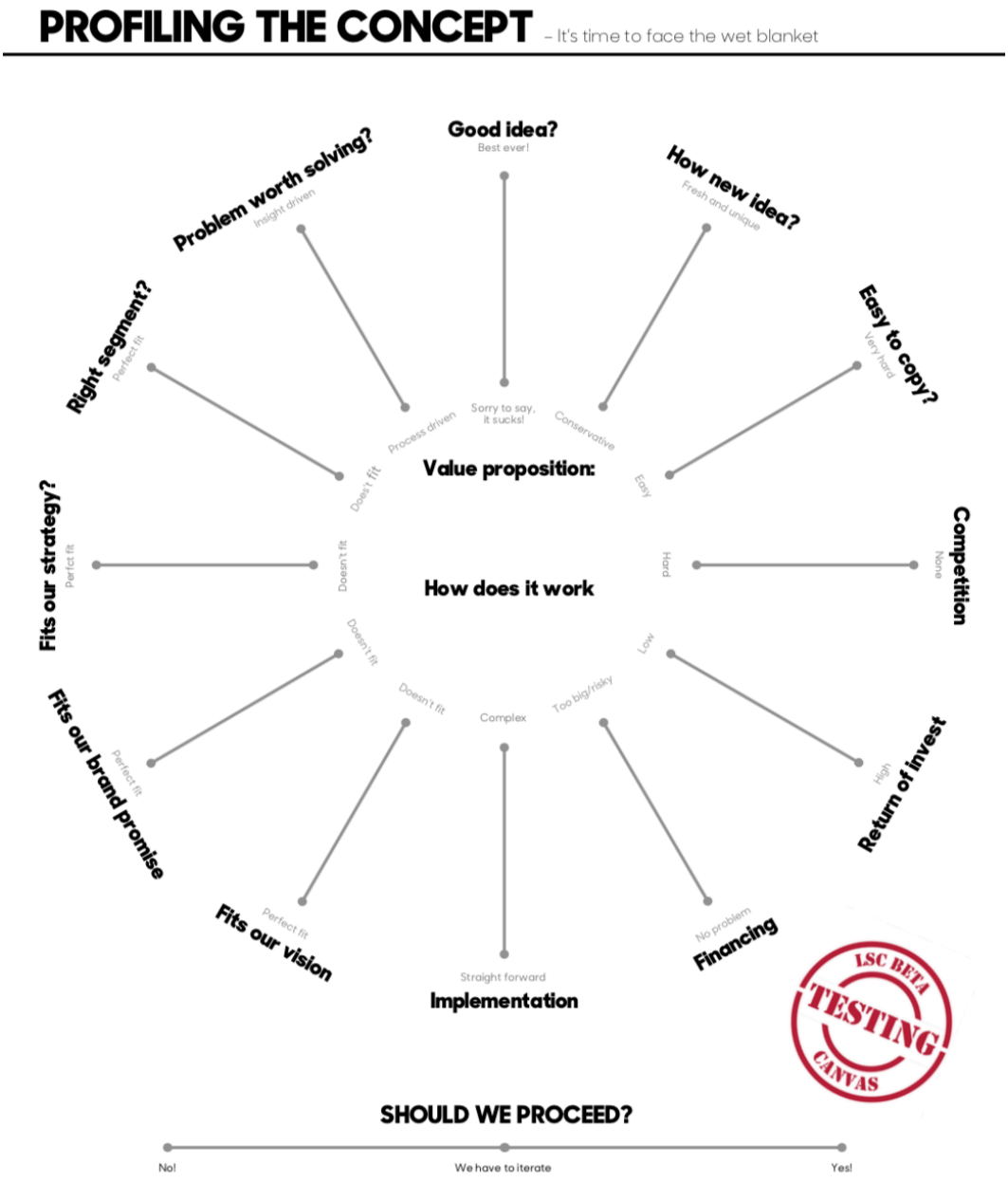
Concept name? Marketplace. Near real-time satellite imaginary as a service.
How does it work? On demand data-set marketplace Automatic drone navigation system (z-index & topography) Buy a piece of the sky. Different levels of data processing? Look after your assets (surveillance)
What differentiates it from other solutions to the same problem? Data speed and accuracy. **Value to our business.** Track the changes so you direct traditional satellites.

The group continued by brainstorming around topics of sea level monitoring, selling different data sets for different prices and combining data for future drone navigation systems and EU regulatory certificates. Also, insurance companies where mentioned as potential customers. During the iteration of this canvas the group had a keen discussion of combining different data streams.

> "We can combine data with other companies, or we can combine some data that we already provide. So, could there be some added value for giving some tracking device to some people, companies, enterprises? And then by combining that data with open data from the sky, you get something more. Or even better, you can standardize technology and provide the SDK's to do the combination." – Innovation Boot Camp participant

4.1.7 Profiling the Concept Canvas

When the group came to the Profiling the Concept canvas, they had two value propositions. One was written down on a red sticky note: “Provide the most recent “DIFF” information about the earth surface”, the other was written down on a yellow sticky note: “Marketplace. Satellite IMG and selected data sets”. The canvas questions were answered and the result was that the differences of the world got a better result, so the team continued with that value proposition.



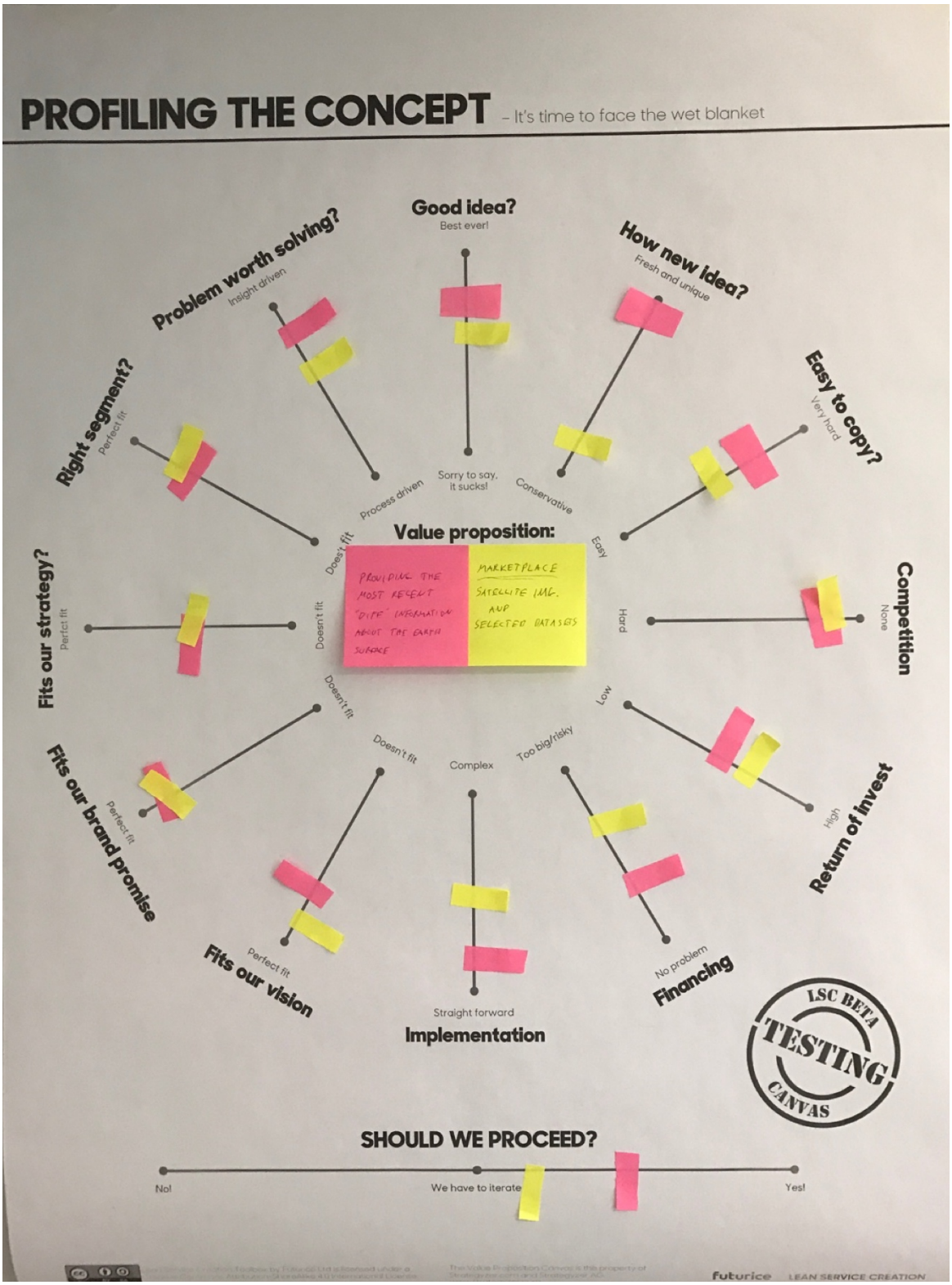


Figure 12. Profiling the Concept canvas filled out by the Boot Camp Team. The scale at the bottom "Should We Proceed", shows the differences of the world to be furthest to towards "yes". (Image by the author, 2017).

4.1.8 Minimum Viable Product – MVP Canvas

The initial question: "**What business problems can we solve with Iceye's data?"**, was answered, on the minimum viable product canvas, in the form of a service. The canvas asks the questions: *What is in the MVP* and *what is not in the MVP?* The new service or minimum viable product MVP, created by the group, was divided into two product categories. One free service and one paid service.

The free service was stated as following:

> **"Highlighting the differences on Google Maps (Heat map with before / after images)"**

This translates into "Diffs of the world", as the group called the service. A new feature or new service on top of Google Maps that would highlight changes in the terrain. Changes would be highlighted with a heat map showing were something has changed, with before and after change images. The information could be provided as a layer on top of Googles maps or as an integrated service with Google as a partner. In the free version no analyse would be provided. The groups paid service, followed the same idea, but with more elaborated integrations to Google Map's services. The service was described by the group as:

> **"Provide rough location alert"**

This translates into a decision support service that could for instance give maritime ice warnings for ships and oilrigs. These short service descriptions were further elaborated by the MVP canvas deepening questions. The table below has a full rendering of the relevant data.

Table 12. Group answers to the Minimum Viable Product canvas. Initial abbreviations have been spelled out and capital letters converted to sentence form.

What is in the MVP?	**Ask Why**
Free: Highlighting the differences on Google Maps (heat map with before / after images) **Payment:** Provide rough location alert	Focus on core solution. Not features. Keep it simple.
What is not in the MVP?	**Ask Why**
Push notifications. Any interpretations.	Fast to produce, keep costs down.

The team initially pursued two different services, but towards the end selected the service presented here under in the chapter Primary Results. The service which was not selected for further development was a market place for SAR satellite images and selected data sets. This service will in real life most likely be part of Iceye's core services, but the group decided to go one step further and refine the SAR data to a new service.

4.2 Secondary Results Summary

During the teams work process, several insights about the SAR data phenomenon was noted. One was that mixing different data streams is one way of creating new services. Another was knowing in depth the systems and sensors capabilities helps to understand and invent new services. The team struggled for a while to understand what the satellites will be able to see and not see. The team wanted toward the end stress that it is important to validate the created service and invent feedback loops with internal and external partners. Finally, the team also noted that the satellites can be seen as an ever-evolving platform for Earth Observing EO sensory, with an endless amount of sensor and application combinations. By benchmarking and studying what has been done before would speed up the innovation process and hinder the team from inventing services already in development or use. Here the branch specific expertise of the development team is key. And it is arguable that the composition of the group determines strongly the

outcome of the innovated service concepts. Simulated problems might therefor lead to simulated results, and "real" challenges with all its inherited context, viable solutions. The group also discussed pivoting and abandoning concepts and company strategies. And marked that it is easier for a startup to do so, but hard for a cumbersome large company to risk everything in the pursuit of a totally new market position and strategic angle.

4.3 Summary of The Empirical Research Results

It can be stated that the empirical research, which had elements of experimentation, was successful. Needed data was gathered and sufficient material was generated for analysis. **T**he group participating at the Innovation Boot Camp, created a new service concept using the Lean Service Creation method. The service concept created by the team, can be described as a heat map or visualized SAR data layer on top of Google Maps. This new layer would highlight changes in the terrain. For a payment, rough location alerts could be provided to aid ships in icy waters. The team also noticed that mixing data streams is one way to create new services. And that knowledge about the systems provided by Iceye is vital for understanding and creating new services. The outcome of the LSC process was regarded by the team as simple or crude.

5 ANALYSIS

The aim of the research was to explore potential applications of Iceye's satellite data. Investigate how Iceye could value co-create services with potential customers and what implications this data usage could have on Iceye's operations and businesses. The research was carried out in the form of an Innovation Boot Camp, following Futurice: Lean Service Creation method. The material gathered during the Innovation Boot Camp presented themes, topics, suggestions and answers in correlation to the stated research questions.

RQ 1. What kind of decision support services could be developed from Iceye's SAR data?
RQ 2. In what way could Iceye value co-create services with potential customers?
RQ 3. Does Iceye's SAR data influence their business network?

The research questions are related and intertwined, but will in the following analysis be answered and elaborated in three separate chapters. The research results, stands as a common repository of the workgroups insights and opinions from the Innovation Boot Camp. It functions as the base for the **thematic analysis**, that branches of to answer the research questions.

The research questions have been divided into three separate themes: big data & analytics, value co-creation and business networks. During the analysis key findings, also presented in the results chapter, are thematized and studied from different angles through the triad of: theoretic references, research results and the workgroups and authors insights.

The research material and results cover a broad spectrum of phenomenon and themes. Within the limits of this work, it will not be possible to deeply analyse all presented themes, but rather present interdisciplinary generalizations. These thoughts or insights might well come to describe the workgroups and the authors homogenic world views and limited knowledge, rather than pioneering solutions and innovative paradigm shifts. The Finnish startup scene is rather young, lacking to some extent self-reflection and criticism. Certain generalizations about digitalization are taken as truths, and many in-

stances are proclaiming to represent the right way or the only way to innovate. This said a diverse workgroup with representatives of both sexes and from different age groups would most likely have contributed to a broader variety of ideas solutions and opinions.

5.1 Services Based on Iceye's SAR Data

RQ 1. What kind of decision support services could be developed from Iceye's SAR data?

The first research question has much in common with the root challenge the group set out to solve during the Innovation Boot Camp: ***"What business problems can we solve with Iceye's data?"***. It is arguable that solving business problems with SAR data defines the kind of services that would be feasible to develop. A business problem can be seen as a monetary motif to develop a new service, whenever it is viable.

According to the literature selected for this thesis, the SAR data gathered by Iceye's future satellite swarm, fulfils the definition of big data. The fully operational swarm of Iceye's satellites, will at any given time output a large amount of data. It will have a high Volume, high Velocity and/or high Variety, bringing Veracity to its users. This will create value for the users in different ways. According to (Davenport, 2014, p. 22) the value of big data can be divided into three classes: cost reductions, decision improvements and improvements in production services.

Lacking a business problem that would need the immediate assistance of SAR data, the group moved on to work with the obvious selling of satellite data and images. Suggesting an online marketplace for satellite data. After some iterations with the LSC canvases the group finally flipped their idea to not selling images at all, but the differences between the satellite images in time. Through this paradigm shift the group invented the concept: "The differences of the world". This data driven service would render a heat map layer on top of for instance google maps. Showing what has changed since the satellite last flew over the area. The groups suggested paid version of the service, would provide rough location alerts for the shipping industry. Warning about icebergs or incoming vessels.

Working with these data driven services gave rise to further insights, of which the **concept of merging data** was an important finding by the group. By merging data streams from other sources, for instance IoT devices, totally new services could be developed. In that way the data mix could contain SAR data and local data streams on the ground. Merging data is potentially more valuable, than optimizing the data gathering of one single data stream. Data, which is related to each other in some way, is more likely to bring value than merging random data cf. (Davenport, 2014, p. 197). An example of this are wearables which uses: global positioning satellites together with the watch internal barometer to determine user altitude. With the additional data of Iceye's topography readings the altitude could be determined more accurately, paving way for future autonomous drone navigation systems. The GPS gives the position, the laser in the drone's belly gives the current altitude and the SAR data maps could warn for incoming higher terrain and obstacles out of reach for the drone's onboard radars and sensors.

What comes to ice monitoring, SAR data could be merged with Upward Looking Sonar (ULS) data, to create ice situational reports with ice thickness and ice coverage data. This data could be displayed together with a ship's location and vessel on-board data in an augmented reality (AR) or virtual reality (VR) wheelhouse or cockpit. By showing data about ice thickness in real-time an avoidance system could be utilized together with a service of suggesting optional routes.

The work group also came to the insight that Iceye's **satellites can be seen as an ever-evolving platform for Earth Observing (EO) sensory**. Making the combinations of potential usage very broad. The group decided how ever to stick with the SAR sensory data, since that was the given task. This insight never the less portrays the versatile potential the satellites have and is not to be diminished or overlooked when new satellites are commissioned and built. The SAR sensory could be the service which pays for the overhead costs but could potentially be supplemented with additional EO sensors and features, broadening the array of future revenue streams.

The insights presented by the workgroup, follows to some extent the development of analytics 3.0. Where we can see that services are shifting from descriptive and predic-

tive services to prescriptive data driven “answers in advance” services. It is arguable to say that Iceye’s SAR data, is generated for **decision support services**. The decision might be as simple as turning right or left or giving the number of large vessels between Iceland and Norway corresponding to the ship transponder data and coastal radar information. Some decision support systems rely on fixed data sets where others rely on a combination of structured and unstructured, internal and external data merged in a constant flow of updated data, supported by a robust infrastructure. Services based on **Continuous Analytics as a Service (CAaaS)**, in combination with Artificial Intelligence and machine learning, accessed from a mobile device might be the future of services developed with Iceye’s SAR data?

These different services that potentially could be developed from Iceye’s SAR data, portrays well the variety and kind of services that could be developed from Iceye’s data. But, it is more meaningful to find common traits in these services then trying to list them. That list would be very long. Yet fail to consider the most important services, the ones that hasn’t been invented yet. In the next chapter we will take a look at the circumstances that could give birth to new innovative services.

5.2 Value Co-Creating Services with Potential Customers

RQ 2. In what <u>way</u> could Iceye value co-create services with potential customers?

A famous quote, truly or falsely credited Henry Ford fits well the innovation work that lies ahead of Iceye: "If I had asked people what they wanted, they would have said faster horses" (Vlaskovits, 2011). In the beginning, the LSC method facilitated the group to think of where they stood, and tried to help the them build on top of others work. The second canvas asked: "Your best guess of the customers problem", to which the group answered: *"My best guess is that the customer doesn't know the problem yet"*. To develop and sell a product not yet imagined calls for a long-term commitment to a complex development process. Innovations is said to emerge through longer interactions (Håkansson & Olsen, 2012). A network process that will take pragmatic problem-solving as well as out of the box thinking to finish.

In what way could Iceye then find that something which isn't a faster horse but an automobile? Iceye must find a way to hand out well defined value prepositions or seek ways to co-create value. During the Innovation Boot Camp, it was noticed that in depth knowledge of Iceye's satellites' capabilities and systems was vital for the creative thinking of the group. This suggests that Iceye should share or even teach their potential customers about their systems and future capabilities, in order for customers to understand what is possible to do with SAR data. This sharing should be done through different channels and on different levels. Taking form of lectures, research paper publishing events, panel discussions, networking events and marketing communication. In the same way should also Iceye get to know their potential customers in different ways. This mutual learning is underlined in the customer-dominant logic (CDL) of service, were companies strive to get involved in the customers context (Heinonen & Strandvik, 2015). This is well visualized by the value creation spheres put forward by (Grönroos & Voima, 2012, p. 141) in chapter 2.2.1.

When potential customers have been identified and mutual interest awoken, value co-creation work could commence through different workshops, innovation boot camps and hackathons. But also, through crowdsourcing (Saarijärvi, et al., 2013, p. 16). In practical terms this means that by applying a method like the Lean Service Creation method, the provider and the customer can jump value creation spheres and meet in the middle in a joint sphere, where value creation in interaction can take place. It is here in the form of a merged dialogical process that value is co-created with the customer (Grönroos & Voima, 2012, p. 141). This way the size of the involved companies does not matter and value co-creation work can be carried out on a more equal level. Instead of having a customer vs. provider setup workshops nourishes network thinking and an exploratory atmosphere. This helps the participants to deepen their relationships and faster get over themselves.

During these workshops a mutual learning process should take place where the representatives of Iceye could learn about the customer's needs and data and systems. Selected potential customers could then start to lower thresholds and diminish friction to co-create value. By merging data, or innovating new ways to harness the SAR data could be the starting point for a joint operation with a potential customer, where Iceye would together with the customer explore resources that could solve the customer's needs or challenges. These deepening relations and business networks could in time bring fruit and develop into interdependencies: relationships in different forms dependent on each other.

> "The immediate managerial consequence of interdependency is to acknowledge the innovation project's dependency on others. Entrepreneurial success depends on others who are never fully controlled by the single actor, nor perfectly adapted to fit to the innovation project." (Håkansson & Olsen, 2012, p. 95).

Having found the potential customers and learned to know them through interviews and workshops the next step would be to make some sort of Minimum Viable Products (MVP). Prototypes that would have the essential service frame plotted out in order to validate a possible end product and the value in use it proposes.

In order to proceed and foster the right kind of climate for this type of development work, Iceye would need to develop their contacts with their business networks on two levels: on a technical and interpersonal level. The Innovation Boot Camps workgroup found it important to: "Provide easily accessible data and/or information to encourage experimentation (and serendipity)". This means providing the right tools for the customer's developers to easily start exploring, learning and developing with SAR data. This could be done in many ways by providing sandboxes, open API's, free SAR data sets, and easy access to multi cloud computing and analyzation services that would pave way and speed up iteration cycles for new products cf. (Davenport, 2014, p. 201). Also assisting with SAR image analyzation libraries for teaching AI to recognize objects and materials like snow, water and metal would be beneficial.

> "These activities generate "waves of new innovations" occurring at the interfaces between systemic "interaction technologies" and numerous networked business innovation and economizing processes. (Håkansson & Olsen, 2012, p. 98)

This data work should according to big data theory, bring: "cost reduction, decision improvement and improvements in production services" (Davenport, 2014, p. 22). The share **volume** of Iceye's future data might in the future save money when there is more EO information at hand. Also having more data should improve accuracy on different levels. There could also be found new data sets, something we don't know about, within the data Iceye is gathering. The speed or **velocity** of the data flow might also save money, when faster decisions are made. And, having a **variety** of data streams would bring more options for future near real-time data-based services.

It is also worth mentioning standardization of data and data delivery. By taking part of different international standardization processes Iceye could stay ahead of the SAR data business, by "dictating" the right kind of data and delivery standards. Even if Iceye's satellites lifecycle is rather short, opening up for fast modifications and new satellite models, it is still important to meet the customer's technical needs and systems now. Not only in the future.

Delivering easy access to good data, without taking care of relationships, can only get Iceye so far. Joint value co-creation ventures and prolonged development processes gives birth to friction. Utilizing a **Customer Success Manager** to build trust, remove friction, maintain momentum, develop relations, update information, coach & mentor, assist with onboarding of projects, and facilitating customer meetings and workshops would be highly recommended. Also benchmarking and sharing different user cases would communicate potential usage. Her also a feedback loop would be important to set up allowing for customers to come with feedback and suggest changes. Iceye's future customers might have pressure to gain fast results and ROI, when Iceye might prioritize developing their satellite platform and future fleet sensory capabilities. There is only so much room on-board the satellite and deciding which customers will get their particular preferences or setup acknowledged might need hard diplomacy.

To sum up this chapter, one could say that staying on the same side of the negotiation table as the customer, by co-creating value assisted by methodologies like the LSC method is highly recommended by the research. In the case of Iceye, this might in the future translate or develop into to service-oriented decision support service based on an elaborate operation of continuous analytics-as-a-service (CAaaS) production. Consisting of a custom-made mashup of sorted and unsorted, internal and external data streams and services. Churned by powerful cloud computing, machine learning and artificial intelligence systems in a global network of satellite antennas and servers, read from your mobile device. Grönroos & Voima, acknowledges that value creation often takes place in a context of networks, but does not elaborate on it further with the risk of complicating their article (Grönroos & Voima, 2012, p. 134). In the next chapter we will have a look at this business network and how Iceye's own data influences their business network.

5.3 The Data in Iceye's Business Network

RQ 3. Does Iceye's SAR data influence their business network?

Iceye is situated in a business network. This network has been formed through the interaction with other companies, but also with organizations, universities and individuals. They have formed relationships in the different ARA layers and become intertwined

with some service providers. This business network supports each other by providing services which Iceye wouldn't manage without. These services consist of technology suppliers, launchpad operators, global antenna networks and servers to mention a few. The sum of this quasi-organization, that makes up the Iceye services, is greater than the actors' separate elements. Making it possible for Iceye to perform activities which they could not perform on their own cf. (Håkansson & Snehota, 1995). This is a school book example of the ARA model in use.

The technological development and digitalization have reduced the price of the services provided in the business network, and made it possible for Iceye to build their service on top of others. This price reduction is funnelled through to Iceye's customers, who in a disruptive manner are offered affordable SAR data. Linking this disruptive service together with others, might pave way for totally new services which hasn't been feasible to develop before due to their high price. This is one example of the interdependencies of technology in the business network, that is strongly linked to the specific context of Iceye's business. According to the ARA model, it is important for Iceye to have a look at their business network and analyse it from a point of: "technology, knowledge, social relations, administrative routines and systems and legal ties" (Håkansson & Snehota, 1995). Changes in the business network might affect Iceye's operations and services dramatically. This can happen through company mergers, bankruptcies or problematic legislation. At the same time Iceye might not have fully developed their company relationships due to neglect or not seeing the possibilities in their own interdependencies and business network cf. (Håkansson & Snehota, 1995, p. 34).

Generally speaking, Iceye's product is data. But, that data can be refined in different degrees. (I will not discuss the satellites as a platform here, since the research was limited to the SAR data.) It can be argued that refining the data shifts Iceye's position on the value chain and changes the dynamics of the business network. Not refining the data at all places Iceye in the category of a data gross handler. Refining the data more might provide higher value propositions and move Iceye closer to the end user. It is said that he who controls the end user often makes the best profits. This might even call for Iceye obtaining some of their smaller customers in the future, otherwise not benefitting from the end users service revenues. This is one way how the data influences the business

network and changes the dynamics between the actors. This was discussed by the workgroup in the context of selling data to google or using google maps as an additional data stream or engine for selling additional services through or with google. The groups suggestion was to diversify the data sets and provide a range of different opportunities for their customers, without getting stuck in the gross handler market position.

There is also some data refinement that can be made for Iceye's own direct benefit. For instance, encrypting the data at the satellite prior to transmission in order for organizations and governments to pay for the data instead of stealing it. Or making data noise reduction already in the satellites own sensors and systems to diminish latency and save post processing costs.

Another way the data influences the business network is through its technical requirements. Discussed earlier in chapter 5.1, services based on a flow of data has certain requirements, which the business network must cater to. We are talking about scalability, robustness, standardisation and speed. When the usage of data goes up different bottlenecks will emerge if the infrastructure isn't planned in the right way. This might cause friction in the business network interdependencies and loosen up or cut resource ties in order to find better ones.

It is clear to see that Iceye's data influences the business network in different ways, of which technology is an important level. But, it is also vital to have a look at other aspects of the data. That of knowledge and social relations. The content of Iceye's data might after all carry the largest impact. Millions of people might come to benefit from Iceye's data services that span both land and sea. Technology companies are used to handle vast amounts of data, but unfolding the knowledge from that data for the good of humanity is a team effort.

6 DISCUSSION

Iceye and the phenomenon of SAR data, has proven itself to be an intriguing journey. My personal learning curve during the writing process has often been very steep, which means I have learned a lot. Through the literature, I have come to understand the technological development laying behind the disruptive rampant of digitalization. I have also come to grasp the phenomenon of value and value co-creation. And seen how these can come together to form a new kind of network interacting on different levels and layers in the ARA model. On a more pragmatic level I have had the privilege to study and practice the LSC method with a team of brilliant minds. The results are encouraging. A small team sat out to create a service concept following the LSC model. With no prior knowledge about Iceye and their satellites, the group managed to create a service concept within a few hours: "The differences of the world". This concept has to my understanding now been implemented and developed into a service by Iceye. The company has a functioning proof of concept in space and a satellite platform to build on. Additional funding has been secured in 2018 and the future of Iceye looks bright. Services can more easily be developed now when the first trials have been carried out and rudimental API and cloud services has been established.

What comes to the gathering of research data, Objectivity was not fully maintained by the facilitator/author during the data gathering. This was due to personal result pressure and too little training in the LSC method. I commented and led the discussion at some points, which might have influenced the process. The ultimate setup would have been to facilitate an Innovation Boot Camp where the participants would have consisted of three teams made up of Iceye's personnel and potential customers. This way the internal knowledge would have served the purpose to the fullest. It would have been beneficial to have representatives of Iceye's potential customers or external experts in SAR satellite data present at the Innovation Boot Camp. Unfortunately, Iceye wasn't willing to share the information who they had preliminary negotiations with and despite an effort of attracting members from the Horizon 2020 SPICES team, (Space-born observations for detecting and forecasting sea ice cover extremes), none of the involved had the time to participate. As a clarification, one of Iceye's personnel did attend the workshop. Al-

so, a panel discussion after the Innovation Boot Camp would have nicely brought all the findings to a full circle.

History shows that the development of big data and analytics follows a certain direction. It is towards a real-time flow of data and the simultaneous analyzation of it, to mixing of structured and unstructured datasets from internal or external processes. But services relying on this kind of systems and data flux are vulnerable, and might stop working from system problems. Predicted megatrends also foresee unstable times which might create areas that are left out of the technological development of these new services. At the same time are mobile services bridging that very gap, which traditional IT infrastructures might be too slow for.

Through my research I have come to certain insights that might be of use for Iceye. I would encourage Iceye to foster openness in every aspect of the word. Build your operations to support open-source strategies and multi cloud services. Offer API's that are easy to use and integrate with. Provide ready software development kits, SDK's for potential partners and comprehensive sandboxes for learning about your data. Assist developers with their work on object recognition systems by providing enough sample data. One way is to feed all your data to the Google cloud and make benefit of Googles computing power in synergy with for instance the Google map engine. In that environment developers can easily make use of existing API's and a familiar infrastructure.

What comes to creating new services, it has been suggested that the satellite data is placed in a cloud computing environment and merged with some third-party data. With the help of analytics from for instance IBM Bluemix in combination with the Watson AI or Googles services, could something new be created. The hard part of the innovation process is not the technology but inventing the sustainable added value. A service that is dependent and interactive with the Iceye mission API. The most important task for innovating the use of satellite data is to find other data streams that can be linked with the satellite data. The new services can then be built for the service provider of that other data stream, to their target audiences. The final formula might be to research potential third-party data streams and interaction in combination with the ICEYE data.

You are part of a network of companies that make your services possible. This means a lot of people work above you, under you and after you. And all of them are not equally vital for your success. Friction between these business network interdependencies can be lowered by not overrating or underrating partners competences in different co-operations. Communication is always key, and mutual learning is always beneficial. Arrange brainstorming sessions, interview your potential customers, make hackathons and innovation boot camps. Take time to understand people, jump into their sphere of interest. Study your customers and ask them what they need. By taking part in different business, startup and educational networks, you can meet people that might be the missing links in your business network. People that unlock new "blue oceans" in a field not known to you. Make use of trade fares. Make case studies of your own customers to show examples of how to use your services. Have other companies like startups develop services for you, outsource and benchmark. But, foremost be: open, patient and kind.

7 RECOMMENDATIONS FOR FURTHER RESEARCH

This thesis has suggested that the Lean Service Creation method is foremost suitable for solving business problems and perhaps not so powerful when applied on a platform or confronted with opportunities. Research is needed to study how the LSC method could be developed for probing opportunities or developing platforms. Also, managerial implications of value co-creation should be researched, since many papers on the topic ended with remarks of the lack of practical advice for implementation. This research could be supported by further studies in practical innovation management in networked economies.

8 CONCLUSION

This thesis has described how a small team of IT professionals, joined forces to value co-create a new service concept, by following Futurice's Lean Service Creation method during an Innovation Boot Camp. Despite limited knowledge about Iceye's satellite systems and synthetic aperture radar data, the team managed to complete the given task by creating the service concept: "The differences of the world". A heat map that shows what has changed since the last satellite pass-over. The group also discovered the importance of merging data and learning together. The three research questions where:

1. What kind of decision support services could be developed from Iceye's SAR data?
2. In what way could Iceye value co-create services with potential customers?
3. Does Iceye's SAR data influence their business network?

The analysis show that decision support services are most likely the kind of services that could be developed from Iceye's SAR data. This development work could commence through a value co-creation effort, where the customer and the provider would create a joint value creation sphere, and through interaction innovate new service concepts. Iceye's satellite data influences their business network interdependencies in different ways. One, being that of technology but also knowledge and social relations. The content of the SAR data itself, might have the greatest impact by giving global situational data for the benefit of us all.

The results from the study are encouraging and provides a working tool for SAR data related value co-creation work. It is recommended that Iceye and other companies, interested in the Lean Service Creation method try it out for themselves. By mutual learning, innovation and value co-creating, ideas for new decision support services can be found.

9 REFERENCES

Davenport, T. H., 2013. Analytics 3.0. *Harvard Business Review,* December, Issue 12, pp. 65-72.

Davenport, T. H., 2014. Big data at work: dispelling the myths, uncovering the opportunities. In: Boston: Harvard Business School Publishing, p. 228.

Delen, D. & Demirkan, H., 2012a. Data, information and analytics as services. *Decision Support Systems,* pp. 359-363.

Demirkan, H. & Delen, D., 2012b. Leveraging the capabilities of service-oriented decision support systems: Putting analytics and big data in cloud. *Decision Support Systems,* pp. 412-421.

Grönroos, C., 2011. Value co-creation in service logic: A critical analysis. *Marketing Theory,* Issue 11, pp. 279-301.

Grönroos, C. & Voima, P., 2012. Critical service logic: making sense of value creation and co-creation. *J. of the Acad. Mark. Sci. (2013) 41:133-150,* pp. 133-150.

Håkansson, H. & Olsen, P.-I., 2012. Innovation management in networked economies. *Journal of Business Market Management,* 5(12), pp. 79-105.

Håkansson, H. & Snehota, I., 1995. *Developing Relationships in Business Networks.* London: Routledge.

Heinonen, K. & Strandvik, T., 2015. Customer-dominant logic: foundations and implications. *Journal of Services Marketing,* 29(6/7), pp. 472-484.

IBM, 2016. *IBM Big Data & Analytics Hub.* [Online]
Available at: http://www.ibmbigdatahub.com/infographic/extracting-business-value-4-vs-big-data
[Accessed 21 March 2017].

Iceye Oy, 2018. *Iceye Web Site.* [Online]
Available at: https://www.iceye.com/hubfs/PNG-ICEYE-X1-Alaska-Noatak-National-

Preserve-compressed.png
[Accessed 18 February 2018].

Münch, J. et al., 2013. Creating Minimum Viable Products in Industry-Academia Collaborations. In: B. Fitzgerald, et al. eds. *Lean Enterprise Software and Systems.* Helsinki: Springer-Verlag Berlin Heidelberg, pp. 137-151.

Normann, R., 2001. *Reframing Business, When the Map Changes the Landscape.* 1st Edition ed. Chichester(West Sussex): John Wiley & Sons Ltd.

Saarijärvi, H., Kannan, P. & Kuusela, H., 2013. Value co-creation: theoretical approaches and practical implications. *European Business Review,* 25(1), pp. 6-19.

Sarvas, R., Nevanlinna, H. & Pesonen, J., 2016. *Lean Service Creation, The Handbook.* v1.7 ed. Helsinki: Futurice.

Toivonen, M., 2016. *Service Innovation - Novel Ways of Creating Value in Actor Systems.* s.l.:Springer Nature.

Vlaskovits, P., 2011. *Harvard Business Review.* [Online]
Available at: https://hbr.org/2011/08/henry-ford-never-said-the-fast
[Accessed 5 August 2018].