

The Behaviour of Consumer and Strategy of Development of Legal Metrology Performance

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Abstract

This study explores the knowledge, attitude, and practice (KAP) in legal metrology since there is very little information on knowledge, attitude, and practice concerning legal metrology. The survey data gathered from 24.360 respondents across 34 provinces in Indonesia assessed the understanding concerning legal metrology by applying descriptive statistics, correlation, and multinomial regression analysis. The results show the consumers generally have better knowledge in legal metrology, an excellent attitude about the importance of legal metrology, and critical behaviour in mitigating fraudulence risk when doing trade transactions at the marketplace. Variable of gender and age tends to impact knowledge, attitude, and practice concerning legal metrology issues. The study also found that the relationship between knowledge, attitude, and practice is likely to be non-linear. The outcomes of exploring the behaviour of consumers through knowledge, attitude, and practice in legal metrology can be beneficial for legal metrology authorities to analyze the impact of setting policies and programs. Also, to develop a strategy to increase public awareness in legal metrology so that the consumers can be more critical in protecting themselves from various fraudulence in measurement in trade transactions.

Keywords: KAP, Consumer Behaviour, Legal Metrology, Level of Understanding

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I. Introduction

Traditional legal metrology authorities have established a legal metrological system to protect consumers from fraudulent activities (Bošnjaković et al., 2018, OIML, 2011, OIML, 2020, Rodrigues Filho and Gonçalves, 2015). Unfortunately, many consumers lack of understanding of the system. They pay less attention to metrological services (e.g., verification and inspection of measuring instruments used for trade and net content of prepackaged products) that guarantee the accuracy and reliability of measurements around them. Although 100 percent of population of an economy are consumers who contribute to national income, they are also the most vulnerable group to deception, unfair and fraudulent practices in legal metrology (OIML, 2020). Therefore, it is relevant that a framework on consumer education and awareness of legal metrology is in place to safeguard their interest.

The majority of previous studies on legal metrology such as Birch (2003), Novikovas (2012), Rodrigues Filho and Gonçalves (2016), Rodrigues Filho et al. (2016), and Rodrigues Filho et al. (2018) have not been focused on consumer perception in legal metrology, with only a few such as Ardianto (2012) and Ardianto (2013) explicitly dealing with the consumer's fraudulence risk in legal metrology. This study addresses the gap in consumer behaviour in the field of legal metrology. The innovation of this study is twofold. First, the research uses the KAP approach, which is the first time in a legal metrology study that analysis in the legal metrology field has been taken at consumer's side by assessing their knowledge, attitude, and practice. Second, the research aims to identify the level of understanding of the consumer in legal metrology and explore the underlying relationship between the level of understanding and the performance of legal metrology authorities in providing a metrological performance.

Furthermore, the understanding of the performance of legal metrology authorities can improve if the level of consumer's understanding of legal metrology can be explored to assess their relationship with the fraudulence risk in measurement. Such an approach can potentially broaden the scope of current research beyond a simple descriptive analysis of consumer understanding in legal metrology, including spatial autocorrelation modelling on how legal metrology authorities' performance is distributed.

This paper is organized into six sections. The following section presents a theoretical framework that explains the dimension of knowledge, attitude, and practicality in shaping the understanding of consumers in legal metrology. The research methodology adopted in this study is presented in Section 3, followed by the key findings from the survey results in Section 4. Section 5 discusses the policy implications of the key findings. The final section concludes this study along with setting up the agenda for future research.

II. Literature Review

An understanding, in general, is defined as a constructive process related to the ability and actions to understand, explore and remember the meaning of the perception of both oral and visual stimuli. Understanding also refers to knowing any information or message and perceiving it in many ways. The understanding of an individual can help develop the individual's potential and solve the problems. The understanding of society is a process in achieving goals, legislation, norms, and other socio-cultural aspects that have been owned, agreed upon, and taken into force by the community.

The understanding is composed of three main elements, which are knowledge, attitude, and practice. It is known as the KAP approach. Knowledge explores the extent to which an individual or community understands various aspects related to legal metrology. Attitude explores the perceptions of the community towards various aspects related to legal metrology and to what extent the strength of these attitudes in the community. While practices determine the community's behaviour in supporting or being actively involved in legal metrology activities and the extent to which these behaviours have become part of the daily process of the community.

In the last two decades, there are many seminal studies exploring knowledge, attitude, and practice to understand the behaviour of people or a group of people in specific fields such as health (Amarasekara et al., 2016, Awad and Aboud, 2015, Watkins et al., 2015, Zhang et al., 2020), food safety (Elinda-Patra et al., 2020, Lee et al., 2017, Sayuti et al., 2020, Sharafi et al., 2018), nutrition (Kigaru et al., 2015) and education (Adeolu et al., 2014). Table 1 summarises the literature review of seminar research on assessing people's behaviour by exploring their knowledge, attitude, and practice in various fields such as health, education, food safety, and food nutrition. However, there is very little information on knowledge, attitude, and practice for legal metrology.

Various factors can affect knowledge, attitude, and practice. For instance, Radhakrishnan et al. (2000) and Sharafi et al. (2018) argue that age and gender are factors that have a contribution to influence knowledge, attitude, and practice. Older people tend to have better knowledge, attitude, and practice than younger people in particular issues. The knowledge may increase from experience facing specific problems.

Elinda-Patra et al. (2020) state that not only age and gender, the level of education is also likely to have a contribution in knowledge, attitude, and practice. In her study in food safety, an individual with higher education has a piece of better knowledge about food safety. The groups also have a better attitude when handling the food such that to minimize the risk. Similarly, Jha et al. (2017) and Zhang et al. (2020) also find that education background influences knowledge, attitude, and practice in relevant fields. In some fields, training experience also influences the understanding of any information. The trained individual or a group of individuals tends to have better knowledge and experience, behaving better in handling the risk (Sayuti et al., 2020, Sharafi et al., 2018).

Socioeconomic is also a variable that is affecting the level of understating. The economic situation of the individual or community is often related to how they can access sources of information and is often related to educational background. Employment and monthly income are examples of variables that can influence the knowledge, attitude, and

practice regarding relevant information (Awad and Aboud, 2015, Križan et al., 2018, Pandian et al., 2006). Meanwhile, Social class shapes individual behaves and acts in certain information (Bakshy et al., 2012, Borgatti and Cross, 2003). Social class tends to have similar values, interests, and behaviours. Rebecca (2015) contends that the effective dissemination of information to reach the understanding of individuals or groups of individuals about specific information is dependent on the social characteristics of the group in which the individual is involved as a member. Rahman et al. (2016) show that religion, marriage, and ethnicity contribute to knowledge, attitude, and practice regarding food safety. Similar results are also indicated in the study of Jha et al. (2017) and Mirmiran et al. (2010).

Table 1. Literature Review on the Seminal Research on Knowledge (K), Attitude (A), and Practice (P)

Studies	Field	Technique	K	A	P	Analyzed Influencing Factors
Larsson and Enander (1997)	Disaster	Statistics descriptive		x		-
Radhakrishnan et al. (2000)	Health	Statistic analysis	x	x	x	Gender, age
Pandian et al. (2006)	Health	Statistic analysis	x	x	x	education, employment, and marriage.
Mirmiran et al. (2010)	Health	Khi-test	x	x	x	Age, education, marital status
Sharif and Al-Malki (2010)	Food safety	Statistic analysis	x	x	x	Gender, discipline
Sanlier and Konaklioglu (2012)	Food safety	Statistic analysis	x	x	x	gender
Adeolu et al. (2014)	Education	descriptive statistics	x	x	x	Gender, age, class
Ma et al. (2014)	Health	Power analysis, multivariate logistic regression	x			-
Awad and Aboud (2015)	Health	Descriptive and multivariate logistic regression	x	x	x	Gender, age, marriage, education level, residence, income, personal health
Kigaru et al. (2015)	Nutrition	Statistics descriptive	x	x	x	-
Watkins et al. (2015)	Health	Statistics descriptive	x	x		-
Al-Shabib et al. (2016)	Food safety	Correlation analysis	x	x	x	-
Amarasekara et al. (2016)	Health	Statistic analysis, ANOVA, post hoc test	x	x	x	Socio-demographic, anthropometric indices
Rahman et al. (2016)	Food safety	Multinomial regression analysis	x	x	x	Age, gender, education, religion, ethnicity, citizenship, family size, marital status, duration of food vending
Jha et al. (2017)	Medicine	Statistic analysis	x	x	x	Gender, profession, ethnicity, education,
Lee et al. (2017)	Food safety	statistical analyses	x	x	x	-
Križan et al. (2018)	Trade	Spatial distribution				gender, age, education, income
Sharafi et al. (2018)	Food safety	Prevalence ratios and linear regression	x	x	x	age, education level, training.
Sharma et al. (2018)	Energy consumption	Statistics descriptive		x		Rural/urban, education,
Soon (2019)	Food	Structural Equation Modelling	x	x	x	age
Elinda-Patra et al. (2020)	Food safety	Partial Least Square Structural Equation Modelling	x	x	x	Age, gender, education, income

Studies	Field	Technique	K	A	P	Analyzed Influencing Factors
Sayuti et al. (2020)	Food safety	Descriptive statistics, regression analysis and indirect method	x	x	x	Age, gender, race, education, course of study, faculty of education, CGPA, training
Zhang et al. (2020)	Health	Statistic analysis	x	x	x	-

Figure 1 shows the relationship between knowledge, attitude, and practice. In some works of literature, such as Muleme et al. (2017), Pan et al. (2017), and Aiga et al. (2016), the relationship among those dimensions is likely to be a linear association. Changes in people's behaviour (practice) linearly come from deep/strong understanding (knowledge), forming a positive attitude, and changes in daily behaviour. However, behaviour change can also occur in a non-linear relationship (Siltrakool, 2018, Supriya and Ramaswami, 2013). The knowledge, for instance, in legal metrology, can contribute to increasing the attitude and practice of an individual or a group of individuals when doing trade transactions. Better knowledge can lead to a better attitude in perceiving the importance of legal metrology. It also can lead to a better practice to be more critical when facing an unfair measurement when having trade transactions. On the other hand, the attitude of belief of the importance of legal metrology can lead to the behaviour to seek further information in legal metrology to underpin legal metrology's perception itself. A better attitude, of course, can lead an individual to be more active when facing fraudulence risk in measurement in a trade transaction.

Similarly, the criticism behaviour in practice can lead individuals to seek advanced information to increase the knowledge and confidence concerning legal metrology. This behaviour might be a part of further efforts underpinned when individuals comply or defend their rights in court. In the end, all dimensions: knowledge, attitude, and practice in legal metrology, are expected to contribute to increased performance of legal metrology done by legal metrology authorities.

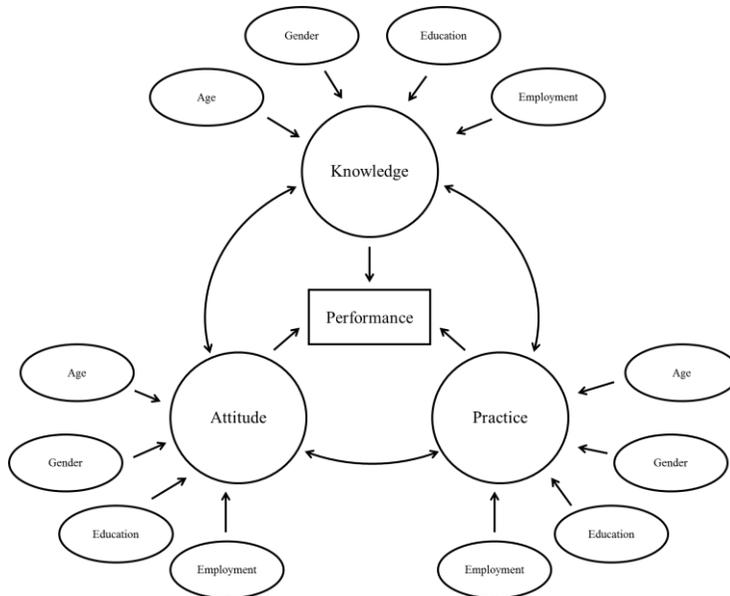


Figure 1. Framework of the relationship between an understanding of consumers in legal metrology and service performance done by legal metrology authorities

III. Research Methodology

3.1 Study area

Legal metrology in Indonesia is performed under Legal Metrology Act No. 2 of 1981. Based on this act, the government issues technical regulations under Ministerial Decree specify the legal units, pattern/type approval, verification, pre-packaged products, the sanction, and the surveillance of measuring instruments. Since the enforcement of the Autonomy Law in 2014, the regional verification offices are under the administration of the District Government (regency/city level) and DKI Jakarta Government. The changing administration structure has impacted the legal metrological structure. The country now has a multi-centric legal metrology structure with 404 legal metrology authorities spread across 34 provinces. Each of which is responsible for providing legal metrological services such as verification and inspection of measuring instruments for trading purposes and disseminating legal metrology.

Confronting with the fact that Indonesia, as an archipelago country with a population of 225 million, it is challenged to shift from the traditional legal metrology approach. The change focuses on providing an infrastructure for performing services (e.g., verification and inspection) to ensure fair trade in measurement to a community approach that promotes intelligent behaviour. The community approach puts the consumer at the centre of the decision. In contrast, the traditional approach focuses on technical solutions, which may be more challenging to achieve because of the long-time and relatively high cost, especially for developing countries.

To promote the community approach, strategically, Indonesian planners need to evaluate the nature and characteristics of consumers and the methods for promoting and educating the community about legal metrology in Indonesia. Mapping their level of understanding covering knowledge, attitude, and practice enables the identification of the behaviour of consumers that can be targeted more efficiently. It also uses limited Indonesian legal metrology authorities' resources to promote education and social campaign in legal metrology.

3.2 Data

Data used in this study is gathered from a survey of 24,360 respondents representing 34 provinces in Indonesia. The total number of the respondent is calculated by the Slovin method, which is a standard method used in the social study to determine the sample size considered the population size and specific margin error (Ellen, 2017, Slovin, 1960). For this study, the population is chosen of 140,218,352 people aged above 18 years old; this age variable refers to consumer protection based on Consumer Protection Act No 8 of 1999 of the Republic of Indonesia. Proportional random sampling is applied in which all provinces are chosen as samples. Then, the size of respondents representing cities and regencies across the province is determined with a 0,01 percent margin error.

The respondents' demographic is shown as follows, from a total of 24,360 respondents, there were 56.2 percent female respondents and 43.8 percent male respondents. About 83.9 percent of respondents were in the productive age of 18-35 years. Most of the respondents have an education background of senior high school graduation (40.6 percent and tertiary education (Diploma and bachelor's degree), 52 percent. About 24.6 percent of

respondents are students, 20.7 percent private employees, and 16.3 percent are entrepreneurs (see Figure 2).

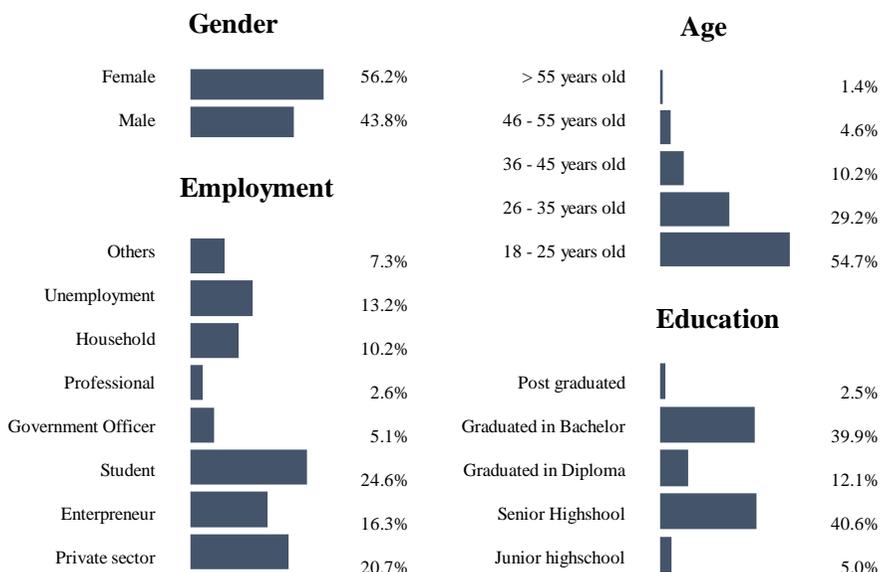


Figure 2. Demographics of 24,360 respondents

This quantitative methodology in gathering data is used through an online survey with a structured survey questionnaire. There are 13 indicators grouped into three dimensions to explore the understanding of consumers in legal metrology: four indicators for knowledge, four indicators for attitude, and five indicators for practices (see Table 2).

Table 2. The Dimensions and Indicators used in the survey

<i>Dimension</i>	<i>Indicators</i>
Knowledge	<ol style="list-style-type: none"> 1. Identification of laws and regulations concerning legal metrology governing the protection from fraudulence in measurement in trading activities. 2. Identification of how to use measuring instruments properly before transaction. 3. Identification of valid verification mark/seal. 4. Identification of the use of measurement unit and its symbols
Attitude	<ol style="list-style-type: none"> 1. The consideration that prepackaged products sold in the market must put net contents in its label. 2. It is important to have a law or regulations to protect consumers from fraudulence in trading goods and services. 3. It is essential to ensure that measuring instruments used for trade shall be marked with a valid verification mark/seal. 4. The consideration that the net contents of the prepackaged product must not be less than the nominal stated in the label.

<i>Dimension</i>	<i>Indicators</i>
Practice	<ol style="list-style-type: none"> 1. Having behaviour checking the condition and the use of measuring instrument used for trade before a transaction 2. Having behaviour or experience in recognizing any fraudulence in measurement (e.g., bought a product with the lesser weight, doubting a fuel dispenser has an illegal component influencing the measurement.) 3. Having behaviour checking, there is an information of netto put in the label of prepackaged products. 4. Having behaviour comparing the net contents of prepackaged products with the information on its label. 5. Having behaviour or experience complaining if there is a mismatch in the trader's weight or volume of purchased goods.

The validity and reliability test was applied to ensure that indicators represented by questions on the questionnaire are valid and can be used to measure each dimension's scoring: Knowledge, Attitude, and Practice. The number of respondents used for the validity and reliability test was 9,105 respondents. The Cronbach Alpha test was then applied for the test, with the results as follows:

Table 3. Cronbach Alpha for Validity and reliability test

Dimension	Cronbach Alpha value	Decision
Knowledge	0.615	indicators measured in the dimension are valid and have relatively good reliability (consistency)
Attitude	0.869	indicators measured in the dimension are valid and reliable
Practice	0.752	indicators measured in the dimension are valid and reliable

Overall, the indicators measured in each dimension are valid and reliable over the significance level of 5 percent. It means that the questions constructed consistently compose the scoring of each dimension. The questionnaire can be used and was then distributed to 24,360 respondents from 34 provinces in Indonesia.

Data gathered from the portal of the Directorate of Metrology Ministry of Trade the Republic of Indonesia (<https://metrologi.kemendag.go.id>) was aggregated with survey data to address the analysis of the relationship between consumer understanding in legal metrology and the performance of legal metrology services done by local legal metrology authorities.

The descriptive analysis was used to compose respondents' demography profiles such as age, gender, educational background, and employment. To analyze the relationship between demography and legal metrology knowledge, attitude, and practice, the correlation analysis, and multinomial regression analysis was used based on the respective scores of knowledge, attitude, and behaviour by Pearson correlation (PASW Statistics 18), at 95% confidence level (significant if the p-value < 0.05).

IV. Result and Key Findings

4.1 The Level of Understanding in Legal Metrology

The survey results show that Knowledge Score is about 69.72, meaning that respondents have a good understanding of legal metrology. More than 70 percent of the

respondents have already known using measurement units and its symbol for "millimetre" and "kilogram." More than 60 percent had known the correct writing of the "grams" with "g" not "gr." However, for using the symbol of "meter," only 24.0 percent of respondents can answer correctly. Most of them are still using "M" instead of "m."

To know the use measuring instrument properly before the transaction, 90.8 percent of respondents notice the fuel dispenser displaying "zero" before filling starts. About 89.0 percent notice that the scales indicator has stopped moving when reading the results, and 87.3 percent notice that the scales must be placed on a level or not tilted. However, for the knowledge of the existing law and regulation concerning legal metrology, only 59 percent of respondents know the legislation that protects consumers from fraudulence in measurement. Interestingly, it was found that more than 83% of respondents did not know or had never seen a verification mark/seal put in the measuring instrument indicating that the measuring instrument is valid for trade purposes. Overall, these results lead to a 69.72 knowledge score.

For Attitude Score, the results show that it is at a level of 81.45, meaning that respondents have an excellent attitude that is important to measure when doing transactions. About 50.2 percent of respondents agree that it is necessary for all pre-packaged products sold at the market shall be put information about net contents on their label. Another 48.1 percent is agreed that the actual net contents of the pre-packaged product must not lesser than the nominal stated in its label. Most respondents agree that measuring instruments used for trade shall have a valid verification mark/seal to ensure that the measuring instruments have good accuracy and accurate measurement results.

In practice, the survey results show that 55.2 percent of respondents tend to check the condition of measuring instruments before transactions regularly. About 59.5 percent can recognize if there is fraudulence in measurement or not. In terms of critical behaviour, about 56.5 percent of respondents are active in submitting complaints to the trader of the call centre if there is a mismatch measurement.

4.2 Factors influencing the consumer's behavior in legal metrology

Figure 3 to Figure 6 shows how some variables such as age, education background, gender, and employment influencing the consumer's behavior in legal metrology through the three dimensions: knowledge, attitude, and practice. Figure 3 shows the boxplot of the dimension against age. It reveals that there is no significant impact of the age of respondents to the level of attitude and practice. Each age range, on average, has similar scores of attitudes that agree with the importance of legal metrology concerning proper measurement in a transaction. Similarly, the same result is shown in the practical dimension, which in overall, the score of practical against a group of respondents based on the age tends to be equal. However, for the knowledge, a group of over 46 years old and 18-25 years old have a better knowledge level than others. There might be a reason for the different levels of knowledge corresponding to any education program done by legal metrology authorities and the changing of the legal metrology system over the last four decades.

Figure 4 shows the relationship between the educational background and the dimension. It can be seen that for the level of knowledge, all groups tend to have a similar score, meaning that the information about legal metrology concerning legislation,

verification mark/seals, and others are likely understood similarly by all groups. Meanwhile, for the attitude, people with higher education such as Diploma, Bachelor degree, and Post Graduated have a better attitude about the importance of measurement when doing the transaction. They agree that it is important that prepackaged products sold in the market shall put net contents in its label, to have a law or regulations to protect the consumer from fraudulence in measurement in trading goods and services. It is important to ensure that measuring instruments used for trade shall be marked with a valid verification mark/seal. The group of people with higher education backgrounds also tends to have a better practice behaviour that is more critical than other groups. They tend to regularly check the condition of measuring instruments before the transaction, making a complaint when mistreated in the transaction.

In gender, both male or female has a similar level of behaviour either in knowledge, attitude, and practice. Figure 5 shows there is no significant difference between gender and each dimension. Interestingly, Figure 6 shows a significant impact of employment on each dimension. Households and entrepreneurs are a group of people with lesser knowledge levels in legal metrology than other groups. Students and government officers tend to have a better knowledge of legal metrology. At the attitude level, a group of government officers is likely to have a higher score, meaning that they are more considering that the role of measurement in doing a transaction is crucial. The fraudulence risk in measurement can be mitigated.

Conversely, group of household tends to have a lower agreement that the role of legal metrology in doing transactions. It can be revealed that there might another considered factor instead of legal metrology within this group when doing transactions. Interestingly, although a household group tends to have a lower level of agreement about the importance of measurement in the transaction, people in this group are likely to have better critical behaviour than others. They tend to have more complaints when being a victim of fraudulence in measurement.

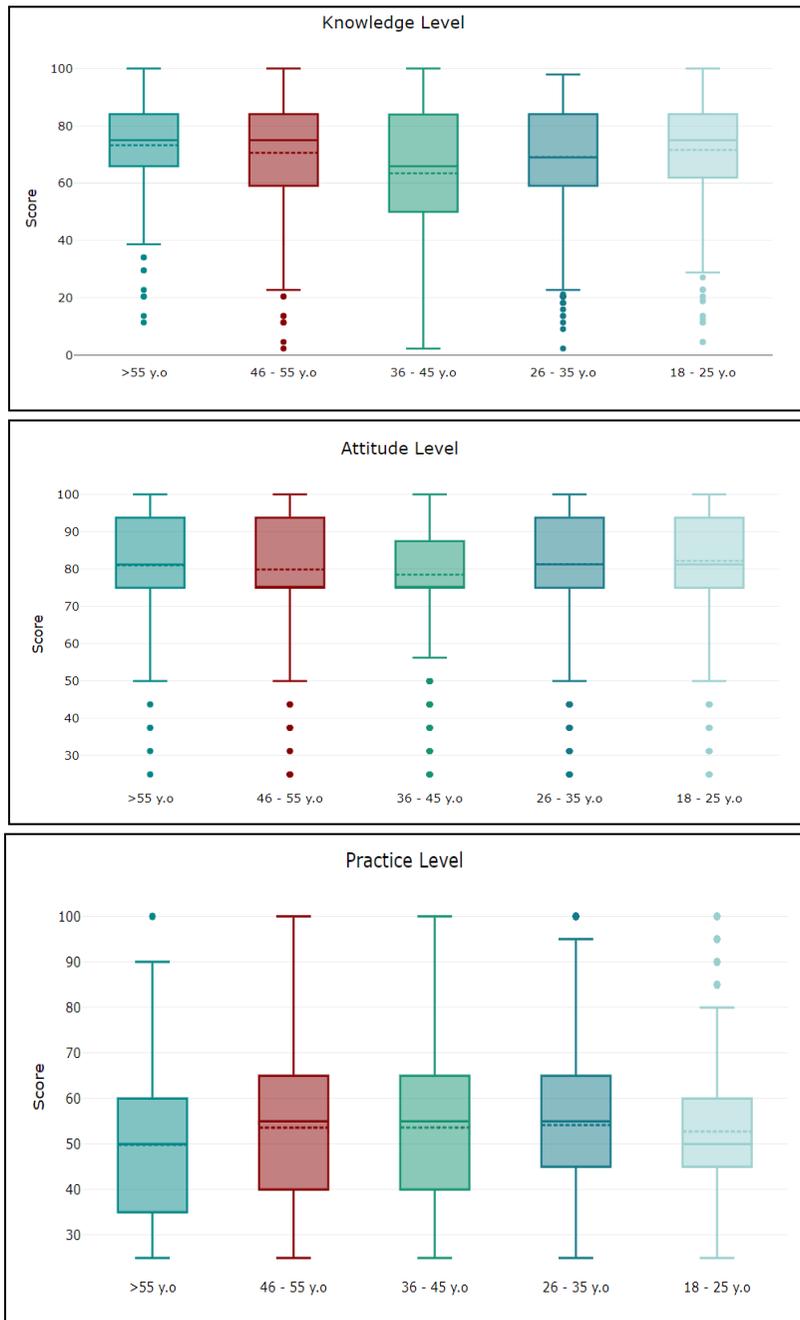


Figure 3. Boxplot of Age against Dimensions: Knowledge, Attitude, and Practice

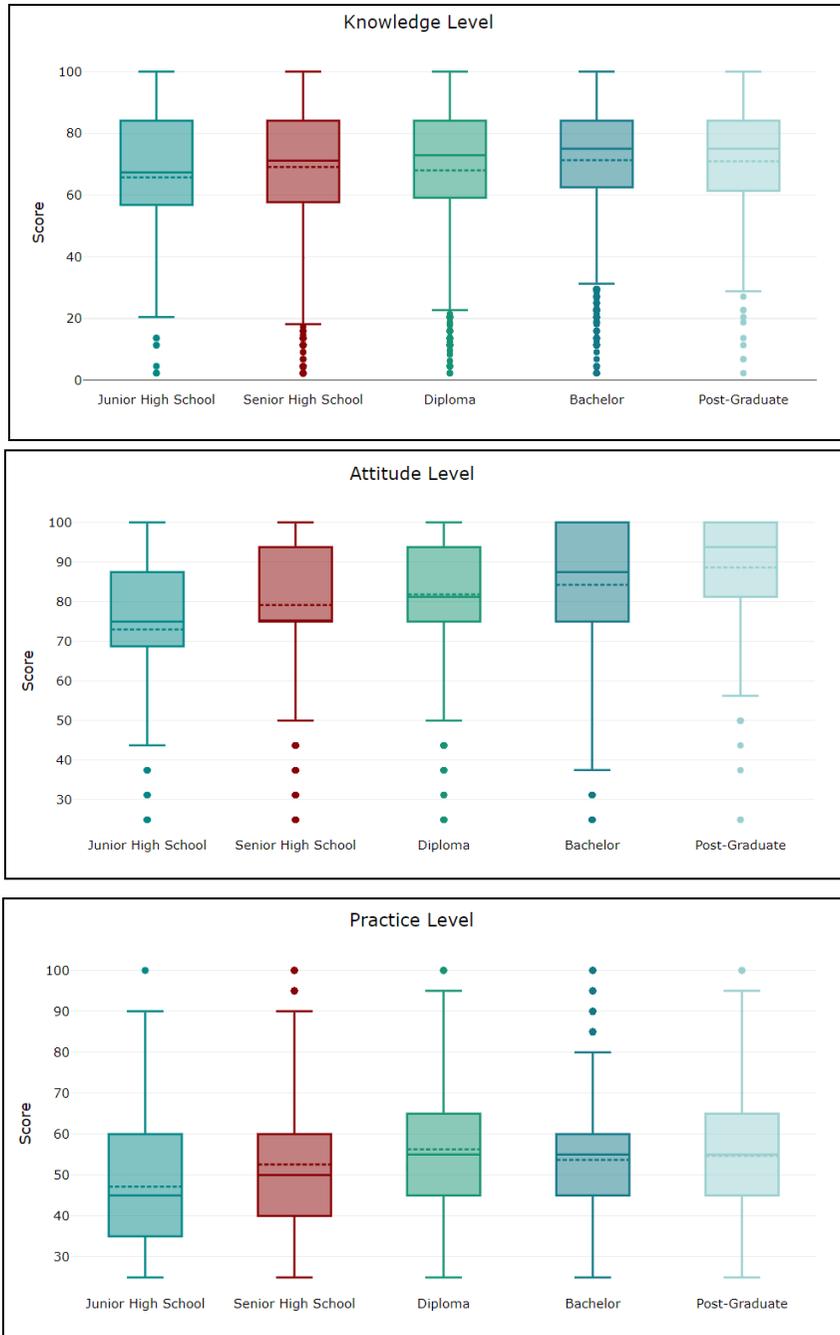


Figure 4. Boxplot of Education Background against Dimensions: Knowledge, Attitude, and Practice

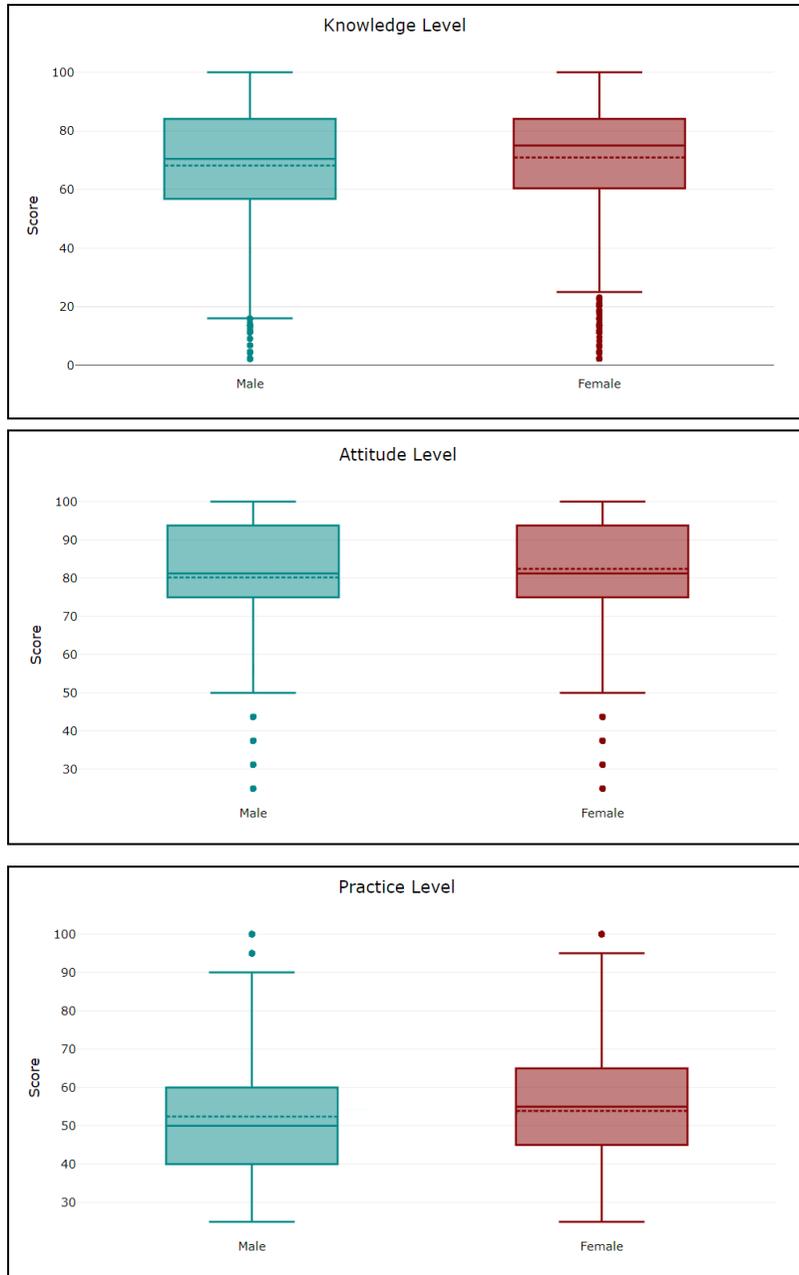


Figure 5. Boxplot of Gender against Dimensions: Knowledge, Attitude, and Practice

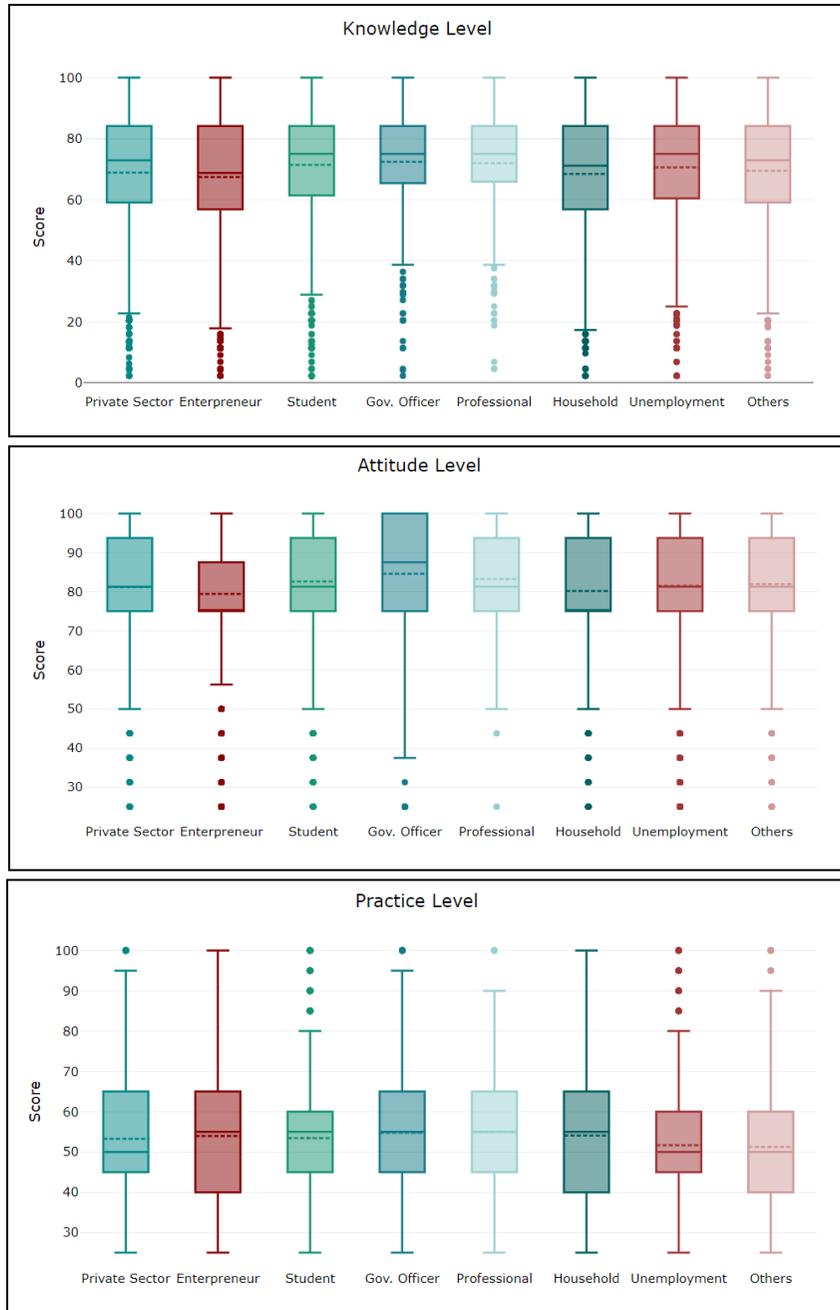


Figure 6. Boxplot of Employment against Dimensions: Knowledge, Attitude, and Practice

Table 4 shows the influence of variables in knowledge, attitude, and practice in legal metrology. Variable of gender, age, and education are likely to have a significant influence on knowledge level. Meanwhile, the employment variable tends to have no significant influence on knowledge ($p > 0.05$). For attitude, only variables of gender and age have a significant influence on attitude in legal metrology. At the same time, employment and education are likely to have no significant impact on attitude ($p > 0.05$). A similar result is also shown in practice for legal metrology. Employment and education variables have p -value greater than 0.05 (a significant level) such that those variables are indicated not to contribute to practice.

Table 4. The influence of variable into dimension: Knowledge, Attitude, and Practice

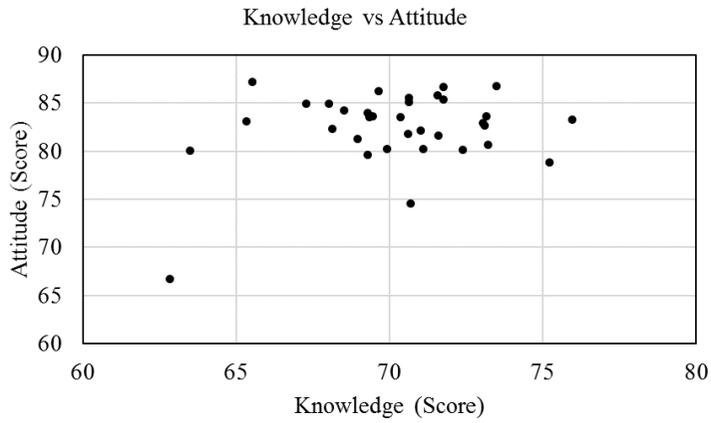
Dimension / Variables	Coefficient	Standard error	t-statistic	P-Value	Lower95%	Upper95%	VIF
Knowledge							
Gender	2.703	0.236	11.430	0.000	2.239	3.166	1.061
Age	-0.798	0.125	-6.364	0.000	-1.044	-0.553	1.038
Employment	0.045	0.052	0.873	0.383	-0.056	0.146	1.049
Education	0.491	0.099	4.955	0.000	0.297	0.685	1.029
Attitude							
Gender	2.034	0.203	10.004	0.000	1.635	2.432	1.061
Age	-0.929	0.108	-8.617	0.000	-1.141	-0.718	1.038
Employment	-0.052	0.044	-1.182	0.237	-0.139	0.034	1.049
Education	-0.022	0.085	-0.257	0.797	-0.189	0.145	1.029
Practice							
Gender	1.600	0.196	8.153	0.000	1.215	1.984	1.061
Age	0.323	0.104	3.100	0.002	0.119	0.527	1.038
Employment	0.083	0.043	1.935	0.053	-0.001	0.166	1.049
Education	-0.030	0.082	-0.369	0.712	-0.191	0.131	1.029

4.3 Correlation between the level of understanding and the performance of designated bodies in legal metrology service

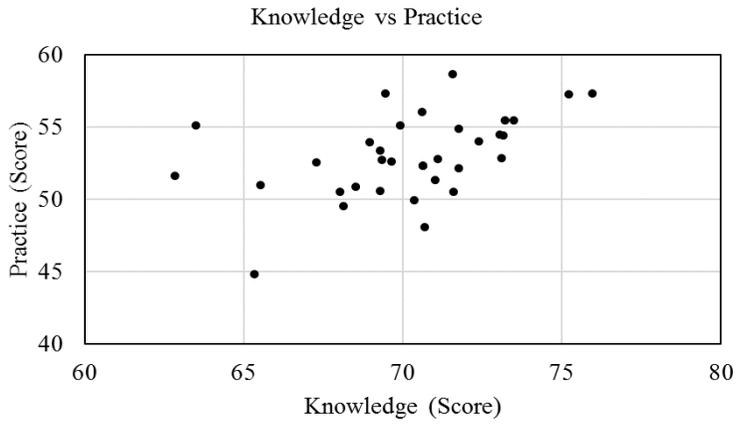
Figure 7 shows the correlation between knowledge, attitude, and practice in legal metrology. It is pretty interesting from the finding of the correlation between each dimension. The trend of the correlation is not linear. Figure 7 (a) shows the correlation between knowledge score and attitude score ($r_s = 0.256$). It can be seen that although the knowledge of legal metrology is increasing, the attitude score is likely to remain at the same level (in this case, at the high level).

Figure 7 (b) shows the correlation between knowledge and practice in legal metrology. The relationship between these dimensions is likely to have a linear relationship ($r_s = 0.477$). If the knowledge is increasing, then the practice score also increases, which means that the knowledge about legislation of legal metrology, verification mark/seals, and other issues about weight and measure might increase the behaviour of respondents to be more aware of legal metrology. They tend to be more critical if being a victim of fraudulence in measurement; they are likely to be more active in checking measuring instruments used for trade prior transactions. It is a natural phenomenon in consumer behaviour.

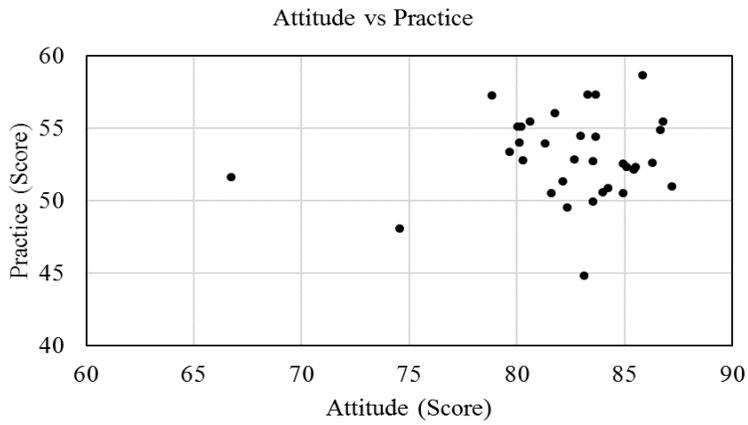
Figure 7 (c) shows the relationship between attitude score and practice score. From this figure, the correlation between those variables tends towards zero ($r_s = 0.095$). Consumers may find the importance of legal metrology, but there is no desire to be more concerned about it.



(a)



(b)



(c)

Figure 7. The correlation between (a) knowledge and attitude, (b) knowledge and practice, and (c) attitude and practice

This study also studies the relationship between each dimension: knowledge, attitude, practice, and legal metrological performance by corresponding legal metrology authority (see Figure 8). Figure 8 (a) shows the relationship between knowledge and legal metrological performance, such as verification activities. The correlation between those variables tends to zero ($r_s = 0.024$). Although it is expected that the more respondents know about legal metrology, it has an impact to increase the performance of legal metrology authority. Figure 8 (b) shows the correlation between attitude and legal metrological performance. There is a slight relationship between those variables ($r_s = 0.027$). Figure 8 (c) shows that the relationship between practice and performance is a non-linear trend ($r_s = 0.226$). Although the behaviour of respondents at a moderate level, the performance of legal metrology authorities to do verification of measuring instruments is likely to remain at the same level.

In sum, there are four key findings. **First**, the score of each dimension has greater than 50 percent, which refers to respondents, generally have good knowledge in legal metrology, an excellent attitude that believes the importance of legal metrology's role in doing the transaction. They also believe moderate practical behaviour leads to critical behaviour in minimizing the fraudulence risk when doing transactions.

Second, gender, age, and education background are likely to impact the knowledge dimension of the respondents concerning legal metrology issues. However, only gender and age tend to have a significant contribution to attitude and practice dimensions. An influencing variable like age is likely to correlate negatively, meaning they have less knowledge of legal metrology than younger groups as people get older.

Third, the relationship between knowledge, attitude, and practice tends to be non-linear relationships. Although the knowledge about legal metrology is increasing, the respondent's attitude tends not to increase and knowledge score, but it is likely to remain at the same level. It reveals that either respondent knows or understands legal metrology (e.g., legislation, verification mark); respondents tend to believe that legal metrology is essential to ensure fair measurement and mitigate the fraudulence risk in measurement when doing transaction.

Fourth, the study found a relationship between respondents' understanding of legal metrology performance levels done by legal metrology authorities. The better respondents' knowledge about legal metrology, the better performance of legal metrology services indicated by increasing the number of verified measuring instruments.

(c)

Figure 8. The correlation between legal metrology performance done by legal metrology authorities and: (a) knowledge, (b) attitude, and (c) practice

V. Discussion and Planning implication

There is new evidence based on the correlation between each dimension of the behaviour of consumers in legal metrology. The behaviour of respondents in legal metrology, in many respects, is a manifestation of the general consumer behaviour concerning legal metrology in their social and situation indicated by age, gender, education background, and employment. The generalized notion of the respondents does not necessarily provide insight into the need of high-risk groups. The main task is to explore how individuals or groups of individuals behave under knowledge, attitude, and practice. If legal metrology authorities are to meet the behaviours of society, they must first understand those behaviours.

The traditional legal metrology authorities have been focused on increasing the performance of their services, providing verification and inspection of measuring instruments. The focus has been underestimated on the consumer's behaviour, which contributes to aid legal metrology authorities to reach their goal. Better knowledge and attitude and more critical practice might increase the business or trader's responsibility to provide valid measuring instruments used in trade in such a way. Mapping the behaviour of consumers in legal metrology can be beneficial for legal metrology authorities to analyze the impact of setting policies and programs to develop a strategy to increase public awareness in legal metrology. This action is needed so that the consumers can be more critical in protecting themselves from various fraudulence in measurement in trade transactions.

VI. Conclusion

In this paper, exploring the relationship of consumer behaviour, attitude, and practice dimension of consumer concerning legal metrology enriched the understanding of consumer behaviour. There are some key findings from the study. First, the respondents generally have better knowledge in legal metrology, an excellent attitude about the importance of legal metrology, and critical behaviour in mitigating fraudulence risk when doing transactions. Second, gender and age tend to impact the respondents' knowledge, attitude, and practice dimension concerning legal metrology issues. Third, the relationship between knowledge, attitude, and practice is likely to be non-linear relationships. Fourth, there is a relationship between the behaviour of respondents and the level of legal metrological performance done by legal metrology authorities.

The outcomes of exploring the behaviour of consumers in legal metrology can be beneficial for legal metrology authorities to analyze the impact of setting policies and programs to develop a strategy to increase public awareness in the field of legal metrology. The rise of public awareness will allow consumers to protect themselves from various fraudulence measurements in trade transactions.

However, although the methods are general, the results indicate that the

relationship in consumer behaviour of legal metrology through its three dimensions cannot be generalized. One needs to consider the more respondents and the different geographical characteristics, including socioeconomic and demographics.

References

- ADEOLU, A., ENESI, D. & ADEOLU, M. 2014. Assessment of secondary school students' knowledge, attitude and practice towards waste management in Ibadan, Oyo State, Nigeria. *Journal of Research in Environmental Science and Toxicology*, 3, 66-73.
- AIGA, H., NGUYEN, V., NGUYEN DINH, C., NGUYEN, T. & NGUYEN, L. 2016. Knowledge, attitude and practices: Assessing maternal and child health care handbook intervention in Vietnam. *BMC Public Health*, 16.
- AL-SHABIB, N. A., MOSILHEY, S. H. & HUSAIN, F. M. 2016. Cross-sectional study on food safety knowledge, attitude and practices of male food handlers employed in restaurants of King Saud University, Saudi Arabia. *Food Control*, 59, 212-217.
- AMARASEKARA, P., DE SILVA, A., SWARNAMALI, H., SENARATH, U. & KATULANDA, P. 2016. Knowledge, Attitudes, and Practices on Lifestyle and Cardiovascular Risk Factors Among Metabolic Syndrome Patients in an Urban Tertiary Care Institute in Sri Lanka. *Asia Pacific Journal of Public Health*, 28, 32S-40S.
- ARDIANTO, R. 2012. A Way to Stimulate Public Awareness. *OIML Bulletin*, LIII (2), 33-38.
- ARDIANTO, R. 2013. Weighing Scales Re-Checker Unit: A Tool to Boost Public Awareness and Encourage Participation in Legal Metrological Control. *OIML Bulletin*, LIV(2), 24-27.
- AWAD, A. I. & ABOUD, E. A. 2015. Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. *PloS one*, 10, e0117910.
- BAKSHY, E., ROSENN, I., MARLOW, C. & ADAMIC, L. The role of social networks in information diffusion. Proceedings of the 21st international conference on World Wide Web, 2012. ACM, 519-528.
- BIRCH, J. 2003. Benefit of legal metrology for the economy and society.
- BORGATTI, S. P. & CROSS, R. 2003. A relational view of information seeking and learning in social networks. *Management science*, 49, 432-445.
- BOŠNJAKOVIĆ, A., BADNJEVIĆ, A. & DŽEMIĆ, Z. 2018. Legal Metrology System—Past, Present, Future. *Inspection of Medical Devices*. Springer.
- ELINDA-PATRA, M., DEWANTI-HARIYADI, R. & NURTAMA, B. 2020. Modeling of food safety knowledge, attitude, and behavior characteristics. *Food Research*, 4, 1045-1052.
- ELLEN, S. 2017. Slovin's Formula Sampling Techniques. Sciencing.
- JHA, N., RATHORE, D. S., SHANKAR, P. R., BHANDARY, S., ALSHAKKA, M. &

- GYAWALI, S. 2017. Knowledge, attitude and practice regarding Pharmacovigilance and consumer Pharmacovigilance among consumers at Lalitpur District, Nepal. *Journal of Nepal Health Research Council*, 15, 31-37.
- KIGARU, D. M. D., LOECHL, C., MOLEAH, T., MACHARIA-MUTIE, C. & NDUNGU, Z. W. 2015. Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: a KAP study. *BMC Nutrition*, 1, 1-8.
- KRIŽAN, F., BILKOVÁ, K., BARLÍK, P., KITA, P. & KITA, P. 2018. SPATIAL DISTRIBUTION OF CONSUMER PREFERENCES CASE STUDY OF SHOPPING MALLS IN BRATISLAVA. *Theoretical and Empirical Researches in Urban Management*, 13, 13-21.
- LARSSON, G. & ENANDER, A. 1997. Preparing for disaster: public attitudes and actions. *Disaster Prevention and Management: An International Journal*, 6, 11-21.
- LEE, H. K., ABDUL HALIM, H., THONG, K. L. & CHAI, L. C. 2017. Assessment of food safety knowledge, attitude, self-reported practices, and microbiological hand hygiene of food handlers. *International journal of environmental research and public health*, 14, 55.
- MA, G. X., SHIVE, S., ZHANG, Y., AQUILANTE, J., TAN, Y., ZHAO, M., SOLOMON, S., ZHU, S., TOUBBEH, J., COLBY, L., MALLYA, G. & ZENG, Q. 2014. Knowledge, Perceptions, and Behaviors Related to Salt Use Among Philadelphia Chinese Take-Out Restaurant Owners and Chefs. *Health Promotion Practice*, 15, 638-645.
- MIRMIRAN, P., MOHAMMADI-NASRABADI, F., OMIDVAR, N., HOSSEINI-ESFAHANI, F., HAMAYELI-MEHRABANI, H., MEHRABI, Y. & AZIZI, F. 2010. Nutritional Knowledge, Attitude and Practice of Tehranian Adults and Their Relation to Serum Lipid and Lipoproteins Tehran Lipid and Glucose Study. *Annals of Nutrition & Metabolism*, 56, 233-240.
- MULEME, J., KANKYA, C., SSEMPEBWA, J. C., MAZERI, S. & MUWONGE, A. 2017. A Framework for Integrating Qualitative and Quantitative Data in Knowledge, Attitude, and Practice Studies: A Case Study of Pesticide Usage in Eastern Uganda. *Frontiers in Public Health*, 5.
- NOVIKOVAS, A. 2012. Peculiarities of administrative legal regulation of metrology. *Jurisprudencija*, 1515-1527.
- OIML 2011. D16 - Principal of assurance of metrological control. International Organization of Legal Metrology.
- OIML 2020. D1 - National metrology systems – Developing the institutional and legislative framework. International Organization of Legal Metrology.
- PAN, H.-H., SHIH, H.-L., WU, L.-F., HUNG, Y.-C., CHU, C.-M. & WANG, K.-Y. 2017. Path modeling of knowledge, attitude and practice toward palliative care consultation service among Taiwanese nursing staff: a cross-sectional study. *BMC Palliative Care*, 16, 42.
- PANDIAN, J. D., SANTOSH, D., KUMAR, T. S., SARMA, P. S. & RADHAKRISHNAN,

- K. 2006. High school students' knowledge, attitude, and practice with respect to epilepsy in Kerala, southern India. *Epilepsy & Behavior*, 9, 492-497.
- RADHAKRISHNAN, K., PANDIAN, J., SANTHOSHKUMAR, T., THOMAS, S., DEETHA, T., SARMA, P., JAYACHANDRAN, D. & MOHAMED, E. 2000. Prevalence, knowledge, attitude, and practice of epilepsy in Kerala, South India. *Epilepsia*, 41, 1027-1035.
- RAHMAN, M. M., ARIF, M. T., BAKAR, K. & BT TALIB, Z. 2016. Food safety knowledge, attitude and hygiene practices among the street food vendors in Northern Kuching City, Sarawak. *Borneo Science*.
- RODRIGUES FILHO, B. A. & GONÇALVES, R. F. 2015. Legal metrology, the economy and society: A systematic literature review. *Measurement*, 69, 155-163.
- RODRIGUES FILHO, B. A. & GONÇALVES, R. F. Measuring the economic impact of metrological frauds in trade metrology using an Input-Output Model. IFIP International Conference on Advances in Production Management Systems, 2016. Springer, 624-632.
- RODRIGUES FILHO, B. A., NONATO, N. & CARVALHO, A. A risk analysis approach applied to field surveillance in utility meters in legal metrology. *Journal of Physics: Conference Series*, 2018. IOP Publishing, 012001.
- RODRIGUES FILHO, B. A., SORATTO, A. & GONÇALVES, R. F. Information systems as a tool to improve legal metrology activities. *Journal of Physics: Conference Series*, 2016. IOP Publishing, 012008.
- SANLIER, N. & KONAKLIOGLU, E. 2012. Food safety knowledge, attitude and food handling practices of students. *British Food Journal*.
- SAYUTI, Y., ALBATTAT, A., ARIFFIN, A., NAZRIN, N. & SILAHUDEEN, T. 2020. Food safety knowledge, attitude and practices among management and science university students, Shah Alam. *Management Science Letters*, 10, 929-936.
- SHARAFI, K., PIRSAHEB, M., MALEKI, S., ARFAEINIA, H., KARIMYAN, K., MORADI, M. & SAFARI, Y. 2018. Knowledge, attitude and practices of farmers about pesticide use, risks, and wastes; a cross-sectional study (Kermanshah, Iran). *Science of the total environment*, 645, 509-517.
- SHARIF, L. & AL-MALKI, T. 2010. Knowledge, attitude and practice of Taif University students on food poisoning. *Food Control*, 21, 55-60.
- SHARMA, S., MOERENHOUT, T. & GARG, V. 2018. Consumer Group Attitudes. *Electricity Sector Reform in Uttar Pradesh*. International Institute for Sustainable Development (IISD).
- SILTRAKOOL, B. 2018. Assessment of community pharmacists' knowledge, attitude and practice regarding non-prescription antimicrobial use and resistance in Thailand.
- SLOVIN, E. 1960. Slovin's formula for sampling technique. *Retrieved on February*, 13, 2013.
- SOON, J. M. 2019. Food allergen knowledge, attitude and practices among UK consumers: A structural modelling approach. *Food Research International*, 120, 375-381.

- SUPRIYA, V. & RAMASWAMI, L. 2013. Knowledge, Attitude And Dietary Practices Of Track And Field Athletic Men And Women Aged 18-22 Years. *International journal of innovative research and development*, 2.
- WATKINS, L. K. F., SANCHEZ, G. V., ALBERT, A. P., ROBERTS, R. M. & HICKS, L. A. 2015. Knowledge and Attitudes Regarding Antibiotic Use Among Adult Consumers, Adult Hispanic Consumers, and Health Care Providers — United States, 2012–2013. *Morbidity and Mortality Weekly Report*, 64, 767-770.
- ZHANG, M., ZHOU, M., TANG, F., WANG, Y., NIE, H., ZHANG, L. & YOU, G. 2020. Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. *Journal of Hospital Infection*, 105, 183-187.