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Implications of Industry Dynamics on Strategy, Case: LoRa Tracking System in Reindeer Husbandry in Finland

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Abstract

Purpose – The purpose of this study was to examine business forces underlying the animal tracking industry in Finland. The goal was to find key factors that affect the competition in the industry. The results were meant to be used as a guide to develop business wise a competitive technology solution to track reindeer.

Methodology – The study was implemented with qualitative research methods. Interviews and desk research were used as data acquisitions methods. The analysis was done using Porter's five competing forces framework (1979) combined with analysis template originally created by Dobbs (2012). The five forces results were then used to support strategy canvas (Kim & Mauborgne 2004–2019) utilization where value curve of Rural IoT death indicator was placed against its competitors to gain insight how death indicator should be positioned to the market.

Findings – Key results from the study indicate that the animal tracking industry in Finland is rather small with 4 main players ruling the market. Products are very a like, supplier components are standardized, buyer groups are only few, substitute products are expensive lacking features and new entrants can possess a credible threat to enter the market. Lora-based Rural IoT death indicator prototype is an example of potential new entrant that can discover strategic sweet spots to enter the market.

Originality/Value – The study provides unique perspective to animal tracking industry in Finland and the results can be used as a starting point when strategically planning new products, services or business models to the proposed market. Future research should be done on rising IoT technologies and their business opportunities more detailed. Also Scandinavian level business studies could indicate suitable new buyer groups for the rivals and could also enrich the data gathered because there are lots of areal similarities in northern countries.

Keywords – animal tracking, five forces, industry analysis, reindeer tracking, Lora

Contents

1 Introduction

Everybody knows we live in digitalization era where everything grows very rapidly and new product launches become an everyday phenomenon. Especially ICT innovations are rising like mushrooms after rain. Technology development is so fast and worldwide it causes component prices to go down and it forces many industries to disrupt traditional products and business models. Digital era comes still with great opportunities for rural areas to keep up with the fast developing world. In Finnish Lapland there is a good environment to create new products and businesses. We have good education system, university, professional research and development units and local authorities to support research funding. Also Lapland provides a great arctic environment to test new technology solutions in harsh conditions. *"If it works here – It'll work everywhere"*.

One of the major problem in Finnish Lapland is the lack of human resources in SME's. Over the half of Lappish enterprises have only 1 employee. There is a great need to be able to support local SME's to grow their businesses, renew their products and services and to protect their businesses from global competitions. TEQU concept is a service created by Lapland University of Applied Sciences which promises to help SME's to renew themselves with fast technology prototypes. It can provide a starting point when enterprises are changing gears to new products and faster reincarnation. TEQU concept is presented in website www.tequ.fi.

One of the interesting industries to boost with new technologies comes from reindeer husbandry. Reindeer husbandry is an important industry in Lapland. There are 200 000 reindeer owned by 5000 farmers. Reindeer move in large geographical areas and there is a lack of good solutions to track their movement. Thousands of reindeer disappear yearly when they are attacked by beasts like bears and wolverine. For reindeer owners it is a very unfortunate circumstance. Luckily there is a compensation system that that makes it possible to acquire circa 1000 € of compensation per dead reindeer. The problem arises when the dead reindeer is not found. Then the compensation is prohibited.

This study discusses Rural IoT project and its aim to create a new technology solution to track reindeer through their lives. To support technology development there is a need to analyze current animal tracking solutions industry in Finland in order to be

able to create competitive new solution for the market. Rural IoT project is carried out between 8/2018-4/2019.

This is a business view of Rural IoT project and purpose of this study is to understand animal tracking industry better. With that processed information strategic implications are provided for the new technology prototype created in this project. These results are meant to be used as a guide to help technology companies to create competitively more sustainable products in animal tracking industry.

Main research questions are presented here:

RQ1
What are the underpinning industry forces of animal tracking systems industry in Finland?

RQ2
What are the strategic implications of the industry forces to new entrants using LoRa technology in reindeer tracking?

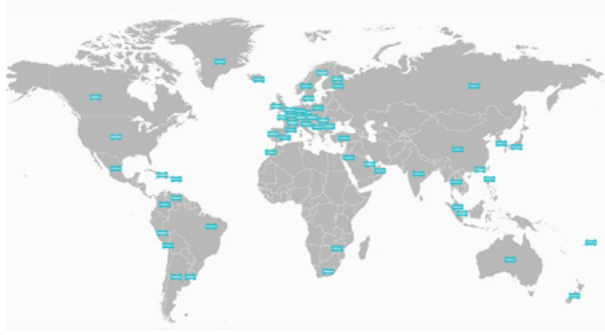
This study is carried out in fast 2 months time window. Therefore it should be noticed it tries to provide a first snapshot of the animal tracking industry and driving business forces behind it.

2 Literature Review of Animal Tracking Industries

2.1 PET WEARABLES INDUSTRY IS GROWING GLOBALLY

This chapter discusses earlier done research and technology trends related to animal tracking solutions from global point of view. The global market size for pet wearables industry was 1.07 billion dollars in 2016. The trend seems that pet owners are increasingly interested in connecting better with their pets. Solutions have been created to support companionship, entertainment, fitness and mental well-being. It is anticipated that the market growth still increases from the current situation. (Grand View Research 2019)

Technology wise wearable devices have many options. IoT, cloud based technologies, mobile technologies and sophisticated analytics will support new solutions to emerge. From sensors perspective there are multiple options and combinations to choose from like GPS, RFID, motion sensors, accelerometers, cameras, wireless technologies etc. One of the key ingredients is battery life which projects how good the wearable solutions really are. Major part of the wearables use smart technologies that consume a lot of power. When talking about the battery life it usually takes only 1-2 days to drain the batteries out. This is a major problem and challenges the rapid industry growth. High cost of wearable devices is also considered a key factor affecting negatively to industry growth. (Grand View Research 2019)



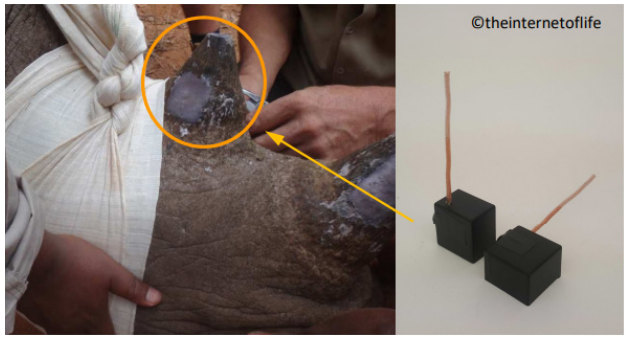
One example of successful pet wearables is Fitbark Inc. Their product Fitbark 2 utilizes modern IoT, cloud and analytics technologies with user centric value propositions. Fitbark promotes that human and dog health should go hand in hand and at same time all this could be fun. The company has expanded to worldwide markets and Fitbark devices are used in 125+ countries. Fitbark can be used to monitor dog's mobility issues, skin diseases, nutrition, cognition, vision and a wide variety of medical conditions. It links with Android and iOS devices and is also connectable to

many other product families like Apple Healthkit or Google Fit. From marketing point of view Fitbark is introduced with appeal to emotion centric approach where a dog is praised to be human's best friend and its wellbeing is told to be as important as its owner's. (Fitbark 2019)

2.2 LORA AND ENERGY HARVESTING SOLUTIONS COULD BE THE KEYS TO BATTERY LIFE PROBLEMS

2.2.1 Lora and use cases

"Lora" stands for long range and it is a wireless radio frequency technology suitable for different kinds of IoT solutions that need long range and energy efficient battery usage. It has become one of the standard technologies in modern IoT networks worldwide. IoT solutions can be used to target big global challenges like energy management, natural resource reduction, pollution control, infrastructure efficiency and more. Typical uses cases lay around themes like smart cities, smart homes and buildings, smart agriculture, smart metering, smart logistics and so on. (Semtech 2019)



Key features of Lora are long range, low power, geolocation and low cost. Additionally it is an open standard. Lora solutions can be used outside and inside because the coverage is suitable for both. Sensors can be connected even 48 km away from base station. LoraWAN protocol is developed to use extremely low power so batteries can last up to 20 years depending on application. Lora based applications can also be used when tracking features are needed and it can be done without excess energy consumption. Low cost is one of the key features of lora because it reduces infrastructure investments, operating costs and end-node sensor costs. And finally LoRaWAN is an open standard and it ensures interoperability between different solutions and applications. (Semtech 2017)

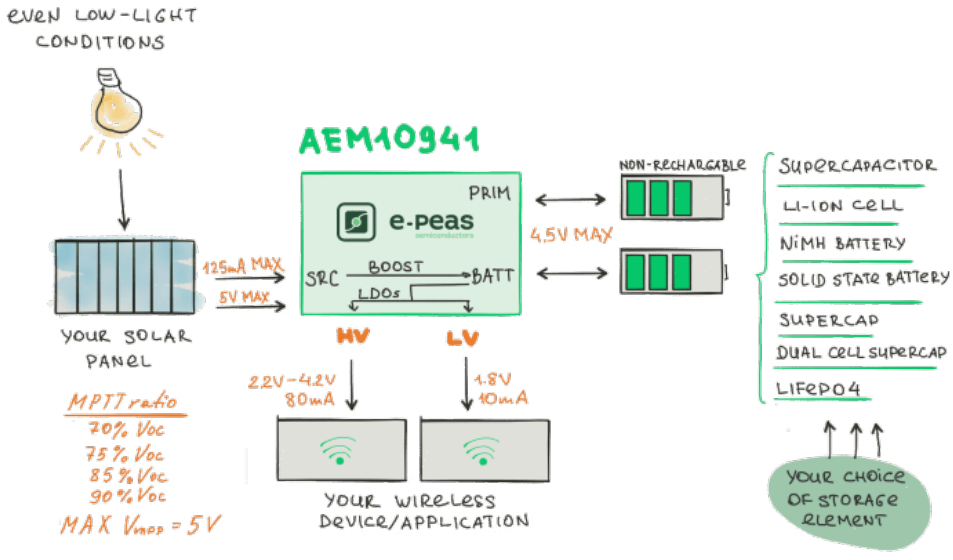
One of the more interesting applications is a rhino tracking solution in national park in Africa. This IoT security solution shows the location of rhinos inside national park so security guards can position themselves close enough to prevent poaching. Same devices can be used to monitor the well-being of park personnel. Central control room is the place to monitor all the assets on the same map. (Semtech 2017)

Another Lora for animals application developer is Actility. Their Lora-based IoT solutions can be used to monitor cattle. Usually location, temperature and heart rate

are the interesting metrics to follow. Lora equipment is attached to collars or ears of the cattle. Triangular tracking is used to determine the location of the cattle. That helps to save battery because GPS is not needed. Actility's IoT solution has been in test with reindeer in Finnish Lapland. Digita Ltd was the Lora network provider in that case. (Actility 2019) Ari Kuukka from Digita commented the first tests have been done in Lapland to evaluate the functionality of Lora network and this specific Lora device. The tested reindeer tracker includes GPS and accelometer. It enables counting the movement of the animal, locating the animal and it also provides an opportunity to test the quality of Digita's Lora network. Data is send to the server once in three hours. Kuukka says that the battery of the tracker lasts about a year. (Actility 2017)

2.2.2 Energy harvesting

Photovoltaic energy harvesting solutions are one of the rising technologies directly related to smart device energy management. This kind of integrated energy management solution uses small solar panels which extract solar energy and transform it to electric power. Energy harvesting controller then directs the electricity to the batteries and to a wireless device at regulated level as can be seen in figure below. Energy harvesting solutions may get rid off the big sized battery and they extend the lifetime of batteries. (E-peas 2019)



(E-peas 2019)

Energy harvesting is also used in Southern North Sea. It is a very active environment in tracking bird migration with GPS. Various gull species are under active tracking. Bird tracking has been developed by the University of Amsterdam, launched in 2013. The Research Institute for Nature and Forest (INBO), the Flanders Marine Institute (VLIZ), Ghent University (UGent), and the University of Antwerp (UA) are following extensively various seagull species with light gps tracking devices. The monitoring devices are equipped with a solar panel to extend battery life. (Research Institute of Nature and Forest 2014)

GPS tracking devices with solar panels are manufactured for example by Ornitela Ltd. With the solar panel, the operating time can be extended considerably, so that the accuracy (points) of the tracking can be increased. Tracking points can be used to evaluate and predict bird behavior and migration. The size of the equipment has been kept low (30g weight), so smaller birds can also be monitored. Ornitrack 30 is based on both the GPS signal and the GSM / GPRS network. (Ornitela 2016)

(Ornitela 2016)

2.3 OTHER NEW RISING IOT-TECHNOLOGIES: NB-IOT AND SIGFOX

Narrow band - Internet of Things aka NB-IOT is one of the new cellular IoT technologies that uses radio frequencies. It is created by 3GPP as a solution for fast growing low power wide area network purposes. The goal is to provide global solution that enables application service companies to deploy their services worldwide. NB-IoT is a standardized protocol created to serve especially rising IoT solutions. It can be used for indoor and outdoor coverage and can support many IoT devices simultaneously. Other advantages are low device cost, low delay sensitivity, low power consumption and optimized network architecture. (GSMA 2017, a and b)

NB-IoT is be supported by all major mobile equipment and component manufacturers and it uses more simple technologies than cellular solutions. (DNA 2019) It can be used in cooperation with 2G, 3G and 4G mobile networks. Because of the more simple technology structure battery life of NB-IoT devices can be expected to last 10 years on multiple use cases. (GSMA 2017, b) NB-IoT is part of 4G standard but it can be also used with upcoming 5G technology. 5G opens up a lot of other possibilities for solutions that need fast response from the network and interaction. (DNA 2019)

SigFox is yet another IoT network technology that promises low power consumption and low cost to be possible to achieve. Sigfox is compatible with Bluetooth, GPS, 2G, 3G, 4G, and Wifi. SigFox operates in the range of license free frequencies at 868 MHz. (SigFox 2019) It can be used to connect numerous objects to the same base station. The base station manages data flow and interacts with cloud in 3 channels. The Sixfox cloud then communicates with customer servers and IoT platorms. Sixfox network consists of this three elements that are devices, gateways and cloud. (Ubidots 2017).

2.4 COMPARISON BETWEEN LORA, NB-IOT AND SIGFOX

Lora, NB-IoT and Sigfox are all low power wide-area IoT network technologies but can be seen not just rivalries but as different options inside the same ecosystem. NB-IoT is the most supported of the technologies because it can operate in cellular networks though it does not use IP based communication. It also responds faster than Lora and provides more data bandwith. Network handoffs are a problem for NB-IoT so it is best suited for stationary applications. Lora's benefits come from the possibility for users to put up their own secure networks and connect their devices to that. Lora uses license free frequency spectrum and has also longer battery life than NB-IoT solutions. Sigfox is the most simple of the three technologies. It has lowest cost radio modules of the three. Drawbacks come from limited data transfer from base station to an endpoint and mobile applications are difficult with Sigfox. (LinkLabs 2018)

3 Methodology

3.1 FIVE FORCES ANALYSIS IN GENERAL

This study uses Five Forces framework to analyze animal tracking industry in Finland. Michael Porter (1980) first introduced the five forces theory which claims that competition in all industries are shaped by dynamic forces, i.e. threat of entry, bargaining power of suppliers, bargaining power of buyers, substitutes and rivalry among existing competitors. Figure below summarises these forces. After the theory was published, many experts and researchers have complemented, altered and even criticized it.

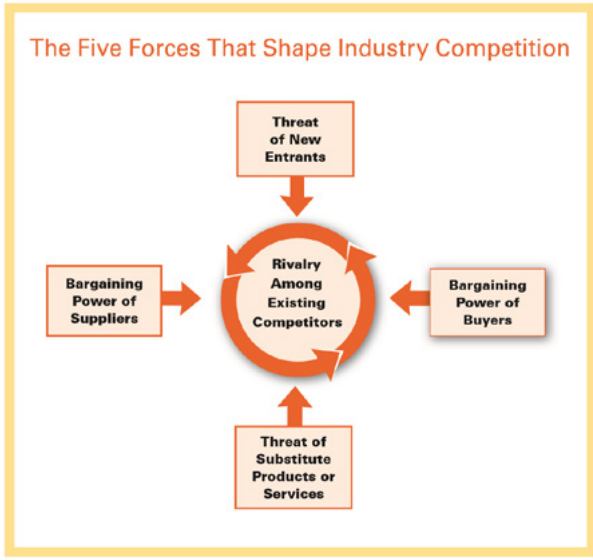
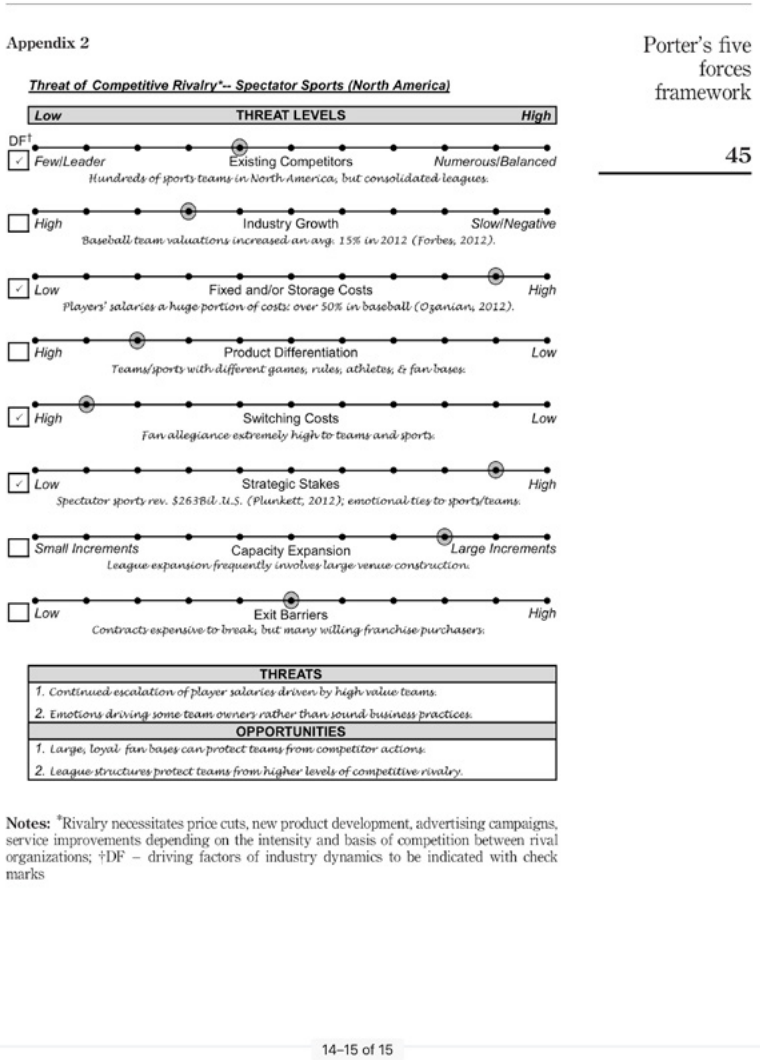


Figure: The Five Forces That Shape Industry Competition, by Michael Porter (1980; 2008)

Michael Dobbs (2012) writes about the challenges of applying Porter's five forces in practice. His views are based on Porter (2008), Magretta (2012) and Dobbs's own views. In order to help making more structured analysis, instead of shallow listing of issues, Michael Dobbs proposes five forces templates. Figure below demonstrates

Dobbs's template in the force of threat of rivalry in spectator sports. In essence, the template seeks to identify the threat, evaluate the threat with 'threat evaluation bar', identify the main Driving Factors of a particular force, and eventually, come up with the main opportunities and threats that can emerge or that exist. The threat and opportunities are external factors to company, that can also be part of other analyses, such as SWOT analysis as explained by Barney (1991).



Appendix 2

Porter's five forces framework

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Threat of Competitive Rivalry-- Spectator Sports (North America)*

Low	THREAT LEVELS	High
DF†		
✓ Few/Leader	Existing Competitors	Numerous/Balanced
	Hundreds of sports teams in North America, but consolidated leagues.	
☐ High	Industry Growth	Slow/Negative
	Baseball team valuations increased an avg. 15% in 2012 (Forbes, 2012).	
✓ Low	Fixed and/or Storage Costs	High
	Players' salaries a huge portion of costs: over 50% in baseball (Ozanian, 2012).	
☐ High	Product Differentiation	Low
	Teams/sports with different games, rules, athletes, & fan bases.	
✓ High	Switching Costs	Low
	Fan allegiance extremely high to teams and sports.	
✓ Low	Strategic Stakes	High
	Spectator sports rev. $263Bil U.S. (Plunkett, 2012); emotional ties to sports/teams.	
☐ Small Increments	Capacity Expansion	Large Increments
	League expansion frequently involves large venue construction.	
☐ Low	Exit Barriers	High
	Contracts expensive to break, but many willing franchise purchasers.	

THREATS
1. Continued escalation of player salaries driven by high value teams.
2. Emotions driving some team owners rather than sound business practices.
OPPORTUNITIES
1. Large, loyal fan bases can protect teams from competitor actions.
2. League structures protect teams from higher levels of competitive rivalry.

Notes: *Rivalry necessitates price cuts, new product development, advertising campaigns, service improvements depending on the intensity and basis of competition between rival organizations; †DF – driving factors of industry dynamics to be indicated with check marks

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Figure: An Example of Five Forces Template in Threat of Existing Rivalry by Michael Dobbs (2012)

Tony Grundy (2006) argues that the five forces model has its limitations and it has only scraped the surface. Furthermore, he proposes an onion model where Porter's five forces are placed in relation to PEST factors (see Kaplan & Norton 2008), growth drivers, five forces and competitive position in a micro-level. Figure below depicts this onion model and its layers from a macro to micro level, overall referred to as the competitive climate.

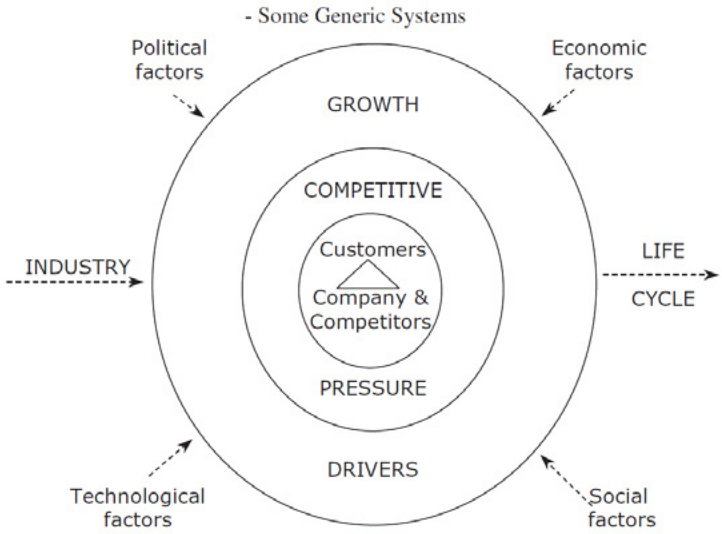


Figure: The Onion Model of Tony Grundy, Also Referred to as 'Competitive Climate' (Grundy, T. 2006)

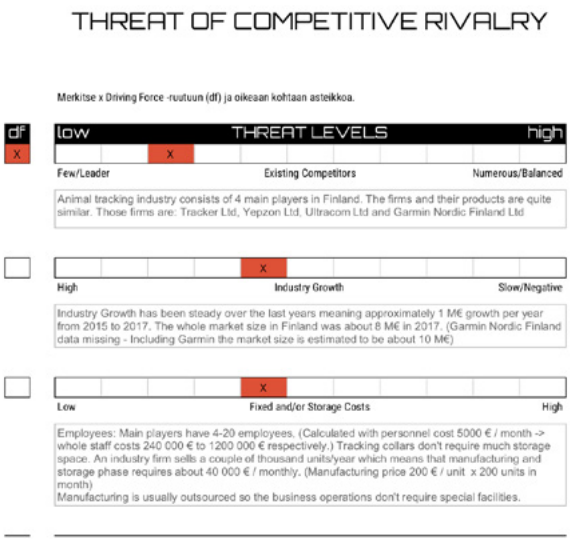
Furthermore, Grundy (2006) sees that segmentation is the key in five forces. He gives an example of funeral services where premium funerals and basic funerals have different forces and different overall attractiveness. He also states that the forces are interdependent and they do not work in isolation.

3.2 DATA ACQUISITION AND PRE-ANALYSIS

Rural IoT project used interviews and desk research when gathering data for the analysis of animal tracking industry in Finland. Reindeer owners, technology companies and dog tracking collar owners were interviewed. In total five interviews were made. Interviews were guided with central themes related to the research topic. Otherwise the discussion in the interviews was freely floating from topic to topic. Here are presented the types of interviewees used in this data acquisition:

1. Reindeer owner
2. Reindeer association agent
3. (Software) technology developer
4. (Hardware) technology developer
5. Hunting dog owner

All interviews were recorded by writing memos with central topics rosen from the discussion. Interview data was enriched with desk research. Desk research was done by using Meltwater data mining service and Google searches. (Digital) University libraries were also utilized during data acquisition. After the data acquisition phase all the data was carefully studied and used in the analysis phase with five forces template originally created by Dobbs (2012). The template was modified to be used effectively by TEQU crew. Here is a sample of the new template.



3.3 STRATEGY CANVAS AS A TOOL TO PROVIDE DIFFERENTIATION

Blue Ocean Strategy theory was created by Kim and Mauborgne in 2004. They also created a tool called strategy canvas which is a diagnostic tool and helps to visualize competing factors of different companies within the same industry. All this is pictured in one "canvas" and it is easy to point strategic differences and similarities between rivals. In this type of visualization the horizontal axis displays the different value making factors whereas the vertical axis shows the level of that parameter as you can see in the figure below. (Kim & Mauborgne 2004–2019)

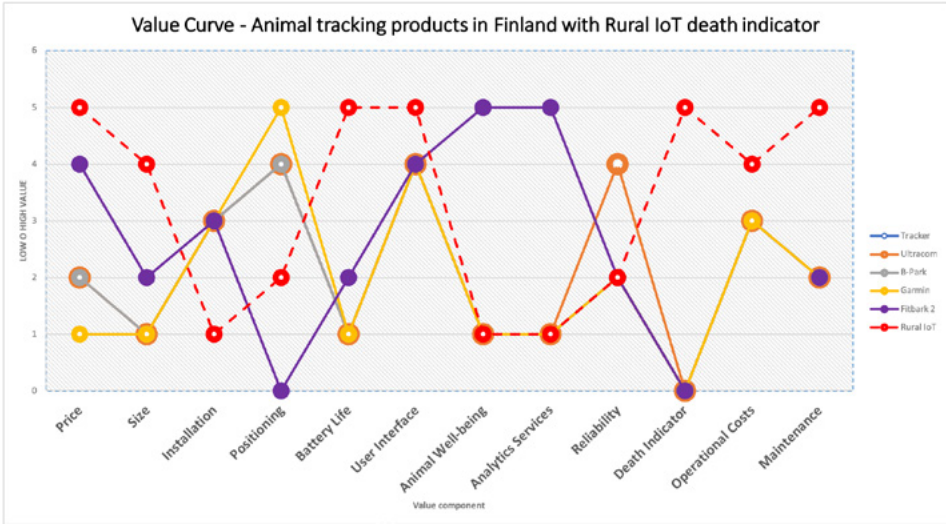


Figure: Value Curve (Modified by TEQU, Originally Kim & Mauborgne 2004–2019)

Strategy canvas visualizes the current state of the competition in a given industry and points out spots where one might find new value making factors that customers will engage in. (Kim & Mauborgne 2004–2019) In this study strategy canvas is used to find strategic sweet spots for *"Rural IoT reindeer death indicator prototype"* after the five competing forces have first been studied out.

4 Five Forces Analysis Results

4.1 FIVE FORCES OF ANIMAL TRACKING INDUSTRY IN FINLAND

Here are the results from the five forces analysis. When reading you should keep in mind that the industry is defined as "Animal tracking industry in Finland". The main products of this market are dog tracking collars which cost from 500 € to 800 €. Additionally there will be operational costs through software licenses. All of the main competitors provide software application (native or web based) as user interface to follow their assets. Here are presented some of the typical market products as examples:

Tracker Ltd's device is meant to be used for dogs as a collar. The price is 850 €. There is GPS, SIM card and 2G/3G connection battery last 48 hours in normal use and temperature range is -25C to +25 C. The device can be remotely updated. It also includes dog whistle, bark alarm, geofencing and a prey detector.

Some of the companies also provide collars that are specially made for reindeer like this red Ultracom device. It signals the location of reindeer and the route and average velocity can also be investigated even later on with the application. All of the tracked reindeer can be monitored via same map. Ultracom promises that this solution is reliable and extremely light for the reindeer to carry on. Also the easiness of use is expressed.

Five forces analysis results are presented below in the following order: Rivalry Among Existing Competitors, Bargaining Power of Suppliers, Bargaining Power of Buyers, Substitute Products and Threat of New Entrants.

4.2 RIVALRY AMONG EXISTING COMPETITORS

4.2.1 Existing Competitors

Animal tracking industry consists of 4 main players in Finland. The firms and their products are quite similar. Those firms are: Tracker Ltd, Yepzon Ltd, Ultracom Ltd and Garmin Nordic Finland Ltd. The whole market size in Finland is approximately 8–10 million euros in 2017 and the four largest firms possess near 95 % of the market share. Tracker Ltd. is the biggest one in Finland market with the revenue of 3,7 M€. The threat level for incumbents is low because there are so few competitors in the market.

4.2.2 Industry Growth

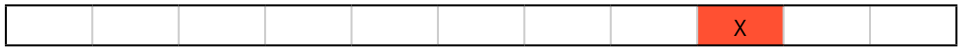
Industry Growth has been steady over the last years meaning approximately 1 M€ growth per year from 2015 to 2017. The whole market size in Finland was about 8 M€ in 2017. (Garmin Nordic Finland data missing - Including Garmin the market size is estimated to be about 10 M€). The threat level is moderate. Because the market is only slow growing there might be future battles ahead.

4.2.3 Fixed and Storage Costs

Animal tracking companies in Finland are quite small. Product development, planning and innovation are done inside main firms but tracking device production with electronics are usually procured from suppliers. Software production varies from firm to firm. Main players have 4–20 employees, (Calculated with personnel cost 5000 € / month -> whole staff costs 240 000 € to 1200 000 € respectively.) Tracking collars don't require much storage space. An industry firm sells a couple of thousand units/ year which means that manufacturing and storage phase requires about 40 000 € / monthly. (Manufacturing price 200 € / unit x 200 units in month). Manufacturing is usually outsourced so the business operations don't require special facilities.

4.2.4 Product differentiation

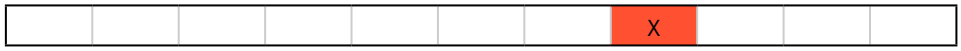
Tracking collars are quite similar in functionality and outlook. Most collar solutions include GPS/VHF, SIM-card, whistle-function and software based user interface including maps. Also product price points are in the range of 500€ to 800 €. In order to run the animal tracking systems, a server infrastructure and data management is needed. This can be organised with in-house servers and data management competence or by third-party services for managing the IT-stack, or by using cloud-based platforms. Product life cycle lasts from 5-7 years. Products are marketed in manly ”engineer guy” fashion highlighting mostly technical features. Because product differentiation is low it causes a threat for current industry firms. Now it is mainly defended through brand aspects.



High Product Differentiation Low

4.2.5 Switching Costs

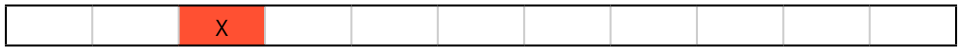
Tracking collars cost 500–800 € so usually buyers don’t want to switch to other brands products too often. Still software licenses don’t cost so much that switching costs would be considerable high. Software licenses are renewed annually. Basically there are no other switching costs than buying a new device. This is a major threat for contemporary companies in the industry. As digitalization continues to spread everywhere and customers learn to require more smart, data based services there is a strategic need to hook buyers with data services that make it more difficult to change products.



High Switching Costs Low

4.2.6 Strategic Stakes

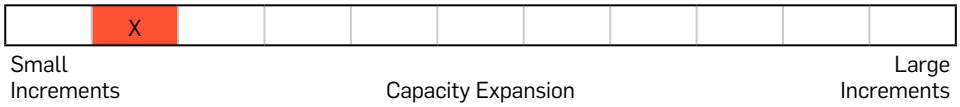
Strategic stakes are quite low. This kind of concentrated market is called Oligopolistic market. In oligopolistic market there are only few players that dominate the market. It usually leads to same kind of products in different companies and when employees change their job they often move to another firm inside the industry which leads to same kind of ideas in all of the oligopolistic firms. Oligopolistic market is quite steady and the rivalry is moderate. No one of the players tries to force competition too hard with offensive moves



Low Strategic Stakes High

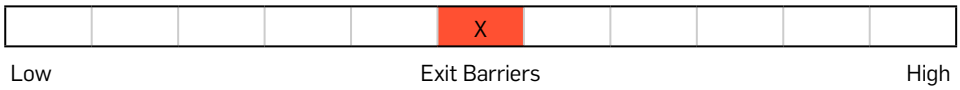
4.2.7 Capacity Expansion

The market is oligopolistic and market size quite small so firms are careful with big moves. That leads to moderate will to expanse capacity. For incumbents it is easy to follow the current demand and to adjust production relating to it.



4.2.8 Exit Barriers

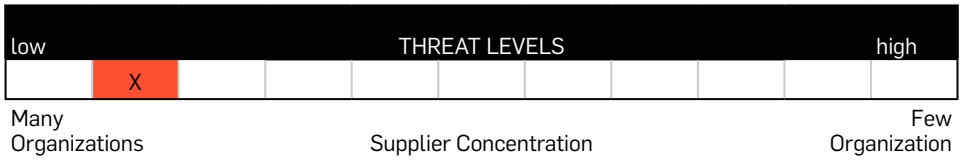
(Most) firms have operated since the 80' so it is emotionally hard to exit the business. Still firms are quite small and profitable so in principle they are easy to sell.



4.3 BARGAINING POWER OF SUPPLIERS

4.3.1 Supplier Concentration

There are many organizations who can deliver electronics, software and mechanical parts so technology supply is quite fragmented. There is a decent competition in networks so operators can't also lift prices. The supply and manufacturing of electronics components is fragmented as there are many major retailers and countless component manufacturers. The basic components and sensors are bulk products that are very standardised. There is nothing special about the suppliers.



4.3.2 Supplier Volume/Profit

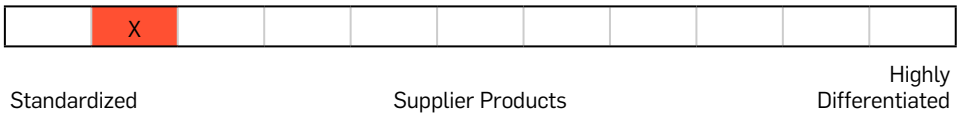
Electronic component manufacturing business returns average profits. Network operators earn about 12% profit. There are high volumes and high profit for component manufacturers and retailers.

4.3.3 Supplier Forward Integration

Animal tracking business is quite small in Finland so the market is not very interesting. Buyers are individuals who can be targeted via web marketing. New technologies will open new possibilities for cost effective IoT services for masses. It is unlikely that the network providers and component manufacturers will integrate forward in the value chain and make animal tracking devices themselves. Still it would be technically quite easy for suppliers to perform forward integration.

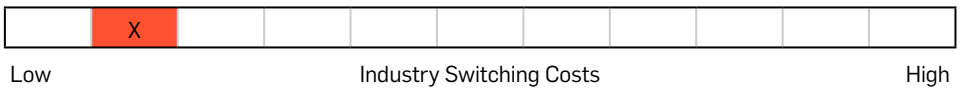
4.3.4 Supplier Products Differentiation

Supplier products consists of standard components and manufacturing methods so there is not much differentiation. The connectivity for current major animal tracking systems is mostly offered through cellular network by major players. There is notable competition between these operators, which presses down the prices.



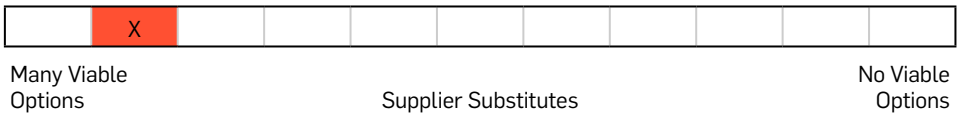
4.3.5 Industry Switching Costs

It is rather easy to change suppliers. There are no long contracts or expensive rare parts or licenses have to be purchased. It does not create significant switching costs in a design phase to switch from a component to another.



4.3.6 Supplier Substitutes

There are lots of component manufactures and software firms available in Finland and even more in international markets so the threat is very low.



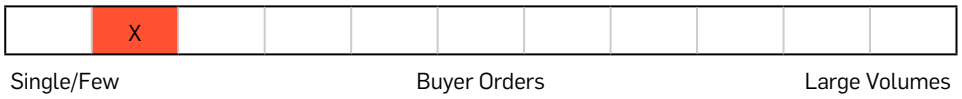
4.4 BARGAINING POWER OF BUYERS

4.4.1 Buyer Orders

According to interviews, a typical buyer is either a hunter or a reindeer owner. There are about 300,000 hunters in Finland who own a hunting card. One hunter usually has 1–2 dogs with their own tracking pool. Officially there are 5,000 reindeer owners in Finland, but there are only 1,000 decision makers. The rest are family members who have been technically marked as reindeer owners.

The maximum allowed number of reindeer in Finland is 200,000. About 100,000 new reindeer are born each year. The herd leader is often put on a gps tracking stack, followed by other reindeer in the herd. Therefore all reindeer do not have a collar because the costs are too high. Thus, the number of purchases is small.

On the basis of these facts, we have assessed the "Buyer Orders" -power of an individual buyer as weak (1) level.



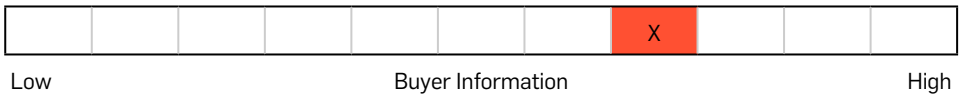
4.4.2 Buyer Information

The operating environment of GPS monitoring collars is mainly in challenging conditions. Whether it's a reindeer or a dog owner, the product requires extreme reliability. Finland's climate brings its own challenges to the products. Hunters and reindeer owners exchange a lot of information from mouth to mouth. The discovered products quickly find their target audience, because the word rushes in these circles quickly. The social network is strong to both reindeer owners and hunters.

With the next generation moving into the mainstream, sharing and getting information through the Internet is increasingly common. Information is available to everyone, so buyers are more aware of what they are getting.

However, buyers cannot demand a lower price because durability is the biggest requirement for products. The main players in the industry have set their prices close to each other. With the growth in turnover in the industry, customers can also start demanding more features and lower prices.

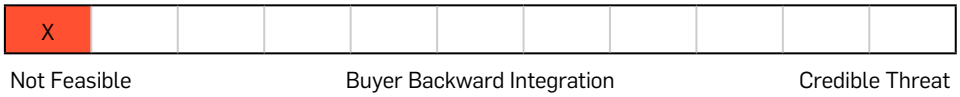
Based on these facts, we estimate the power of "buyer knowledge" to a moderate (7) level.



4.4.3 Buyer Backward Integration

Based on interviews, buyers are private individuals. There are no professional hunters in Finland, so hunting is a hobby activity. Reindeer owners are practitioners, but based on interviews they are not able to threaten the industry because they lack the necessary know-how to produce products.

On the basis of the fact, we do not see the threat that buyers begin to produce a competing product.

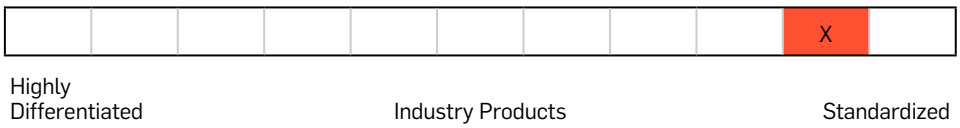


4.4.4 Industry Products

The survey has identified the major players in the field and their product offering. The companies are very similar in their brand, the products are very similar to each other. Products from different price groups are on the same level with different actors. Marketing focuses on the technical characteristics of all players, as the buyer group is men. It can be argued that this is an oligopolistic industry.

Product development has been very low over the years. Product features have stagnated to the same level as they were in the 2010s. The products of the industry are very similar in shape, characteristics and technical solutions.

Based on these facts, we estimate the "Industry Products" factor to be very high (9) level. In addition, we have also marked this factor as one Driving Factor. The biggest contributor is the weak product development in recent years. It is very likely that there will soon be new players in the industry or new products based on IoT technology. This technology can be used to develop operating time and features in a cost-effective manner. In addition, the technology makes it possible to lower the cost structure.

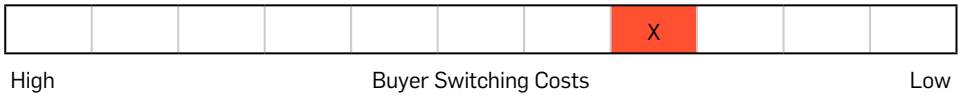


4.4.5 Buyer Switching Costs

GPS Tracking Panels prices are around 500-800 € depending on model and features. The product usually requires a sim card and a license for the application being used. The additional cost of these is 50-100e / year. Spare parts such as batteries, housings and antennas are available.

Although the purchase price of the product is relatively high, the product's lifetime is 5-7 years, so the annual cost will not be excessive. The buyer is not bound by long-term contracts, so it is not difficult to switch the product to a different supplier. The variety of products between different manufacturers is small, so changing the product is also easy in this regard.

Based on the fact, we raise the "Buyer switching cost" to a moderate high (7) level. The most important factor is the customer's lack of commitment to a particular product.

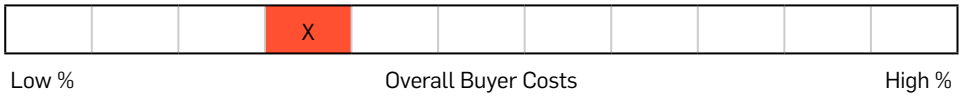


4.4.6 Overall Buyer Costs

The purchase price of the product is reasonable compared to the average buyer's income. The life of the product reduces the total price of the product, so the price of the product is not significant for the average buyer.

According to interviews, a single buyer buys a small quantity of products. Hunters buy 1-2 products on average every 5 years. The reindeer owner buys a few. Thus, the average buyer cannot influence the price of the product as a whole, as the purchases are small compared to the sales volumes in the industry.

On the basis of the collected fact, we estimate "Overall Buyer costs" to be low (3). The product is not a significant cost item for the user compared to his / her income.



4.4.7 Buyer Profitability

Products are bought by hunters and reindeer owners. Hunting in Finland is based entirely on hobby activities, with the aim not being financial productivity. Hunting clubs sell some meat outside, but this often only covers the club's maintenance costs.

Reindeer owners are mainly practitioners whose products include reindeer meat, reindeer products and various reindeer activities. Reindeer are followed by GPS collars mainly for beast damage. In addition, monitoring is used in autumn and spring when reindeer are separated.

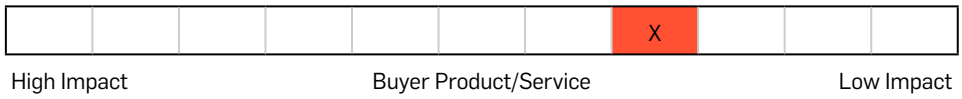
According to the interviews, the reindeer calf weighs about 15-20 kg, the price with bones is about 16 € / kg. The reindeer selling price is about 300 € / reindeer. If the reindeer gets eaten by beasts, the owner of the reindeer can get compensation of around € 1,000 / reindeer. Every year 25,000 to 30,000 reindeer disappear, with 5000

reindeer only be found. On the basis of the collected fact, we estimate the ”Buyer profitability” force to the moderate level (6).

4.4.8 Buyer Product/Service

According to the interviews, hunters and reindeer owners actively use GPS collars to track their animals. For hunters, the product brings value when they find their dog if they get lost. In addition, they can guide other hunters by following the dog so they can achieve the best possible result. For reindeer owners GPS collars are important aids because their livelihoods are partly based on these devices.

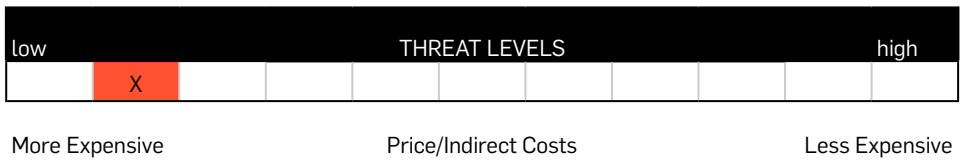
On the basis of the interviews, we estimate the ”Buyer Product / Service” to be low (2). Devices assist in action but are not a necessity to achieve the same productivity.



4.5 SUBSTITUTES

4.5.1 Price / Indirect Cost

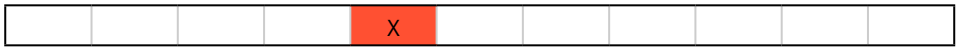
Substitute products/services for animal tracking: Drone, helicopter, sleding, ATV, outdoorsmen, bikers, skiiers. All of the mentioned subsitute products are expensive or otherwise slow and hard to operate and do not provide same kind of features like tracking collar devices. The threat of substitute product through price or cost is low.



4.5.2 Buyer Price Sensitivity

Industry products are important to buyers, though they have good information on the products. Animal tracking products have to be reliable and robust. All of the current products have similar price points so there are no major cost benefits for buyer to

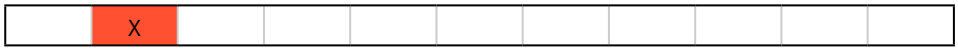
change brands or to change to substitute industry products. There is still a rising possibility for new comers enabled by cheap and capable IoT technologies. New technology also affects the price sensitivity of buyers when the information about ne technologies comes commonly known.



Low Buyer Price Sensitivity High

4.5.3 Performance

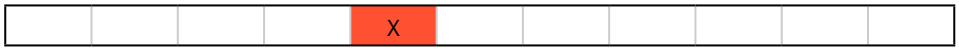
Substitute products are costly and slow to operate. Substitute product's tracking range is often wider, but the speed is slower so the operation is not cost-effective. Tracking collars can be used passively so the herders do not need to manually follow the animals all the time. Substitute products performance is much lower than the performance of animal tracking collars.



Lower Performance Higher

4.5.4 Buyer Switching Costs (From Substitute Products)

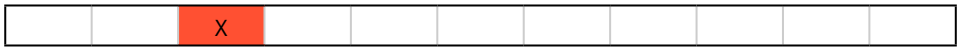
Substitute products are more expensive than industry's products. This leads to higher investment costs for the substitutes (drones, ATV's & sleds). Still there are no long agreements in substitute industry products with buyers. Switching costs are moderate.



High Buyer Switching Costs (From Substitute Products) Low

4.5.5 Buyer Profile

Substitute products have multiple and different buyer groups that are motorists, campers, farmers, photographers and leisure timers. In animal tracking industry buyer groups are concentrated to dog owners and reindeer herders so there are only few different buyer profiles. Because substitute industries have multiple options to sell for there is no big threat for tracking industry firms to be afraid of.



High Buyer Profile Low

4.5.6 Substitute Industry Price / Performance Trends

Alternative products are targeted at different buyer profiles. The same products are being used to monitor animals. Drones are developing to have more flying range but can't still produce exact positioning of animals and also need an operator to remotely controlling the flight. Currently there is no threat or no significant impact from substitute products.

4.6 THREAT OF NEW ENTRANTS

4.6.1 Supply-Side Economies of Scale

Scaling is relatively easy due to the large supply. As volume grows, optimizing the chain is very important. Current animal tracking market in Finland is rather small so there are no great benefits in the supply-side and mass production of tracking devices is not needed. Therefore supply-side doesn't introduce great strategic protection to current firms in the business.

4.6.2 Demand-Side Benefits of Scale

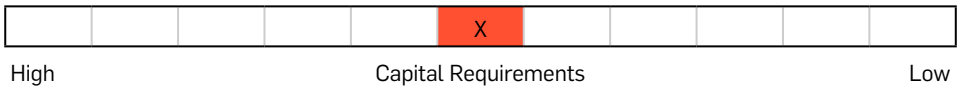
Current products have moderate network effects. Tracking systems can be used in groups and applications (map) can show several animals on their single interface views. Still there are no significant network effects so that the users would gain more value from other users choice of (products) brand.

4.6.3 Switching Costs

Industry products are mainly dog tracking collars and they have relatively low switching costs. Product prices range from 500 € - 800 € divided for life cycle 5-7 years the cost is low. No long agreements, only monthly or annual licenses.

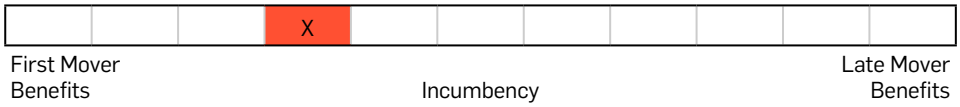
4.6.4 Capital Requirements

One of the biggest costs of getting into the industry is the casting molds and the marketing of the business. Other costs consist of the smallest entities.



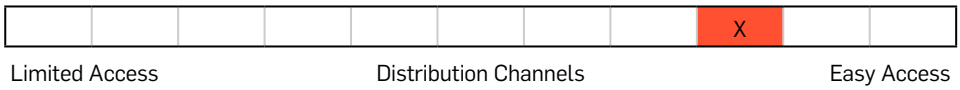
4.6.5 Incumbency

Product development has been slow in the industry, so a company with new technology has an advantage. A much cheaper price with the same features is a requirement. Product reliability is a key factor among buyers so the known brands gather benefits compared to new comers.



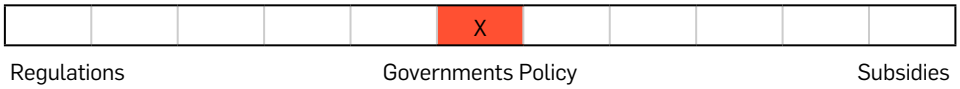
4.6.6 Distribution Channels

For new entrants it is a challenge to match the (cost) effectivity of incumbents in traditional distribution channels. Now in digital era this factor is changing and customers are able to buy their products directly from online stores. In this case, the logistics chain is cost effective.



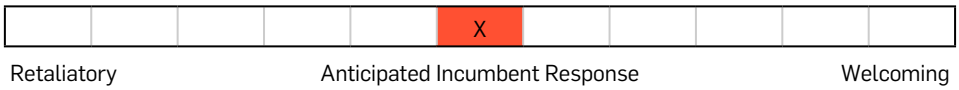
4.6.7 Governments Policy

The products in the industry are of collar type, where there are no specific regulations for the product itself. If the product is placed inside the animal, the requirements of the product will increase and refer to certain standardization.



4.6.8 Anticipated Incumbent Response

There will be few new players in the industry, newcomers will be taken into account by large players, and products will be copied.



5 Summary of Five Forces and Implications for Strategy

5.1 RIVALRY SUMMARY

The rivalry amongst existing competitors culminated to two key factors that were the most dominant aspects driving the competition dynamics. Those were Existing Competitors and Product Differentiation (figure below). At first Existing Competitors popped out because there are only four major players in the industry (Tracker Ltd, Yepzon Ltd, Ultracom Ltd and Garmin Nordic Finland Ltd), with the same type of operations and products. The sector grows lightly every year, but the market is not divided into more operators. The second Driving Factor (Product Differentiation) is also strongly related to the first. The products are almost identical in their characteristics. Product development has been slow and marketing has been largely focused on ”engineer guy” style. Usually in this type of oligopolistic market the firms are quite similar because employees change their employers to rival firms. That leads to situation where knowledge and expertise circulates from firm to firm and basically the all look the same.

Based on the study, there is a strategic opportunity to launch new type of products. Trackers have long been based on the same radio technologies, user interfaces and technical features. New technologies (IoT, Cloud, web, mobile) enable potential business opportunities for newcomers in this field. Particularly new features, different price points and new service models are advantages that today’s actors cannot widely offer with their current products.

In current situation tracker owners in Finland have strong communities where grapevine communication strongly affects people’s purchaising decisions. That helps to protect existing brands to some extent. But there is a strong risk that the possibilities can invert to threats when not utilized as the ”digital era momentum” is going on. Rising technologies and only moderate switching costs can lead to risks that buyers are likely to change their choice of brand and product when newcomers arise.

All in all, the industry has room for newcomers to offer either products with new technology or products with completely different, ”appeal to emotion” centric value propositions. The industry’s net sales are growing positively every year, making it easier to access this industry. The age distribution of the user base will decrease in the next few years, when young people will be able to demand new features from their products and services.

Figure: Dynamics of Rivalry

5.2 SUPPLIERS SUMMARY

On the basis of the results, two Driving Factors emerged from the supplier side force: Supplier Forward Integration and Supplier Products (see Figure below). Forward integration is possible because the products are moderately simple in technology and there are big players in electronics and networks industries who are interested in new markets and end node markets also. In addition, new trends in the industry are known in the supply chain as they are actively involved in electronics manufacturing.

Supplier products greatly affect the industry dynamics of trackers. Standardized supply components lead to low prices and rather similar solutions inside the industry. Competition in the supply industry is tight as components are widely available. There are lots of component manufacturers to choose from and they can not demand a premium price of their products. Pretty standardized supply lifts the interest in newcomers to reach the tracker markets.

Threat of Suppliers force characteristics make it possible to execute new strategic moves. New customer segments can be reached by redesigning of products and creating new value propositions. One possibility is also to see the opportunity to grow rapidly in the industry, as subcontractors can be easily increased without compromising quality.

On the other side strategic threats are created by new IoT solutions. With the new technology there will surely be new competitors in the industry, such as Digita Ltd., who has expressed interest in the industry. At the same time, new service models are emerging.

Figure: Dynamics of Supply

5.3 BUYER SUMMARY

Threat of Buyers analysis emerges two key driving factors: Industry products and Buyer product/service (See Figure Below). Industry Products became one of the Driving Factors, because the industry's products are largely similar (standardized). Another Driving Factor is the Buyer Product / Service that arose mainly due to the importance of trackers ability to effectively follow buyer's assets in daily operations. Effectiveness of operations is very important for reindeer husbandry and hunters.

The strategic differentiation possibilities emerge from the lack of differentiation in products inside the industry. Future technology solutions in the industry (IoT, etc.) will cause challenges for old technology suppliers. The new technology also enables a significantly lower cost structure for device owners. As the costs fall and the properties grow, new customer segments can be created, which will increase the turnover of the industry.

On the other hand, strategic threats are created when the customer learns more about new technologies and gets more product information. The customer will understand that it is possible to demand new technology and features for existing products. In addition, getting new products to do the same job is always easier. The second strategic threat was the moderately low switching costs of the products. Customers are not tied to a specific product or product family. The customer is ready to change the product if he is not satisfied with the reliability of the product.

The buyer power culminates to a fact that they are ready for new type of products. In particular, reliability and power consumption are of interest to buyers. Power consumption is one of the major problems with today's tracking devices, as the product's lifetime is relatively short. With a new technological solution, power consumption can be reduced significantly, while providing new information on the animal being monitored. It is highly anticipated that new IoT technology devices will enter the market in the coming years, with a much longer service life than current products. New products are likely to enter the scene. Buyers, animals and markets are ready.

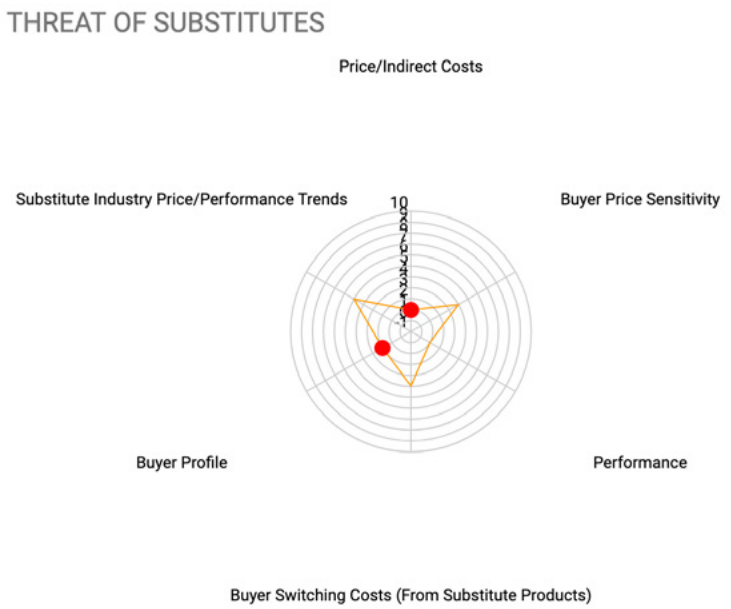


Figure: Dynamics of Buyers

5.4 SUBSTITUTE PRODUCTS SUMMARY

Threat of Substitute Products analysis lifts up two key factors driving the dynamics of competition: Substitute Product Price and Buyers Profile (See Figure Below). Substitute products (ATV, sleds, drones) are way more expensive than animal tracking collars and do not possess a straight threat for industry products. They also lack the "automated" tracking features that animal collars are packed in with. Substitute products require active users/pilots to operate them.

The second key factor Buyer profile is totally different in substitute industries. In substitute industries buyer groups come from many segments and substitute products are developed to serve their specific needs. Difference in price points and features

between animal tracking industry and substitutes comes from the different needs in these wide variety of buyer groups.

Although it does not seem that substitute products form a big threat to firms it can be seen that there is an opportunity for substitute products to gain market share, especially through social media. New tracking services based on network effects (social media) and crowdsourcing (visual observation) can be one way to stand out from current competitors. The efficiency and cost-effectiveness of social media are high, so the new service can be lucrative for both the entrepreneur and the customer.

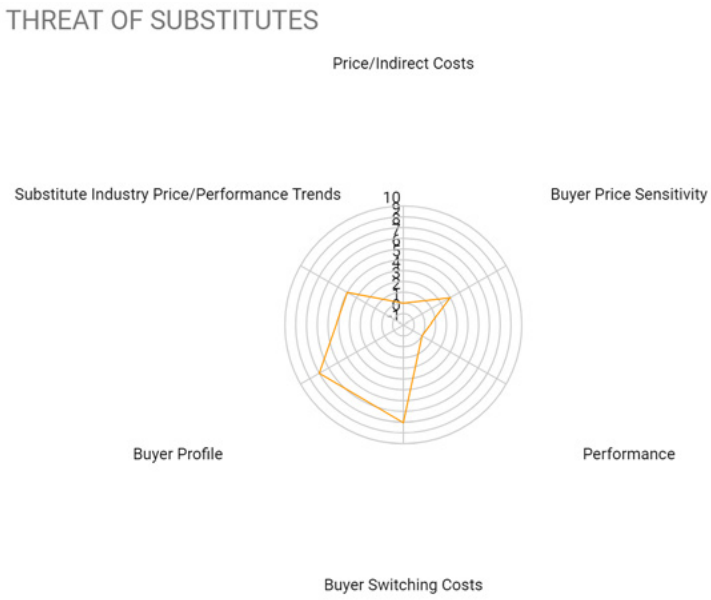


Figure: Dynamics of Substitute Products

5.5 NEW ENTRANTS SUMMARY

Threat of New Entrants analysis revealed to major factors driving the competition: Switching Costs and Incumbency (See Figure Below). The analysis showed that products switching costs were not high but rather sufficient. Low switching costs lead to customer's ease of switching the old product to the new manufacturer's product. Customers have no long-term commitment to current products, making the possible switch quick and easy.

Second Driving Factor rose from Incumbency. As the industry has long been experiencing mild competition it has led to only small number of customer segments and slow product development. Current brands have loyal customers so the brands have an advantage if they launch new products or features. Incumbency protects current

firms to some extent but there is a threat of new entrants who can benefit from coming outside with new business models, value propositions, technologies, services, or uses etc. New entrants may benefit from the digital era possibilities when there is no need for an old big distribution network and they can operate logistically very cost-efficiently.

The overall view shows that Threat of New Entrants is strong and it is highly likely that new entrants will be in the industry in the coming years. Successful new entry requires a new perspective on the products. New Entrants can cause changes in the industry structure, because the probability of breaking the oligopoly is strong. With the market increasingly focused on identifying and targeting customer segments, it is possible to find new customers for the industry.

5.6 Figure: Dynamics of Threat of New Entry

5.7 STRATEGIC IMPLICATIONS FOR RURAL IOT DEATH INDICATOR - VALUE CURVE

Strategy canvas on Animal Tracking Products in Finland describes with value curves how different products differ from each other. The curve is used to indicate how Rural IoT death indicator implant is measuring against its competitors. Rural IoT death indicator prototype is marked with red color in the following value curve (See Figure Below). The curve level does not represent superiority, but shows the stand out features from other comparable products in certain areas. The products in the comparison are

specifically designed for animal tracking or products used in reindeer tracking. Manufacturers include Tracker, Ultracom, B-Park Garmin, Fitbark and the Rural IoT prototype. Fitbark comes from a different market segment (pets) and is brought to the list for comparison because of the features that link to animal welfare. Fitbark products have not been used by reindeer.

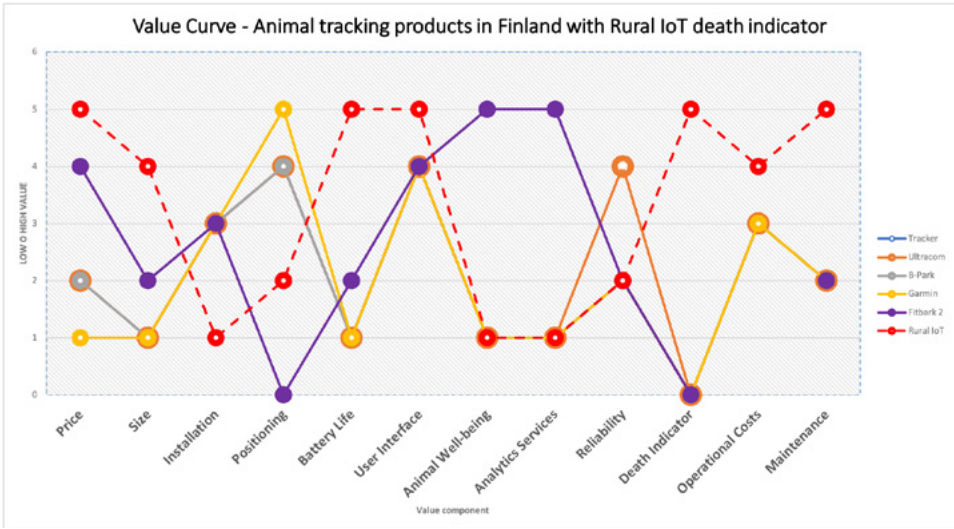


Figure: Value Curve of Animal Tracking products in Finland

The *Price* of Rural IoT prototype in Value Curve (See Figure below) is the most favorable to its competitors. The Prototype sales *Price* estimate is around € 30, while competitors' prices are € 500-800. The *Size* of the prototype is favorable when compared to its competitors, because with other manufacturers the product is placed in the animal's collar. *Installation* of Rural IoT prototype is weaker than the *installation* of other manufacturers' products because the product must be installed inside the animal being monitored. *Positioning i*s weaker than the competitors because the animal's rough position is only obtained once a day via Lora Network. The products of other manufacturers can track the animal in almost live mode. *Battery life* in prototype is superior to its competitors. The prototype battery lasts approximately 10 years, while other monitoring devices have a maximum of 2 years.

The device *User Interface* in Rural IoT prototype is more user friendly than its rivals, because it can be activated by NFC zip. Only the Fitbark product can monitor *Animal Well-being.* Rural IoT Prototype and other manufacturers' products mainly follow motion, heat or sound. *Analyzing Services* are by far the best with Fitbark. Data from other devices is not analyzed to the extent that it would benefit the customer. There is no big difference between the prototype and the products of different manu-

facturers in terms of *Reliability. Death Indicator* feature is not currently included in any manufacturer's product. It is only included in Rural IoT prototype. Operational Costs are all in the same range in the products on the market. A slight advantage for Rural IoT prototype comes from SIM-free technology. Other products need own licensing program as well as the operator's sim card. *Maintenance* is a key difference between industry products and Rural IoT prototype. Rural IoT Proto is not serviceable because the product is designed to be completely maintenance free. Spare parts for competitors are available for and their products are easy to send for service. This comparison shows that there are multiple features where Rural IoT death indicator prototype can differ from its competitors to provide real value to its potential buyers.

6 Conclusions

This business report studied animal tracking industry in Finland by using Porter's five forces framework as an analysis tool. It also gave strategic insight how to create a new technology solution suitable for these markets. Results were meant to be used as a helping hand for the forming of new prototype created in this same Rural IoT project. The study was organised by TEQU group of Lapland University of Applied Sciences.

Main research questions were:

RQ1: What are the underpinning industry forces of animal tracking systems industry in Finland?

RQ2: What are the strategic implications of the industry forces to new entrants using LoRa technology in reindeer tracking?

Animal tracking market in Finland consisted of 4 main players who dominated the market with tracking collar type products which were quite similar in features, outlook and functionalities. The market size is rather small (8–10 M€ / year). The market seemed quite stuck in place device technology wise. Late improvements were made mostly to native application and web interface parts. This leads to real threat in near future when IoT technologies are expanding to every market. Similar threats are emerging worldwide. According to Grand View Research (2019) wearables industry for pets/animals is rising rapidly and it is already a huge market achieving 1.07 billion dollars in 2016. It also seems that the trend is that pet owners are increasingly interested in connecting better with their pets. Solutions have been created to support companionship, entertainment, fitness and mental well-being. (Grand View Research 2019). There are plenty of opportunities for new entrants to achieve differentiation in Finland's market.

Suppliers do not have great power to leverage prices down in animal tracking industry. Components and technologies are well standardized and new technologies are emerging in fast pace. In worldwide view it seems that long range wide area networks like Lora, NB-IoT and Sigfox are rising and will establish more low cost opportunities for supply parts (LinkLabs 2018.) This brings more attraction to animal tracking industries and correlates with Grand View Research (2019) report.

In Finland tracker buyers purchase only small numbers of devices and the devices are important to buyers. That combined to only few providers, buyers can't leverage the prices down. Still it seems that as buyer information on products and digital possibilities increases, it can strengthen their power. According to Fitbark (2019) animal care is rising in popularity worldwide and owners are keen to invest more money on their pets well-being. Newest technology (analytics, cloud, smart sensors), to track animal well-being and to establish connection with their owners can lead to worldwide business success (Fitbark 2019).

Substitute products like ATV, sleds and drones can be used to track reindeer and hunter's dogs. Though they do not produce good results doing the job and they also cost a lot more than collar type trackers. Buyer groups for substitute products vary greatly from animal tracking industry. Worldwide view shows that alternate ways to handle device battery life can be seen as a threat or possibility to Finland's animal tracking market. Energy harvesting solutions can be used to reduce the battery size of tracking devices (E-peas 2019). Energy harvesting can be done with light solar panels attached to tracking devices at the same time extending battery lifetime (Research Institute of Nature and Forest 2014).

New entrants have lots of opportunities to enter the Finland market from technology point of view. The entrance is protected by relatively small market size and brand loyalty of current customers. Medium switching costs make it possible to change providers if new solutions arise. Globally new mobile technologies like NB-IoT will put up possibilities for new entrants. GSMA (2017) reports that cellular NB-IoT technology provides a global solution that enables application service companies to deploy their services anywhere in the world. According to Ubidots (2017) one new option is IoT technology Sigfox that enables low power consumption and low cost solutions to be created and used in synchrony with Bluetooth, GPS, 2G, 3G, 4G, and Wifi. The third rising technology Lora also uses extremely low power compared to current cellular (2G, 3G, 4G) technologies and can be used to track animals (Semtech 2017).

The analysis showed that there are a lot of strategic spots for new entrants to dip in. Rural IoT death indicator prototype was created to serve especially the needs of reindeer herders. Long battery life, death indicator feature, low power consumption, positioning and durability were the key features needed in the reindeer case. Some features like whistles and collars were eliminated to cut cost. Technology wise Lora was chosen to be used as basis for product design. With Lora and advanced electronics planning it was possible to create small, implant size death indicator - tracker that can be installed inside reindeer skin. Basic features include reindeer temperature tracking, rough positioning through Lora once a day and GPS signaling when reindeer temperature drops (after the death).

Future research can be split to two directions. Enriched data from current animal tracking industry in Finland and Scandinavia should be studied. Scandinavian areas are quite similar from operating point of view and new data could show even more detailed aspects of the competition and driving forces affecting it. Another research line should focus on finding new customers segments that could use rising technologies (like Lora in Rural IoT death indicator) to provide animal tracking services.

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The purpose of this study was to examine business forces underlying the animal tracking industry in Finland. The goal was to find key factors that affect the competition in the industry. The results were meant to be used as a guide to develop business wise a competitive technology solution to track reindeer. Key results from the study indicate that the animal tracking industry in Finland is rather small with 4 main players ruling the market. Products are very a like, supplier components are standardized, buyer groups are only few, substitute products are expensive lacking features and new entrants can possess a credible threat to enter the market. Lora-based Rural IoT death indicator prototype is an example of potential new entrant that can discover strategic sweet spots to enter the market. The study provides unique perspective to animal tracking industry in Finland and the results can be used as a starting point when strategically planning new products, services or business models to the proposed market. The study was funded by the Regional Council of Lapland and produced by the TEQU research group.

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