Analysis of the Financial Feasibility of Reusing the Former Plastic Manufacturing Heritage Site in Taiwan

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***Abstract*—The restoration and reuse of cultural heritage sites have become important issues in cultural heritage conservation. Financial feasibility related to the reuse and sustainable development of cultural heritage is key factor in the continuous conservation of cultural heritage. This study utilized engineering economics with comprehensive cost and revenue estimations to evaluate the economic feasibility analysis of restoration and reuse to reveal the financial indicators and risk analysis of the Former Plastic Manufacturing Heritage Site in Taiwan. Results reveal that at an interest rate of 5%, the site's NPV is NT$90.18 million, SLR is 115.5%, project and equity IRR and ERR are 6.20% and 5.37%, meaning that it can fully cover its own expenses, make profit, which also reflects the attractiveness of this investment to the Group. The heritage site will begin to generate profits in 2051, 31 years after it commences operations in 2021. Risk analysis reveals that the site's financial structure is sensitive to visitor numbers and the purchase rate, which efforts should go into raising visitor numbers and purchase rate it can greatly strengthen the site's financial robustness and help it to avoid financial losses when faced with rising interest rates.**

***Index Terms*—Industrial heritage conservation, restoration and reuse, financial feasibility analysis, engineering economics.**

I. Introduction

The restoration and reuse of cultural heritage sites have become important issues in cultural heritage conservation. Many unique historical buildings have been renovated in Taiwan and given a new value to conform to the cultural and historical trend of cultural heritage reuse and revitalization. With a growing amount of cultural heritage restoration and reuse processes, the government and public find themselves under growing pressure to provide funds for cultural heritage maintenance. Financial feasibility related to the reuse and sustainable development of cultural heritage is key factors in the continuous conservation of cultural heritage. Therefore, analysis of the financial feasibility of cultural heritage restoration and reuse is a very important aspect of cultural heritage conservation.

The Former Plastic Manufacturing Heritage Site is the birthplace of Taiwan's plastics industry. Built in the last century, the factory manufactured the plastic material polyvinyl chloride (PVC). After two decades, the factory served as a place for PVC research and development by the Plastics manufacturing group, which included work on product quality improvement and new product development.

The greater part of the land of the former factory is a state-owned property. The factory stopped its production after 60 years in accordance with the local urban plan. Due to the importance of the factory in the history of the plastics industry's development in Taiwan, the Former Plastic Manufacturing Heritage Site proposed that some facilities of the factory be recognized as cultural heritage sites to be conserved after reaching an agreement with the Government. A historical building site was planned for construction in order to preserve parts of the factory facilities, dormitories, and offices located within urban green corridors and site land. The Former Plastic Manufacturing Heritage Site agreed to provide financial assistance to establish a foundation for the restoration, reuse, and operations management for the site and proposed to recognize it as a cultural heritage site, suggesting reuse possibilities. Thus, the future costs of restoration, reuse, and operations management, as well as the revenues from reuse, were estimated prior to construction of the site. A financial evaluation was conducted to provide the company's decision-makers with a reference for estimating the foundation's scale and to provide a basis for the future development of heritage economics.

Engineering economics is a financial evaluation method that is often applied in engineering investment projects to determine their financial efficiency using the concepts of compound interest and discounts while considering the time value of money under the principle of economic equivalence. In the past, the analysis of a project's financial feasibility was used in very few cultural heritage restoration and reuse cases, while there has been rapid development in the interdisciplinary convergence of economic evaluation, cultural heritage conservation, and construction in recent years. This study employed engineering economics to evaluate the financial feasibility of the Former Plastic Manufacturing Heritage Site Project and also conducted sensitivity analyses, thus contributing to the field due to the rarity of such analyses in the past.

This study conducted financial and risk analyses for the construction and operation of the Former Plastic Manufacturing Heritage Site from 2017 to 2070, estimating different types of financial indicators and performing sensitivity analyses in order to assist Plastics manufacturing group decision-makers and the government in their decisions regarding site investments and operations management and to provide criteria for the financial evaluation of other cultural heritage conservation efforts.

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II. The Model

A. Model Introduction

In financial management, engineering economics is referred to as the capital budget decision-making method. Engineering economics is the main method for decision-making regarding investments into historical site restoration and reuse projects and financial management plans. This evaluation method is used in resource allocation and investment decision-making to solve engineering issues and achieve economic efficiency. According to [1], the initial publication of *The Engineering Economist* by Arthur Lesser in 1955 distinguished engineering economics as a special discipline and initiated its application in the evaluation of engineering projects.

Engineering economics combines construction planning and economic theory. Life-time financial planning is recommended for future construction and operations during engineering projects for heritage restoration and reuse in order to forecast the restoration and reuse costs and the revenues from reuse based on economic theory. The financial programming and risk sensitivity analysis of restoration and reuse projects under different possible discount rates, times, and risks can provide financial criteria for finance- and operation-related decision-making in cultural heritage restoration and reuse, as well as a basis for restoration and reuse decision-making under various conditions.

B. Financial Index

The following nine financial criteria were considered ([2]).

1) Net present value (NPV)

The NPV serves as a reference when making investment-related decisions. An investment project can be accepted if cash inflows are greater than cash outflows, i.e. NPV>0, and rejected otherwise.

2) Self-liquidating ratio (SLR)

An SLR greater than 100% indicates that a project is entirely self-liquidating, that is, all invested construction costs can be returned as net operating income. An SLR less than 100% but greater than 0% indicates that a project is not entirely self-liquidating and requires government investment in infrastructure.

3) Benefit-cost ratio (B/C ratio)

The B/C ratio is calculated by dividing current revenue by current costs. A B/C ratio greater than 1 indicates financial feasibility.

4) Internal rate of return (IRR)

The IRR makes the estimated total current value of cash inflows in an investment plan equal to the estimated current total value of cash outflows; that is, it allows the project to break-even and NPV to equal 0.

5) External rate of return (ERR)

In case of high cash flow volatility in an investment project, the IRR can produce multiple solutions which may cause indecision in policy-makers. In this case, adjusting the IRR to the WACC (weighted average capital cost) and determining the current value of cash outflows over the term of investment using the discounted WACC, cash inflows compounded by the WACC, and making cash inflow and outflow discount rates equal is the ERR.

If the weighted cost of capital is smaller than ERR, then NPV>0 and the project should be accepted.

6) Discount payback period (DPP)

A short payback period after the discount attracts investors.

7) Profit index (PI)

After the discount, investments starting from NT$1 can earn future operating income.

A project is feasible if PI>1 and not feasible otherwise.

8) Equity rate of return (equity IRR)

IRR can only be obtained from equity capital. Higher Equity IRR is more beneficial for shareholders.

9) Equity net present value (equity ERR)

NPV can be obtained only from equity capital. Higher Equity ERR is more beneficial for shareholders.

This study used the nine indicators described above to determine financial indicators and conducted risk analysis by integrating changes in site revenues and costs.

III. Data Processing and Parameter Setting

A. Financial Evaluation

This chapter introduces the financial evaluation for the restoration and reuse project. This study estimated that the project would be completed within four years from 2017 to 2020 and begins operation in 2021. The operating period analyzed was 50 years, between 2021 and 2070. The results in this chapter explained the effective reuse of site space and extended the marketing concept of the Plastic manufacturing group and an evaluation of the financial feasibility of historical building conservation and reuse, providing reference for competent authorities and the Plastic manufacturing group.

Reference [3] evaluated Hala Koszyki, a large indoor retail market constructed in the commercial district in the center of Warsaw in 1908, conducting an engineering economics analysis of the restoration and reuse of this retail market. Due to insufficient space, the restoration of the retail market began in 2005, and its renovated main hall was expected to include 10,000 square meters of retail space. Moreover, three 200 meter high dwelling/commercial buildings and an underground parking lot were constructed.

Reference [3] applied engineering economics and designed four situations, from the restoration and reuse of the old buildings to the construction of new buildings. The results showed that the return on investments for building restoration and reuse was 16% (the discounted costs were 76 million euros, while the discounted benefits were 88 million euros), whereas the return on investments for building restoration and new construction was approximately 19%. This indicated that the return on investments for building restoration and reuse was higher than that in many engineering projects. As in the engineering projects in the new energy industry described below, this can serve as financial motivation for cultural heritage restoration and reuse. Hala Koszyki officially re-opened in October 2016.

Reference [4], [5] applied engineering economics to evaluate the feasibility of new energy sources, such as biogas, algal biofuel, biohydrogen, and biobutanol, from the perspective of a bioeconomy. Reference [6] utilized engineering economics to evaluate the financial evaluation of water utility of Swiss. Reference [7]-[9] are also utilized engineering economics to evaluate financial feasibility of cultural heritage. The studies described above show that engineering economics is highly applicable to current industrial heritage issues and can be used in decisions relating to a company's and the government's restoration and reuse policies.

The internal costs of the site evaluated in this study included:

1) Restoration and reuse investigation costs (evaluation of the current state and safety of each historical building, the history of the Former Plastic Manufacturing Heritage Site area, an analysis of landscape and cultivation within the site area, etc.) (NT$3.3 million)
2) Kaohsiung factory history 3D exhibition and website development costs (NT$1.5 million)
3) Costs of restoration of historical buildings within the conservation site area (NT$94.92 million), display facilities (NT$25.50 million), and reuse design and construction (NT$ 29.71 million)
4) Costs of new landscape engineering within the site (NT$40.55 million), a Skyway green corridor (NT$206.86 million), and infrastructure engineering (NT$10.50 million)
5) Costs related to cleaning and waste management in active areas in the site, maintenance, recycling, wastewater management, the drainage system, walking paths, indoor decoration, the thermal energy supply, waste management, air conditioning, night illumination, guided tours, the spray irrigation system, clearance, new plant cultivation, and utilities
6) Operating and maintenance costs after site reuse, repair costs, salary (staff costs), and insurance costs (including labor insurance, health insurance, public liability insurance, and property insurance)
7) Replacement costs associated with restoration, indoor display decoration, and landscape engineering
8) Costs related to marketing, public relations, and the organization of various activities
9) Other costs related to commissioned services, such as design, CIS, logo, website, and Facebook
10) Costs related to taxation, management, administration, design supervision, quality control, hygiene and safety facilities, services, general affairs, postage, fax, phone, and stationery
11) Lawyer and accountant service costs
12) Internal benefits of the Former Plastic Manufacturing Heritage Site were determined by business items, including:
13) Standard OT royalties and operating royalties from the dormitories for singles turned youth hotel
14) 20% revenues from the cafes reconstructed from the employee canteen
15) 20% revenues from the rent and cultural innovative stores reconstructed from the 2-unit townhouse dormitories
16) Sales revenues from Taiwan plastics souvenirs sold in private green stores, cultural innovative stores, and the tourist information office
17) Revenues from outdoor restaurants and food trucks and indoor restaurants
18) Revenues from advertisements inside and outside the site and on its website

B. Financial Analysis Parameters

Base year is 2017. Construction for four years, 2017 to 2020. Operating for 50 years from 2021 to 2070.

Duration of Operating-Transfer (OT) contraction is 5 years

Price inflation is 1.18% annually.

Wage inflation is 1.71% in a 5-year interval.

Due to the absence of financing requirements on behalf of the Plastic manufacturing group, the capital structure used in this project was 100% self-funded.

Most Attractive Rate of Return (MARR)

Due to the presence of historical buildings and cultural innovative companies and hotels in the site area of the Songshan factory, it is very similar to the project investigated in this study in terms of operating nature and business items. Therefore, it served as a reference for the financial parameters used in this study. Due to the high credit rating, low bad debt risk, and low risk premium of the Plastic manufacturing group, the minimum acceptable rate of return (MARR) at (a) WACC, (b) risk premium, and (c) estimated break-even point equal to 5% was used as the main discount rate in the financial analysis. The lower limit of MARR was 3.5%, and the upper limit of MARR was 8.9%, which was the same as the upper limit of Taipei City Government's IRR in the Songshan Cultural Park. Sensitivity analysis was conducted for three discount rate levels with regard to the financial performance of the park.

Tax base assumption

The land is public land and the site is managed under an adoptive management framework; thus, there were no land rent-related issues. The site has a profit plan, and since the plan set profit-seeking enterprise income tax at 17%, said 17% was deducted from site sales revenue.

Equipment replacement and overhaul

viii-1) Interior and decorating cost

Interior and decorating cost has a lifespan of about 10 years, and 10% of this cost is designated over 10 years for the estimation of equipment replacement cost.

viii-2) Operation and other equipment

Operation and other equipment have a lifespan of about 10 years, and 5% of this cost is designated over 10 years for the estimation of equipment replacement cost.

Youth hostel royalty

ix-1) Fixed royalty

The youth hostel, which was previously a hostel for singles, is managed under an OT framework. From the date of the signing of the land and building lease contract, the site's operator shall pay a fixed royalty of NT$5,259,878 annually. The contract duration is five years, and every five years, the fixed royalty is raised slightly by 5% based on the 5-year inflation rate and economic conditions.

ix-2) Royalty for changes in operations

Set at 5% of the site operator's actual operating income (pre-tax) for the year.

C. Initial Investment Cost

The plan's initial investment costs include re-modelling costs and preliminary expenses, and are estimated to be NT$417 million (Table I).

TABLE I: TOTAL EXPENDITURE FOR RESTORATION AND REUSE OF HERITAGE SITE

No.	Items	Cost (NT$)
1	Budget for the restoration and reuse of historical buildings	159,199,066
2	Budget for landscaping	40,548,463
3	Budget for the skyway green corridor	206,863,122
4	Budget for public art	10,497,984
	Total	417,108,636

Source: Estimated by the authors.

D. Total Expenditure for Restoration and Reuse

Includes NT$40,548,463 for landscaping, NT$206,863,122 for the skyway green corridor, and NT$10,497,984 for public art. The park's total restoration and reuse cost is NT$417,108,636 (Table Ⅱ).

TABLE II: TOTAL EXPENDITURE FOR RESTORATION AND REUSE OF THE 14 HISTORICAL BUILDINGS IN THE PLASTIC HERITAGE SITE UNIT: NT$

No.	Building name	Restoration cost	Project cost	Reuse cost	Total
1	Founders' offices	24,093,562	2,340,000	1,400,000	27,833,562
2	Guardroom	1,545,896	0	75,000	1,620,896
3	Founder's Hostel	7,042,351	2,340,000	1,356,600	10,738,951
4	Dormitory for singles	15,656,825	0	14,060,000	29,716,825
5	Employee store	4,400,531	0	1,020,000	5,420,531
6	2-unit townhouse dormitory (A)	2,800,889	0	680,000	3,480,889
7	2-unit townhouse dormitory (B)	2,800,889	0	680,000	3,480,889
8	2-unit townhouse dormitory (C)	6,284,854	0	1,530,000	7,814,854
9	2-unit townhouse dormitory (D)	6,284,854	0	1,530,000	7,814,854
10	2-unit townhouse dormitory (E)	5,936,456	0	1,445,000	7,381,456
11	2-unit townhouse dormitory (F)	5,936,456	0	1,445,000	7,381,456
12	Materials warehouse	10,489,564	15,400,000	4,200,000	30,089,564
13	Coral stone wall	350,947	15,600	0	366,547
14	Furnace exhaust chimney	1,305,155	5,408,000	291,000	7,004,155
	Total	94,929,230	25,503,600	29,712,600	150,145,430

Source: Estimated by the authors

E. Estimation of operating income

The operating income was estimated based on market information (including conditions in the area surrounding the land, spending power, the characteristics of various industries, and public information) and the land's future operations plan and marketability. Because the site hosts for-profit activities, a profit-seeking enterprise income tax of 17% is deducted from operating income, and each operating income item is adjusted based on an inflation rate of 1.18%.

In its first year of operation (2021), the site will generate an operating income of NT$396 million with an annual revenue of NT$482 million, of which NT$22.8 million in revenue will be drawn from the townhouse cultural and creative shops, NT$9.58 million will come from the Plastic manufacturing group' green products and cultural and creative souvenirs, NT$5.259 million will come from the youth hostel's OT royalty, and a primary revenue of NT$4.33 million will come from rent paid (per ping) by the townhouse cultural and creative shops. The following estimations for the project's operating income show the impact of changes to and the importance of each revenue item.

F. Operating and Maintenance Costs

The relevant operating costs and expenditures for operating items, including personnel expenses, equipment maintenance expenses, insurance expenses, and other operating expenses, are estimated based on the expense ratio under general market conditions. Additionally, preliminary estimates of the project's operating expenses (OPEX) in its first year (2021) are NT$10,817,058, and will adjust by price inflation and wage inflation.

IV. FINANCIAL CALCULATION RESULTS AND ANALYSIS

A. Financial Cost-Benefit Analysis and Debt-Paying Ability

This study used engineering economics to evaluate the site's financial feasibility using the site's discounted cash flow by time value and economic equivalence principles.

The site would be constructed from 2017 to 2020 and operate for 50 years from 2021 to 2070; the interest rate (discount rate) was set at 5%. This was a baseline scenario for analysis; in other words, financial feasibility analysis assumed an interest rate of 5% and other operating environment conditions remain unchanged.

Sensitivity analysis was used for risk assessment. Using the above interest rate (discount rate) of 5%, upper and lower limits were set at 3.5% and 8.9%. With respect to revenue, visitor numbers and purchase rates were increased by 100%, percentage drawn was adjusted from 15% to 25%, and rent was raised higher than that at the Songshan Cultural and Creative Park, thus providing us with five risk scenarios. Cost-wise, O&M cost and initial investment costs were increased by 100% to form three risk scenarios, thereby allowing the Plastic manufacturing group (the investor) and decision-makers to understand the project's operational risks.

B. Baseline Scenario Analysis: Financial Feasibility Analysis Assuming an Interest Rate of 5% and That Other Operating Conditions Remain Unchanged

At an interest rate of 5% (Table III), the site's NPV is NT$90.18 million, of which the present values of revenues and costs are NT$671 million and NT$581 million, respectively, indicating that at an interest rate of 5%, this project's operating income and cost can generate NT$90.18 million in actual purchasing power for its investors in 2017. This means that the site is worth investing in.

The project's SLR is 115.5%, meaning that it can fully cover its own expenses. This is a positive piece of financial and management information for the Plastic manufacturing

group and the foundation that will be managing the site. The project's IRR is 6.20%, which is higher than the MARR of 5%, implying an additional 1.2% in unexpected profits; thus, this project is an attractive investment for the Plastic manufacturing group. ERR is slightly lower at 5.37%, but higher than MARR; therefore, the project's return on investment is sufficiently attractive, although it was originally a non-profit project conceived for commemorative purposes. Equity IRR and equity ERR are consistent with original IRR and ERR. This is because the site is fully funded by the Plastic manufacturing group which owns 100% of its equity and no external loans were taken. As a result, these values are consistent and higher than MIRR, which reflects the attractiveness of this investment to shareholders.

The project's benefit-cost ratio is 1.16, indicating that the present value of the project's earnings is higher than the present value of its cost by 116%. This is positive news for the project's investors. The project's PI is 1.24, implying that each NT$1 in initial investment made by the project's shareholders is able to generate NT$1.24 in operating profits, making this project profitable for its shareholders.

With regard to payback period, the site will begin to generate profits in 2051, 31 years after it commences operations in 2021, and it will continue to do so until 2070. Although the project's payback period is long and may not seem attractive compared to other general investments, the site itself carries a commemorative significance and generating profits is not the objective. Of greater importance is the ability of the foundation to operate the site in a self-sufficient manner. Moreover, the latter 20 years (until 2070) will see a gradual increase in profits, providing financial soundness and confidence for the Plastic manufacturing group.

TABLE III: FINANCIAL FEASIBILITY ANALYSIS FOR BASELINE AND SENSITIVITY ANALYSIS

Interest rate	Baseline 5.00%	3.50%	8.90%
NPV (NT$)	90,178,445	262,988,936	-117,050,238
IRR	6.20%	6.20%	6.20%
ERR	5.37%	4.51%	7.91%
Equity IRR	6.20%	6.20%	6.20%
Equity ERR	5.37%	4.51%	7.91%
PV Revenue	$ 671,219,258	$ 926,607,256	$ 345,303,948
PV Cost	$ 581,040,812	$ 663,618,321	$ 462,354,186
B/C	1.16	1.40	0.75
Profit Index	1.24	1.67	0.67
Discount Payback period	31 years after operation at 2051	23 years after operation at 2043	Never payback.
Self-liquidation ratio SLR	115.5%	139.6%	74.7%
Base year	2017	2017	2017

Source: Estimated by the authors.

C. Risk Assessment

For the interest rate risk analysis, given that interest rates can fluctuate and have a considerable impact on the project's financial assessment, the upper and lower distribution of rates was applied to calculate risk sensitivity. As for other revenue and cost elements, a reduction in cost would benefit the site's finances; thus, the management should watch for an unanticipated rise in costs while assuming revenues continue to rise. By doing so, we can observe the operational advantages of future financial growth; therefore, cost and revenue for the other types of risk analyses were increased and the results for lower costs and revenues can be inferred.

1) Interest rate risk analysis

Table III also shows that a 3.5% interest rate can generate a NPV of NT$263 million, far higher than the NT$90.18 million at 5%. But at 8.9%, NPV is -NT$117 million, at which point the site would incur financial losses. The site's financial position is interest-sensitive; hence, the Plastic manufacturing group and Foundation must monitor the interest rates of the Group and the site to ensure the operational stability of the parent company, maintain the financial and operational stability of the site, and preserve the site's original public and commemorative nature, all of which maintain the financial indicators.

The same applies to other financial indicators; at a 3.5% interest rate, B/C ratio is 1.40, SLR is 139.6%, and PI is 1.67, indicating that the site will be financially sound at this interest rate. In this case, the initial cost will be recovered in 2043, eight years earlier than projected at a 5% interest rate. At an 8.9% interest rate, B/C ratio is 0.75, SLR is 74.7%, and PI is 0.67, indicating that the parent company would need to inject an additional 25.3% in funding. Thus, in this case, the investment would not be recovered at the start of 2070.

2) Risk analysis doubling the number of visitors

This risk scenario doubles the number of visitors from 500 to 1,000 per day (from 182,500 to 365,000 per year). It is also assumed that the site's restaurants, cultural and creative shops, and indoor and outdoor cafes will double the number of purchasing customers.

Table IV shows that all of the indicators will rise to a considerable degree. At a 5% interest rate, NPV is NT$614 million, IRR is 11.99%, ERR is 6.86%, and SLR is over 200%. These figures are much higher compared to the scenario in which visitor numbers are normal (NPV is NT$95.36 million, IRR is 6.28%, ERR is 5.47%, and SLR is 116.6%). At an interest rate of 8.9%, NPV is positive NT$76 million, IRR is 10.49%. ERR is 9.11%, and SLR is above 100%, indicating a substantial improvement in overall finances.

TABLE IV: FINANCIAL FEASIBILITY ANALYSIS FOR DOUBLING THE NUMBER OF VISITORS

Interest rate	5.00%	3.50%	8.90%
NPV	613,557,104	783,580,014	76,001,675
IRR	11.99%	10.49%	10.49%
ERR	6.86%	5.67%	9.11%
Equity IRR	11.99%	10.49%	10.49%
Equity ERR	6.86%	5.67%	9.11%
PW Revenue	$ 1,216,405,360	$ 1,468,889,630	$ 546,399,690
PW Cost	$ 602,848,256	$ 685,309,616	$ 470,398,016
B/C	2.02	2.14	1.16
Profit Index	2.61	3.00	1.21
Self-liquidation ratio	201.8%	214.3%	116.2%

The above results show that the the Former Plastic Manufacturing Heritage Site 's financial structure is sensitive to visitor numbers and that efforts should go into raising visitor numbers as this can greatly strengthen the site's financial robustness and help it to avoid financial losses when faced with rising interest rates. It is therefore also

recommended that the parent company create image ads for the site. The site can also promote its commemorative and recreational values via the Internet and Facebook and conduct outdoor teaching and other activities for local communities and schools.

3) Risk analysis doubling the purchase rate

In this scenario, the purchase rate for the Plastic manufacturing group's green material products is raised from 15% to 30% and the purchase rate for items sold at cultural and creative shops is raised from 10% to 20%, while everything else remained unchanged. The results show that at an interest rate of 5%, NPV is NT$582 million, IRR is 11.68%, ERR is 6.80%, and SLR is 196.8%, which are slightly lower compared to the scenario where visitor numbers are doubled, yet higher than those when revenue is raised. Performance is even better at a 3.5% interest rate. At an interest rate of 8.9%, NPV is still a positive NT$60.5 million, IRR is 10.18%, ERR is 9.04%, and SLR is above 100%, indicating that overall finances will improve considerably in this case (Table V).

TABLE V: FINANCIAL FEASIBILITY ANALYSIS FOR DOUBLING THE PURCHASE RATE

Interest rate	5.00%	3.50%	8.90%
NPV	582,220,135	741,988,813	60,578,320
IRR	11.68%	10.18%	10.18%
ERR	6.80%	5.60%	9.04%
Equity IRR	11.68%	10.18%	10.18%
Equity ERR	6.80%	5.60%	9.04%
PW Revenue	$ 1,183,762,684	$ 1,425,565,462	$ 530,333,696
PW Cost	$ 601,542,549	$ 683,576,649	$ 469,755,376
B/C	1.97	2.09	1.13
Profit Index	2.52	2.89	1.17
Self-liquidation ratio	196.79%	208.55%	112.90%

Similar to the scenario in which visitor numbers were doubled, the results for this scenario show that the Former Plastics Site's financial structure is sensitive to purchase rates and that efforts should be made to raise the purchase rates for this can greatly strengthen the site's financial robustness and help to avoid the risk of financial losses when facing economic downturns or lower visitor numbers. It is also recommended that the foundation create various indoor and outdoor environments with different atmospheres and music within the site in order to increase the length of time that visitors remain in the site. The site should determine the items to be sold at its cultural and creative shops based on innovativeness and creativity, and select only shops that sell meaningful and attractive items.

As for Plastic manufacturing group's own products, its green materials and green products exemplify Plastic manufacturing group's new values in an important way. The application of green cement and green plastic will greatly strengthen the connection between Plastic manufacturing group and environmental awareness and introduce Plastic manufacturing group's green materials and products to the public. Providing more discounts for items sold within the site would further bind the Plastic manufacturing group brand with sustainability, quality, and environmental awareness, send positive messages about the Plastic manufacturing group, raise its corporate social responsibility (CSR) image, and allow the public, as well as suppliers and buyers, to purchase Plastic manufacturing group's green materials products. It is also recommended that the site introduce cultural and creative products, locally made products, and various foods that can project a positive image of Plastic manufacturing group and raise the site's purchase rates.

4) Increasing percentage drawn from sales from 15% to 25%

Although raising the percentage drawn from sales can improve the site's finances, the impact of this change is smaller compared to the two scenarios above. The site and the Plastic manufacturing group are the main actors in the two scenarios; moreover, they can promote the site's unique commemorative value and image which helps build long-lasting value. Drawing from the shops' sales does not help to expand into new markets or improve the site's image. The shops would also be less likely to stay. Given that 25% is almost comparable to the rates for department store stalls, this should be set as an upper limit, as raising the rate any higher would decrease the willingness of businesses to set up within the site (Table VI).

TABLE VI: FINANCIAL FEASIBILITY ANALYSIS FOR INCREASING PERCENTAGE DRAWN FROM SALES FROM 15% TO 25%

Interest rate	5.00%	3.50%	8.90%
NPV	341,212,256	610,049,655	11,651,037
IRR	9.15%	9.15%	9.15%
ERR	6.22%	5.35%	8.78%
Equity IRR	9.15%	9.15%	9.15%
Equity ERR	6.22%	5.35%	8.78%
PW Revenue	$ 932,712,810	$ 1,288,128,839	$ 479,367,776
PW Cost	$ 591,500,554	$ 678,079,184	$ 467,716,739
B/C	1.58	1.90	1.02
Profit Index	1.89	2.56	1.03
Self-liquidation ratio SLR	157.69%	189.97%	102.49%

5) Rent compared to that at the songshan cultural and creative park

When rent increases from the Songshan Cultural and Creative Park's adjusted price of NT$1050/ping to its BOT investment proposal price of NT$1800/ping, with a 5% interest rate, NPV is NT$102 million, IRR is 6.36% , ERR is 5.42%, and SLR is 117.61%, slightly greater than at the baseline. Similar to the risk scenarios above, performance improves when the interest rate is 3.5%, where NPV is NT$279 million. At 8.9%, NPV is negative NT$117 million, B/C ratio is 0.76, PI is 0.69, and SLR is 76.07%, indicating that Plastic manufacturing group must inject an additional 23.97% and the investment would not be recovered at the start of 2070. The overall financial structure in this scenario is poor, as shown in Table VII.

As above, the site's financial situation is not sensitive to the rent interest rate and adjusting the price of rent does not have a large impact on the site's finances. Cultural and creative companies cannot carry on at a price of NT$1800/ping in Taipei; therefore, the Songshan Cultural and Creative Park has recently lowered the rent price for cultural and creative companies to NT$600/ping. Plastic manufacturing group and the Site Foundation can also be lenient with the rent prices in order to facilitate the development of the cultural and creative

industry.

6) Increasing total income 10%

When total income increases 10% with a 5% interest rate, NPV is NT$154 million, IRR is 7.01%, ERR is 5.62%, and SLR is 126.49%, all greater than at the baseline. Similar to the risk scenarios above, performance improves when the interest rate is 3.5% where NPV is NT$263 million. At 8.9%, NPV is negative NT$117 million, B/C ratio is 0.75, PI is 0.67, and SLR is 74.68%, indicating that Plastic manufacturing group must inject an additional 25.32% to offset the low working capital and the investment would not be recovered at the start of 2070. The overall financial structure in this scenario is poor, as shown in Table VIII.

TABLE VII: FINANCIAL FEASIBILITY ANALYSIS FOR RENT COMPARED TO THAT AT THE SONGSHAN CULTURAL AND CREATIVE PARK

Interest rate	5.00%	3.50%	8.90%
NPV	102,430,046	279,833,466	-110,698,188
IRR	6.36%	6.36%	6.36%
ERR	5.42%	4.56%	7.96%
Equity IRR	6.36%	6.36%	6.36%
Equity ERR	5.42%	4.56%	7.96%
PW Revenue	$ 683,981,342	$ 944,153,642	$ 351,920,667
PW Cost	$ 581,551,296	$ 664,320,176	$ 462,618,855
B/C	1.18	1.42	0.76
Profit Index	1.27	1.71	0.69
Self-liquidation ratio SLR	117.61%	142.12%	76.07%

TABLE VIII: FINANCIAL FEASIBILITY ANALYSIS FOR INCREASING TOTAL INCOME 10%

Interest rate	5.00%	3.50%	8.90%
NPV	154,615,494	262,988,936	-117,050,238
IRR	7.01%	6.20%	6.20%
ERR	5.62%	4.51%	7.91%
Equity IRR	7.01%	6.20%	6.20%
Equity ERR	5.62%	4.51%	7.91%
PW Revenue	$ 738,341,183	$ 926,607,256	$ 345,303,948
PW Cost	$ 583,725,689	$ 663,618,321	$ 462,354,186
B/C	1.26	1.40	0.75
Profit Index	1.40	1.67	0.67
Self-liquidation ratio SLR	126.49%	139.63%	74.68%

7) Increasing total costs, initial investment costs, and operating costs 10%

There are many ways that could increase total income 10%; in order to avoid the risks incurred by rising interest rates, the Foundation's long term task should be to increase the site's total income by at least 10%.

TABLE IX: FINANCIAL FEASIBILITY ANALYSIS FOR INCREASING TOTAL COSTS, INITIAL INVESTMENT COSTS, AND OPERATING COSTS 10%

Interest rate 5.00%	Total costs increase 10%	Initial investment costs increase 10%	Operating costs increase 10%
NPV	32,074,364	51,980,476	70,272,334
IRR	5.40%	5.64%	5.94%
ERR	5.09%	5.18%	5.28%
Equity IRR	5.40%	5.64%	5.94%
Equity ERR	5.09%	5.18%	5.28%
PW Revenue	$ 671,219,258	$ 671,219,258	$ 671,219,258
PW Cost	$ 639,144,893	$ 619,238,782	$ 600,946,924
B/C	1.05	1.08	1.12
Profit Index	1.08	1.12	1.18
Self-liquidation ratio SLR	105.02%	108.4%	111.69%

When each of these three costs separately increase by 10%, NPV is 32.07, 51.98, and 70.27, respectively, IRR is 5.10%, 5.64%, and 5.94%, respectively, and SLR is 105.02%, 108.0%, and 111.69%, respectively, all lower than the 115.5% at the baseline. This shows that an increase in total costs has the largest impact and that an increase in operating costs has less of a negative impact than an increase in initial investment costs. Therefore, the site must ensure that the initial investment cost is not too high as the influence of controlling operating costs is not as powerful (Table IX).

V. CONCLUSION

This study conducted a financial evaluation for a site; at the baseline (5% interest), this project was financially feasible. After 50 years of operation, the site would have a NPV of NT$90.18 million (2017), an average annual net profit of NT$1,803,600, and an SLR of 115.52%, conforming to the financial performance of a commemorative, public, leisure, restored and reused historical building and non-profit site with social value. This site must consider other risks in the future, for example, high interest rates and increasing costs. In order to avoid these risks, effective strategies include increasing the number of visitors and buy rates.

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