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Verification of Private Maritime Security Company of Malaysia Conceptual Framework by Using Factor Analysis

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ABSTRACT

Conceptual framework of Private Maritime Security Company of Malaysia has been developed earlier based on the Standard Operation Procedure of relevant ministries in Malaysia, relevant local regulations, relevant international regulations and relevant international guidelines. The framework was developed through qualitative approach of Delphi method. The objective of this research was to verify developed framework through a quantitative approach. The first step was to obtain the framework. Second step was to identified factors, constructs and items in the framework. Third step was to develop survey questionnaire based on factors, constructs and items in the framework. Fourth step was conducted a pilot study. Fifth step was conducted a full survey to relevant personal in government agencies and PMSC. Sixth step was data analysis using factor analysis to determine the correlation between factors, constructs, and items. Quantitative results were used to compare and verify result of the earlier qualitative framework.

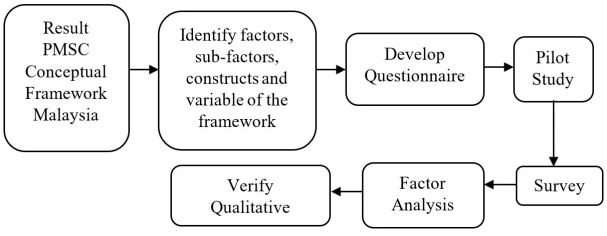
1. Introduction.

A previous study had developed a framework of Private Maritime Security Company (PMSC) of Malaysia (Anwar et al., 2021). The framework was developed based on existing standard operating procedure (SOP) of Ministry of Home Affairs (MOHA) and National Security Council Malaysia (NSC) for PMSC in Malaysia, relevant local regulations, relevant international regulations and relevant international guidelines. Development of the framework involving experts from MOHA, NSC and PMSC that involve two Delphi sessions. The first session was by individual expert engagement and second was by group engagement or workshop, which resulted the development of the framework by qualitative approach. To complete the study, a quantitative approach was needed to further verify the framework although it has been verified qualitatively during the workshop. Therefore, the objective of this study is to verify the developed framework by quantitative approach.

2. Methodology.

The overall research activities are shown in flowchart of Figure 1.

Figure 1: Flow chart of research activities.



Source: Authors.

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The first step is to obtain result of PMSC conceptual framework Malaysia by conducting a literature search. The relevant article was searched by using SCOPUS online database that accessed through University Malaysia Terengganu Library online data guide. There were many fields can be used for the search, such as first author, source title and keywords (Falagas et al., 2008). Title was chosen and "private and maritime and security and company" was key-in in the document search. After click the search button, a list of documents was appeared and the relevant articles was chosen for download.

The second step was to identify the factors, sub-factors, constructs and items of the Malaysia PMSC framework. These elements can be identified in the framework developed by Anwar et al. (2021). The third step was to develop survey questionnaire. The survey questionnaires were developed based on factors, sub-factors, constructs and items identified in second step. The minimum questions or items for each construct was two. Six-point Likert's scale was used as standard response for each question. The Likert-scale produce the ordinal data, which is used to measure the opinions or perceptions of the participants related to the single 'latent' variable (Joshi, Kale, Chandel, & Pal, 2015). When measuring behaviour needs on a range, a rating scale is more useful (Leedy & Ormrod, 2010). These devices can be used to measure people's behaviour and attitudes (Leedy & Ormrod, 2010) to produce empirical data. The 6 points Likert-scale is selected because it gives a definite response to either agree or disagree with the given statements compared to 5 points Likert-scale which gives the respondents an option to either agree or disagree with the given statements. Furthermore, the 6-points analysis would support the requirement for factor analysis, which requires at least a 4-points scale. The higher points of the Likert-scale, the better the ordinal data suited for the factor analysis (Piaw, 2009).

The fourth step was conducting pilot study to five lecturers with background in nautical operation. The objective of the pilot study was to determine the reliability of the questions based on result of the Cronbach alpha. Value above 0.7 is acceptable to conduct the full survey (Chang and Liao, 2009; Kamis, Ahmad Fuad and Saadon, 2020).

The fifth step was conducted the full survey. During the time this research was conducted, there were five private maritime companies registered in Malaysia, namely Global One Security Services, Tropical Quantum, Ratusan Paksi Security, Kaisar Maritime, and STS Security Training Services. Government agencies that directly related to the supervision of private maritime security companies are Ministry of Home Affairs (Security Division), National Security Council (Maritime Division) and Royal Malaysian Police. It is hard to determine the minimum number of respondents for the survey. Furthermore, certain agencies were reluctant to give their response. However, the sampling adequacy depends on value of KMO-Bartlett. The value of KMO-Bartlett should above 0.5 to be accepted for factor analysis.

The sixth step is data analysis. Data analysis of Exploratory Factor Analysis (EFA) was conducted by using Principal Component Analysis (PCA) with varimax rotation. EFA would determine number of latent variables underlie the items or questions used in the survey (Chang and Liao, 2009; Paker and Vural, 2016; Sari, Bulut and Pirnar, 2016). PCA is used to determine the correlation between the developed items (questions) with the constructs of the factors and to lessen the number of items into a smaller set (Piaw, 2009). The main purpose is to analyse the structure of the items observed with the construct and factors variables (Abdi & Williams, 2010). Results of PCA would be used to verify the relationship between factors, sub-factors, constructs and items in the PMSC framework. Prior to PCA, KMO measure of sampling adequacy was conducted. Bartlett's test of sphericity was also conducted to determine the correlation between the factors or items surveyed.

3. Results and Discussion.

3.1. PMSC Factors of Malaysia.

PMSC Framework of Malaysia obtained from Anwar et al. (2021) is shown in Figure 2. There are four main factors, namely services, company, regulation/guideline, and agencies. The services factor is type of services that offered by the PMSC. The company factor is the main part of the PMSC that involves in providing the services. The regulation/guideline factor is the relevant local and international regulation and guideline to PMSC. The agencies factor is the relevant agencies that regulate and supervise PMSC operation in Malaysia.

3.2. Factor Analysis.

The purpose of the quantitative study is to test and verify number of factors and constructs identified earlier in the qualitative study. The empirical data for the study was collected by using a questionnaire survey. The steps taken to develop the questionnaire followed as stipulated by Piaw (2011). The items measured in the survey questionnaire were based on Standard Operational Procedure (SOP) obtained from MOHA, and UNCLOS (United Nations, 1982). The responses were using a six-point Likert's Scale where 1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = slightly agree, and 5 = agree, 6 = strongly disagree (Joshi et al., 2015). The pilot study was conducted prior to the full survey to five maritime lecturers of Universiti Malaysia Terengganu, to determine the reliability of the questionnaire. Table 1 shows the result of the sample size of 5 and Table 2 shows the reliability's result. The result of Cronbach's Alpha of the pilot study was 0.976 for 54 items, which is above 0.7 and considered as reliable (Piaw, 2011).

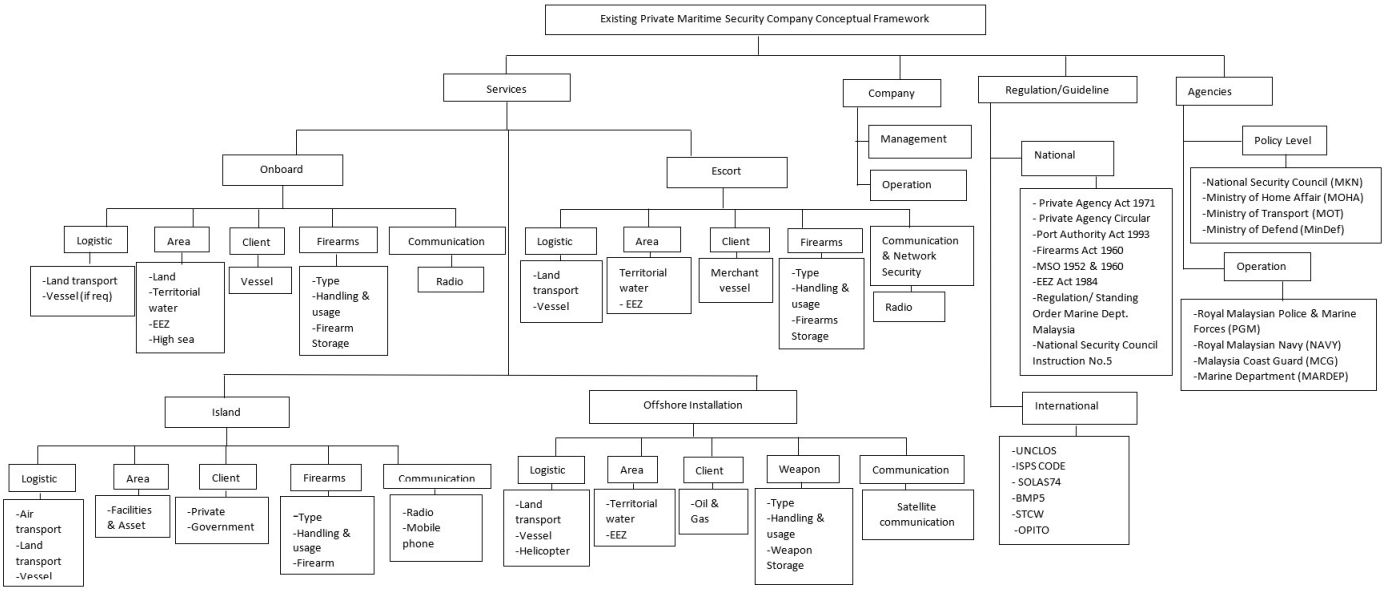
Table 1: Sample Size Pilot Study.

		N	%
Cases	Valid	5	100.0
	Excluded[a]	0	0.0
	Total	5	100.0

a. Listwise deletion based on all variables in the procedure.

Source: Authors.

Figure 2: Quantitative PMSC Conceptual Framework of Malaysia.



Source: Authors.

Table 2: Reliability Statistics Pilot Study.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.976	0.980	54

Source: Authors.

Upon satisfied with the results of the pilot study, a full questionnaire survey was conducted from January to June 2021. A total of 30 respondents that were relevant with private maritime security services were involved in the survey from various government agencies, ports, and companies. Table 3 shows the result of the sample size of 30 and Table 4 shows the reliability's result. The result of Cronbach's Alpha of the full survey was 0.964 for 54 items, which is above 0.7 and considered as reliable (Piaw, 2011). The sample size for the survey is unable to determine because number of people that involve with PMSC in Malaysia is limited and unknown. However, the minimum number to conduct factor analysis must be met in order to get a reliable result. Budaev (2010) set a general rule after reviewing findings from Preacher & MacCallum (2002) and de Winter, Dodou, & Wieringa (2009) that factor analysis requires a large sample of at least 100, however, sample as low as 25 is adequate if few of the factors are well-defined and all the communalities are high. Therefore, a sample of 30 in this study with high communalities as shown in Table 5 is adequate to conduct the factor analysis.

The respondents are selected based on their relevancy to subject matter and willingness to cooperate. The respondents are from a relevant government agencies, oil and gas, PMSC, shipping company, intergovernmental organization, and port police. The number of respondent and its percentage are 11 (37%), 3 (10%), 2 (7%), 8 (27%), 1 (3%), and 5 (17%) respectively. The government agencies were National Security Council (NSC), Maritime Enforcement Agency Malaysia (MMEA), Marine Department Malaysia (MDM). There were officials from the relevant ministry not able to give their response due to certain reasons.

Table 3: Sample Size Full Survey.

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	0.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Source: Authors.

Table 4: Reliability Statistics Full Survey.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.964	0.966	54

Source: Authors.

Exploratory Factor Analysis (EFA) with principal component analysis (PCA) and varimax rotation were conducted. The EFA was conducted in two ways. The first EFA was to determine number of factor available under the PMSC framework. This is to match with number of factors identified from the Delphi method in Anwar et al. (2021). The factors under the PMSC framework are service, company, regulation and agency. The second EFA was to determine number of constructs available

Table 5: Communalities.

Item	Initial	Extraction
The PMSC management should provide insurance coverage on their security guard	1.000	0.785
PMSC should prepare annual report for audit purpose	1.000	0.745
PMSC should provide specific maritime security training for their Security guard	1.000	0.758
PMSC should consider flag state (Country ship's registered) jurisdiction in their operation	1.000	0.677
PMSC should subscribed AIS online service to support their operation	1.000	0.805
Firearms should be mounted at certain point on the escort boat	1.000	0.550
PMSC personnel use small boat to patrols around island's resort facility	1.000	0.733
PMSC Security guard protect people on an island's resort from kidnapping	1.000	0.860
Firearms should be emptied and put on safe mode before stored	1.000	0.657
Ministry of Home Affair should be the leading regulatory body of PMSC in Malaysia	1.000	0.926
Ministry of Home Affair should be a leading on monitoring the PMSC operation	1.000	0.925
IMO should be the main body to issue guidelines and regulations related to PMSC	1.000	0.502
PMSC should apply ISPS Code to determine level of security applied	1.000	0.755
National Security Council should be a leading agency that monitor PMSC operation in Malaysia	1.000	0.844
Extraction Method: Principal Component Analysis.		

Source: Authors.

under service factor, namely onboard, escort, island and offshore installation.

Result of factor analysis on PMSC framework are as follows. Result of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy on PMSC framework was 0.714 (Table 6), which is middling and adequate (Kaiser, 1974). Four (4) components / factors were extracted by using fixed number of factors from the 54 items, which we reduced to 14 items (Table 10). Bartlett's test of sphericity was less than 0.05, which showed a substantial correlation in the data. Hence, the data was appropriate for factor analysis. Factors/components 1, 2, 3 and 4 were named as company, agency, services, and regulation respectively.

Table 6: Communalities.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.714
Bartlett's Test of Sphericity	Approx. Chi-Square	245.238
	df	91
	Sig.	0.000

Source: Authors.

Table 7 shows the result of factor analysis for PMSC's factors. Filter of factor loading less than 0.5 was applied in the scale. There were 5 items were correlated with component/factor 1 (company). The items were item 1, item 2, item 3, item 4 and item 6 with factor loading 0.869, 0.861, 0.856, 0.759, and 0.673 respectively. There were 3 items were correlated with component/factor 2 (agency). The items were item 6, item 7, and item 8 with factor loading 0.928, 0.908, and 0.813 respectively. Four items were correlated with component/factor 3 which is named as service. Namely, item 9 with 0.908, item 10 with 0.736, item 11 with 0.681 and item 12 was service with 0.590. Two items were correlated with component/factor 4 which is named as regulation. Namely, item 11 with 0.845 and item 12 with 0.527.

Table 7: Rotated Component Matrix for services, company, regulation and agency.

Item	Component			
	1	2	3	4
PMSC should subscribed AIS online service to support their operation	0.869			
The PMSC management should provide insurance coverage on their security guard	0.861			
PMSC should provide specific maritime security training for their Security guard	0.856			
PMSC should consider flag state (Country ship's registered) jurisdiction in their operation	0.759			
PMSC should prepare annual report for audit purpose	0.673			
Ministry of Home Affair should be a leading on monitoring the PMSC operation		0.928		
Ministry of Home Affair should be the leading regulatory body of PMSC in Malaysia		0.908		
National Security Council should be a leading agency that monitor PMSC operation in Malaysia		0.813		
PMSC Security guard protect people on an island's resort from kidnapping			0.908	
Firearms should be emptied and put on safe mode before stored			0.736	
Firearms should be mounted at certain point on the escort boat			0.681	
PMSC personnel use small boat to patrols around island's resort facility			0.590	
PMSC should apply ISPS Code to determine level of security applied				0.845
IMO should be the main body to issue guidelines and regulations related to PMSC				0.527

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 6 iterations.

Source: Authors.

Service factor comprise of constructs onboard, escort, island and offshore installation with a total of 33 item/questions. Number of item/questions for construct services, onboard, escort, island and offshore installation were 8, 7, 8, and 9 respectively. Result of factor analysis on services factor are as follows. Result of KMO measure of sampling adequacy for onboard, escort, island and offshore installation services are 0.589, 0.576, 0.418 and 0.753 are shown in Table 8, Table 9, Table 10 and Table 11, respectively. KMO's value below 0.5 is unacceptable, 0.5's is miserable, and 0.7's is middling (Kaiser, 1974; S. Meyers, C. Gamst and Guarino, 2013). Therefore, KMO values for three services are acceptable except for island service. Result of the Bartlett's Test of Sphericity for all four constructs

are statistically significant. Therefore, the results obtained from the survey is appropriate for analysis.

Table 8: KMO and Bartlett's test for construct onboard.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.589
Bartlett's Test of Sphericity	Approx. Chi-Square	17.288
	Df	6
	Sig.	0.008

Source: Authors.

Table 9: KMO and Bartlett's test for construct escort.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.576
Bartlett's Test of Sphericity	Approx. Chi-Square	106.455
	df	15
	Sig.	0.000

Source: Authors.

Table 10: KMO and Bartlett's Test for construct Island.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.418
Bartlett's Test of Sphericity	Approx. Chi-Square	47.970
	df	10
	Sig.	0.000

Source: Authors.

Table 11: KMO and Bartlett's Test for construct offshore installation.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.753
Bartlett's Test of Sphericity	Approx. Chi-Square	89.609
	df	15
	Sig.	0.000

Source: Authors.

Results of onboard service is shown in Table 12. Four (4) components / construct were extracted by using fixed number of factors from 8 items. Onboard services initially had 8 items but reduced to 4 items that correlated with the four constructs. For component/construct 1 that named as firearms, item 1 correlated with 0.960. For component/construct 2 referred as communication, item 2 correlated with 0.976. Component/construct 3 named as area correlated with item 3 with 0.990. Component/construct 4 named as logistic, correlated with item 4 with 0.918.

Table 12: Rotated component matrix for construct onboard.

	Component			
	1	2	3	4
PMSC's firearms should be kept in the ship's safe locker all the time	0.960			
PMSC personnel should use radio to coordinate their operation		0.976		
At high seas, PMSC should follows the country law of the ship's flag			0.990	
PMSC personnel should use company boat from jetty to ship				0.918

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Source: Authors.

Result of escort service is shown in Table 13. Four (4) components / construct were extracted by using fixed number of factors from 7 items. Escort services initially had 7 items but reduced to 6 items that correlated with the four constructs. For component/construct 1, 2 items were correlated, namely item 1 (communication) with 0.942 and item 2 (communication) with 0.865. For component/construct 2, there was 2 items correlated, namely item 3 (logistic) with 0.949 and item 4 (logistic) with 0.922. Component/construct 3 was correlated with item 3 (area) with 0.903. Component/construct 4 was correlated with item 4 (firearms) with 0.798. From the correlation results, component/construct 1, 2, 3 and 4 are considered as communication, logistic, area and firearms.

Table 13: Rotated component matrix for construct escort.

	Component			
	1	2	3	4
Marine Radio is used to coordinate movement of escort boat and client's vessel	0.942			
Marine Radio is used for communication between vessel and the escort boat	0.865			
A-full cabin boat should be used to escort a vessel with a considerable range		0.949		
A medium-sized boat fitted is used to escort a vessel within 12 nm from shore		0.922		
Security escort boat operation should follow UNCLOS in EEZ waters			0.903	
Firearms should be mounted at certain point on the escort boat				0.798

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Source: Authors.

Result of island services is shown in Table 14. Four (4)

components / construct were extracted by using fixed number of factors from 7 items. Island services initially had 8 items but reduced to 6 items that correlated with four constructs. For component/construct 1, 2 items were correlated, namely item 1 (area) with 0.919 and item 2 (area) with 0.899. For component/construct 2, there was 1 item correlated, namely item 3 (logistic) with 0.968. Component/construct 3 was correlated with item 4 (communication) with 0.926. Component/construct 5 was correlated with item 4 (firearms) with 0.928. From the correlation results, component/construct 1, 2, 3 and 4 are considered as area, logistic, communication, and firearms.

Table 14: Rotated component matrix for construct island.

	Component			
	1	2	3	4
PMSC personnel should patrol around the island's resort	0.919			
PMSC Security guard protect people on an island's resort from kidnapping	0.899			
PMSC personnel should use bicycle to travel from accommodation place to their Security guard post on island		0.968		
Satellite communication is used for communication between a remote island's resort with police station on main land			0.926	
Firearms safe locker in island's resort should be monitored by CCTV at all time				0.928

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Source: Authors.

Table 15: Rotated component matrix for construct offshore installation.

	Component			
	1	2	3	4
OSV should be used to conduct security surveillance around the offshore installation	0.923			
Offshore support vessels (OSV) are used by security company as a platform to Security guard the offshore installation from any threat	0.882			
Marine radio is used to report any suspected targets to the offshore installation operator		0.899		
Marine radio is used at offshore installation to direct security vessel to any suspected threats		0.836		
Security guards should use approved type of weapon for offshore installation			0.949	
Security guards perform security surveillance within 500 meters radius from the offshore installation				0.956

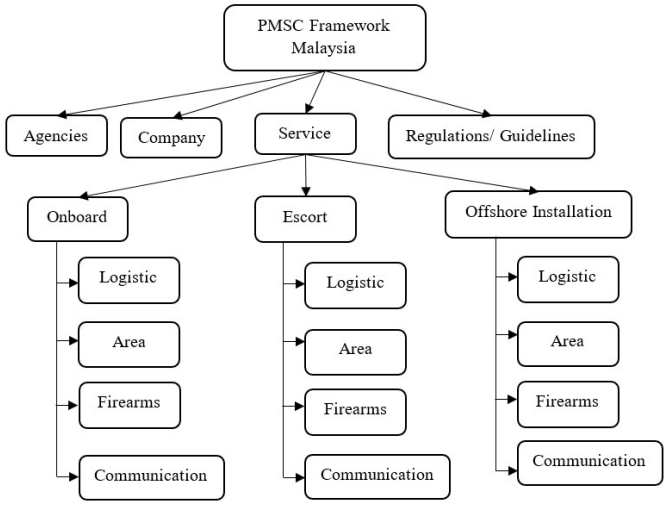
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Source: Authors.

For offshore installation service, 4 components / construct were extracted by using fixed number of factors from 7 items (Table 15). Island services initially had 9 items but reduced to 6 items that correlated with four constructs. For component/construct 1, 2 items were correlated, namely item 1 logistic) with 0.923 and item 2 (logistic) with 0.882. For component/construct 2, there were 2 items correlated, namely item 3 (communication) with 0.899 and item 4 (communication) with 0.836. Component/construct 3 was correlated with item 5 (firearms) with 0.949. Component / construct 4 was correlated with item 6 (area) with 0.956. From the correlation results, component / construct 1, 2, 3 and 4 are considered as area, logistic, firearms and communication.

Through the qualitative approach, PMSC framework had identified four factors under service factor, namely agencies, regulations/guidelines, service and company as shown in Figure 2. Through the quantitative approach, KMO and Bartlett test was conducted on these four factors, which the result was adequate and had considerable correlation between the four factors. This is in-line with qualitative result in Figure 2. Then KMO and Bartlett test conducted to four constructs under service factor, namely onboard, escort, island and offshore installations. Results showed that the KMO sampling adequacy is acceptable for onboard, escort and offshore installation, except island. Result of Bartlett's test for the four constructs suggested that there was a substantial correlation in all four constructs data. Due to result of KMO, the remaining construct under service factor is three, namely onboard, escort and offshore installation. Each construct has four component of items, namely logistic, area, firearms and communication as shown in Figure 3.

Figure 3: PMSC Framework Malaysia according to factor analysis.



Source: Authors.

Conclusions.

The objective of this research is to verify the qualitative PMSC conceptual framework of Malaysia develop earlier by using the quantitative method. There were four factors in the qualitative PMSC framework, namely agencies, regulations / guidelines, service and company. The EFA had also obtained the four similar factors. In the qualitative approach, under factor service, there were four constructs, namely onboard, escort, island and offshore installation. The quantitative approach had also obtained four constructs. However, the KMO value for

island was unacceptable. In the qualitative framework under each construct, there were four items, namely logistics, area, firearms and communications. Similar results were obtained by using EFA. Based on the results of the factor analysis, the quantitative approach (EFA) had verified the qualitative PMSC framework develop earlier.

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