

Cost Benefit Analysis (CBA) For Development Plan of The 1st University Teaching Port

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Abstract: The Teaching Port concept aims to align the tertiary education and training to fulfill the needs of modern maritime industrial practice. As for Universiti Malaysia Terengganu (UMT), the location of the campus is very strategic as it located along the coast of South China Sea so it gives an advantage to the university's vision as a country's leading and globally respected marine-focused university. Apart of the University Development Plan (2021-2030), UMT will develop the first Teaching port in Malaysia. This teaching port is also fulfilling the practical education for other area in the university such as Tourism, Marine Science and others. Therefore, this paper analyzed the development plan that have been proposed based on the Cost Benefit Analysis. The interview sessions were conducted with university's top management and selected expert. The collected data from the interview were used to derive the online survey questionnaire and distributed to selected group of people. Then, the data from the survey was analyzed by using Demand and Supply relationship, expert judgment and Choosing by Advantages to rank the capacities that had high potential for the development of Pantai UMT as a teaching port. As for the recommendations on the potential development of propose teaching port, there were only top three were selected. Then, it were analyzed by a Cost Benefit Analysis (CBA). The analysis was divided into two parts, mainly cost and benefit that comprises of nine steps. In simpler form, the total cost and benefit are calculated. Finally, it is identified that Public Marine Research Center, Tourism Center and Water Sport Center have the highest potential and demand among those six potential capacities. Based on CBA for the three capacities, it is found that these three capacities have a lot of benefits and profitable if it's operated as facilities in the teaching port.

1. Introduction

Universiti Malaysia Terengganu (UMT) is the 14th public university established in Malaysia. It first became fully autonomous as a university college on 1 July 2001 and was renamed Universiti Malaysia Terengganu on 1 February 2007. UMT is located at a coast facing the South China Sea in

Kuala Nerus. UMT has its own beach, which support it identity and niche as a marine focus university in Malaysia.

The Teaching Port approach presented in this study aims at a much broader use of novel learning methods for the introduction of young maritime professional and high skill workers to a wide spectrum of industrial problems. The Teaching Port paradigm comprises the relevant educational approach and the necessary practical training for the facilitation of interaction between industry and academia. The Teaching Port aims to bridge a gap between theory and practical in delivery of knowledge. Both knowledge channels of the paradigm are presented, in the context of this work, within real-life practical applications. The Teaching Port paradigm provides a real-life environment for students and research mariners to develop their skills and comprehend the challenges involved in everyday industrial practice. This teaching port is also satisfying the practical education for other area in the university such as Tourism, Marine Science, Student Development and others. Therefore, the concept of commercial jetty is implied in this Teaching Port.

Basically, commercial jetty is a concept of multipurpose jetty which is, in this case, for the purpose to fulfill the university needs and support the development for the university. As one of the government academic institution, in order to achieve the university's vision as globally respected marine-focused university. Commercial is a medium that making or intended to make a profit. In a nutshell, commercial jetty is for to increase the economy of the area by using the concept of multipurpose-jetty or hub. From authors' observation, UMT beach already meets the criteria to make it have the potential to develop as a Teaching Port.

UMT is also a university that focuses on marine and maritime area that also have a department that focusing on the strategic development plan called as "Pusat Transformasi, Perancangan Strategik Dan Risiko" or TSR. According to [9], the location of UMT is very strategic. Therefore, this has raised the concern over the prospect of UMT which was well known for its marine and maritime based university. Based on the university blueprint "Sustainable Campus", UMT is the only government university that has its own beach, but, the development plan for the area is not fully utilized its capacities.

In addition, UMT is continuously upgrading its research capacity and capabilities in other areas such as maritime studies, economics, management, basic sciences, physical sciences, engineering, and others. For the research activities, UMT have been provided by government with a facility for marine research such as boats and research vessel [1]. However, all that facilities located at the jetty and harbor around Kuala Terengganu, so what is the use of the UMT located by coastal area. Therefore, it results in conducting a research on the prospect of potential capacities for the development of UMT beach. The main objectives are to identify the potential capacity for the better development's plan of UMT beach and then, rank it the most potential capacity based on the demand and supply relationship. Finally, this paper focus on to conduct a cost benefit analysis (CBA) on the potential development of the beach as the 1st university with Teaching Port by using micro strategic development concept.

2. Literature Review

2.1. Introduction

Potential capacity is for the long term and indicates the available capacity at hand which can be utilized to influence the planning of senior management [4]. Therefore, this research would give an idea on how to developed UMT beach as a commercial jetty which have multipurpose uses such as, a university's jetty that functioned as the research or tourism centre for the east of Malaysia, specifically, Terengganu. This commercial jetty or hub is also the effective Centre of an activity, region, or network [12]. The purpose of this research is to identify and listed all the possible potential

nautical activities in UMT as well as ranking the activities according to their potential. Second, conducting a cost benefit analysis to find out whether the potential activities are beneficial to pursue. And third, in order to find which activities are beneficial to pursue, the demand and supply analysis in Kuala Terengganu was also conducted. Based on previous research, few authors also had classified nautical tourism according to their activities [7] and industry [13]. With the increase of profit, it arise the awareness to further developing potential nautical activities in Kuala Terengganu by making the European nautical activities as a reference.

2.2. Current Plan of *Pantai* UMT



Figure 1: Development Plan of UMT Sustainable Campus Phase 2 (2021-2030).

Based on the Development Plan of UMT Sustainable Campus 2015-2020, UMT only focuses on the construction of breakwater structure. Then, in the Development Plan of UMT Sustainable Campus Phase 2 (2021-2030), UMT is going to develop the Marina UMT in the area of the beach.

The marina will be equipped with a fully stocked mini port for marina management, office building, a teaching and learning, inns and cafeteria. The Marina UMT will be located at area number 9.

2.3. Increase the Economy of Jetty's area

The World Bank Group helps countries promote strong governance of marine and coastal resources to improve the contribution to sustainable and inclusive growth by integrating coastal resource management and developing knowledge and capacity around ocean health [2].

By applying the idea of the World Bank Group, in a small portion, in UMT beach, the economy of the university and the community will increase, as we can centralize all the services in the campus area. Proper management of fisheries, investment in sustainable aquaculture and protection of key habitats can restore the productivity of the ocean and return benefits to billions of people in developing countries while ensuring future growth, food security and jobs for coastal communities [2]. The development of shoreline management capacity is involving each sector aiming for increasing community economy life along this area [3]. The development of minor ports or small jetty support the major ports which directly and indirectly helps to improve the major economy problem of the developing countries like India [10].

3. Methodology

Figure 2 shows steps in methodology design that have been carried out as a building block to successfully complete the research.

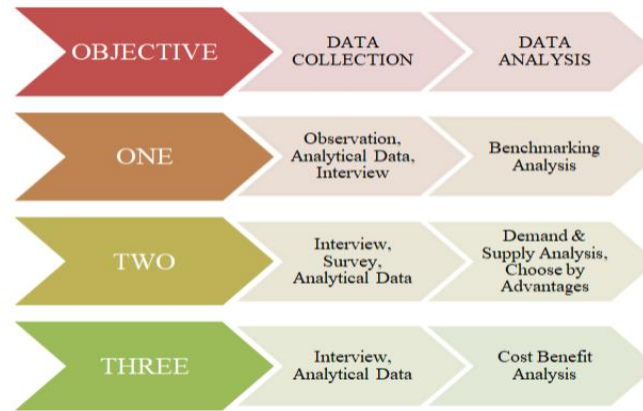


Figure 2: Methodology Design of Research

3.1. Benchmarking Analysis

This method is used to find out the potential development's capacities by comparing the current situation and plan available in other waters such as South Africa, Australia and others country with UMT beach, Kuala Nerus. The capacities were compared in terms of geographical location, climate and services provide to verify the suitability of the development to be operated in the beach. The data obtained was directly from analytical data.

3.2. Demand and Supply Relation to Multi-criteria Decision Analysis

In the second objective, a survey and interview had conducted to find out the demand of the identified potential development's capacities and the needs of targeted user which are willing to utilize this service in UMT beach. The relationship between the demand and supply is analysed by using graphical representation to find out the most potential development's capacities. In the demand and supply relationship between the targeted user interest and the project area situation, the activities which are potential to be conducted are confirmed by the intersection of those two. These entire factors are analysed by Multi-criteria Decisions Analysis (MCDA) which is Choosing by Advantages (CBA). CBA is a collaborative and transparent decision making system. Perhaps the most used CBA method is the Tabular Method, which is used to choose among two or more mutually exclusive alternatives that are not of equal cost [5]. In CBA, decisions are based on advantages of alternatives, which are positive differences, not advantages and disadvantages; this avoids double counting. In the survey conducted, samples are given closed end questions, multiple choice questions and short paragraph questions. The samples are required to choose the answer for each question shown. The data obtained are analysed by using Microsoft Excel analysis and Google Sheet. Meanwhile, the interview result is based on researcher and interviewee understanding.

3.3. Cost Benefits Analysis

This analysis was conducted to find out the most beneficial potential nautical activities. The data were collected and verified by the service provider through interviews sessions. This analysis was

conducted on each of the identified potential nautical activities. Based on the result of this analysis, the most beneficial nautical activities are identified. In simpler form, the total cost and benefit are calculated. In this phase, all the cost and benefit involved are taken into consideration. This is done by listing all the cost such as fixed cost (FC), indirect cost, variable cost (VC), and direct cost. As for benefit, the entire potential future occurrence by conducting the activities are taken into consideration and calculated. A monetary value to the cost and benefit are assigned. Next, the calculated costs and benefits are compared. The step proceeds by discounting the future costs and benefit to obtain present values. The discount rate used in this analysis are 3%, 7% and 10%. Afterward, the net present value (NPV) is computed for each identified potential nautical activities. The net present value (NPV) of each potential nautical activity is calculated based on the formula as follow:

$$NPV = \sum_{t=0}^T (Bt - Ct) / (1 + r)^t \quad (1)$$

Where,

- Bt = the benefit at time t
- Ct = the cost at time t
- r = the discount rate
- t = the year
- T = number of years over which the future costs or benefits are expected to occur.

The NPV can be obtained by two ways. One is from the above formula and another is from the formula:

$$NPV = PV(B) - PV(C) \quad (2)$$

Where,

- PV (B) = the present value of benefits
- PV (C) = the present value of cost s

In the Microsoft Excel Analysis, the NPV is obtained by summing the present value (PV) of each year. The NPV is calculated for each discount rate respectively. The PV is obtained by multiplying the net benefit with the discount factor for each year

4. Results and Discussion

4.1. Data Collection Process

Based on the benchmarking analysis, the potential development capacities that identified are six capacities. These facilities gain their needs in develop countries such as United State, Australia and Spain, and its suitable to be provided in UMT beach, Kuala Nerus. Table I shows the summary and comparison of the functional purposes of the facilities based on the literature review from above mentioned countries which indicate future education. These potential development capacities are analyzed and ranked the most potential capacity based on the demand and supply relationship in the area.

4.2. Data Analysis Process

1. Demand and Supply Relationship

From total of 173 sample, 157 sample or 90.8% have interest in this concept while the other 9.2% does not interest in commercial marina concept. By comparing the actual situation of UMT beach and the demand capacities as the new facilities in the current plan of development of the beach, it is found out that the most potential capacity based on the demand and supply relationship in UMT beach is Water Sport Center which is 151 of sample. Then, the rest are followed by Tourism Center, Public

Marine Research Center, Community Center, Marina Dock and the last, Interpretative Center. 89.6% of the sample is agreed if all above facilities are combined in one center hub because it will help them in any ways.

Table 1: Identified Potential Development Capacities

Potential Capacities	Functional Purposes
Marina Dock	Waterfront Place, Jetty Island & Boat Launch, Fuel Dock, Marina event venue, Barge’s Activity, Full marina services and Facilities
Marine Research Center	Rehabilitation of Marine Life, Observatory Monitoring Programs, Water Temperature Survey Results, Fish Species Survey Results, Education Centre, Collaboration program and research with the universities
Water Sport Center	One-stop headquarter for water sport, sport needs and fishing need. Sailing Boat, Rowing, Stand Up Paddle Boarding, Kayaking, Parasailing, Kite boarding, Surfboard, Jet Boat, Swimming, rafting, Fly board, , Wakeboard
Interpretative Center	Heritage of the Area, Evolution of the area, Souvenirs and mementos center, Museum
Community Center	Fishing Docks, Parks & Open Space, Wildlife & Bird watching, Events & Activities, Fishing Docks, Meeting Space, Retail Area for community use, Boat slip rentals, bait & tackle, fuel, food, beer, restaurant & boat ramp.
Tourism Center	Underwater observatory, Sunset Train Ride, Tourism Information Booth, Cruise/ Passenger Boat Jetty, Beach, Cultural activities, Guided tour, diving and scuba guide, Segway visits, Yacht and boat Service

2. Multi-Criteria Decision Analysis (Choosing by Advantages)

With all these responds from the sample, the MCDA are continued to analyze the rank of capacities as the facilities to develop in the commercial marina. There are several factors with the purpose of differentiating between alternatives have been selected. The factors that considers are:

- a. The Demand-The sample’s interest on any capacities.
- b. The Supply-The observation made on the availability of capacities at the beach.
- c. The Potential-Sample’s preference regarding the advantages of the potential capacities.

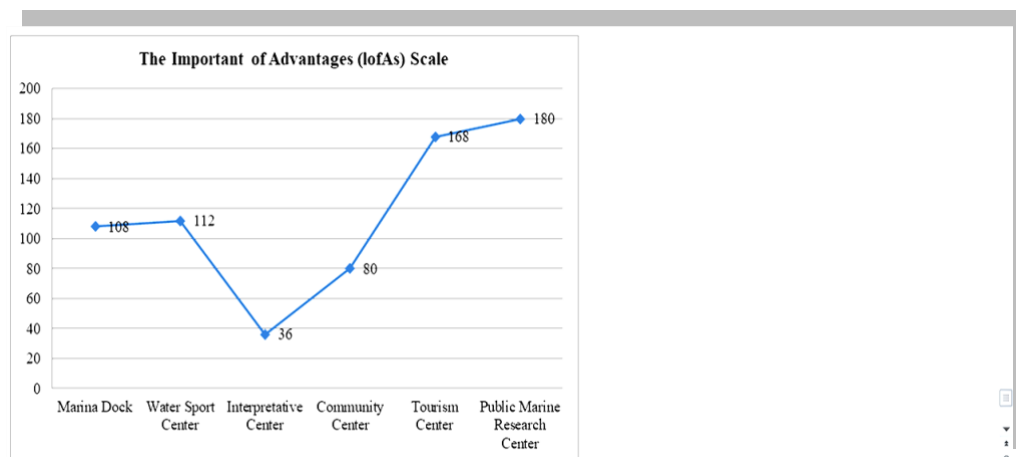


Figure 3: Choosing by Advantages Analysis

Based on Figure 3, it's showing that the most potential capacity based on the demand and supply relationship in UMT beach is Public Marine Research Center with total "Important of Advantages Scale" (lofAs) score, 180 points. Then, the rest are followed by Tourism Center with 168 points, Water Sport Center with 112 points, Marina Dock with 108 points, Community Center with 80 points and lastly, Interpretative Center with lofAs score, 36 points.

3. Cost Benefits Analysis

Based on the Choose by Advantages analysis, the potential development capacities that ranked from the highest are Public Marine Research Center, Tourism Center, Water Sport Center, Marina Dock, Community Center and the least rank, Interpretative Center. These facilities are ranked as the most promising potential development capacities and its suitable to be provided in UMT beach, Kuala Nerus. Therefore, as for the recommendations on the potential development of UMT beach as Teaching Port by using micro strategic development concept based on the most potential capacity, after interview with university authority as the early stage of the development, there are only top three going to select. These top three are analyzed by using cost benefit tool to find out their potential and recommended for final suggestion to university. As an example, Public Marine Research Center, all the cost is listed below in Table II and as for the expected benefit in Table III. These benefits are based on the business collaboration with others organization such as Ministry of Tourism, sport's club and others related to the suggested facilities. This step is repeated for all three top potential capacities.

Where,

W= Operational Cost per Week (RM)

X = Operational Cost per Month (RM)

Y = Total Operating Month (RM)

Z = First Year Cost (RM)

Table 2: Total Operational Cost (General) for Public Marine Research Center

Category	Details	W	X	Y	Z	Yearly Cost (RM)
Fixed Cost (FC)	*Insurance					
	Labor	2620	10480	12	125760	125760
Indirect Cost	Computing	50		1	50	
	Maintenance	100	400	12	4800	4800
	Security 1. CCTV	8273		1	8273	
Variable Cost (VC)	Energy Usage	167	668	12	8016	8016
	Production	300		1	300	
Direct Cost	Assets	10000		1	10000	
	Equipment	200000		1	200000	
Total Cost					357199	138576

In Figure 4, the comparison between those three for one year is showing that the expected highest profit is Tourism Center but with the lowest cost of operation. In different, Public Marine Research Center has possessed the highest cost of operation but expected to gain the lowest profit out three facilities to be suggested for UMT beach.

Table 3: Total Benefit (Expectation) For Public Marine Research Center

Revenue	Benefit per Week (RM)	Benefit per Month (RM)	First Year Benefit (RM)	Yearly Benefit (RM)
Membership	5 per person	20	240	240
Rental	6000 (for 5 researchers)	24000	288000	288000
Event	3800 (for one event)	15200	182400	182400
Total Benefit			470640	470640

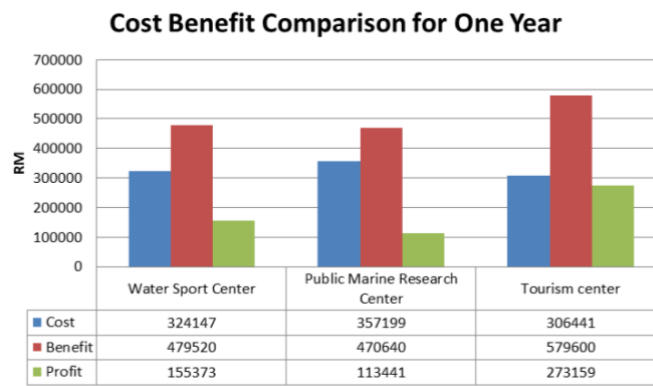


Figure 4: Cost Benefit Comparison for One Year

In the next step of CBA, the NPV are calculated for each identified activity for 4 years with discount rate 3%, 7% and 10%, as an example for Public Marine Research Center with 3% shows in Table 4. Then, the final NPV for each discount rate and each capacity in UMT Beach showed in Table 4.

Table 4: NPV For Public Marine Research Center With 3% Discount Rate

Year	Costs	Benefits	Net Benefits	Discount Rate	
				3%	
				Discount Factor	Present Value
0	357199	0	357199	1	-357199
1	138576	470640	332064	0.970874	322392.30
2	138576	470640	332064	0.942596	313002.20
3	138576	470640	332064	0.915142	303885.71
4	138576	470640	332064	0.888487	295034.55
Net Present Value (NPV)					877115.76

For the highest discount rate, 10%, Tourism Center has obtained the highest positive NPV with RM 1, 071309.12. And for the lowest discount rate, 3%, Tourism Center also obtained the highest positive NPV with RM 1, 309158. 85

Table 5: NPV for Potential Capacities of UMT Beach

Capacities	NPV for Four Years (RM)		
	3%	7%	10%
Water Sport Center	762078.55	665677.35	602163.63
Public Marine Research Center	877115.76	767571.84	695399.04
Tourism Center	1,309158.95	1,165776.39	1,071309.12

4.3. Knowledge of Identified Capacities

Based on identified capacities, all the capacities are potentially to be developing as facilities of commercial marina in UMT beach. Some of the capacities are new even to some of marina in other countries. However, that does not decrease the potential for those facilities to be realised. Interpretative Center for example, it was only developed recently. Although some of them had built since early of the development of teaching port at their respective area, their functions always needed and helped the improvement of the marina. Some sample may even have no knowledge on any of the potential capacities listed, but the interests of them are increasing. Thus, explaining their potential for development.

4.4. Relationship between Interest and Potential among Respondents

Based on the survey conducted, it is identified that 156 sample or 90.2% are interested in developing a marina in UMT. Among these sample, 166 sample or 96% had used or involved in water activities such as tourism, water transportation, or even fishing. Thus, it can be established that the 157 sample or 90.8%, sample who are interested in the idea of developing commercial marina in the beach and 155 sample or 89.6% of the sample also acknowledged the advantages if a number of facilities can be combined in one centre hub called as commercial marina. Therefore, their interest in developing the commercial marina is proven. This has proven that the existing plan for UMT needs to be improved because the demand of the users is different. Although, 29.5% of the education background of the sample is from Maritime, it does not affect the interest rate in facilities to be recommended for the commercial marina. Thus, it can be assumed that the education background does not matter in terms of interest rate in idea of developing a teaching port at UMT beach as most of them possessed interest.

4.5. Most Potential Capacities

With reference six capacities above, there are only three capacities that compatible to be built in UMT as part in the Teaching Port for early stage of development. However, the other three capacities also can be built in the future for the future development of expansion of this commercial marina. Therefore, based on the intersections between the interest rate of the sample or demand, the possibility for availability from the observation or supply and the potential rate or the sample's preferences, the capacities which fit all these three criteria according to highest potential are Public Marine Research Center, Tourism Center and Water Sport Center. Based on the assessed CBA, it is found out that the most beneficial activities to operate for the teaching port is Tourism Center with profit RM 273,159.00. Each NPV calculated for each potential capacity are obtained positive. A positive NPV indicate the potential capacities are efficient to be developed. The non-quantitative benefits that also gained from those capacities, all these centers will act as the training center for students to apply all their knowledge into practical lessons. This Teaching Port is for the educational benefits to the university. For example, for Tourism Management students, they will train and assisted by the

lecturers, to manage and operate the tourism center in their own way and concept based on their knowledge.

5. Conclusions and Recommendation

5.1. Recommendation and Suggestion

Based on the most potential capacities that discovered, a concept plan of beach's development is suggested by referring to the Micro Strategic Development Concept. Teaching Port with the concept of Commercial Marina is targeted functioning as functional integration of different neighbourhoods (communities), to improve access to social amenities and work opportunities, optimising existing infrastructure and engineering services [8].

From the interview conducted, university authority agreed that all of six capacities discussed are relevant and have huge potential in developing the marina at UMT. Based on the latest design construction plan, as in the Figure 5, shows that several building are going to build in the port area, so this building can be assigned as the facilities for enhancing the concept of commercial marina.

However, from the discussion, an additional wave breaker is suggested to be built to control the level of wave due to the condition of UMT beach that facing an open sea. From these potentials, there are a lots of development on infrastructures should be planned as well. The infrastructure is influenced by the services offered, population size and distances between access points in an area.

The main reason to suggest an additional water breaker is because it is for ensuring suitability of the placement for the suggested location of Water Sport Centre. For Public Marine Research Centre, the suggested location must be near with the Marine Biotechnology Institute Building. As for the location for those three facilities, everything clearly shown in Figure 5, this results in the establishment of hub centres which offer permanent services including, government, economic, community and private sector services, education and skills development, telecommunication, communication and information.



Figure 5: Suggestion of the Location of the Facilities of Commercial Marina and Suggestion on Additional Water Breaker

5.2. Conclusion

With the uncertainty of the capacities that contributing to develop the beach as the Teaching Port with concept of commercial jetty, this research is aiming to discover the actual potential in creating the plan and analyse the impact by demand supply and MCDA with CBA analysis. Whenever possible, this research formulates a platform for develop UMT beach as the 1st university with Teaching Port by using micro strategic development concept based on the most potential capacity. In advanced, it will able to contribute in enhancing the university activities and increase their productivity and efficiency and improve the quality of the practical lessons.

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