ABSTRAK

Mesin *maker* merupakan mesin kritis pada proses produksi rokok HS filter di PT Gisara Tantra Berkarya karena berfungsi sebagai pusat pembentukan batang rokok dan menentukan kapasitas *output* lini produksi. Tingginya frekuensi kerusakan pada mesin tersebut menyebabkan *downtime* yang besar sehingga mengurangi waktu operasi efektif, menurunkan *availability* mesin, menghambat aliran proses produksi, serta berdampak pada tidak tercapainya target produksi perusahaan. Selama periode pengamatan, mesin *maker* mengalami 33 kali kejadian kerusakan dengan total *downtime* mencapai 50,09 jam atau berkontribusi sebesar 46,70% dari total *downtime* seluruh mesin produksi. Kebijakan perawatan yang diterapkan perusahaan masih didominasi oleh *corrective maintenance* sehingga tindakan perbaikan dilakukan setelah terjadi kerusakan. Kondisi tersebut menyebabkan tingginya kehilangan waktu produksi dan biaya perawatan.

Penelitian ini bertujuan menentukan interval *preventive maintenance* yang optimal untuk meminimasi *downtime* dan meningkatkan kinerja sistem produksi mesin maker menggunakan integrasi *Reliability-Centered Maintenance* (RCM) dan *Discrete Event Simulation* (DES).Analisis RCM dilakukan melalui tahapan *Failure Mode and Effects Analysis* (FMEA), *Logic Tree Analysis* (LTA), identifikasi distribusi kerusakan, perhitungan *Mean Time Between Failure* (MTBF), *Mean Time to Repair* (MTTR), serta penentuan interval *preventive maintenance* berdasarkan nilai *reliability, maintainability, downtime ratio*, dan *availability*. Hasil interval perawatan yang diperoleh kemudian diimplementasikan ke dalam model simulasi menggunakan Siemens Tecnomatix Plant Simulation untuk mengevaluasi dampaknya terhadap performansi sistem produksi. Validasi model dilakukan menggunakan uji-t dan menghasilkan nilai p-*value* sebesar 0,211111 sehingga model simulasi dinyatakan mampu merepresentasikan kondisi aktual sistem produksi.

Hasil penelitian menunjukkan bahwa tindakan perawatan yang direkomendasikan meliputi *Condition Directed, Time Directed*, dan *Failure Finding* dengan interval *preventive maintenance* optimal pada hari ke-17, ke-25, ke-38, ke-42, dan ke-85. Penerapan kebijakan perawatan usulan mampu menurunkan total *downtime* mesin *maker* dari 50,09 jam menjadi 21,01 jam atau sebesar 58,05%. Kondisi tersebut meningkatkan throughput produksi dari 29.616 *box* menjadi 31.252 *box* serta meningkatkan *reliability* dan *availability* mesin. Analisis biaya menunjukkan bahwa total biaya maintenance dapat diturunkan dari Rp80.945.103 menjadi Rp27.837.266 sehingga diperoleh penghematan sebesar Rp53.107.837 atau 65,65%. Hasil penelitian membuktikan bahwa integrasi *Reliability-Centered Maintenance* dan *Discrete Event Simulation* efektif digunakan untuk meningkatkan keandalan mesin, performansi sistem produksi, dan efisiensi biaya perawatan pada industri manufaktur rokok.

Kata kunci: *Reliability-Centered Maintenance, Discrete Event Simulation, preventive maintenance, downtime, reliability, availability.*

ABSTRACT

The maker machine is a critical machine in the HS *filter cigarette production process at* PT Gisara Tantra Berkarya *because it serves as the primary unit for cigarette rod formation and determines the production line output capacity. Frequent machine failures have resulted in substantial downtime, reducing effective operating time, lowering machine availability, disrupting production flow, and contributing to the failure to achieve production targets. During the observation period, the maker machine experienced 33 failure events with a total downtime of 50.09 hours, accounting for 46.70% of the total downtime of all production machines. The company's maintenance policy is predominantly based on corrective maintenance, where repair activities are conducted only after failures occur. This condition leads to significant production losses and increased maintenance costs.*

This study aims to determine the optimal preventive maintenance interval to minimize downtime and improve production system performance through the integration of Reliability-Centered Maintenance (RCM) and *Discrete Event Simulation* (DES). *The* RCM *analysis was conducted through Failure Mode and Effects Analysis* (FMEA), *Logic Tree Analysis* (LTA*), failure distribution identification, Mean Time Between Failure* (MTBF) *and Mean Time to Repair* (MTTR) *calculations, as well as the determination of preventive maintenance intervals based on reliability, maintainability, downtime ratio, and availability values. The resulting maintenance intervals were then implemented in a simulation model developed using Siemens Tecnomatix Plant Simulation to evaluate their impact on production system performance. Model validation was performed using a t-test and produced a p-value of 0.211111, indicating that the simulation model adequately represented the actual production system.*

The results indicate that the recommended maintenance actions consist of Condition Directed, Time Directed, and Failure Finding, with optimal preventive maintenance intervals on the 17th, 25th, 38th, 42nd, and 85th days. The proposed maintenance policy reduced total maker machine downtime from 50.09 hours to 21.01 hours, representing a reduction of 58.05%. This improvement increased production throughput from 29,616 boxes to 31,252 boxes while enhancing machine reliability and availability. Cost analysis revealed that total maintenance costs could be reduced from IDR *80,945,103 to* IDR *27,837,266, resulting in savings of* IDR *53,107,837 or 65.65%. The findings demonstrate that the integration of* RCM *and* DES *is effective in improving machine reliability, production system performance, and maintenance cost efficiency in the cigarette manufacturing industry.*

Keywords: *Reliability-Centered Maintenance, Discrete Event Simulation, preventive maintenance, downtime, reliability, availability.*