Employee Satisfaction Towards Integration of Quality Management System: A Case Study of Malaysian Automotive Manufacturer

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ABSTRACT

This paper presents a case study to analyse the workers' satisfaction level on the implementation of an integrated quality system between the IATF 16949 and Toyota Production System focusing on internal audit activity in one automotive company in Malaysia. The main goal was to validate and investigate the issues and challenges those employees in the organisation faced before and after the systems were integrated. Rasch Measurement Model was used to analyse the data collected. Initially, pilot data were conducted, and the data were used to construct the survey questionnaire with 3 constructs and 47 items. A total of 30 respondents from various departments were assessed with the demographic traits of position in the organization and years of service. From the pre-implementation survey, most of the respondents agreed that too many documents were involved throughout both audits and lack of training for auditee on both systems was the main cause to the ineffective implementation of both systems, particularly at mass production process. Both items were measured below the person mean value in variable map (pre-implementation). After the integrated system, the post-survey analysis proved that too many documents and lack of training were above person mean value in variable map (post-implementation). The results revealed that most of the respondents agreed the integration of both systems has given an effective result and good impact to the organization's performance.

Keywords: *Rasch Model; IATF 16949; Toyota Production System; Internal Quality Audit; Automotive*

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Introduction

Quality management system implementation has become a must for automotive companies in Malaysia to be able to become the first-tier vendor to car manufacturer company [1]. With that requirement, the International Automotive Task Force (IATF) has required all automotive companies to be at least certified with quality management system called IATF 16949 standard [2]. However, to remain competitive in the market, many companies have looked for supplementary system to facilitate the process in maintaining the products quality yet price competitive [3]. The most prominent system among the automotive companies in Malaysia was the Toyota Production System (TPS) in supplementing the current quality management system [4].

Managing quality has become the most significant core processes and widely accepted goal, ultimately for the competitiveness of organization [5], [6]. In quality management system (QMS), it is incorporated with design, control and development of goods, services and processes in the supply chain management in order to achieve company's goals [7]. However, each QMS has its own set of rules methodology towards the execution of a quality system and a different strategy in certifying the objective of its quality system [8]. Certainly with this certification, the organization's aim is to maintain competitiveness by continuous improvement, with the key concern being the minimization of variation and waste in the supply chain [9]. IATF 16949 standards is a QMS for automotive company that is inclusive with continuous improvement, with a focus on defect prevention, and supply chain variation and waste reduction [2].

Additionally, to enhance the control of products quality, QMS requirements for automotive production, service and supplementary parts are abided with Customer-Specific Requirements (CSR's) [3]. Process review activities such as methods of evaluation and implementation of improvements need to be conducted by the automotive companies as it is an important requirement by the International Automotive Task Force (IATF) [10]. Nevertheless, in maintaining the products quality and process efficiency, many companies have adopted a supplementary quality management system, such as TPS, to support the efficiency of supply chain management. For that reason, many companies have developed an integration of quality management system to attain a fully, efficient and feasible system of organizational and to cope with its core complexity [11], [12]. Integrated management system is agreed as a comprehensive model and holistic approach. It is viewed as a feasible approach for cost savings, operational efficiency, and it signifies sustainable development and business excellent [13]. Integration is also a term that may be applied to industrial difficulties with several perspectives on the same object [14].

According to Sampaio et al. [15], it is a strong point for any organization that implements more than one management system to do it in an

integrated approach. The necessity to examine this integrated concept in this context is seen as important [16]. The amount of duplication work associated with independent running and administering certification systems and related documentation will be reduced with a fully integrated approach of certification system adoption [17]. Therefore, it is very crucial to consider several requirements before, during and after an integration process. As agreed by S. Zeng et al. [18], the first step towards integration is to improve knowledge and common use of systems.

Until now there is no standard instrument that could effectively measure the effectiveness of the integration and satisfaction level within the organization, this paper will examine the validity and reliability of a questionnaire through the development of quality measurement instruments that will effectively measure the satisfaction level within the organization. The selection of a quality measurement is essential which depends on many factors. Justification of evaluation method should be considered before proceeding to develop the instrument. As mentioned by Petrillo et al. [19], if the development of the instrument is for descriptive purposes and on a limited budget, a superficial examination of the Classical test theory (CTT) based on psychometric properties is possible, but an Item response theory (IRT) should be considered if a thorough psychometric evaluation is required. Classical test theory (CTT) and Item response theory (IRT) can be effective in supporting a quantitative measurement of items and scales during the content-validity phase [20].

To date, the Rasch Model is one of the most well-known and well-established approaches for analysing quantitative data that heavily rely on the IRT technique [21]. It is used to examine the validity and reliability of a questionnaire, and it is developed through the quantitative data collection. The objective of Rasch analysis is to examine the extent of observed rating scale data in satisfying the measurement [22]. Rasch model is a common probabilistic model that measures the latent traits on a linear scale using log odds by identifying the location of items and respondents [23]. Furthermore, it is a hierarchical order of each item constructed on a level of complexity, including an ability score for each subject [24]. Rasch Model functions with the measurement of respondent's response to items, using the same scale at the same time. This is called conjoint measurement. In the Rasch model, based on the responses, a scale will be created. Using survey responses, a scale is created that works as a ruler-continuous and equal interval scale, as well as measurement unit called Logit [23]. Rasch model can also be utilized as a psychometric model for evaluating categorical data, such as answers to questions on a reading assessment or questionnaire responses. As applied by Boone [25], this tool is useful for documenting and evaluating how well such instruments measure. According to Boone, this tool can also be used as a psychometric technique to enhance the precision with observed instrument quality and computed respondents' performances [25]. In Rasch model, it is

assumed that a person of high ability will most likely be able to complete any given task, while a simple task can be completed without trouble by anyone of any ability level [23].

In this study, Rasch analysis was applied to validate a pilot study that focused on analysing the satisfaction level of audit integration system between IATF 16949 and Toyota Production System in one of the main automotive suppliers in Malaysia. The main objective was to analyse on the difficulties and the challenges faced by the workers in the company before and after the integration of both systems. Before the integration, the quality audit in the company was performed separately to fulfil the requirement of both systems which were IATF 16949 and TPS. This is because both systems have different yearly audit plan and different documents preparation. In a year, 22 internal system audits were scheduled for IATF 16949 and 12 for TPS. For internal product/process audit, an average of 50 audits was conducted yearly which represented each part number produced by the company. Through detailed comparison of both systems, it showed that both systems had similar requirements in terms of standards, tools, parameters, and audit process. Thus, it has led to a misunderstanding between auditors and auditees, which caused poor audit effectiveness in terms of production and quality audit performance. Furthermore, the verification criteria and audit findings for both systems were published in documents that were relatively similar. As a result, a new integrated system was developed to fulfil both system requirements.

Research Methodology

In this quantitative analysis research, the data collection was performed through survey questionnaire approach as suggested by Boone [25]. The Statistical Package for Social Science (SPSS) V 21 was applied for the purpose of data entry and data coding. To analyse the data, Rasch Model using Winstep V 3.72.3 was performed to construct reliability of the test and validity of the instrument.

Sample

The case study was conducted in one of the automotive factories in Shah Alam, Malaysia. The sampling method applied in this study was random sampling. Random sampling was chosen because each unit's probability of inclusion can be estimated, credible estimates can be given together with estimates of the sample error, and inferences about the population can be formed [26]. Thus, the respondents were randomly selected among the workforce in the company, where they were from the same population and group of respondents for the pilot study. The respondents were from the plant operation, involving the management staff, quality control (QC) inspectors, warehouse supervisor, production engineer and production line leaders. These respondents were

selected as they were directly involved with the quality management system audit process. In order to get an equal probability of sample selection with unbiased representation of the total workforce [27], 100 questionnaires were distributed to the targeted population (respondents were randomly selected). Then, 30 persons responded and successfully answered the survey, excluding those who have responded in the pilot study. Therefore, for this study, 30 responses were sufficient for data analysis. This was suggested by Linacre [28] in which Rasch Model is capable of analysing as low as 16 respondents for 95% of confidence level, and as low as 27 respondents for 99% confidence level. However, analysis with larger sample size is more recommended to increase validity of the study [20].

Data collection

Data collection was conducted by a survey using a set of questionnaires that was designed specifically for the respondents. The survey questionnaire consisted of four sections. The first section was the demographic aspects with years of working, department of working and position in the organization as the questions asked in this section. This is important to determine where the difficulties and problems occurred and at which level they must be solved. The second, third and fourth sections were the determination of the difficulties and problems that occurred in conducting the internal quality audit; difficulties that arise before the audit process, difficulties that arise during conducting the audit process and difficulties that arise during the closing audit process, respectively. In these three sections, the 5-Likert rating questions were laid out. The 5-Likert rating questions were designed with rating forms; which consisted of 0=strongly disagree, 1=disagree, 2=somewhat agree, 3=agree, and 4=strongly agree [29]–[31]. The same questionnaire was used to study the satisfaction level, before and after the integration of internal quality audit process at mass production. To get the data consistency, the questionnaire was distributed to the same respondents (before and after the integration process).

Data analysis

The main aims of the analysis were to measure the challenges gained before the new system implementation and the effectiveness of the new integrated system. Therefore, to obtain a good data analysis of survey questionnaire, a statistical software for Rasch model analysis named Winstep software V3.72.3 was used. Literature studies showed that the Rasch model has been used in other research fields such as education [32]–[36], food and beverages [23], [37], medical [24], and sport [38] and it was proven capable to measure any subjective assessment. At the same time, Rasch is also capable to convert all ordinal data into ratio data. In the questionnaire, the survey focused on the respondent's point of views in the implementation of the current audit system for both IATF 16949 and T 7PS. The survey also aimed to identify the needs

to integrate both systems for Mass Production (Customer Oriented Process, COP 7 under IATF 16949).

Reliability of the test was analysed using the Winstep software. Subsequently, adequacy of the person and item separation index of the test were identified followed by determining and measuring the challenges and difficulties encountered by the respondents. The activities were implemented by Variable Map in Rasch model analysis. According to Khusaini [15], the Variable Map in Rasch is a great tool to check the item's reliability and see how closely the items correspond to the respondents that are being measured. The Variable Map was applied to stipulate the relationship between respondents and items. With the Variable Map analysis, it will predict the respondent's capability to correctly respond to an item, with the likelihood of success determined by the disparity between the person's skill and the item's difficulty.

Meanwhile, the validity of the questionnaire was appropriately established during the pilot study stage [39]. The relevancy of the questionnaire in producing the correct response or conclusion was related to the validity of the questionnaire. Thus, to guarantee that the questionnaire was credible, face validity and content validity were conducted during the pilot study stage. As advised by Gaber [40], the questionnaire's face validity and content validity were endorsed by a company expert and experienced user (with 20 years of experience) of the research subject.

Supplementary questions for demographics were included which were used to do profiling of each respondent; position in the organisation, the department being attached to, and years of employment in the organisation. To answer the questionnaire, the respondents were not required to identify their names and the responses were treated as 'Confidential'.

Results and Discussion

In this study, the analysis focused on the verdicts of the item and respondent reliability and Variable Map (VM). Figure 1, Figure 2, and Figure 3 demonstrate the respondents' satisfaction level in terms of three demographic traits: position, department, and years of service. As can be seen, most of the respondents were from middle management staff level. The respondents of this survey also comprised of other departments such as supply chain, research, and development as well as marketing. In addition, most of the respondents have been working in the company with 5 to 10 years of service. Therefore, this study was credible because the respondents were significantly involved in day-to-day activities at the production process as well as throughout the audit process.

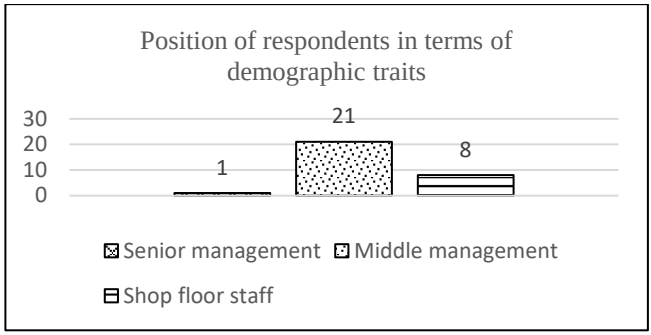

Figure 1: Position of respondents in terms of demographic traits

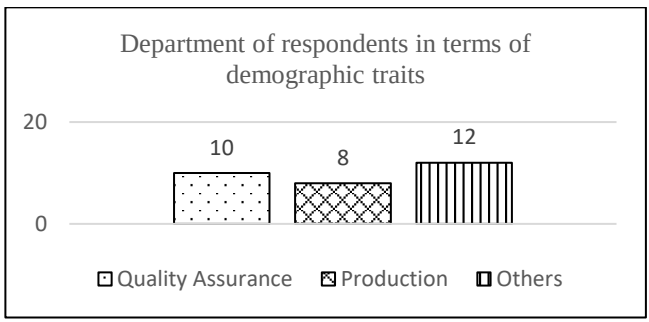

Figure 2: Department of respondents in terms of demographic traits

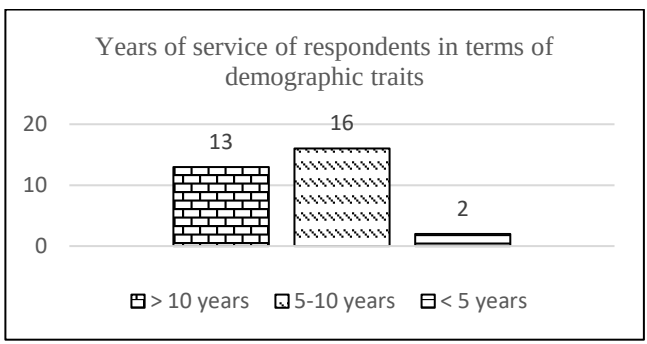

Figure 3: Years of service of respondents in terms of demographic traits

Pre-survey study analysis was conducted to measure the satisfaction level of the respondents before the integration of IATF 16949 and TPS system. The study was done on the process of internal quality audit at mass production.

In order to start the analysis, it is important to know that the items fit to ensure they measure what is to be measured [36]. There were three criteria needed to be met, which were the outfit MNSQ (mean-square), outfit ZSTD (Z standardized score) and point measure correlation values [41]. Based on Figure 4, the outfit MNSQ value of 0.98 was remarkably close to the expected value of '1' and within the expected range of $0.5 < y < 1.5$. The outfit ZSTD value of -0.1 was remarkably close to the expected value of 'zero' and within the normality range of $-2 < Z < +2$. Meanwhile, the item reliability value should be more than 0.7 in order to indicate the item's sufficiency in the instrument [42], [43]. As shown in Figure 4, the item reliability value was 0.80; hence, the number of items was sufficient, and the instrument was fit. In this study, it indicated that these items were adequate to measure the level of satisfaction during the internal quality audit. It is important that the person fits the Rasch Model reasonably well, for the persons or respondents in this study do fit the Rasch model perfectly.

At the same time, it is also important to observe the reliability values, which are Cronbach alpha (α) value, person reliability value, size of the person, and valid responses [36]. As displayed in Figure 4, the Cronbach's alpha (α) and person reliability values were 0.96 and 0.95, respectively. With the value of more than 0.7 (Cronbach's alpha (α) and person reliability), it was proven that using another set of items to measure similar study with a similar set of person placement was equitable [37]. This indicated that the instrument's internal consistency in measuring the respondents' conceptual comprehension of the topic was excellent [35]. Hence, it suggests that more research into this instrument is possible. [35].

Meanwhile, the summary statistics displayed a person separation of 4.23, which indicated that it was good. As suggested by Linacre [38], the value greater than or equal to 2.0 indicates that the index separation is good. It indicates that the instrument categorises the responses into four different types of profiles.

```
     SUMMARY OF 30 MEASURED Person
-------------------------------------------------------------------------------
|          TOTAL                          MODEL          INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE   ERROR      MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN     116.4      40.0        1.97     .26      1.03    -.2    .98    -.3 |
| S.D.      18.9        .0        1.27     .04       .53    2.3    .52    2.2 |
| MAX.     150.0      40.0        4.60     .37      2.74    5.3   2.65    5.1 |
| MIN.      79.0      40.0        -.20     .22       .34   -3.9    .33   -4.0 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .29 TRUE SD    1.23  SEPARATION  4.23  Person RELIABILITY  .95 |
|MODEL RMSE    .26 TRUE SD    1.24  SEPARATION  4.68  Person RELIABILITY  .96 |
| S.E. OF Person MEAN = .24                                                   |
-------------------------------------------------------------------------------
Person RAW SCORE-TO-MEASURE CORRELATION = .99
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .96


     SUMMARY OF 40 MEASURED Item
-------------------------------------------------------------------------------
|          TOTAL                          MODEL          INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE   ERROR      MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN      87.3      30.0         .00     .30      1.02     .0    .98    -.1 |
| S.D.       8.5        .0         .71     .02       .36    1.4    .36    1.4 |
| MAX.     100.0      30.0        1.66     .33      1.73    2.4   1.85    2.8 |
| MIN.      66.0      30.0       -1.18     .26       .38   -3.0    .36   -3.1 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .32 TRUE SD     .64  SEPARATION  2.00  Item   RELIABILITY  .80 |
|MODEL RMSE    .30 TRUE SD     .65  SEPARATION  2.19  Item   RELIABILITY  .83 |
| S.E. OF Item MEAN = .11                                                     |
-------------------------------------------------------------------------------
UMEAN=.0000 USCALE=1.0000
Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
1200 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 2179.40 with 1128 d.f. p=.0000
Global Root-Mean-Square Residual (excluding extreme scores): .6301
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Figure 4: Summary statistics for person and items (Pre-survey)

Figure 5 is the Variable Map (Pre-Survey) that shows the distribution and ability level of the respondents towards the item using the same scale [23]. The left side of the Variable Map shows the distribution and ability of the respondents while the distribution of difficulty levels of items is on the right side [44]. The difficulty level of respondents' item is measured with a unit measurement called "Log of odd units" or "Logit" which has equal intervals. It is a vertical dashed line that acts as a ruler, separating the data generated for persons (on the left) and items (on the right) [23]. The letter "M" at the centre of the vertical line represents the average of the mean for the item and person. The letter "S" represents one standard deviation away from the mean and T denotes two standard deviations away from the mean. The item mean is calibrated (zero-set) by the Winstep software and it is always at zero (0) Logit. As for person, the mean for person depends on the respondent since the person has a 50:50 likelihood of agreeing to the question asked [45].

As shown in Figure 5, the left side represents the respondents' ability who replied to this survey. The most agreeable respondents were ranked at the

top, while the opposites were ranked at the bottom. On the right side, the most agreeable items regarding the challenges arise throughout the process of internal audit were at the bottom, and the less agreeable items were at the top of the map. As for the items, all items were below the person's mean of 1.97 logit. It can be said that most of the respondents agreed with the challenges and difficulties faced throughout the concurrent implementation of IATF 16949 and TPS systems. The most agreeable item was B4 (Too many documents preparation for the auditors), D2 (Too many controlled documents need to be handled to conduct the audit process) and D9 (Lack of training for auditee on integrated quality management system (TPS and IATF 16949) standard). The least agreeable items were C1 (Difficult in getting commitment from auditee and auditors to conduct closing audit meeting for integrated quality management system (TPS and IATF 16949)) and D10 (Difficult for auditor to accept new changes).

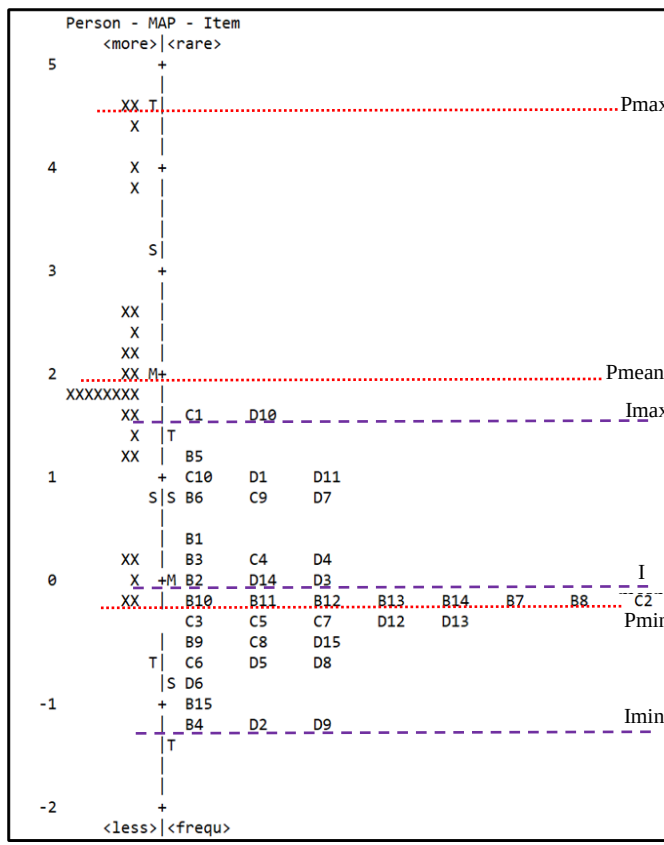

Figure 5: Variable Map (Pre-survey)

Then, post-survey study analysis was conducted to measure the satisfaction level of the respondents after the integration of IATF 16949 and TPS. The survey was conducted using the same set of questionnaire as post-survey analysis. The summary statistics for person in Figure 6 showed that the Cronbach alpha value for post survey study data was 0.94 which was a bit low from the pre-survey study data of 0.96. Anyhow, it was still more than 0.7 and indicated that the analysis was reliable and further investigation was allowed to be conducted [35].

Meanwhile, further investigation showed that the person's reliability for post survey study yielded 0.93 which was lower than pre-survey study data of 0.95. With the value of more than 0.7, it indicated that the respondents' sample involved in this study had consistency towards this survey, if tested against the test items [43]. Figure 6 also shows the item fit statistics measure order. Post survey data for the outfit MNSQ of items was 0.99 and outfit ZSTD was -0.2, whilst pre-survey data for the outfit MNSQ value was 0.98 and outfit ZSTD value was -0.1. Both measurements were within the expected range of $0.5 < y < 1.5$ and $-2 < Z < +2$, respectively. Also, it can be seen in Figure 6 that the item reliability value for post survey data was 0.91 which was higher than pre-survey data of 0.8 and more than the expected value of 0.7. Therefore, it indicated that these items were sufficient, and the instrument was fit.

```
    SUMMARY OF 30 MEASURED Person
-------------------------------------------------------------------------------
|          TOTAL                          MODEL         INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE   ERROR      MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN      49.3      40.0       -1.71     .25       .98    -.6    .99    -.5 |
| S.D.      16.9        .0        1.02     .01       .79    2.8    .77    2.7 |
| MAX.      88.0      40.0         .54     .28      3.73    7.8   3.64    7.8 |
| MIN.      24.0      40.0       -3.36     .23       .24   -5.1    .27   -4.6 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .28 TRUE SD     .98  SEPARATION  3.56  Person RELIABILITY  .93 |
|MODEL RMSE    .25 TRUE SD     .99  SEPARATION  3.96  Person RELIABILITY  .94 |
| S.E. OF Person MEAN = .19                                                   |
-------------------------------------------------------------------------------
Person RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .94


    SUMMARY OF 40 MEASURED Item
-------------------------------------------------------------------------------
|          TOTAL                          MODEL         INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE   ERROR      MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN      37.0      30.0         .00     .29      1.01    -.1    .99    -.2 |
| S.D.      12.9        .0        1.07     .02       .50    1.8    .48    1.8 |
| MAX.      58.0      30.0        2.06     .35      2.59    4.7   2.54    4.6 |
| MIN.      14.0      30.0       -1.66     .27       .29   -3.8    .29   -3.8 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .32 TRUE SD    1.02  SEPARATION  3.24  Item   RELIABILITY  .91 |
|MODEL RMSE    .29 TRUE SD    1.03  SEPARATION  3.54  Item   RELIABILITY  .93 |
| S.E. OF Item MEAN = .17                                                     |
-------------------------------------------------------------------------------
UMEAN=.0000 USCALE=1.0000
Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
1200 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 2251.90 with 1128 d.f. p=.0000
Global Root-Mean-Square Residual (excluding extreme scores): .6324
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Figure 6: Summary statistics for person and items (post-survey)

As shown in Figure 7 for the Variable Map (Post-survey), the left side represents the respondents' ability who replied to this survey. Given a 50:50 chance that these respondents consented to the inquiry posed, the mean for person is dependent on the respondents [19]. As you can see from the Variable Map, the person mean value was at -1.71 logit. It indicates that most of the respondents did not agree with the challenges and difficulties faced after the integration of the IATF 16949 and TPS systems. While on the right side, the item mean value was at 0.00 logit. It showed that the scale for the item mean was calibrated to zero when the person had a 50:50 probability of answering it [29] as it was always at zero (0) Logit. Based on the survey responses, C9 (Cost impact on excessive time to complete audit process for integrated quality management system (TPS and IATF 16949) standard) and C10 (Cost impact on excessive time on process of closing non-conformances report arise from integrated quality management system (TPS and IATF 16949) audit) were the least agreeable items after both systems were integrated. Meanwhile, the most agreeable items were B15 (Difficult to transform culture for implementing the integrated quality management system) and D13 (Differences in the TPS and IATF 16949 audit process requirements). This proved that most of the respondents agreed the challenges and difficulties faced throughout the concurrent implementation of IATF 16949 and TPS system had diminished, and the integration of both systems had given an effective result to the organization's performance.

Nevertheless, items data for pre-survey as shown in Figure 5 were situated at below level, while items data for post survey as shown in Figure 7 were situated at upper level. It showed that most of the challenges were faced by the respondents during the pre-survey, whilst when the same challenges were answered by the same respondents during the post survey, it gave an opposite result. Thus, it can be said that the respondents agreed they faced the challenges during the implementation of both systems (before the integration) as shown in Figure 5. However, the contradictory result in Figure 7 showed that the respondents did not agree they faced the same challenges after the integration. This proved that the respondents were satisfied with the integration system as it helped to reduce the redundancy of both quality management systems. Consequently, the internal audit process can be performed in a more efficient way which will directly help the organization to operate effectively. Table 1 depicted a summary of the comparisons between pre and post survey for item fit and reliability value. It indicates that both pre and post survey questionnaire data were reliable and valid. The findings were able to identify the challenges and hurdles faced by the employees. Thus, this questionnaire was legitimate to measure the employee satisfaction with the integrated system's implementation for both systems.

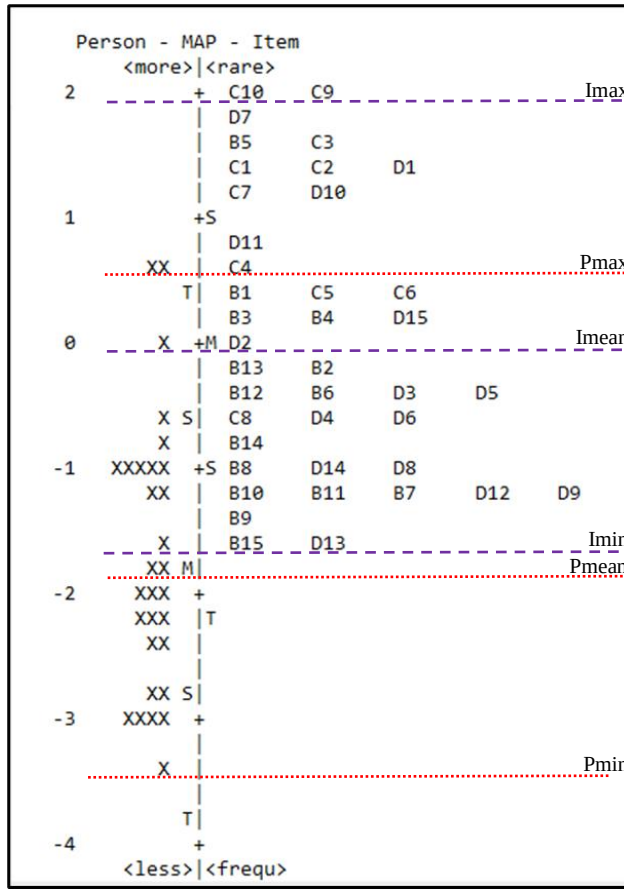

Figure 7: Variable Map (Post-survey)

Table 1: Comparison between pre and post survey for item fit and reliability value

Criteria	**Pre survey**	**Post survey**
Cronbach alpha value	0.96	0.94
Person reliability	0.95	0.93
Item reliability	0.80	0.91
Outfit MNSQ	0.98	0.99
Outfit ZSTD	-0.1	-0.2

Conclusion

The results of analysis proved that most of the respondents agreed the implementation of both IATF 16949 and TPS concurrently has caused difficulties in their daily tasks. From the outcomes, it clearly showed that most of the respondents, particularly from middle management staff which have been working in the company within 5 to 10 years of service, agreed that having too many documents involved throughout both audits (B4 and D2) was the main cause on the ineffective execution of both IATF 16949 and TPS systems, particularly at mass production process (this study was focused on the mass production process). Both items were measured below the person mean value. After the integrated system was implemented, the post-survey analysis proved that items B4 (0.27 logit) and D2 (-0.05 logit) were above person mean value, -1.71 logit. To further improve the integrated system, the company is suggested to continue providing knowledge training and culture information within the organization especially to those people who are directly involved with the new integrated system. As such, more feedback can be gathered for continuous improvement. However, after the integration of both systems has been successfully done, there are two other items that need to be focused on the next improvement plan which are B15 (Difficult to transform culture for implementing the integrated quality management system) and D13 (Differences in the TPS and IATF 16949 audit process requirements). Both items focus on knowledge training and culture formation within the organization. Furthermore, since the number of samples was kept to a bare minimum and collected from a single target population, it was not feasible to apply for additional corporate research. Thus, it is suggested that future research be conducted with the participation of another automotive company that has already implemented IATF 16949 and TPS in their operations. To improve the study's validity, another survey with a larger sample size will be conducted.

Acknowledgments

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