# A simple tool for resource availability optimization: A case study of dairy whey supply for single cell protein and oil production in Latvia

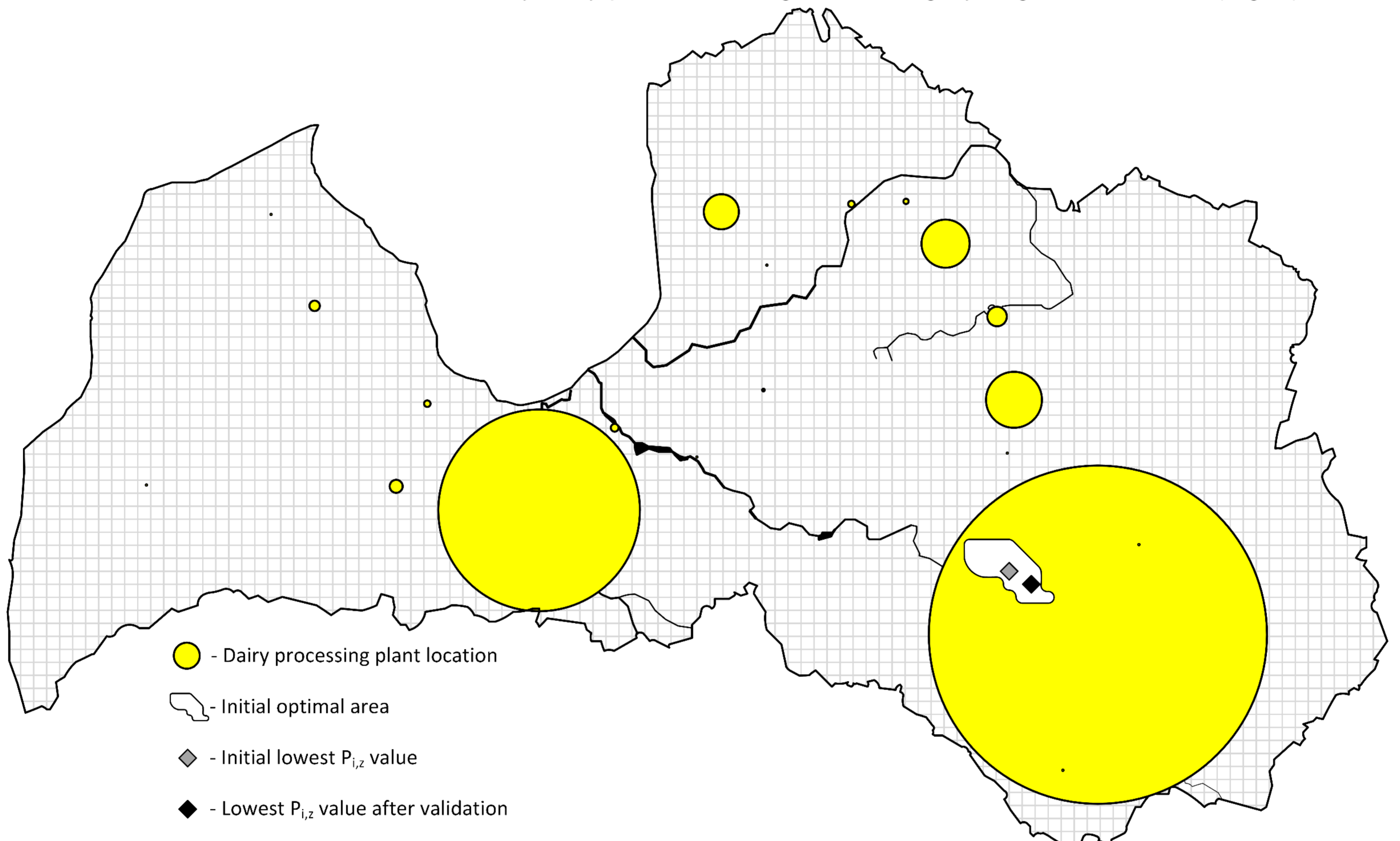## K. Spalvins, D. Blumberga
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## Introduction

Single cell proteins (SCP) and oils (SCO) are promising alternatives for replacing conventional feed ingredients in animal and aquaculture fish feeds. The production costs of SCP and SCO need to be reduced by using inexpensive substrates (production by-products). To calculate the substrate availability and to find optimal location for the potential SCP/SCO plant, a simple and quick-to-use model was developed, which is based on the calculation and validation of the initial site location and validation to confirm the accuracy of the results.

## Optimization model

The optimization model was developed using MS Excel, MS Visio and Google Maps. For the case study the locations of all milk processing plants were marked (Fig. 1). The map of Latvia was placed on XY axis and distance was calculated from each axis value to from every dairy plant in a straight line using Pythagorean theorem (Fig. 1).



Legend:
- ⬤ - Dairy processing plant location
- ▭ - Initial optimal area
- ◇ - Initial lowest $P_{i,z}$ value
- ◆ - Lowest $P_{i,z}$ value after validation

**Figure 1.** Results of the optimization model for generated whey in Latvia in 2019.

Distances were multiplied by the generated whey volumes in each dairy plant (Fig. 1, circles proportional to volume). The lowest calculated value called initial lowest $P_{i,z}$ value (Fig. 1) represents the location where the largest amount of whey can be delivered to by traveling the shortest distance.

Optimization model was validated by marking an area of the 20 lowest $P_{i,z}$ values called initial optimal area (Fig. 1). From this area populated settlements were marked. These settlements were used to recalculate real distances using national and local motorways using Google Maps. The resulting distances from each company to each of the settlements were used to find the validated optimal SCP/SCO plant location (Fig. 1).

## Conclusions

- In this article the proposed model was used for a case study to determine the availability of whey and calculate the optimal SCP/SCO production plant location in Latvia.

- The model does not require prior knowledge of location optimization or experience with dedicated software from the user.

- The case study showed that the model is valid, and can be used as a simple tool to find the optimal location for acquisition of any type of resource from multiple sources to single production plant.

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