

DECISION SUPPORT SYSTEM FOR INVENTORY PREDICTION USING FUZZY TSUKAMOTO METHOD (CASE STUDY: UMKM BAYOU INDONESIA)

SISTEM PENUNJANG KEPUTUSAN PREDIKSI PERSEDIAAN BARANG MENGGUNAKAN METODE FUZZY TSUKAMOTO (STUDI KASUS: UMKM BAYOU INDONESIA)

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Abstract - *UMKM Bayou Indonesia, a provider of various acrylic products, faces the problem of overproduction due to manual planning, which results in stock buildup and the waste of raw materials and labor. The objective of this research is to develop a decision support system that utilizes the Fuzzy Tsukamoto method to predict production quantities. Predictions are derived from the analysis of historical data, including the number of orders, shipments, and final stock. The processing of each piece of data is carried out through the implementation of fuzzy logic, with the objective of generating a predicted production value for the subsequent period. This research offers novel contributions in three primary areas: technical aspects, implementation context, and practical measurement of system benefits. It differs from previous studies in two key ways. First, it focuses on simulating fuzzy methods, whereas previous studies have not considered real system integration or a specific MSME context. This method was integrated into an operational CodeIgniter-based web application for the first time for manufacturing Small and Medium-sized Enterprises (SMEs) in Indonesia, surpassing previous studies that were limited to the theoretical simulation level. Before the system's implementation, the manual planning method showed a high error rate, quantified by a Mean Absolute Percentage Error (MAPE) of 21.5%. The proposed system demonstrated a substantial improvement, achieving a MAPE of 8.7% and a Root Mean Squared Error (RMSE) of 11.2 units. This increase in accuracy directly contributes to a reduction in excess production differences by up to 30% per month. The findings of the study indicate that the method is capable of producing more accurate and flexible predictions, thereby reducing the likelihood of over-production and enhancing operational efficiency. The system demonstrated a 85% precision rate, which is a marked improvement over the accuracy of manual data collection methods. Furthermore, it has been observed that the system has the potential to reduce the discrepancy in measurements by up to 30% on a monthly basis. Prior to the present moment, the absence of computerized systems characterized the baseline quantitative data. The input and planning stages are conducted manually, employing Excel records or manual documentation. This method results in a delay of approximately two to three days in the production of the final printed version. The potential efficacy of this research lies in its ability to expedite the decision-making process, rendering it real-time. The estimated efficiency enhancement is projected to range from 60% to 70%.*

Keywords - *Prediction System, Production Results, Stock, Fuzzy Tsukamoto, UMKM.*

Abstrak - *UMKM Bayou Indonesia, sebagai penyedia berbagai produk akrilik, menghadapi masalah kelebihan produksi karena perencanaan yang masih manual, menyebabkan penumpukan stok dan pemborosan bahan baku serta tenaga kerja. Penelitian ini bertujuan untuk membangun sistem penunjang keputusan yang memprediksi jumlah produksi menggunakan metode Fuzzy Tsukamoto. Prediksi dilakukan dengan mengolah data historis seperti jumlah order, pengiriman, dan stok akhir. Setiap data diolah menggunakan logika fuzzy untuk menghasilkan nilai prediksi produksi pada periode berikutnya. Penelitian ini menawarkan novelty dalam aspek teknis, konteks implementasi, dan pengukuran manfaat sistem secara praktis, yang menjadikannya berbeda dari studi-studi sebelumnya.*

yang hanya fokus pada simulasi metode fuzzy tanpa integrasi sistem riil atau tanpa konteks UMKM spesifik. Metode ini untuk pertama kalinya diintegrasikan ke dalam aplikasi web operasional berbasis CodeIgniter untuk UMKM manufaktur di Indonesia, melampaui studi-studi sebelumnya yang terbatas pada level simulasi teoretis. Sebelum implementasi sistem, metode perencanaan manual menunjukkan tingkat kesalahan yang tinggi, yang terkuantifikasi melalui Mean Absolute Percentage Error (MAPE) sebesar 21.5%. Sistem yang diusulkan menunjukkan perbaikan substansial dengan mencapai MAPE sebesar 8.7% dan Root Mean Squared Error (RMSE) sebesar 11.2 unit. Peningkatan akurasi ini secara langsung berkontribusi pada pengurangan selisih kelebihan produksi hingga 30% per bulan. Hasil sistem menunjukkan bahwa metode ini mampu memberikan prediksi yang lebih akurat dan fleksibel, sehingga dapat mengurangi risiko overproduksi dan meningkatkan efisiensi operasional. Sistem menghasilkan akurasi $\pm 85\%$ dibanding data manual sebelumnya, serta mengurangi selisih produksi berlebih hingga 30% per bulan. The preceding quantitative baseline was characterized by the absence of a computerized system. The input and planning stages were executed manually, utilizing Excel notes or handwriting, which resulted in delays in production decisions ranging from two to three days. This research has the potential to accelerate the decision-making process to real-time, with an estimated time efficiency increase of 60-70%.

Kata Kunci - Sistem Prediksi, Hasil Produksi, Stok, Fuzzy Tsukamoto, UMKM.