

Marko Kempas

International Business Development in Precision and
Smart Farming Application

Degree Programme in Business Management
And Entrepreneurship
2018

INTERNATIONAL BUSINESS DEVELOPMENT IN PRECISION AND SMART FARMING APPLICATION

Kempas, Marko
Satakunta University of Applied Sciences
Degree Programme in Business Management and Entrepreneurship
Master of Business Administration
January 2018
Supervisor: Antola Kati
Number of pages: 63
Appendices: 11

Keywords: Smart farming, Industrial IoT, Precision farming, Business Model Canvas

This study investigates Case Company possibilities to enter to fast growing and developing smart farming business in area. This business area is developing alongside with digitalization and internet of things, where reliable data transfer is needed. Case Company is looking for new alternatives to enter into Smart Farming Business. This business area has been identified going to strongly rely on technology around the world. Case Company is known as manufacturer of reliable mission and business critical communication and data transfer solutions for applications like machine control and utility networks controlling and monitoring..

The project started with study of alternative ways to make business development in fast changing environment. Also tool to visualize business development plan and structure for personnel to enable more efficient team work was important. Action research was selected for research method, because it is efficient method to plan, act, collect and analyze gathered information to re-plan future activities based on information gained. Process repeated again whenever needed. Customer needs and plans were decided to study with a pattern of pre-defined qualitative questions. Discussions and workshops held with customer around the world. It took two years to have several workshops with five different customers, having 16 person participating totally in these discussions.

Collected data and supplement literature were source for Business Model Canvas, which visualizes business opportunities well. This Business Model Canvas summarized business development alternatives for Case Company, when starting to enter into new business segment. Based on this model, development plan with next steps were created to ensure possibilities to enter this fast changing and growing market. Case Company has possibilities to expand its' business on smart farming application segment, where reliable data transfer is needed. During discussion and workshops of this project, Case Company convinced a global customer to start development project for smart farming application together with Case Company.

KANSAINVÄLISEN LIIKETOIMINNAN KEHITTÄMINEN ÄLYKKÄÄN MAATALOUDEN SOVELLUKSEN TARPEISIIN

Kempas, Marko
Satakunnan ammattikorkeakoulu
BME:n koulutusohjelma
Tammikuu 2018
Ohjaaja: Antola Kati
Sivumäärä: 63
Liitteitä: 11

Avainsanat: Smart farming, IoT, tarkkuusmaatalous, Business Model Canvas

Tämän tutkimuksen lähtökohtana oli selvittää yrityksen mahdollisuudet päästä mukaan nopeasti kehittyvän tarkkuusmaatalouden tiedonsiirtoa vaativien sovelluksien kehittämiseen. Yrityksen tavoitteena on saada tarjontansa osaksi maailmanlaajuisesti toimivien laitevalmistajien tarjontaa, sekä tarjota tuotteita ja palveluita myös pienemmille paikallisille toimijoille. Tämä liiketoiminta-ala oli tunnistettu voimakkaasti kehittyväksi, teknistyväksi ja kasvavaksi maailmalla. Yritys on tunnettu vaativien tiedonsiirtoratkaisujen toimittajana reaaliaikaista tiedonsiirtoa vaativilla liiketoiminta-alueilla, kuten esimerkiksi sähköverkkojen ohjaus ja valvonta sekä koneohjaus.

Projekti aloitettiin tutustumalla vaihtoehtoisiin tapoihin kehittää liiketoimintaa nopeasti muuttuvassa ympäristössä, sekä siellä tapahtuvan kehityksen kuvaamista mahdollisimman yksinkertaisesti henkilöstölle, jotta kehitykseen ja ideointiin voidaan osallistua myös suuremmalla ryhmällä yrityksen eri toiminnoista. Tutkimusmenetelmäksi valikoitui toimintatutkimus, joka soveltuu hyvin tiedon keräämiseen alati muuttuvassa ympäristössä, jolloin asioita, joita halutaan tehdä: suunnitellaan, toteutetaan ja havainnoidaan, sekä sen perusteella uudistetaan suunnitelmaa uudelleen ja käydään prosessi uudelleen läpi. Asiakkaiden tarpeiden ja tulevaisuuden tahtotilojen selvittäminen päätettiin suorittaa soveltaen kvalitatiivisiä esimääritettyjä kysymyksiä apuna käyttäen. Haastatteluja suoritettiin useita kertoja asiakkaiden kanssa eri puolilla maailmaa kahden vuoden aikajaksolla. Otoksen koko kasvoi 16 henkilöön viidessä eri yrityksessä.

Kerättyjen tietojen sekä muun lähdemateriaalin perusteella laadittiin Ostervaldin mukainen Business Model Canvas kuvaaja, jossa tiivistetysti kuvattiin liiketoimintamallin edellytykset yrityksen hakeutuessa uusille liiketoiminta-alueille. Näiden perusteella voidaan yritykselle laatia suunnitelma, jolla sen asemaa nopeasti kehittyvän ja teknistyvän maatalouden alueella voidaan kehittää ja parantaa sekä laajentaa. Kehityshankkeen aikana saavutettiin avauksia kansainvälisten suurasiakkaiden kanssa. Yritys pystyi aloittamaan uusia hankkeita, jotka ovat suoraan suunniteltu älykkään maatalouden tarpeisiin yhdessä asiakkaan tuotekehityksen kanssa.

TABLE OF CONTENT

ABBREVIATIONS/TERMINOLOGY:	6
1 INTRODUCTION	7
2 PURPOSE AND OBJECTIVES OF THE STUDY	8
3 METHODOLOGY AND RESEARCH PROCESS	9
3.1 Action Research	9
3.2 Data collection	11
4 INDUSTRY AND CASE COMPANY DESCRIPTION	16
4.1 Industry Description	16
4.2 Case Company Introduction	23
5 BUSINESS MODEL CANVAS	25
5.1 Business Model Canvas	26
5.1.1 Customer Segment	28
5.1.2 Value Propositions	29
5.1.3 Channels	31
5.1.4 Customer Relationships	33
5.1.5 Revenue streams	34
5.1.6 Key Resources	35
5.1.7 Key Activities	36
5.1.8 Key Partners	37
5.1.9 Cost Structure	38
5.2 Usage of business Model Canvas	39
6 RESULTS	40
7 CONCLUSIONS AND RECOMMENDATIONS	48
REFERENCES	50
APPENDICES	52
Appendix 1. Questions	53
Appendix 2. Smart Farm by AGCO	54
Appendix 3. Complexity of Smart Farm systems	55
Appendix 4. Agribot and drone by University of Sydney	56
Appendix 5 Smart Farm overview	57
Appendix 6. Action research status with customers and themes	58
Appendix 7. Business model canvas for case company	59
Appendix 8. Aspects of precision farming	60
Appendix 9. Smart Farming growth rates in geographical regions between 2013 and 2020.61	
Appendix 10. Complete connectivity in Smart Farm by Hexagon	62

Appendix 11. Smart Farming process in ERP by Hexagon	63
--	----

ABBREVIATIONS/TERMINOLOGY:

GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IoT	Internet of Things
ITS	Intelligent traffic systems
MARS	Monitoring Agricultural ReSources
OEM	Original Equipment Manufacturer
RTK	Real time Kinematics
SCADA	Supervisory Control And Data Acquisition
SME	Small or Medium Enterprise
SU	Sales Unit, responsible for application sales
UHF	Ultra High Frequency
VRA	Variable Rate Applications; seeding, weed control, fertilizer, line and soil cultivation intensity

1 INTRODUCTION

Farming has been vital element for human beings since they have settled down and stopped collecting vegetables. Farming industry has machined and developed fast since second world war. People population is growing and everyone must feed by human basis. Since 1950, 0,50 hectares farmland per person will decrease down to 0,19 hectares per person in year 2025. This means that food supply and availability needs to be more efficient than before. Smart farming has created new technological industry around agriculture to gain more efficiency from soil with minimal operational expenditure, because also farming has become industry where costs, gross margins are followed in details and process efficiency is developed with similar methods we have used to see in automotive industry.

In future farming equipment are collecting independently information from unsolicited sources of data located on farm. The farming business will have various needs to automate processes, unman equipment and handle big data. Farms in South-America, Russia and many other places are employing hundreds of peoples to monitor, control and operate in farm, which are several thousands of hectares wide. In Europe, several institutions are making research and development for unmanned equipment development for agricultural robots, often they are called AgriBots.

Case Company, founded in 1986, is a Finnish electronics and telecommunications company that specializes in the design, manufacturing and international sales & marketing of radio modems and routers for wireless data communication and alarm transfer. Case Company is one of the leading suppliers in the world, operating worldwide through our wide distribution network. Case Company has over 60 independent distributors worldwide, serving customers over 100 countries. Main business applications are Global Navigation Satellite System (GNSS), fleet management and utility networks; oil, gas, electricity and water distribution.

This thesis describes future development trends of precision farming and industrial agriculture, which is called as Smart Farming and seeks answers on how case company can create value for customers and capture value from precision farming industry and what offering is needed or expected to be needed. The thesis aims to find ways to new business development with new application areas and expanding business with existing customers by having interviews and workshops with their business management and engineering teams. New application segments and customers are identified based on findings with existing customers and screening possibilities outside existing customer and application database. As a result, Business Model Canvas is created to identify to visualize new business ideas and channels to make business, in addition recommended next steps, that Case Company should do, are identified and described. By following these first steps company is enabled to extend its existing business towards Smart Farming solutions.

Theoretical part of thesis describes theoretical framework, which is used in data analysis and business model creation. Research method is selected to be action research. This method is suitable, when plans are evolving at same time as data is collected and time is elapsing. This method with such a flexibility is suitable for new business development, where new information gained needs to be adapted in next phase of progress.

2 PURPOSE AND OBJECTIVES OF THE STUDY

The main purpose of this thesis is to find and develop precision farming application offering for the needs of the case company business. This will be done by defining appropriate international new business model and plan for precision farming application area, which are suitable for Case company business.

I choose this subject, because farming trend is growing globally and farming industry is going to have technical development in coming years, when Internet of Things, Industrial Internet of Things, Ethernet, Position with many other trends are reaching farming equipment. I see that Case company can have potential growth by serving precision farming industry not only selling equipment, but solutions and services in future.

Main objectives in developing marketing strategy and action plan are as follows:

1. What information solutions are needed in future in precision farming applications?
2. What is expected in future technology roadmap in smart and precision farming in order to develop marketing strategy?
3. Who are major customers (equipment manufacturers, service providers, integrators, contractors, farmers) and where is major growth potential (in customers' business)?

Developed marketing strategy and roadmap will be used as strategic and practical tools for the new business model for case Company's precision farming sales unit.

3 METHODOLOGY AND RESEARCH PROCESS

3.1 Action Research

Research method of my thesis is Action Research. Selecting this method is relevant, when analysis and development is done during research, analysis from history to present is done, alternatives are developed during research to reach set targets and research delivers new information about operations and possible new theories about it. Important part is to test analyzed and created actions in practice to gain new information to basis for new action planning. (Aaltola & Valli 2010, 214-229.)

Action Research method is suitable for practical study in real world, where researcher tries to resolve problems and improve existing situation or practice. This done in cooperation between work community and when deepening customer relations between companies or by individual person, who collaborates, participates and evaluates situation and practices to find out place for improvements and new innovations. Goal for study is to make changes happen and help people to change reality so it can be researched and develop people (companies, enterprises) collaboration and cooperation.

Action research theory and practice is not seen as two different issues, but these are different angle of view of same issue. History of action research term is from 1940s', when John Collier used it when he studied agriculture development in Indian Reservation in USA. The action research study follows path of planning, acting, observing and reflecting and after that starting same loop again, as shown in figure 1.

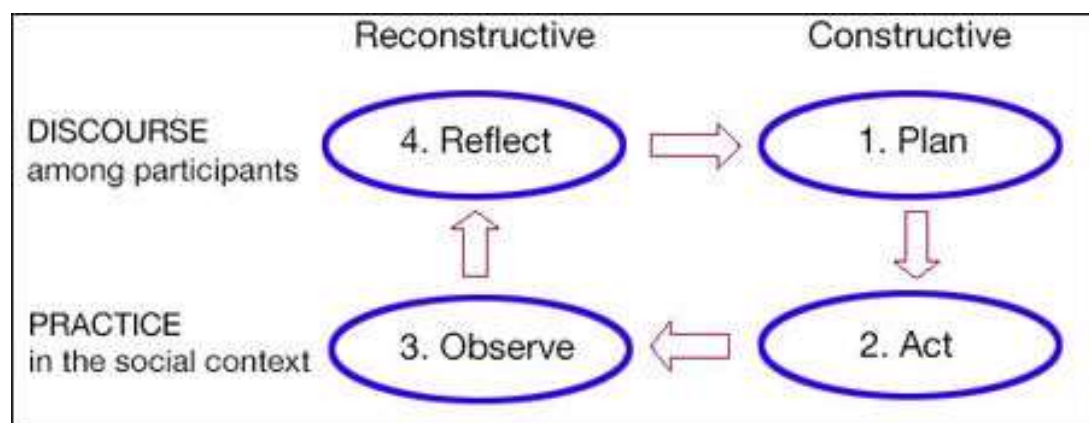


Figure 1, Action research cycle. (Website of the Wikiversity)

Action research means small intervention to real world and situation and studying effects of situation. Action research aims to solve practical problems and to improve practices and methods for future development. (Metsämuuronen 2006, 102.)

Action research is usable, when one is trying to find solution to problem, when offering training inside working society, when finding of new point of views to work with, when communication between working society, when subjective problem solving is allowed. Technical problem solving normally starts from external input. Action research advantage is that research and planning are proceeding parallel, which means

that research results are evaluated immediately during planning and new focus for research can be determined.

Action research target is specified and sample is limited, one can criticize that sample is not presenting the whole population and variation is not controlled, therefore results are not generic, but case specific. Problematic is also that researcher is making study and research by their own interest and target of study is not having same interest to participate to study. Theory and practice have not met in every cases of study, then theory is for researcher and action planned based on that is for operators in application field. (Metsämuuronen 2006, 103-112.)

Based on my experience, action research is similar as agile development methods used in technology industry now adays. Agile development method is aiming to fast produce something to understand and evaluate. Based on evaluation progress or corrective actions are defined. Often there is small, limited or changing amount of information in use and only way to get more information is to create demo or proof of concept.

3.2 Data collection

Data collection followed process, which is following basis of action research loop, includes three main Themes for action research loops with feedback possibility to re-work previous themes with information gained. Figure 2 presents the process flow of this thesis. All themes were handled with all defined customers, if applicable. Themes and customers were presented more detailed later in this chapter. This process was aiming to produce detailed information to identify business model for Case Company's Smart Farming business and start-up new business and transactions between Case Company and Customer.

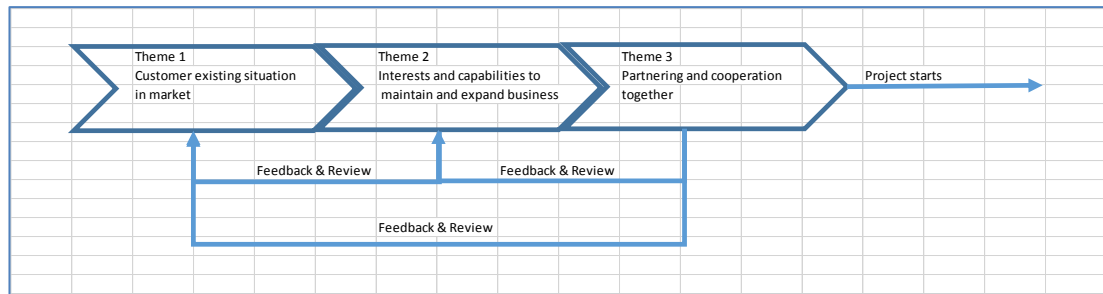


Figure 2. Process for thesis data collection.

Data collection was done as qualitative interviews. There were sixteen face to face interviews, these sessions were carried out during between year 2015 and 2017. Questions for interviews were defined from case company point of view. Data collection was done by interviewing recognized world leading companies' technical and product management representatives. Data collections were planned to be as meetings, where topics include outlook of future farmers need, industry overview of use cases, interviewees view of technological development and use case development. Ideal discussion will cover many aspect and themes, which may lead to pre-set direction of answers. Customer companies and persons interviewed cannot be published due reason of non-disclosure. Thesis report includes anonymous overview of market answers and summarized conclusion over the industry.

Question set-up was created to formulate overview of future development of smart and precision farming industry. Questions examined industry technology usage, key customers and application segments now and tomorrow. Important part of interview was also to have vision from customers, that how they see their business model changing in coming years, from equipment and machinery vendors towards solution and service business. Based on interviews customer segment overview of future business and market development summary was compiled.

Secondary sources of information such as written reports, from e.g. European Union, were also used as a part of data collection and analysis. Several governmental units have created their analysis of present situation and future outlook of precision farming. Precision farming application information is growing all the time, new reports and studies are available several times a year. Market information was collected from sev-

eral sources after discussing on internal and external stakeholders and reviewing reports available. European Commission was source of data in two different manners; Horizon 2020 project is funding multinational development projects in agriculture segment among other segments too and EU has released their studies and interprets for future development. Literal material was available from internet at sites of technology dealers, equipment manufacturers and ministries of agriculture and under United Nations. Figure 3 presents United Nations main themes and goals for sustainable development to end poverty, protect the planet Earth and ensure prosperity for all. Precision and smart farming are strongly related to zero hunger, clean water, decent work, and responsible production, life below water and life on land themes. These goals requires new technologies and know-how to use soil more efficient and enable possibilities to feed people equally all around the world. By using these UN themes and programs Case Company is identified as sustainable partner for business.



Figure 3. Website of UN www.un.org

Themes for data collection are:

- 1) existing situation in market,
- 2) development ideas for future and
- 3) Collaborating possibilities with case company.

Main objective is to find out present situation of customer companies and their interest and capabilities to maintain and develop their business in future, where changes towards digitalization will break historical approach of OEM's in future. Case company

technology leadership and capabilities are bring up front to make customers to be interest in new market entry possibilities with new and improved technologies and requirements from end users.

Theme to screen for customer existing situation on the market is to create overall understand of customer situation at the present market. This enables Case Company to present its existing offering and solutions available immediately to take in use by customer. At same time customer explains their use cases, which is situation to find out room of improvements to make business more efficient. Several development ideas and potential roadmap items is normally identified to fulfill customer minimum viable product needs to make market entry with them. Information gathered from this theme evolves before next meeting about development plans. Case Company makes improvements in offering, creates solution alternatives and prepares product more ready for customer engineering testing and piloting. Based on this information, market intelligent and technology intelligent preparations for next theme workshop are created.

Future development theme Case Company has created alternative solutions to customer existing business challenge. At the same time planning themes are revealed to customer to introduce Case Company's vision of future connectivity items. Based on this futuristic plan customer is involved and challenged to reveal their plans and make alignment between planning of both companies. Based on previous meeting about situation and Case Company solution and offering presentation, customer may introduce its project pipeline, where they have considered Case Company to fit. This in important phase to have mutual decision to start implementing solution together for first project based on existing offering. If customer is capable to present their ideas of future requirements and needs, then Case Company and customer need to agree development seminar for collaborating for strategical and tactical level.

During collaborating theme workshops possibilities to cooperate, share information and make market entries together evaluated and discussed. At this phase, development potential project to implement existing offering is already ongoing, customer have firsthand experience of Case Company's way of operating. This increases reliability and personnel is more familiar between each other. In case there is no development project with existing offering, case Company needs to ensure and convince customer

with its plan and solution excellence for future. Some references are used to present and promote solutions already provided to market.

Customers, which are defined to be part of thesis, are named as Customer 1, Customer 2, Customer 3, Customer 4 and Customer 5. They are operating in three different business segment; machine and equipment manufacturers, solution manufacturers and service providers. These customers are presenting top of modern Smart farming companies and they are located in Central Europe, North-America and Finland. Customer companies are operating globally and they have several development sites around the world, they also have customers in all continents. Customer companies met are located in Germany, Italy, Finland, USA and Canada.

My role as developer and researcher has three major tasks to complete; gather and collect data, evaluate development needs and create plan to make business in segment of Smart Farming. Based on analysis, I conducted follow up meetings and discussions with customers. Information gathered from customers leads case company to align future development plans. Information was collected from selected customer, named as Customer 1 to Customer 5, for privacy reasons, by having three theme sessions with different main objectives. Figure 4 presents time plan for each customer and theme. As shown in figure 4, all customers behaved differently, for example theme three was not handled with Customer 1 at all, during data collection phase and with Customer 2, there were three different sessions around theme 2.

		2015				2016				2017			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Customer 1	Theme 1												
	Theme 2												
	Theme 3												
Customer 2	Theme 1												
	Theme 2												
	Theme 3												
Customer 3	Theme 1												
	Theme 2												
	Theme 3												
Customer 4	Theme 1												
	Theme 2												
	Theme 3												
Customer 5	Theme 1												
	Theme 2												
	Theme 3												

Figure 4. Customer and theme workshop plan.

Customers 2, 3, 4 and 5 are operating in precision farming application area and they have started from hardware and machinery business point of view in history. They are reviewing their future development plans are willing to cooperate with case company. Customer 1 has entered to business from software and architecture business area, they have not used to operate with heavy machinery, but they see possibilities with hyper-connectivity, big data and data analyzing segments in smart farming. They are not networked globally with Smart Farming companies yet.

4 INDUSTRY AND CASE COMPANY DESCRIPTION

4.1 Industry Description

Precision farming aims to give technological aid for farmers to make their plant producing more efficiently, ground itself is not growing, but people and animals to feed are. “Food for thought. World can feed itself”, says Robert Lane, CEO of Deere. (Colvin 2008)

As megatrends towards 2050 show, those natural resources per capita are decreasing as shown in figure 5. Earth population is growing and urbanization is strong, water and soil are constant resources available. Therefore, smart farming is aiming to improve soil usage and lower water usage, minimize oil consumption and enable better crops than earlier. Farmland, soil is decreasing from existing 0,25 hectares per person to 0,16 hectares by 2015, this means 36% less farm land to enable crop cultivation and animal husbandry to feed people by using 30 to 60% less water. Obviously, more efficient ways, than today, to make farming are needed urgently. This has been recognized and ways to take more advanced technology to assist farmers with a reasonable cost are under consideration in many different forums around the world.

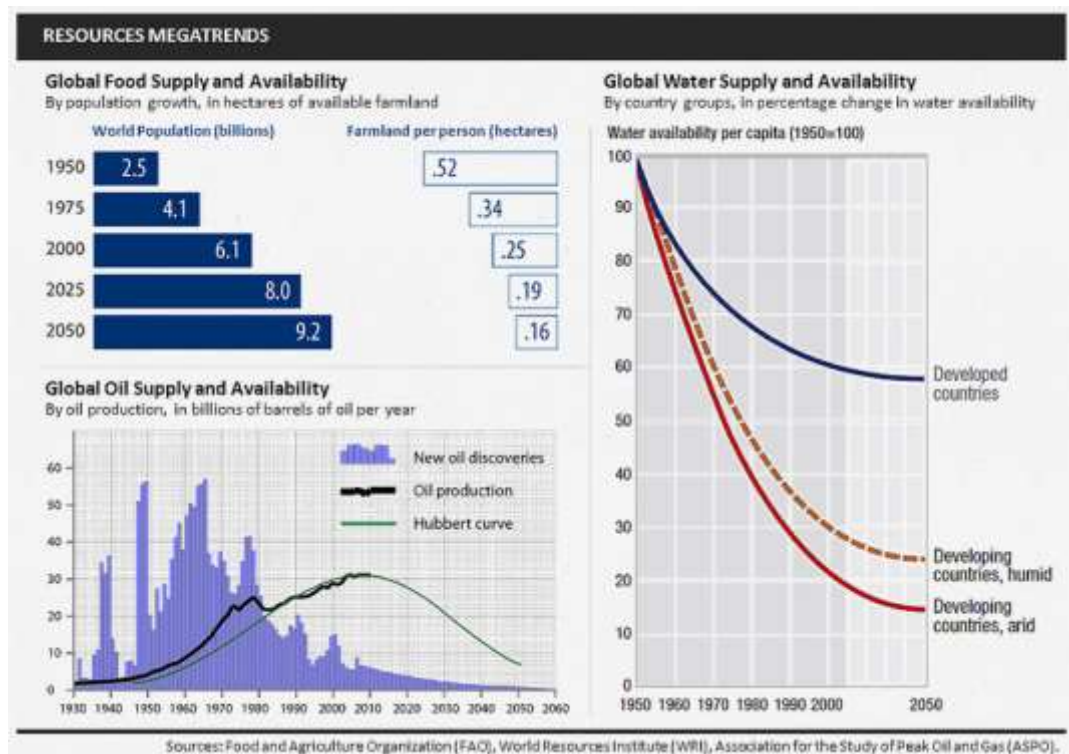


Figure 5. Resource megatrends towards 2050. (Website of Megatrends Watch Institute)

Present international precision farming business environment is fast changing, lot of information is available, global mobility is fast and networking with people is easy, therefore several theories and methods is mixed to create best suitable framework to use.

Agriculture Industry is going to grow in Precision Farming segment, where technology is widely used in farming planning, monitoring and control. Precision agriculture is broadly relying on different technology applications and information flows and analysis to enable farmers to manage crop production process. This complexity is presented in figure 6, in future farmers need to have capabilities to handle several sources of information coming from different equipment and machinery. In addition, competence and resources to handle and manage such a variety of equipment is needed in future farm. Existing generation of farmers needs to orient themselves towards technology to keep their farms able to compete in market. Equipment, which did not even exist thirty years ago, are common in farms within next two to ten years period. Farmers are getting information, that has not been available before, in real time and accurate directly from autonomous farming land equipment, flying drones, sensors from fields

or equipment working on field. Decision making accuracy improves and farm can be managed as factories of today.

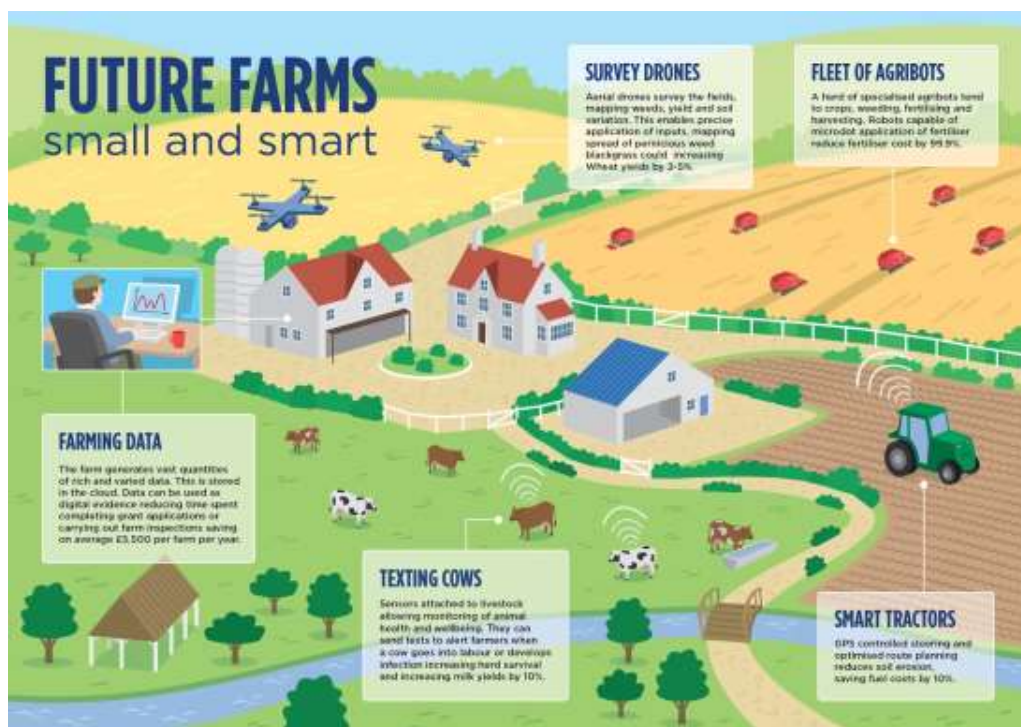


Figure 6. Future farm, smart (website of Pulse)

Precision farming is going to heavily modern way of agriculture that people have previously adopted. **Economic** losses are minimized by optimizing use of resources, which are for example workforce, machine time, energy consumption, usage of fertilizers, water, and so on. **Technological** development on farm requires usage of GNSS systems, variable rate application (VRA) technologies for precise location information and site-specific management system and services. These investments requires financing. **Environmental** and sustainable aspects are one the most important aspects when considering benefits of precision farming, these aspects identified by United Nation as sustainable development on earth. When losses are reduced, appropriate amount of fertilizers are used in soil, water and nutrition usage is optimized by analyzing information gathered from fields from the essential resources. **Management** of precision farming is taken in to next level, when traditional farmer's assumptions and knowledge is filled with exact information directly from field. Site-specific differences is recog-

nized and adjusted more detailed than earlier. Appendix 8 visualizes four major element on precision farming; economic, technology, environment and management. (MarketsandMarkets 2014, 39)

This thesis is focused on technological part of precision farming, because Case Company is, as today, a technology provider for industry. Technological part of precision farming market splits in component categories such as; automation and control systems, sensing and monitoring devices and farm management systems as figure seven presents.

Automation & control includes connectivity to machinery in farm; e.g. harvesters, tractors and drones. This equipment communicates with cloud services and servers sharing farm's business data, sensor information of humidity, greenleaf, soil fertilizers quantity and position and telemetry of themselves. Information is used, when optimizing equipment parallel use in production. Where is irrigation or fertilization needed, when harvesting is started and from where. Equipment are receiving real time kinematic (RTK) positioning signal all the time, based on this information auto guiding system is driving on routes, which are pre-defined by farmers at season planning time. Drivers need to review and monitor information displayed on cockpit. During harvesting period, fields are populated with equipment harvesting, supporting logistics and services. Harvesting equipment are driving in fields and collecting crops to its container. Harvesting is not stopped or harvesting equipment is not leaving from field for container emptying, but everything is done as a part of harvesting process by wingman. Wingman is driving with tractor in equal line and speed with harvester, while it empties crop containers, this is enabled by accurate positions and speed information communicated between equipment itself and farming system. Wingman leaves to supply crop drying center prior shipment to mills and another wingman is ordered to harvester, when container is filling again. Labor and equipment are in the most efficient use of all time during harvesting period.

Sensing and monitoring devices are collecting and feeding data to farmer to make decisions based on facts from field. Based on information irrigation, fertilization, and pest control and production optimization done.

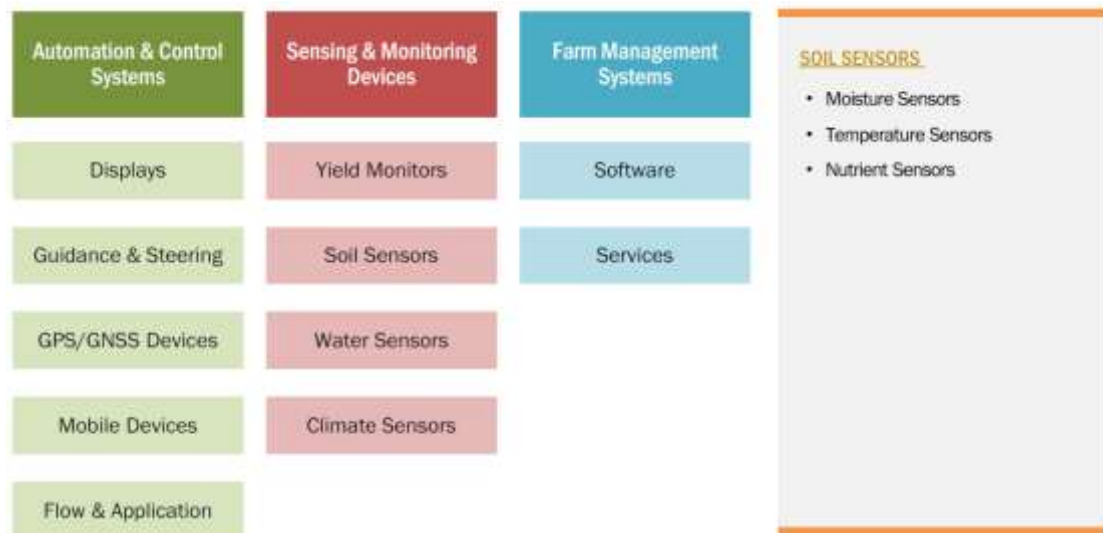


Figure 7, Global Precision farming market by component. . (Website of Markets and Markets)

This data collection and information based decision making is business case for future Smart Farming industry for Case Company. Farmers needs accurate information from different types of equipment generating data to make decisions for their business. Accurate information is collected from data points with different technologies. Data is processed in smart faming enterprise resource planning system. Managed data is shown back to users' dashboards around the farm and its partners. This data amount is doubled in next three years of period, all that data is produce with different Internet of Things (IoT) devices in farms as figure 8 indicates, it also indicates that estimation of IoT devices sold to smart farming increases from 36 million devices in 2016 to 75 million devices sold annually in 2020. This creates market expectation from existing value of 5.18 B USD in year 2016 to 11.23 B USD in year 2020. (MarketsandMarkets, 2014, 39)

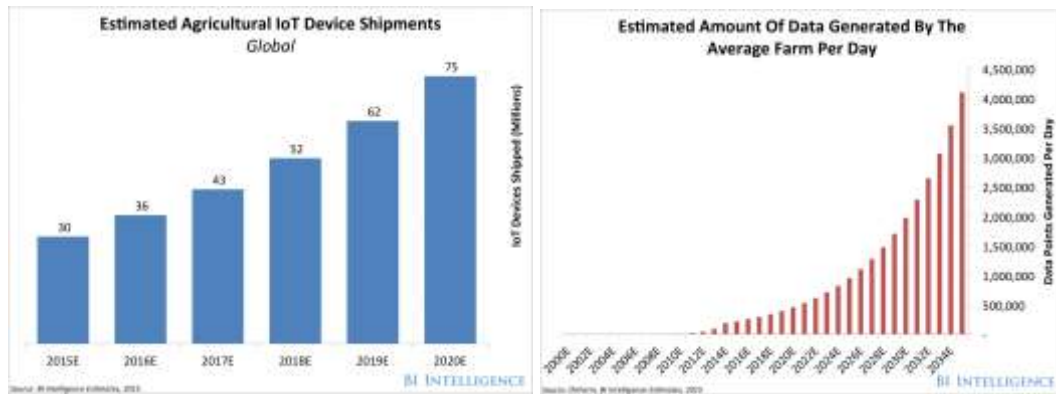


Figure 8. Agricultural IoT devices and data generation estimates (Website of Business Insider)

Today smart farming business is evolving fast, technology leaders are capable to define solutions and offering to farmers. Market is growing fastest in Americas and Europe. It is expected that in 2020 Asia-Pacific region starts growing equally of faster compared to Americas as in appendix 9.

Smart farming industry end-users are farmers all around the world. Supply chain has several layers between Case Company and end users. Figure 9 visualizes supply chain set-up to serve farmers. Original equipment manufacturers and their distributors and suppliers serve these farmers, their solutions and equipment are industrialized so that end users can directly have added value when taken in use, for example farms purchases John Deere harvesting machine with auto guiding system. Based on my experience Case Company offering is suitable for OEM manufacturers, their components suppliers and distributors. Case Company offering is not directly used by farmers, but requires some more components and equipment to create benefit to farmers. Major original equipment manufacturers recognized are for example Reinke, John Deere, Agco, Case New Holland and similar.

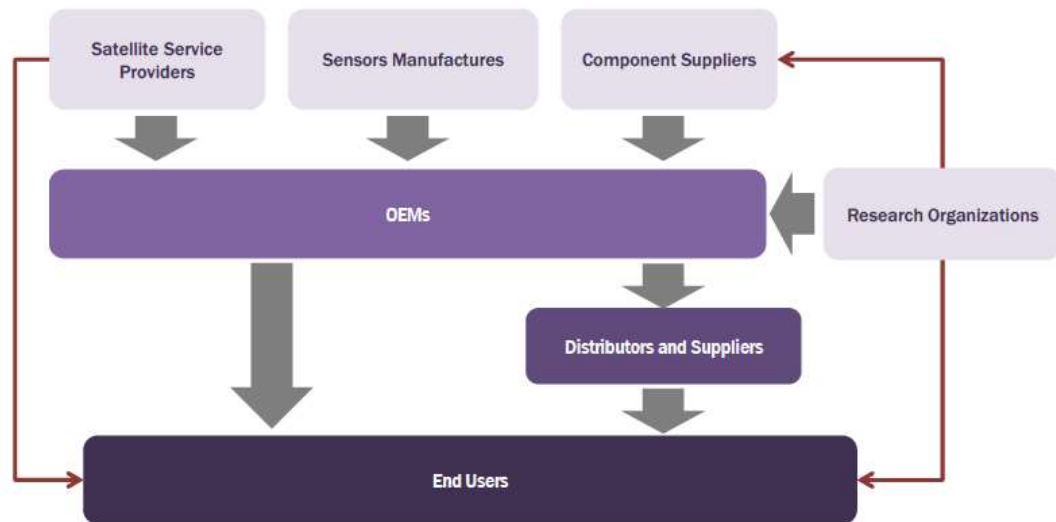


Figure 9. Supply Chain analysis (MarketsandMarkets, Precision Farming Market, 2014, 39)

Sensor manufacturers and component suppliers are expanding their offering towards agricultural IoT offering. Distributors and suppliers are making service business in addition to equipment sales. Additional equipment sales includes aftermarket equipment installed on machinery in field to enable technological benefits of auto guiding, computer aided planning and telemetry information for preventive maintenance. Services varies from installing systems to farms, rent and operate equipment during harvesting season, preventive maintenance services and mixtures of all those.

Competitive landscape in Smart Farming includes global industrial connectivity equipment and service providers, but also several consumer level equipment used especially in smaller farms. Consumer level equipment lowers selling prices. Industrial level equipment has better after market services, reliability and quality level compared to commercial equipment and in many cases estimation is that, total cost of ownership is lower with industrial level higher capital expenditure equipment.

Biggest challenge is to find major key partners and start cooperation with them to find out what is required for most competitive solutions for futures end-users. The solution shall be easy to commission, easy to maintain and update and scalable when needed. Many of solutions will evolve fast in next five years, when more new technologies and ideas to use them with new application appears.

4.2 Case Company Introduction

Case Company, founded in 1986, is a Finnish electronics and telecommunications company that specializes in the design, manufacturing and international sales & marketing of radio modems for wireless data communication and alarm transfer. Case Company is one of the leading suppliers in the world, operating worldwide through our wide distribution network. Case Company has over 60 independent distributors worldwide, serving customers over 100 countries as shown in figure 10. Business application areas are GNSS, fleet management and utility networks; oil, gas, electricity and water distribution.

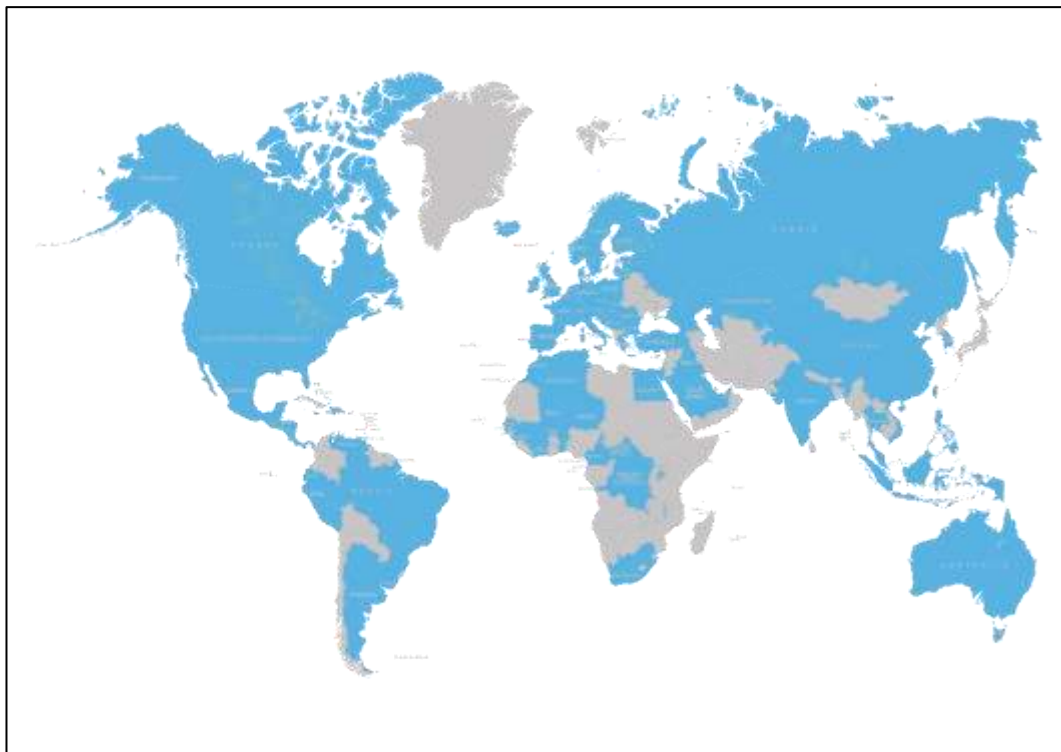


Figure 10. Coverage of Case Company Distribution network

Case Company has different sales units (SU), which are focusing their own business development in their application segment. The segments are Global Navigation Satellite Systems (GNSS), intelligent traffic systems (ITS) and supervisory control and data acquisition (SCADA).

Cornerstones of Case Company's success are the experienced personnel, high quality products, innovativeness, effectiveness, service level and customer needs driven focus on everything we do. Consequently, Case Company possesses the world's widest selection of products in its field. Through impeccable quality control, vigilant product development and dedicated customer service, we have been able to establish a firm position in the market.

SU GNSS has been focused on land survey and machine control customers on industrial segment. Partly these customers and several other more traditional agriculture customers are also focusing on precision farming. Application has different needs and therefore New Business Development is needed for precision farming, to allow better customer focus and commitment to enable growth in Case Company as well.

Case company products are industrial data radio modems, which are used in sub one gigahertz frequencies. Typical radio modems and radio routers product families are presented in figure 11. This allows radio communication with better link distances than for example Wi-Fi, also radio network is controlled by end user by themselves and they are not dependent on public network for example cellular networks, which are run by operator, who selling services to customers. The cellular network is not reliable when there is electricity blackouts in area or many customers are overloading network simultaneously, but could be used as an alternative technology alongside radio modem to increase availability in all circumstances. Typical use cases presented in appendixes.






	Satellite	EASy	Satellar
Overview of product family	<ul style="list-style-type: none"> Widely used standard modems that have been in production for over 15 years – 2AS modems were introduced in 1993 and 3AS in 1996 Product family includes VHF, UHF and license free modems VHF and UHF modems have a tuning range of $\pm 1-2$ MHz from central frequency Data speed of radio up to 19.2 kbps 3AS modems are offered with and without NMS software compatibility 	<ul style="list-style-type: none"> Product family launched in 2009-10 EASy modem is a high volume product with guaranteed 48h delivery EASy UHF radio modems have a superior 70 MHz tuning range and are hence suitable for a wide range of applications EASy family includes OEM modems that are integrated into customers' own devices OEM modems are available as both UHF and VHF Data speed of radio up to 38.4 kbps 	<ul style="list-style-type: none"> New generation digital UHF radio modems launched in 2009 Wide tuning range of 45 MHz Modular construction – radio unit (RU) and central unit (CU) RU alone are used as a modem with serial interface or router in packet-routing. Combination of CU and RU works as a TCP/IP modem Ethernet and USB connectivity Data speed of radio up to 230 kbps. Data speed up to 700 kbps under development
Product examples	 <p>3AS 869 3AS Epic 3AS Epic Pro</p>  <p>License free 1915 License free 1870</p>	 <p>EASy EASy Pro</p>  <p>M3-TR3 M3-R3 M3-TR1</p>	 <p>XT 5R RU</p> <p>XT 5RC RU & CU</p>

Figure 11: Some typical radio modem products of Case Company

5 BUSINESS MODEL CANVAS

This thesis considers two different main themes in theoretical framework. One is to define case company competitiveness in target market and define how case company can create value for customer and capture value to gain more for itself in future.

Theoretical framework is based on Osterwalds' Business Model Canvas. It is visual and effective tool to describe business idea and chain to others. Case company has used Business Model Canvas, when defining changes in business and industry logic is seen, new application segments are considered and new offering is created to market. Brainstorming with team is working by placing posters on table and then continued to update Business Model Canvas from there to present for approvals. Business Model Canvas tool is fast to introduce to new team members and randomly visiting experts

are able to give their review comments after studying model, which makes idea visible at once.

World economic are changing faster all the time, new tools and ways to make business is invented. Evolution of these tools are needed to keep up with the speed of business change. Can business models be easy to understand, update and model with computer aided design systems? Company strategy and business models need to be aligned with company's organization and technology they are using. Fast feedback loop to update findings and changes in business model, value chain and market evolution is must. Business models are like action researches, one must create model, make plans and implementation and then create new business model. (Osterwalder, A. 2004, 16-21)

5.1 Business Model Canvas

Business Model Canvas is used for tool to collect and visualize findings for reader. This model enables individual usage for each customer group interviewed and findings can be collect as Case Company overview for Agriculture development. (Osterwalder & Pigneur 2009, 4-5)

Visual business model concept aims to be easy to understand and present. Today's business is fast changing. The stakeholder amount is increasing and customer needs are changing due technological development. Therefore, concept of simple model, which is easy to understand and update after changes are identified is useful in business management. Business model canvas template is presented in figure 12. (Osterwalder A. 2004, 16)

According to Osterwalder business includes three layers when business case is identified. Strategic layer is where the main planning is done by setting up vision, goals and target. Business model layer defines money-earning logic, often also called industrial logic. All workflow and resources are handled via process layer. When all these three are combined, one has full overview and understanding on present business case situation. Present situation is not stable and constant anymore. Situations are changing and

business model requires updates in designing changes, finding out financing of the changes and re-implementation after changes designed and financed. This evolving business model follows basic principles of action research, after information is gained plans are revised. (Osterwalder A. 2004, 18-19)



Figure 12. Business Model Canvas template (Website of Business Model Generation)

Business Model Canvas is divided in nine segments to be evaluated and considered to create overall view to studied topic.

5.1.1 Customer Segment

In this segment, there is defined groups of organizations and companies a company targets to make business with. This is one of the most important segment, because after decisions design is then build around understanding of these specific customer needs. Therefore, wrongly made customer segment definition may lead workgroup to make analysis and decisions on market, where company is not aiming.

Customer segment can be divided in different types of segments, which have different expectations for value creation and distribution channel. For example, in niche market customer needs are more specific and relationship between business to business partners is deeper than in mass market, where company does not know each of its customers. (Osterwalder & Pigneur 2009, 18)

Case Company customer segment includes at begin four known OEM manufacturers in Precision farming business and one software focused service company, which is interested to enter this new and fast growing market area. One of targets is to find more new potential customer in this segment-combining offering from several companies to solution for end users. Case company has not contacted end-users, farmers, and this could be the case in future as well. Market will de-fragment in too many smaller revue streams, which will cause more resource usage internally. Larger and globally active OEM's, integrators and system providers are in focus to create market entry and offering match with their needs. Second phase could be larger regional and local OEM's, integrators and service providers, which are active and contact in their local customers. For this already created operating mode and offering is suitable, probably some regional variation may be required based on my experience.

5.1.2 Value Propositions

The value proposition part describes main solutions, products and services, that creates value adding to selected Customer segment companies and organizations. These should fulfil customer requirements to satisfy business needs of these selected customers, of course some of offering may exceed customer requirements and give new ideas and innovations to customers as well, to create their businesses and values even higher. Either these values are alongside existing market offers or innovative and new in segment creating disruptive offering and making competitive situation in new ways.

Value proposition is something between newness, performance, customization, design, brand, price, cost reduction, risk reduction and usability. Customer value is applied most efficiently when offering is getting the job done and customer is satisfied or expectation is even exceeding. (Osterwalder & Pigneur 2009, 20)

Value proposition is mixture of targeting, differentiation, positioning and segmentation, where customers on focus are convinced about seller's improved differences against solutions on market. Depending on customer maturity in their business segment, differences promoted may vary; seller needs to justify differences best suited to customers need. Differences are offering superiority, pricing, availability; functionality or services depending on what customers estimated to value and improve their own business and profitability. When need is known, then seller can promote correct products with best possible pricing and placement to customer by arguing customer to get much more benefits with higher price or same price to having same benefits with less price or equal depending on situation faced on customer offering lifecycle as shown in figure 13. (Kotler & Armstrong 2012, 5, 29, 209-212)

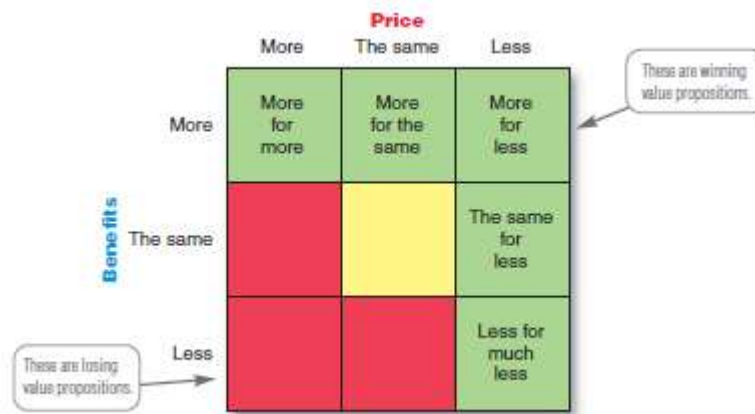


Figure 13. Value Propositions matrix (Kotler & Armstrong 2012, 213)

Value proposition enables companies to identify and understand their existing offerings value proposition compared to competitors and offering available in market. Value proposition may vary between customers, even if market and application segment is similar. This is dependent on customers' existing situation and need compared to their competitors. Value is not only limited to product and offering pricing, but also to total cost of life cycle and customer utility, which is not easy to measure, because it is more scaled in qualitative measures. (Osterwalder A. 2004, 51-54)

Case Company existing market offer and value has been around global navigation satellite systems real time kinematics signal transferring from fixed ground stations to operating machines and personnel. With this technology positioning and auto guiding is capable to reach accuracy and repeatability less than three centimeters. This increases customer value in soil and resource usage and savings in labor, fuel and fertilizer costs for example. Based on my experience, existing offering in easiest and best value add promise to new customers.

Case Company has interesting technologies, which may developed for suitable offering to Smart Farming application. This expands Case Company possibilities to overtake future connectivity needs in farms and provide single point for all communications needs for OEM's and system integrators. These add value by simplifying supply chain, aftermarket services and shortening development phase, when all equipment are

from same source and are compatible between each other, but also with major competitors of Case Company and OEM manufacturers. Case Company has good knowledge and expertise on local spectrum management around the world, which is not the case among customers, therefore consultancy is provided at beginning, when new business cases are discussed. In future, hyper connectivity is one of the biggest megatrends, this means that person, and machines, sensors, equipment and databases are communicating and sharing data between each other all the time. Case Company has been prepared for this in industrial segment.

5.1.3 Channels

Channel includes all contact points to customers in Customer segment. This means ways to communicate and contact customers, sales and distributing products and services to customers. By doing communication and sales to customers, it increases customer segments awareness about company and its offering. This helps and enables customer to evaluate company offering before making purchasing decisions, evaluation allows customer also to include specific requirements prior deliveries. Also all aftermarket services are supplied via this channel to customers and their customers.

To find establish properly working channel different channel phases needs to be concerned with customer segment. Company needs to evaluate whether making direct or indirect sales by itself or via partners. Notable issue is that partner marketing and channel creates lower profit margins to manufacturer itself.

Not depending marketing and channel types, every customer segment relationship in business-to-business sales has its own channel phases, shown in figure 14, these phases are similar to every channel phase. Only means and persons performing channel phases are varying depending on selected channel type. Phases include steps from very early contacts of creating awareness and knowledge about company's existence and offering to make customer making constant growing business repeatedly. (Osterwalder & Pigneur 2009, 24)

Channel Types		Channel Phases				
Own	Direct					
	Sales force					
	Web sales					
Partner	Indirect					
	Own stores					
	Partner stores					
	Wholesaler					

Figure 14. Business Model Generation example of Channel Phases (Osterwalder & Pigneur 2009, 25)

Based on my experience Case Company is focused for business-to-business customers and mainly uses own sales force to create and maintain customer relationships. For global customers own direct sales contacting is key to achieve trust and express commitment to these customers. Direct global customers have bigger volume needs, own supply chains and decision processes. Case Company is flexible and adopts customer specific business models by customers. Often new product development, variation, proof of concept and testing is required before purchases done. Customers' development team is involved with Case Company's project team to mutually define requirements, scope of work, and definition of done and time plan, which serves both parties interest to get high quality solutions available in reasonable time to market. This is also way to proof Case Company's value add in supply chain.

Partners and value add distributors serve local customers, where they offer existing products and solutions to these customers. They also adopt to their customer business model and supply chain. Smaller customers and distributors' benefits development and testing work done with major OEM companies.

From history, it has noticed that establishing new customer relationship takes from three to seven years ending up first commercial deliveries to customers. Products developed for certain market have lifecycle from ten to fifteen years depending on customer. During this period, some updates are required, but main concept remains the same. After getting customer involved some certain offering, they are not willingness to change to another supplier or partner with reason not seriously defecting their own business, because development and testing cycle is often longer and failure mechanism repairing.

After market services are intended to give locally, directly to end-customers or OEM customer dealers by value add distributors. Often OEM contact Case Company directly, because then they are able to gain more competence to handle similar cases by themselves next time if needed. All warranty repairs and maintenance is done in Case Company not depending on direct sales or distribution sales channel used, because special expertise and equipment are required for this.

5.1.4 Customer Relationships

In business to business customer relationships personal contacts are very still important, customers are keen to know their partners in person to lower contacting and sharing trigger level, better you know easier is to brainstorm. In addition to good personal contacts customer are needed to serve with dedicated organizational assistance, like trainings, seminar, pilot testing and proof of concepts to make them more aware of offering and competencies, where company is capable know and in future.

When relationship deepens with proven business values to both parties on transaction, the conclusion of joint plans for the future will be mutually beneficial and therefore both are closely committed to sharing them. (Osterwalder & Pigneur 2009, 26)

Based on my experience Case Company creates and has created personal and direct contact with customer's key persons. These persons are contacted periodically to update business situation, forecast and estimates. Same time there are good opportunities to shares new ideas, brainstorm, to challenge to think out of box and deepen relationship. Sales team with key account managers are main contacts to customer in daily operations of relationships and business. Development team and delivery operation team are involved whenever situation requires or Case Company is making projects with customer.

New standard products and offering is offered for customer piloting free of charge. Customers have then normally period of three to six months to test and evaluate product. After test period equipment are returned. In several cases customers found interesting features and developed need for such a products by themselves. Many customers

had wanted to make some changes and variation to standard product to make it fit better to their need, this opens new mutual project with them and ensures long period of deliveries afterwards.

In period of 12 to 18 months, each major customer is invited to case Company's technology seminar, which is customized for this customer only. This is event, where Case Company open roadmap and development sights and expects customers openly participating in discussion to have new prospects and ideas for their own development path.

Case Company attends in several fairs and seminars yearly. Main exhibitions participated are Intergeo, Agri, SIMA, GeoMundo, ION, in addition to these more than ten smaller regional exhibition are visited.

5.1.5 Revenue streams

Each customer segment and even each customer in segment may have individual revenue stream in business-to-business relations ship. Company needs carefully evaluate added value for each of its customers and have different scenarios from where revue is collected from. Revenue streams normally have different ways for pricing determination and collecting mechanisms. Typical revenue streams are asset sale, usage fees, subscription fees, renting and licensing.

In asset sale customer is buying product for himself and is having ownership for it.

In fee based revenue streams, like usage, subscription and renting, customer is paying agreed revenues based on usage, features or time used of such a product or service.

By selling a license, company sells intellectual property rights to further use licensed product, service or technology to benefit customers' business. There are several ways to define licensing costs like single payment, royalty fee based on customers own sales, time related payment among others. (Osterwalder & Pigneur 2009, 28)

Revue stream to Case Company appears from two different sales channel; distribution channel and direct sales to global customers. At begin, revue is coming from product and asset sales. Future offering will include non-tangible items such as subscriptions,

services fees, data maintenance, frequency allocation and network design and erection activities. New revenue stream development takes two or more years to develop and evolve. Based on my experience typical customers of today are not having such an operating modes yet in large scale, but fast developing IoT subscriptions are forming this.

5.1.6 Key Resources

Key resources are combination of personnel, financial, intellectual, personnel, equipment and partner pool. Different business cases require different resources to success. Electronics manufacturing company needs different amount of resources to create product than freelancer journalist for example; facilities, equipment, personnel, raw materials among others.

Financial resources are important, when defining company's capabilities to compete in market against pricing, but also offer different kinds of funding elements to customer to add value in offering, but also ensuring closing deals. (Osterwalder & Pigneur 2009, 32)

Nowadays, when capable technology is available for relative easy integration, innovative and capable people with good social skills are valued resources to enable ideas and networking to create more value. In addition to that, depending on business of course, some may need intellectual resources, who are capable to make research and development from scratches as well and then creating value and competitive edge for company in long term. This is often the case with high technology companies. Every company requires R&D at some level.

Based on my experience Case Company identifies itself as high technology Company in market, which develops products and makes manufacturing itself. Key resources are sales, technical sales, R&D personnel in embedded firmware and hardware development and sourcing. Supporting function includes delivery operation and services.

Competence resources from different stakeholders for example technology and component suppliers are use, customer engineering personnel is widely used in projects. By making design and manufacturing itself, case company have several possibilities to affect production pricing, gross margin and fixed costs, this also allows flexibility towards customer interface, partially making this as customer and supply chain value as well. To improve Intellectual resources Case Company motives and trains personnel. Different innovation and motivation systems are taking in place to allow personnel to use their time for out-of-the-box thinking and information sharing both internal and external.

5.1.7 Key Activities

These key activities are the most important things and actions, the company must do to ensure its business is running and is creating value for itself and its customers. This includes activities to screen and analyze market segments to reach into market, get to know customers, help customer to enhance their business by creating new offerings, producing products and services, supply them to customers and then earning beneficial revenues. (Osterwalder & Pigneur 2009, 34)

As high technology Company, Case Company needs to do research activities all the time to ensure competence and technology availability in time, or earlier than others. Key activities to screen market and contact customers are important part to create new possibilities to make business and identify potential project prospects early enough with customers. Helping customers and their customers ensures Case Company awareness in field that they are competent and reliable partner to rely on with connectivity issues. Network design center is making new network design and existing network problem solving in field to ensure that customers have frustration free experience to take technology in use and to continue using it. Network design and problem solving could be used also as promoting and piloting of Case Company offering to new customers. Research and project teams are meeting customer research and development teams, during these meeting information and future plans are shared, with most trusted

and long term customer long term road maps are shared and aligned to meet mutual targets in future businesses.

5.1.8 Key Partners

World is changing fast at the moment, and especially fields of technology are developing in S-curves. To lower business risk and enable, wider offering companies are looking for long-term partners to cooperate, optimize their mutual business model, and take care of their own business models too. With partners' companies can create new business opportunities faster to market and create such a value they are not capable to bring to market by themselves alone. Partnerships can be created between different stakeholders like e.g: customer – company, company – supplier, company – competitor, company – alliance. Depending on target company may have several beneficial partnerships defined case by case. SME's maybe required to have partners in large scale early customer ship to ensure their capability to make deliverables and ensure financial and economical existence during and after project the project. These are needed to define based on customer segment and their expectation of existing and future business, which is most valuable to company itself. (Osterwalder & Pigner 2009, 36)

Case Company seeks for beneficial partnerships with global customers and their potential suppliers to enable offering, which is wide enough to attract customers. Existing smart farming product are already complex with several technologies from different technology segments, that no company can handle that by itself and keep it's competences up to date. Component suppliers and technology providers for radio equipment are identified as case Company's partners. Based on my experience in future, new type of partners around data management, sensing, application development and artificial intelligence development are needed. New partners are vital to fulfil technology gaps with state of the art competences and offering, Case Company's core technology is complement with partners offering, which is fitted to Case Company's offering. Value add and position in value chain, must be ensured by providing exclusive features and offering.

5.1.9 Cost Structure

Depending on company business model and customer segment cost structures may or may not be that vital for business. Companies' whole cost structure from fixed costs, variable costs and funding cost is collected here. Depending on market segment consideration between Value-Driven and Cost-Driven structure is considered. More customized offering customer have, more value it creates to customer, less important cost is for him. (Osterwalder & Pigner 2009, 38)

Cost structure of offering and product remains same depending not from, which pricing is selected; cost-driven or value-driven. Customers and buyers have adopted good-value pricing strategy to their purchases. Good-value-pricing is mixture of good quality, features and pricing with services needed included, using that method buyer aligns their needs, requirements with reasonable price (Kotler & Armstrong 2012, 292). Case Company needs to explain and make customer to understand the value of its offering based on customer requirements.

Based on my experience Case Company has good understanding and overview of product cost, manufacturing, development and service cost, because they are manufacturing all radio equipment by themselves. Customers have possibilities to minimize their product variation costs by agreeing to pay non-recurring engineering costs that are related to project. Often development projects are seen more generic ones, which are implemented with several customer during one Case Company project, then normally engineering costs are minimal or not even existing. Product price itself is combination between generic market price level, customer value addition and company's price level.

5.2 Usage of business Model Canvas

Business model canvas tool can be used for many purposes after creating and updating from different angles of review

Strategic and development planning is done with canvas. It Creates visualization and blue print for strategy. This guides discussion around topic by visualizing all vital information at once. This is tool is use full also in Business Unit level, where planning is done by Business Unit to define and outlook their plans to other Business Units inside company.

Business model canvas can be used to understand competition in market segment. Then study is needed to be done from competitor point of view, afterwards constraints and limitations of competitor can be seen from overall picture. And this allows users to understand, where they should head and focus next.

Canvas also can be used for Innovations and new ideas development. For new ideas and concepts, Business Model Canvas is created and alternatives are considered and carefully evaluated, this may reveal new ideas how we can serve customers better in future. At same time, it deepens our understanding of customers need and requirements. This may also lead us to new partnerships, co-operations, mergers and acquisitions, which creates more value for customers by serving them better with wider portfolio.

Business model canvas has become very useful tool for different needs. There are several different variations. Some are more focusing on customer segment problem solving and solution generating called as LEAN Business Model Canvas. In figure 15, existing problem is described in problem box and possible solution or idea to solve problem is noted next to it. When these are marked-up, sellers' unique values to buyers are identified. Rest of business model canvas follows similar aspects as original Osterwalder business canvas. At the end, there should be seen, if solving customer problem with unique solution is worth for business or not, and needed re-evaluation can be done. (Website of BM Toolbox)



Figure 15: Website of the Business Model Toolbox

6 RESULTS

At begin of data collection overall Case Company product development plans were gathered to be presented alongside pre-defined interview questions and workshop topics. Workshops with all themes took long period of time, more than two years was spent to present ideas, collect data and revisit plans and discussions.

Three main objectives for study were; what information solutions is needed, what technologies is used and with whom Case Company should make business? This was studied with more detailed question pattern included in appendix 1. Data collection was organized in seven different locations around the world; Americas, Asia and Europe. More than sixteen person met, representing business management, technology and

product management and procurement. Interviewed persons were not involved in animal husbandry, this segment appeared to be own technical part and is therefore excluded from this thesis.

After few first theme sessions with customers idea of expansion of product portfolio came obvious as well as requirements to enhance existing products to meet customer needs better. Case company product portfolio required some enhancements and adjacent technologies needed to implement alongside of Case Company's own offering to enable easier solutions to customers from single source, also device management in field will be easier if amount of supplier are reduced or interfaces are standardized.

Customer 1 was met twice, during Q3 2015 and again in Q2 2016, to discuss about future of services and solutions needed in fields of software infrastructure and user experience. Customer's development manager, vice president sales, vice president digital solutions participated and managing director participated in these two interview and workshop sessions lasted half day at time. There were found mutual prospects for future new business development by combining both companies suitable offering as solution towards customer. Based on this Case Company defined alternative development paths for new product families to expand solution defined together. After second theme session, it was agreed that when either of companies found possibility to make offer to customer, theme three session is held.

Customer 2 theme session was in Q3 2015. In that full day session with project management and commodity management was defined that data transfer equipment is needed in real time kinematics signal transmission. Need of base station equipment and moving remotes were identified to use globally. Before there two of expand business, Case Company sketch idea of RTK base stations and rovers suitable for application. Customer 2 was deeply interested of expanding business with Case Company, therefore several theme two of expand business interviews and workshops were held between Q4 2015 and Q4 2016 in three different location around the world; one in Europe and two in Americas. Participants for these full day or two day sessions were product managers, project managers and local business development management. As a result of these meetings, Case Company has ensured Customer 2 to add Case Company's offering into their own solution in three market areas. Between these sessions

and theme three cooperation discussion and workshop, Case Company has updated and re-defined strategy and product roadmap for future needs based on information gained from customers. In cooperation theme discussion and workshop, it was mutually agreed that Customer will implement Case Company's forthcoming offering to their solution in precision and smart farming applications in auto-guidance application and expands towards future telemetry and controlling needs for autonomous and semi-autonomous machinery. Customer 2 is also participant in global standardization workgroup, where future smart farming standards are created, Case company ensures information availability early enough to react on coming changes and requirements.

Customer 3 has strong development sites in Europe and North America, therefore two separate theme one discussions were needed to identify existing situation in market for both of the development sites. During European full day in Q4 2015 session chief engineer, product manager and procurement management was met. This team is focused on intelligent solutions needed in machinery, they seemed not to have good visibility to Customer 3 future development, and they have no new needs and requirements set for them at the moment, of course must be remembered that at that time business segment was in high recession phase all around the world. American half day session in Q2 2016 was more successful when, chief technology officer, procurement management and product manager was met. Because material from European discussion and workshop was available before hands also topics of business expansion was discussed. Future data transfer needs were identified and some technology roadmap items were discussed. Customer 3 has strong opinion that during years 2017 and 2018 is time define future technologies needed and select partners to cooperate to enable development to start during 2019. Both parties in discussion identified that there is definitely need for theme three discussion for collaborating and cooperation. At same time agreed, that both parties prepare draft version of their vision for future of Smart farming in fields of data transfer and internet of things at farm. Theme three discussion was held in Q2 2017 in America, with same participants as in Q2 2016 session. Feedback received from discussion convinced, that Case Company's offering is matching to customers' future needs. As a drawback, it was noticed, that existing competitors of Case Company are local companies and have strong position in Customer 3 supply chain. Case Company needs to define actions towards this strong relationship to enable entry to American markets with this customer.

Customer 4 is known already longer period of time from other application and business segments. Customer 4 has expanded their businesses towards farming applications and was therefore very interesting partner to Case Company, because several years of cooperation was done already in land surveying application segment. In Q1 2016, during half day theme one discussion of existing situation in market vice president of engineering presented their situation today. There were noticed, that some of existing products are re-usable also in smart farming applications. Customer 4 has started collecting their strategy and vision towards smart farming, and there was several points, where Case Company's offering of today could be used. Organization were presented to each other and next discussion of theme two: expand business was agreed to held in Q3 2016 with more detailed information from Customer 4 side about coming plans to progress and Case Company plans about solutions to fulfil needs in coming years. Participants were from product management and vice president of engineering. With this information, Case Company was able to define plans and roadmaps more detailed again, future requirements and needs started to be clear. In theme three discussion of partnering and cooperation, Case Company presented new ideas of hybrid data transfer network equipment to enable several communication methods to collaborate with gateway equipment. This ideas was granted as good one and agreed to consider as one of development alternatives in coming projects. Meanwhile retrofit of existing products to smart farming agreed to continue.

Customer 5 is a part of global group focusing on high technology electronics component development for precision farming machinery. Because Customer 4 is located overseas, themes one and two discussions of existing situation in market and capabilities to expand markets were combined in full day workshop in Q2 2015. Customer 4 participants were from OEM project management, product management, system architect engineering and compliance and regulatory management, total of six persons from customer side. Customer 5 has strategy and plans for smart farming offering, which they have already started. They are doing next generation development for products to be released in 2019, Case Company timing to enable such a meeting was good. Direct product requirements were gathered from Customer 5 product feature list for review. This customer has most sophisticated view of their market expansion and port-

folio development for years from 2017 to 2021. Immediately some of these requirements were directed to project teams. This was first customer with direct need to develop something for new needs. Customer 5 was eager to have more information against their requirements in 2015 and sharing more ideas for coming projects. During Q2 2016, themes two and three of maintain and expand business and cooperation discussions were combined for workshop with same participants as year earlier. Case Company presented solutions for requirements got in 2015 and Customer 5 has created new needs and requirements and also aligned some plans with information shared from Case Company. Together parties agreed, that theme three collaborating and cooperation discussion is needed to fix mutual development path for years from 2017 to 2020. This meeting took place in America during 1Q 2017. Case Company learned Customer 5 requirements and roadmap for coming next two years, which also included Case Company's development and roadmap information included. It was agreed that Customer 5 and Case Company start two projects in year 2017 and two more in 2018, aiming to product launches for 2018-2020.

As a note from customer interviews, discussions and workshops, all customers are in different phases on their development path, at the end there was seen three to four commonalities that Case Company can promote in future to enhance customer's development. In addition, more time spent regularly with customer enables amount of information, which is valuable to Case Company as personal relationship created between parties. These will definitely improve interaction between parties in coming information sharing and business action created.

In theme 1 discussions about existing market situation, many customer pointed out their existing applications around auto guiding, enabling more accurate machine operations. Question about existing application and requirements of today concluded discussion of market, where most of interviewed companies are already. The most used Case Company offering around GNSS RTK signaling with UHF, to achieve most accurate positioning of machinery in auto guiding application, raised for base line topic for futures machinery positioning and guiding. This is saving soil, fuel and fertilization cost and optimizes resource usages. Need for GNSS fixed base and repeater stations are needed around farms or as service networks by distributors. Existing market had

requirements for product features and characteristics, which if implemented will enable usage of case company offering.

In theme 2 discussion about expanding business in future many companies shared some ideas to make usage of equipment as easy as possible for farmers. Machinery are communicating between each other, farm management and supplier's service center. Ease of use is key element, when adding technology in farm environment. Farm management should be able to remotely connect to machinery when employees need assistance or new tasks are programmed in task listing. Telematics and process information shared is used for making agricultural production planning and equipment preventive maintenance planning and spare part ordering based on this information. By being proactive and predicting status overview in field and on equipment, possible production down times are minimized and the most valuable equipment are kept in business with high duty rate. This kind of data transfer requires broader volumes of data technologies Cellular 4G, WiFi and Bluetooth are used for this one.

Challenges now are that several independent communication systems needs to implement in farm automation to fulfill all needs. There is room for integrator, who enables required coverage with lesser products in portfolio and with interoperability between each other. Major OEM customers also requires global certification for communication technologies to enable possibilities to participate local markets with their distribution networks. To gain complete connectivity needed in smart farm system needs to collect and store massive amount of data. From this data business intelligent reporting, analysis and planning. This planning results to precise information and work que for fleet and machinery to be in place at time, fleet support to enable fuel and services in place, seed and harvesting plans and also material logistics for inbound and outbound purposes. If all of these are not properly connected, it requires more manual operation planning without updated information, which may lead unpredictable stoppage or non-cost efficient business, which scales when farm sizes are growing.

None of the customer has considered connectivity as a service, but a part of their offering for one application at time. This might be one of key finding, when building up

Case Company offering to next level. Build more added value around customer applications by combining several data transfer technologies under single gateway device, which enables cost efficient scalability in farms when expanding to new smart farm applications. Services for network topology design and connectivity services for clouds and edge servers will be included in smart farms application portfolio in future.

Developing sights towards futures smart farm influenced open brainstorming with all interviewed persons, because at the moment market is going to growth again and new solutions needed to fulfill changed needs. IoT, drones and farm automation has created new potential application collect data from field for analysis and decision making. Major part of companies are looking for centralized farm management system, which will include data collection and asset management and production management in a same system. As today, this is seen complex, because many customer site has machinery from several OEM's and these are not efficiently discussing between each other and service centers. There is room for application standardization to enable common interfacing between systems, or separate cloud services, which are combining all data for farmers' data management. All major companies are developing their own offering and alignment with common standards for better interoperability comes later on.

Technologies for future connectivity solutions includes meshed license free low voltage UHF radio or LTE/5G module for sensor data collection, broadband backhaul communication system to collect and repeat them between data source and farm management database. Sensor radio equipment is normally considered to be low cost with low power consumption. These sensors might be used only once with life times from few months to years. Public technologies such as cellular technology is used to transfer machinery telemetries to OEM manufacturers' service center, if data is not available from farm management database. Public technologies are kept unreliable, but easy to use and cheaper to invest than UHF radios and back hauls for example. UHF radio is needed for GNSS RTK signaling for most precise applications at least next 10 years timeframe.

Results, feedback and ideas from different market segment customers were combined at Case Company. This information was modified as Case Company solution and of-

fering plan, which was handled with customers in theme two discussions about business expansions. At same time more direct product enhancement were presented to show Case Company's capabilities to handle and react to customer requirements, this was also important for further discussion. Results and findings of the data collection is summarized in Business Model Canvas in appendix 7. First ideas of new business model ideas were used in theme three collaborating and cooperation discussions, which led Case Company to situation of new projects together with customer research and development teams.

OEM manufacturers are studying autonomous equipment used in farms in future, which could be similar to presented in figure 16. Fastest growing autonomous segments are drones and agricultural robots. The drone segment has developed fast last years and has achieved industrial maturity. The drones are seen in data collection over fields and forests as well as linking information from sensors to farm management system. The drones have capability to carry different camera, inspection and measurement equipment on fly. Legislation in major part of world enables only line of sight to operator, who is flying the drone. The drones are under control of operator with two different communication channel narrow band radio and broadband radio. Broadband radio enables data streaming capabilities while flying, so that operators are having real time video stream, pictures, measurement results and telematics from drone, while narrow band radio is used for control back up in case of emergency.



Figure 16. Different autonomous farming equipment (Website of Google)

Precision farming development in coming years estimated to evolve faster and companies are expecting growth starting from 2018. They are expecting to have alliances, mergers and acquisitions while they are defining and developing their offering. Many OEM will establish or have established already Smart Farming Engineering Centers to develop future solutions and offering to their customer.

Clear trendsetter could not be identified today, but the one who makes solution to combine all farm data management under same cloud interoperating, will be strong ones. IoT and big data is bringing new companies entering to market creating new offerings and services around information systems. Major OEM companies are making their predictions and activities for collecting most vital elements in future's business inside same group of companies.

7 CONCLUSIONS AND RECOMMENDATIONS

It seems that in future, ones who are collecting, managing and analyzing data, are the ones needed in value chain more and more. Their role will become more important in coming years. This role is not suitable directly to Case Company, but with right partners, several segments in future's smart farming can be covered.

Because development path seems not clear now due the reason of fast evolving, Case Company is strongly recommended to be transparent from ecosystem point of view. Partner and follow-up with several different existing customer with futuristic roadmaps, but also do not forget new comers in business area, because business and technology is evolving in fast and agile way.

One development path leads to continue development with equipment and machinery manufacturers, they need reliable communications equipment for fleet. This is one of the strongholds' of Case Company, as this has partially done in machine control business for RTK signaling from fixed land base stations to mobile remote stations. In smart farming, this functionality enables precise auto guiding system usage ending in future to autonomous equipment real time positioning needs.

New segment in machinery level is agricultural drones; in this market, Case Company is capable to do similar development as in machine control business, but with flying machinery. China regulatory and Chinese agricultural development is enabling fastest to pilot and start producing drones for agricultural and civil market, legislations and

regulatory issues are solved or left open for further development after more information from first experiences are gained. These drone communications development could then be used as references for other agricultural regions. Further technical sales effort is needed to enable this development among first companies in the world.

Alongside precise position of machinery needed for auto-guiding systems, automated and modern farms will need telematics information from sensors, equipment and other processes of farm. Equipment used for RTK and position signaling can be expanded with some feature additions to serve this need in near future. Increase of telemetry information and machine-to-machine communication is evident development on future. Case Company should focus on defining and developing their solution to future farm connectivity needs.

System level connectivity integration together with companies offering enterprise resource programs and databases seems to be potential channel to enter new market segment globally. All needed information points are designed in the system allowing scalability and data management with dash boards are designed in same phase taking account all customer needs and demands. System level suppliers in future are companies like Hexagon, Agrivi, Thales among others. System level connectivity as service either in leased or sales based could new business are for Case Company, this kind of transaction models will create new alternatives to make business in future farms. In the farms, where amount of data increases, equipment need supply their information into bigger systems to enable real-time decisions based on data received from field to make smart farm business more efficient and sustainable.

This thesis succeed to collect and analyze information from customer, which was needed to make first market entries into Smart Farming business for Case Company. The study combined information of today and created information base for Case Company to expand screening other new business alternatives in Smart Farming applications area. Information collected and analyzed was accurate enough, because based on this information some new customer projects were started with global OEM manufacturers. Next research alternatives could be automated asset management used together with machinery telematics information and alternatives to expand internet of things coverage in areas, where public and cellular networks are not available,

REFERENCES

- Aaltola Juhani, Valli Raine. 2010. Ikkunoita tutkimusmetodeihin I. PS-Kustannus.
- Armstrong G, Kotler & Philip. 2012. Principles Of Marketing. Upper Saddle River, NJ: Pearson/Prentice-Hall.
- Colin Geoff. 2008. Special Report Fortune: C-suite Strategies. Time Inc.
- Hollensen Svend. 2011. Global Marketing – A decision-oriented approach 5th edition. Prentice-Hall.
- Kotler P. & Keller K. 2006. Marketing Management. Pearson Education Ltd.
- MarketsandMarkets. 2014. Precision Farming Market - Global Forecasts to 2020. MartkesandMarkets.
- Metsämuuronen Jari. 2006. Laadullisen tutkimuksen käsikirja. Gummerus kirjapaino Oy.
- Metsämuuronen, Jari. 2005. Tutkimuksen tekemisen perusteet ihmistieteissä. International Methelp Ky
- Osterwalder, A. & Pigner, Y. 2009. Business Model Generation: A handbook for Visionaries, Game Changers, and Challengers. Wiley & Sons: New Jersey
- Osterwalder, A. 2004. The Business Model Ontology a Proposition in a Design Science Approach. Ecole des Hautes Etudes Commerciales de l'Université de Lausanne
- Subhash C. Jain. 2000. Marketing Planning and Strategy. South-Western Educational Publishing
- Zarco-Tejada P., Hubbard N., Loudjani P. 2014. PRECISION AGRICULTURE: AN OPPORTUNITY FOR EU FARMERS - POTENTIAL SUPPORT WITH THE CAP 2014-2020. European Union.
- Website of Agrivi. Referred 24.4.2017 <http://www.agrivi.com>
- Website of Business Insider. Referred 3.5.2017 <http://www.businessinsider.com/internet-of-things-smart-agriculture-2016-10?r=US&IR=T&IR=T>
- Website of LinkedIn Pulse. Referred 3.5.2017. <https://www.linkedin.com/pulse/new-data-driven-business-models-agri-food-sector-data-protonotarios>

Website of Business Model Generation. Referred to 15.10.2016. <http://www.businessmodelgeneration.com>

Website of Business Model Toolbox. Referred 1.11.2016
<http://bmttoolbox.net/tools/lean-canvas/>

Website of Google. Referred 7.11.2017 www.google.com

Website of Hexagon Agriculture. Referred 7.11.2017 <http://hexagonagriculture.com/>

Website of the Megatrendswatch.com. Referred 24.4.2017 www.mega-trendswatch.com

Website of Nonlinear Thinking. Referred 22.5.2017 http://nonlinearthinking.typepad.com/nonlinear_thinking/2008/07/the-business-model-canvas.html

Website of United Nations. Referred 22.10.2016 <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

APPENDICES

Appendix 1. Questions

Question set-up is created to be used for guideline and openings for discussions

- 1) What are your existing applications and their requirements, where you need information during your operation? Ideal to open discussion to screen, what kind of communication needs customer and potential customer has identified already.
- 2) What is your offering to future industry and what are developing outlooks towards Industrial IoT and Smart Farms?
- 3) How you see precision farming developing in next years, or in longer term
- 4) What are or who is the trendsetters of future?
- 5) What makes your offering unique and how case company can support your solution development?
- 6) How you see your business model to change in coming years?
- 7) Describe your decision making process, how to get involved until transactions? How customers are used to make decision, is there need for proof of concept, piloting, competitor compatibility needs for direct replacements, price, quality and process requirements and similar.
- 8) Are you willing to open your roadmaps to align development activities in future? To collect customers and market view of short term development and long term

development plans. Short term needs can be fulfilled with varying existing offering, but for longer term needs customized versions of product can be created. This is useful information if requirements and needs are homogenous along industry, allowing only minor variation need at case company.

Appendix 2. Smart Farm by AGCO



Smart Farm by AGCO (<http://investors.agcocorp.com/>)

Appendix 3. Complexity of Smart Farm systems



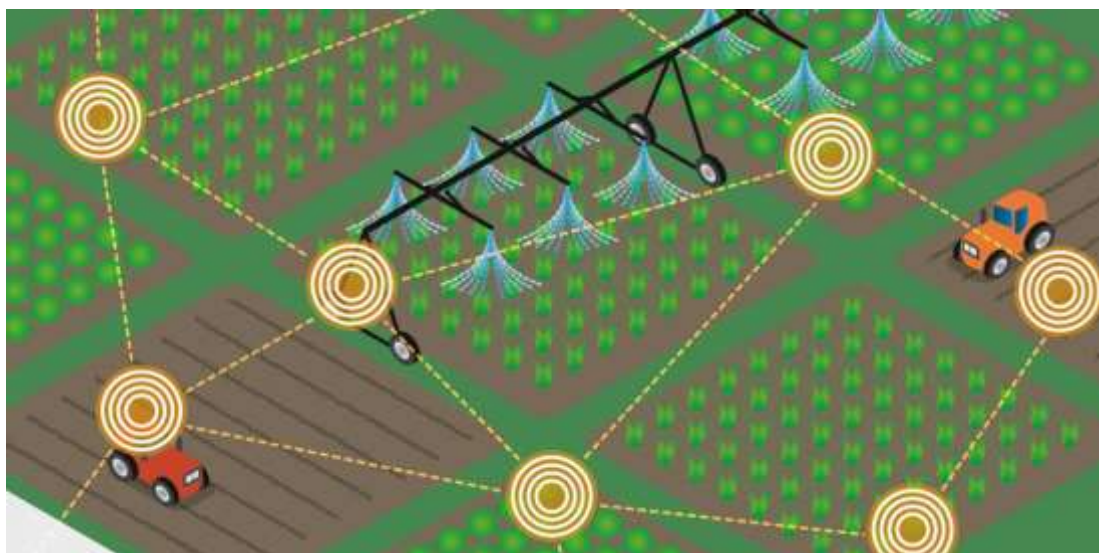
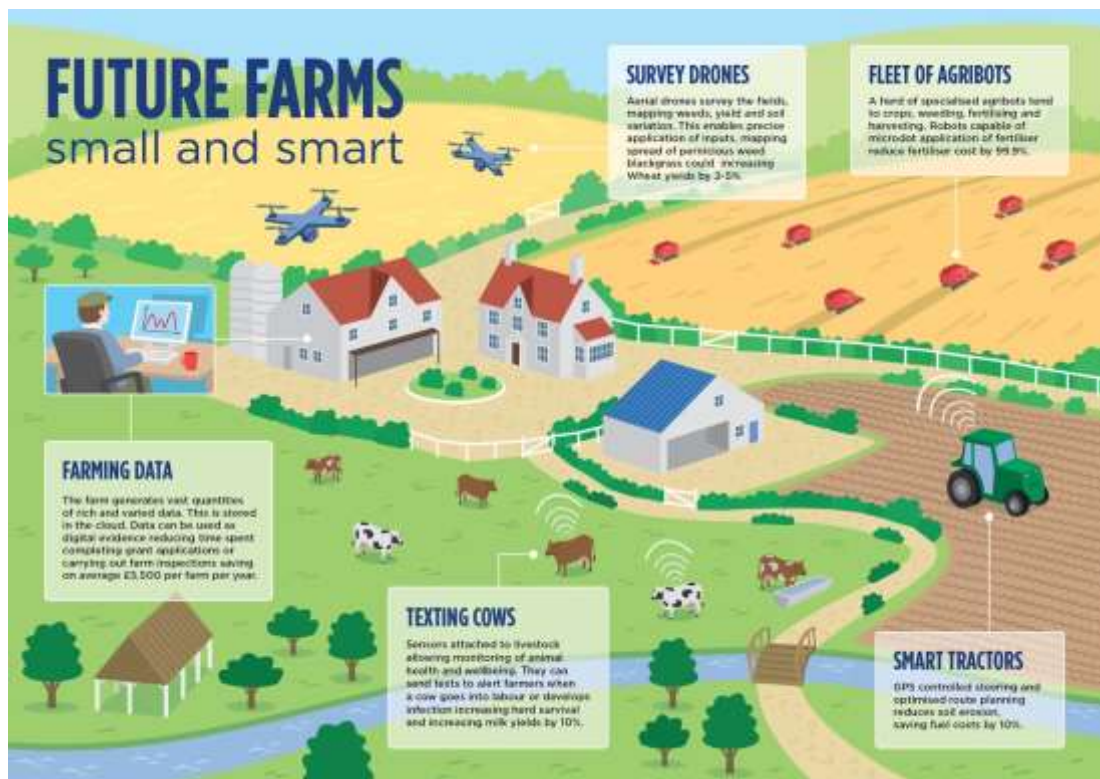
Smart Farm application (website of Agrivi)

Appendix 4. Agribot and drone by University of Sydney



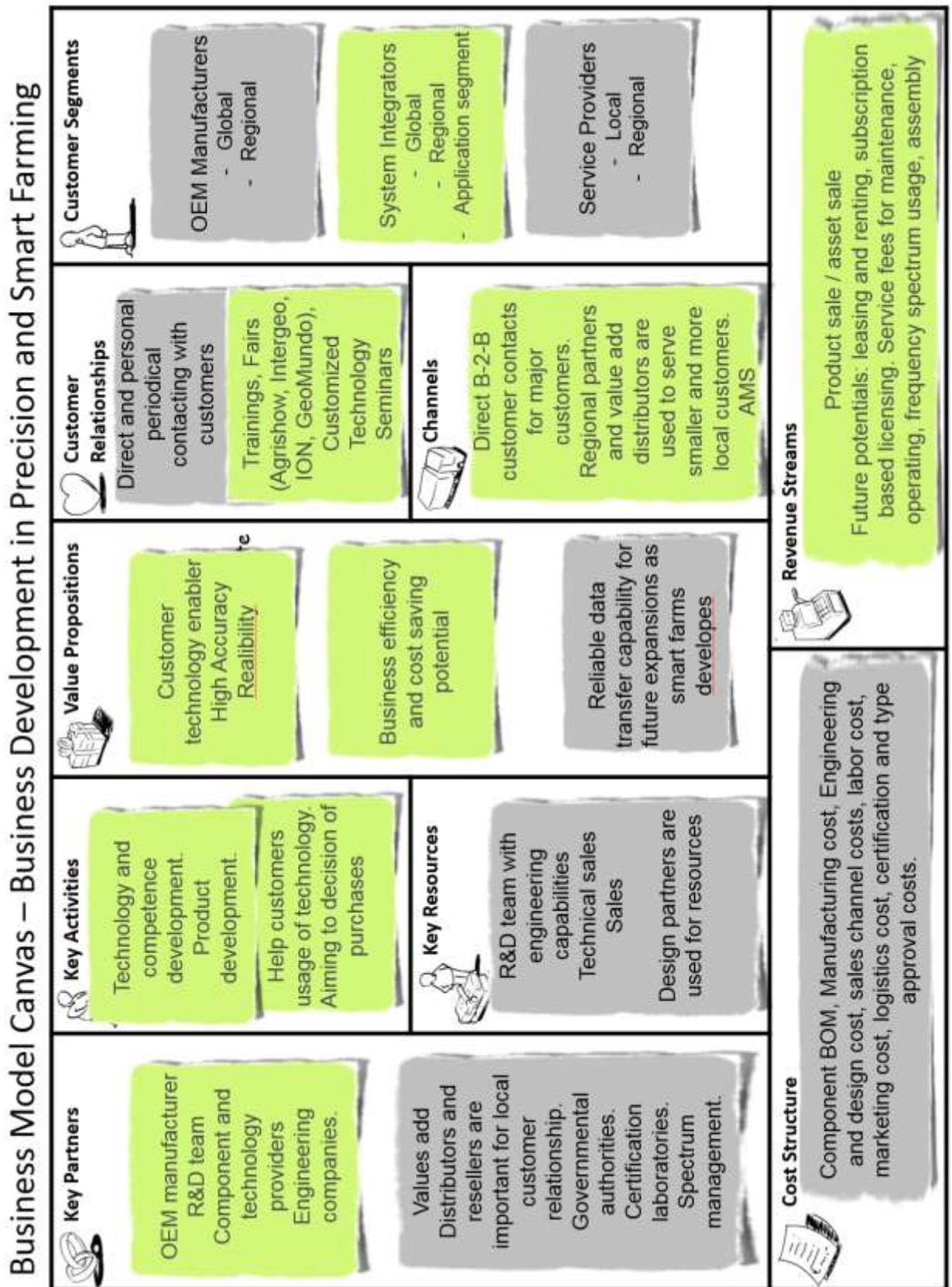
Robot for Intelligent Perception and Precision Application
(<http://www.economist.com/technology-quarterly/2016-06-09/factory-fresh> , referred
3.5.2017)

Appendix 5 Smart Farm overview



<https://www.linkedin.com/pulse/new-data-driven-business-models-agri-food-sector-data-protonotarios>

Appendix 7. Business model canvas for case company

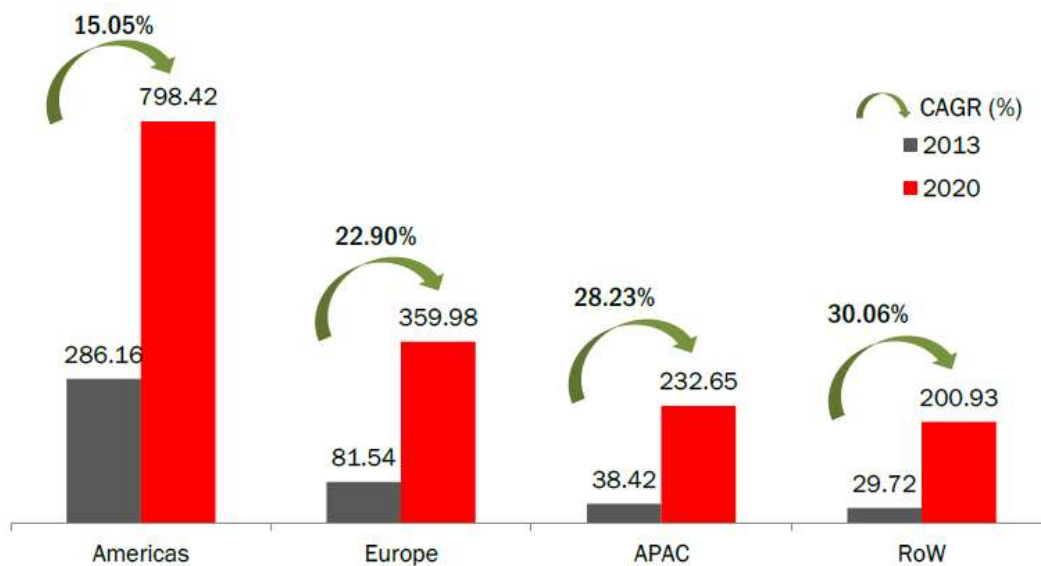


Appendix 8. Aspects of precision farming



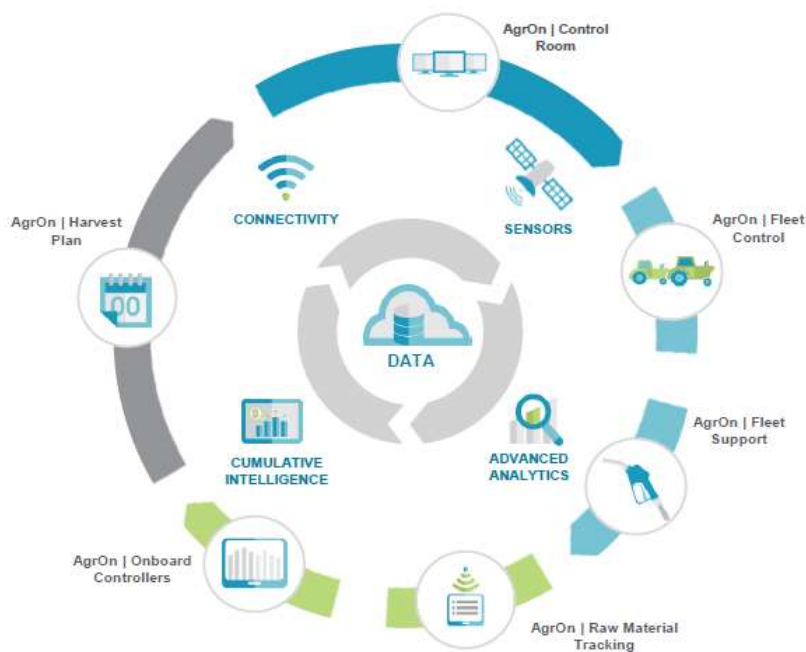
Aspects of precision farming. (Website of Markets and Markets)

Appendix 9. Smart Farming growth rates in geographical regions between 2013 and 2020.



Growth rates in regions (MarketsandMarkets, Precision Farming Market, p37)

Appendix 10. Complete connectivity in Smart Farm by Hexagon



Complete connectivity in Smart Farm (Website of Hexagon Agriculture)

Appendix 11. Smart Farming process in ERP by Hexagon



Smart Farming process from Enterprise Resource Planning (Website of Hexagon Agriculture)