Republic of Turkey
Fujitsu Kyushu Systems, Ltd. (FJQS)

Republic of Turkey

First Attempt, 2013

Privatized Technology Promotional Business for the Social and Economic Development of Developing Countries

Smart Agriculture (Livestock & Greenhouse Horticulture) Promotional Business Utilizing ICT

November, 2016

Independent Administrative Agency
Japan International Cooperation Agency (JICA)

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Chapter 1 Business Background and Summary

1-1 Background

With more than 30 years of domestic business, our company has been accumulating skills, knowledge and experience in the field of agricultural ICT. In 2012, the Fujitsu Group announced the "Food & Agriculture Cloud: Akisai" product group, systematized to expand into the Japanese domestic agricultural ICT market as well as the global market.[1]

Fujitsu Technology Solutions Turkey (hereinafter "FTS Turkey"), a group company based in Turkey began a study of the feasibility of bringing Akisai into the domestic market. During the study, they visited the Ministry of Agriculture of Turkey and the Embassy of Japan in Turkey, among others to gather information and opinions. By making use of our technology, they sought to determine whether they could contribute to Turkey's agriculture and began preparations. Since April 2013, we have held several meetings with the highest levels of the Ministry of Agriculture of Turkey and have received positive feedback from the Deputy Vice-Minister regarding collaboration with the private sector.

Additionally, FTS Turkey has a proven track record (infrastructure) of biometric security with the local government using a solution for pension fraud prevention using vascular authentication technology. Utilizing the connections established through existing business, it is possible for intergovernmental collaboration to promote new businesses, such as the policy framework of smart agriculture with the public and private sectors of both countries. Further, when traveling to Turkey in June 2013, I met with the Japanese Ambassador to Turkey and the Head of the JICA Turkey Office and introduced our company's agricultural solutions as well as the details of our planned activities in Turkey.

The technology and systems provided by our company include "Gyuho SaaS" (hereinafter "Gyuho") that "detects signs of estrus" as well as "Greenhouse Horticulture SaaS" (hereinafter "UECS") which "measures and visualizes environmental data in a greenhouse". Unlike management, sales, or accounting systems, these are applicable to any country regardless of cultural or business customs, but must be adapted to suit the varying markets, climates, and cultivation or breeding methods of each country. In order to successfully expand into Turkey, the market climate, scale and competition must first be analyzed in order to make the correct judgments regarding business development. At the same time, running proofs of concept for each system (Gyuho/UECS) at local sites (ranch/greenhouse), the results in Turkey can be made clear, and raising awareness in the market and with the government affiliated organizations is of the utmost importance. Realizing these goals is the reason for our application.

[1] "Food & Agriculture Cloud: Akisai" is a service based on the concept of "contribution to the future with plentiful food through ICT", using ICT at production sites to tie together logistics, regions and consumers through the value chain. It is a cloud service for agricultural businesses that covers outdoor and factory cultivation as well as animal husbandry from production to management and sales.

1-2 Project Outline and Objectives

1) Project Objectives

Through proofs of concept, define the following objectives:

- Verify the degree of contribution to the target country (Turkey)
- Verify (certify) the technology and effects
- Study the mmarketplace
- Improve the system based on challenges observed on-site

2) Project implementation period: November 19, 2014 - November 18, 2016

3) Project Details

○ Outline of the Project's Products

Consists of two ICT systems and the corresponding hardware: Gyuho, which provides improved productivity and reduced costs for cattle breeding, and UECS, which provides quality and productivity improvements through measurement and automation of fruit/vegetable greenhouse facilities. For this project, only UECS's measurement functionality and not its control functionality is employed.

○ Implementation Summary

Gyuho: Proofs of concept conducted on two (2) farms that are under the jurisdiction of the Cattle Breeders' Associations of Turkey (hereinafter "CBAT") and verify the effectiveness of the technology.

UECS: Proof of concept conducted at a greenhouse belonging to the Faculty of Agricultural at Ankara University (hereinafter "AU") and verify the effectiveness of the technology.

Conditions for location selection of proofs of concept are as follows:

Gyuho: Dairy or beef cattle breeding ranch where networking and power supply can be secured.

UECS: Vegetable or flower growing greenhouse where networking and power supply can be secured.

The selection was decided after confirming by photograph and survey at the discretion of the local organizations, CBAT and AU.

○ Outline and Objectives of Acceptance Activities in Japan

With the objective of comparing the local proof of concept results with the precedent case studies in Japan which brings new observations that lead to further improvement, we will conduct on-site inspections and workshops. We will also strengthen the bonds between local organizations (CBAT and AU) and the Fujitsu Group, as well as conduct information exchange, including top management of the Fujitsu Group.

○ Outline and Objectives of Local Activities

We will verify through proofs of concept whether Japanese products and technology will function correctly (data acquisition, status visualization, notification email) in the target country's (Turkey's) environment (networking, cultivation, breeding climate, etc.) and to prove that "workload reduction" and "productivity improvement" can be obtained using ICT in the target country's (Turkey's) ranches and greenhouses. We will also proceed with a parallel study of marketability with the intent to expand the business. Gyuho will be studied at two locations that are under CBAT's jurisdiction, and UECS will be studied at AU's greenhouse facilities.

1-3 Technologies to Promulgate

■ Gyuho Product Overview

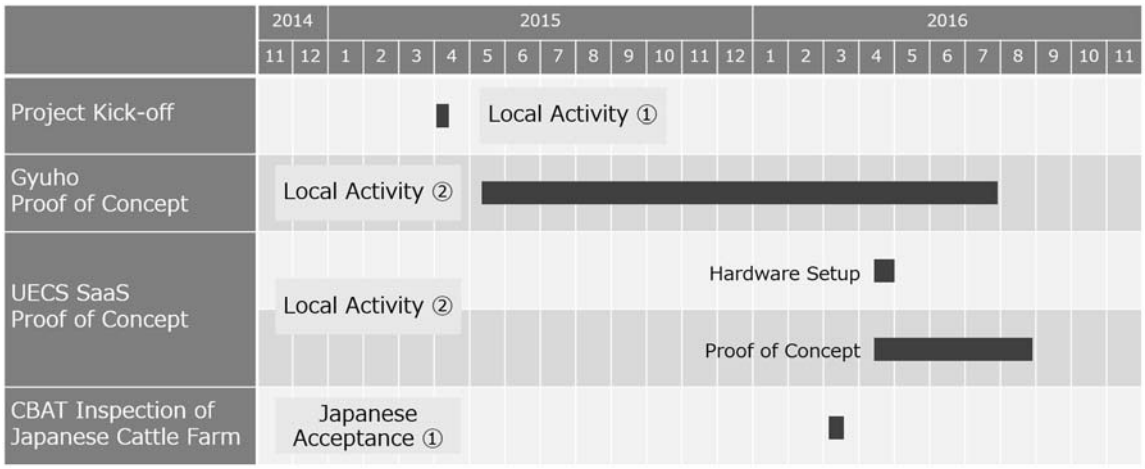
- Utilizing the cow's behavioral characteristics (marked increase in activity during estrus), detect the onset of estrus by monitoring stepcount data from a pedometer. Higher conception rates become possible.
- Reduces losses for dairy and beef livestock farmers. Promotes improved efficiency through early disease detection and gender selection.
- As a cloud service, reliable data and an ever current platform are provided.

■ UECS Product Overview

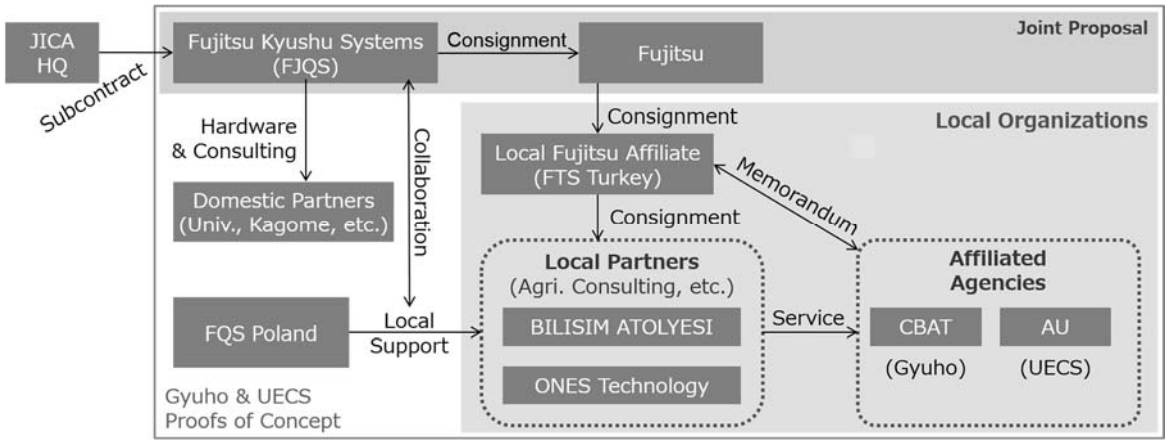
- Based on the Japanese greenhouse horticulture and plant factory complex environment control system "Ubiquitous Environment Control System" (UECS).
- By connecting a greenhouse to the cloud, it becomes possible to monitor and remotely control it from a PC or mobile device.
- Utilize data accumulated in the cloud to improve cultivation technologies.

1-4 Implementation Schedule & Personnel Plan (Achievements)

1) Implementation Schedule



2) Promotion System



1-4-1 Japanese Acceptance Activities

○ Activity Plan (as of April 2015 Contract Revision)

1) Inspection by CBAT of a Japanese ranch implementing Gyuho (Mar 2016)

Goal: ・Invite members of CBAT to inspect a Japanese ranch employing Gyuho, consult with them and exchange opinions regarding the status of a proof of concept and of the Gyuho system.

・Establish relations with stakeholders: Gyuho Sales Department (Fujitsu, Government & Public Systems Unit), Gyuho Development Team (Fujitsu Kyushu Systems, Next Generation Social Solutions Unit), Comtec Co. Ltd.

2) Inspection by AU of a Japanese facility (July 2016)

Goal: ・Invite members of AU to inspect a Japanese greenhouse employing UECS, consult with them and exchange opinions regarding the status of a proof of concept and of the UECS system.

・Establish relations with stakeholders: UECS Development Team (Fujitsu Kyushu Systems, Next Generation Social Solutions Unit), Professor Hoshi of Kinki University (UECS Protocol Developer)

3) Final Project Evaluation (August 2016)

Goal: ・Meet to discuss plans to complete the project: FTS Turkey, Local Partners (BILISIM ATOLYESI, ONES Technology)

1-4-2 On-Site Activities

○ Activity Plan (as of April 2015 Contract Revision)

1) Project Kick-off (April 2015)

Goal: ・ Kick off the project with the local agencies (CBAT and AU).

2) Gyuho Proof of Concept (May 2015 onward)

Goal: ・ Perform setup and operations checks in preparation for the Gyuho Proofs of Concept.

3) UECS Proof of Concept (April 2016)

Goal: ・ Perform setup and operations checks in preparation for the UECS Proofs of Concept.

4) Project Mid-Term Evaluation (June 2016)

Goal: ・ Verify the project's progress and challenges.

Chapter 2 Challenges and Market Possibility in the Turkish Agricultural Sector

- As "Agriculture" is one of the most important industries in Turkey, and various challenges (declining farmer population, quality and safety issues, need to improve exportation and production) have become clear, the government has begun taking steps toward the development of solutions.

- "Assured Quality", "Safe Food Provision", "Increased Export = Increased Production", "Expanding into the Global Market = High Added Value". In order to realize these concepts, the use of ICT, data collection, analysis and utilization rather than just traditional methods of "intuition" or "experience" is preferred. In this way the "scientific agriculture" vision that the government strives for can be made possible.

- Japanese companies like Kagome (tomato production) and Yanmar (agricultural machinery) centered on seedling companies (Takii & Co, Sakata Seed, and Kaneko Seeds Co) are entering Turkey's agricultural market. To develop the Turkish market, collaboration with these companies will prove effective.

- Taking into consideration that the agricultural fields in Turkey that are as follows: 1) the largest scale in Europe, 2) increasing export volume, 3) future growth expectations, which is of great importance to the government, 4) the present lack of ICT agriculture, and 5) high trust in Japanese products and technologies. Beginning with the products and technologies used in this project's proofs of concept, the possibilities in agricultural ICT market have increased greatly.

Chapter 3 Project Implementation: Content and Results

3-1 The 1st Japanese Acceptance Activity (CBAT's Visit to Japan)

3-1-1 Activity Outline

○ CBAT's Visit to Japan

Goal:
- Invite members of CBAT to inspect a Japanese ranch employing Gyuho, consult with them and exchange opinions regarding the status of a proof of concept and of the Gyuho system.
- Establish relations with stakeholders: Gyuho Sales Department (Fujitsu, Government & Public Systems Unit), Gyuho Development Team (Fujitsu Kyushu Systems, Next Generation Social Solutions Unit), Comtec Co. Ltd.

Period: March 14 – 18, 2016

Correspondents: Fujitsu, Ltd.
MATSUNAGA Masahiko (Supervisor)
Fujitsu Kyushu Systems, Ltd.
AIKAWA Yoshimasa, UCHINO Tetsuya, KANAMORI Akihito, TAKAJIMA Hidemitsu, YAMADA Hidenori (Supervisors)
Comtec Co., Ltd.
SASAGURI Kou (External Resource)

Beyond those listed above, there is additional correspondence with Fujitsu's Managing Director Kiwaki, Executive Officer Kamata, Director Mori as well as Fujitsu Kyushu Systems' President Kuroda and management staff.

Visitors: CBAT:
İlhan KÖTEN (Vice President)
Sırrı ÖZTÜRK (Board Member)
Yunus GÜZEL (Board Member)
Edip YILDIZ (Board Member)
Nurhan DAYAN (Board Member)
Ahmet YILMAZ (Board Member)
İbrahim KARAKOYUNLU (Agricultural Engineer)
FTS Turkey:
Şevket HASDEMIR (Enterprise Sales)

Details: Agenda
- ○ Tour of Fujitsu's NetCommunity (Demo Center), followed by a meeting then dinner.
- ○ Meeting with Fujitsu Kyushu Systems, then dinner
- ○ Inspection of a ranch that has implemented Gyuho (Takate Ranch)
- ○ Dinner with Fujitsu executives

3-1-2 Summary of Research Results

- Despite business circumstances and health issues preventing CBAT President Cemalettin OZDEN, the owner of the farm where a proof of concept is being conducted, and Executive Director Dr. Huseyin VELIOGLU from coming to Japan, communication in a variety of settings was possible with the CBAT members that did come, good relations were forged, and frank opinions of Gyuho and points for improvement were received. Realization of a meaningful exchange of opinions regarding expansion into Turkey as well as Central Asian and other European countries.

- With regards to Gyuho's functionality, it became clear from the perspective of the ranch managers that rather than just the "detection of signs of estrus" provided by Gyuho, a total ranch management solution was preferable. For example, "notification of the next possible day of estrus" and "notification of the possibility of conception after artificial insemination" among others should be included.

- Based on the opinions and requests received, improvements and additions to the functionality are under consideration and specific solutions are in planning.

- During their stay, we not only visited the ranch and our offices, but took them to dinner and accompanied them in their free time for shopping or exploring the city. Through this extended period spent together, we built up a trusting relationship. We regard this as a very significant achievement regarding future business development in Turkey.

3-2 The 1st Local Activity (Project Kick-off)

3-2-1 Activity Outline

- Project Kick-off

Goal: With the start of this project, we kick-off with the affiliate organizations (CBAT and AU).

Period: March 31 – April 5, 2015

Correspondents: Fujitsu Kyushu Systems, Ltd.,
Next Generation Social Solutions Unit,
Global SaaS Business Promotion Office,
UCHINO Tetsuya (Supervisor)
FTS Turkey
Şevket HASDEMIR, Gozde SUMER
BILISIM ATOLYESI
Tolun PULAK (External Resource)
FQS Poland
Sebastian GURGUL

Details: Along with our local contacts at FTS Turkey, BILISIM ATOLYESI's Tolun PULAK and FQS Poland members, we visited the local affiliates (CBAT, AU) and completed the final adjustments and work orders for the proofs of concept.

3-2-2 Summary of the Outcome

- Starting with CBAT President Cemalettin OZDEN, we discussed with the association's management and demonstrated Gyuho, and verified their positive response. A good relationship including the local members has been established.

- The Faculty of Agriculture at AU had fallen into a state where they could not be reached for a while due personnel changes, but with this kick-off we were able to rebuild relations with them.

3-3 The 2nd Local Activity (Gyuho Proof of Concept)

3-3-1 Activity Outline (Ranch 1)

○ Gyuho Proof of Concept (Ranch 1)

Goal:
- Setup hardware, initialize the system, and confirm operation for the proof of concept.
- System monitoring and support for the farmers for the duration of the proof of concept.

[Proof of Concept Details]

Goals:
- Verify that Gyuho can operate in the Turkish climate (ranch, networking, etc.) and measure its effectiveness.
- Determine challenges encountered while operating in Turkey.

Details:
- Data acquisition and necessary notification must be performed reliably.
- The effectiveness of using Gyuho (labor/cost reduction, etc.) is apparent.

Period: May 11, 2015 – February 24, 2016

Correspondents:
FTS Turkey
Şevket HASDEMIR, Gozde SUMER
BILISIM ATOLYESI
Tolun PULAK (External Resource)
FQS Poland
Sebastian GURGUL, Szymon DROZDZ
CBAT Regional Office Correspondent (one occasion)

Details:
- Setup necessary hardware (pedometers, receiver, antenna) and verify operation (data transmission).
- Monitor the Gyuho proof of concept and provide operational support to the famers.

3-3-2 Summary of the Outcome (Ranch 1)

1) Evaluation Results

① Comparison of the calving interval of pregnant cows vs non-pregnant cows:
During the evaluation period, there were 10 cows that conceived and 9 that did not. (Incidentally, one cow [AT513133118] gave birth during the evaluation period and was not inseminated afterward so it was not included in the evaluation.)

	Num. of Cows	Detection Frequency (AI Count)	Dry Period	Average (per cow)		Reference Value
				Detection Frequency (AI Count)	Dry Period (X)	Calving Interval (285+30+X)
Conception	10	19	577	1.9	57.7	372.7
No Concep.	9	33	1,744	3.7	193.8	> 508.8

For the reference value, the calculated calving interval (Pregnant Period of 280 days plus the Voluntary Wait Period [VWP] of 30 days, added to the evaluated Dry Period) for cows that conceived is 372.7 days, which is close to the goal of one calving per year (365 days), while the interval for cows that did not conceive is 508.8 days. As the conception in the non-pregnant cows could not be confirmed, this data is ultimately for reference only.

- Comparison of the number of times estrus was detected (fertilization) in cows that conceived vs cows that did not:
  Cows that conceived had a dry period of approximately 50 days, and insemination and expected estrus occurred in constant levels. Cows that did not conceive had lower than expected numbers of estrus detection frequencies. [Number of estrus detections {33} ÷ (dry period {1744} ÷ estrus cycle {21}) = estrus detection rate {40%}]
- Comparison of the insemination interval of cows that conceived vs cows that did not:
  The number of inseminations is 19 for cows that conceived and 33 for cows that did not. Whether insemination was conducted in accordance with the estrus cycle (21 days) or not is compared. (Conception after a single insemination is invalid. For the interval between multiple inseminations, the number of attempts during the 7 days spanning from 3 days before to 3 days after the start of the estrus cycle is compared.)
  The insemination rate during that 7 day period in cows that conceived is 60%, while in cows that did not conceive it is 32%. It can be inferred that insemination aligning with the estrus cycle has an effect on conception rates.
- Breeding problems encountered by the farmers with non-conceiving cows:

	Problems Encountered
Detection Frequency (AI Count)	Low estrus detection count (number of inseminations) (Expected estrus frequency: 40%)
Timing of AI	Estrus not detected aligning with the estrus cycle. (32% were inseminated outside the 7 day period.)

② Comparison of estrus detection by Gyuho vs by farmer manually:
Based on the farmer's breeding information and the number of Gyuho's detection notifications, the number of estrus detections is compared.

	Num. of Cows	① Dry Period (days)	② Expected Estrus Freq. (①÷ 21 days)	Detection by Farmer		Detection by Gyuho	
				③ Detected	④ Missed	⑤ Detected	⑥ Missed
				Ratio (%) (① ÷ ②)	Ratio (%) (④ ÷ ②)	Ratio (%) (⑤ ÷ ②)	Ratio (%) (⑥ ÷ ②)
Conception	10	577	27	19	8	23	4
				69%	31%	84%	16%
No Concep.	9	1,744	83	33	50	93	0
				40%	60%	112%	0%

Among cows that conceived, the detection rate by farmer is 19 (69%) while Gyuho counted 23 (84%). Among cows that did not conceive, the rate by farmer is 33 (40%) while Gyuho counted 93 (112%). Because Gyuho's detection rate is high, it can be said that it is contributing to missed detection prevention (cost reduction, such as unnecessary feeding costs).

■ Points of consideration when implementing Gyuho

	Points of Consideration
Estrus cycle determination	In cows that did not conceive, the estrus detection rate is 112%, and it is necessary to determine whether the detected estrus aligns with the estrus cycle.

3-3-3 Activity Outline (Ranch 2)

○ Gyuho Proof of Concept (Ranch 2)

Goal:
- Setup hardware, initialize the system, and confirm operation for the proof of concept.
- System monitoring and support for the farmers for the duration of the proof of concept.

[Proof of Concept Details]

Goals:
- Verify that Gyuho can operate in the Turkish climate (ranch, networking, etc.) and measure its effectiveness.
- Determine challenges encountered while operating in Turkey.
- ✻ Verify system operation in a different environment (geography, infrastructure) than Ranch 1.

Details:
- Data acquisition and necessary notification must be performed reliably.
- The effectiveness of using Gyuho (labor/cost reduction, etc.) is apparent.

Period: June 18 – July 26, 2016

Correspondents: FTS Turkey
Şevket HASDEMIR, Gozde SUMER
BILISIM ATOLYESI
Tolun PULAK (External Resource)
CBAT Regional Office Correspondent (one occasion)

Details:
- Setup necessary hardware (pedometers, receiver, antenna) and verify operation (data transmission).
- Monitor the Gyuho proof of concept and provide operational support to the famers.

3-3-4 Summary of the Outcome (Ranch 2)

1) Evaluation Results

① Reliability of Detection Notifications at the Time of Transmission
15 (100%) notifications were sent during this proof of concept, and of those, 4 (27%) were assured, 3 (20%) had high reliability, and 8 (53%) had medium or low reliability.

② Estrus Detection Rate of Gyuho

List of estrus detected by cow
(Reliability: ◎ Assured, ○ High, △ Medium, × Low)

Num	Designation	Notifications	Step Count at Time of Notification			Detection Reliability	Reasoning
			< 3,000	> 3,000	> 6,000		
1	TR02333727	1	—	1	—	△	
2	TR02372653	1	—	1	—	△	
3	TR02380851	2	—	1	1	◎	Repeated notification on 6/20, 21
4	TR02381061	2	—	—	2	◎	Notification aligns with cycle
5	TR02381144	1	—	1	—	△	
6	TR02382941	1	—	—	1	○	More than 6,000 steps: 7,390
7	TR02383095	1	—	1	—	△	
8	TR02383096	2	—	1	1	○	More than 6,000 steps: 7,430
9	TR20862878	1	—	1	—	△	
10	TR351813745	2	—	2	—	△	
11	TR44614750	1	1	—	—	×	
Total		15	1	9	5	-	

During the month long proof of concept, 10 notifications of medium reliability or higher were sent, with a detection rate of 90.9%. [(Assured (2) + High (2) + Medium (6)) ÷ Cow Count (11)]

3-4 The 3rd Local Activity (UECS Setup)

3-4-1 Activity Outline

○ UECS Equipment Setup and Instruction

Goal:
- Conduct introductions with Professor Gokhan SOYLEMEZOGLU, the Dean of the Faculty of Agriculture.
- In preparation for the proof of concept, conduct equipment setup, operations checks and operation instruction. This proof of concept aims to verify that UECS can operate in Turkey and determine the challenges that arise, as well as prove the effectiveness of greenhouse cultivation utilizing data collection and visualization from various sensors (temperature, CO_2 levels, sunlight, rainfall) setup in the greenhouse.

[Proof of Concept Details]

Goals:
- Verify that UECS can operate in the Turkish climate (ranch, networking, etc.) and measure its effectiveness.
- Determine challenges encountered while operating in Turkey.

Details:
- Data acquisition and necessary notification must be performed reliably.
- The effectiveness of using UECS (labor/cost reduction, etc.) is apparent.

Period: April 24 – 28, 2016

Correspondents: Fujitsu Kyushu Systems, Ltd.,
Next Generation Social Solutions Unit,
UCHINO Tetsuya (Supervisor)
Research & Development Department
ISHII Megumi (Supervisor)
FTS Turkey
Şevket HASDEMIR, Gozde SUMER
BILISIM ATOLYESI
Tolun PULAK (External Resource)
ONES Technology
Onur SIRMATEL (External Resource)
FQS Poland
Szymon DROZDZ

Details: Agenda

○ Introductions with the Dean of the Faculty of Agriculture. (Professor Gokhan SOYLEMEZOGLU)

○ Installation of UECS hardware and operations check.

○ UECS operational instruction.

○ Visit CBAT

3-4-2 Summary of the Outcome

- ○ After meeting Professor Gokhan SOYLEMEZOGLU, the Dean of the Faculty of Agriculture, again for the first time in over a year, we reconfirmed his intent to participate in our proof of concept. He also prepared dedicated staff and an implementation structure.
- ○ Hardware installation occurred without incident, and data transmission from all installed sensors was confirmed. Özge ŞAHIN, the system user, was able to understand and operate the UECS system without issue.
- ○ Visited to CBAT to exchange opinions regarding commercialization in Turkey, as well as pay thanks for their visit to Japan in March 2016. The biggest issue was the price of the hardware. We received the opinion regarding the importance of recognition and market share by entering the market with a low price of €50 per pedometer.

3-5 The 4th Local Activity (UECS Proof of Concept)

3-5-1 Activity Outline

○ UECS Proof of Concept

Goal:
- Verify that UECS operates without issue in Turkish climate and prove the system's effectiveness.

[Proof of Concept Details]

Goals:
- Verify that UECS can operate in the Turkish climate (ranch, networking, etc.) and measure its effectiveness.
- Determine challenges encountered while operating in Turkey.

Details:
- Data acquisition (temperature, CO_2 levels, sunlight, rainfall) and necessary notification (abnormal temperature/rainfall) must be performed reliably.
- The effectiveness of using UECE (labor/cost reduction, etc.) is apparent.

Period: April 26 – September 30, 2016

Correspondents: AU, Faculty of Agriculture
Özge ŞAHIN (Lecturer)
BILISIM ATOLYESI
Tolun PULAK (External Resource)
ONES Technology
Onur SIRMATEL (External Resource)

In the 3rd local activity, instruction in operation of the system and the various screens displayed for Özge ŞAHIN was completed, and since sufficient assistance provided to the local personnel, there was no further support from external sources.

Details:
- Perform a proof of concept in one greenhouse on campus at AU.
- Monitor the UECS proof of concept and provide operational support to AU staff.

3-5-2 Summary of the Outcome

1) Evaluation Results

① Daily Operational Situation

- Verify the operation of the aforementioned sensors (data acquisition and transmission to the cloud) and that there are no problems.
- Cross-checked thermometer data with independent thermometer readings; no problems.

② Greenhouse's Internal Environment

- Comparing rainy to sunny weather, the greenhouse experienced markedly lower temperatures and levels of sunlight, with higher levels of humidity. Since no abnormal values were observed, it can be assumed the system was operating normally.

③ Cultivation Status

Since the proof of concept began, the following crops have been cultivated, in numbers of bowls:

・Corn:	148	・Sunflowers:	40
・Perennials:	12	・Soybeans:	60
・Beans:	139	・Wheat:	12
・Lentils:	60	・Chickpeas:	60

④ Evaluation and Effectiveness of UECS

- Verified that after hardware installation, from April 26, 2016 onward, data from the sensors was collected every 5 minutes. (The system is stable.)
- During the 4 months of the proof of concept, alerts from UECS were sent for 63 days in total. Without the alerts, the possibility for abnormal temperatures or rainfall to go unnoticed increases, as does the damage to the crops being cultivated. For farmers, damaged crops is a very big problem, and UECS is very effective in preventing this situation. When connected to control equipment, remote control and automation becomes possible, further increasing the system's effectiveness.

Num	Alert Type	Reaction to Alert
1	Abnormal Temperature	Controls such as ridge/side windows, opaque curtains, and heat pumps can be engaged to raise or lower the temperature in the greenhouse, and monitor the situation from then on.
2	Rainfall	Ridge/Side windows can be shut to prevent seepage of rain. Heavy rainfall and night showers require extra caution.

- The following comments were received from Özge ŞAHIN, who operated the system during the proof of concept.
  - ✔ The data collected was effective in maintaining an optimal climate (temperature, humidity, CO_2 levels) for the crop's cultivation. It was also helpful for another greenhouse equipped with analog tools that was used for a different proof of concept performed in parallel. (Comparisons of sensor data, etc.)
  - ✔ Since alerts are sent automatically at the time of abnormal temperature or rainfall, it can effectively prevent overlooking necessary labor, such as shutting windows or adjusting the temperature when needed.
  - ✔ UECS was extremely useful because it collects necessary data (temperature, humidity, CO_2, sunlight, rainfall) and maintains an optimum climate for crops to cultivate.

2) Requests from AU

- A system that can collect data from various sensors (temperature, humidity, CO_2, sunlight), visualize it and sends notifications about abnormalities is an extremely useful one. However, a system that can automatically engage control mechanisms (windows, heaters, ventilation, etc.) based on that sensor data to create an optimum cultivation climate is even more effective.

3-6 General Overview

3-6-1 Goal Achievement

1) Validation of degree of contribution for Turkey

① In the agricultural sector, contributions of agricultural practice based on science, not relying on experience and intuition can be made by utilizing ICT to "Know the State" and "Change the State". It is possible to "develop human resources", "improve quality", "improve productivity", "grow revenue", "improve efficiency" using agricultural science.

- "Know the State": environment (temperature, humidity, wind speed, rainfall, etc.), movement (open/closed, on/off, transition, step count), status (photosynthesis, Stress, disease), growth forecast and crop size.
- "Change the State": open/close windows and curtains, supply fuel, human labor (changes to plans, etc.)

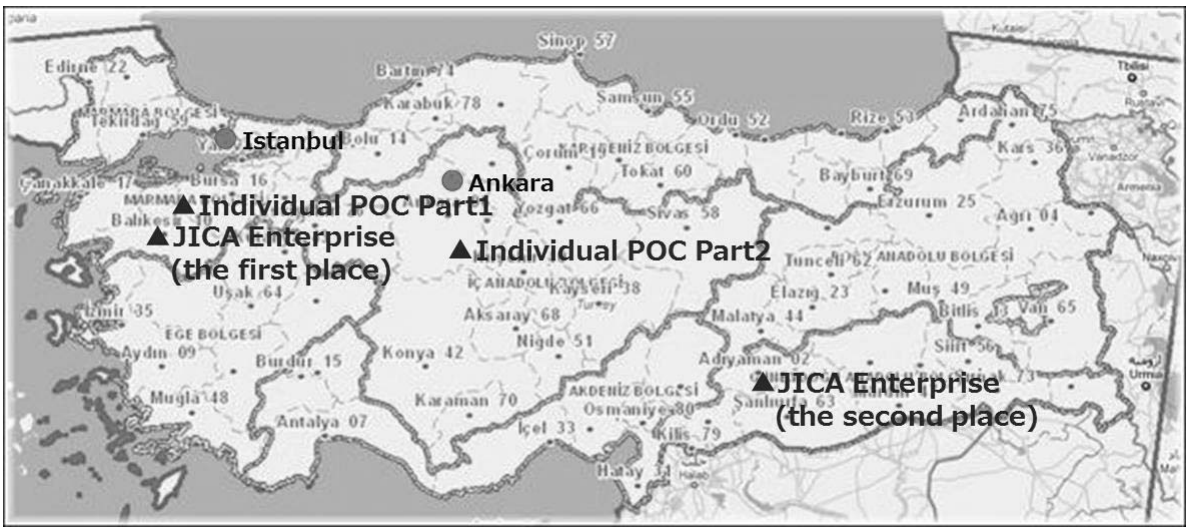
② It has been proven that utilizing ICT in agriculture can very efficiently realize load reduction for farmers with this project. For instance, Gyuho can monitor the estrus sign of cows in real-time, 24 hours a day, 356 days a year and notify the farmer of changes. It is very helpful for the farmers to reduce their workload. UECS can visualize the environmental information in a greenhouse (temperature, humidity, sunlight, CO_2 levels, and rainfall) and provide remote monitoring. In addition, by making sending notifications to avoid missing temperature abnormities, it is possible to take the necessary actions. (Close windows, switch on/off the fans, etc.) Also the system provided is a cloud-based system and so operators can check the status from wherever they are.

③ As a result of the reduced workload and improved productivity, costs have been reduced. The proof of concept is limited to "detection of signs of estrus in cows" and "measure and visualize the environment in a greenhouse", however it has been confirmed that agricultural ICT can contribute to Turkish agriculture.
* As this is a cloud-based solution, a network environment must be established in advance.

2) Proof of Technology and Effectiveness

① Gyuho

- There are proofs of concept conducted in two different farms in Turkey for this project as well as other proofs of concept conducted by two separate farms. From these results, we have verified that there is no problem operating Gyuho in Turkey. Data collection and notification messages have been working properly. There were small issues caused by network conditions, however it did not largely impact to the project.
- The network conditions were not stable on the second farm, so the proof of concept had to be canceled. There is still some network issues but it will not interfere with our business in Turkey if proper hardware (router, etc.) is used and the network in Turkey continues to improve.
- It has been proven that the characteristics of cows are same in Turkey as everywhere else. (For example, the amount of activity increase when the cow enters estrus, and the estrus cycle being 21 days.)
- The three key points of "cost reduction", "farmer's workload reduction", and "improved productivity", it is clear that utilizing ICT provides a "farmer's workload reduction". By avoiding missing estrus signs during the night, it is possible to consistently inseminate cows every 21 days and as a result, it can be said that "feeding cost" = "cost reduction" and "improve conception rate" = "improved productivity". According to the members of CBAT, utilizing Gyuho is a very efficient way to reduce economic losses. The rate of unsuccessful inseminations dropped from 13-30% to less than 10% and the average number of inseminations fell from 2.3 attempts to 1.7 attempts.
- CBAT commented that they will be responsible for the operation and maintenance of the estrus detection system when the Ministry of Agriculture make their decision. Gyuho is effective for detecting signs of estrus but to implement and expand into Turkey, the support of the Ministry of Agriculture is essential.



② UECS

- We have verified that there is no problem operating UECS in Turkey.
- Data collection and visualizing from sensors (temperature, humidity, CO_2, sunlight, rainfall) were performing normally.
- Notifications when the system detected abnormal temperature, rainfall or lack of transmissions (684 total alerts), necessary action was taken. No matter where the farmer is, visualizations and notifications are available from the cloud 24 hours a day, 365 days a year. They achieved "cost reduction" too by not needing labor overnight.
- As AU requested, further effectiveness is expected once automatic control is implemented. It will be necessary to conduct another proof of concept with automatic control before developing the business.

3) Market Research

There is a large market and many policies made by government in Turkey. It has been proven that with the effectiveness of these technologies, there sufficient market in Turkey. The market is 3.5 times larger than Japan's for Gyuho and 1.4 times larger for UECS. The comparison with competing products, Gyuho and UECS have some added value. From the results of the proofs of concept in other countries like Korea, Poland and Romani, Gyuho and UECS are competitive.

Gyuho

Gyuho	DeLaval (Sweden), Afimilk (Israel)
Year-round uninterrupted notification with real-time monitoring within a 150m range	Data collected just once or twice per day, and only when in the cowshed
5 year battery life	1-2 year battery life
For dairy and meat cattle	For only dairy cattle
Available for first-lactation cow	Not available for first-lactation cow

The Polish National Research Institute of Animal Production conducted a proof of concept for Gyuho and found it performed favorably when compared to Afimilk.

[Estrus Detection Ratio] Farm 1: Gyuho: 98.4% Afimilk: 91.9%
Farm 2: Gyuho: 98.3% Afimilk: 96.7%

UECS

UECS	Priva, Hortimax (Netherlands)
Year-round uninterrupted monitoring	Not a cloud-based system
Distributed autonomous system, arising problem do not halt the entire system	Centralized system, arising problems crash the entire system
Available for any size of greenhouse	Cost of implementation is too high, only for very large greenhouses
Easy cabling and maintenance	Complicated cabling
The spec is open source and it is possible for users to set parameters	The system is black box by the makers

FTS Turkey has built a good relationship with Turkish Government agencies through some past projects. Also there is communication with Japanese Embassy in Turkey. CBAT and AU also have great relations with the Turkish Government.
In addition to some Japanese companies like Kagome, Yanmar, Takii & Co, Sakata Seed have offices and are doing business in Turkey. This is one of the opportunities for building a network of relationships in Turkey.

4) System Improvement by Determination of Challenges

The following issues are extracted.

① Operation

- And improvement of the user interface of the current system and a simplification of features are necessary. Especially the user interface must be standardized for global use. For example, to use icons instead of words. Also the revision and improvement of product manuals are necessary.
- From an operational point of view, it is important to build a team who can support local customers. Additional training for BILISIM ATOLYESI and ONES Technology is necessary.

② Improvement of Features

- As CBAT commented, Gyuho is only an estrus detection system. It is just a part of the livestock farmer's management. A total solution for supporting livestock farmers is necessary. Based on the requests from CBAT and the current plan for system development is to start building such a total solution.
- As for UECS, a proof of concept including automated control and an expanded hardware set (sensors) is necessary.

3-6-2 Understandability and Requests from Affiliated Organizations

[Gyuho]

- CBAT fully understands Gyuho after thorough proofs of concept in 4 farms and they visited a cattle farm in Japan. Also they understand that Gyuho is superior compared to DeLaval and Afimilk.
- It has been confirmed that they can help install Gyuho on the farms who are members of CBAT and advise when to expand into other countries.
- Lower cost of pedometers and building a total solution are challenges for building out the business in Turkey.

[UECS]

- Özge ŞAHIN from the Faculty of Agriculture at AU has been the sole operator during the proof of concept and understands the basic functions of UECS and systems effectiveness.
- AU agreed to continuous proofs of concept at the university, and to provide another greenhouse and promotional support by way of research publications.
- AU requested that automated control be built into the system. It will be allow for more effectiveness. Arrangements for another proof of concept are necessary.

3-6-3 Challenges and Countermeasures of Market Penetration and Promotion

1) Derived Challenges and Countermeasures

Based on the results of the proofs of concept and the opinions of the affiliated organizations regarding the business expansion of Gyuho and UECS into Turkey, the following issues were derived:

① Pricing

[Gyuho]

- Due to differing business practices, simple comparison is not possible. (Other companies mainly sell large equipment such as milking parlors, making inexpensive estrus detection devices as support products.) Compared to competing products, Gyuho has superior features such radio range and battery life, but commands a higher price. Reduction of the price is a challenge for business development.
  [Price of pedometers: Competitors: approx. $80-90, Gyuho: approx. $160. (Current Standard Pricing)]

[UECS]

- Although a survey of the competition was not completed, many details are unknown, but in general, compared to Priva based in the Netherlands (despite a difference in scale), UECS has proven less expensive in many cases.

[Solutions]

- Continuous negotiation with hardware manufacturers. (Ongoing)
  → Negotiations for discounting (approx. 20%, €125/unit) based on lot conditions for Gyuho pedometers have concluded, while consideration for continued reductions (inexpensive manufacture of pedometers for use abroad) is still under discussion.
- Promotion of subsidies. (Subsidies for Turkey and other European countries is in use or being studied.)
  → Subsidies in Japan and South Korea are in use. An application for subsides in for the European Union has been initiated.)
- Promotion of leasing options. (A case model being developed in Japan.)

② Hardware Procurement

[Gyuho]

- Hardware required for business development (pedometers, receivers, antennas) are exported from Japan. (As it is designed and manufactured specifically for Gyuho, finding substitutes is difficult.) However, to develop the business further in Turkey, where price reduction is a key issue, consideration of alternative hardware is also necessary.

[UECS]

- With regards to UECS, all sensors were brought in from Japan in this case, but to develop the business, locally procured sensors will be necessary. To that end, the standardization of the connection interface as well as collaboration with vendors in Turkey is also necessary.

[Solutions]

- Continued negotiations with the manufacturer, Comtec Co. [Gyuho]
- Standardization of interface for easy connection to local hardware. [UECS]
- Selection of and collaboration with local hardware manufacturers. [UECS]

③ Hardware Sales Certification

[Gyuho/UECS]

- A certification, similar to the CE mark in Europe, seems to be necessary to sell hardware in Turkey. There is concern that since the process for acquiring the CE mark is taking a significant amount of time, business development will be affected.

[Solutions]

- Research the certification system in Turkey as well as the necessary procedures and ask for timely correspondence. [Gyuho/UECS]
- For UECS, proceed as above, with consideration for local procurement to avoid unnecessary certifications.

④ Total Solution

[Gyuho]

- Although system is designed to "detect signs of estrus", but other functionality required for ranch management including "notify of the next possible estrus" and "notify of possible conception after artificial insemination" are in demand.

[UECS]

- Automatic control functionality in addition to data analysis, as requested by AU, is in demand. This functionality is already part of the system but was not part of the scope of the proof of concept. Further demonstration may be necessary.

[Solutions]

- Research into "disease symptom detection" and a "delivery monitoring system" are already underway. Consideration of new and expanded functionality as well as new solutions that are possible within the limitations of the current system are also underway. [Gyuho]

⑤ Operational Improvement

[Gyuho]

- A system originally developed for domestic use, improvement of the user interface (ease of use and understandability) and functionality (separation of optional from mandatory features) is necessary to operate in Turkey.
- Manuals for the users (farmers, administrators) need to be maintained, though the aim is for the system to be useable without requiring a manual.

[UECS]

- Unlike Gyuho, UECS has a fully developed user interface.
- Like Gyuho however, a development of a manual is necessary in lieu of a self-explanatory interface.

[Solutions]

- User Interface Improvement: Icons instead of words.
- Functionality Improvement based on local needs. [Gyuho/UECS]
- Improvement of the operational manuals. [Gyuho/UECS]

⑥ Instruction and Enhancement of Local Organization

[Gyuho/UECS]

- One challenge ahead is the training of our local partners (BILISIM ATOLYESI, ONES Technology) to provide support to customers so they may use the product correctly and effectively. (Improvement of manuals and training methods.)
- Provision of further information, including improved manuals, to those local partners (BILISIM ATOLYESI, ONES Technology) is also necessary.

[Solutions]

- Conduct continuous training for our local partners (BILISIM ATOLYESI, ONES Technology).
- Enhance the local support system from FQS Poland.
- Improvement of the operational manuals. [Gyuho/UECS]

⑦ Improvement of the Local Infrastructure

[Gyuho/UECS]

- The systems we provide are cloud-based, and as such, the network environment is absolutely essential. In this case, the infrastructure less than perfect network environment (GSM was insufficient) was the source of operational hiccups.

[Solutions]

- For future development, it will be necessary to conduct a survey of the local networking environment ahead of deployment to verify that there will be no interruptions in service and to clarify points of responsibility in contract.
- Using this case as an example and working with the affiliated organizations, an approach to the government can be made.
- Additionally, we will enhance the monitoring system in order to reduce the effects during operation.

Chapter 4 The Direction of Business Deployment following Promotion

4-1 Business Goals

○ Promotion of this project through the proof of concept, the technology was verified and challenges were determined. The aim is to deploy the two products "Gyuho SaaS" and "Greenhouse Horticulture SaaS" into the Turkish market.

○ Following introduction into Turkey, consideration of expansion into surrounding countries (Central Asia) is the next step.

[Business Plan]

・Goals for 5 years after sales begin in Turkey

Solution	Deployment Ratio	Ref.: # of Farmers	Target Year
Gyuho	70,000 cows (0.5%)	1,000	2021
UECS	350ha (0.5%)	10,000	2022

■ Gyuho Cattle in Turkey numbers 14,000,000, with 70,000 (0.5%) being our goal.

[Reasoning]
Assuming that the sales goal for Gyuho's monthly service fees is 300 million yen, and that the fee per cow per month is €3 (about 360 yen), approximately 70,000 cows must be outfitted.

(360 yen × 12 months × 70,000 cows = approx. 300 million yen)

■ UECS Greenhouses in Turkey have a collected area of 1,400ha, with 350ha (0.5%) being our goal.

[Reasoning]
Assuming that the sales goal for UECS's monthly service fees is 300 million yen, and that the fee per node (sensors and controllable units, eg. heater) per month is €3 (about 360 yen), approximately 10,000 farms (approx. 350ha) must be outfitted.

(360 yen × 12 months × 10,000 farms × avg. 7 nodes = approx. 300 million yen)

[Cumulative Totals for Deployment Goals]

	2016	2017	2018	2019	2020	2021
Gyuho (cows)	100	3,000	22,500	45,000	**70,000**	80,000
UECS (hectares)	-	10	40	120	230	**350**

・To develop and expand the business in Turkey, we intend to actively invest internally in the necessary procedures, conducting proofs of concept before deployment, improvements to the systems.

・Price setting for Turkey is decided, but the investments listed above are not limited to Turkey and are general. The goal of this particular business plan is solely the number of deployments.

(Sales Policy)

■ Gyuho

Target:

1) CBAT member ranches (30,000 farmers, 300 million cows)

Policies:

1) Hardware price reduction
   → Continuing negotiations with manufacturer Comtec, and consider possible alternatives.
2) Take advantage of the relationship with CBAT to expand.
   → Deploy to CBAT member ranches.
   → Promotional collaboration (improve reputation) from the reports included in the proof of concept.
   → Collaboration with the Ministry of Agriculture of Turkey (subsidies, standardization)
3) Promotion of the collaboration with the government.
   → Financial cooperation through subsidies.
   → Promotion of standardization in Turkey.

■ UECS

Target:

1) AU
2) Other universities
3) Agricultural Corporations (approx. 60 organizations)

Policies:

1) Take advantage of the relationship with AU's promotion and introduction to other horticultural companies.
   → Collaborative promotion through research paper presentations.
   → Deployment to AU's greenhouses.
   → Cooperation with other universities and horticultural companies.
2) Market development through collaboration with Japanese seedling companies. (Takii & Co, Sakata Seed, etc.)
   → Take advantage of the relationships in Japan to collaborate in Turkey.
3) Promotion of the collaboration with the government.
   → Financial cooperation through subsidies.
   → Promotion of standardization in Turkey.

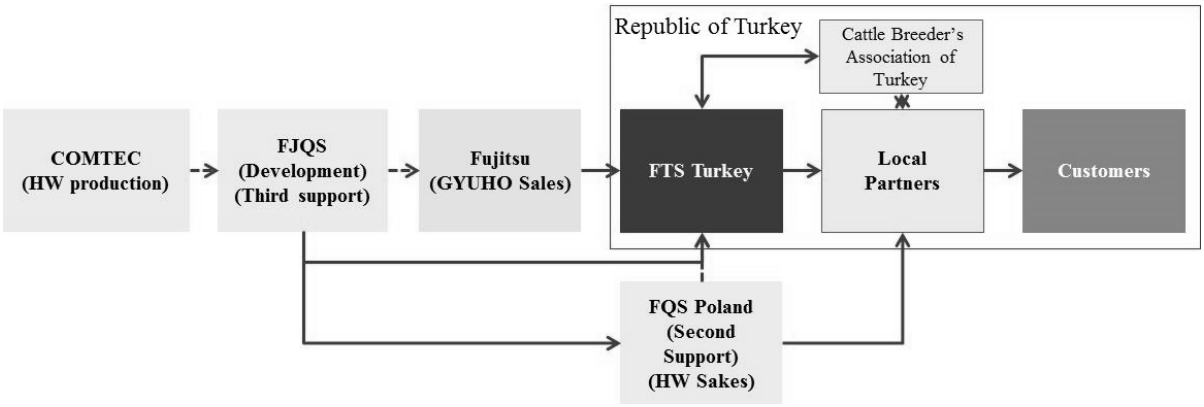
・ Prioritize the development of business in Turkey, while the planned expansion into surrounding Central Asia is pending will be a separate study and project plan.

4-2 Project Implementation Structure

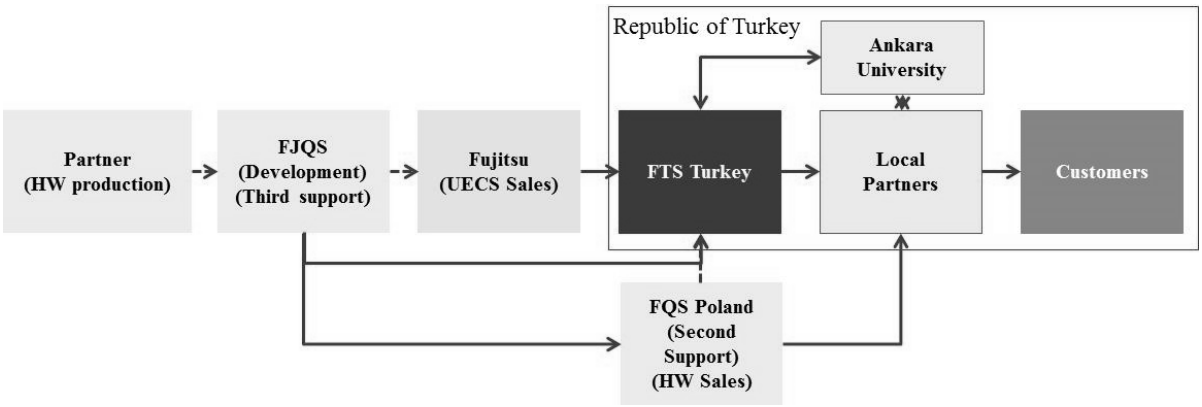
○ This proof of concept project for developing the business and expanding in Turkey, with support of affiliated organizations like CBAT and AU, we hope to see continued support and cooperation of the Japanese Embassy in Turkey and JICA Turkey as well. CBAT has jurisdiction over approximately 30,000 farms and with their cooperation deploying and expanding the business, we can increase awareness in domestically including the government as well as analysis and expansion into surrounding Central Asian countries. With AU, promotion and publicity through research papers and publications for government agencies and other horticultural organizations as well as further proofs of concept at the university to continue collaborative research. We hope to continue to share information regarding and build relationships with local companies and related organizations with the Japanese Embassy in Turkey and JICA Turkey as well.

○ The proposed project implementation structure is as follows:

[Gyuho]



[UECS]



○ Regarding project promotion, as CBAT's comments pointed out, collaboration with the Ministry of Agriculture of Turkey is essential. We hope to collaborate with them on government policy and utilization of subsidies. Taking advantage of CBAT and AU as an introduction, as well as using the connections of FTS Turkey and our local partners (BILISIM ATOLYESI, ONES Technology), we plan to approach the Ministry of Agriculture of Turkey.

○ Additionally, we plan to collaborate on market development and promotion in Turkey with other Japanese companies. For example, using UECS at Kagome's tomato production farm, building a customer base by collaborating with seedling companies like Takii & Co and Sakata Seed to introduce local agricultural corporations and farmers, and promotion from Nikkei BP (March 2016: participated in Seminar @ Istanbul, Gyuho and UECS material was on display), the possibilities continue to increase.

4-3 Schedule for Rollout

Business Expanding Schedule　　(●:Completed、○:Ongoing、N:Not yet started)　　FY: Japanese finacial year

NO		Activity Content	progress	FY 2016 Second Half	FY 2017 First Half	FY 2017 Second Half	FY 2018 First Half	FY 2018 Second Half	FY 2019 First Half	FY 2019 Second Half	FY 2020 ～
0		JICA Business completion report	○	▲Nov.18							
1	Common	Consideration and correspond with the extraction challenge	○								
		・Price setting	○								
		・Hardware procurement	N								
		・Total solution	○								
		・Improvement of operability and operability	N								
		・Development and strengthening of the local organization	N								
		・Local infrastructure improvement	N								
2	Gyutho SaaS (Connected Cow)	Planning and Marketing	○								
		・Marketing research	●								
		・Investigation of legal regulations, competing products, etc.	●								
		・Business plan (price, sales channels, etc.)	○								
3		Development and commercialization	○								
		・Intellectual property corresponding (trademark, other companies' infringement, etc.)	●								
		・Hardware authentication (CE mark, etc.)	○								
		・Product registration (internal office procedures)	●								
		・Safety export management (Parameter sheet)	●								
		・Manual maintenance	○								
		・Local partner technology transfer (education)	○								
4		Promotion	○								
		・Sales promotion tool maintenance	○								
		・Local partner support	○								
5		Sale	N								
		・Turkey	N								
		・Neighboring countries (*Carrying out the above process before sales)	N								
6		Sales support (secondary support, process improvement)									
7	Greenhouse Horticulture SaaS	Planning and Marketing	○								
		・Marketing research	○								
		・Investigation of legal regulations, competing products, etc.	○								
		・Business plan (price, sales channels, etc.)	N								
8		Development and commercialization	○								
		・Intellectual property corresponding (trademark, other companies' infringement, etc.)	○								
		・Hardware authentication (CE mark, etc.)	N								
		・Product registration (internal office procedures)	N								
		・Safety export management (Parameter sheet)	N								
		・Manual maintenance	○								
		・Local partner technology transfer (education)	N								
9		Promotion	○								
		・Sales promotion tool maintenance	○								
		・Local partner support	N								
10		Sale	N								
		・Turkey	N								
		・Neighboring countries (*Carrying out the above process before sales)	N								
11		Sales support (secondary support, process improvement)	N								

Continual promotions and product improvement


ジャイカ
JICA