WASTE REDUCTION GUIDELINE FOR PRODUCTION LINE USING BOOLEAN ALGEBRA

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We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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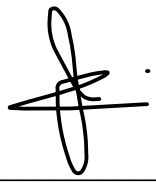

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ABSTRAK

Barisan produksi di dalam industri pembuatan automotif melibatkan banyak proses-proses dan ini akan menghasilkan banyak pembaziran. Pembaziran yang terkumpul di dalam barisan produksi akan memberi kesan kepada keseluruhan proses-proses produksi. Peta Aliran Nilai(PAN) boleh digunakan untuk menjejak pembaziran dari proses-proses produksi. Walaubagaimanapun, kajian-kajian yang terdahulu hanya tertumpu kepada penyingkiran pembaziran dan tidak menyediakan garis panduan yang boleh digunakan oleh pengilang untuk menentukan jumlah pembaziran yang perlu disingkirkan dari barisan produksi. Oleh itu, pengilang memerlukan garis panduan dalam menyingkirkan jumlah pembaziran dari barisan produksi. Garis panduan boleh digunakan untuk menentukan pembaziran yang perlu disingkirkan, dan hanya yang tidak boleh dielakkan atau pembaziran "baik" harus dikekalkan. Objektif kajian ini adalah untuk membangunkan satu model yang boleh menghasilkan penyingkiran terhadap pembaziran untuk barisan produksi berdasarkan Algebra Boolean dari PAN dan untuk membuat satu garis panduan dalam menentukan jumlah pembaziran yang harus dikurangkan dari barisan produksi dan untuk mengesahkan model dengan syarikat dalam industri automotif. Kajian ini bermula dengan pemerhatian dan pengumpulan data di dalam syarikat automotif. Data digunakan untuk melukis Peta Keadaan Semasa. Pembaziran-pembaziran dikenalpasti dengan menggunakan Peta Keadaan Semasa dan dikurangkan dengan konsep Logik Boolean. Jadual kebenaran telah dibina berdasarkan simbol-simbol Logik dan telah menunjukkan kombinasi boleh ditentukan dengan memilih aktiviti-aktiviti yang minimal. Peta Keadaan Masadepan telah dibangunkan berdasarkan kombinasi yang diperoleh dari fasa sebelum ini. Normalisasi terhadap masa diterbitkan untuk mendapatkan masa yang paling minimal yang diperlukan bagi penanda aras terhadap masa aktiviti yang lain. Masa yang dinormalisasikan diterbitkan yang mana diperlukan dalam jadual kebenaran kerana kaedah ini hanya membenarkan nilai tunggal sahaja wujud di dalam jadual kebenaran. Nilai yang berbeza-beza masa yang dinormalisasikan perlu dikurangkan untuk mencapai keperluan aktiviti yang paling minimal. Sementara itu, model ini mampu menghasilkan kombinasi-kombinasi antara pembaziran dari Peta Keadaan Semasa. Kombinasi menunjukkan masa aktiviti yang total yang boleh dianggap sebagai pembaziran dalam barisan produksi. Hasilnya, Peta Keadaan Masadepan boleh dicapai dengan mengurangkan masa aktiviti yang digunakan. Rentetan itu, masa yang total yang digunakan di dalam Peta Keadaan Masadepan telah dikurangkan dan ianya kurang dari masa yang diguna di dalam Peta Keadaan Semasa. Kesimpulannya, model yang dicadangkan boleh digunakan oleh pengilang untuk membuat kombinasi-kombinasi terhadap pembaziran untuk mencari jumlah pembaziran yang harus disingkirkan. Garis panduan boleh digunakan untuk menentukan jumlah-jumlah pembaziran yang harus disingkirkan dalam mencapai barisan pengeluaran yang masa tersingkat dengan membuat pengurangan berterusan atas pembaziran yang wujud dalam barisan pengeluaran.

ABSTRACT

Production line in automotive manufacturing industries involves a lot of processes and this can produce a lot of wastes. The accumulated waste from the production line can give an effect on the entire production process. Value Stream Mapping (VSM) can be used to trace wastes from production processes. However, previous studies only focused on eliminating the wastes and did not provide a guideline that can be used by the manufacturer to determine the amount of wastes that should be eliminated from the production line. Therefore, manufacturer needs a guideline in eliminating amount of wastes from production line. The guideline can be used to determine the wastes that need to be eliminated, and only unavoidable or "good" wastes should be retained. The objectives of this research are to develop a model that can produce the elimination of wastes for production line based on Boolean algebra from VSM and to create a guideline in determining the amount of wastes that should be reduced from production line and to validate the model with the company in automotive industry. This research starts with observation and data collection in automotive company. The data are used to draw the Current State Map. The wastes were identified by using Current State Map and were reduced with the Boolean Logic concept. The truth table was constructed based on Logic gates and indicated the combination that can be determined by choosing the minimum activities. Future State Map was developed based on the combination that had obtained from the previous phase. The time normalization had been derived to obtain the most minimum time that needed for benchmark against with others time of different activities. Normalized time was derived which is needed in truth table because this method only allows a single value exists in truth table. The different values of the normalized time need to be reduced to achieve the most minimum requirement of the activities. Meanwhile, the model is able to produce the combinations among the wastes from the Current State Map. The combinations show the total time of the activities that can be considered as the wastes in the production line. The result, Future State Map can be achieved by reducing time consumed of the activities. Consequently, the total time consumed in the Future State Map was reduced and is less than time consumed in Current State Map. As a conclusion, the proposed model can be used by the manufacturer to create the combinations among the wastes to find out the amount of wastes that should be eliminated. The guideline can be used to determine the amount of wastes that should be eliminated in achieving the shortest time of the production line by making continuous reductions on the wastes that exist in production line.

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LIST OF ABBREVIATIONS

AGR	Artificial Groundwater Recharge
BiW	Body in White
FIFO	First In First Out
FTA	Fault Tree Analysis
LM	Lean Manufacturing
PPC	Primary Part Control
PSS	Product Service System
SMED	Single-Minute Exchange of Dies
TPS	Toyota Production System
TRIZ	Theory for Invention Problem Solving
VSM	Value Stream Mapping

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