Part I. Smarf’s Vision for Smart Agriculture Revolution in Africa
1. Agricultural Opportunities in Africa

50% of the world’s remaining uncultivated land is in Africa.

Agriculture accounts for 32% of total GDP of Africa.

By 2030, the World Bank estimates that Africa’s agriculture sector could constitute a $1 trn opportunity.
Agriculture productivity fails to rise fast enough to meet the needs of a rapidly growing population.

Over the past 30 years, the population of Africa increased 2 times, but agriculture productivity increased only 1.8 times.

Source: UNICEF
In Africa, only about 6% of the total cultivated land is irrigated. Still, Africa’s water strain comes largely from its agriculture.

The challenge across the region is to provide an environment that enables countries to draw on the water where needed and use it in the most effective and sustainable way possible.
4. Irrigation Potential in Africa

“...It is estimated that irrigation alone could increase output by up to 50% in Africa...”

- Kanayo Nwanze, IFAD President
Statement for Africa Agriculture Science Week, July 2013

Groundwater reserves in Africa are about 100 times greater than surface water, but only 1% of land in Africa is irrigated with ground water. With the right investments, this could be increased to 50% of all cropland.
5. Effect of Drip Irrigation on Cotton, Maize and Tomato

“... Wilde credits the more efficient water delivery to the plant's roots with increasing yields of 3 to 4 times greater for both lint and cotton seed than what he had with more traditional furrow irrigation...”

Source: http://www.netafimusa.com

Maize yield with drip irrigation is 57% higher than that with furrow.

“....Drip system gave 5941.2 kg/ha of maize while 3782 kg/ha for furrow....”

Source: Effects of Drip and Furrow Irrigation Systems Application on Growth Characteristics and Yield of Sweet Maize under Sandy Loam Soil

Tomato yield was 38% greater in 2012 than in 2010 and averaged over the 2 years, 48% higher in the drip irrigation than in the overhead irrigation systems

Source: Overhead and Drip Irrigation System Effects on Tomato Growth and Yield in California's Central Valley
SMARF enables every farm to reap the benefits of IoT

SMARF tries to deliver enormous benefits of IoT to every farmer at a low cost. To pull this off, SMARF has developed SMARF valve which can be applied to most outdoor farms and a platform which can be used for various useful purposes including field-device control, data accumulation and analysis.
Part II. Introduction of Company and Product/Service
1. Company Overview

SMARF Co., Ltd
Smart irrigation/fertigation service
Established in Apr. 2015
Product and service: wireless valve and pump actuator, wireless soil sensor, AI-based irrigation/fertilization control platform
Technical area: RF communication / data analysis / self generation / IoT platform
Main target: outdoor farms

SMARF develops intelligent irrigation/fertigation solution
Smart and convenient irrigation/fertilization valve most suitable for outdoor farming!

- No external power required
- No control panel required
- Long range coverage (8km)
- Coverage expansion with gateway
- Ultra-low power design
Soil sensors for outdoor farms which help to identify optimal irrigation/fertilization scenarios

Cost: a fifth of conventional soil sensor
Compact size, two sets of probes
Wide coverage (RF, LoRa and etc.)
Coverage expansion via gateways
Ultra-low power consumption
3. Product - FAROTA

Platform that enables automation through pattern analysis and irrigation/fertilization regardless of time and place

As an IoT S/W platform
- Connecting devices
- Managing System resource
- Sending Actuating request

As a Data logger
- Gathering Sensor data from SMARF & 3rd party devices

As a Data Analysis system
- Analyzing Periodic data
- Analyzing Micro-climate
- Calculating irrigation scenario
4. Application Example: SMARF Solution

Components of SMARF solution

- Non-powered fertilizer mixer (0.4~4% precision)
- SMARF Valve
- Flexible tubes
- Drip nozzle for uniform irrigation (pressure compensation, underground/surface)
- Send irrigation/fertilization data through underground soil sensor (transmission/analysis of data)
5. Application Example: SMARF Solution for African Agriculture

Solar-powered SMARF solution

- Solar-powered SMARF solution
- Non-powered Fertilizer injector (0.4~4% precision)
- Drip nozzle for uniform irrigation (pressure compensation, underground/surface)
- Send irrigation/fertilization data through underground soil sensor (transmission/analysis of data)
SMARF irrigation/fertigation solution has been used in various regions in Korea including Sunsan, Buyeo and etc. In April 2018, SMARF signed an MOU with SKT and Orion, and under the MOU, Orion’s several contract farms adopted SMARF Solution.
7. Actual Result of Using SMARF Solution

Yield **29%** Increased, Starch content and uniformity Increased

Sprinkler irrigated vs. Smarf Solution irrigated

<table>
<thead>
<tr>
<th>Sprinkler</th>
<th>Smarf Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 t/ha</td>
<td>23.1 t/ha</td>
</tr>
</tbody>
</table>
8. Economic Value Additionally Generated by SMARF Solution

\[
\frac{39t - 30t}{\text{Yield from SMARF Solution applied area}} = \frac{9,000 \text{ kg}}{\text{Yield from control area}} \times \frac{1\$}{\text{Wholesale price per kg (past five year average)}}
\]

The value of additional yield per hectare:

\[9,000 \text{ $ / ha}\]
## 9. High-ROI Irrigation Solution - SMARF

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>EA</th>
<th>Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIS</td>
<td>1ha / DripK</td>
<td>1</td>
<td>1300</td>
<td>1300</td>
</tr>
<tr>
<td>Mixing pump</td>
<td>Mixing pump / 0.4 ~5%</td>
<td>1</td>
<td>500</td>
<td>500</td>
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<tr>
<td>Pump</td>
<td>Pressure pump</td>
<td></td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Valve</td>
<td>dn40 / solenoid</td>
<td>2</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>Actuator</td>
<td>SMARF Valve</td>
<td>1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Actuator</td>
<td>SMARF Pump</td>
<td></td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Barrel</td>
<td>100L</td>
<td>Poly-Nylon</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Pipe/Hose</td>
<td>PE</td>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Sensor</td>
<td>Soil sensor / Temp ,EC,Humidity</td>
<td>4</td>
<td>40</td>
<td>160</td>
</tr>
</tbody>
</table>

* Unit: US Dollar

**Cost of investment in irrigation (with SMARF solution)**

$3,000

**Revenue from investment in irrigation**

$9,000

**High ROI 300%**
“Aid that empowers people to stand on their own feet is helpful and very necessary.”
<table>
<thead>
<tr>
<th>No.</th>
<th>Applicant</th>
<th>Country</th>
<th>Progress</th>
<th>Application/Registration No.</th>
<th>Title of Intellectual property(patent)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Hanbyul Chae</td>
<td>Korea</td>
<td>Registered patent</td>
<td>Application No. (10-2015-0173810) Registration No. (10-1796838)</td>
<td>The device for growing plants and the system using the device</td>
<td></td>
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<td>3</td>
<td>Hanbyul Chae</td>
<td>Korea</td>
<td>Registered Trademark</td>
<td>Application No. (40-2015-0093367) Registration No. (40-1217745)</td>
<td>SMARF (Category: 7th type farming device and 4 others)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SMARF Co., Ltd.</td>
<td>Korea</td>
<td>Registered Trademark</td>
<td>Application No. (40-2016-0116936) Registration No. (40-1292292)</td>
<td>FOROTA (Category: 9th type computer software platform and 18 others)</td>
<td></td>
</tr>
</tbody>
</table>
12. Team Members

**CEO**
Hanbyul Chae

Roles:
- Overall management, domestic sales, strategy development

**COO**
Kyungtae Kim

Roles:
- Operation management, purchasing materials, overseas sales (China)

**System Architect**
Wonjin Heo

Roles:
- System design, machine learning, back-end development, operation

**Accountant**
Nara Lee

Roles:
- Accounting, general affairs, working expense mgmt.

**HW Engineer**
Donghee Ahn

Roles:
- HW design, HW development

**Global Sales**
Gwangheon Seo

Roles:
- Translation (English-Korean), overseas sales (English speaking countries), business development

**SW Engineer**
Muhyung Park

Roles:
- Modular front-end development, firm-ware development

**Designer**
Minjung Yang

Roles:
- Product/graphic/UI design
MAKE YOUR FARM SMART

SMART
Part III. Appendix
Solution Overview

Process of the installation and use of intelligent irrigation solution

1. Process of installation
2. Tractor and equipment setup
3. Irrigation system installation
4. Sensor placement
5. Connection and setup
6. Mobile app integration
7. Monitoring and adjustment
To automate irrigation/fertilization optimized for potato production by gathering/analyzing the data on irrigation and environment.