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A TOOL TO MEASURE QUALITY ENGINEERING TOOLS AND TECHNIQUES IMPLEMENTATION IN MALAYSIAN AND INDONESIAN AUTOMOTIVE COMPANIES

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5.1 INTRODUCTION

Organizations operating in the automotive sector must continually improve their product quality and delivery, reduce material and labor costs, waste, and vulnerability in the supply chain. Poor-quality components entering the supply chain create massive problems for vehicle manufacturers thus making product quality key to survival (Hoyle, 2005). To be able to increase the quality of products continuously and to satisfy customers, the automotive related companies should consider adopting and implementing quality engineering (QE). QE is one of the approaches that can be used to implement continuous quality improvement. Komashie et al. (2007) believed that quantifying and improving quality requires the use of specific methods or tools.

QE is defined as the discipline that includes the technical methods, management and costing approaches, statistical problem-solving tools, training and motivational methods, computer information systems, and all the sciences behind them that are needed for designing, producing and delivering products and

1. What are the quality engineering (QE) tools and techniques that are actually being implemented in automotive industry?
2. What are the benefits and shortcomings of these QE tools and techniques?
3. What are the factors that automotive industries have to consider when selecting QE tools and techniques?
4. What are other factors that affect automotive industries considerations in selecting QE tools and techniques?
5. What are the difficulties faced by automotive industries in adopting QE tools and techniques?

At the end of Section 2, the panel of experts will ask to list all critical factors that most important contributing to effective of QE tools and techniques. The aim of Section 2 is to help us identify the current status of QE tools and techniques awareness and adoption amongst automotive industries in Malaysia and Indonesia and also identify critical success factors (CSFs) for QE implementation. The last section enquired the perceptions of CSFs for QE implementation. In this section all CSFs for effective implementation of QE tools and techniques based on extensive literature review had been identified and developed as the proposed AHP critical factors model as stated in Putri and Yusof (2008b).

Thus, a panel of experts was formed to carry out the first round of Delphi method to validate the identified critical factors for effective implementation of QE that obtained through extensive literature review. Participating in the panel of experts (formed in April-December 2008) were eight quality engineering professionals and industrialist from Malaysian and Indonesian automotive industries: quality engineering manager, quality assurance manager, and quality inspection manager from Astra Daihatsu Motor Company Indonesia; QA manager from TRW automotive electronics Malaysia; General manager/executive director of Automotive Industries Sdn. Bhd. Malaysia; Chief operating officer Inokom Corporation Sdn. Bhd. Malaysia; Senior general manager of Toyota Motor Manufacturing Indonesia; and specialist of quality engineering from academia, Department of Industrial Engineering,

Bandung Institute of Technology. Members of the panel of experts are shown in Table 5.3.

Table 5.3 Member of the panel of experts

Name	Position of Expert
B.R.W.	Head of warranty system and quality system department Astra Daihatsu Motor Indonesia
N.W.	Department head of quality engineering Astra Daihatsu Motor Indonesia
H.S.	Head of quality inspection department Astra Daihatsu Motor (ADM) Indonesia
H.A.	QA manager of TRW automotive electronics Malaysia
A.R.N.	Executive director of Automotive industries Sdn. Bhd. Malaysia
I.M.D.	Senior General Manager of Toyota Motor Manufacturing Indonesia (TMMIN) Company
Z.O	Chief operating officer Inokom Corporation Sdn. Bhd. Malaysia
D.I.	Specialist from academia

After completion the first round of Delphi method, we summarize responses to the first questionnaire and develop a feedback report. Responses to questions could be grouped or categorized by frequency or other criteria. The next step of the Delphi method is conducting the second round. For the purpose, we will develop the second questionnaire, mail it to the respondents, and obtain the responses. This questionnaire will develop from the first questionnaire (the first round) responses. Respondents independently evaluate earlier responses based on a feedback report from the initial questionnaire. The aim of the first and second round of Delphi method is to validate the identified critical factors for effective implementation of QE that obtained through extensive literature review.

The third round will be conducted after consensus amongst the panel of experts relating to the CSFs model for effective QE implementation achieved. In the third round of Delphi method, the

panel of experts will ask to obtain a pair-wise comparison matrix for the criteria. In this step, the researcher will develop pair wise comparison questionnaire using Saaty's scale (Saaty, 1994).

5.6 RESULTS AND DISCUSSIONS

Most of the commonly adopted tools in automotive industries according to the panel of experts include customer surveys, failure mode and effect analysis (FMEA), tolerancing that are used in product planning; parameter design as used in product design; process control plan and preliminary process capability studies that are used in process design; feedback, assessment and corrective action as used in product and process validation; meanwhile for production stage, the automotive industries commonly used seven basic tools, seven new tools and process capability studies.

However, it is surprising that some of the tools and techniques investigated in this research study are not adapted to some of automotive industries especially in Indonesia automotive industries. Actually Indonesian automotive industry is essentially an assembly industry, dominated by the major Japanese car manufacturers. Astra Daihatsu Motor (ADM) Company and Toyota Motor Manufacturing Indonesia (TMMIN) Company are the subsidiaries of Astra International Company. Astra International is the major assembler in Indonesia. ADM and TMMIN company are received engineering drawing of product and its specification from their mother company i.e. Astra International Japan. Thus, most of automobile industry in Indonesia did not conduct some of QE stages such as product planning, product design and process design.

It is evident from the findings that many factors influence the adoption of QE tools and techniques. Based on the previous studies as well as the results from the first round of Delphi method, these factors can be classified into internal and external factors. Monetary cost, usefulness, user friendliness (easy to use), time, flexibility, and popularity of tools are internal factors which may influence the usage of tools. External factors such as culture, project

nature, necessity and organization/industries account for the external influence.

From the findings, the two primary internal considerations are user friendliness (easy to use) and usefulness. Time is a secondary internal factor. The remaining three factors, monetary cost, popularity of the tools and flexibility, appear to be less significant to the panel of experts in their decision on tools' adoption. Meanwhile, the two primary external factors are necessity and organization/industries. Project nature is a secondary external consideration. Culture appears to be less significant to the panel of experts in selection of QE tools and techniques. Other factors affecting choice of tools and techniques adopted according to panel of experts are human side; competency and basic skill of user; legal requirements; customer requirements; standard business requirements; risk level; reliability and endurance; benchmarking purposes; direction from mother companies; training by the external introduces "new" QE tools; and understanding the basic concept of any QE tools in nature language is very lacking therefore will result in "less 10 %" commitment or support during the implementation stage.

According to panel of experts, there are some benefits of QE tools and techniques i.e.:

1. To find the root cause of the problem.
2. Think of problem solving immediately.
3. To meet customer requirements.
4. To ensure the process of statistical control/control chart is statistically stable and capable.
5. As a tool for continuous improvement.
6. To provide awareness on quality status.
7. Visibility.
8. Traceability.
9. Quality performance trend.
10. Quality conscious minded.
11. To support smooth regular quality activity.
12. To eliminate previous problem.

13. To improve the existing product or process.

Many authors agree that the use and selection of quality management tools and techniques are vital to support and develop the quality improvement process (Bunney and Dale, 1997). However, companies, in this case automotive industries, do encounter a range of difficulties in their use and application of quality engineering tools and techniques. The findings from the first round of Delphi method indicate that there are some difficulties faced by automotive industries in adopting QE tools and techniques i.e.:

1. Lack of knowledge about the tools relating to when, where, how to apply the tools and techniques and what to monitor and measure with the tools and techniques.
2. Lack of management commitment.
3. Lack of statistical knowledge.
4. Lack of communication.
5. Lack of resources.
6. Lack of understanding of the potential benefits of the tools.
7. Lack of education and training.
8. Poor measurement system and data handling.
9. Poor attitude towards quality improvement.
10. Lack of team work and cooperation.
11. Lack of awareness of tools and techniques available.
12. Lack of quality system.
13. Sense of quality of operator still low.

Most of expert panel stated that lack of knowledge about the tools; lack of statistical knowledge; lack of communication; lack of resources; and lack of management commitment are the primary difficulties faced by automotive industries in adopting QE tools and techniques. It is evident that many of the tools and techniques to be used in the QE stages require a sound basis of training and education in terms of statistical knowledge.

By identifying the critical factors that make for effective use of QE tools and techniques, the results from the first round of Delphi method could be useful for developing the established AHP

model for QE tools and techniques implementation. In the last section of Questionnaire 1, the panel of experts was asked to determine whether they agree with identified CSFs and sub-factors under each CSFs. If they disagree with CSFs and sub-factors under each CSFs, they could make any adjustment by deleting, moving or modifying CSFs and sub-factors and could write down any comments regarding the proposed CSFs model. Based on the findings of Delphi Round 1, mainly the panel of experts are agree with the proposed AHP model for effective and successful QE tools and techniques implementation. However, one or the other experts make any adjustment on the proposed AHP model by adding in new CSFs at level 2 i.e. quality technical material which divided into two sub criteria at level 3: standardization quality standard and quality control (QC) technical management and quality jiritsuka (independent) which consist of two sub criteria at level 3: develop management to become QC management and independence without support from mother company. Thus, the result from Delphi round 1 relating to hierarchy structure of CSFs model become the new proposed model of CSFs for effective and successful QE tools and techniques implementation as shown in Figure 5.2.

5.7 CONCLUSIONS AND FURTHER RESEARCH

The use of QE tools and techniques is a vital component of any successful quality improvement process. The application of these tools and techniques at the specialty automotive industries demonstrates the many difficulties that can be experienced when trying to apply them. The findings from the first round confirm the CSFs for effective and successful QE tools and techniques are really needed to support continuous improvement process. This paper attempted to pinpoint areas lacking in implementation of QE tools and techniques and difficulties faced by company relating to QE practices. By conducting the first round of Delphi method, we were able to collect experts' opinion in term of critical factors contributing to effective QE tools and techniques.

Further research will centre on conducting the next steps of Delphi method i.e. the second and third round. The purpose of the second round is to obtain agreement from the panel of experts on the hierarchy structure of the critical factors obtained from the analysis of the first round. In questionnaire 2, the Delphi panel will review the result from the first round and will respond whether they agreed with the new hierarchical structure and whether criteria and sub criteria needed more modification or not. The hierarchical structure will modify by incorporating responses to questionnaire 2, resulting in the final structure of CSFs for effective and successful QE tools and techniques implementation.

Finally, in the third round, we will develop a pair wise comparison questionnaire of the critical factors identified in the Delphi process. It will be used to collect pair wise comparison data. Pair wise comparison that used in the AHP process intent on comparing the relative importance criteria and sub criteria in all possible pairs. By the pair wise comparison data, we can obtain the priority and ranking of each criteria and sub criteria in terms of effective and successful QE tools and techniques implementation. It is hoped that the results will create much clearer understanding of these critical factors and benefit both countries in the quest for quality engineering excellence in the automotive industry.

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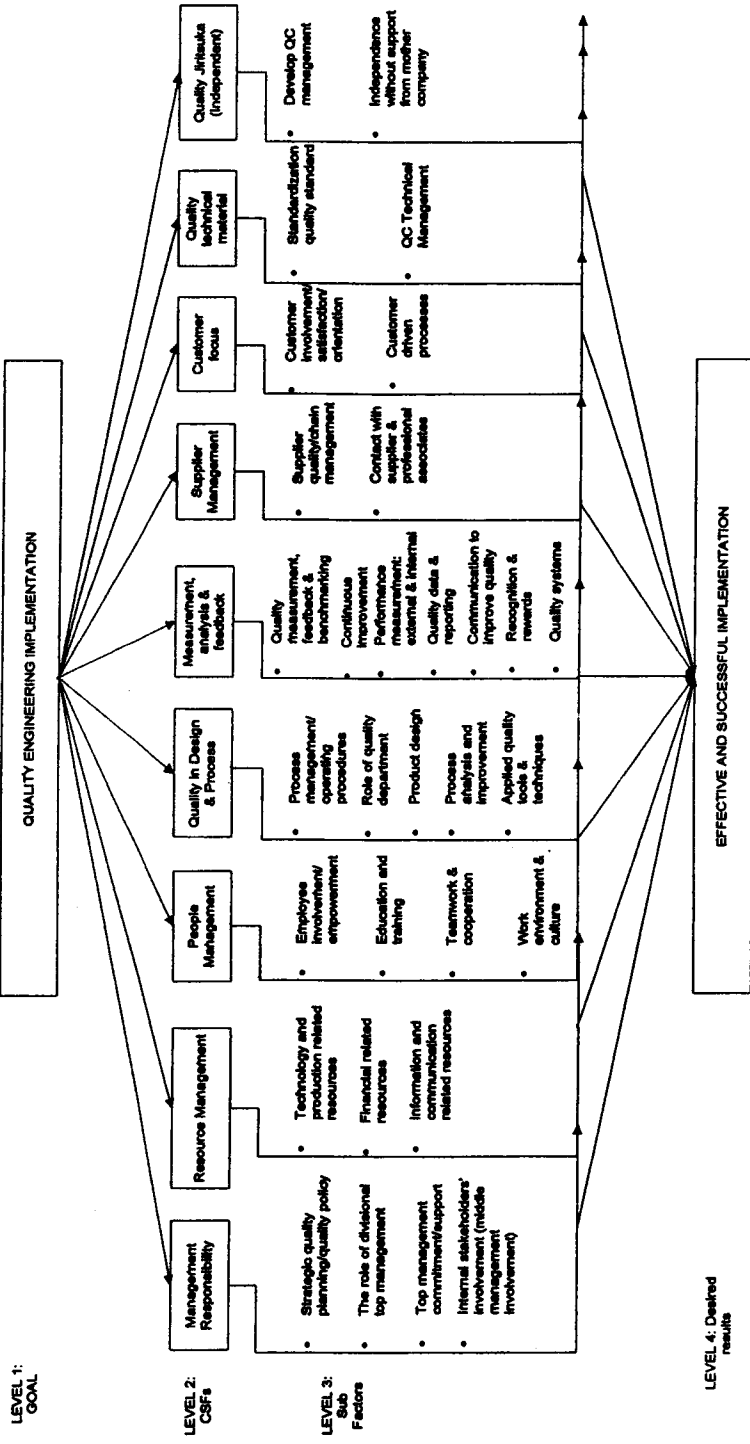


Figure 5.2 Results from Delphi Round 1