3D Model of High-Altitude Cabbage Farm Quantifies Crop Yield to Stabilize Kimchi Prices

Low 2020 Cabbage Production in South Korea Inflates Value of Beloved Kimchi Vegetable

The national dish of South Korea is kimchi, a combination of salted and fermented cabbage and other vegetables, most often seasoned with garlic, onion, and red pepper. A staple on Korean tables, kimchi's sour and spicy flavors are an accompaniment at most meals.

Beyond being beloved for its taste, kimchi has a long-standing cultural presence in the history of South Korea. Its origin begins about 2,000 years ago, when the country's long, harsh winters compelled Koreans to salt and store vegetables in earthen jars so they could stay preserved for long periods of time and offer nutrition during the cold months.

In late fall, many South Koreans purchase bulk quantities of cabbages and other vegetables used in kimchi. They season and prepare the mass amount of vegetables to ferment for many months so it can be enjoyed the following year. This time period of kimchi preparation and preservation is called *gimjang*. This group or family ritual is such a highly regarded and special South Korean tradition that in 2013 it was listed as a UNESCO Intangible Cultural Heritage.

As a significant ethnic food and intrinsic component of Korean life, the status of the country's cabbage crop has a significant impact on its citizens. The country most recently saw the effects of limited cabbage – leading to a shortage of kimchi — several years ago.

In 2020, a surge in precipitation as a result of typhoons caused the South Korean cabbage crop to crash. With not enough cabbage produced to meet the country's substantial demand, cabbage prices inflated by 60%.

The instability in cabbage rates prompted the Korea Rural Economic Institute to investigate cabbage production to forecast future prices. A national policy research institute, Korea Rural Economic Institute hired SISTECH to assess the value of the cabbage grown in the village of Anbandegi, which includes the country's largest high-altitude vegetable farm. The organization wanted to estimate the amount of cabbage growing in the farm to quantify the volume of cabbages that could be shipped and sold.

With all of the town's mountains covered in cabbage fields, Anbandegi is located 1,100 meters above sea level and is located in the Pyeongchang county of the Gangwon province. The area's steep terrain requires farmers to physically harvest and cultivate all of the fields; machines are incapable of dealing with the alpine landscape.

In the past, estimations of cabbage harvest volumes were also done by farmers in the field. This process was labor intensive, time consuming, and inexact. To accurately measure the cabbage production at Anbandegi, SISTECH created a 3D model of the entire region with Bentley Systems' technology to determine if the volume of product could meet supplier demand and, ultimately, stabilize the price of kimchi.

The project team input images of the Anbandegi farm taken by an unmanned aerial vehicle (UAV) into Bentley Systems' ContextCapture application. This technology swiftly generates accurate digital twins of the physical world from aerial photographs or point clouds. The software used the airborne imagery to create a 3D model of the mountain's existing conditions.

SISTECH used the 3D model to determine the dimensions of the farmed sections of the mountain, as well as the amount of arable land available to grow cabbage in each of those sections, and the types of cabbage that can be grown in each section. Knowing the amount and variety of cabbages throughout the farm enabled SISTECH to precisely calculate shipment volumes for each type of cabbage to determine if the volume would meet demand and stabilize kimchi vegetable prices.

This new method of calculating cabbage production and shipment volumes with a 3D model reduced expenses by 20%.

Looking forward, continued usage of UAV imagery and reality modeling for the purpose of estimating arable cabbage yield in South Korea will benefit the country. Quickly generating a 3D model of a mountainous farm will enable Korea Rural Economic Institute to accurately forecast kimchi vegetable pricing. Additionally, in the event climatic conditions again negatively impact cabbage production, Korea Rural Economic Institute can predict future inflation.

Given the societal significance and economic importance of kimchi in South Korea, precise knowledge of the country's current crop harvest allows the country to quantify how much additional cabbage may need to be imported.

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Image 1

Caption: As a significant ethnic food and intrinsic component of Korean life, the status of the country's cabbage crop has a significant impact on its citizens. The country most recently saw the effects of limited cabbage – leading to a shortage of kimchi – several years ago.
Image courtesy of SISTECH

Image 2

Caption: The instability in cabbage rates prompted the Korea Rural Economic Institute to investigate cabbage production to forecast future prices. A national policy research institute, Korea Rural Economic Institute hired SISTECH to assess the value of the cabbage grown in the village of Anbandegi, which includes the country's largest high-altitude vegetable farm.
Image courtesy of SISTECH

Image 3

Caption: To accurately measure the cabbage production in the village of Anbandegi, SISTECH created a 3D model of the entire region with Bentley Systems' technology to determine if the volume of product could meet supplier demand and, ultimately, stabilize the price of kimchi.
Image courtesy of SISTECH