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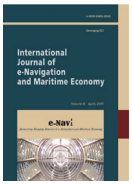

Original article

Factor Related to Operational of Marina in West Coast Peninsular Malaysia☆

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Abstract

Marina is a small port located along a coastline that provides facilities and services for small boats and yachts. The main facilities of marina are pontoon, freshwater, and power supplies. Marina also provides service for boat maintenance and service, and security. In Malaysia, the marina is operated by private companies and Marine Department Malaysia. All the marinas in Malaysia provide the same facilities and services, however they are not operating at the same level. Few marinas had closed their operation due to insufficient number of boats arrived to their marina. The reason of this issue is lack of study about marina operation and management in Malaysia. Further study should be done in this field to overcome this issue and increased the growth of economy for marina. Therefore, the objective of this study to determine the factors to establish a marina in Malaysia and to identify the reason certain marina less performed. This research focused on the marina operators on the west coast of Peninsular Malaysia. The literature review was used to identify the factors to establish a marina. The Analytic Hierarchy Process (AHP) approach was used to analyse the data. This method had ranked the crucial factors from the highest to the lowest percentage. Four main criteria to establish a marina had been identified, namely locations, facilities, services, and promotion. Besides that, there also the sub-criteria for all the main factor to describe it. All the identified factors had been analysed to find the most important factor. The consolidate result showed that geography, security, berthing, purpose, boat chandlery and boat service are the highest percentage among other factors. It concludes that it is the most important factor to establish a marina. These results can be used to improve the operation of marina in Malaysia by focusing on these aforementioned factors.

Keywords: Marina, Operation, Malaysia

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1. Introduction

Marina is a mooring facility or port located on a body of water that provides dockage, moorings, shelter, storage, fuel docks, supplies and maintenance services for boats, yachts and cabin cruisers that also provides direct walkway access for each boat and an adequate depth of water (Global Marina Institute, 2014, p.15). Marina is designed to provide facilities and services for small boats. Globally, the marina is the place for leisure activity such as sailing event and yacht rental where are located along the riverbank that connected to the sea and inland. The largest marina in the world is Porto Montenegro at Montenegro. Besides that, The Yacht Harbour Association (TYHA) and the Marina Industries Association (MIA) has introduced Gold Anchor which is the global marina accreditation that designed to enhance the standard of the marina in the world. In Malaysia, there are 26 marinas which are managed by Marine Department Malaysia, and some are private marina. The major marina in Malaysia are the Royal Langkawi Yacht Club Langkawi, Sutera Harbour Kota Kinabalu and Puteri Harbour Johor Bahru.

Marina can be classified in many types based on its function, which is homeport marina, tourist destination marina, stopover marina, boatyard, yacht club, Venetian docks, and anchorage (Ross, 2003). Thriving marina should be built based on market study and can give multiple functions for the boat owner and user (Kinsella et al., 2014). The market demand, boat data and past report are the components that need to be seen to establish a marina (Raviv et al., 2009). The thriving marina must be able to respond to the changing of markets and plan for future modernization improvement (Kizielewicz & Lukovic, 2013). Besides that, the locations, services, facilities, and promotions are the main factor to establish a marina.

The location of the marina should be located along the coastline and have access to the city (Alkaya et al., 2011). It necessary for the marina to have accessibility to the land and water (Uri et al., 1979). The water can provide boat service, and the land will give advantage to the business enterprise. The other consideration that needs to take for build marina is the location detail which is the wind, wave, geology, water depth and environment (Rivero et al., 2013). The spring and neap tide are the information that needs to be identified to ensure safe navigation for entering and leaving the marina (Hasan, 2014). At the same time, the currents speed and direction are essential to avoid sediment precipitation at marina locations (Hasan, 2014).

Next, the facilities of the marina must be compatible with the current trends in the industry, the demand from boat owner and the site conditions (City et al., 2017). The necessary facilities for the marina are floating dock, boatyard, power supplies and fuel. The floating must either the fixed or portable floating docks based on the tidal range, wave, current and debris condition. It is important because the boat owner is seeking safe berthing (Škorić et al., 2018). For electric power, it should be located at preferred locations to easiest for boat and maintenance use (City et al., 2017). The other amenities are security such as security staff, dock lighting and surveillance equipment (City et al., 2017). It is important to ensure the safety of the boat and facilities at the marina.

The facilities are the only extra part of the marina success, and the central part is the service provided for the marina (Uri et al., 1979). The service that can provide depends on the facilities at the marina. The service should be offered based on marina consumer to make sure it is entirely operated (Raviv et

al., 2009). The primary services for the marina are berthing, maintenance and repair, and security services.

Although marina in Malaysia has all the facilities and services, its operation does not reach the same level. There is some successfully operated, and some are not. Report audit 2019 stated that about half a million has losses caused by the failure of marina operation (Jayamanogaran, 2019). It happens because the marina does not have any yacht arrival and facilities damaged. Therefore, this research aims to determine the factor to establish a marina in Malaysia. Then the outcome will be used to identify the reason for the marina less performed than the others. This research will be focusing on the marina on the west coast of Peninsular Malaysia, and the result can be as a guideline for marina operation.

2. Methodology

The flowchart of the research activities is shown in Figure 1 below.

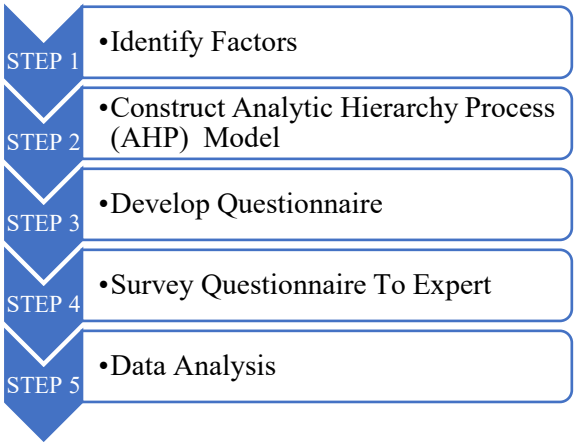

Figure 1: Flowchart of research activity

The first step was to identify factors that are required to establish a marina. This was conducted through a rigorous literature review on journals, proceedings, and on-line materials. A systematic review has been performed to identify factors and before analysed by using AHP. Systematic review is the method that using specific reference and question that focused on the research (Robinson & Lowe, 2015). This method produces a much reliable outcome for the research.

The second step was to determine the reason for certain marina were less successful or even failed. In order to do this, the data from the literature review is used to construct the AHP model, which is shown in Figure 2. The AHP method was used because it is sufficiently achieved the objective. The model contains three levels, the first level is the goal, second is the criteria, and the third level is sub-criteria (T. L. Saaty, 1987).

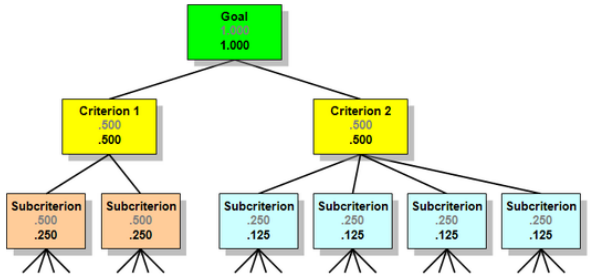

Figure 2: AHP Model

The third step was developed questionnaire by using pair-wise comparison technique. This method uses to find the relative weight of each criterion. The pair-wise comparison technique is conduct with the n criteria was arranged in the row and column of a $n \times n$ matrix. Then the ratio scale was applied to the matrix. Table 1 shows the ratio scale.

Table 1: The ratio scale of pair-wise comparison (R. W. Saaty, 1987)

Numerical Assessment	Linguistic meaning
1	Equally important
3	A little important
5	Important
7	Very important
9	Extremely important
2, 4, 6, 8	Intermediate values of important

The certified judgements on pairs of attributes A_i and A_j are represented by a $n \times n$ matrix A as shown in Equation 1.

$$A = (a_{ij}) = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a/a_{12} & 1 & \dots & a_{2n} \\ . & . & \dots & . \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{bmatrix} \quad (1)$$

where $i, j = 1, 2, 3, \dots, n$ and each a_{ij} is the relative importance of the attribute A_i to attribute A_j.

For a matrix of order n, $(n \times (n-1)/2)$ comparisons are required. The weight value of each criteria is calculated using Equation 2.

$$w_k = \frac{1}{n}\sum_{j=1}^{n}\left(\frac{a_{kj}}{\sum_{i=1}^{n} a_{ij}}\right) \quad (k = 1, 2, 3, \dots, n) \quad (2)$$

where a_{ij} stands for the entry of row i and column j in a comparison matrix of order n.

The fourth step was the survey questionnaire to the expert. It is conducted at Admiral Marina and Leisure Club, Port Dickson, Pangkor Marina, Pangkor, and Pulau Indah Marina. The first and second marina is private owned, while the third is a government marina. Figure 3 shows the area of the questionnaire distributed. There are two criteria for the respondent. The first criteria were individuals that are holding a senior managerial post at the marina. The second criteria were manager of a yacht's charter company in the marina.

Figure 3: Area of research (top blue dots– Pangkor Marina, middle blue dots–Pulau Indah Marina, below blue dots– Admiral Marina)

The fifth step was data analysis by checking the Consistency Ratio (*CR*) from the weight values obtained from the pair-wise comparison matrix. The *CR* value is calculated using the equations (T. L. Saaty, 1990):

$$CR = \frac{CI}{RI} \quad (3)$$

$$CI = \frac{\lambda_{max} - n}{n-1} \quad (4)$$

$$\lambda_{max} = \frac{\sum_{j=1}^{n} \frac{\sum_{k=1}^{n} w_k a_{jk}}{w_j}}{n} \quad (5)$$

where n is the number of items being compared and λ_{max} stands for the maximum weight value of the $n \times n$ comparison matrix, *RI* stands for the Random Index and *CI* stands for Consistency Index. Table 2 Shows the random index values.

Table 2: Random index (*RI*) values

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

When the *CR* value more than 0.10, it indicates an inconsistency in pair-wise comparison. If *CR* is 0.10 or less, the consistency of the pair-wise comparisons is considered as reasonable (R. W. Saaty, 1987).

3. Result and Discussion

The management of Admiral Marina and Leisure Club of Port Dickson, Pangkor Marina of Lumut, and Pulau Indah Marina had responded to the survey. Table 3 shows the list of factors that had been determined by literature review. There were 35 factors of a successful marina had been identified. Figure 4 shows the AHP model of the successful marina. To identify the factor to establish a marina, this model has been constructed after the information has been put in AHP online software. Level 1 is the goal for this model which is a successful marina. Level 2 is the

criteria; four criteria have been identified, which is the location, facilities, services, and promotions. Level 2 are the sub-criteria for level 1. The sub-criteria of locations are purpose, accessibility, and geography. There are 13 sub-criteria for facilities, the floating jetty, boatyard, surveillance system, hotel, marine supply shop, restaurant, swimming pool, bus stop/taxi/e-hailing, power supplies, freshwater, fuel, government office, and helpdesk. For the services, there are nine sub-criteria, which is berthing, boat maintenance and repair, security, accommodation, boat chandlery, tourism services, land transportation, immigration services, and insurance services. The sub-criteria for promotions are social media, mass media, website, Word of Mouth Marketing (WOMM), and brochure.

Table 3: Factor of the successful marina

Factor	Reference
Locations	(City et al., 2017), (Hasan, 2014)
Facilities	(Škorić et al., 2018), (Jankovic & Vlasic, 2018)
Services	(Škorić et al., 2018), (Paker & Vural, 2016), (Raviv et al., 2009)
Promotions	(KHALID et al., 2010)
Purpose	(Ross, 2003)
Accessibility	(Paker & Vural, 2016), (Ross, 2003),
Geography	(Hasan, 2014), (Alkaya et al., 2011), (Ross, 2003)
Floating Jetty	(Škorić et al., 2018), (City et al., 2017), (Tsuneyoshi, 2005)
Boatyard	(Škorić et al., 2018), (Paker & Vural, 2016), (Kizielewicz & Lukovic, 2013)
Surveillance System	(Paker & Vural, 2016)
Hotel	(Ross, 2003)
Marine Supply Shop	(Ross, 2003)
Restaurant	(Škorić et al., 2018), (Ross, 2003)
Swimming Pool	(Uri et al., 1979)
Bus Stop/ Taxi/ e-Hailing	(Škorić et al., 2018)
Power Supplies	(Tsuneyoshi, 2005), (Ross, 2003)
Freshwater	(Tsuneyoshi, 2005), (Ross, 2003)
Fuel	(Tsuneyoshi, 2005)
Government Office	(Raviv et al., 2009)
Helpdesk	(Paker & Vural, 2016), (Kizielewicz & Lukovic, 2013)
Berthing	(City et al., 2017)
Boat Maintenance and Repair	(Škorić et al., 2018), (Jankovic & Vlasic, 2018)
Security	(Paker & Vural, 2016), (Kinsella et al., 2014), (Raviv et al., 2009)
Accommodation	(Škorić et al., 2018), (Tsuneyoshi, 2005)
Boat Chandlery	(Ross, 2003)
Tourism Service	(Paker & Vural, 2016), (Kizielewicz & Lukovic, 2013)
Land Transportation	(Škorić et al., 2018),(Paker & Vural, 2016)
Immigration Service	(Škorić et al., 2018)
Insurance Service	(City et al., 2017)
Social Media	(Sari et al., 2016), (Consulting et al., 2015)
Mass Media	(Consulting et al., 2015)
Website	(Consulting et al., 2015)
Club Website	(Consulting et al., 2015)
Word of Mouth Marketing (WOMM)	(Consulting et al., 2015)

Brochure (Consulting et al., 2015)

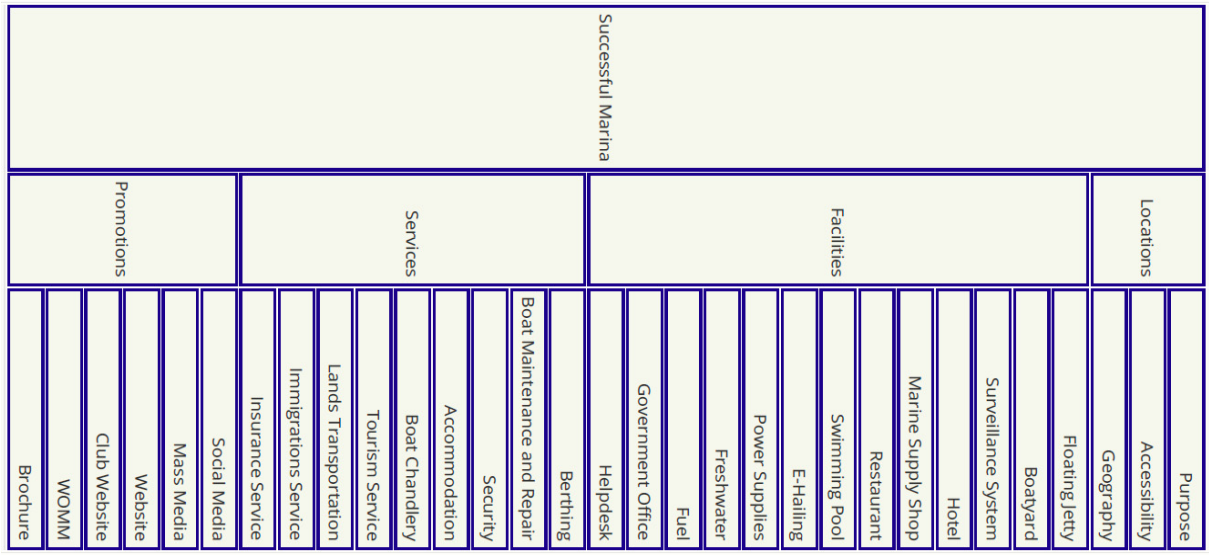

Figure 4: AHP Model of Successful Marina

3.2 Weight Stage Main Criteria

Table 4 shows a summary of all three respondents on weight stage (main criteria).

The value of consistency ratio is 1.6% which is less than 10% hence it is valid data. It concludes that the services (46.2%) are the most important factor, followed by locations (20%), facilities (19.6%), and promotions (14.2%).

Table 4: Weight stage (Main Criteria)

Participants	Locations	Facilities	Services	Promotions	CR_{max}
Group Result	20.0%	19.6%	46.2%	14.2%	1.6%
Respondent 1	25.0%	25.0%	25.0%	25.0%	0.0%
Respondent 2	5.5%	5.0%	71.7%	17.8%	14.8%
Respondent 3	32.1%	32.1%	32.1%	3.6%	0.0%

3.3 Weight Stage Sub-Criteria (Locations)

Table 5 shows a summary of all three respondents on weight stage (sub-criteria locations).

The value of consistency ratio is 6.2% which is less than 10% hence it is valid data. It concludes the geography (41.7%) is the most important factor followed by purpose (32.7%) and accessibility (25.6%).

Participants	Purpose	Accessibility	Geography	CR_{max}
Group Result	32.7%	25.6%	41.7%	6.2%
Respondent 1	33.3%	33.3%	33.3%	0.0%
Respondent 2	33.3%	33.3%	33.3%	0.0%
Respondent 3	28.1%	13.5%	58.4%	58.5%

Table 5: Weight Stage Sub-Criteria (Locations)

3.4 Weight Stage Sub-Criteria (Facilities)

Table 6 shows a summary of all three respondents on weight stage sub-criteria (locations).

The value of consistency ratio is 4.4% which is more than 10% hence it is valid data. It

concludes the floating jetty (11.7%) is the most important factor followed by freshwater (9.0%), marine supply shop (8.7%), government office (8.7%), fuel (8.3%), helpdesk (8.3%), boatyard (8.0%), power supplies (7.6%), surveillance system (7.0%), e-hailing/bus/taxi (6.0%), restaurant (5.9%), hotel (5.3%), and swimming pool (5.3%).

Table 6: Weight Stage Sub-Criteria (Facilities)

Participants	Floating Jetty	Boatyard	Surveillance System	Hotel	Restaurant	Swimming Pool	Cr_{max}
Group Result	11.7%	8.0%	7.0%	5.3%	8.7%	5.9%	4.4%
Respondent 1	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	0.0%
Respondent 2	14.9%	8.4%	4.6%	4.7%	11.4%	3.9%	46.8%
Respondent 3	17.5%	6.0%	7.2%	7.2%	6.0%	7.2%	5.3%

Participants	Bus/Taxi/ E-Hailing	Power Supplies	Freshwater	Fuel	Government Office	Helpdesk	Cr_{max}
Group Result	6.0%	7.6%	9.0%	8.3%	8.7%	8.3%	4.4%
Respondent 1	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	0.0%
Respondent 2	4.0%	7.4%	10.6%	9.2%	9.9%	8.1%	46.8%
Respondent 3	6.0%	7.2%	7.2%	7.2%	7.2%	7.2%	5.3%

3.5 Weight Stage Sub-Criteria (Services)

Table 7 shows a summary of all three respondents on weight stage sub-criteria (Services).

The value of consistency ratio is 1.4% which is less than 10% hence it is valid data.

It concludes the berthing (15.4%) and security (15.4%) is the most important factor followed by boat chandlery (13.7%), boat maintenance and repair (13.2%), immigrations service (11.2%), land transportations (8.3%), tourism service (7.9%), accommodation (7.6%), and insurance service (7.2%).

Table 7: Weight Stage Sub-Criteria (Services)

Participants	Berthing	Boat Maintenance and repair	Security	Accommodation	Boat Chandlery	CR_{max}
Group Result	15.4%	13.2%	15.4%	7.6%	13.7%	1.4%
Respondent 1	11.1%	11.1%	11.1%	11.1%	11.1%	0.0%
Respondent 2	24.5%	13.9%	24.4%	2.7%	16.3%	13.2%
Respondent 3	11.1%	11.1%	11.1%	11.1%	11.1%	0.0%

Participants	Tourism Service	Land Transportation	Immigrations Service	Insurance Service	CR_{max}
Group Result	7.9%	8.3%	11.2%	7.2%	1.4%
Respondent 1	11.1%	11.1%	11.1%	11.1%	0.0%
Respondent 2	3.0%	3.8%	9.1%	2.4%	13.2%
Respondent 3	11.1%	11.1%	11.1%	11.1%	0.0%

3.6 Weight Stage Sub-Criteria (Promotions)

Table 8 shows a summary of all three respondents on weight stage sub-criteria (promotions).

The value of consistency ratio is 6.0% which

is less than 10% hence it is valid data. It concludes the website (22.3%) is the most important factor followed by Word of Mouth Marketing (WOMM) (20.6%), social media (19.4%), mass media (16.9%), club website (11.0%) and brochure (9.8%).

Participants	Social Media	Mass Media	Website	Club Website	WOMM	Brochure	CR_{max}
Group Result	19.4%	16.9%	22.3%	11.0%	20.6%	9.8%	6.0%
Respondent 1	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%	0.0%
Respondent 2	19.5%	19.7%	30.2%	3.1%	25.9%	1.6%	84.7%
Respondent 3	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%	0.0%

Table 8: Weight Stage Sub-Criteria (Promotions)

3.7 Consolidates Result

Figure 5 shows the consolidates result of all factor. The highest rank factor for a successful marina is the geography, security, berthing, purpose, boat chandlery, boat maintenance and repair, immigration service and accessibility. This support with the previous result by (Škorić et al., 2018) on the Republic of Croatia that showed the berthing capacity, infrastructure and service influence the economic growth and performance of marina. It concludes that the main factor for a successful marina is to provide the amenities for boat and the basic needs for boaters. The geography, security, berthing, boat chandlery, repair and maintenance service are the basic need for a boat to ensure the safety of the property and safe navigation. At the same time, the immigration services and accessibility are the necessity for the boaters to easiest their journey.

This research is focused on the marina operators, so the result is from their view and experiences of the current trends of customers at their marinas. To support the result, there also needs the view of boaters about the marina. It will help to ensure that the marina can fulfil the customer's demands.

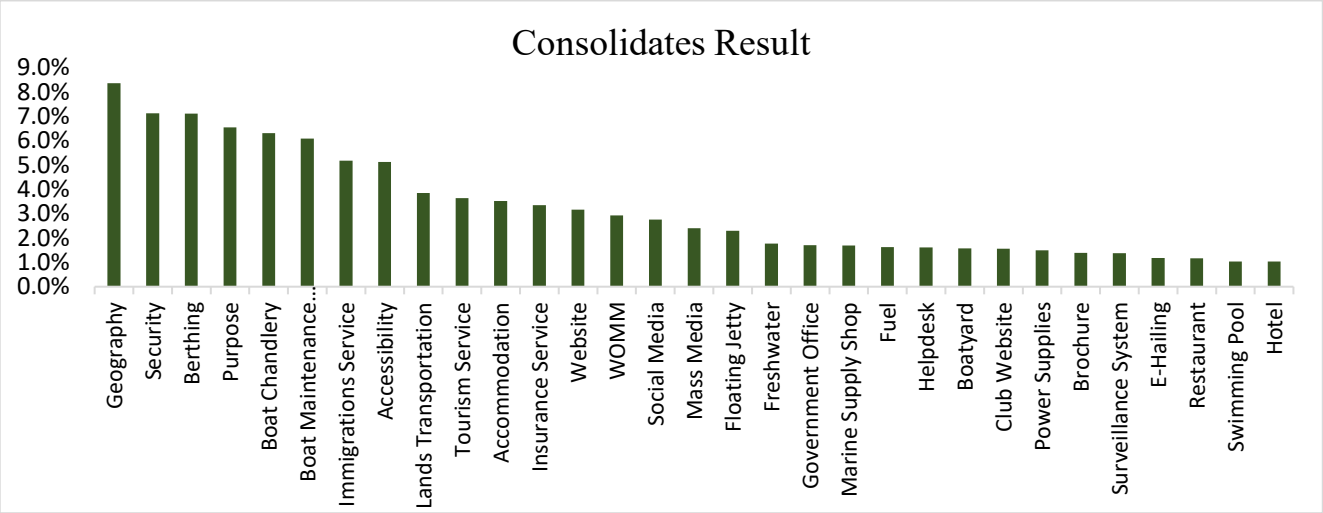

Figure 5: Consolidates Result

4. Conclusion

In conclusion, this research had ranked the factor for a successful marina. The literature review had been used to determine the factor to establish a marina. Based on

the result, the main factors are the location, facilities, services and promotions. Then all of the factors had been analysed by the AHP to rank the most important factor to establish a marina. The consolidates result shown that the geography, security, berthing, purpose, boat chandlery, maintenance and repair service are the highest factor. The result can be used to identify the reason certain marina less performed and can be served as a reference for an interest group of people or companies to improve their marina operation. For future research, the study should be expanded to the whole region of Malaysia.

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