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MODEL PENDUKUNG KEPUTUSAN KESESUAIAN LAHAN DAN SUPPLY CHAIN MANAGEMENT UNTUK DISTRIBUSI HASIL
TANAMAN SAYURAN
Petrus Wolo, Dr. Sri Mulyana, M.Kom; Aina Musdholifah, S.Kom., M.Kom., Pg.D
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INTISARI

MODEL PENDUKUNG KEPUTUSAN KESESUAIAN LAHAN DAN *SUPPLY CHAIN MANAGEMENT* UNTUK DISTRIBUSI HASIL TANAMAN SAYURAN

Oleh
Petrus Wolo
22/499986/SPA/00850

Produktivitas tanaman sayuran salah satunya dipengaruhi oleh kesesuaian antara jenis tanaman yang dibudidayakan dengan kondisi lahan serta efektivitas sistem pendistribusian. Namun, Sistem Pendukung Keputusan (SPK) yang ada saat ini masih menghasilkan tingkat ketepatan keputusan yang relatif terbatas karena hanya berfokus pada proses perangkingan alternatif tanpa menghasilkan keputusan operasional berupa klasifikasi kesesuaian lahan. Selain itu, pendistribusian hasil tanaman sayuran dalam *Supply Chain Management* (SCM) belum sepenuhnya mampu mengakomodasi ketidakseimbangan antara pasokan dan permintaan pasar karena belum terintegrasi antara model prediksi hasil produksi dengan sistem pemilihan lahan pemasok yang hasilnya dapat memenuhi prediksi hasil permintaan pasar.

Pada penelitian ini, dikembangkan model SPK kesesuaian lahan untuk merekomendasikan tanaman sayuran berdasarkan kondisi lahan menggunakan kombinasi antara metode *Analytic Hierarchy Process* (AHP), interpolasi linear, *profile matching* yang terintegrasi dengan pengetahuan berbasis aturan (*rule-based)*. Hasil rekomendasi tersebut, digunakan untuk membangun model prediksi hasil produksi tanaman sayuran menggunakan metode *Artificial Neural Network* (ANN), yang selanjutnya diintegrasikan ke dalam model SPK pemilihan lahan pemasok menggunakan metode AHP dan metode *Technique for Order Preference by Similarity to Ideal Solution* (TOPSIS) untuk memenuhi hasil dari model prediksi permintaan pasar menggunakan metode ANN dalam SCM distribusi hasil tanaman sayuran. Kontribusi penelitian ini terletak pada integrasi pengetahuan berbasis aturan (*rule-based*) dalam model SPK kesesuaian lahan dan integrasi prediksi hasil produksi ke dalam model SPK pemilihan lahan pemasok, untuk memenuhi estimasi permintaan pasar dalam SCM distribusi hasil tanaman sayuran.

Hasil evaluasi menunjukkan bahwa model SPK penentuan kesesuaian lahan mengalami peningkatan kinerja seiring bertambahnya jumlah alternatif rekomendasi, dengan skenario prioritas uji top-5 menghasilkan kinerja terbaik dengan akurasi 94%, *recall* 94%, dan presisi 100%. Model prediksi hasil produksi pemasok dan permintaan pasar menunjukkan rata-rata tingkat kesalahan validasi relatif rendah dengan nilai *Root Mean Square Error* (RMSE) dan *Mean Absolute Error* (MAE) masing-masing sebesar 0,218 dan 0,167, sedangkan untuk prediksi hasil permintaan, 0,338 dan 0,303 untuk permintaan univariat, serta 0,375 dan 0,401 untuk permintaan multivariat. Sementara itu, model SPK pemilihan lahan pemasok mencapai akurasi 82%, *recall* 72% dan presisi 92%, sehingga model yang dikembangkan mampu mendukung perencanaan distribusi tanaman sayuran dalam kerangka SCM.

Kata kunci**:** SPK, SCM, AHP, Interpolasi linear, *Profile matching,* TOPSIS, *Rule-based*, ANN, Tanaman sayuran.

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ABSTRACT

DECISION SUPPORT MODEL FOR LAND SUITABILITY AND SUPPLY CHAIN MANAGEMENT FOR VEGETABLE CROP DISTRIBUTION

By
Petrus Wolo
22/499986/SPA/00850

The productivity of vegetable crops is influenced, among other factors, by the suitability between the cultivated crop species and the land characteristics, as well as by the effectiveness of the distribution system. Nevertheless, current Decision Support Systems (DSS) demonstrate limited decision-making performance, as they predominantly emphasize the ranking of alternatives rather than generating operational decisions through land suitability classification. In addition, agricultural product distribution within Supply Chain Management (SCM) frameworks has not yet fully accommodated the imbalance between supply and market demand due to the absence of integration between production forecasting models and supplier land selection systems, whose outputs are expected to satisfy forecasted market demand.

In this study, a land suitability DSS was developed to recommend vegetable crops based on land conditions using a combination of the Analytic Hierarchy Process (AHP), linear interpolation, profile matching, and rule-based knowledge. The resulting recommendations were used to develop a vegetable production forecasting model using an Artificial Neural Network (ANN), which was subsequently integrated into a supplier land selection DSS based on AHP and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The supplier selection model also incorporates market demand forecasts generated using ANN to support vegetable distribution planning within a SCM framework. The main contribution of this research lies in the integration of rule-based knowledge into the land suitability DSS and the integration of production forecasting results into the supplier land selection DSS, enabling more effective fulfillment of projected market demand in vegetable supply chain distribution.

The evaluation results demonstrated that the land suitability DSS model achieved progressively better performance with an increasing number of recommendation alternatives, with the top-5 recommendation scenario providing the highest performance, attaining 94% accuracy, 94% recall, and 100% precision. The supplier production forecasting and market demand forecasting models showed relatively low validation errors, with RMSE and MAE values of 0.218 and 0.167 for production forecasting, 0.338 and 0.303 for univariate demand forecasting, and 0.375 and 0.401 for multivariate demand forecasting, respectively. In addition, the supplier land selection DSS model achieved 82% accuracy, 72% recall, and 92% precision. These findings confirm that the proposed models can effectively support vegetable distribution planning within the SCM framework.

Keywords**:** DSS, SCM, AHP, Linear interpolation, Profile matching, TOPSIS, Rule-based knowledge*,* ANN, Vegetable crop.