INTEGRATED SINGLE MINUTE EXCHANGE OF DIE (ISMED) APPROACH TO IMPROVE TANDEM PRESS LINE OPERATION OUTPUT IN AUTOMOTIVE INDUSTRY

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Doctor of Philosophy

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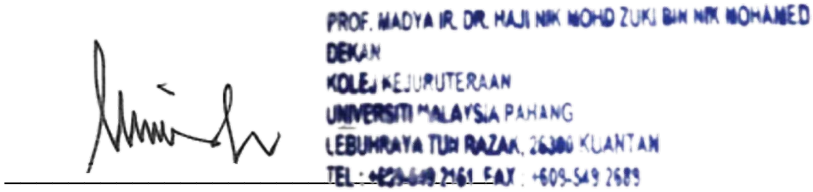
SUPERVISOR'S DECLARATION

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 Doctor of Philosophy.



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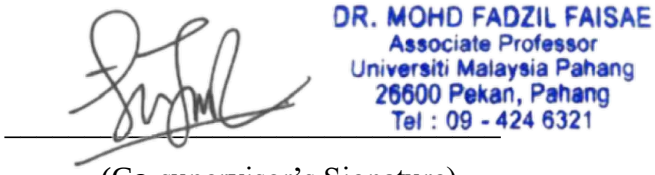

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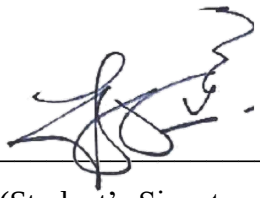
I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.



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A thesis submitted in fulfillment of the requirements
for the award of the degree of
Doctor of Philosophy

College of Engineering

UNIVERSITI MALAYSIA PAHANG

OCTOBER 2021

ACKNOWLEDGEMENTS

"In the Name of Allah; Most Gracious, Most Merciful. Praise be to Allah, Lord of the Worlds; Most Gracious, Most Merciful; Master of the Day of Judgment. You alone we worship, and to You alone we turn for help. Guide us to the straight path; the path of those you have blessed; not of those who have earned Your anger, nor of those who have gone astray." (Al-Fatiha, 1:1-7)

Alhamdulillah, on top of everything thank you Allah SWT, for giving His endless blessings, knowledge, and strength to make my study accomplished.

The completion of my doctoral dissertation would not have been possible without the invaluable encouragement, wise guidance and constant advice from my supervisor, Assoc. Professor Ir. Dr. Haji Nik Mohd Zuki Bin Nik Mohamed, who believed in my abilities and provided those helpful suggestions to improve the thesis. I truly could not wish for a better supervisor who consistently and persuasively expressed a spirit of adventure in research and interpersonal skills. Special thanks also to my co-supervisor, Assoc. Prof. Dr. Mohd Fadzil Faisae bin Ab. Rashid. May Allah bless them all with His mercy and barakah.

Special appreciation goes to "Abah" and "Mak" for their doa's, to my beloved wife, Nor Rafidah bt. Abdullah, for her constant support, our lovely kids, the gems that I have been blessed with for their sacrifices. All these supports come together, which makes me stronger to encounter the entire challenge through my study. Million thanks to all my fellow PhD colleagues, who enriched my learning by sharing their wealth of knowledge to motivate me to accomplish this study.

Finally, special thanks to Ministry of Higher Education (MOHE) through MyBrain15, which enabled me to pursue my study in PhD Program at Universiti Malaysia Pahang, Thank you very much.

ABSTRAK

Di dalam perkembangan ekonomi masa kini, daya saing berasaskan oleh pergolakan hebat dan konflik yang melampau. Persekitaran yang terganggu ini telah mendesak syarikat untuk memperbaharui system operasi dengan menerapkan pelbagai pendekatan seperti Agile, Lean, TPM, TQM, dan sebagainya untuk terus daya saing di pasaran agar berjaya mencapai matlamat mereka. Penyelidikan ini memfokuskan pada prestasi pengeluaran proses stamping dalam industri automotif Malaysia. Sebilangan besar kumpulan pengurangan waktu perubahan atau penyediaan diatur atau dikaitkan dengan kaedah "Shingo's Single Minute Exchange of Die" (SMED), yang menunjukkan penukaran operasi persediaan dalaman ke operasi luaran. SMED telah dimulakan oleh kebanyakan syarikat tetapi gagal melaksanakannya. Isu utama yang diperhatikan dan dibuktikan dalam data yang dikumpulkan dari industri adalah bahawa penggunaan masa yang panjang diambil dalam proses pertukaran acuan, yang sangat mempengaruhi hasil pengeluaran yang dirancang. Kesan langsung yang paling ketara terhadap keadaan ini kepada industri adalah kenaikan kos operasi kerana masa tambahan perlu diambil untuk memenuhi pengeluaran yang dirancang. Oleh itu, penyelidikan ini bertujuan untuk mewujudkan kerangka kerja baru yang dapat mengoptimumkan kecekapan proses peralihan acuan, yang dapat menurunkan keseluruhan kos pengeluaran, yang mungkin sebahagian penjimatan boleh dikongsi keuntungannya dengan pengguna. Kajian ini dilakukan dalam beberapa tahap - pertama, pengumpulan data berkaitan dengan pembetukan komponen di premis automotif untuk membuat kajian simulasi. Kedua, analisis pengeluaran semasa menggunakan simulasi "WITNESS". Data keluaran simulasi ini kemudian dibandingkan dengan data perindustrian sebenar. Dengan menggunakan proses peralihan acuan secara sistematik, kerangka alternatif baru dicadangkan. Rangka kerja ini menggabungkan "Single Minute Exchange of Die (SMED)", "VSM" dan "WITNESS" simulasi untuk menjadikannya sebagai "Integrated Single Minute Exchange of Die" (ISMED)". Kaedah yang dicadangkan ini telah menurunkan proses pertukaran acuan dari 1,509.5 saat menjadi 750.75 saat, kemudian ia menurun lagi menjadi 569.75 saat, iaitu pengurangan waktu bersih sebanyak 62.2%. Pada tahap ketiga, proses pertukaran acuan yang dipilih kemudian dilakukan analisis menggunakan simulasi "WITNESS". Hasilnya menunjukkan bahawa pengeluaran harian meningkat secara beransur-ansur dari 1,100 keping menjadi 1,500 keping, kemudian meningkat lagi menjadi 2,145 keping. Hasilnya kemudiannya disahkan lagi melalui analisis Kaedah Delphi. Kerangka baru yang dicadangkan dalam kajian ini telah disahkan oleh lima pakar yang dipilih dari pelbagai latar belakang industri automotif. Seperti yang dibuktikan dalam data analitik, diyakini bahawa kerangka baru ini akan meningkatkan jumlah hasil dalam proses pembuatan, terutamanya dalam pembuatan komponen pembentukan otomotif

ABSTRACT

In today's economic world, competitiveness is characterized by great agitation and extreme conflict. This disturbed environment has compelled firms to renew themselves by implementing various approaches such as Agile, Lean, TPM, TQM, and so on, to remain competitive in the market and achieve their goals successfully. This research is focusing on the production performance of the stamping process in Malaysia's automotive industry. Most of the changeover or setup time reductions are governed or associated with Shingo's Single Minute Exchange of Die (SMED) method, which suggests the conversion of internal setup operations to external operations. SMED has been initiated by most of the companies but failed to implement it. Thus, what is observed and evidenced in data collected from industry players is that an unacceptably long time is taken in the die/tooling change process, which grossly affects the planned production output. The most significant direct impact of this situation on the industry is the increase in operating costs due to additional time taken to meet the planned production output. Therefore, this research aims to establish a new framework that can improve the efficiency of the die changeover process, which could lower the overall production cost, which could partially transfer the savings to the consumers. The study was conducted in few stages first, data collection correlates with the automotive stamping premise to create a simulation procedure. Second, analyse the current production output using WITNESS simulation. This simulated output data will later be compared to the actual industrial data. Using a systematic die changeover process, a new alternative framework was proposed. The framework combined "Single Minute Exchange of Die (SMED)", lean tools and simulation to become an "Integrated Single Minute Exchange of Die (ISMED)". It shows that the proposed method decreased the changeover processes from the initial 1509.5 seconds to 750.75 seconds, then further decreased to 569.75 seconds, with a net 62.2% time reduction. In the third stage, the selected process is then subjected to analysis using WITNESS simulation. The result shows that the daily production output has increased gradually from 1,100 pieces to 1,500 pieces, then further increased to 2,145 pieces. The output was later further validated through Delphi Method analysis. The new framework proposed in this study has been verified by five experts selected from various backgrounds in the automotive industry. As evidenced by analytical data, it is believed that this new framework will strengthen the total output in the manufacturing process, especially in the manufacturing of automotive stamping parts.

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