Financial Feasibility Analysis of Concrete Casting Using Mini-Cranes in Coastal Areas and Small Islands

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ABSTRACT- The main objective of this paper is to determine the value of financial feasibility analysis as an academic study of mini-cranes made by researchers, so that it can be used by the community, case studies on Wangiwangi Island, Wakatobi Regency. We conducted a financial feasibility analysis of the mini-cranes from the design and assemblies of researchers to test the feasibility value, so that it can be used by the community. The results of the study recommend that the mini-crane designed by the researcher is very feasible, both mathematically and non-mathematically to be used, mobilized to Wangiwangi Island, Wakatobi Regency. The limitation of the study is that it cannot provide a very detailed and complete description, and only presenting screenshots of the results of data analysis both by hand or manually and by spreadsheets can clearly appear in this paper. This paper focuses on mini-cranes from the design and assemblies of researchers, so that it can be used by the community, so it is necessary to conduct a financial feasibility analysis before launch.

Keywords: Mini-crane, Concrete-pump, Financial feasibility**.**

1 INTRODUCTION

Concrete is a part of the construction that is very widely used in infrastructure development [1], this is because concrete is very easy to make, formed and uses local materials, only cement materials are made in the factory.

Concrete is part of construction that is widely used for infrastructure development because concrete is easy to work on and the price is relatively cheaper than steel and resistant to natural influences, this is according to the opinion [2] as follows: "Conventional concrete consists of Portland Cement, aggregate course, fine aggregate, sand, and water. This type of concrete is very common and can be produced locally using a simple method. Concrete is a very important material and is widely used to build various infrastructures such as bridges, highways, dams and other urban infrastructure. This makes concrete, in terms of quantity, the most widely used material for humans after water".

In the government policy of the Republic of Indonesia, there is a so-called Construction Expansion Index, this regulation is useful for measuring the level of construction cost in an area in Indonesia, then it will be used to determine the value of the annual budget from each region in Indonesia [3]. To determine the construction cost index will be determined using a two-method approach, first by using the input method approach, which records all the important materials used combined with wages and equipment rent according to their respective weights, second with the output price approach, where construction will measure by its selling value. Both of these approach methods each have advantages and disadvantages, but the Indonesian government uses an input approach, this includes overhead, while the output approach incorporates management costs and contractor profits.

The use of alternative methods or new methods in concrete casting work in remote areas is very helpful, although using simple equipment, appropriate technology, small scale, can move quickly, cheap investment costs, use local spare parts and can be made and operated by the local community using simple equipments will be more effective and efficient [4].

Appropriate Technology rarely explains it, the word is not purely from the technology itself, it is true that Appropriate Technology means that the technology used is very simple, but the word comes from economics that has nothing to do with technology, the word came from an economist from Germany named EF Schumacher. This German writer has written the book "Small is Beautiful", believes that "small businesses will increasingly contribute strongly in the future for the prosperity of a nation" [5].

That Appropriate Technology starts from the small can be useful and contribute in the future to the prosperity of a nation. On the other hand, Appropriate Technology is also growing rapidly in addition to the use of high technology. Appropriate Technology by [6] in his book entitled "Appropriate Technology for Sustainable Living" says what is Appropriate Technology but still Schumacher's book is used to explain and summarize the philosophy of Appropriate Technology in his book, Small Is Beautiful (1978) where he describes the central doctrine of Appropriate Technology as (a) simple, (b) small scale, (c) low cost, and (d) without violence. The US Office of Technology Assessment has perfected these principles by describing Appropriate Technology as (a) small scale, (b) saving energy, (c)

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environmentally friendly, (d) labor intensive, (e) controlled by the local community, and (f) sustainable at the local level. [6] also says about the definition of Appropriate Technology that can be defined as "intentional formation of matter, energy, and processes to meet needs". Technology and design processes are closely interrelated, for the creation of all artifacts, environments, and man-made systems is the result of deliberate activity by the designer, whether he is an architect, a farmer, a housewife, or a child. The design, whether we choose to call it or not, is around us. Actually what is the purpose of Appropriate Technology, still in his book [6] says that "Designers work in a variety of obstacles, and trade-offs are always involved. First, there are broad goals determined by society or by business plans: increased productivity; greater market share; higher level of employment; more interesting community; etc". And the next goal is to be more clear and detailed then; "In its most basic sense, the right technological goals represent the basic human and social values that we hope for everyone."

2 LITERATURE REVIEW

Concrete casting is a very important job, this work must be carried out properly, to obtain the highest quality concrete quality. It is strongly recommended by Concrete casting is a very important job, this work must be carried out properly, to obtain the highest quality concrete quality. It is strongly recommended by [7] that "we know the properties of fresh concrete mixtures and now we must look at practical ways of producing fresh concrete and placing it in forms so that it can harden into structural or building material: hardened concrete, usually referred to only as concrete. The sequence of operations is as follows. The right amount of cement, aggregate, and water, maybe also from a mixture, is stacked and mixed in a concrete mixer. " that "we know the properties of fresh concrete mixtures and now we must look at practical ways of producing fresh concrete and placing it in forms so that it can harden into structural or building material: hardened concrete, usually referred to only as concrete. The sequence of operations is as follows. The right amount of cement, aggregate, and water, maybe also from a mixture, is stacked and mixed in a concrete mixer. "

Concrete is widely used in Indonesia, this is because concrete has special characteristics, the materials or materials are mostly local, mainly used as reinforced concrete, this is explained by [8] that "reinforced concrete materials are widely used in concrete construction boned in Indonesia. This material has many advantages over other building materials, including 1) Cheaper; 2) Easy to form (related to architectural functions); 3) High fire resistance; 4) Having high strength; 5) Low maintenance costs; 6) The forming material is easily obtained ".

The implementation of concrete casting must choose the right equipment in accordance with the scale of need, between small, medium and large scale, in order to produce concrete according to purpose, this is in accordance with the opinion [8]: must be truly chosen, in order to fulfill several objectives, namely: economy; avoid segregation; laying concrete before the concrete starts to become hard. The method of implementation and transportation can be carried out in several ways, namely by buggy, bucket, and crane, hoisting tower, cableway, gutters (cuts), belt conveyors, dump-trucks, concrete-pumps, and agitators-trucks. Each has advantages and disadvantages in certain conditions must calculate its capacity " if small-scale casting using large-scale equipment is very inefficient and vice versa. The use of alternative mini-cranes resulting from innovation is a solution.

Likewise according to [9] that: "At each use of equipment and equipment selection in project development, it should be considered, namely the location and condition of the project, the plan of the project building includes the time and cost as well as the working method of the equipment itself." by the condition of the location and condition of the magnitude of the project being worked on.

Before the development of science, monumental artifacts or sites were built without having to think about how much money was used, and after civilization and the emergence of philosophies of science and science developed, then monumental and present artifacts or sites were called infrastructure, the development process must use or adhere to the principles economics and the most famous is called cost estimation or engineering estimation [1].

Phenomena that occur in the area or in small islands to build multi-story buildings that are done manually have difficulty getting construction workers, if there is a very expensive price because the community is busy with activities according to the work they already have. Using ready-mix concrete there is no company that provides, so the use of assembled mini-cranes can be an alternative. In manual concrete casting work using construction labor, the process of lifting the concrete mixture from the bottom up using a bucket is lifted continuously, will cause pain and can cause work accidents [10].

The approach that will be used to complete productivity and efficiency in mini-cranes, a equipment that will be used as a new method in concrete casting, is to use guidelines issued by the Indonesian government in this case issued by the Ministry of Public Works of the Republic of Indonesia namely with the name Price Analysis Guidelines Work Unit [11]. This guide will be used as a reference.

In a project activity, construction equipment is a major factor that is of particular concern in budgeting, any detail must be measured in designing the budget, whether it is rented or purchased, if rented, the use will be adjusted to the needs and if purchased, the project does not buy at full price except in a multi-year project [12].

However the model of heavy equipment productivity can be solved using mathematical equations, but it must be seen its characteristics and usefulness, surely all will be controlled by humans or operators, so that sometimes its productivity can be in accordance with the speed and skill of the operator, but in this mathematical equation has been calculated, including natural factors, material factors and the condition of the equipment that is going to work or are working [12].

Net present value (NPV) is a method of calculating the net value at present and is calculated at a certain interest rate [13]. if NPV> 0, it means that the number of present value benefits is

greater than the number of present value costs, calculated at the same interest rate with the discount rate so that it is declared feasible. If NPV <0, it means that the costs incurred are greater than the benefits (benefits) so that they are declared not feasible. If NPV = 0, it means that it is in a state of break event which will return exactly the opportunity cost of. capital. The mathematical equation used:

$$NPV = \sum_{t=0}^{n} \frac{(C)t}{(1+i)^t} - \sum_{t=0}^{n} \frac{Co)t}{(1+i)^t} \quad \text{..... (1)}$$

where,
NPV = Net present value
(C)t = Annual cash inflows
(Co)t = Annual cash outflows
n = Total number of periods
i = Required return or discount rate
t = Number of time periods

The decision guideline is :
If NPV = positive, the project proposal can beaccepted, the higher the NPV number the better.
If NPV = negative, the project proposal was rejected.
If NPV = 0 means neutral.

The Internal Rate of Return (IRR) is a return flow that produces an NPV of cash inflows = NPV of cash outflows. In the NPV method, the analysis is carried out by determining in advance the amount of the return (discount) (i), then calculating the present net value (PV) of the cash flow in and out. For the IRR, NPV = 0 is determined first, then find out how much the return (discount) is (i) so that the thing happens. The formula is as follows:

$$\sum_{t=0}^{n} \frac{(C)t}{(1+i)^t} - \sum_{t=0}^{n} \frac{Co)t}{(1+i)^t} \quad \text{..... (2)}$$

where,
(C)t = Annual cash inflows
(Co)t = Annual cash outflows
i = Required return or discount rate
n = Total number of periods

The decision guideline is :
If IRR > i (Discount Rate), the project is economically acceptable at the discount rate.
If IRR < i (Discount Rate), the project is not economically acceptable at the discount rate.

Another variation of Profitability index (PI) of the NPV criterion is Profitability Indes (PI), which shows the ability to bring profit per unit value of the investment. Defined as follows:

$$IP = \frac{\sum_{t=0}^{n} \frac{(C)t}{(1+i)^2}}{\sum_{t=0}^{n} \frac{(C0)t}{(1+i)t}} \quad \text{..... (3)}$$

where,
(C)t = Annual cash inflows
(Co)t = Annual cash outflows
i = Required return or discount rate
n = Total number of periods

The evaluation guideline for a single project using the PI is the same as for the BCR.
If PI ≥ 1.0, the project is economically acceptable at the discount rate.
If P I < 1.0, the project is not economically acceptable at the discount rate.

Remember, the computations for PI and BCR are essentially the same, except the PI is usually applied without disbenefits estimated. The PI has another name: the present worth index (PWI). It is often used to rank and assist in the selection of independent projects when the capital budget is limited.

Benefit-Cost Ratio (BCR) is a practical way to estimate benefits where analysis and evaluation are needed and various perspectives relevant to the costs or benefits contributed. It is said that it is feasible if the ratio between the benefits to the costs required is greater than one [14]. With the mathematical equation the cost-benefit ratio is normally stated as follows:

$$BCR = \frac{B-D}{C} \quad \text{..... (4)}$$

where,
B = Benefit
D = Disbenefit
C = Cost

The decision guideline is :
If BCR ≥ 1.0, accept the project as economically justifi ed for the estimates and discount rate applied.
If BCR < 1.0, the project is not economically acceptable.

3 RESEARCH METHODS

Conduct an analysis of the financial feasibility of the mini-cranes from the design and assemblies of researchers to test the feasibility value, so that it can be used by the community.
As a case study, the location is a Wangiwangi island in Wakatobi Regency, on the small island located in the capital of Wakatobi Regency in figure 1.

In this financial feasibility analysis, it was described that there were 2 types of concrete lifting equipment and materials in the process of building construction, mini-cranes which were designed and assembled by researchers and concrete-pump trucks, which of these two types were more feasible to use.

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Fig.1. Research Map

4 RESULTS

In the analysis of the financial feasibility of concrete casting work that will choose two types of equipment between the mini-crane and concrete-pump, which of the two devices is more feasible to be sent to Wangiwangi island, Wakatobi Regency, hereby will be described in detail, as follows:

4.1. Rent Equipment Analysis

The intended mini-cranes are the result of design and assembly by the researchers themselves, with the following description:

TABLE 1
EQUIPMENT RENT ANALYSIS

No	Description	Code	Quantity		Unit	Information
			Mini-Crane	Concrete- Pump		
A	General					$Cf=\frac{i(1+i)^n}{(1+i)^n-1}$
1	Power	Pw	60	600	HP	
2	Capasity	C	800	800	Kg	
3	Economics period	n	4	4	Years	$R=\frac{(L-R)Cf}{O}$
4	Operating Hours/year	O	2,000	2,000	Hours	
5	Local Prices	L	90,000,000	90,000,000	IDR	$I=\frac{2\%\ R}{O}$
6	Discount rate	i	10	10	%	
7	Tax	T	10	10	%	
8	Fuel prices	Fp	7,000	7,000	IDR	F = (0.125-0.175)Ltr/HP/ Hoursx P x Fp
9	Lubricant prices	Lp	30,000	30,000	IDR	
B	Direct Cost					
1	Residual value 10%.Lp	R	9,000,000.00	100,000,000.00	IDR	
2	Capital factor	Cf	0.31547	0.31547	IDR	Luc=(0.10-0.20)Ltr/HP/ Hours x P x Lp
3	Direct cost:					
	a. Return on capital	R	12,776.57	141,961.86	IDR	
	b. Insurance and Others	I	90.00	1,000.00	IDR	
	Subtotal (B)	2	12,866.57	142,961.86	IDR	$Ws=\frac{(6.25-8,75)L}{O}$
C	Indirect Cost					
1	Fuel	F	63,000.00	210,000.00	IDR	$Sp=\frac{(12.5-17,5)L}{O}$
2	Lubricant	Luc	27,000.00	90,000.00	IDR	
3	Workshop	Ws	3,375.00	37,500.00	IDR	
4	Sparepart	Sp	6,750.00	75,000.00	IDR	
	Subtotal(C)	3	100,125.00	412,500.00	IDR	
C	Total cost					
1	Total = (B) + (C)	To	112,991.57	555,461.86	IDR	
2	Tax 10% x To	Tx	11,299.16	55,546.19	IDR	
	Total cost	Tot	124,290.72	611,008.05	IDR	

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Based on the calculation results in table 1, it can be seen that the value of rental of Mini-crane equipment is IDR 124,290.72/hours and Concrete-pump is IDR 611,008.05/ hours.

4.2. Time schedule and Value of Investment

Equipment time schedule in 1 year for 4 years and income value are as follows:

TABLE 2
TIME SCHEDULE AND VALUE OF INVESTMENT

Year	Duration			Rent Equipment (IDR)		Investasi (IDR)		
	Hours	Days	Mounths	Haurs	Years	Unit Prices	Mobilization	Total
1	2	3	4	5	6	7	8	9
A	Mini-Crane							
1	8	22	12	124,291	262,502,010	90,000,00	20,000,000	110,000,000
2	8	22	12	124,291	262,502,010			
3	8	22	12	124,291	262,502,010			
4	8	22	12	124,291	262,502,010			
B	Concrete-Pump							
1		22	12	611,008	1,290,448,997	1,000,000,00	150,000,000	1,150,000,000
2	8	22	12	611,008	1,290,448,997			
3	8	22	12	611,008	1,290,448,997			
4	8	22	12	611,008	1,290,448,997			

In table 2, column 1 is the current investment year, column 2 is the working hours of the equipment in a day, planned for 8 hours per day, column 3 is the number of equipment work days in a planned 22 working days per month, column 5 is the hourly equipment rental value work, the value obtained is based on analysis for IDR124,291.00 mini-cranes and IDR611,008.05 concrete-pump while in column 6 is the equipment rental value in a year obtained by multiplying columns 2 x 3 x 4 x 5, then obtained for mini-cranes IDR 262,502,010.00 per year and for the concrete-pump IDR1,290,448,997.00 per year.

Investment value only occurs in the first year, with the following description: In column 1 is only the first year of investment, column 2 is the purchase value of the equipment because it is investment capital, column 3 is the cost of mobilizing equipments planned from Kendari to Wangiwangi Island, Wakatobi Regency, in column 4 is the total number of multiplication results from column 2 and column 3. Then the value will be used to calculate NPV, BCR, PI, and IRR.

4.3. Financial Feasibility Analysis by Hand or Manual

	A	B	C	D	E	F	G	H
1	NPV PI IRR BCR Analysis by Hand or Manual							
2	Year	Cash Flow (IDR)		Discount	Discount	Present Value (IDR)		
3		Mini-Crane	Concrete Pump	Rate	Factor	Mini-Crane	Concrete Pump	Crossover Rate
4	0	(110,000,000.00)	(830,000,000.00)	12%	1.000000	(110,000,000.00)	(830,000,000.00)	(720,000,000.00)
5	1	262,502,009.73	1,100,532,517.98		0.998801	262,187,384.87	1,099,213,461.82	838,030,508.25
6	2	262,502,009.73	1,100,532,517.98		0.997604	261,873,137.11	1,097,895,986.64	838,030,508.25
7	3	262,502,009.73	1,100,532,517.98		0.996409	261,559,265.99	1,096,580,090.53	838,030,508.25
8	4	262,502,009.73	1,100,532,517.98		0.995214	261,245,771.06	1,095,265,771.61	838,030,508.25
9	NPV (+)					1,046,865,559.02	4,388,955,310.60	3,352,122,032.98
10	∑ NPV					936,865,559.02	3,558,955,310.60	2,632,122,032.98
11	IRR	236.78322%	127.6581%	Calculated using steps 1, 2 and 3, with the criteria NPV = 0				
12	PI					9.517	5.288	
13	BCR					9.517	5.288	4.656
14					NPV (+)	=SUM(F5:F8)	=SUM(G5:G8)	
15					∑ NPV	=SUM(F4:F8)	=SUM(G4:G8)	
16					PI	=F9/-F4	=G9/-G4	
17					BCR	=F9/-F4	=G9/-G4	=H9/-H4
18					Present Value	=B4*E4	=C4*E4	=C4-B4
19					Discount Factor	=1/(1+$D$4/100)^A4		

Fig. 2 Screenshot NPV by Hand or Manual with the help of Spreadsheets

Based on Figure 2, the analysis shows financial feasibility by hand or manual using a manual formula even though it uses the help of Spreadsheets. Starting from discount factor =1/(1+$D$4/100)^A4, Present value =B4*E4,NPV(+) =SUM(F5:F8), ∑NPV =SUM(F4:F8), PI =F9/-F4, BCR =F9/-F4 and for IRR must be analyzed using trail and error.

IRR analysis by hand or manual must use a trial and error method with the following description:

	J	K	L	M	N	O	P	Q	R
1	IRR Analysis by Hand or Manual Step 1st								
2	Year	Cash Flow (IDR)		Trial and Error	Zerro Factor	NPV Mini-Crane	Trial and Error (TE)	Zerro Factor	NPV Concrete Pump
3		Mini-Crane	Concrete Pump	(TE)	(ZF)	(IDR) = 0 (Zerro)		(ZF)	(IDR) = 0 (Zerro)
4	0	(110,000,000.00)	(830,000,000.00)	2.1500000000	1.0000	(110,000,000.00)	0.8885000000	1.0000	(830,000,000.00)
5	1	262,502,009.73	1,100,532,517.98		0.3175	83,333,971.34		0.5295	582,754,841.40
6	2	262,502,009.73	1,100,532,517.98		0.1008	26,455,229.00		0.2804	308,580,800.32
7	3	262,502,009.73	1,100,532,517.98		0.0320	8,398,485.40		0.1485	163,399,947.22
8	4	262,502,009.73	1,100,532,517.98		0.0102	2,666,185.84		0.0786	86,523,668.10
9	NPV = 0					10,853,871.58			311,259,257.03
10	IRR = Discount Rate that makes NPV = 0					NPV =N4*K4			
11	(Zerro Fector) ZF= $(1+TE)^{-n}$					=(1+$M$4)^-J4			

Figure. 3. Screenshot IRR Step 1st by Hand or Manual with the help of Spreadsheets

In Figure 3 Zero Factor> ZF= $(1+TE)^{-n}$ and Trial and Error (TE) = 2.15 and 0.88850, at this trail position NPV is still IDR10,853,871.58 and IDR311,259,257.03. Next try again in the following step 2nd:

	J	K	L	M	N	O	P	Q	R
14	IRR Analysis by Hand or Manual Step 2nd								
15	Year	Cash Flow (IDR)		Trial and	Zerro Factor	NPV Mini-Crane	Trial and Error	Zerro Factor	NPV Concrete Pump
16		Mini-Crane	Concrete Pump	Error (TE)	(ZF)	(IDR) = 0 (Zerro)	(TE)	(ZF)	(IDR) = 0 (Zerro)
17	0	(110,000,000.00)	(830,000,000.00)	2.8750000000	1.0000	(110,000,000.00)	1.2500000000	1.0000	(830,000,000.00)
18	1	262,502,009.73	1,100,532,517.98		0.2581	67,742,454.12		0.4444	489,125,563.55
19	2	262,502,009.73	1,100,532,517.98		0.0666	17,481,923.65		0.1975	217,389,139.35
20	3	262,502,009.73	1,100,532,517.98		0.0172	4,511,464.17		0.0878	96,617,395.27
21	4	262,502,009.73	1,100,532,517.98		0.0044	1,164,248.82		0.0390	42,941,064.56
22	NPV = 0					(19,099,909.25)			16,073,162.73

Fig. 4. Screenshot IRR Step2nd by Hand or Manual with the help of Spreadsheets

In figure 4 Trial and Error (TE) = 2.875 and 1,250 NPV is not equal to 0. Next try again in the following step 3rd:

	J	K	L	M	N	O	P	Q	R
25	IRR Analysis by Hand or Manual Step 3rd								
26	Year	Cash Flow (IDR)		Trial and	Zerro Factor	NPV Mini-Crane	Trial and Error	Zerro Factor	NPV Concrete Pump
27		Mini-Crane	Concrete Pump	Error (TE)	(ZF)	(IDR) = 0 (Zerro)	(TE)	(ZF)	(IDR) = 0 (Zerro)
28	0	(110,000,000.00)	(830,000,000.00)	2.3678321510	1.0000	(110,000,000.00)	1.2765808214205	1.0000	(830,000,000.00)
29	1	262,502,009.73	1,100,532,517.98		0.2969	77,943,911.09		0.4393	483,414,648.68
30	2	262,502,009.73	1,100,532,517.98		0.0882	23,143,644.81		0.1929	212,342,405.83
31	3	262,502,009.73	1,100,532,517.98		0.0262	6,871,970.98		0.0848	93,272,509.30
32	4	262,502,009.73	1,100,532,517.98		0.0078	2,040,473.12		0.0372	40,970,436.20
33	NPV = 0					0.000			0.000
34	IRR			236.78322%			127.65808%		

Fig. 5. Screenshot IRR Step 3rd by Hand or Manual with the help of Spreadsheets

In Figure 5 Trial and Error (TE) = 2.367832151 and 1.2765808214205 and in step 3 this value of NPV = 0,000, then this step can be recommended to be stopped because it has reached the desired value, so we see how much the trial error (TE) and it turns out the values are 2.367832151 and 1.2765808214205, this means the IRR value is 236.7832151% and 127.65808% or simplified to 236.78%. And 127.66%.Financial

4.4. Feasibility Analysis by Spreadsheet

In addition to analysis by hand or manual, to give an idea that doing analysis using spreadsheets can also be done and the results are relatively the same and faster, practical and easy. It will be described as follows:

	A	B	C	D	E	F	G
2	NPV PI IRR BCR Analysis by Spreadsheet						
3	Year	Cash Flow		Discount	Present Value		
4		Mini-Crane	Concrete Pump	Rate	Mini-Crane	Concrete Pump	Crossover Rate
5	0	(IDR 110,000,000)	(IDR 830,000,000)	12%	(IDR 110,000,000)	(IDR 830,000,000)	(IDR 720,000,000)
6	1	IDR 262,502,010	IDR 1,100,532,518		IDR 262,187,385	IDR 1,099,213,462	IDR 838,030,508
7	2	IDR 262,502,010	IDR 1,100,532,518		IDR 261,873,137	IDR 1,097,895,987	IDR 838,030,508
8	3	IDR 262,502,010	IDR 1,100,532,518		IDR 261,559,266	IDR 1,096,580,091	IDR 838,030,508
9	4	IDR 262,502,010	IDR 1,100,532,518		IDR 261,245,771	IDR 1,095,265,772	IDR 838,030,508
10	NPV (+)				IDR 1,046,865,559	IDR 4,388,955,311	IDR 3,352,122,033
11	∑ NPV				IDR 936,865,559	IDR 3,558,955,311	IDR 2,632,122,033
12	IRR				236.380%	127.385%	110.461%
13	PI	7.248	4.027				
14	BCR				9.517	5.288	4.656
15					NPV (+) =SUM(E6:E9)	=SUM(F6:F9)	
16					∑ NPV =SUM(E5:E9)	=SUM(F5:F9)	
17					IRR =IRR(E5:E9)	=IRR(F5:F9)	
18	PI =NPV(D5,B6,B7,B8,B9)/-B5						
19	PI =NPV(D5,C6,C7,C8,C9)				BCR =E10/-E5	=F10/-F5	
20					Present Value =PV($D$5/100,A5,,-B5)	=PV($D$5/100,A5,,-C5)	=C5-B5
21						Crossover Rate = IRR	=IRR(G5:G9)

Fig. 6. Screenshot NPV ∑NPV IRR PI BCR by Spreadsheet

In figure 6, to determine the PV for each year in cell E5 to E9 is formulatext =PV($D $5/100,A5,,-B5) this formula is copied from cells E5 to E9,

NPV (+) in cell C32 is formulatext =SUM(E6:E9) only PV is positive, ∑ NPV in cell E16 is formulatext =SUM(E5:E9), this sums all PVs both positive PV and negative PV. IRR =IRR(E5:E9), PI =NPV(D5,B6,B7,B8,B9)/-B5 and for BCR =E10/-E5.

To determine the crossover and it turns out that it is the same as the IRR taken from the difference from the cash flow of the two devices, the value of the crossover or IRR is obtained at 110.461%. From the Spreadsheet view for crossover or IRR =IRR(G5: G9).

	I	J	K
1	NPV Chart Profile		
2	Rate	NPV Mini-Crane	NPV Concrete Pump
3	0%	IDR 940,008,038.93	IDR 3,572,130,071.91
4	1%	IDR 914,273,799.23	IDR 3,464,239,973.70
5	2%	IDR 889,536,435.92	IDR 3,360,529,252.53
6	3%	IDR 865,745,801.11	IDR 3,260,787,664.82
7	4%	IDR 842,854,791.49	IDR 3,164,817,731.15
8	5%	IDR 820,819,133.75	IDR 3,072,433,836.97
9	6%	IDR 799,597,187.27	IDR 2,983,461,405.00
10	7%	IDR 779,149,762.21	IDR 2,897,736,133.00
11	8%	IDR 759,439,952.00	IDR 2,815,103,291.14
12	9%	IDR 740,432,978.70	IDR 2,735,417,073.84
13	10%	IDR 722,096,050.25	IDR 2,658,540,001.32
14	11%	IDR 704,398,228.60	IDR 2,584,342,366.66
15	12%	IDR 687,310,307.75	IDR 2,512,701,724.42

	I	J	K	L
110	107%	IDR 121,967,103.95	IDR 142,515,758.09	
111	108%	IDR 120,072,010.28	IDR 134,570,629.57	
112	109%	IDR 118,205,740.70	IDR 126,746,345.22	
113	110%	IDR 116,367,676.29	IDR 119,040,310.31	
114	111%	IDR 114,557,215.00	IDR 111,450,000.71	
115	112%	IDR 112,773,771.05	IDR 103,972,960.60	
116	113%	IDR 111,016,774.46	IDR 96,606,800.28	
117	114%	IDR 109,285,670.47	IDR 89,349,194.02	
118	115%	IDR 107,579,919.12	IDR 82,197,878.00	
119	116%	IDR 105,898,994.73	IDR 75,150,648.33	
120	117%	IDR 104,242,385.47	IDR 68,205,359.17	
121	118%	IDR 102,609,592.91	IDR 61,359,920.89	
122	119%	IDR 101,000,131.61	IDR 54,612,298.27	
123	120%	IDR 99,413,528.70	IDR 47,960,508.84	
124	NPV =NPV(I103,$B$6:$B$9)+$B$5			
125			NPV =NPV(I104,$C$6:$C$9)+$C$5	

Fig. 7. Screenshot NPV Chart by Spreadsheet

To determine or make an NPV Profile, what must be made before is to make the NPV Chart Spreadsheet as shown in Figure 7, each according to the Rate value from 0% to 120% NPV =NPV(H3,$B$28:$B$31)+$B$27.

Based on Figure 7 is the data that will be used to make the NPV Profile chart as shown in Figure 8.

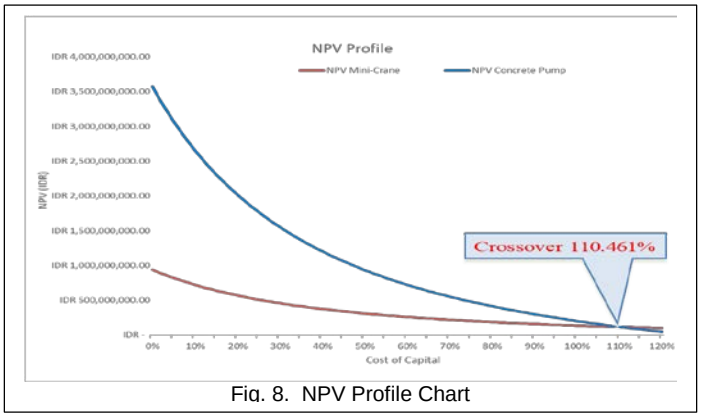

Fig. 8. NPV Profile Chart

Based on figure 8, this illustrates the condition of the NPV display in graphical form. Where the NPV line of mini-cranes and the NPV concrete-pump line intersects at the value of 110,461%, this is the point called the IRR, where the capital return flow occurs at this point.

5 DISCUSSION

5.1 Types and Specifications of mini cranes

These mini-crane use the principles of appropriate technology, all materials or materials used to make them are taken from scrap metal waste, that is the difference with those offered on the market, can be made and repaired by young people or people in

remote cities or remote islands, because the main engine uses waste motorbike or car engines. Mini cranes can be developed by the community with the benefits of this financial feasibility analysis.

Fig. 9. Concrete-Pump Hose

Fig. 10. Concrete-Pump Truck

In figure 9 a concrete-pump is used to pump concrete up to floors 1, 2, 3 and so on. This equipment is only for pumping concrete mixes and cannot be used to lift other materials.

While in figure 10 a mini-crane produced by a researcher besides being able to lift another excess concrete mixture can lift all the material needed for construction. For mobilization to Wangiwangi Island, Wakatobi Regency is cheaper than using concrete-pump.

Fig. 11. Mini-crane

Fig. 12. Motorcycle engine waste

The principle of appropriate technology in modern times like today is still very relevant and very desirable because it is simpler and cheaper and does not require high technology and spare parts do not depend on imported products.

5.2 Summary of Financial Feasibility Values

Based on the results of the analysis of the financial feasibility of concrete casting using mini-cranes and concrete-pumps on the coast and small islands, which are more feasible to use and mobilize. More information will be explained in table 3, the following:

TABLE 3
SUMMARY OF FINANCIAL FEASIBILITY VALUES

No.	Description	Feasibility Values (IDR)			
		By Hand or Manual		By Spreadsheet	
		Mini-Crane	Concrete-Pump	Mini-Crane	Concrete-Pump
1	2	3	4	5	6
1	NPV (+)	1,046,865,559.02	4,388,955,310.60	1,046,865,559.02	4,388,955,310.60
2	∑NPV	936,865,559.02	3,558,955,310.60	936,865,559.02	3,558,955,310.60
3	IRR	236.7832%	127.6581%	236.3796%	127.3852%
4	PI	9.5170	5.2879	7.2483	4.0274
5	BCR	9.5170	5.2879	9.5170	5.2879
6	BCR Crossover Rate	4.6557		4.6557	
7	IRR Crossover Rate			110.4605%	

Based on table 3 there are similarities and differences between financial feasibility calculated using hand or manual and using spreadsheets, namely at NPV and ∑NPV both the hand or manual and spreadsheet of the two equipments are relatively the same there is no difference, for IRR there are differences but not significant, for PI there is a very significant difference, for the same BCR there is no difference and the crossover BCR is also relatively the same with no difference. Whereas IRR Crossover only occurs on Spreadsheets and does not occur by hand or manually.

Based on table 3, in terms of financial feasibility, the NPV and ∑NPV of the two types of equipments and the two types of calculation methods are very feasible because all values are> 0, so it is recommended that it is very feasible. The IRR of the two types of equipments and the two types of calculation methods are very feasible because all values are> 1, thus it is recommended that it is very feasible. PI of both types of equipment and the two types of calculation methods are very feasible because all values> 1, thus recommended are very feasible. The BCR of the two types of equipments and the two types of calculation methods are very feasible because all values> 1, thus recommended are very feasible.

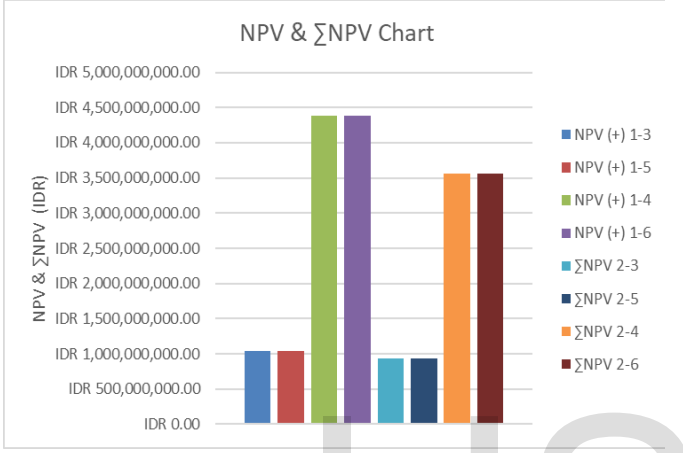

Fig. 12. NPV & ∑NPV Histogram

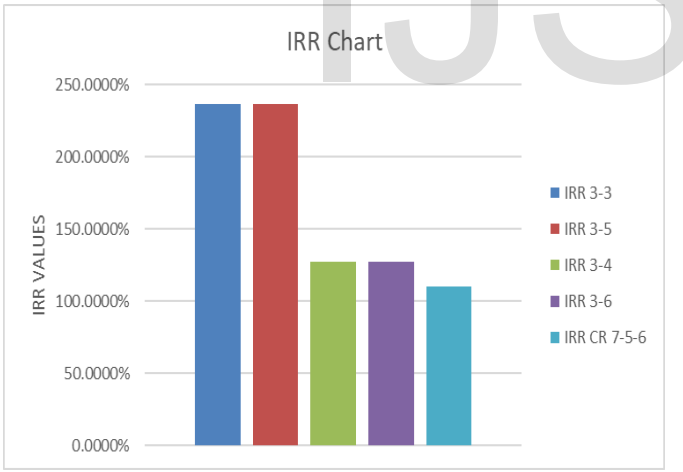

Fig. 13. IRR Histogram

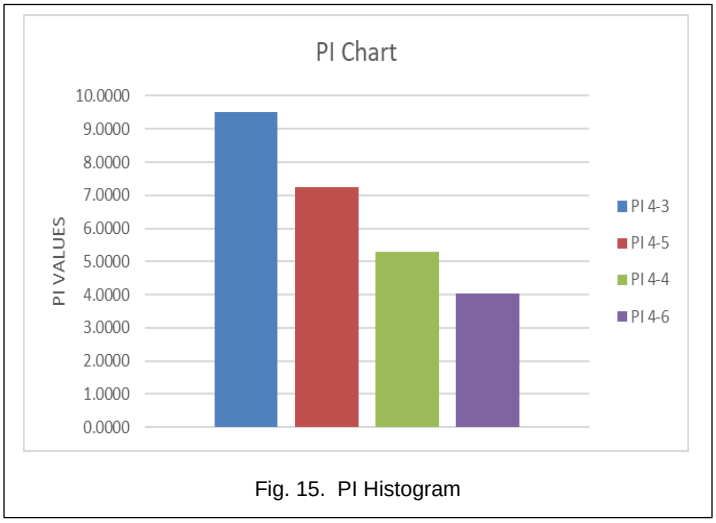

Fig. 15. PI Histogram

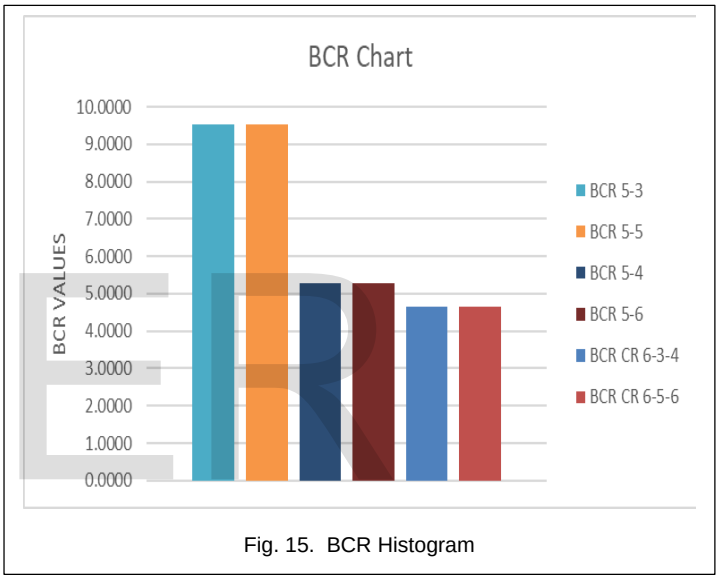

Fig. 15. BCR Histogram

Selected and recommended which equipment will be sent to Wangiwangi Island, Wakatobi Regency, the recommended mini-cranes are as shown in table 3. In the analysis and mathematical studies, the value is very feasible and in terms of non-mathematical or non-feasibility analysis, mini-cranes besides lifting mixtures concrete can also lift other materials such as reinforcing steel, concrete fromwork wood, bricks, and other materials, in detail .

4.5. Research limitations and suggestions for further research

Further research suggestions and creative ideas:

a) Design of mini-cranes using 3 phase electricity compared to 1 phase (Manual and full hydraulic).
b) Design of mini-cranes based on Arduino Uno servo motors (Robotic, Remote control and Automation or without operators).
c) Design of mini-cranes using a 7 HP diesel engine (Manual and full hydraulic).
d) Design of a mini crane using a steam engine made from coconut shell fuel.
e) Design of mini-cranes using solar cell.

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f) Design of mini-cranes using a portable Honda engine (starter coil or pull) compared to a motorcycle engine waste.
g) Design of mini-cranes using 200cc engines of Honda Tiger motorcycle waste.

6 CONCLUSIONS

The conclusion that based on the results obtained is as follows:
The results of a concrete financial feasibility analysis of the use of concrete casting equipments in coastal and remote islands or in this case Wangiwangi Island, Wakatobi Regency, are advised to use mini-cranes, the reason is supported by a mathematical financial feasibility analysis and the most important is supported by non-mathematical analysis, namely mini-cranes besides being able to lift concrete mixes, they can also lift other materials in the construction of a project while the concrete-pump cannot be used to lift other materials.

There are two ways to solve the case of a financial feasibility analysis, namely the first in a classic or by hand or manual way, this method takes a long time and still uses trial and error, and the second is the Spreadsheet method, this method is very easy, fast and no longer using trial and error methods.

Based on the results of the financial feasibility analysis, for concrete casting in coastal areas and small islands the use of mini-cranes is highly recommended, especially equipment that is based on appropriate technology, this is because spare parts and human resources for operators and technicians are sufficiently available and able to handle it, this type of equipment is still very much needed for infrastructure development in remote areas, coastal areas and small islands using concrete-pumps and modern equipment are not recommended and are not feasible, except for special and large-scale projects.

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