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**Perancangan dan Analisis Model Simulasi Sistem Produksi Batik Cap Berdasarkan Karakteristik Demand
dan Strategi Pemenuhan Pesanan pada Industri Batik Skala UMKM**
Chakra Nayotama Amirudin, Dr. Eng. Ir. Muh Arif Wibisono, S.T., M.T., IPM., ASEAN Eng.
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INTISARI

Industri batik cap skala UMKM menghadapi karakteristik *demand* yang beragam, mulai dari kebutuhan produk siap stok, variasi motif dan warna, hingga desain khusus. Penelitian ini bertujuan mengidentifikasi karakteristik *demand* produk batik cap serta menyusun model simulasi untuk menentukan rekomendasi strategi pemenuhan pesanan yang sesuai. Karakteristik *demand* diperoleh melalui survei terhadap 380 responden dan data *marketplace*, kemudian digunakan untuk membangun random *demand* selama 180 hari. Model *generate random demand* dikembangkan menggunakan distribusi Poisson untuk total *demand* bulanan, distribusi Dirichlet untuk proporsi MTS, MTO, dan DTO, serta Wilson Confidence Interval sebagai batas validasi proporsi. Model simulasi dibangun menggunakan Python pada Google Colab dengan membandingkan 24 kombinasi skenario, yaitu empat strategi pemenuhan pesanan (MTS, MTO, *Hybrid* MTS-MTO, dan *Hybrid* MTS-MTO-DTO), dua kalender kerja (5 hari dan 6 hari), serta tiga skema tenaga kerja (gaji bulanan, upah borongan, dan upah harian). Indikator operasional yang dianalisis meliputi *demand* terpenuhi, *lost sales*, *service level*, dan *lead time*, sedangkan indikator finansial meliputi pendapatan, biaya, profit, arus kas, dan margin. Hasil survei menunjukkan proporsi *demand* sebesar 45,07% MTS, 40,25% MTO, dan 14,68% DTO. Hasil simulasi menunjukkan bahwa skenario *Hybrid* MTS-MTO-DTO 5 hari dengan upah harian merupakan skenario terbaik secara keseluruhan, dengan profit Rp85.284.467, arus kas Rp64.929.106, margin 22,42%, dan *demand* terpenuhi 3.804 unit dari total *demand* 4.027 unit. Dengan demikian, strategi *hybrid* yang menggabungkan MTS, MTO, dan DTO mampu melayani cakupan *demand* paling luas dan menghasilkan kinerja finansial terbaik.

Kata kunci: batik cap, simulasi produksi, karakteristik *demand*, strategi pemenuhan pesanan, *hybrid* MTS-MTO-DTO.

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ABSTRAK

MSME-scale stamped batik production faces diverse demand characteristics, ranging from ready-stock products, wider motif and color variations, to customized designs. This study aims to identify the demand characteristics of stamped batik products and develop a simulation model to determine suitable order fulfillment strategy recommendations. Demand characteristics were obtained through a survey of 380 respondents and marketplace data, which were then used to generate random demand for a 180-day simulation horizon. The random demand model was developed using the Poisson distribution for monthly total demand, the Dirichlet distribution for the proportions of MTS, MTO, and DTO demand, and the Wilson Confidence Interval as the validation range for demand proportions. The simulation model was developed using Python in Google Colab by comparing 24 scenario combinations, consisting of four order fulfillment strategies (MTS, MTO, Hybrid MTS-MTO, and Hybrid MTS-MTO-DTO), two working calendars (5-day and 6-day), and three labor payment schemes (monthly salary, piece-rate wage, and daily wage). The operational indicators analyzed include fulfilled demand, lost sales, service level, and lead time, while the financial indicators include revenue, cost, profit, cash flow, and profit margin. The survey results show demand proportions of 45.07% MTS, 40.25% MTO, and 14.68% DTO. The simulation results indicate that the Hybrid MTS-MTO-DTO strategy with a 5-day working calendar and daily wage scheme is the best overall scenario, generating a profit of Rp85,284,467, cash flow of Rp64,929,106, profit margin of 22.42%, and fulfilling 3,804 units out of 4,027 total demand units. Therefore, the hybrid strategy integrating MTS, MTO, and DTO is able to serve the widest demand coverage and provide the best financial performance.

Keywords: stamped batik, production simulation, demand characteristics, order fulfillment strategy, Hybrid MTS-MTO-DTO.