Tampere University of Applied Sciences

Business model evolution

Case study – Embedded SIM

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ABSTRACT

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Telecommunication industry technologies are developing rapidly, which creates pressure for Telecom operators' business models that must be adapted to keep competitive advantage. The purpose of this thesis was to find out how one new technology embedded SIM would effect on operators consumer business. Telia Finland was used as a case study company to be able to conduct research in real business context.

For business model evaluation between scenarios Business model Canvas was used used to visualize and understand possibilities and challenges. Disruptive innovation model was used as a theoretical background for evaluation. The thesis used a Qualitative research approach, where the data was collected through semi-structured interviews Quantitative data from literature and market reviews and will also be used to complement understanding about research topic.

The value of this thesis is to give overall understanding for this new technology implications for business models and identified new business possibilities. Further research would be required for detailed analysis of found topics.

Key words: disruption, business model, new technology, mobile operator, embedded SIM

CONTENTS

ABBREVIATIONS AND TERMS

ARPU	Average Revenue Per User
CPE	Customer Premises Equipment
CSP	Communications Services Provider
DSP	Digital Services Provider
eSIM	Embedded Subscriber Identity Module
GSMA	GSM Association
MNO	Mobile Network Operator
M2M	Machine-to-Machine communication
OTT	Over-the-Top

1 INTRODUCTION

1.1 Thesis background

Telecommunication industry technologies are developing rapidly, which creates pressure for Telecom operators' business models that must be adapted to keep competitive advantage. "The traditional connectivity-centric business model will work only for few Telco's with a low-cost base. The biggest challenge facing the other Telco's is to remain relevant to customers. The classic telco position is eroding due to competition from alternative connectivity providers, IT services firms, and over-the-top providers" (Forrester, Biebel, 2018).

One of new emerging technologies is called Embedded SIM (eSIM), which is a candidate for becoming the dominant design for customer identification in mobile business (GSMA, 2018). Embedded SIM is expected to provide significant business and customer benefits but also changes and potentially challenges or threats for Telecom operator business models. It's important to understand what kind of business scenarios Embedded SIM creates, what are the implications towards customers and the operators' existing business models.

eSIM is a global specification by the GSMA which enables remote SIM provisioning of mobile devices. eSIM was originally made for M2M communications but is now coming to consumer devices like phones and smartwatches as well. eSIM allows consumers to store multiple operator profiles on a device simultaneously and to switch between them in terminal, though only one can be used at a time. Manufacturers and operators can now allow consumers to select the operator of their choice and then securely download that operator's SIM application to any device pre-embedded with a certified eSIM hardware module. Remote provisioning and embedding the SIM to devices in factory means significantly smaller devices can be supported. (GSMA, 2018)

The first companion devices supporting eSIM have already been launched in 2016 (source: Samsung). During Fall 2018 Apple launched eSIM support for iPhones and iPads (source: Apple) as one of key phone vendors and others are following.

eSIM in operator environment will require investments for new technology, totally new processes and will potentially be a major change and a potential threat for the current value chain and business model. One potential challenge with eSIM from operator's perspective is the threat of losing direct sales contact with customers, potentially dramatically affecting operator possibilities in the value chain. The possibility for end user to easily change subscription from device without the need for changing physical SIM is also expected to increase churn among operator customers. Embedded SIM also enables easier access for new global players to enter Telco's business, challenging existing players with new technology and enabling fully digitalized SIM logistics in global scale.

The purpose of this thesis is to study what new possibilities and challenges embedded SIM as a new technology could provide for operator Telia Finland. The thesis will focus on Telia Finland consumer services and value proposal for customers. The research question is how this emerging technology affects operator business models, what are the scenarios and their consequences. Studying this matter is vital for Telia Finland to provide enough data and recommendations for moving forward with this potentially dominating new technology.

1.2 Research topic

According to GSMA, Telecom operators have been providing from 1991 onwards GSM technology-based services for customers where customer identification has been done on a separate identification module called SIM, subscriber identification module. Adoption for mobile services has been phenomenal, in 2018 the number of people connected with mobile technology reached 5.1 billion, having a total of 8.0 billion SIM cards. Majority of these SIM cards are currently removable. The new emerging technology embedded SIM means a SIM that's typically soldered to the device in factory during manufacturing and it's substantially smaller in size than current SIMs. But what makes the size of a SIM important? Because eSIMs could be integrated to completely new types of devices such as smart watches, fitness bands, portable health systems and various other devices bringing all kind of new services for consumers and new business potential for operators. (GSMA, 2015)

Another key feature of eSIM is remote provisioning which allows consumers to remotely activate eSIM on portable devices. Consumers could for example download multiple operators' profiles for devices and activate=change operators on the fly. (GSMA, 2018) Another possibility with eSIM could be that it effects on customers channels and sales. Device vendors as an example could start selling devices directly to customers including subscriptions, bypassing operators' sales channels. This would have a major impact on operators' business models and ability to be competitive on consumer business, where customer channels and data are the key competitive advantage.

According to Telia Finland financial reports, mobile subscriptions are a key revenue and profitability generator for operator. It's important that new technologies such as eSIM that could affect or even disrupt existing business models, will be thoroughly investigated from technological and especially from business perspective.

1.3 eSIM possibilities and challenges

The purpose with this thesis is to investigate Embedded SIM technology suitability for Telia Finland consumer customer business. What is technology readiness of Embedded SIM technology for consumer market and how does it effect on existing business models and processes. eSIM is expected to bring many advantages for consumer customer digitalizing customer onboarding processes without the need for physical SIM changes. It's also expected to create new business potential for operators by enabling new types of devices promoting connectivity sales. Getting rid of physical SIM logistics is expected to reduce costs and waste supporting operator's sustainability agenda.

Challenge for eSIM from operator perspective is that it could open door for disruptive business models, potentially bypassing operators' sales channel and customer relationship. According to Mckinsey (Meffert, Mohr, 2017) operator's business models are already heavily stressed by global OTT-players. "OTT players are offering core telco services such as voice or messaging, and the media space

is becoming their domain. Tech and Internet companies are also increasingly active in growth areas, such as cloud space and services, competing with Telco's for clients and revenue. They are tying customers to their own ecosystems, while making reliance on traditional operators a thing of the past." Ott players revenue cannibalization can be seen on figure 1 below. As can be seen on figure voice and messaging services has already been heavily cannibalized by OTT-players.

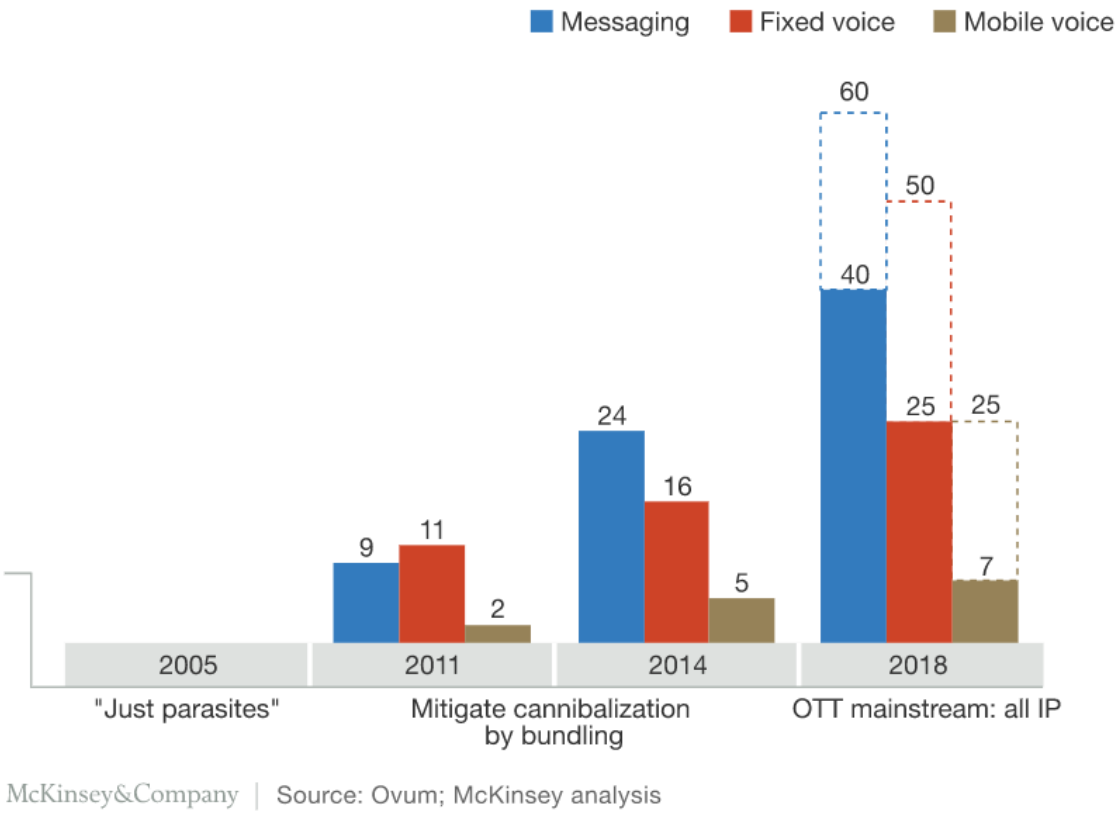

Figure 1) OTT revenue cannibalization (Meffert, Mohr.2017)

"With carrier-neutral connectivity (for example, e-SIM), many tech and Internet companies are enabling seamless changes between operators and eliminating the hassle of changing telecom providers. Hence, digital players are systematically attacking existing telco profit pools and will continue to do so eating up Telco's' revenues and margins". (Meffert, Mohr, 2017).

One example of taking into use of this potentially disruptive technology is Google's Fi service (previously called Google Project-FI) where Google is providing a mobile phone bundled with Google's mobile subscription services in USA. Google is working as mobile virtual network operator and is buying network ca-

pacity from T-Mobile, Sprint and US-Cellular. The key feature of Google FI Service is that it can dynamically switch between network operators, providing better coverage in USA than any of these network operators by themselves. Google is supporting eSIM in its latest phones, allowing Google and customers to swap between mobile networks on the fly. (Google, 2019)

This kind of approach is leading operator disintermediation on value chain. The operators would become wholesalers of network capacity, not connected to end-customers in any way. This would lead operators for highly questionable position in value chain and revenue cannibalization.

According to GSMA Mobile Connectivity Index, Finland has been a forerunner in mobile services for many years. However, growth on the Finnish mobile market has been saturated and is declining as can be seen on Traficom latest subscription report on figure 2 below. New technologies such as 5G and IoT are expected to bring new business potential but are requiring high investments. It's required that operators are streamlining existing core business to secure competitiveness in global scale. Digitalization is one of the key processes required to meet that goal; embedded SIM could be a vital part of this journey.

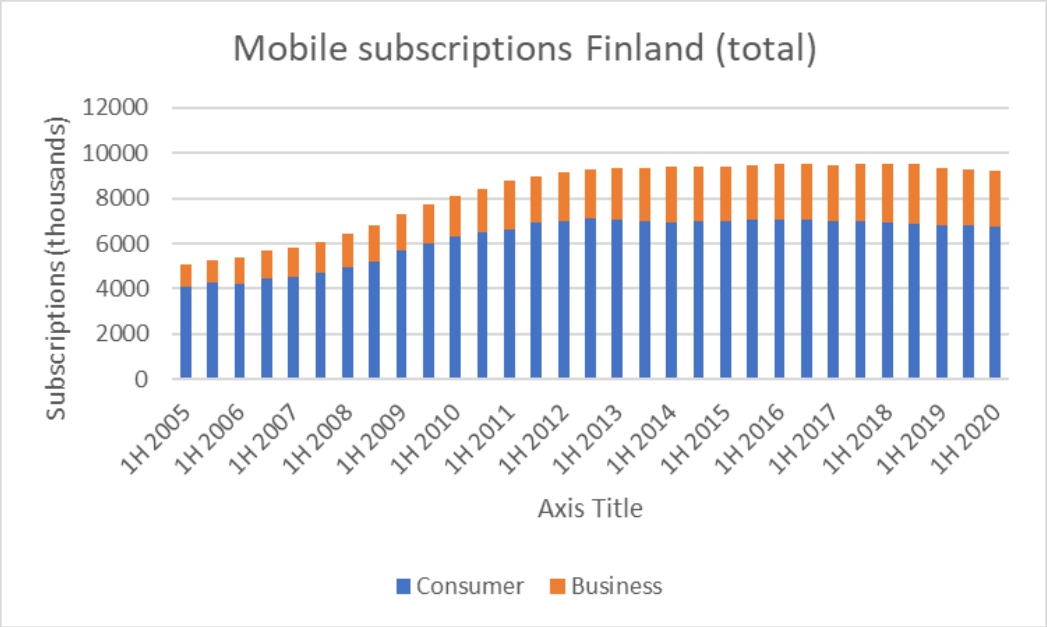

Figure 2) Finnish mobile subscriptions (Source: Traficom)

1.4 Case study company

The benefit of using a case study company is to be able to utilize insights and knowledge related to research topic in real life operator environment. Telia Finland is very suitable choice for studying eSIM business models for this case study, since it has been forerunner bringing new services in this area for Nordic and Baltic countries and has been actively participating standardization for this area (Telia, 2016). Timing suits also well for this research purposes, business is on very early stage and business models are still under development.

Telia Finland previously known as Sonera has a complete range of mobile services and is one of the leading mobile operators in Finland. Telia is also a large provider of fixed communications and TV services. The operator offers communication services and broadband access to businesses and consumers across the country and has a strong presence with a complete selection of fixed services in the northern, eastern and south western areas of Finland. The company provides wholesale services in both mobile and fixed communications. Telia has its own sales channels as well as a far-reaching network of external dealers. Telia Finland is part of Telia Company which is the result of fusion of Sonera and Telia in 2002 (Telia, 2019)

Telia Company key facts and figures

- Founded in 1853
- The share is listed at Nasdaq Stockholm and Nasdaq Helsinki
- Approximately 472,000 shareholders
- Present in Denmark, Estonia, Finland, Latvia, Lithuania, Norway and Sweden.
- Included in some of the most recognized sustainability indices, FTSE4Good and oekomPrime

As of year-end 2019 for continuing operations

- Net sales SEK 85,965 million
- Adjusted EBITDA SEK 31,017 million
- CAPEX Excluding licenses SEK 14,113 million
- Earnings per share SEK 1.77
- 24.2 million subscriptions
- 20,800 employees

Telia Company was the first operator in the Nordics and Baltics to introduce eSIM support in Norway and Estonia in 2016 when launching Samsung Gears S2 classic for these markets. According to Telia Company solution was based on industry association GSMA standards, which means other eSIM devices coming to the market can also be connected to Telia's network in those countries.

Telia Company has during Fall 2018 enabled the eSIM solution in Finland and was first operator that launched just-released new Samsung Galaxy Watch with an embedded SIM card." Services go digital, and similarly the future of the SIM card is digital. We want to be in the front line and introduce more smooth service to our customers now that eSIM devices are getting more and more common. Managing your subscriptions will be easier with eSIM, when an increasing number of smart devices around us need an internet connection," says Jussi Vuorinen, head of device business at Telia Finland. (Telia, 2018)

1.5 Research question(s)

The main research question is: How could emerging Embedded SIM technology affect for Telia Finland business possibilities?

To answer the main research question, the three following sub-research questions need to be answered:

- What is readiness for embedded SIM technology for mass market mobile services?
- What customer value eSIM creates and how customers are perceiving embedded SIM?
- How Embedded SIM as potentially disrupting technology would affect for Telia Finland business models, what are possible scenarios?

2 THEORETICAL FRAMEWORK

2.1 Concepts and theories

The main concept for this thesis is business development, product development, consumer decision making and disruptive technologies. These concepts are very broad, and they could separately be theoretical frameworks for this thesis.

Embedded SIM is a new technology and the suitability of this technology for consumer mass market services is one of the key questions for this thesis. From operator perspective eSIM is still on a very early stage, customer demand barely exists. In Finnish market Telia has launched eSIM as first operator 08/2018 (Telia, 2018). Telia's competitors has launched eSIM around 1 year later than Telia , DNA during 6/2019 (Lehtiniitty,2019) and Elisa during 7/2019 (Elisa, 2019) and) Each of these operators are currently supporting few devices with eSIM, mass market penetration for eSIM hasn't yet realized.

eSIM could be considered as disruptive technology since it might affect value chain remarkably and especially change operator's role with it. Disruptive innovation theory was originally introduced by Clayton Christensen in his book Innovators Dilemma, 1997. This theory and its predecessors are used as theoretical background for analysing eSIM technology's potentially disruptive implications. Business model Canvas is used in this thesis to validate how eSIM will provide value for end users and how will it effect on existing business models.

2.2 Business model Canvas

The Business Model Canvas was initially proposed by Alexander Osterwalder and has gradually developed since 2008 when the concept was launched. Business model canvas is widely used and powerful tool for understanding, designing and reworking business models. For business model evaluation between scenarios Business model Canvas will be used to visualize and understand possibilities and challenges (Osterwalder, 2013).

According to Osterwalder, “A business model describes the rationale of how an organization creates, delivers, and captures value”. The Business Model Canvas is a strategic management and lean start up template for developing new or documenting existing business models. It is a visual chart with elements describing an organization/product/services value proposition, infrastructure, customers and finance. It assists in aligning activities by illustrating potential trade-offs. (Osterwalder, Pigneur, 2010). Business model canvas building blocks are presented in Figure 3 below.

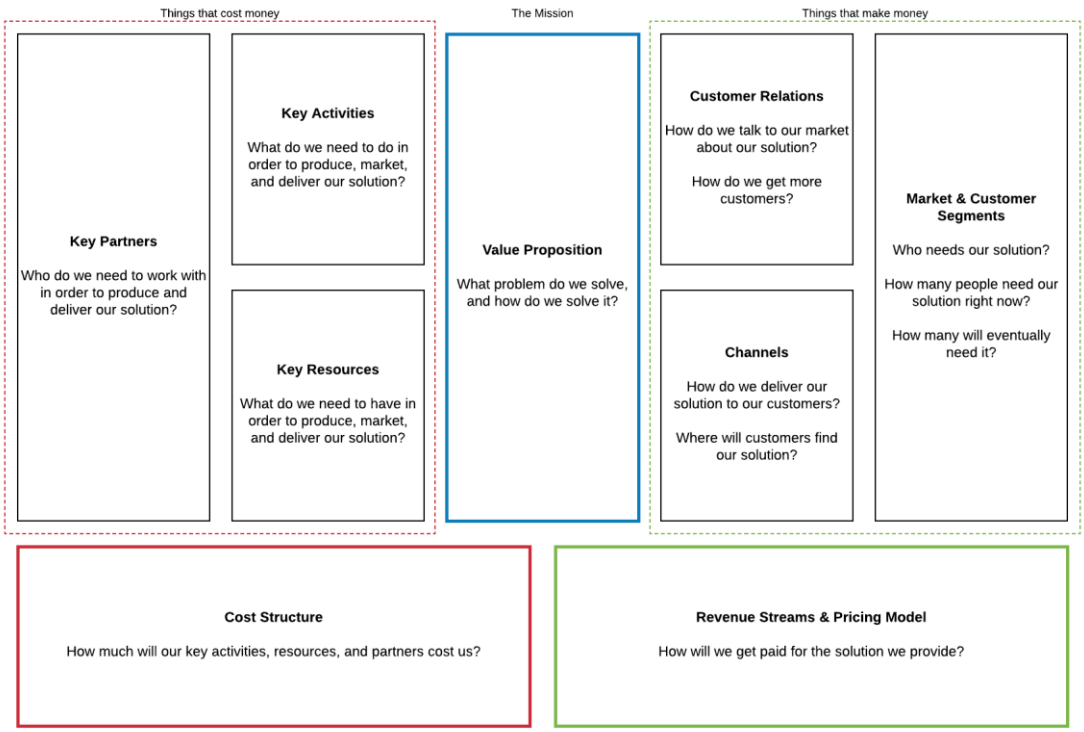

Figure 3) Business model Canvas building blocks

Value proposition describes the benefits customers can expect from your products and services. The Value Proposition Canvas is an ad-on tool introduced by Osterwalder, Pigneur & all within book called Value Proposition Design 2014. Value Proposition Canvas help create value for your customer and is tool for value discovery. The Value Proposition Canvas is a breakout of the two building blocks: The Customer Segment and the Value Proposition. With the Customer Profile customer understanding is clarified. Customer segment is divided in three parts. Customer jobs describes what customers are trying to get done in their work and in their lives. Gains describe the outcomes that customers want to

achieve or benefits they are seeking. Pains describe bad outcomes, risks and obstacles related to customer jobs that customers want to avoid. With the Value Map it is described how it is intended to create value for that customer. It breaks your value proposition down into products and services, pain relievers and gain creators. (Osterwalder et all, 2014).

Value proposition Canvas will be used in this research to identify and analyse end customer value difference with eSIM compared to physical SIM. Value proposition canvas helps to invent new and improve existing value propositions for example which pain points current physical SIM card usage has from customer perspective and if eSIM would be able to help with those pains. The Value Proposition Canvas presented in figure 4.

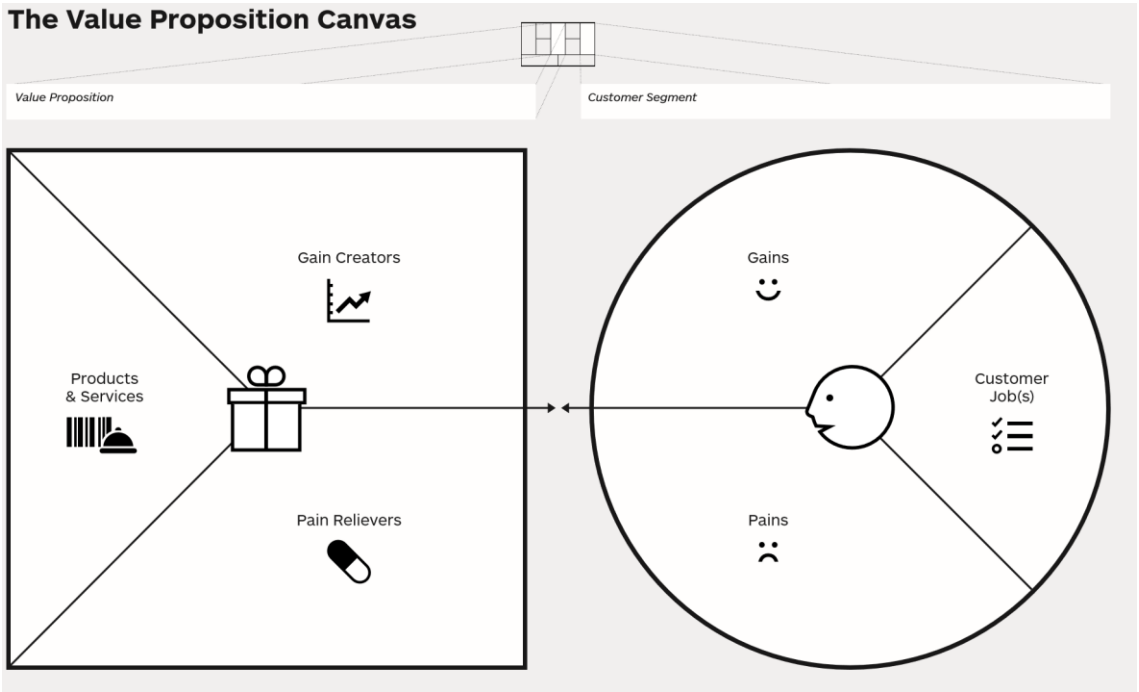

Figure 4) Value proposition Canvas

2.3 Types of innovation

Greg Satel has created innovation matrix that helps identifying right type of strategy to solve problem by asking two questions: How well can we define that problem? And how well we can define the skill domain(s) needed to solve it. (Satel, 2017)

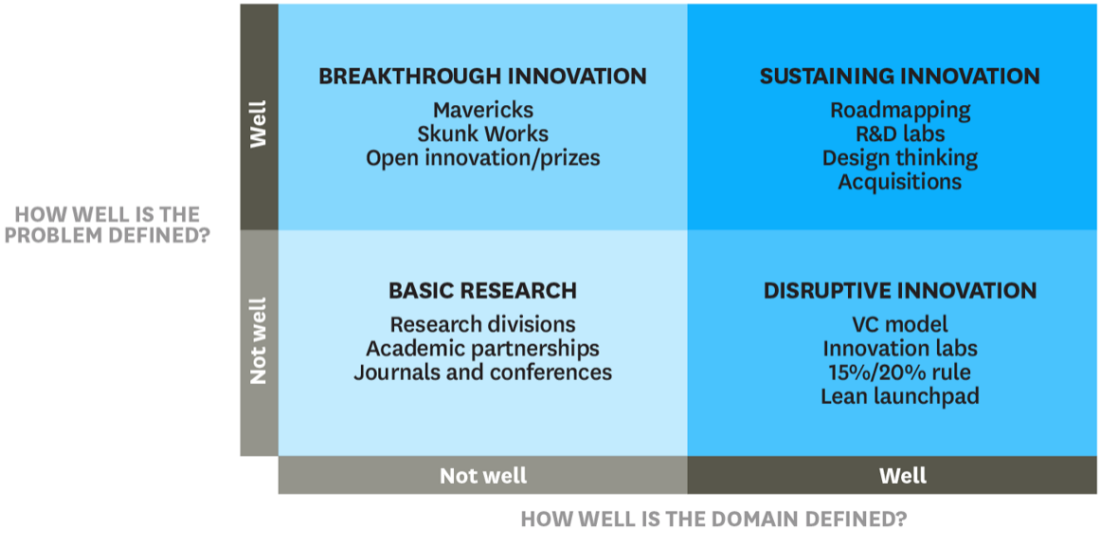

Figure 5) Innovation types (source: Greg Satel HBR)

Innovation types as defined by Greg Satel (Satel, 2017) are described in following chapter.

Sustaining innovation. In this case we are looking forward way to improve our existing capabilities in existing markets. We have good understanding what problems needs to be solved and what assets are required to solve them. Major part of innovations is happening here. We typically want to improve things we are already doing with existing customers.

Breakthrough innovation. In this case we are aware of problem but it's very hard to solve. In cases like these, we need to find totally new skill domains. Open innovation strategies can be highly effective in this regard, because they help to expose the problem to diverse skill domains.

Basic research. When both problem and domain are not well defined we are discussing innovation requiring basic research, resulting discovery of some new phenomenon. An example of this could be Albert Einstein general relativity theory

published in 1915 and still play essential roles in technologies ranging from nuclear energy to computer technologies and GPS satellites.

Disruptive innovation. When needed skills to solve problem are easy to find, but problem is not well defined, we are discussing disruptive innovation. Disruptive innovation is more detailly explained in following chapter.

2.4 Disruptive innovation

Disruptive innovation is a concept introduced by professor, academic and business consultant Clayton Christensen first in an HBR article and later in his book called Innovator's Dilemma 1997. (Satel, 2017). Christensen provided an explanation for the failure of respected and well-managed incumbents. Companies are faced with this dilemma, because are doing the same things i.e investing on sustaining innovations typically on high paying customers. Companies are listening to their typically most demanding customers, investing in the business and creating distinctive capabilities that would exceed needs for some segments but ignore needs for others. This open door for new entrants with potentially finding new solutions to meet customer needs for those overlooked segments, delivering feasible functionality with lower cost. New entrants are then moving to upmarket, providing products with functionality that mainstream customers are needing. "When mainstream customers start adopting the entrants' offerings in volume, disruption has occurred." (Christensen et All, 2015). Disruptive innovation model is described below in Figure 6.

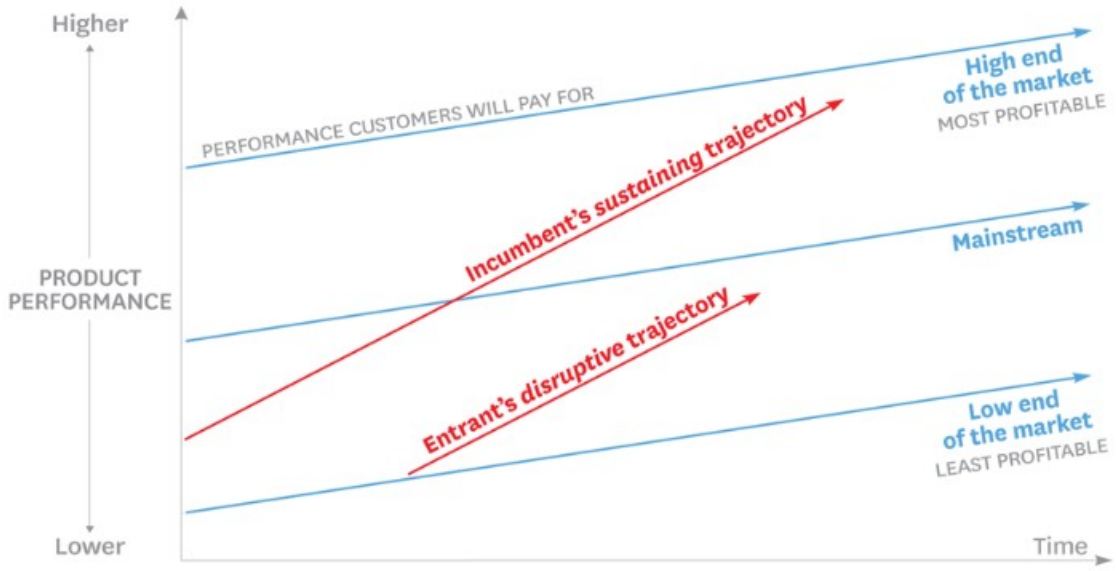

Figure 6) The disruptive innovation Model (Christensen et all, 2015)

Research and content of disruptive innovation has evolved during past decades. Disruption can come in different varieties: Low-end disruption and new-market disruption. New-market disruption refers to businesses that compete against non-consumption in lower margin customers. Like low-end disruption, the products offered are generally seen as "good enough," and the emerging business is profitable at these lower prices. Its notable that New-Market disruption also included high-end disruption meaning that initially new disruptive innovation can be also offered on higher price than existing products. Example of new market disruption is Netflix, where product characteristics are ease of use, immediate access, inexpensive, simple and other unique values for specific functions. (Jimet et All, Feb 2020). Types of disruptive innovation can be seen on Figure 7.

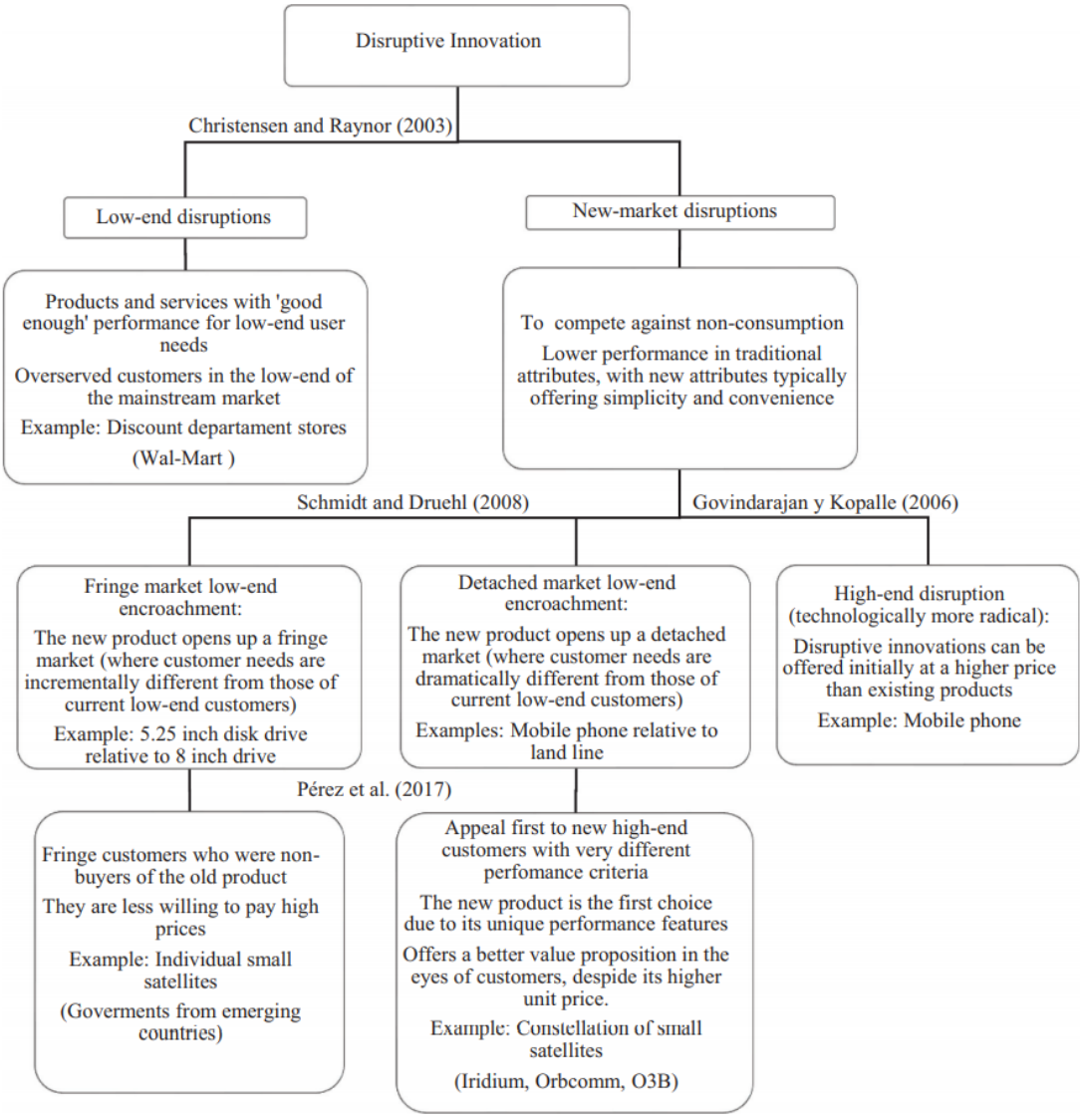

Figure 7) Types of disruptive innovation (Jimet et All, Feb 2020)

For this research it's important to analyze potential candidates for disruption with embedded SIM technology both with low-end market and new-market perspective.

2.5 Big Bang Disruption

New model of disruptive innovation has emerged during last decade. This new model doesn't follow Clayton Christensen's classic model, entering the market as a cheap substitute to a high-end product that incumbents are offering. Instead these new competitors are beating existing players on both price and quality and can address and win every customer segment. Example of this kind of "big bang" disruption has happened with navigation device providers TomTom, Garmin and Magellan. Smartphone OS suppliers Google and Apple has included free navigation applications preloaded on smartphones, suddenly there's no need for buying additional devices and new disruptive innovation will take over market on very fast pace.

Big-bang disruptions come out of the blue from companies who aren't your traditional competitors. Typically, they are developed by inventors that might just do experiments with existing technologies which new products or functionalities they can dream up. "Once launched, these innovations don't adhere to conventional strategic paths or normal patterns of market adoption. That makes them incredibly hard to combat. There's almost no time to adapt to big-bang disruptions. Bold strategies are the only way to cope". (Downes, Nunes, 2013)
Would embedded SIM promote, enable or be part of big bang disruption is an question to be elaborated within this research.

3 METHODOLOGY

3.1 Research approach

Qualitative research approach is mainly used for this thesis. Quantitative data from literature and market reviews and will also be used to complement understanding about research topic. Case study methodology is used for this thesis. Thesis objective is limited to one technology and operator. Research question(s) for these are mainly “how” and “what” questions and focus of study is a contemporary phenomenon. According to Yin (Yin, 2014) case study will fit well for this kind of research. High level process followed in this thesis presented in Figure 3 below.

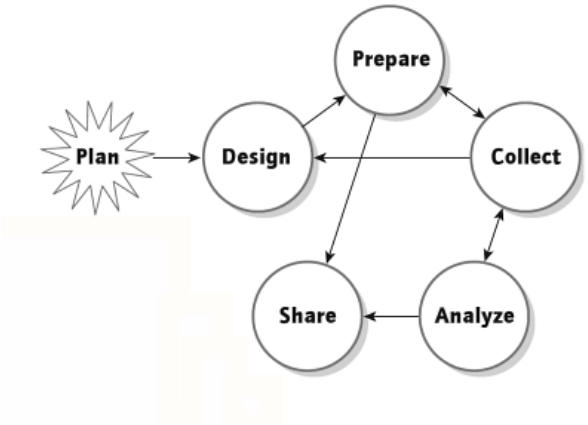

Figure 8) Case Study research process

3.2 Data acquisitions methods

Data acquisitions methods planned used in this research:

- Utilizing existing data related to eSIM, from Telia Finland
- Utilizing existing data regarding eSIM from standardization organization GSMA and vendors providing eSIM solutions.
- Interviews, Telia Company and external company “eSIM industry experts” are interviewed to gather data and insights.
- Customer data for countries that already has launched eSIM. Finnish customer data will be used and data from Norway and Estonia if available.

Data Acquisitions were gathered in iterative process as described in Figure 9.

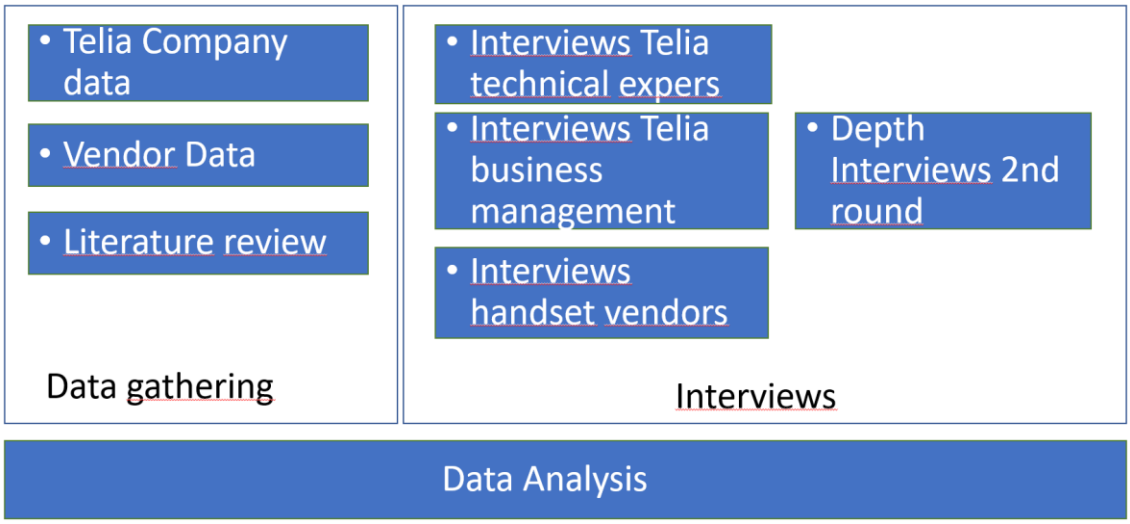

Figure 9. Research data acquisition methods

Interviews with Telia Company experts were conducted during March-April 2019. People for interview were selected all having several years of expertise in SIM related technologies or Mobile operator connectivity and device business. Within Telia Company eSIM has been launched during interview period in three countries (Norway, Estonia and Finland), insights were gathered for all these countries. Interviews were recorded and transcripts were written to enable high quality data for analysis. Prior conclusions depth interviews where held with specialists for topics needing more clarification. Also, market and vendor data were several times updated during research to secure up-to-date information.

Research interviews were concluded according to table 1) below

Nr.	Title/Position	Company	Length	Type
1	Head of device business	Telia Finland	2x45 min	face-to-face
2	Product Manager (SIM)	Telia Finland	2x45	face-to-face
3	Commercial Product Manager / Multidevice	TeliaCompany	1x60min	face-to-face
4	Business Manager Connectivity	Telia Finland	1x60 min	skype
5	Senior Development manager	Telia Estonia	1x60 min	Skype
6	Head of product delivery	Telia Norway	1x60 min	Skype

Table 1) Research interviews

3.3 Data analysis methods

In this research content analysis methods are used. Target for content analysis is to provide more information about research topic by arranging data for more compressed and clear structure without losing information it contains. Content data analyse could be inductive or deductive. Within this research inductive research method is used based on research data. (Tuomi, Sarajärvi, 2018).

Comments received during the interviews and relevant to the study were collected on a datasheet and categorized according to the theoretical frameworks used. Additionally, patterns and similarities in interview results were identified.

The collected results from the interviews were cross-examined against the theoretical frameworks and previous research. Research results were also reviewed and discussed with key stakeholders.

4 EMBEDDED SIM

4.1 Subscriber Identity Module (SIM)

Subscriber identity module aka SIM card was introduced to support secure, identifiable and authenticated access to mobile networks. SIM card was first time introduced with GSM services in Europe in 1991. SIM card is small smartcard providing identification and authentication mechanism. The data stored in the SIM card includes a unique serial number called ICCID, International Mobile Subscriber Identity or IMSI, Security Authentication information, temporary information about the network, a Personal Identification Number or PIN and a Personal Unblocking code or PUK for unlocking. (Elprocus, 2020).

Giesecke and Devrient supplied the first commercial SIM cards to a Finnish Network operator Radiolinja when they open first commercial GSM-network in Finland 1991. (GSMA Intelligence, 2020).

Figure 10 shows the evolution of SIM card. Traditional SIM cards are removable, and their sizes are from credit card size (1FF) to size of Nano SIM card (9x11mm). Size of embedded SIM card could be much smaller (2x1mm) and its physically build into mobile terminal and cannot be removed and replaced with another SIM card

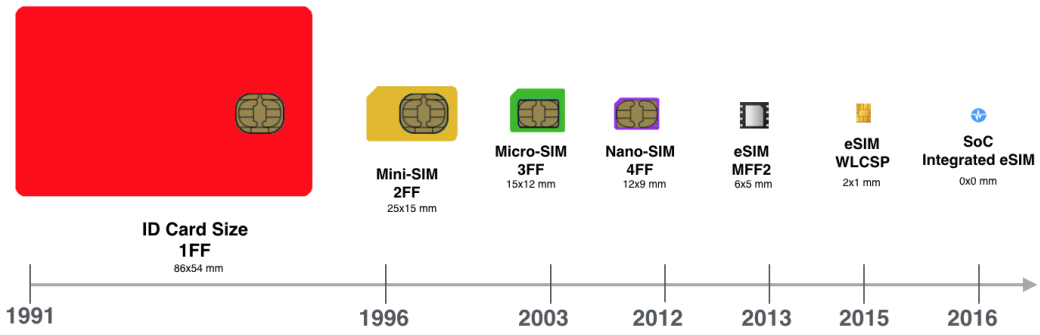

Figure 10) Sim card evolution (Source Honeywell 2018)

For consumer use cases first commercial deployment happened 2016 when Samsung released Gear S2 Classic Smartwatch with GSMA compliant eSIM sup-

port. The company worked with technology vendors and operators including operators M1 Limited, Orange, Singtel, StarHub Ltd., Telefónica, TeliaSonera, Vodafone Group and SIM Vendors – Gemalto, Giesecke & Devrient (G&D) and Oberthur Technologies. First commercial launches happened with these operators 03/2016 onwards. (Samsung, 2016)

4.2 Embedded SIM

eSIM is a specification by the GSMA which enables remote SIM provisioning of mobile devices. Specification is divided on 2 solutions, M2M solution and Consumer Solution. M2M solution is providing solution for Internet of Things market connectivity where there's no interaction needed/possible to with devices during onboarding. An example of this kind of solution would be eSIM that's installed for cars in factory providing emergency call services or automatic meter reading service (ARM) that's automatically collecting consumption, diagnostic and status for electricity or water consumption. Within these kind of use cases provisioning of mobile connectivity subscriber to device will be preferably done remotely and without any interaction needed in device (GSMA, 2018).

Consumer solution targeted consumer and enterprise customers (end-users) and use cases are for example phones and smartwatches. End user interaction is required when consumers are selecting network connectivity provider and, on some cases, also services during onboarding. Within this research, focus will be on Consumer solution only. eSIM now allows consumers to store multiple operator profiles on a device simultaneously, and switch between them in device, though only one can be used at a time. The specification now extends to a wider range of devices, beyond the single companion device made possible with the first release. Manufacturers and operators can now enable consumers to select the operator of their choice and then securely download that operator's eSIM profile to any device (GSMA, 2018).

According to GSMA Embedded SIM is expected to provide following benefits for consumers:

- Simpler device setup, all devices will come with SIM card inbuild. Operator change will happen with digital onboarding process, no need to visit for physical shops or order SIM delivery.
- New type of devices that can operate independently with own mobile connectivity services for e.g smartwatches.

Operators gain new business opportunities from a world of intelligently connected services and devices, reduce the logistical costs associated with handling traditional SIM cards and retain existing SIM security levels. (GSMA, 2018)

On the other hand, eSIM potentially open possibilities for disruption from operator perspective (Meffert, Mohr.2017). Operators might be for example lose direct customer sales channels, in case devices including connectivity subscriptions could be sold for customers directly from device vendors channels. This could dramatically effect on operators position in value chain.

4.3 How Embedded SIM works

The integrity of traditional physical SIM cards is protected by using secure facilities for their manufacture, which includes loading of software and operator credentials. SIM manufacturer delivers physical SIM's for operator's wholesale to be delivered via operator channels for example via retail shops to the end users.
Embedded SIM extends the reach of the secure facilities from specific physical locations, to any location where the device can be reached over the internet. eSIM protocols provide security and integrity for data transfer. (GSMA, 2018). Embedded SIM cards are not owned or delivered by operator; they are built in for used device for e.g. Smartphone or Smartwatch from factory. End user download operator profile for device via secure channels to active connectivity service.

Traditional SIM card processes from end user perspective adapted from GSMA specification (GSMA, 2018) are described in Figures 11,12 and 13.

Figure 11) Traditional SIM card process

1) Customer buys connectivity service from Red operator, which provides operator SIM card to end users. SIM card is inserted on phone and customer can activate and start using operator service.
2) Customer wants to change operator and makes contract with Blue operator. Blue operator provides SIM card for customer.
3) Customer is swapping new Blue operator SIM card for phone and is able to activate new operator connectivity service.

With Remote SIM Provisioning used with embedded SIM's, there are no traditional SIM card delivered. Embedded SIM card in build in for device from factory and can include multiple SIM profiles, which contains operator and subscriber data. Figures 12 and 13 presents process how embedded SIM card onboarding works. Process is adapted from GSMA specification (GSMA, 2018)

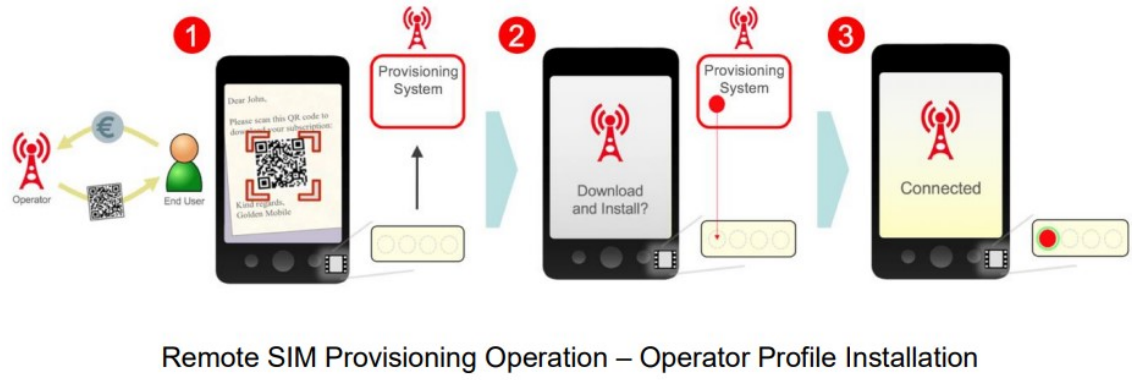

Figure 12 eSIM operator profile installation

1) End user wants to buy connectivity service from Red operator. Operator provides instruction how to download operator profile, in this case QR-core download is used.
2) QR-core contains address for operator provisioning system and end user will connect to that system and download and install operator profile.
3) End user can start using Red operator service

Figure 13) Embedded SIM users operator swap process

4) End user wants to change operator and buy connectivity service from Blue operator. End user downloads and install operator profiles based on operator instructions
5) End user is now having 2 operators' profiles in phone and can switch between these.
6) End user can start using Red operator service

4.4 eSIM alternatives

There are few alternatives for embedded SIM, namely Apple SIM, soft SIM and iSIM. Apple has been providing with several USA based carriers service called Apple SIM which provided cellular connectivity for your iPad's from 2014 onwards. Within inbuild SIM card you can connect to several operator services without need for swapping SIM cards. During 2018 Apple introduced support for standard eSIM and has been bringing this support for all new devices launched after that (Apple, 2020). It seems Apple is not introducing Apple SIM support for new devices i.e. eSIM seems to be long term solution selected by apple replacing Apple SIM.

Soft SIM would be software applications and data that perform functionality of SIM card but does not include secure data storage. Soft SIM would be a collection of software applications and data that perform all the functionality of a SIM card but does not reside in any kind of secure data storage i.e. data is stored in the communications device memory and processor. According to GSMA operators are worried about potential security issues caused by utilizing software-based SIM solutions without physical security element and are not supporting this kind of approach. Weaker security could lead serious loss of customer confidence towards operator capability to provide services. (GSMA, 2015)
During research similar input arrived from interviews, software-based SIM is one alternative but has weaker security and poses threat for leaking operators' profiles and introduce new risk of fraud. Software-based SIM solution weren't commercially available during research period and were not evaluated in this research.

There are other technologies under development like iSIM and nuSIM for IoT connectivity. Standardization hasn't realized yet and real-life products in consumer business doesn't exist. These solutions were not evaluated in this research since they are not targeted for consumer solutions.

5 OPERATOR BUSINESS MODEL

5.1 Mobile operator business model

Telia Finland B2C business contains Connectivity business (Fixed and Mobile), TV and Content services and Value-added services. During research period Telia Company has bought Bonnier broadcasting including brands MTV and C More present in Finnish market. According to Telia "The combination of the best networks and content in the Nordics enables new customer offerings and business opportunities." (Telia & Bonnier, 2019). Potential changes for business models are not included as scope for this research, focus will be on connectivity business.

Telia Finland existing business model regarding B2C mass market mobile services based on interview results is presented in Business Model Canvas figure 14 below.

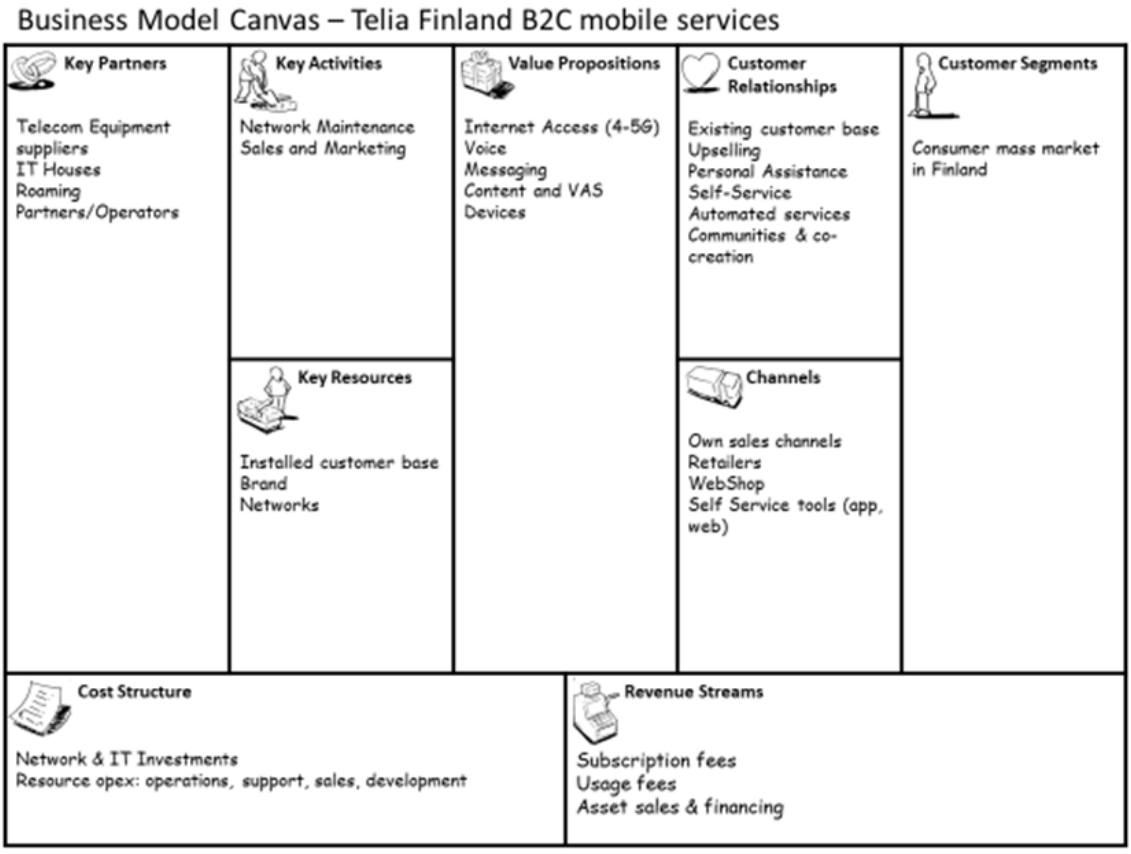

Figure 14) Telia Finland B2C mobile services Canvas

Telia Finland existing Business model Canvas 9 building blocks based on interviews are explained in following chapter.

Customer Segment

Telia's B2C business is addressing mass market consumer customers with segmented approach. Segments are divided based on demographic values like age and behavioral values like usage, spending patterns and loyalty. As an example, if your age is under 28 years, you will get discount for your subscriptions. Earlier Telia had totally separate brand and services for price sensitive customers (tele.fi) but those operations have been closed during 2017 when merging Sonera and Tele.fi brands for Telia.

Value proposition

Telia's value proposition is based on range of products/offerings providing value for customers solving their connectivity and communication issues and providing value added services that are solving specific customers need for example reducing financial risk with device-insurance. Mobile/Connectivity offering consist of following products:

- Internet access (2,3,4,5G)
- Mobile Broadband (4G,5G)
- Voice, Messaging
- Devices, financing and device-insurance
- Value added services (for e.g. music, security, streaming video services, premium support and mobile-id)

Channels

Telia is selling their services via own sales channels including own shops, Telia Express (shop in shop concepts) and customer care, e-shop and self-service portal/mobile application. Services are also sold via external retailers and telemarketing.

Customer relationship

Customer relationship for Telia is mainly focused on customer acquisition, customer retention and upselling. Customer relationship if organized in customer channels organization providing following functionality

- personal assistance
- self-service

- automated services
- communities
- Co-creation

Revenue streams

Telia's revenue streams consist of both transaction revenues and recurring revenues. Revenue Streams related to mobile services are:

- subscription fees
- Usage fees
- asset sales & financing

Key resources

Key resources for providing services towards customers are Mobile networks including licenses, customer channels (personnel and digital) and installed customer base.

Key Activities

Key activities include Network and IT Production, Sales and Marketing and Customer care.

Key partnerships

- Telecom Equipment supplies
- IT houses
- Value added service providers like Spotify

Cost structure

- Networks and IT infrastructure
- Services and sales
- Customer care

5.2 eSIM market situation in Finland

Telia

Telia Finland was first operator in Finland that launched embedded SIM support 08/2018 with the just-released new Samsung Galaxy Watch. After that operator

has introduced support for new eSIM devices like Apple Watches, iPhones and Samsung and Huawei phones. One number service, where you could share same phone number with two devices, is supported both with Apple and Samsung smartwatches. Limitations with eSIM is that Prepaid subscriptions are not available. Pricing for eSIM activation is similar than with physical SIM (Source: Telia Finland webpages and interviews).

Elisa

According to Elisa its eSIM could be installed for all eSIM supported devices Elisa is selling. Limitations with services: No Prepaid subscriptions with eSIM, Mobile-id service is not available and One-number service only works with Apple watches not with Samsung watches. Pricing for eSIM activation is similar than with physical SIM (Source: Elisa webpages).

DNA

According to DNA its eSIM service support Apple phones and tables, other devices like Smartwatches and phones are not currently supported. Known limitations are that there's no One-number services available for Samsung or Apple watches and Activation of eSIM requires visit to DNA stores, i.e. sales/onboarding flow is not totally digitalized from customer perspective. Pricing for eSIM activation is similar than with physical sim (source: DNA webpages)

Based on interviews, market opening for Finland has started bit slowly and main milestone has happened during 2019, when eSIM was introduced with Apple and Samsung products. Based on research, Telia Finland is having most comprehensive support now for eSIM services in Finnish markets, but other competitors are also gearing out to reach out the gap.

5.3 Global market

Based on research, one use case globally stands out to be actively promoting eSIM usage is global Internet access for travelers. Majority of global roaming providers with connectivity services targeted for travelers, has included eSIM based services as part of their offerings during past couple years. There are also totally new players in this area providing services only via eSIM. Example of these kind of service providers are Truphone and Ubigi, which are Apple certified eSIM operators and provide services among with incumbent operators AT&T, T-Mobile and Verizon Wireless in USA. Both providers are offering connectivity services globally, including Finland. With eSIM, services like these could be bought instantly and taking into use in your device. There's not any kind of physical interaction needed, very convenient and fast onboarding from and-user perspective. According to Ericsson Consumer lab survey, half of yearly travelers are connected to mobile data abroad using local SIM card (Ericsson, 2019). Customer interest for Internet access abroad are described in Figure 15 below.

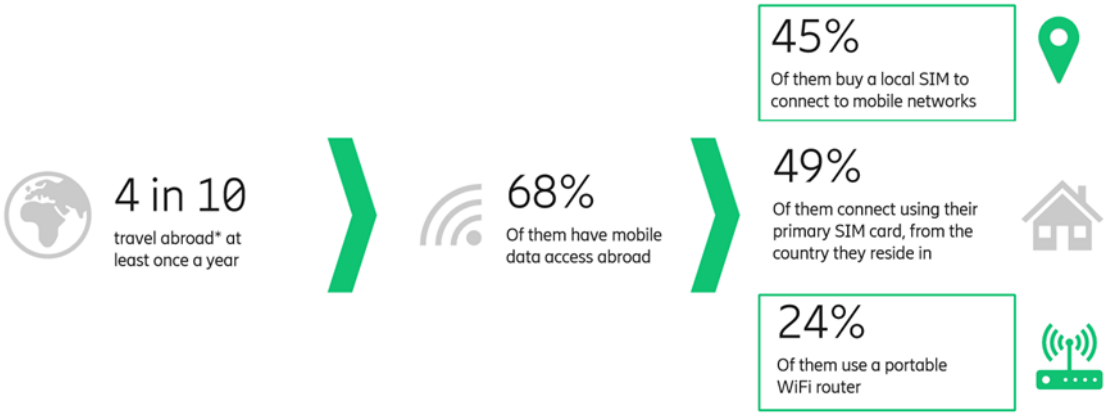

Figure 15) Customer interest for internet access abroad (source Ericsson, 2019)

Google FI is mobile virtual network operator offering mobile connectivity services (voice, data, messaging) for US citizens. Google FI services were originally launched with Google's own Nexus phones but are now supporting also Apple, Samsung, Huawei, LG and HTC phones (Google 2020).

According to customer reviews available in Internet, Google FI service quality is highly appreciated. Power of three networks in one subscription, good throughput, international coverage and fantastic application that's easy to use are pros

for this service. Limited number of phones supported and higher price plans than other players lacking unlimited plans are highlighted cons. “For customers who fit the target market, Google Fi is a high-quality cell phone service provider that will likely make them very happy” (Ismail, 2019).

5.4 Role of regulation

Operator business in Finland is regulated by national authorities, legislation and EU-level regulation. (Laakso et. all, 2012). During interviews and analysis, it came clear that regulation plays big role in mobile business. There are no regulations that’s directly touching eSIM as such, but some regulations are related and will have effects for eSIM business possibilities.

As part of Digital Single Marked strategy, members of the EU have been able to travel without roaming charges known as Roam like at home (RLAH) from 2017 onwards. RLAH implies that a customer pays the same rate for mobile use (voice, SMS, data) wherever within the EE. The retail rate for roaming traffic will be set to the domestic rate effectively allowing the user to roam (at the same rates) like at home. Regulated prices are listed below (Eu, 2017).

- €0.032 per min of voice call, as of 15 June 2017
- €0.01 per SMS, as of 15 June 2017
- A step by step reduction over 5 years for data caps decreasing from €7.7/GB (on 15 June 2017) to €6/GB (01/01/2018), €4.5/GB (01/01/2019), €3.5/GB (01/01/2020), €3/GB (01/01/2021) and €2.5/GB (01/01/2022)

Roam Like at Home promotes competition within EU and allows people to travel within EEA with regulated prices that are set to meet domestic prices. Low prices are lowering the market entry and creates business possibilities within Europe for new player acting as Mobile Virtual Network Operators and Service Providers. eSIM as new technology simplifying customer processes, combined with low regulated prices are promoting global competition that can be seen with many new global players entering Service Providers towards travelers. Incumbent players in this case are neglecting needs of low-end market and open door for disruption.

6 ANALYSIS AND FINDINGS

6.1 Embedded SIM business potential and status

Based on research and interviews, device support for eSIM has been limited for first 3 years eSIM standard has been available from 2015 onwards. Companion devices such as smartwatches has been the first devices supporting eSIM from 2016 onwards. In Fall 2018 Apple launched eSIM support for iPads and Apple Watches and iPhones. Samsung has been introducing eSIM support for Smart-watches 2016 and from 2019 onwards has been focusing bringing eSIM support for flagship phones. According to Gsmarena (www.gsmarena.com) there are 65 separate devices (phones and smartwatches) supporting eSIM in November 2020 available. There are 2376 devices available with traditional SIM. Although less than 3% of available devices currently supports eSIM, volumes of sold eSIM devices are much higher since vendor are introducing those for newest devices. Table 3 below lists summary of devices currently supporting eSIM.

Vendor	Model	Device type
Apple	iPhone 11, 12	phone
	iPhone XR/XS	phone
	IPad Pro, Mini, Air	tablet
	Watch series 3,4,5 and 6	smartwatch
Samsung	Galaxy Watch	smartwatch
	Gear S3	smartwatch
	Galaxy Z Fold2	phone
	Galaxy Watch Active2	smartwatch
	Galaxy S20	phone
	Galaxy Note 20	phone
	Galaxy Z Flip	phone
Google	Pixel 2,3,4	phone
LG/Google	Nexus 5X, 6 and 6P	phone
Huawei	Watch 2	smartwatch
	P40	phone
Microsoft	Surface tablet pro	Tablet
Motorola	G6, X4 and Razr	phone
NUU	Mobile X5	phone
TCL	MoveTime	smartwatch
ZTE	Nubia Alpha	smartwatch

Table 3. Devices supporting eSIM

Forecast of eSIM shipments between device types is presented on Figure 16 below (Source Counterpoint research). According to Counterpoint research, NB-Iot and 5G will catalyse the inflection point for eSIM adoption across different connected devices and application in global scale. eSIM device shipments are estimated to reach 2 Billion units by 2025.

As can be seen of forecast eSIM penetration has been started from B2B IoT devices and Smartwatches. Apple introduced eSIM support during fall 2018 as first remarkable smartphone vendor, this initiated high growth for eSIM penetration with smartphones that can be seen on forecast. It's expected that other big smartphone makers like Samsung and Huawei will follow and introduce their support for eSIM in near future. Motorola has launched Razr 2019 phone during November 2019 as a first phone without physical SIM support. With current situation, bold move targeting smaller markets in situation where many of operators are still lacking eSIM support.

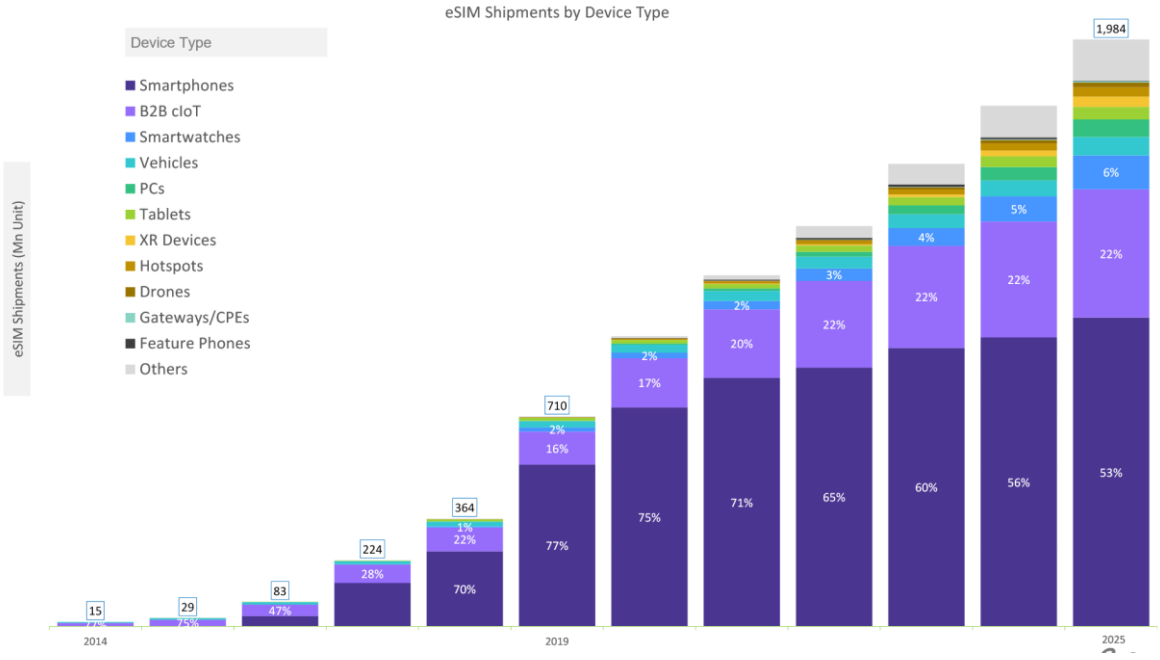

Figure 16) global eSIM shipment by device type, (Source: Counterpoint Research 2019)

How long it will take that eSIM will become dominant technology for mobile services authentication method for smartphones? GSMA has made forecast for

worldwide eSIM smartphone penetration in Figure 17 below. Forecast including low, medium and high adoption scenarios. As can be seen on forecast volumes are currently on low level, 2020 is expected to be turning point for eSIM smartphone connections. In high adoption scenario ~40% of smartphones will be eSIM connected in 2025, in low adoption scenario ~22%. Based on this forecast 60-78% of smartphones will be connected with physical SIM card in 2025.

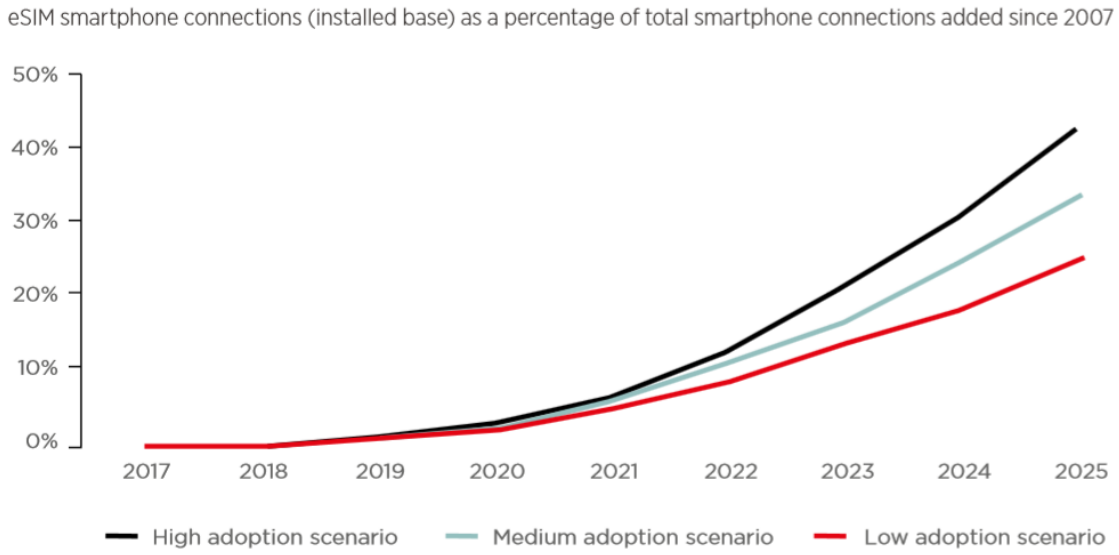

Figure 17: Worldwide eSIM smartphone connections forecast, Source GSMA

Based on research information Smartphones are currenty driven eSIM adoption volumes and this will continue in coming years. There are 4 items identified to gate adoption of eSIM usage : eSIM technology, devices, operator support and end user needs. All these items are now sorted, and growth is expected to gain high volumes in coming years.

6.2 Embedded SIM affect for current business model

During interviews and research of topic, it came clear that eSIM will have substantial effect on operator's business model. In order to be relevant provider within eSIM area following topics are highlighted:

- Digitalization, embedded SIM requires fully digital processes
- Business support systems and technologies, requires substantial investments to be able to make viable services from end-user perspective
- Business model renewal need to be dynamic, value propositions, new customer needs exist, requires sub segmenting for new device categories

Summary of changes for Telia Finland B2C business model due eSIM is presented in Figure 18 below

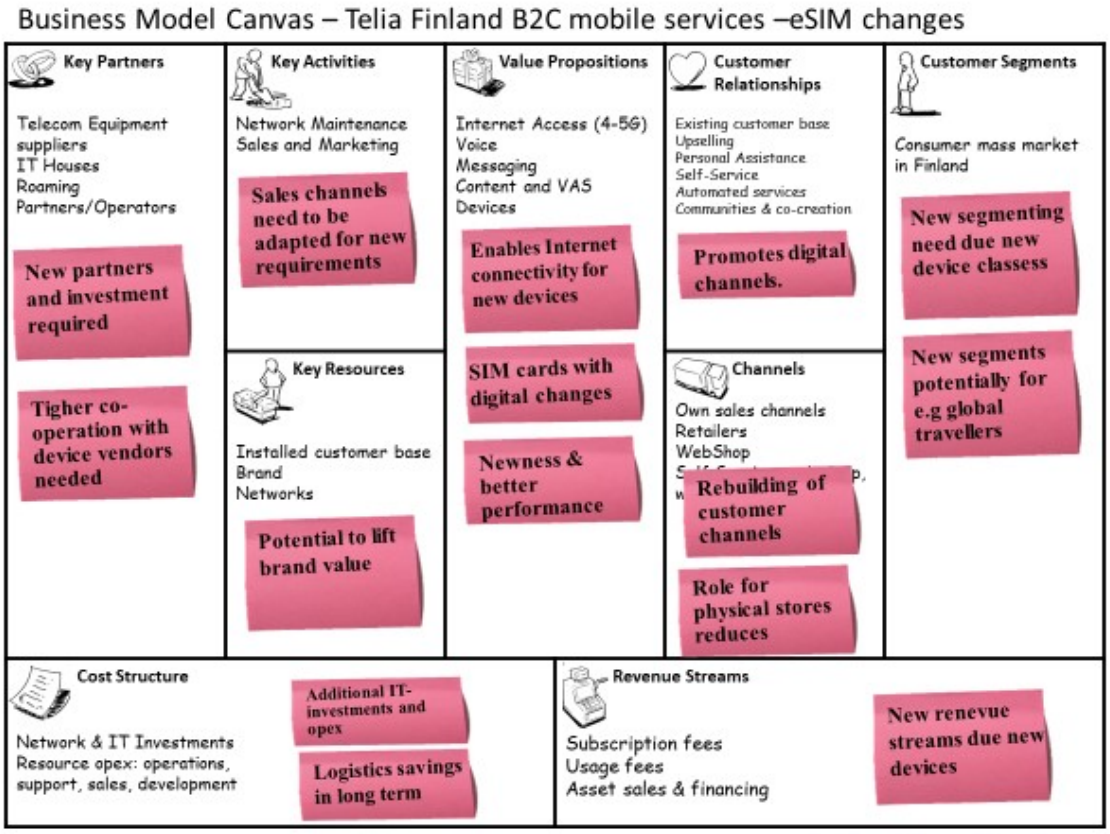

Figure 18: Telia Finland B2C mobile services – eSIM changes

Value proposition:

Embedded SIM have following consequences for consumer customer value proposition:

- Enables Internet connectivity offering for new devices, for example companion devices smartwatches, IoT devices etc. This creates new use cases and value for customers as an example first phone for small children could be smartwatch providing same basic functionality as traditional phones (communication, messaging, tracking, reachability/one-number service). New kind of value proposition compared to existing offerings.
- Digitalizing SIM changing processes makes changing subscription and SIM easier for customers. Downloading and installing embedded SIM can be done wherever without need for contacting operator physically, can be done for e.g. during travelling. Enhancing convenience for the customer for getting the job done much faster than before.
- Enables connecting multiple subscriptions for single phone, for e.g. company subscription and personnel subscription in same phone, example Apple Dual SIM functionality. Improved product performance and new functionality.
- For some operators Embedded SIM is not currently supporting Mobile-ID authentication services currently, you still need to have physical SIM to be able to use is for e.g. banking purposes i.e. eSIM will have negative effect for this value proposition. Telia Finland has been supporting Mobile-ID with eSIM from 10/2020 onwards.
- Although digitalizing SIM processes is expected to gain lower cost this is not visible in customer pricing.
- Operators need to continue providing SIM´s with existing physical channels as well, savings are expected to be realized in long run assuming high eSIM utilization.

Customer Segments

- Embedded SIM creates need for creating sub segmenting based on device/service categories. For e.g smartwatch related marketing communication should be done for customers who are interested in these kinds of devices and connectivity services.
- Embedded SIM enables potential for new customer segments, for example global travelers or travelers visiting Finland.

Channels

- Embedded SIM generates need for building new digitalized subscription onboarding process, only online process is needed/supported with eSIM-delivery.
- Existing physical and online sales channels need to be adapted to be able to support selling devices and connectivity services for customers utilizing eSIM-devices.
- Operators connectivity services will be embedded for device vendors sales channels i.e new channels defined by device vendors will be introduced.
- Role of physical shops reduces, eSIM will promote that change.

Customer relationship

- Embedded SIM enables connectivity services for new kind of devices allows upselling of services for existing base and new customer acquisition.
- Customer expectations for totally digitalized services requires investment for self-service tools.
- Customers are very keen on getting newest services in use. Communities & co-creation with customers suits well with these kinds of new services strengthening customer relationship and securing high usability of new services.

Revenue Streams

- New revenue streams due new devices with connectivity services. Potentially new customer segments demanding new services.
- Potential loss of roaming revenues due much easier onboarding of local SIMs for travelers.

Key partners

- Stronger partnership with device vendors required.
- New functionality/needed with telecom equipment suppliers/partners
- New functionality needed with IT houses

Key Activities

- Investments are needed digital customer channels and IT/Processes to be able to meet digitalization requirements.
- Develop and operate digital services.
- Develop and manage partnership relations.
- Recruit new customers through sales and marketing using online channels supported by analytics.
- Serve customers through online channels.

Key resources

- New partnership needed with some new technology
- Existing partnership with device vendors, SIM manufactures needs to be evolved and adapted

Cost structure

- New digital customer processes need to be built
- Technology investments for network and IT platforms
- Existing physical SIMs need to be supported on top of eSIM i.e. existing cost base partly remains
- Logistics cost for SIM reduces
- Sales cost reduces in long term due online

To summarize following are biggest changes needed in operators business model to be able to support eSIM related services:

- Totally new digital channels need to be built for eSIM purposes
- Sales processes need to be adapted accordingly
- Investment needed for technologies both in IT and in network side
- Deepening partnership with device verdors

6.3 New business possibilities with eSIM

During case study following new business possibilities were identified with eSIM for mobile operators:

A) Totally new devices supporting connectivity
   eSIM enables new kind of devices supporting connectivity for e.g. Smart-watches, wearables, IoT devices creating new revenue possibilities for operators.

B) Multi-Device business
   Operators can sell new devices for consumers for e.g. smart watches with one number subscriptions, enabling new revenue streams and differentiation possibilities.

C) International business
   eSIM enables smooth fully digitalized onboarding process and transition between used operators from end-user perspective. This allows possibility to offer more conveniently domestic subscriptions for example for people travelling to Finland.

D) Sustainability
   Digitalizing customer flows enables cost savings by removing physical SIM-logistics cost and reducing waste, supports operator’s sustainability targets.

E) Digitalization
   eSIM is one building block for MNO’s to digitalize customer flows to be relevant player in future mobile business.

6.4 Scenarios

One key question regarding eSIM is that how it will influence operator business models, what kind of scenarios exists. During literately review and interviews following main scenarios were identified:

A) Mobile Network Operator driven business
B) CPE vendor driven business, example Apple or Samsung
C) OTT vendor driven business, example Google

Mobile Network operator business is current main scenario, where MNO's oversee value chain and are handling customers interface. CPE vendor driven business scenario would mean that device vendors, like Apple of Samsung would take over customer interface selling devices including operator connectivity services directly for end customers. OTT vendor driven business would mean that global OTT players like Google would be taking over customer interface. Based on research results mobile network operator driven business model is expected to be most likely approach in future. Both CPE vendor driven, and OTT driven models are also expected to be happen on some areas moderate likely or likely challenging operators position in value chain.

Research results are presented in figure 19

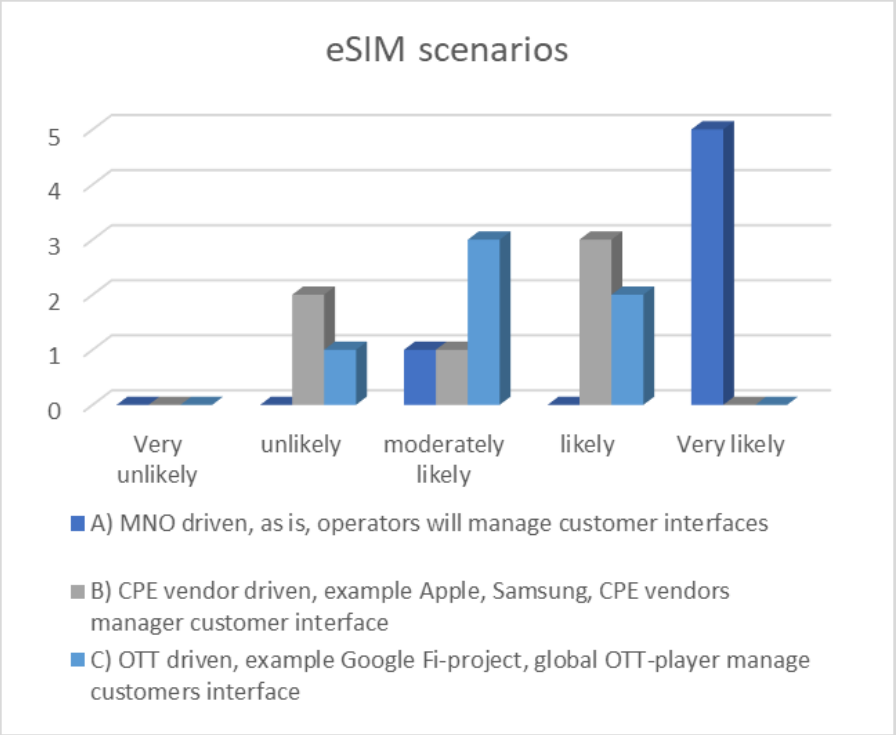

Figure 19) Probability of business scenarios

Operator concerns regarding eSIM is presented in figure 20 below. Increased competition within the digital ecosystem and lower retail channel power are identified as key concerns from operator perspective.

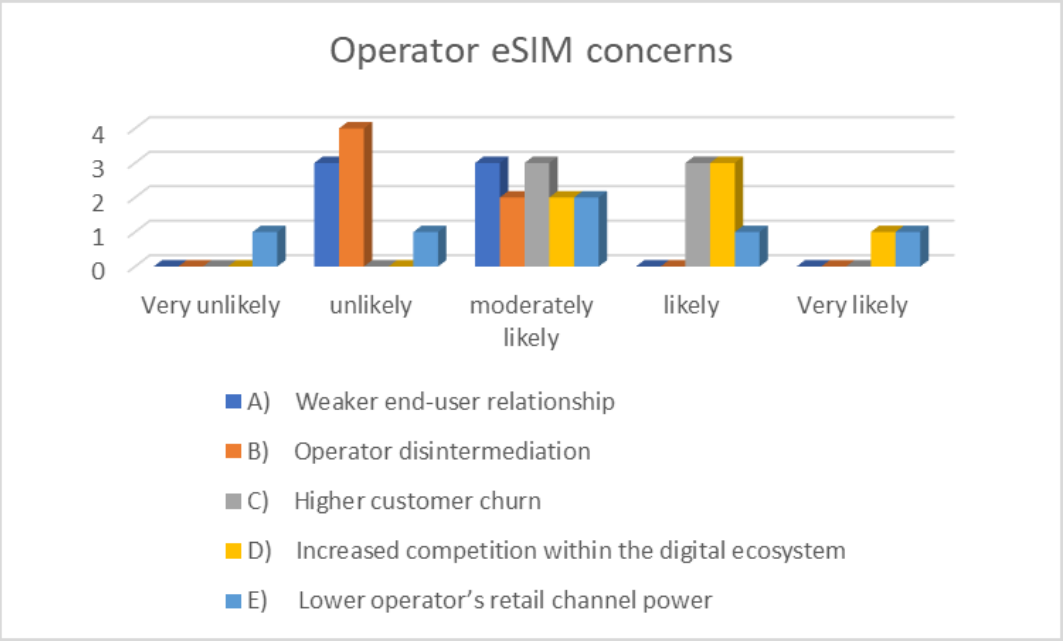

Figure 20) Probability of business scenarios

7 CONCLUSIONS AND DISCUSSION

7.1 Answering the Research Questions

What is readiness for embedded SIM technology for mass market mobile services?

Based on interviews with key stakeholders and customer data, eSIM service technology is ready for mass market and that's happening right now. New technologies always have challenges, benefit for Telia Finland is that it started investing and learning for this new technology in very early phase already in 2015. During research period all operators in Finland has brought eSIM services available for consumers and it is happening globally as well with majority of operators. To be able to make customer journey successful eSIM requires substantial amount of work and investments.

What customer value eSIM creates and how customers are perceiving embedded SIM? eSIM provides following key values for customers:

- Enables Internet connectivity offering for new devices, for example companion devices smartwatches, IoT devices etc. This creates new use cases and value for customers as an example first phone for small children could be smartwatch providing same basic functionality as traditional phones
- Digitalizing SIM changing processes makes changing subscription and SIM easier for customers. Downloading and installing embedded SIM can be done wherever without need for contacting operator physically, can be done for e.g. during travelling. Enhancing convenience for the customer for getting the job done much faster than before.

How Embedded SIM as potentially disrupting technology would affect for Telia Finland business models, what are possible scenarios? Potential scenarios during research were identified and are identified as:

A) Mobile Network Operator driven business
B) CPE vendor driven business, example Apple or Samsung

C) OTT vendor driven business, example Google

Managing the implications for these identified scenarios requires more detailed analysis and is recommendation for further study.

7.2 Research limitations and suggestions for improvement

Subject was very new for this research, there were not much data available on the beginning. Case study operator has very competent professionals working in this area contributing extremely well for this research. It could be questioned if results are viable with limited numbers of interviews. This risk was mitigated with iterative rounds with key stakeholders and utilizing external data for example to verify results.

7.3 Further Research

Further research in found scenarios are highly recommended. Another topic for future research could be more detailed study of founded new business opportunities as an example global traveller business.

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8 APPENDIX

Appendix 1. Interview questions

1. Company name

2. Person and position

3. You have introduced eSIM in Finnish market recently, how is customers perceiving
eSIM compared to physical SIMs, will it effect on customer satisfaction?

4. You have introduced eSIM in other countries as well, is there differences between countries with customer perception about eSIM ?
5. You are only operator in Finland supporting eSIM, do you think other operators will follow?
6. To which customers you are selling eSIM today
7. Is there a product push or market pull for eSIM ?
8 What customer problems eSIM solves?
9. There's 2.0 GSMA eSIM standard available, do you think eSIM is feasible for mass market consumer business with this version?
10. eSIM is new technology how do you see Interoperability with eSIM compared to normal SIM ? Environment: eUICC --- Subscription Manager --- multivendor
- How to secure interoperability?
- will it require extra effort you as an operator?
- how do you see this will evolve?
11. Future eSIM development, what features are on roadmap to support consumer business?
12. How eSIM will change manufacturing, logictics and supply chain processes?
13. How do you see eSIM readiness for mass market rollout, anything preventing this?
14. What pros/cons eSIM provides for consumers?
15. What benefits eSIM provides for you as operator?
16. What benefits/challenges eSIM provides for terminal vendors?
17. What benefits/challenges eSIM provides for SIM vendors?

18. Why there's very limited numbers of CPE's supporting eSIM ?

19. You were first mover with eSIM on Finnish market, do you consider the timing successful? Why?

20. What are your growth expectations? what is driving growth?

21. Are you expecting eSIM to replace or complement physical SIM, in which timeframe?

22. Will there be need for having physical SIM's in future, in which use cases?

23. Do you see other alternatives for eSIM, what are they?

24. According to GSMA following are main operator concerns regarding eSIM, how do you see probability of these?

A) Weaker end-user relationship

Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely

B) Operator disintermediation

Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely

C) Higher customer churn

Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely

D) Increased competition within the digital ecosystem

Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely

E) Lower operator's retail channel power

Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely

F)

25. What new business possibilities you see with eSIM for b2c business as an operator? Can you give some examples?

26. What differentiation possibilities eSIM provides for you as an operator?

27 What risks do you see eSIM could bring for Telia b2c business and how to mitigate

a) Technology related risks (interoperability, security,)?
b) Customer related risks, perception, intake?
c) Business related risks?
d) Something else?

28. Which of the Telia Finland business model objectives eSIM will effect and how?

Customer segments(b2c)

Value proposition
Channels
Customer relationship
Key partners
Revenue Streams
Key resources/Key activities
Cost structure

29. Will eSIM change/disrupt operator business models, how?
30. How do you see following potential scenarios for eSIM business models
A) MNO driven, as is, operators will manage customer interfaces
Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely
B) CPE vendor driven, example Apple, Samsung, CPE vendors manager customer interface
Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely
C) OTT driven, example Google Fi-project, global OTT-player manage customers interface
Very unlikely, Unlikely, Moderately Likely, Likely, Very Likely
D) Something else please define?

31. How you as an operator are planning to secure your position in eSIM business models?