UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF SERVICE TOOL FAILURE MODE AND EFFECT ANALYSIS (STFMEA) MODULE FOR AUTOMOTIVE SERVICE CENTERS

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MASTER OF SCIENCE

UNIVERSITI PUTRA MALAYSIA

2011

DEVELOPMENT OF SERVICE TOOL FAILURE MODE AND EFFECT ANALYSIS (STFMEA) MODULE FOR AUTOMOTIVE SERVICE CENTERS

By

ERIALDI BIN SYAHRIAL

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

December 2011

In dedication to:

My dear parents, for their continuous support and encouragement;

my beloved wife, Aslina Binti Siman for her uncounted caring as well as

my daughter and son, Nur Aifa Eryna and Muhammad Fi Firdaus who always cheers

my family.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

DEVELOPMENT OF SERVICE TOOL FAILURE MODE AND EFFECT ANALYSIS (STFMEA) MODULE FOR AUTOMOTIVE SERVICE CENTRES

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ERIALDI BIN SYAHRIAL

December 2011

Chairman : Ir. Hj. Mohd Rasid bin Osman

Faculty : Engineering

Failure Mode and Effect Analysis (FMEA) is one of well-known quality tools, which evolved gradually since its inception in NASA aerospace industry in the year 1963. Then, it has spread to the automotive industry to quantify and prevent possible potential failures at the early stage before reaching the customer. Based on a survey conducted at selected Malaysian automotive service centres, the result shows that the actual service tools utilization by service personnel was only 14.2%. That means the service procedures that performed by service personnel were not followed the service requirements and it could cause to a safety issue to the service personnel, customer and vehicle. Besides that, the service personnel are lack of technical knowledge on FMEA implementation and less awareness on the effect of not using service tools during service or repair. The objective of this study is to establish Service Tool Failure Mode and Effect Analysis (STFMEA) Module for Malaysia automotive industry in order to identify potential failure modes, potential effects, potential causes, service control detection and service control prevention. In this research, a new Occurrence Rating Table and STFMEA Datasheet were developed first in order to support the STFMEA Module development. A car

automotive company is known as VATA was selected and four (4) of the VATA service centres were identified as case study companies. The two most available service tool's brand, known as 'Service Tool A and 'Service Tool B' tools were selected and they became the focus items at each of identified service centres. During the initial study, a FMEA awareness survey was conducted and 98% of users fully understood about the FMEA application and advantages. Another survey was conducted to all users on the new Occurrence Rating Table and as a result, 98% of users answered correctly the questions related to new Occurrence Rating Table application. From the analysis conducted in four (4) VATA service centres, the highest Risk Priority Number (RPN) is 700. Towards ensuring the STFMEA Module is easy to be applied and do not affect the daily servicing tasks, the module was established in Microsoft Excel with some information linked to pdf file format as agreed by all the 23 service personnel during STFMEA Module presentation and actual application. The advantages of the module are the users can directly access all the FMEA datasheets, understand the potential risks and captured service tool technical information immediately. According to the end users feedback during STFMEA Module survey, 100% of the participated service personnel agreed that they could understand all the potential failure modes easily as well as realise with all the potential effect if the service tool is not being used during after sales service. All these feedbacks show that the developed Service Tool Failure Mode and Effect Analysis (STFMEA) Module is a very valuable and user-friendly quality tool for after sales service personnel at VATA service centres.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putera Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBANGUNAN MODUL ANALISIS TAHAP KEGAGALAN DAN KESAN PADA PERALATAAN KHAS SERVIS UNTUK PUSAT SERVIS AUTOMOTIF

Oleh

ERIALDI BIN SYAHRIAL

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Analisis Tahap Kegagalan dan Kesan adalah merupakan salah satu alat kualiti yang amat dikenali ramai yang berkembang dari semasa ke semasa bermula dari pelaksanaan awal oleh syarikat angkasa lepas, NASA pada tahun 1963. Kemudian, alat kualiti ini telah digunapakai secara meluas dalam industri automotif untuk mengenalpasti dan mengelak kemungkinan potensi kegagalan di peringkat awal pembangunan sebelum ia berlaku kepada pelanggan. Berdasarkan kaji sedikit di syarikat-syarikat kajian kes, keputusannya menunjukkan bahawa kadar sebenar penggunaan peralatan khas servis oleh jurutenik-juruteknik hanyalah 14.2%. Ini menunjukkan prosedur-prosedur servis yang dilaksanakan oleh juruteknik adalah tidak mengikut keperluan servis di mana ia boleh mengakibatkan isu keselamatan kepada juruteknik, pengguna kenderaan dan kenderaan tersebut. Selain daripada itu, juruteknik-juruteknik yang sediada mempunyai pengetahuan teknikal yang agak sedikit di dalam pelaksanaan Analisis Tahap Kegagalan dan Kesan serta kurang kesedaran tentang kesan yang mungkin boleh berlaku jika tidak menggunakan peralatan khas servis semasa servis dan baikpulih kenderaan. Objektif utama penyelidikan ini ialah untuk menghasilkan Modul Analisis Tahap Kegagalan dan Kesan bagi peralatan khas

servis dalam industri automotif agar ia dapat mengenalpasti potensi tahap kegagalan, potensi kesan, potensi sebab, kawalan kenalpasti masalah servis dan kawalan untuk mengelak masalah servis jika tidak menggunakan peralatan khas servis semasa menjalankan kerja-kerja penyelenggaraan dan penggantian alat kenderaan untuk kenderaan pelanggan di pusat servis kenderaan. Di dalam kajian ini, Jadual Kelas Kekerapan yang baru dan Analisis Tahap Kegagalan dan Kesan bagi peralatan khas servis telah dihasilkan terlebih dahulu dalam mengukuhkan pembangunan Modul Analisis Tahap Kegagalan dan Kesan untuk peralatan khas servis. Syarikat automotif dikenali sebagai VATA telah dipilih dan empat (4) pusat servis kenderaan VATA telah pun dikenalpasti sebagai syarikat kajian kes. Dua jenama peralatan khas servis yang paling banyak iaitu yang bernama 'Peralatan Khas Servis A' dan 'Peralatan Khas Servis B' telah dipilih dan semua peralatan ini telah menjadi perkara fokus di setiap pusat servis kenderaan tersebut. Semasa penyelidikan awal, satu kaji selidik berkaitan kesedaran Analisis Tahap Kegagalan dan Kesan telah dijalankan dan 98% daripada pengguna sangat memahami tentang keseluruhan penggunaan dan kelebihan Analisis Tahap Kegagalan dan Kesan ini. Satu lagi kaji selidik telah dijalankan ke atas semua pengguna mengenai Jadual Kelas Kekerapan yang baru ini dan dari kaji sedikit tersebut, 98% daripada pengguna telah menjawab dengan betul mengenai penggunaan Jadual Kelas Kekerapan yang baru ini. Daripada analisis yang dilaksanakan di empat (4) pusat servis kenderaan VATA, Nombor Keutamaan Risiko yang tertinggi ialah 700. Bagi memastikan Modul Analisis Tahap Kegagalan dan Kesan untuk peralatan khas servis mudah digunapakai dan tidak mengganggu tugasan harian di pusat servis, satu pengkalan data menggunakan Microsoft Excel telah dibangunkan dimana sebahagian maklumat telah

dihubungkan terus ke fail format ‘pdf’ seperti yang dipersetujui oleh kesemua 23 juruteknik berpengalaman semasa pembentangan dan penggunaan sebenar Modul Analisis Tahap Kegagalan dan Kesan untuk peralatan khas servis. Kelebihan-kelebihan modul ini adalah para pengguna dapat melayari terus kesemua dokumen Analisis Tahap Kegagalan dan Kesan, memahami semua risiko yang berpotensi dan mengenalpasti dengan jelas maklumat teknikal peralatan khas servis. Berdasarkan maklumbalas para pengguna semasa kaji selidik Modul Analisis Tahap Kegagalan dan Kesan untuk peralatan khas servis, para pengguna yang terlibat di dalam kaji sedikit ini sangat bersetuju 100% bahawa mereka mudah memahami kesemua potensi tahap kegagalan dan menyedari keseluruhan potensi kesannya jika peralatan khas servis tidak digunapakai semasa servis selepas jualan. Berdasarkan kesemua maklumbalas ini, ini menunjukkan bahawa Pembangunan Modul Analisis Tahap Kegagalan dan Kesan untuk peralatan khas servis adalah sangat bernilai dan alat kualiti yang mesra pelanggan untuk penggunaan juruteknik servis di pusat-pusat servis kenderaan VATA.

ACKNOWLEDGEMENT

All the praise to Allah the Al-Mighty for his blessing and benevolence.

The author wishes to express his sincere gratitude and appreciation to the numerous individuals whose have contributed towards the completion of this thesis:

- To all my supervisors: Ir. Hj. Mohd Rasid bin Osman, Prof. Datin Dr. Napsiah binti Ismail, Prof. Dr. Wong Shaw Voon for their invaluable advise, supervision and assistance;
- To all related engineers and technicians at VATA automotive company for their participation in verifying STFMEA datasheets;
- To all top management and service personnel at four (4) VATA service centres as case study companies for their willingness to participate in interviews, presentations, discussions, meetings, verification and validation sessions in order to achieve all the research objectives;
- To all other individuals that directly and indirectly involved in this research

Thank you for all the supports, contributions and co-operations.

May Allah bless you all.

I certify that a Thesis Examination Committee has met on 13 December 2011 to conduct the final examination of Erialdi bin Syahrial on his thesis entitled "Development of Service Tool Failure Mode and Effect Analysis (STFMEA) Module for Automotive Service Centers" in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirements for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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DECLARATION

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

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ERIALDI BIN SYAHRIAL

Date: 13th December 2011

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

FMEA	-	Failure Mode and Effect Analysis
STFMEA	-	Service Tool Failure Mode and Effect Analysis
DFMEA	-	Design Failure Mode and Effect Analysis
PFMEA	-	Process Failure Mode and Effect Analysis
SFMEA	-	Service Failure Mode and Effect Analysis
RPN	-	Risk Priority Number
VATA	-	Car Manufacturing Company in Malaysia
SCA	-	Service Center A
SCB	-	Service Center B
SCC	-	Service Center C
SCD	-	Service Center D
STA	-	Service Tool A
STB	-	Service Tool B
CD	-	Compact Disc
4M	-	Man, Machine, Method and Material
SRT	-	Severity Rating Table
ORT	-	Occurrence Rating Table
DRT	-	Detection Rating Table

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