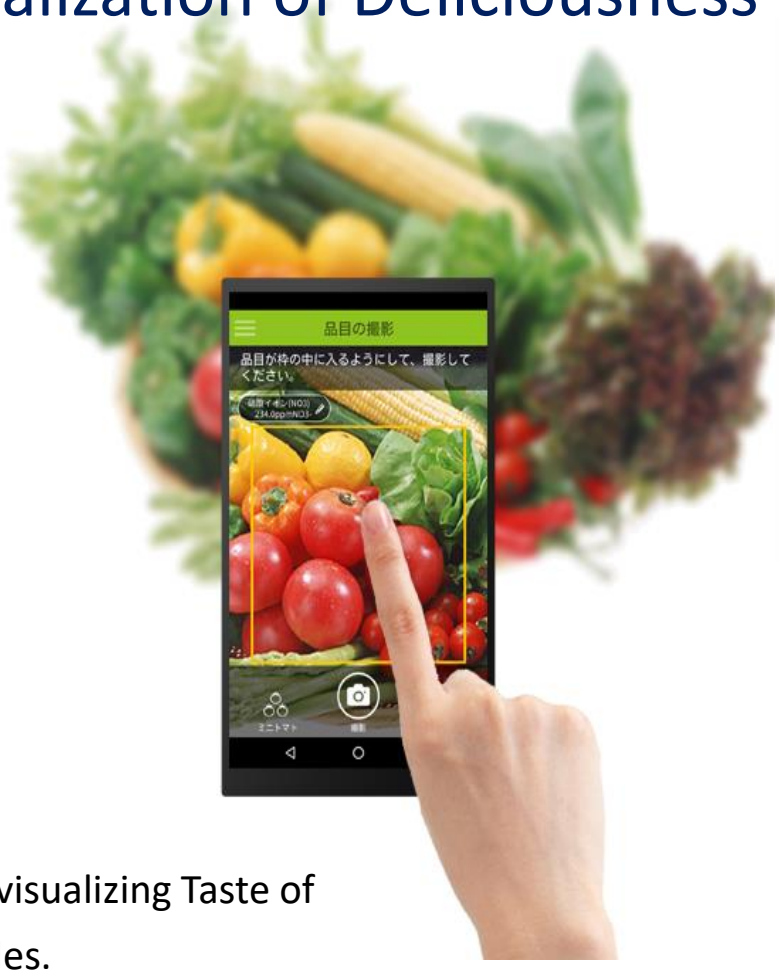
Agricultural DX and Open Innovation Strategy with "Visualization of Deliciousness" Technology



System of taste visualization
おいしさの見える化
Business plan admited by law cerification METI since 2016

Image Analysis for visualizing Taste of Fruits and Vegetables.

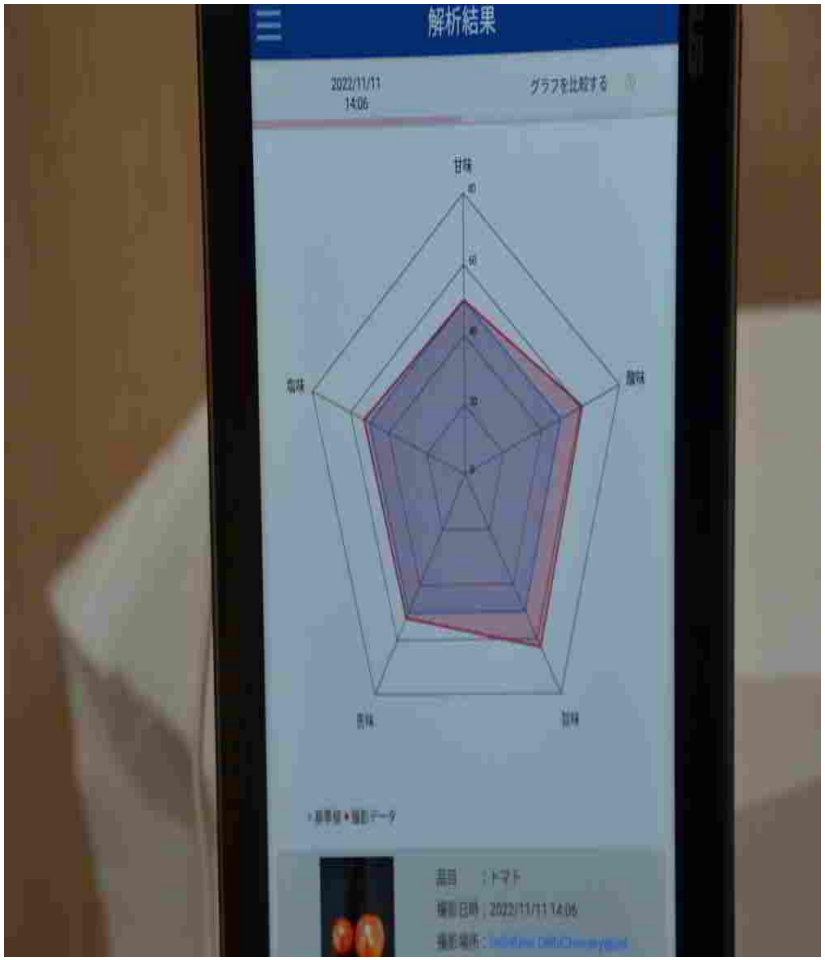
Developed AI to instantly create graphs by photos from smartphones and other devices.

SUSTAINABLE DEVELOPMENT GOALS

Makuta Amenity Co., Ltd.
Takehiro MAKUTA

Measuring quality from photographic images Agricultural Digital Formation (DX) Advancing with Artificial Intelligence (AI) Analysis

Development of a service that instantly analyzes the "deliciousness" of vegetables, fruits, and other agricultural products from images taken with smartphones and other devices, and "visualizes" them with numerical values and graphs. Since image analysis is performed by AI in the cloud, this DX technology can be used worldwide as long as there is a communication environment. It is the world's first to analyze quality with visible light without destroying crops. Anyone can easily use the system by downloading a dedicated smartphone application. The UI (user interface) has been designed to display not only graphs, but also icons and comments.



Immediate display of analysis results

・Deviation of sweetness, umami (fifth category of taste, corresponding to the flavour of glutamates), saltiness, acidity, and bitterness

・Display of sugar content (brix) in %.

・Taste characteristics with "comments" and "icons

・In addition, synchronization of measurement location and time

A system that charges users with whom it has a contractual relationship according to the amount used.

Expansion of eligible items
Additional development of ripeness determination
"Visualization of the best time to eat".

Items available for taste analysis as of January 2023(18 items)

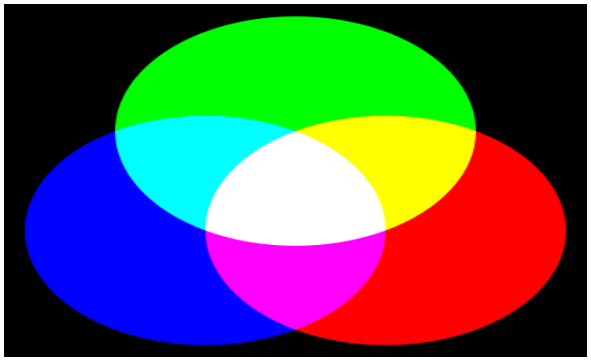
Tomato, mini-tomato, cucumber, spinach, komatsuna, turnip, strawberry (Tochiotome), broccoli, carrot, apple (Fuji), cherry, Chinese cabbage, lettuce, grape (Kyoho), grape (Shine Muscat), asparagus, tangerine (Onshu)

Additional ripeness analysis also developed (2 types)
LaFrance, Arles melon 〔Expanding sequentially〕

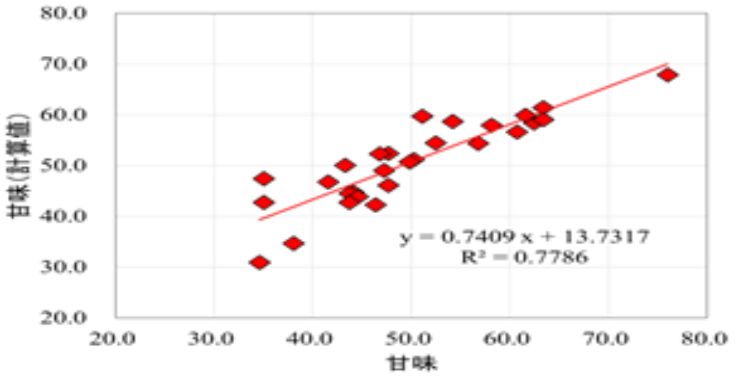
Technical Overview of "Agricultural Product Judgment System" by Image Analysis

Solution by visible light (RGB)⇒ (Non-destructive) quality evaluation

“Visualization of Deliciousness”



赤 (Red)　緑 (Green)青 (Blue)



The image (the human eye actually perceives only three colors: red (Red), green (Green), and blue (Blue), because there are only three types of photoreceptor cells that perceive light, and intermediate colors other than these three colors are perceived by combining red, blue, and green. The three colors (R, G, and B) are decomposed by a spectroscope, and the correlation between the light intensity distribution given as a function of wavelength or frequency and the "taste factor" determined by destructive inspection of the produce in question is determined. The algorithm for each item can be created and programmed. Algorithms are created for each item, and judgment is made by programmed AI (Artificial Intelligence).

Although the number of combinations of items, colors, and survey items is enormous, big data analysis has greatly accelerated the progress of the work.

This technology is based on multiple regression to determine the correlation between RGB and data on "taste" obtained by destructive analysis using taste sensors, HPLC, Brix sugar analyzers, and other analytical instruments, and quantitative values of related amino acids (for example, glutamic acid, a component of umami) and actual food consumption, and to extract items that show a correlation (or inverse correlation) above a certain level. The above figure shows the results of analysis of komatsuna (Brassica napus).

The above figure is the result of analysis of Komatsuna (Brassica napus), and the actual value of sweetness measured with a Brix sugar meter and the calculated value based on R (red), G (green), B (blue), etc. (actual value: horizontal axis, calculated value (this technology): vertical axis), the adjusted R-square of the multiple correlation coefficient (square of multiple correlation coefficient) is 0.7786 (multiple correlation coefficient: 0.882), as also indicated in the figure. 0.7 to 1, it falls under the category of "strongly correlated".

The use of correlation coefficients in nondestructive testing is also used in rice taste meters and near-infrared sugar meters.

Scheme for development and operation of this technology

Government affiliated institution

Us

Research Institutes/Universities

Industry-University-Government Collaboration

Project certification and development funding

Collaborative Research and Data Accumulation

Open Innovation

Partner Company

Partner Company

Partner Company

Service Offerings

Comparison with conventional technologies

Measurement cost is about 1/100 (according to Nihon Keizai Shimbun: newspaper)

Optical sensor

(sugar content measurement by near infrared)

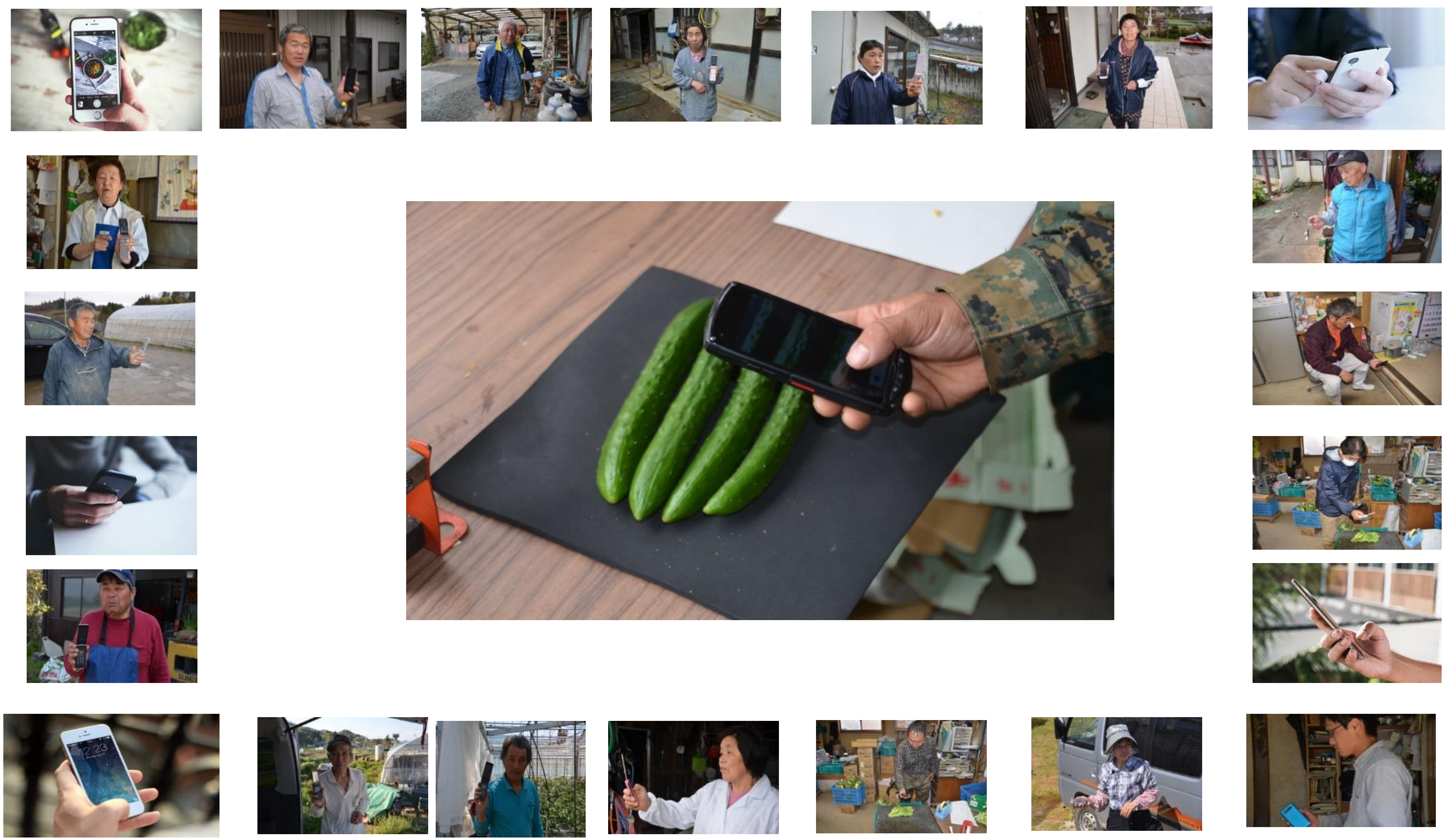
- Expensive measuring equipment and facility and construction costs
- Carried to the installation facility (common selection area, etc.)
- Only sugar content is measured.

Our technology

(image analysis taste measurement)

- Photographed with a smartphone or other digital devices
- Send images → Receive in the cloud
- AI analyzes the taste and deep learning improves accuracy.
- In addition to "sugar content" and "flavor," "astringency" and "saltiness" are also analyzed.
- Radar chart, augmented reality (AR), and digital signage for easy understanding

Lots of people already own smartphones.

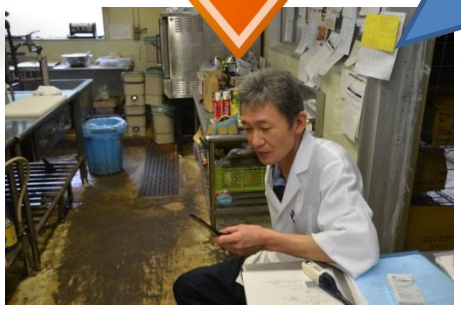


Diverse "visualization" information use

Skewering the Supply Chain
「Informatization」
DX model originating from agriculture

Improve production for continued competitiveness

【 Agricultural Producers 】



Information-based purchasing

【 Hotels & Restaurants 】

Differentiation by product information

【Stores】

Sales of appropriate materials and consulting

【 Sales of materials, etc. 】

Cultivation improvement and quality check

Selection and procurement of ingredients to suit the dish

Provide detailed product information and recipe suggestions

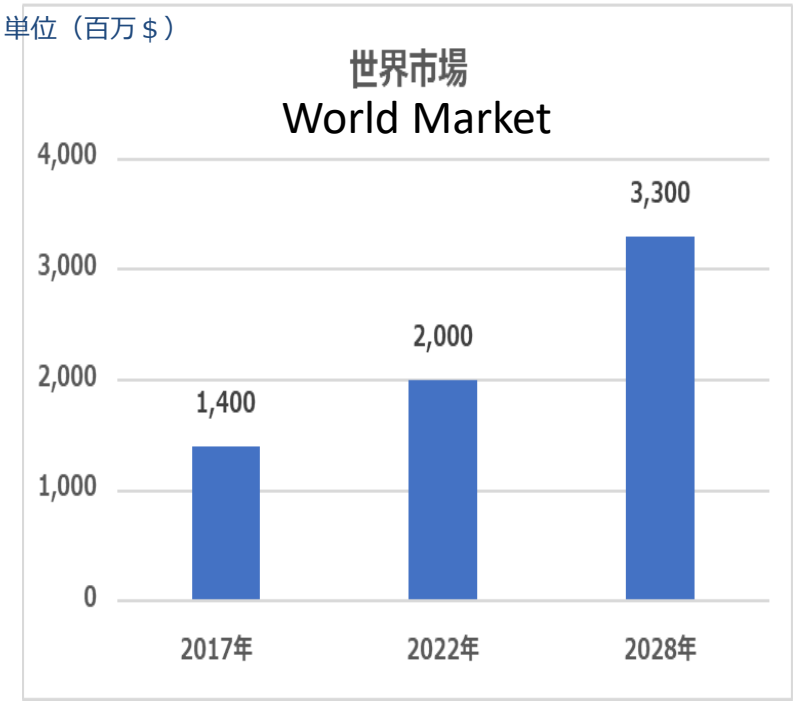
Accurate proposals from plant factories to home gardens

Revitalization of agriculture through the use of DX (ICT, AI, IoT) and Business Opportunities

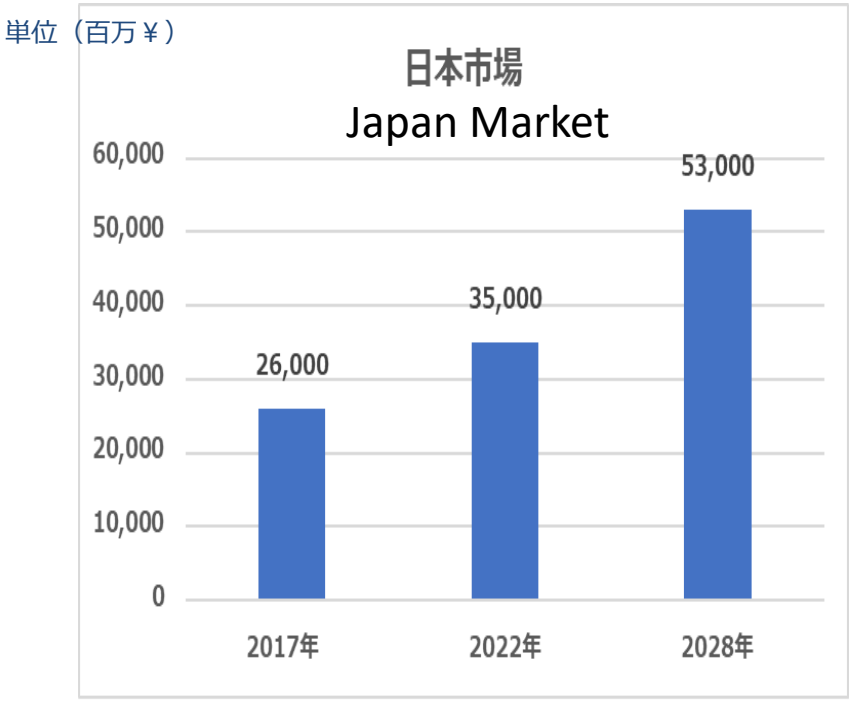
Size of the global and Japanese markets for ICT for food and agriculture

(Results of 2017, Forecasts of 2022 &2028)

Units: 1 million USD



Units: 1 million JPY



Value has changed from things (hardware) to things (user experience (UX))

Example: What happened with smartphones (smartphone revolution)

Spec games as a phone, such as thinness, small size, and long time

The value changes

the playing field changes

Disruptive innovations

Apple/Google
(Entry of non-telecom companies)

An open platform for applications was provided, offering a vast value was provided by allowing users to freely choose from a vast array of applications.

Mr. Kenji Kushida
Stanford Univ.
Research Associate

At first, the smartphone appeared to be a touch-activated cell phone with a big screen, but In reality, they offered a very different value.

Don't miss the moment when the rules of the game change and the evaluation axes change.

Features of the "Visualization of Deliciousness" system

A use area that spans from production to consumption
in a non-destructive, simple, and instantaneous manner through the use of mobile devices such as smartphones

Change the way you buy vegetables!

"how to make" and "how to sell" are also!

Demonstrative examples of "apps" and "data

in stores (manager interviewed by broadcaster)

"It also increases the value of the product by communicating information about taste, something we couldn't do before, and by capturing customer preferences."

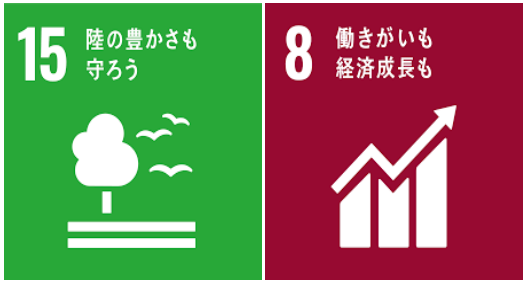
Shipment with “Taste Guarantee”
Quality improvement for production farmers and shipping organizations

Global Needs

AI and the cloud are not limited by distance or location!

Certain prospects for practical application in India

Compatible with local tomatoes
(within the dynamic range)



Measures to address poverty issues.
Potential for use in “fair trade”.

Expanding into new markets

Further technological development and service level improvement

CASE

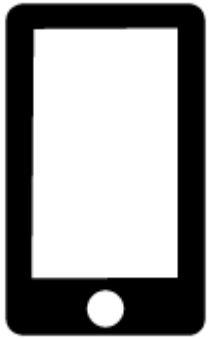
Joint research with a major tea processing company

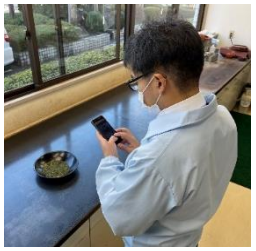
ITOEN

伊藤園

Raw tea leaves (rough)

Tea leaf photo → AI analysis
Easy Quality Assessment





Product

Analytical equipment for tea evaluation is expensive and they are used infrequently, and are a burden to farmers in particular.

- **Reduction of evaluation costs**
- **Effective for production guidance**

☆ ITOEN is a major food company handling 25% of Japan's rough tea

Through agricultural product image analysis, we aim to solve new social issues through DX, form new industries, and develop business systems.

SUSTAINABLE DEVELOPMENT GOALS

Thank you for your attention.

※ Website where this technology is described　http://makuta-amenity.com/iot/