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FEASIBILITY ANALYSIS OF THE PROVISION OF EARTHQUAKE-RESISTANT CONSTRUCTION HOUSE (ERCH) INFRASTRUCTURE WITH THE GOVERNMENT AND BUSINESS ENTITY COOPERATION SCHEME (GBECS)

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ABSTRACT

Indonesia, situated on tectonic plate boundaries, is highly susceptible to earthquakes that cause significant damage to infrastructure and housing, particularly impacting low-income communities (LIC). This study evaluates the feasibility of providing Earthquake-Resistant Construction Houses (ERCH) through a Public-Private Partnership (PPP) scheme. Using qualitative and quantitative methods, the research examines technical, financial, and economic aspects of the PPP scheme, focusing on earthquake-resistant technologies and the involvement of government and business entities. Findings indicate that the PPP scheme effectively addresses challenges such as limited government budgets and land availability while promoting the construction of 10,000 special housing units for disaster-prone areas under Indonesia's 2020–2024 Infrastructure Development Framework. Financial analysis shows a 25% Internal Rate of Return (IRR), a payback period of four years, and sustainable viability through private-sector participation and government guarantees. This study highlights the potential of PPP schemes to enhance disaster resilience, optimize resources, and provide sustainable housing solutions for vulnerable communities.

KEYWORDS *Earthquake-resistant construction, Public-Private Partnership (PPP), Disaster Resilience, Low-Income Communities.*

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INTRODUCTION

Indonesia lies between four tectonic plates: Eurasian Plate, Indo-Australian Plate, Pacific Ocean Plate, and Philippine Sea Plate. The movement of these plates makes Indonesia prone to geological disasters, especially earthquakes. From 2000 to 2021, there were 5 to 26 damaging earthquakes each year that caused casualties and infrastructure damage. In 2018, major earthquakes in Lombok and Palu caused thousands of deaths and significant material damage, including the destruction of tens of thousands of homes.

The Indonesian government seeks to provide decent housing, especially for Low-Income Communities (LIC), with its 2020-2024 strategic program. However, various obstacles such as budget constraints, suboptimal regulations, and the dynamics of building material prices hinder the achievement of these targets. Therefore, financing innovations and collaboration with the private sector through the Public Private Partnership (PPP) scheme are needed to increase the supply of livable and affordable housing.

The PPP scheme aims to optimize the involvement of business entities in the provision of special housing for disaster victims, overcome land limitations, financing, and development efficiency. The government is also continuing the One Million Houses Program, including the construction of special houses for disaster-affected communities and target groups in remote and high-risk areas.

Earthquake-resistant buildings are designed not to collapse during an earthquake, although they may suffer damage that meets certain requirements. The philosophy is that, in a small earthquake, the main structure of the building remains intact; in a medium earthquake, the main structure may be slightly damaged but can be repaired; and in a strong earthquake, the building may be damaged but must not collapse completely to protect the occupants. This basic principle is important given that Indonesia is located at the confluence of several tectonic plates. The earthquake resistance of a building is obtained through analysis of the strength, stiffness and stability of the structure in accordance with SNI-1726-2019. In addition to earthquake intensity, duration, strength and frequency, building damage is also influenced by soil conditions and building design. Earthquake-resistant buildings must use lightweight but strong materials, such as EPS Sandwich Panel. The ERCH structural system, which uses metallic rigid frames and polymer composite panels, is an example of this technology. The philosophy of earthquake-resistant buildings includes resistance to minor earthquakes without damage, moderate earthquakes with damage to structural components that can be repaired, and major earthquakes with damage but still safe for occupants. Research and implementation of earthquake-resistant buildings continues to reduce the risk caused by earthquakes, such as in the permanent housing construction project in Palu that uses RISHA technology. The government also provides disaster management funds through various sources to support post-disaster rehabilitation and reconstruction.

Based on the existing background, the construction of Earthquake Resistant Construction Houses is important because of the frequent earthquakes that damage buildings. This development is included in the 2020-2024 Infrastructure Development Framework to provide decent and safe housing, and is the main target of the Ministry of Public Works and Housing to create 10,000 special housing units.

With a housing backlog for Low-Income Communities (LIC) of 5 million units, the provision of earthquake-resistant housing is needed, especially in earthquake-prone areas.

This research asks questions about the PPP scheme in the provision of Earthquake Resistant Housing infrastructure and the financial and economic feasibility of the scheme. The objective is to realize the provision of Earthquake Resistant Construction House infrastructure with the PPP scheme and analyze the financial and economic feasibility of this development.

This research is limited to the Earthquake Resistant Construction House building resulting from BRIN innovation, with a focus on analyzing financial and economic feasibility and PPP financing schemes. The benefits of this research include providing references for other researchers, consideration for the government, information for communities in earthquake-prone areas, and guidelines for the development of public housing infrastructure with Public-Private Partnership schemes.

Literature Review

Public-Private Partnership (PPP)

Public-Private Partnership (PPP) is regulated in Presidential Regulation No. 38/2015, which defines infrastructure as technical, physical, system, hardware, and software facilities to serve the public and support economic and social growth. Due to limited government funds, PPP is used to provide infrastructure by using resources from business entities, which includes risk sharing. PPP infrastructure covers 19 sectors, such as transportation, roads, water resources, irrigation, drinking water, wastewater management, energy, telecommunications, tourism, education, health, and public housing.

Infrastructure financing is divided into conventional (from government budget) and non-conventional (from non-government budget). Non-government financing instruments include betterment levies, development impact fees, land readjustment, regional loans, bonds, development exaction, excess condemnation, linkage, asset management, joint ventures, PPP-AP, PPP-VGF, government guarantee PPP, partial construction PPP, PPP-ESCO, PINA, CSR, and philanthropy.

Factors that drive the need for PPP include limited government budgets, additional sources of funding, private participation in viable projects, and maintenance of infrastructure by private parties to ensure the longevity of facilities. PPP helps in overcoming the limitations of government funds, ensuring development efficiency and effectiveness, and optimizing the involvement of business entities in providing infrastructure needed for the public interest.

Cooperation Scheme

Public Private Partnership (PPP) schemes include five main types that can evolve into various variations, namely Management Contracts, Lease Contracts, Concessions, Build-Manage-Operate Contracts, and Build-Own-Manage-Operate Contracts. According to Gatti (2013), these PPP types include Maintenance and Operation, Design-Build, Turn-Key, Wraparound Addition, Lease-Purchase,

Temporary Privatization, Design-Build-Operate, Buy/Lease-Develop-Operate, Build-Operate-Transfer, Build-Own-Operate-Transfer, and Build-Own-Operate. PPP schemes can be grouped into four based on the source of return on investment: Regular PPP, AP (Ability to Pay) PPP, VGF (Viability Gap Funding) PPP, and Service availability/Hybrid Financing PPP. Regular PPP relies on user tariffs, AP PPP is based on the user's ability to pay, VGF PPP receives viability support from the government, and Service availability PPP is funded through government payments for social infrastructure services. These schemes enable private participation in infrastructure provision and overcome limited government funding.

Government Support and Government Guarantees for PPP Projects

To attract the participation of Business Entities in the provision of infrastructure through the PPP scheme, the Government provides Government Support and Government Guarantees. Government Support in the form of fiscal contributions or tax incentives aims to increase the financial viability of PPP projects, making them more attractive to investors. This form of support includes financial feasibility through Viability Gap Funding (VGF), which helps fulfill part of the investment fund requirements, and Availability Payment, which provides periodic payments for the availability of infrastructure services in accordance with the PPP agreement.

The Government Guarantee, provided by the Minister of Finance, includes financial compensation through risk sharing, which improves the bankability of PPP projects and enables funding at more competitive interest rates. PT Penjaminan Infrastruktur Indonesia (Persero) or IIGF, serves as the infrastructure guarantee agency, ensuring the guarantee process through a one-stop mechanism, improving governance, transparency, and consistency of the guarantee process, as well as minimizing the direct impact on the state budget.

Structure of Public Housing Sector PPP

The PPP structure of the Public Housing Sector based on the Minister of Public Works and Public Housing Regulation No.20/PRT/M/2017, states that special houses are houses to meet special needs, built in the form of single houses or row houses with various typologies, and equipped with infrastructure, facilities, and public utilities. The main beneficiaries are disaster-affected communities. The PPP-AP scheme is used for the provision and financing of public housing for LIC, consisting of two types of structures: service usage-based and service availability-based. The PJPK of this project can be the Minister, Governor, Regent, or Mayor according to their authority. The housing development cooperation scheme uses the BOT or Availability Payment scheme, due to the flexibility of the transaction with flexible housing ownership financing/credit. In the BOT scheme, the Business Entity pays a fixed contribution to the government and faces the risk of demand and default of payment of residential owners/tenants. Whereas in the AP scheme, this risk is borne by the government, enabling accelerated provision of decent housing without down payments. The advantages of AP PPP include flexibility, service innovation, and certainty of project completion. Economic analysis includes demand, market, revenue, and social costs and benefits analysis, with valuation

parameters such as ENPV, EIRR, and BCR. Success factors for PPPs include trust, communication, decision-maker support, party selection based on performance, monitoring, clear performance indicators, balanced risk sharing, and guaranteed return on investment.

RESEARCH METHOD

Research Strategy

According to Yin (1994), three conditions influence the choice of research strategy: the type of research questions being asked such as "what", "how", "why", "who", and "where"; the degree of control the researcher has over the events under study; and the focus on contemporary events rather than past events. The table of research measurement strategies shows that experiments and case studies are suitable for answering "how" and "why" questions with sufficient control over contemporary events, while surveys and archival analysis are more suitable for "who", "what", and "where" questions.

Research Stages

According to Hadoyo (2018), research consists of three phases: the first phase involves identifying the research problem and planning the methodological design; the second phase involves creating research instruments and collecting data; and the third phase involves selecting samples, collecting data, analyzing, and summarizing the results. This type of research is descriptive qualitative, which aims to determine the value of independent variables without comparison between variables, with the researcher as the main instrument.

Research Instruments

Research instruments are used to measure the variables under study. The data collected included primary and secondary data. Primary data was obtained from interviews with experts, while secondary data came from books, journals, and archival documents. The instruments used in this research include data collection, data archives, and structured interviews with experts. The data required includes tax parameters, geographical and disaster conditions, and economic needs.

Data Analysis

Data analysis involved two stages: the first stage was initial validation by analyzing archival data related to the construction costs of earthquake-resistant houses, and the second stage was final validation of the variables with experts. To answer the second problem, data analysis was also conducted in two stages: initial and final validation of economic and financial variables with experts, to ensure the accuracy and clarification of the variables used.

RESULT AND DISCUSSION

Earthquake Disaster Management

In this research, it is not necessarily the case that houses or shelters for earthquake survivors are immediately built in response to earthquake disasters. In accordance with the president's directive, the government prepared aid funds to repair damaged houses for earthquake victims and to carry out post-earthquake recovery. Compensation assistance is as follows: severely damaged houses receive Rp. 60,000,000, moderately damaged houses receive 30,000,000 and lightly damaged houses receive Rp. 15,000,000. As for the condition of the house on the ground or collapsed, the government is trying to build permanent housing by looking at geographical conditions and disaster zones whether it is possible to build on the land or relocate to a place that is safe against earthquake zoning or fault areas.

For the construction of earthquake-resistant construction houses, the Government and Business Entity Cooperation scheme can be used, considering the financial condition of the Government and the PAD of the local government.

Technical Feasibility

For the handling of earthquake victims with land relocation solutions, for example, there is a land area of 1 Ha with a house type of 36 m2 and a plot area of 1 house of 75 m2. The basic building coefficient (KDB) for housing and settlement areas is 80%.

Land Area = 10,000 m2
KDB = 80%
DB value= 80% x10,000
= 8000 m2

So, the land area allowed to build buildings, facilities and infrastructure is 8000 m2. As for the value of the Building Floor Coefficient (KLB) for residential and residential areas which has a maximum value of 1.5

Floor area of 1 house = 45 m2
Lot size of 1 house = 75 m2
KLB value = 45/ 75
= 0.6

Based on the calculation of KDB & KLB, the earthquake-resistant housing to be built has met the spatial feasibility because the KLB value < KDB.

Experts

In interviews with experts on the construction of earthquake-resistant houses, as long as there is insurance, it is legal. The government issues compensation funds per household for lightly damaged buildings of Rp. 15 million, moderately damaged 30 million and severely damaged 60 million as the basis for calculating initial capital. both from the government and private parties.

The ideal and suitable PPP scheme for public housing development, especially for earthquake-resistant houses, depends on the purchasing power of the community. For example, toll road PPP is included in the regular KBPU because

of the ability to pay the tariff. In the research, it can use AP PPP if, for example, those affected are mostly well-off people, and the conditions of the affected areas are high quality human resources, and the local fiscal conditions are quite good. Capex in this study includes land acquisition, building costs per unit, taxes. Land acquisition can be calculated by tax zoning in the local area. OPEX can be in the form of routine maintenance costs, taxes. While revenue can be in the form of community installments for 1 unit of earthquake-resistant housing, compensation costs from the government and businesses (markets, hospitals, shops).

With the existence of Presidential Regulation 38 of 2015, it can increase the availability of public infrastructure through public and private cooperation, increase private participation in government projects in public infrastructure, provide an overview of new information in public-private cooperation infrastructure provision projects.

Feasibility Analysis

In calculating cash flow, first determine CAPEX, OPEX, Operations and Maintenance and revenue.

CAPEX & OPEX

Land acquisition costs due to assumptions if land relocation is needed because the occupied land is no longer safe because it is included in the disaster zoning. With the availability of land is 1 Ha with the price of land per m2 is Rp.1000,000, with 1 Ha of land based on existing shelter projects in Central Sulawesi, 50 units of type 36/75 buildings are obtained.

House Construction Cost

No.	Komponen	Kebutuhan	Harga Satuan	Harga
1.	Sloop, Kolom, Balok (batang)	46	1.000.000	46.000.000
2.	Joint Struktur (unit)	46	500.000	23.000.000
3.	Pondasi (m2)	60	250.000	15.000.000
4.	Bearing Pad (unit)	5	2.400.000	12.000.000
5.	Penutup Atap (m2)	50	180.000	9.000.000
6.	Rangka Kuda kuda, reng dan balok nok Baja Ringan (batang)	50	100.000	5.000.000
Total				**110.000.000**

No.	Komponen	Kebutuhan	Harga Satuan	Harga
1.	Panel Komposit (m2)	75	700.000	52.500.000
2.	Plafond penutup (panel) (m2)	64	200.000	12.800.000
3.	Runner panel / aluminum ekstrud (batang)	45	200.000	9.000.000
4.	Pintu utama (unit)	4	2.000.000	8.000.000
5.	Keramik Kamar utama (m2)	35	200.000	7.000.000
6.	Rangka Plafond (m2)	64	100.000	6.400.000
7.	Jendela kaca single dan Kusen Aluminum silver 0,65 X 2,2 m (unit)	3	2.000.000	6.000.000
8.	Dinding Kamar Mandi (m2)	20	250.000	5.000.000
9.	Pintu geser (unit)	1	4.000.000	4.000.000
10.	Jendela kaca single dan Kusen Aluminum (unit)	2	1.500.000	3.000.000
11.	Jendela kaca double dan Kusen Aluminum (unit)	1	3.000.000	3.000.000
12.	Jendela mati (unit)	1	3.000.000	3.000.000
13.	Kanopi Teras (unit)	1	3.000.000	3.000.000
14.	Listplang (m)	50	50.000	2.500.000
15.	Septitank/WC (unit)	1	1.800.000	1.800.000
16.	Silicon seal (tabung)	20	75.000	1.500.000
17.	Kloset jongkok (unit)	1	1.500.000	1.500.000
18.	Flourdrain dan shower (paket)	1	1.500.000	1.500.000
19.	Titik Lampu (titik)	5	300.000	1.500.000
20.	Kabel dan MCB (paket)	1	1.500.000	1.500.000
21.	Pipa PVC 4 », dari dapur 3 » (paket)	1	1.500.000	1.500.000
22.	Pintu Kamar mandi (unit)	1	1.000.000	1.000.000
23.	Bouven (unit)	1	1.000.000	1.000.000
24.	Keramik kamar mandi (m2)	4	250.000	1.000.000
25.	Terpasang 4 kran (Kamar mandi, dapur dan luar), (paket)	1	1.000.000	1.000.000
Total				**140.000.000**

Construction House Type 36/75 price per unit is Rp. 250,000,000 and tax is 11%. OPEX consists of routine security maintenance, marketing costs, office and vehicles.

No	Description	Assumsption		Cost	Remark
1	**CAPEX**				
	Tanah	1,000,000	m2	10,000,000,000	Kebutuhan 1 ha
	Pengolahan Tanah	1	ls	1,000,000,000	
	Rumah RKTG Tipe 36/75	250,000,000	/unit	12,500,000,000	
	Pemasangan Tiang Listrik	7,000,000	/bh	357,000,000	
	Pemasangan Listril 1300 VA	51	unit	75,780,900	1,485,900
	Pembangunan Sarpras	Lumpsum		5,000,000,000	
	Total			28,932,780,900	
	PPN 11%			3182605899	
	Total CAPEX			32,115,386,799	
	Pembulatan			**32,115,390,000**	
2	**OPEX**				
	Maintenance				
	- Pemeliharaan rutin	1000		561,600,000	dihitung per m2 /bulan tiap tahun selama 5 th
	-Security	4 orang		96,000,000	3 shif
	Biaya Pemasaran	50000		900,000,000	biaya per unit selama 1 tahun
	Fasilitas				
	-Office	50	m2	10,000,000	
	-kendaraan	1	ls	150,000	
	Total			1,567,750,000	
	PPN 11%			172,452,500	
	Total OPEX			**1,740,202,500**	

Revenue

Project Assumptions: 10-year concession period with 30% equity and 40% compensation from the government because 60% is paid by the community in monthly installments of 1 million rupees for 10 years. 2% inflation.

Uraian		Satuan	Nilai
Sewa loss (20 loss)	500,000	bulan	60,000,000
Sewa Pertokoan (20)	1,000,000	bulan	120,000,000
Cicilan dari masyarakat	1,250,000	bulan	7,500,000,000
Kompensasi dari Pemerintah	840,000	bulan	5,040,000,000
			12,720,000,000
inflasi	2	%	254,400,000
Pendapatan			**12,974,400,000**

Cashflow

Assumstion			
Discount Rate	10%		OPEX
Intial Investment	32,115,390,000		1,740,202,500
Revenue Growth	12,974,400,000		
Inflation	2%		
Lamaa Project	10		

Tahun		Tahun 0	Tahun 1	Tahun 2	Tahun 3	Tahun 4	Tahun 5	Tahun 6	Tahun 7	Tahun 8	Tahun 9	Tahun 10
Revenue				12,974,400,000	12,974,400,000	12,974,400,000	12,974,400,000	12,974,400,000	12,974,400,000	12,974,400,000	12,974,400,000	12,974,400,000
OPEX			1,740,202,500	1,771,526,145	1,803,413,616	1,835,875,061	1,868,920,812	1,902,561,386	1,936,807,491	1,971,670,026	2,007,160,087	2,043,288,968
EBITDA			1,740,202,500	11,202,873,855	11,170,986,384	11,138,524,939	11,105,479,188	11,071,838,614	11,037,592,509	11,002,729,974	10,967,239,913	10,931,111,032
EBITDA Margin			0	86%	86%	86%	86%	85%	85%	85%	85%	84%
Initiial Investment		(32,115,390,000)										
EBITDA			1,740,202,500	11,202,873,855	11,170,986,384	11,138,524,939	11,105,479,188	11,071,838,614	11,037,592,509	11,002,729,974	10,967,239,913	10,931,111,032
Net Cashflow		**(32,115,390,000)**	**1,740,202,500**	**11,202,873,855**	**11,170,986,384**	**11,138,524,939**	**11,105,479,188**	**11,071,838,614**	**11,037,592,509**	**11,002,729,974**	**10,967,239,913**	**10,931,111,032**
Accunulated Cashflow		**(32,115,390,000)**	**(30,375,187,500)**	**(19,172,313,645)**	**(8,001,327,261)**	**3,137,197,679**	**14,242,676,867**	**25,314,515,481**	**36,352,107,989**	**47,354,837,963**	**58,322,077,876**	**69,253,188,908**
	BT	AT										
IRR	**25%**											
NPV	**27,533,750,379**	**1,541,316,398**										
Payback Period	**4**	**-**										
ROI	**56%**	**3.1%**										
Cost of Investment												
Initial Investment		32,115,390,000										
OPEX			1,740,202,500	1,771,526,145	1,803,413,616	1,835,875,061	1,868,920,812	1,902,561,386	1,936,807,491	1,971,670,026	2,007,160,087	2,043,288,968
Maintenance												
Cost of Investment		**32,115,390,000**	**1,740,202,500**	**1,771,526,145**	**1,803,413,616**	**1,835,875,061**	**1,868,920,812**	**1,902,561,386**	**1,936,807,491**	**1,971,670,026**	**2,007,160,087**	**2,043,288,968**
PV Cost of Investment		32,115,390,000	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711	1,709,432,711
Acc.COI		**32,115,390,000**	**33,824,822,711**	**35,534,255,422**	**37,243,688,134**	**38,953,120,845**	**40,662,553,556**	**42,371,986,267**	**44,081,418,978**	**45,790,851,690**	**47,500,284,401**	**49,209,717,112**

Asumsi i	9%	
Asumsi ppn	3%	dari pendapatan

Tahun ke	Cash inflow	Cash outflow	CFBT	NPV (BT)	PV (CFBT)	PV of NPV (CBT)	Taxable Income	Tax	CFAT	NPV (AT)	PV (CFAT)	PV of NPV (CFAT)
0		32,115,390,000	(32,115,390,000)	(32,115,390,000)	(32,115,390,000)	(32,115,390,000)			(32,115,390,000)	(32,115,390,000)	(32,115,390,000)	(32,115,390,000)
1	12,974,400,000	1,740,202,500	11,234,197,500	(20,881,192,500)	10,306,603,211	(21,808,786,789)	11,234,197,500	389,232,000	10,844,965,500	(21,270,424,500)	9,949,509,633	(22,165,880,367)
2	12,974,400,000	1,771,526,145	11,202,873,855	(9,678,318,645)	19,707,100,713	(2,101,686,076)	11,202,873,855	389,232,000	10,813,641,855	(10,456,782,645)	19,022,398,348	(3,143,482,019)
3	12,974,400,000	1,803,413,616	11,170,986,384	1,492,667,739	28,277,058,249	26,175,372,173	11,170,986,384	389,232,000	10,781,754,384	324,971,739	18,966,304,741	15,822,822,722
4	12,974,400,000	1,835,875,061	11,138,524,939	12,631,192,679	36,085,700,647	62,261,072,819	11,138,524,939	389,232,000	10,749,292,939	11,074,264,679	34,824,698,000	50,647,520,722
5	12,974,400,000	1,868,920,812	11,105,479,188	23,736,671,867	43,196,441,155	105,457,513,974	11,105,479,188	389,232,000	10,716,247,188	21,790,511,867	41,682,464,414	92,329,985,136
6	12,974,400,000	1,902,561,386	11,071,838,614	34,808,510,481	49,667,366,665	155,124,880,639	11,071,838,614	389,232,000	10,682,606,614	32,473,118,481	47,921,303,600	140,251,288,736
7	12,974,400,000	1,936,807,491	11,037,592,509	45,846,102,989	55,551,682,509	210,676,563,148	11,037,592,509	389,232,000	10,648,360,509	43,121,478,989	53,592,696,211	193,843,984,947
8	12,974,400,000	1,971,670,026	11,002,729,974	56,848,832,963	60,898,120,173	271,574,683,321	11,002,729,974	389,232,000	10,613,497,974	53,734,976,963	58,743,791,460	252,587,776,407
9	12,974,400,000	2,007,160,087	10,967,239,913	67,816,072,876	65,751,311,029	337,325,994,350	10,967,239,913	389,232,000	10,578,007,913	64,312,984,876	63,417,769,090	316,005,545,497
10	12,974,400,000	2,043,288,968	10,931,111,032	78,747,183,908	70,152,128,895	407,478,123,245	10,931,111,032	389,232,000	10,541,879,032	74,854,863,908	67,654,171,153	383,659,716,650
	129,744,000,000	**50,996,816,092**	**78,747,183,908**		**407,478,123,245**		**110,862,573,908**	**3,892,320,000**	**106,970,253,908**		**383,659,716,650**	

	CFBT	CFAT
IRR	32.68%	31.32%
NPV	3,833,020,749	1,541,316,398
PAYBACK PERIOD	3	3
ROI	55.95%	3.13%

MARR	
Cost of capital	9.00%
Biaya lain u/ memperoleh investasi	1.20%
Biaya mitigasi risiko	0.90%
MARR	11.10%

Bank	Suku bunga
ADB	5%
BCA	6.25%
JBIC	6.25%
World Banl	4.90%

Cost of Debt (CoD)	
- Tingkat suku bunga	5.60%
- Pajak yang berlaku	25%
CoD = Tingkat suku bunga x (1-pajak yang berlaku)	**4.20%**
Cost of Equity (CoE)	
- Risk Free Rate	6.61%
- Beta	1.90%
- Equity Risk Premium	8.03%
- Country Risk Premium	2.80%
- Specify Risk	2.00%
CoE = Risk Free Rate + (Beta x Equity Risk Premium) + Country Risk Premiun + Specific Risk	**11.56%**

WACC Debt	
- CoD	4.20%
- Weight Debt	30%
WACC Debt = CoD x Weight Debt	**1.26%**
WACC Equity	
- CoE	11.56%
- Weight Equity	70%
- WACC Equity = CoE x Weight Equity	8.09%
Total WACC = WACC Debt + WACC Equity	**9.35%**
Total WACC (pembulatan)	**9.00%**

EBITDA stands for *Earning Before Interest, Taxes, Depreciation, and Amortization* or income before interest, taxes, depreciation, and amortization. In general, the term is a tool used to measure the financial performance of a company. From the pre-tax cashflow calculation, the IRR is 25%, the NPV is 27,533,750,379 with a payback period of 4 years, with a Return on Investment of 56%. While in the calculation of cash flow with the assumption of interest 9% and the assumption of ppn 3% of income obtained IRR (Before Tax) 32.68%, NPV (BT) of 3,833,020,749 with Payback Period decreased to 3 years. After tax IRR drops 1% to 31.32%. NPV becomes 1,541,316,398 and payback period remains at 3 years. Return on Investment (ROI) on CFBT was obtained at 55.95%, for those already taxed at 3.13%.

MARR can also be said to be the minimum value of the acceptable interest rate of return. The size of the MARR is influenced by the value of the cost of capital and the level of risk/uncertainty faced. In the cashflow calculation, the MARR value is 11.10%.

The economic values obtained in the above analysis indicate whether the project is financially viable or not. As in the following table:

Kelayakan	Keterangan
IRR > MARR	Layak
NPV > 0	Layak
PbP < n (10)	Layak
ROI > 0	Layak

CONCLUSION

Based on the analysis from chapter 4, the following conclusions can be drawn: 1. In order to restore the condition of houses damaged by earthquakes, it is not always necessary to build new shelters. Rather classify the type of damage based on the severity of the condition of the building. Lightly damaged, moderately damaged, severely damaged and flat / collapsed. For the lightly to severely damaged group, cash compensation is given so that they can be repaired quickly. Especially for flat houses, new housing will be provided or relocated in a new place. 2. Public housing infrastructure development, especially for earthquake victims, can use the PPP scheme. The AP PPP scheme can be used if the purchasing power of the community is high enough and the fiscal capacity / PAD of the area is quite good. 3. From the cashflow calculation, figures are obtained that show the feasibility of the project can be carried out.

Based on the research that has been done, the following suggestions can be obtained: 1. There needs to be more depth related to the provision of earthquake-resistant construction housing infrastructure with other PPP schemes. 2. Further research is needed in terms of infrastructure investment in the provision of earthquake-resistant housing, because only a few are interested in this project, mostly investing in rusunawa and other flats.

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