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A Study on the Business Feasibility of Marine Leisure Ship

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Abstract : *The purpose of this study is to evaluate the feasibility of the new marine leisure ships. In order to achieve the research purpose, the cost and income were calculated based on the operating of other marine leisure ships, and the feasibility of the project was empirically analyzed. This study established a research model that applies the values derived by empirically analyzing ships with similar specifications, to the new marine leisure ships. We then calculated the cost-benefit analysis, net present value, and internal return, and evaluated the feasibility of the project based on this. As a result of the business feasibility analysis of investing in marine leisure ship, it was found that economic feasibility exists with a B/C of 1.042 and 1.049 for new and secondhand ships, respectively; however, considering the stability of the ship and the publicity and continuity of the business operation, it is recommended to invest in new ships compared to secondhand ships. The total benefit over the 10-year operating period using a social discount rate of 4.5% was evaluated to be about KRW 292.0 billion, which is higher than the total cost of KRW 256.6 billion. In conclusion, the profitability analysis showed that the B/C was 1.042, the NPV was KRW 193 billion, and the IRR was 2.1%, which indicates that profitability is weakly secured.*

Key Words : *Marine leisure ships, B/C Ratio, NPV, IRR, Social discount rate*

1. Introduction

S. Korea is a peninsula country surrounded by the sea on three sides, and has a number of islands in its territorial waters. Therefore, due to these geopolitical characteristics, convenience for moving to each island plays a very important role in the S. Korea, and it has good conditions for revitalizing island tourism (Park and Hong, 2012). In the case of peoples on manned islands, where maritime transportation is all about land, the existence of this is very important. For them, which is the only means of using the infrastructure of land cities. However, the frequency of ships that can travel to each island in S. Korea is very low, and the maritime transportation infrastructure is also insufficient (Lee et al., 2021). Therefore, access to the island should be improved through the operation of fast and frequently operated transportation. For this reason, this study attempted to improve the convenience of transportation between islands and shore side and to revitalize island tourism by conducting a project feasibility analysis on new maritime transportation methods on four manned islands in Gyeonggi-do. New maritime transportation refers to a new concept of ship with the characteristics of marine leisure ships where you can enjoy marine tourism as well as passenger transportation. It should be noted that the new maritime transportation means are ships with the characteristics of marine leisure ships, and the investment cost is very low compared to commercial ships, but from the perspective of private investors, the investment cost is never low and the risk is high. In particular, in the case of passenger ships that share the same characteristics of marine leisure ships, their profitability is so low that it cannot be operated without support from governments (Choi and Noh, 2020). Therefore, if the business feasibility analysis for new maritime transportation is performed incorrectly, the cost as a result is very high for investors and can have a long-term impact. The purpose of this study is to evaluate the feasibility of the project according to the introduction and operation of new marine leisure ships. In order to achieve the research purpose, the cost was calculated based on the operating cost of other marine leisure ships, and the income was calculated based on the freight charge for marine leisure ships currently operating in other regions, and the feasibility of the project was empirically analysed. The project feasibility was analyzed by applying the value derived through this empirical analysis to B/C, NPV, IRR. This study established a research model that applies the values derived by empirically analyzing ships with similar specifications to ships to cost-benefit analysis (B/C), net present value (NPV), and internal return (IRR), and evaluated the feasibility of the project based on this. Finally, the conclusions and implications of the study and the limitations of the study were described.

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2. Literature review

As national income increases, the quality of life improves, and value consumption is becoming important (Choi et al., 2019). As a

result, new patterns such as culture and ecotourism are preferred as tourism patterns, and interest in islands is gradually increasing as a tourist destination that can satisfy them (Korea Maritime Institute, 2017). Therefore, it is important to determine the feasibility of the project so that can be started in a financially sound direction for the introduction of new marine leisure ships that can enhance access to the island. However, research on the value evaluation and business feasibility of ships with the characteristics of marine leisure similar to those of new maritime transportation, which is the subject of this study, is insufficient. As a result of a more extensive investigation of the subject of the study, it can be confirmed that research on merchant ships, trains, and roads has been conducted. The feasibility of the project for opening a route for passenger ships with the characteristics of marine leisure similar to new maritime transportation has been studied. The feasibility of the project to newly open the Jangheung-Goheung marine route through the B/C technique, and a result of the study, it was confirmed that the B/C was 1.19. However, this takes into account social benefits, and negative results are derived only from the ship's operating income. These results suggest that the opening of routes should be treated as a public policy (Choi and Noh, 2020). In the case of research on ship investment projects, a study was conducted to analyze the financial business feasibility of ship investment in shipping logistics companies through dynamic valuation of secondhand ships. In this study, the business feasibility analysis was evaluated by calculating the results derived through system dynamics as net present value and internal rate of return (Choi and Lee, 2017). If look at the study more broadly, various business feasibility evaluation studies on roads and railways are observed. Research has been conducted to find new benefits by further expanding the benefits of moving roads underground from the existing four benefits of reducing vehicle driving costs, travel time, traffic accident reduction benefits, and environmental costs (air pollution and noise). In this study, new benefits such as noise damage reduction, habitat damage reduction, and upper space utilization were presented, thereby enhancing the objectivity of the feasibility evaluation of transportation investment projects (Jang et al., 2021). In addition, as environmental problems emerged worldwide, research on the quantification of environmental benefits of the railway project feasibility study was conducted. In this study, environmental costs such as noise value, air pollution cost, and carbon were quantified to objectify the benefits of sustainable development in the railway project (Nam et al., 2011). As such, business feasibility evaluation for roads, railways, and the recent emerging environment is being actively conducted, while business feasibility evaluation for ships with marine leisure characteristics is insufficient. In the methodology of business feasibility analysis, it is appropriate to use cost-benefit analysis as the main research method and use net present value and internal rate of return as an auxiliary means, considering that the social utility value can be considered properly. Table 1 summarized the research gap between previous studied and this study.

Table 1. Previous research and this study

Subject of study		Research Metods	Note
Existing study	Goheung-Jangheung New Route Opening Project	B/C, NPV, IRR	Feasibility of the new passenger route project between Jangheung Gate and Goheung Nokdong
	The Financial Business of Ship Investment in Shipping Logistics Companies through Valuation of Used Vessels	NPV, IRR via System Dynamics	Business Feasibility of Ship Investment in Shipping Companies through Valuation of Used Vessels
	Benefits of Road Underground Projects	New benefits such as reducing noise damage, reducing habitat damage, and utilizing upper space are derived.	Benefits of Underground Roads
	Environmental Benefits of Railway Business quantification	Quantifying environmental costs such as noise value, air pollution costs, and carbon	Quantification of Environmental Benefits of Railway Business
This study	Business Feasibility of New Marine Transportation Means	B/C, NPV, IRR	Feasibility of Marine Leisure Ship Business for 12-seater Motor Boats

3. Research Methodology

3.1 Research model through empirical case analysis

The subject of this study was an empirical analysis based on a ship with a similar specification to the ship to be put in as a new means of sea transportation and a domestic city A. Labor costs, fuel costs, fixed costs, and insurance premiums were calculated by applying similar ships, and facility costs were calculated based on

city A. The project feasibility was analyzed by applying the value derived through this empirical analysis to B/C, NPV, IRR. The formula description for each model is as follows.

$$\frac{B}{C} = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} / \sum_{t=0}^{n} \frac{C_t}{(1+r)^t} \quad (1)$$
$$\therefore \frac{B}{C} = \sum_{t=0}^{10} \frac{B_t}{(1+0.045)^t} / \sum_{t=0}^{10} \frac{C_t}{(1+0.045)^t}$$

B_t = net present value of benefits, C= net present value of costs

According to (1), in this study, the social discount rate was set at 4.5%, analyzed until the 10th year, and conducted a project feasibility study, so n=10 and r=0.045 were set.

$$NPV = (\frac{R_1}{(1+r)} + \frac{R_2}{(1+r)^2} + \cdots + \frac{R_n}{(1+r)^n}) - C \quad (2)$$
$$= \sum_{t=1}^{n} \frac{R_t}{(1+r)^t} - C$$
$$\therefore NPV = \sum_{t=1}^{10} \frac{R_t}{(1+0.045)^t} - C$$

R_t= cash inflow in t time, C=T cash outflow in o time

$$IRR; \frac{R_1}{(1+r)^2} + \frac{R_2}{(1+r)^2} + \cdots \frac{R_n}{(1+r)^2} = C \quad (3)$$
$$\sum_{t=1}^{n} \frac{R_t}{(1+r)^t} - C = 0$$
$$\therefore \sum_{t=1}^{10} \frac{R_t}{(1+r)^t} - C = 0$$

3.2 Procedure of research

This study was conducted according to the procedures and methods as shown in Table 2 below to analyze the feasibility of the new marine leisure ships. First, the ships to be deployed to estimate the cash flow of new marine leisure ships were divided into new shipbuilding and introduction of secondhand ships, and then the business conditions for cost and benefit estimation were determined based on these conditions and the social discount rate was applied according to the preliminary feasibility study guidelines of the National Finance Act. After that, the analysis items were determined by itemizing project costs, operating costs, and various operating profits by period, and the operating balance during the evaluation period was estimated by predicting passenger demand. Finally, the feasibility of the project was evaluated by deriving the present value by performing a cost-benefit analysis according to the cash flow of the project proposal.

Table 2. Procedure of research

Step 1	Establish conditions for business feasibility analysis - Determining business conditions such as discount rate (expected return), cost estimation, and benefit estimation
Step 2	Determining and estimating analysis items - Determination of itemization of project cost, operating cost and operating profit and estimation method for each item
Step 3	Business Feasibility Analysis - Prepare cash flow tables, derive present value (NPV/IRR), and analyze B/C

3.3 Establish conditions for business feasibility analysis

3.3.1 Fundamental premise for business feasibility

The new marine leisure ships are a new concept of transportation with the characteristics of marine leisure, and will be implemented as a public investment project. In addition, it was assumed that the new maritime transportation means were operated by putting them into the routes of Gukhwa Island, Ippa Island, Land Island, and Pungdo Island in Gyeonggi-do, and the study was conducted on the condition that a total of six ships were operated. Public policies incur costs in the early stages, and the benefits of the policy gradually arise over a long period of time, so the appropriate investment value of the time to be analyzed should be considered. In addition, the policy assessment should be based on increased or reduced benefits rather than on the public sector's own revenue or cost reduction, which should include effects that cannot be measured in monetary value, thus requiring reasonable cost, benefits and discount rates to determine whether the introduction of new maritime transportation is socioeconomic.

3.3.2 Social discount rate

The most basic characteristic of public investment projects is that large costs are invested in the early stages, and the resulting benefits are gradually generated over a long period of time. Compared to the private sector, benefits take longer to be generated in the public sector. Because these costs and the resulting benefits are different at different times, should set a reference point for the analysis to compare them at the same value. Governments of each country are setting various social discount rates in consideration of the social/economic situation of each country and the need for investment projects. In the case of S. Korea, the social discount rate is classified and applied according to the type and purpose of domestic public investment projects as shown in Table 3 below.

Table 3. Social discount rate criteria for public investment projects

Type	Preliminary Feasibility Study of National Finance Law	Feasibility Study of Local Finance Law	Eligibility Study for Private Investment Act
Concepts and objectives	Budget reflection prior to feasibility study to determine government and investment priorities	Investigation for determining financial investment and priorities during investment review	Quantitative Valuation of the Comparative Advantage of Private Investment Projects
Social discount rate	4.5%	4.5%	4.5%
Financial discount rate	4.5%	4.5%	Profitable type 4.5% Rental type 6%
Target project	Total project cost 50 billion the national budget of 30 billion won	Total project cost of KRW 50 billion or more among projects subject to investment review	Projects promoted by relevant laws and regulations
Investigative agency	KDI	Korea Institute for Local Administration	KDI

In the case of this projects, which are the subject of this study, they fall under the feasibility study category of the local finance law because they have the nature of public investment, but the project cost is less than 50 billion won, which is excluded from the application of the relevant law. However, the same level of discount rate of 4.5% is applied to the application of the social discount rate for business feasibility analysis in this study.

3.3.3 Cost estimation

The project cost for operating new ships was calculated as shown in Table 4 below based on the operating cost of other existing marine leisure ships

Table 4. Cost estimation items for marine leisure ships

Type	Category
Capital Expenses	Cost of construction of new shipbuilding, cost of introducing used ship
Operating expenses	Fuel expenses, crew expenses (labor expenses, welfare expenses), ship maintenance expenses (ship supply expenses, maintenance expenses)
Fixed cost	Ship depreciation expenses, insurance premiums, operating expenses (pillowage fees, property taxes, etc.)
Facility expenses	Introduction and operation expenses of convenience facilities
General Management cost	Other expenses (facility maintenance expenses, etc.)

3.4 Estimation of operating profit

3.4.1 Operating costs

The operating cost of new marine leisure ships was analyzed by applying similar ships, and a business type was formed by introducing and operating six ships. As a result of estimating operating costs, the annual amount is estimated to be KRW 10.25 billion, which is equivalent to pure ship operating costs excluding depreciation and ship costs. The results of operating cost estimation are shown in Table 5 below.

Table 5. Total operating costs

Type (Unit: 10,000Won)			Cost	Note
Capital expenses	Construction of new shipbuilding		150,000	25,000*6
	Purchasing of second-hand ships (10Y)		90,000	15,000*6
Operating expenses	Labor costs	Operation Job	25,200	Based on 6 captains. 350*12mon*6
		Operation support Job	6,600	Based on 1 representative office manager and 1 office manager 300*12mon+250*12mon
	Fuel cost		53,760	Fuel consumption of similar ships is applied according to the fuel unit price of 1,400/liter.
	Ship maintenance costs	Shipping cost	1,008	Calculated on a monthly basis of KRW 150,000 by referring to the shipping cost of similar ships.
		Maintenance costs	1,200	Calculated on an annual basis of KRW 1 million by referring to similar ship maintenance costs.
Fixed Cost	Insurance fee		4,830	It is the sum of passenger insurance premiums, crew insurance premiums, and ship insurance premiums by referring to the costs of similar ships.
	General cost		2,700	The cost of a similar ship is referred to as various incidental expenses such as cleaning fees and fees.
General administrative expenses	Administrative expenses		7,200	Other labor costs and other expenses for similar ships are applied
Total			102,498	

3.4.2 Facility costs

The transport capacity was calculated by assuming 6 ships and 4 voyages. As a result, it was derived that the daily transport capacity is 576 people and the annual transport capacity is 115,200 people. Therefore, ships and infrastructure that can be used by 115,200 people per year are required when operating new ships. The overall infrastructure cost required for the smooth operation of marine leisure ships was KRW 12,649 million in total, which was analyzed by including it as a facility cost item in the economic feasibility analysis. The cost of this facility is limited to mooring facilities for berthing marine leisure ships, and other necessary overall costs are regarded as national project costs.

3.4.3 Operating income

Based on the forecasts derived through empirical analysis, the total annual income was expected as shown in Table 6 by applying fares collectively. The unit price used for passenger income analysis was applied at KRW 26,000 by applying the average fare of marine leisure ships operating similar routes in S. Korea. Furthermore, the annual growth rate of the number of passengers carried was taken into account to estimate the expected passenger revenue until 2030. 1st year annual demand is calculated by reflecting the expected occupancy rate (based on the occupancy rate in other case) from the annual transport capacity of ships. The average annual demand growth rate for 2021-2030 is 1.7%, which is the rate of increase over the past 10 years for the "entertainment and culture" category of household expenditures, based on the average and growth rate of household expenditures published by Statistics S. Korea. Therefore, it is expected that the occupancy rate will remain at 85%-93% for 10 years if the six new vessels are maintained.

Table 6. Estimation of demand & income

Years	Demand(people)	Freight	Income(won)
1st year	46,080	26,000 won	1,198,080,000
2nd year	46,863		1,218,447,360
3rd year	47,660		1,239,160,965
4th year	48,470		1,260,226,702
5th year	49,294		1,281,650,555
6th year	50,132		1,303,438,615
7th year	50,985		1,325,597,071
8th year	51,851		1,348,132,222
9th year	52,733		1,371,050,469
10th year	53,629		1,394,358,327

3.4.4 Estimating the profit of operations

As a result of estimating the operating profit based on the expected costs and revenues for the next 10 years, the operating profit is expected to be around KRW 0.98 billion-1.87 billion per year for the next 10 years, and the cumulative total profit for 10 years is expected to be around KRW 14.22 billion. At this time, the operating profit was analyzed as the cash flow from pure ship operation. The results of operating profit estimation is shown in Table 7 below.

Table 7. Operating profit estimation results (10,000won)

Type	1st year	2nd year	3rd year	10th year
Revenue	119,808	121,845	123,916	139,436
Passenger revenue	119,808	121,845	123,916	139,436
Total cost	109,998	111,078	112,183	120,689
Operating cost	87,768	88,607	89,467	96,113
Personnel cost	31,800	32,595	33,410	39,714
Fuel cost	53,760	53,760	53,760	53,760
Ship maintenance cost	2,208	2,252	2,297	2,639
Fixed cost	14,730	14,826	14,925	15,672
Insurance fee	4,830	4,926	5,025	5,772
General fee	2,700	2,700	2,700	2,700
General management fee	7,200	7,344	74,909	86,047
Estimated balance	9,810	10,767	11,733	18,746
Accumulated Profit and Loss (10years)	9,810	20,577	32,310	142,245

4. Results of a business feasibility analysis

4.1 probability analysis

The ship investment feasibility analysis for a newbuilding and 10 years of operation was evaluated with an NPV of 192,953,723 and an IRR of 2.1%. On the other hand, when analyzing the feasibility of investing in a secondhand ship and operating it for 10 years, the NPV was evaluated as 332,465,218 and the IRR as 7.1%. It was found that both new ship construction and secondhand ship purchase are profitable for ship operation, but it is appropriate to analyze the economic feasibility based on new ship construction in consideration of the stability and public interest in ship operation. The results of probability are shown in Table 8 below.

Table 8. Results of feasibility

Type	NPV(10Y total)
Newbuilding	192,953,723
Secondhand	332,465,218
Gap	139,511,495

4.2 Cost-benefit analysis

The project to introduce a new marine leisure ships, which is the subject of this study, has a public investment character as it reflects public interest such as improving transportation convenience and securing the right to live for residents and tourists. Therefore, it is necessary to conduct a cost-benefit analysis that reflects various social benefit factors in addition to profitability analysis. Based on the KDI's preliminary feasibility analysis guidelines, the benefits were calculated as shown in the following Table 9 by applying the unit price for each benefit item and the unit price for operating costs.

Table 9. Benefit estimation items

Type	Items
Direct benefits	1. Reduce vehicle operating costs 2. Reduced travel time 3. Reduced traffic accidents 4. Parking cost reduction benefits, etc.
Indirect benefits	1. Reduced environmental costs 2. Regional development effect 3. Expansion of market area 4. Reorganization of local industrial structure

However, the KDI explained that among the benefits of transportation conversion projects, factors such as increased comfort, regional development effects, market expansion, and regional industrial structure reorganization are difficult to quantify and controversial to calculate directly as benefits, so they are excluded from the business feasibility analysis. In the case of this study, the benefits of reducing vehicle operating costs, traffic accidents, and environmental costs were also excluded because it is an expansion of new transportation methods rather than a replacement of existing transportation methods. Therefore, the benefits of the analysis reflected the benefits of reducing travel time due to improved accessibility compared to existing ferry ships. The benefits related to this were calculated by (4)

$$VOTS = VOT_{project\ not\ implemented} - VOT_{project\ implemented} \quad (4)$$

$$VOT = \sum_{l}\sum_{l=1}^{4}(T_{kl} * P_k * Q_{kl} * 365)$$

As a result of the analysis, the benefit of reducing travel time costs was expected to be around KRW 1,626 Mil per year.

The results of the benefit analysis show that the travel time savings due to improved transportation convenience is greater than the operating revenue generated by the ship operation. The total benefits derived from the benefit analysis are shown in Table 10 below.

Table 10. Benefit analysis results (million won)

Type	Operating income	Reduce travel time costs	Total Benefit
1st year	1,198	1,626	2,824
2nd year	1,218	1,626	2,844
3rd year	1,239	1,626	2,865
4th year	1,260	1,626	2,886
5th year	1,282	1,626	2,908
6th year	1,303	1,626	2,929
7th year	1,326	1,626	2,952
8th year	1,348	1,626	2,974
9th year	1,371	1,626	2,997
10th year	1,394	1,626	3,020

From these process, it is economically feasible with a B/C ratio of 1.042. In addition, the total benefit over the 10-year operation period using a social discount rate of 4.5% was evaluated to be about KRW 292.0 billion, which is higher than the total cost of about KRW 256.6 billion. In conclusion, the B/C is 1.042, the NPV is KRW 9.56 billion, and the IRR is 1.6%. The results of economic analysis are shown in Table 11 below.

Table 11. Economic analysis results

Type	Present value		Economic feasibility		
	Cost (Mil KRW)	Benefit (Mil KRW)	B/C	NPV (Mil KRW)	IRR
New ship	25,666	29,202	1.042	956	1.60%
secondhand ship	25,066	29,202	1.049	1,095	1.98%

4.3 Results of a feasibility analysis

The cost-benefit analysis of introducing a new marine leisure ships showed that the B/C ratio was 1.042, indicating economic feasibility. The NPV, which is an important profitability analysis indicator from an operator's perspective, was KRW 193 billion and the IRR was 2.1%, indicating that profitability is weakly secured. In the case of the entire business, if the facility cost increases by 7.8%, the transportation demand decreases by 9.4%, and the fare decreases by 10%, the business will not be secured, so adjustment of the operational aspect and clarification of the facility cost will be necessary. Therefore, a clearer review of facility costs and continuous monitoring of changes in fare demand are required for the success of this project. The results of sensitivity analysis according to changes in facility costs are shown in Table 12 below.

Table 12. Sensitivity analysis according to changes in facility costs

Facility costs	B/C	NPV(Mil won)
-10%	1.101	2,166
-5%	1.070	1,561
Base	1.042	956
+5%	1.015	350
+7.8%	1.000	0

5. Conclusions and Recommendations

The purpose of this study is to evaluate the business feasibility of a new marine leisure ships by conducting a business feasibility analysis. As a result of the business feasibility analysis of investing in new maritime transportation, it was found that economic feasibility exists with a B/C of 1.042 and 1.049 for new and secondhand ships, respectively; however, considering the stability of the ship and the publicity and continuity of the business operation, it is recommended to invest in new ships compared to secondhand ships.

The total benefit over the 10-year operating period using a social discount rate of 4.5% was evaluated to be about KRW 292.0 billion, which is higher than the total cost of KRW 256.6 billion. In conclusion, the profitability analysis showed that the B/C was 1.042, the NPV was KRW 193 billion, and the IRR was 2.1%, which indicates that profitability is weakly secured. Based on this, the following implications were drawn.

First, the profitability of the new maritime transportation business, like the passenger ferry business, was a concern due to its characteristics as a marine leisure ships, but it was confirmed that it was profitable enough for private investors to invest.

Second, by using cost-benefit analysis to evaluate the feasibility of the project, we were able to see how maritime transportation affects the social factor of reducing travel time.

Third, by conducting a business feasibility analysis of maritime transportation and marine leisure ships, which have been rarely observed so far, we laid the foundation for future business feasibility assessments of maritime transportation and marine leisure ships by systematically organizing social benefits and demand forecasts.

However, despite the implications of this study, it has the following limitations, which require further research or monitoring.

First, It is necessary to establish measures for business uncertainty and risk management through sensitivity analysis for various items. Through this study, it was found that a 7.9% increase in facility costs was negative for economic feasibility. Therefore, it is necessary to analyze the sensitivity of various factors such as passenger demand, usage fees, and labor costs. In addition, it is necessary to improve reliability by adjusting the operational aspects and clarifying the facility cost.

Second, among the benefits of the introduction of new marine leisure ships, factors such as increased comfort, regional development effects, expanded market area, and reorganization of local industrial structure are difficult to quantify and may be controversial to calculate directly as benefits, Therefore, in order to increase the reliability of the evaluation results, it is necessary to improve the relevant social benefit factors.

Finally, in economic evaluation, the analysis period has a significant impact on the B/C value, so it is one of the most important factors. In this research, the analysis period is 10 years, but in general, which is set in consideration of the durability of the vessel. This point should be advanced to improve the reliability of the research results.

We hope that future monitoring and follow-up studies will address these limitations.

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