

## Development of competence items for vehicle inspectors of private vehicle inspection companies in Taiwan

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**ABSTRACT:** In this study, the authors examined the development of competence items for vehicle inspectors of private vehicle inspection companies. The study was based on a literature review of relevant inspections and analysis of vehicle inspector competence items, as well as three rounds of Delphi technique questionnaires. The authors invited 19 vehicle inspection professionals, which included automobile experts, practical workers, vehicle inspection company administrators and supervising authority persons to complete a three-round survey that was projected using a Delphi technique. The authors employed descriptive statistics and used nonparametric statistics, Kolmogorov-Smirnov (K-S) One Sample Test. The results showed that competence items using seventeen items were divided into four domains. The main finding of this study provides guidelines for vehicle inspectors of private vehicle inspection companies, something that could be a reference framework for developing vehicle inspection courses in college education and industrial training.

### INTRODUCTION

According to Ministry of Transportation and Communications statistics in Taiwan [1], the total number of registered motor vehicles in Taiwan is 7,342,855 (shown in Figure 1, comprising 6,213,870 passenger cars, 874,271 pick-up trucks, 161,931 large trucks, 31,960 buses and 60,823 specialised cars). Car users cause various damage to their cars in line with their car usage, so car maintenance and inspection are important to ensure the normal function and operation of their cars in the process of continuous duty. Therefore, regular inspections have been implemented [2].

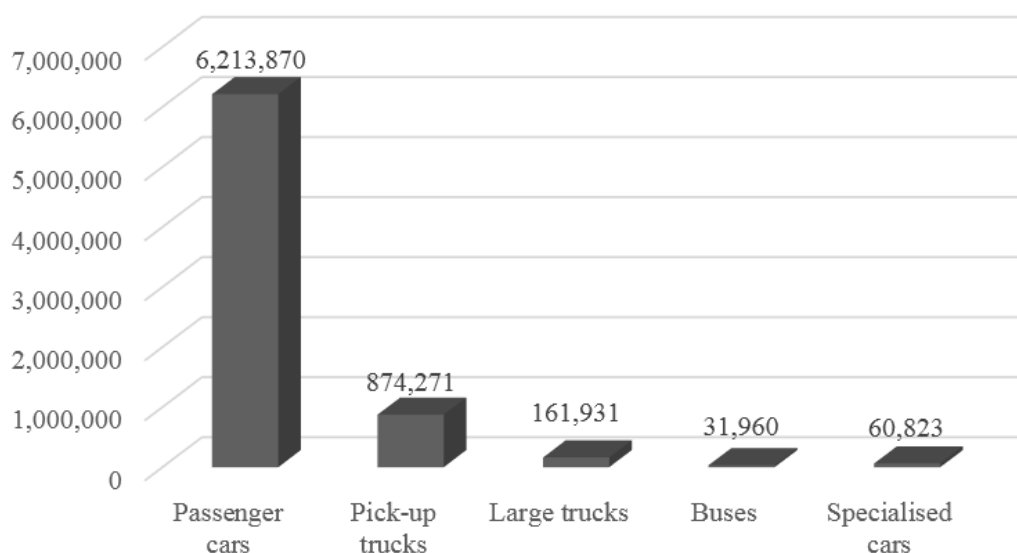


Figure 1: Total registration number of motor vehicles in Taiwan (2013).

Regular inspection is an important task for vehicle inspectors in charge of checking on car safety for the public; vehicle inspectors have to have a related vehicle background to qualify for applying the vehicle inspector test. Moreover, vehicle inspectors have to know related inspection regulations for various types of vehicle, supervision regulations and car safety procedures, as well as continuously update their own knowledge of new technologies of cars and obtain professional licenses. Educational training is a learning experience, which intends to make an individual to achieve

a relatively lasting change in his/her competence, so as to advance their work performance [3]. Therefore, there is a need to focus on vehicle inspectors' education and training and corresponding abilities that can improve the quality of vehicle inspection. Vehicle inspectors' professional competence must advance with the times, so as to change vehicle inspectors' knowledge, technique and attitudes, accordingly. However, there has been an absence of relevant research and discussions in the past.

Psychologist Abraham Maslow, proposed and advocated that human needs can be divided into five levels: physiological needs, security needs, social needs, self-esteem needs and self-actualisation needs, and these needs must be satisfied hierarchically from bottom to top as a pyramid. A brief introduction to these needs is showed as follows:

1. Physiological needs: these are biological and fundamental needs;
2. Security needs: when all physiological needs are satisfied and are no longer controlling thoughts and behaviours, the needs for security can become active;
3. Social needs: seek to be accepted by others and the sense of belonging;
4. Self-esteem needs: needs for independence, goal-achieving, professionalism, approval, status and respect from others;
5. Self-actualisation needs: when all of the foregoing needs are satisfied, then, and only then, are the needs for self-actualisation activated, and he/she will strive for his/her ideal or goal that they have determined. At that time, in view of Abraham Maslow's safety theory, one knows that each person needs safety, identification or dependence for his/her life. In addition, vehicle inspectors must take all responsibilities for vehicle inspections and car safety, as well as for all car drivers' road safety.

Experience in vehicle inspection and car maintenance cannot be accumulated within a short period of time. Vehicle inspectors have to undergo many learning and practical experiences; thus, the cultivation and training of automobile professionals (including technicians for automotive maintenance and vehicle inspectors) will have certain difficulty; therefore, to understand vehicle inspectors' necessary competence through research is critical. This is the first research motivation of this study.

Dalton proposed that work competence, which is the necessary ability to compose all work, and knowledge, skills, behaviour and personal traits are embedded in the work competence, which forms a model [4]. In the era of the global knowledge-based economy, levels of professional ability affect vehicle inspectors' future competitiveness. Therefore, vehicle inspectors must have learning and problem-solving abilities, the assurance of which is the second research motivation of this study. Article 61-1 of the Highways Traffic Act in Taiwan: car inspections and driver license tests shall be made by the personnel who are qualified by examination and with certification [5]. Car maintenance personnel must have the Level B technician license for automotive mechanics to handle such operations [6].

There have been few domestic and foreign studies and insufficient research related to vehicle inspectors; therefore, this study attempts to construct a set of competence items for vehicle inspectors, which can be referred to the faculty of automobile departments and professional lecturers in the training process of vehicle inspectors. To sum up, it is necessary to reach further understanding of vehicle inspectors' competence items in private vehicle inspection companies, which is the third research motivation of this study.

Based on research motivations, this study collected and summarised the literature related to vehicle inspectors. This was in order to construct and investigate vehicle inspectors' competence items, as well as to screen competence items for vehicle inspectors of private vehicle inspection companies, using a Delphi technique with experts. Therefore, the research purposes are:

1. To establish a complete competence items system for vehicle inspectors of private vehicle inspection companies;
2. To investigate the importance level for vehicle inspectors' competence items for private vehicle inspection companies.

### Competence Analysis

The concept of competence was first proposed by McClelland in 1973, and since that time, the term has been widely interpreted. According to Lysaght and Altschuld, competence is the external behaviour of an individual according to his/her knowledge, skills and attitude [7]. Weinert considered performance competence to be the knowledge, sentiment and skills required to undertake and complete a task [8]. Competence can be categorised into general and professional.

Competence indicates that an individual has acquired (through study or experience) the knowledge, skills and attitude required to perform particular functions in various aspects of life [9]. Competence is necessary for everybody's personal development, sense of citizenship, social integration and involvement [10].

The main purpose of analysing competence is to verify whether an individual possesses the knowledge, attitudes and skills required in the workplace [11][12]. The curriculum should be implemented and the process of analysing competence should determine whether competent individuals have attained the required standards [13]. It is suggested

that the term competence is used as a criterion for judging the success of performance. Competence frameworks have been applied in various settings, including the educational professionals recruiting and developing staff, as well as curriculum design [14-15].

## METHODOLOGY

The literature related to vehicle inspectors' competence was used as the research basis, and the authors applied *competence items* as the research framework to investigate and analyse the construction of competence items for vehicle inspectors of private vehicle inspection companies. Through the opinions provided by experts after they reviewed the questionnaire, this study has adopted the data collected from three rounds of implementing a Delphi technique and expert opinions to generalise and summarise and, then, screen out necessary competence items for vehicle inspectors of private vehicle inspection companies.

### Delphi Technique

The Delphi technique is designed as a group communication process for achieving a convergence of opinion on a specific real-world issue. The Delphi process has been used in various fields of study, including programme planning, needs assessment, policy determination and resource utilisation, and to explore or expose underlying assumptions, as well as to correlate judgments in many disciplines. The Delphi technique is well suited as a technique for consensus building by using a series of questionnaires delivered using multiple iterations to collect data from a panel of selected subjects [16].

The number of experts used in a Delphi technique is generally determined by the number required to constitute a representative pooling of judgments and the information-processing capability of the research team. Some authors suggest that 10-15 subjects could be sufficient, if the background of the Delphi technique subjects is homogeneous [17].

To investigate the integrity for each level, the authors selected four groups of Delphi technique experts, and the grouping methods are as in Table 1:

Table 1: Delphi technique experts sampling group analysis table.

Grouping order	Grouping property	Grouping population
1	Automobile expert group	4
2	Private vehicle inspection companies, vehicle inspectors group (practical worker group)	6
3	Private vehicle inspection companies, administrators group	3
4	Supervising authority, vehicle inspection personnel group	6
Total		19

The main tool used in this study was the *...Delphi technique survey questionnaire for vehicle inspectors' competence items of private vehicle inspection companies*, by means of collecting and analysing related items from the domestic and foreign literature. It was used initially to organise and analyse the competence items for vehicle inspectors of private vehicle inspection companies and, then, compiled and made into a draft of *...survey questionnaire for vehicle inspectors' competence items of private vehicle inspection companies*.

In addition, it was submitted to experts for further review, revised into an experts' validity-constructed questionnaire, then, the experts' validity-constructed questionnaire was used with a Delphi technique questionnaire survey to ask Delphi technique experts for their opinions and advice. After carrying out three rounds of revision, combining and adding/deleting items for such a questionnaire, and after obtaining consistency among experts' opinions, eventually a generalised and organised list of necessary competence items for vehicle inspectors of private vehicle inspection companies was prepared.

### Research Implementation

By using the Delphi technique method, three consecutive rounds of filling out a questionnaire were completed, focusing on the same objects of expertise with four different statuses to carry out the opinion collection and obtaining a common view. This section describes each phase of implementing the Delphi technique method:

1. Implementation of the first round Delphi technique questionnaire: implementing period of the first-round Delphi technique questionnaire was from January to February 2014, sending the questionnaire to Delphi technique experts to fill in, carrying out the confirmation or collection of the questionnaire, and collecting all the first-round questionnaires was accomplished before the end of March 2014;
2. Implementation of the second round Delphi technique questionnaire: the second-round questionnaire was based on the collected results of the returned first-round Delphi technique questionnaire, as well as added *mean* and

*standard deviation* data from the first-round questionnaire to compile the second-round Delphi technique questionnaire. The implementing period of the second-round Delphi technique questionnaire was from March to April 2014, sending the questionnaire, and confirming or collecting the second-round questionnaire had been completed before the end of April 2014;

3. Implementation of the third round Delphi technique questionnaire: the third-round questionnaire was based on the collected results of the returned second-round Delphi technique questionnaire, as well as added *mean* and *standard deviation* data from the second-round questionnaire to compile the third-round Delphi technique questionnaire. The implementing period of the third-round Delphi technique questionnaire was from April to May 2014, and after the confirmation of the questionnaire, the third-round questionnaire was completed before the end of June 2014.

#### Data Processing

This study was based on data from the literature, which was used to ask experts and scholars for their opinions and, then, for integrating and developing an initial competence domains and items. After being reviewed by experts and conforming to experts' validity standards, three rounds of Delphi technique questionnaire survey were employed.

In addition, after conforming to reliability and validity tests, it was used to investigate the consistency to assess the reliability and correctness of the collected data and analytic results. The data processing contained qualitative and quantitative sections, and SPSS statistical software was adopted to carry out the statistical analysis.

#### DATA ANALYSIS AND DISCUSSION

This study used a self-compiled *Delphi technique survey questionnaire of the competence items for vehicle inspectors of private vehicle inspection companies* to collect data, and according to the collected data of such questionnaire survey, it carried out statistical tests to understand competence items for vehicle inspectors of private vehicle inspection companies.

In accordance with the viewpoints and opinions from experts' and scholars' returned questionnaires, this study analysed the competence items for vehicle inspectors of private vehicle inspection companies, and identified the domains of the questionnaire that covered: 1) knowledge; 2) skills; 3) attitude; and 4) traits, and used the statistical data comprising mode, mean, SD and K-S One Sample Test goodness of fit for each domain.

#### First Data Processing Analysis of Delphi Technique Experts Questionnaire

This study was based on a Delphi technique method to carry out the survey in January 2014. Nineteen questionnaires were distributed, and all were returned. In addition, according to experts' viewpoints and opinions in the first returned questionnaire, this study was based on domains and items to summarise and analyse the mode, mean, SD and importance items.

- Major domains of competence items that are: 1) knowledge; 2) skills; 3) attitude; and 4) traits, and statistical analysis results of the Delphi technique experts' questionnaire are showed in Table 2.

Table 2: Four major domains of competence items - statistical analysis table.

Four major domains of competence items	Mode	Mean	SD	K-S test
Knowledge	5	4.84	0.375	2.203
Skills	5	4.63	0.496	1.756
Attitude	5	4.89	0.315	2.291
Traits	5	4.58	0.507	1.638

All experts' and scholars' assessment results of each domain by focusing on four major domains showed that the mean of each domain is more than 4.5, the SD is less than 1, and the mode was 5; therefore, there were no major differences among them. After carrying out the K-S One Sample Test, each domain has reached a significant level. Hence, the overall initial assessment results showed that Delphi technique experts' opinions reached appropriate levels of consistency and adaptability.

- Competence items: the seventeen items of car maintenance competence are: automobile inspection competence; language communication competence; automobile inspection ability; command of technology; problem-solving ability; environmental adaptability; good communication and interpersonal skills; teamwork skills; leadership competence; car maintenance competence; customer satisfaction orientation; enthusiasm for research and study; organisational identification; emotional management and control; occupational ethics and sentiment, and safety; hygiene literacy.

After carrying out statistical analysis on the Delphi technique experts' questionnaire, the results are shown in Table 3.

Table 3: Competence items - statistical analysis table.

Domains	Items	Mode	Mean	SD	K-S test
Knowledge	Car maintenance competence	5	4.632	0.496	1.756
Knowledge	Automobile inspection competence	5	4.895	0.459	2.346
Knowledge	Language communication competence	4	4.053	0.405	1.946
Skill	Automobile inspection ability	5	4.790	0.535	2.158
Skill	Command of technology	4	4.368	0.597	1.352
Skill	Problem-solving ability	5	4.579	0.507	1.638
Skill	Environmental adaptability	5	4.368	0.761	1.408
Skill	Good communication and interpersonal skills	5	4.526	0.612	1.567
Skill	Leadership competence	4	4.000	0.333	1.950
Skill	Car maintenance competence	5	4.263	0.806	1.279
Attitude	Customer satisfaction orientation	5	4.684	0.478	1.874
Attitude	Enthusiasm for research and study	4	4.158	0.502	1.800
Attitude	Organisational identification	4	4.368	0.598	1.352
Traits	Occupational ethics and sentiment	5	4.737	0.452	1.990
Traits	Safety and hygiene literacy	5	4.579	0.607	1.690

All experts' and scholars' assessment results of each item focus on seventeen items. It can be seen that the mean of each item is more than 4 and some of competence items are more than 4.5. The inspection mode was either 4 or 5; thus, they did not have major differences among them. Therefore, the initial assessment results showed that Delphi technique experts' opinions have reached appropriate levels of consistency and adaptability.

#### Second Data Processing Analysis of the Delphi Technique Experts' Questionnaire

For all experts' assessment results of each item that focused on domains and items, the modes of all items are more than 4, and SD are less than 1; thus, under this initial determination, there were no differences in experts' opinions. In terms of questionnaire opinions, all experts thought that there was no need to revise the questionnaire. Thus, the overall initial assessment result is that Delphi technique experts' opinions have a certain consistency and adaptability.

#### Third Data Processing Analysis of the Delphi Technique Experts' Questionnaire

For all experts' assessment results of each item that focused on domains and items, the modes of all items are more than 4, and SD are all less than 1; thus, under this initial determination, there are no differences in experts' opinions. After implementing the K-S One Sample Test, it was discovered that two items did not reach a significant level, which meant the experts did not have identical opinions about the items; and for the questionnaire opinions, 15 experts thought that there was no need to revise the list of items. Therefore, the overall initial assessment results showed that Delphi technique experts' opinions have not yet reached the required consistency, but each item had its own adaptability.

### CONCLUSIONS

By using the Delphi technique experts' survey, analysing and discussing the comprehensive results of this study, the following conclusions can be reached: 1) seventeen competence items divided into four domains can be used for vehicle inspectors of private vehicle inspection companies; and 2) the findings of this study concerning the competence items show that the ordering of these four domains at the first level is according to their own priority. Attitude and knowledge are the most important domains of vehicle inspectors' competence items, whereas the domain of attitude belongs to hidden competences. As has been pointed out by Spencer and Spencer, this is also difficult to change [18]. However, the experience and related educational training could be used to change them.

Analysis of the vehicle inspectors' second level of competence items in order of priority shows that automobile inspection competence and automobile inspection ability are the more important items for vehicle inspectors of private vehicle inspection companies, followed by car maintenance competence; customer satisfaction orientation; emotional control management and occupational ethics and sentiment. Then, follow problem-solving ability and good communication and interpersonal skills.

The results of this study provide guidelines for vehicle inspectors of private vehicle inspection companies, and can be used as a reference for the development of instructional materials. The research finding could be a reference framework for planning and developing vehicle inspection courses in college education and industrial training.

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