ssnup
Smallholder Safety Net
Upscaling Programme

ARTIFICIAL INTELLIGENCE APPLICATION TO IMPROVE THE QUALITY EVALUATION OF THE CROPS SOLD BY FARMERS IN INDIA

Market linkages

Partner organisation

Sohan Lal Commodity Management Pvt Ltd (SLCM), founded in 2004, is a leading Indian agri-service company. It provides warehousing, collateral management, financial, and procurement services, holding the largest market share among privately owned warehousing firms in India. SLCM operates nearly 6,899 warehouses across more than 20 states, handling approximately 160 crop varieties. The company primarily supports smallholder farmers with an average of 2 hectares of land. SLCM focuses on both profitability and social impact, benefiting over 6 million people in agricultural supply chains and 33 million low-income households as of 2020.

The challenge

Quality assessment is crucial for regularly monitoring crops stored in SLCM warehouses and determining their prices for sale or use as collateral to secure financing. SLCM has dedicated quality laboratories for this purpose. **However, this quality assessment process was manual and cumbersome, taking about three days and incurring significant costs.** It involved sampling from stock, sealing, sending samples to the lab for analysis, and generating quality reports, with costs associated with courier services, quality scientists, laboratory administration, and reporting.

The proposed solutions

The project aimed to increase the smallholder farmers' income through the implementation of an Artificial Intelligence (AI) image-based application to automate crop quality assessment. The application automatically identifies the commodity, classify defects using image analysis, and determine quality grades and prices.

The key expected outcomes of the project were:

1 **Reduce the quality assessment time** from three days to three seconds.

2 **Shorten lead time** for crop listings and accelerate sales.

3 **Ensure** transparent and fair pricing.

4 **Save costs** through process optimisation.

5 **Position SLCM as a technology leader** in agriculture.

6 **Enhance SLCM's corporate social responsibility** outcomes.

7 **Target 5 million farmer users** by 2023.

8 **Reach 37,500 trader and consumer users** by 2023.

9 **Increase farmers' income by 8-10%** by 2023.

IMPACT INVESTOR

incofin
INVESTMENT MANAGEMENT

PARTNER ORGANISATION

Sohan Lal
Commodity Management

India

NUMBER OF FARMERS REACHED

233,177

AGRICULTURAL VALUE CHAIN

Rice, maize, and chickpea

START DATE

February 2022

END DATE

June 2023

TOTAL EXPENDITURE

€ 153,287
Including € 106,118 (69%)
financed by SSNUP

key results

1 **AI quality assessment Agri Reach application** successfully developed, tested, integrated with the internal system, and launched. The quality assessment app, _now live on the Google Play Store_, can perform quality control for rice, maize, and chickpea.

3 days to 3 seconds reduction in quality assessment time.

700 staff members trained and able to train to use the app through video tutorials and infographics.

21 permanent jobs created in the organisation due to the project.

233,177 smallholder farmers (12% women) whose crops are scanned by the new application.

32,705 end-consumers, from middlemen to agri-logistic workers using the new app.

Through better transparency and a more direct connection with traders, processors and consumers, smallholder farmers benefit from quicker sales at a fair and unbiased price, reducing lead time to enlisting crops for trade and fostering mutual confidence for future higher value transactions on the rice, maize and chickpea markets.

SDGs supported by the project

2. Zero hunger
2.4 Adoption of productive, sustainable and resilient agricultural practices

8. Decent work and economic growth
8.5 Access to decent work and equal pay for equal work

12. Responsible consumption and production
12.5 Reducing waste and recycling

lessons learnt

✓ **Smallholder farmers can directly benefit from digitalization along the value chain**

Smallholder farmers can benefit significantly from digitalization, even without using nor mastering the technology themselves. By strengthening market enhancement tools and improving transparency between various actors along the chain, digitization enables a trickle-down effect, sometimes right down to smallholder farmers. Direct benefits can include faster and fairer transactions, together with live monitoring of crop quality and information sharing on the market value of their products.

✓ **Data quality is crucial for machine learning models**

Commodities vary in size, shape, colour, and texture, posing challenges for machine learning models in making accurate predictions. In addition, obtaining large, diverse datasets, especially for rare commodities, is difficult. Limited data can lead to overfitting and reduced model generalisability. Therefore, high-quality data is essential for the accuracy and reliability of machine learning models in commodity quality checking. Datasets with clean, labelled, diverse images accurately representing the physical parameters of the commodities greatly enhance model performance. Technical knowledge of the crops is necessary to select relevant features for the learning algorithms.

✓ **Choosing and fine-tuning machine-learning algorithms, with continuous monitoring and updates, is key**

The SLCM technology team experimented with multiple models to find the best fit. Developing models that are both accurate and interpretable is essential, especially where decisions require clear explanations and justification. In commodity quality checking, machine learning models need regular monitoring and updates to maintain accuracy and relevance. As market conditions evolve, new commodities may enter, existing profiles may shift, and quality standards can change due to regulations or consumer preferences. These dynamics require ongoing model retraining to incorporate new data and adjust, which is vital for maintaining the application's reliability and effectiveness.

✓ **Expert and user feedback integration is crucial**

Integrating expert and user feedback is crucial for the continuous improvement and refinement of machine learning models, particularly in complex fields like commodity quality assessment. Feedback from industry experts and quality control professionals is invaluable, as these individuals possess a deep understanding of the specific challenges and nuances of the commodities being evaluated. Their insights can help identify areas where the models may be underperforming or where additional features might be needed to enhance accuracy.

✓ **Ensuring that the new application complies with quality regulations is critical but complex**

The new application must be designed to comply with industry-specific standards, safety protocols, and legal requirements, which can vary significantly across markets and over time. Additionally, understanding and navigating intellectual property rights is essential for its sustainable deployment. Regulatory compliance and intellectual property considerations require close collaboration with legal experts, continuous updates to stay aligned with evolving regulations, and careful documentation of all processes to ensure transparency and accountability.

Perspectives

After the project's completion, SLCM continues to enhance the application's accuracy by incorporating new grain features into its assessment algorithms. Additionally, SLCM actively engages in marketing efforts to raise awareness of the application among farmers and other value chain actors and encourage its adoption.