Feasibility of water apple farming in Demak Regency

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Abstract. The development of water apple in Demak Regency has spread in all sub-districts. In addition to varying land areas, water apple productivity in each sub-district also varies from low to high. This could also be due to changes in the dry climate, which are longer than usual. This study aims at determining the investment costs, operational costs, benefits, and feasibility of water apple farming in Demak Regency. The research method used is descriptive analysis. Samples were determined purposively as many as 25 farmers from the existing population based on the age of the water apple plant. This study indicates that the investment cost used in the cultivation of water apple per 2000 m2 area is IDR 715,822,520, operating costs of IDR 814,209,869, and the resulting benefits of IDR 1,644,446,187. Water apple farming has a feasible category to run with a Net Present Value (NPV) of IDR 114,413,798; B/C of 1.15; Internal Rate of Return (IRR) of 7.20%; and Pay Back Period for 14.6 years. The potential of Demak district for water apple farming needs to be developed by rejuvenating it by the Standard Operating Procedures for water apple cultivation.

1 Introduction

All agriculture sectors are getting impact from climate change, including water apple. It makes the water apple production become more challenging. But it seems not stop farmer to produce this commodity. Water apple (*Syzygium aqueum*) is a horticultural plant originating from the Indo-China region and spreading to the Pacific islands, including Indonesia and Malaysia. At first, water apple was only used as an ornamental plant and a complement to the yard. However, along with the development of human thought, they use water apple farming as their daily livelihood for household income generating. They can increase their income as in the image of water apple farming [1] by breeding water apple on a larger scale. In addition to its sweet and refreshing taste, water apple is also rich in health benefits such as maintaining heart health, increasing endurance and being an antioxidant and antidiabetic [2]

In general, there are many varieties of water apple scattered throughout the world. There are various varieties ranging from those with large sizes such as super green water apple varieties to ones that have a delightful taste, such as water apple images. There are various kinds of water apple varieties, namely super green honey water apple, king rose water apple, pomegranate water apple, red cincalo water apple, Citra water apple, green deli honey water

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apple, and others [3]. Several varieties of water apple that are bred in Indonesia are the image variety, the pomegranate variety, the *camplong* variety, the super green apple variety, the *cincalo* variety, the *bol* variety, and the water apple variety [4].

Demak is one of the largest areas that produce water apples in Indonesia. The water apple production in Demak reached 78,249 quintals in 2018 [5]**.** The water apple found in Demak Regency can be classified into three types: the image water apple, the green water apple, and the pomegranate red water apple [6]. The potential and market opportunities of water apple are quite large. Many people choose water apple as fruits that will be processed into various processed foods such as fruit salad and sweets. Water apple, which is rich in water content, is a seasonal fruit. The availability of water apple will be abundant in certain seasons and is still relatively easy to obtain because of the large amount of water apple plant production, in addition to the role of farmers who start to breed this plant regularly so that the production of water apple plants will run throughout the year. However, in the past year, the water apple plant could not grow optimally and there was even a decrease in the productivity of water apple in various areas in the district of Demak. This is due to climate change due to a long summer [7].

The comprehensive coverage of horticultural crops makes agriculture one of the fields that can give hope to the Indonesian economy. The rapid progress of the agricultural sector can also guarantee someone to invest in this field so that it can increase the income, and support productivity investment by farmer households [8].

Investment in agriculture has begun to be considered for businesspeople, and many have started to implement it. Agricultural investment has a high level of capital security and low risk. In addition, investment in agriculture, primarily agricultural land, has a positive correlation with inflation. Historically, farmland values have generally increased faster than inflation, this makes farmland an effective inflation hedge and can make capital safer. One of the sub-sectors that are the mainstay for investment is the horticulture sub-sector, which is water apple. Various studies on the feasibility analysis of water apples have been carried out, such as the feasibility of water apple [9], the financial feasibility of figs in India [10], the financial feasibility of lime farming [11] nd the feasibility of Keprok SoE Citrus farming in Indonesia [12].

The high economic value of water apple in Demak district has caused people who initially planted water apple only to decorate and complement their home gardens, now turning water apple farming into a source of daily livelihood. Fluctuating prices cause water apple cultivation to require a high extra cost for investment and operational costs. Costs that include investment include land rent, seeds, equipment, and others, while costs that include operations include labor costs, fertilizers, pesticides, and so on. Based on the investment costs and operational costs and the value of the benefits obtained, it is very important to analyze the feasibility of water apple in Demak district so that this water apple farming business can develop well and be harvested all the time. This study aims to determine the investment costs, operational costs, benefits and feasibility of water apple farming in Demak district.

2 Research method

This research was conducted in Demak Regency, Central Java Province, with the consideration that Demak Regency is one of the largest water apple centers in Central Java. The research method used is descriptive analysis. Determined by purposive sample, as many as 25 farmers are respondents that were selected purposively from the total population of water apple farmers by age water apple farming were age 0 to 25 years. The descriptive analysis consists of costs (investment costs and operational costs) and water apple farming benefits. While the Feasibility Analysis of water apple farming consists of NPV, Net B/C, IRR, and Pay Back Period which is written with the equation follow 1-4:

2.1 Net present value (NPV)

$$NPV = NB\ (1 + i)^{-n} \quad (1)$$

2.2 IRR or internal rate of return

$$IRR = i_1 + \frac{NPV1}{(NPV1 - NPV2)}\ (i_2 - i_1) \quad (2)$$

2.3 Net B / C

$$Net\ B/C = \frac{NPV +}{NPV -} \quad (3)$$

Description:
NB = Net Benefit = Benefit - Cost
i = Discount factor / interest rate
n = Year (time)
NPV_1 = Net present value which is positive
NPV_2 = Net present value which is negative
Bt = cash flow in year t.
Ct= cash outflow year t

2.4 Payback period

$$PP = \frac{Cost\ of\ Invesment}{Annual\ Cash\ Inflow} \quad (4)$$

3 Results and discussion

3.1 Cost of Water Apple Farming

Water apple farming is a business that has a profit orientation. There are two types of costs needed in water apple farming: investment and operational costs. Investment costs are costs incurred by farmers at the beginning of cultivation activities consisting of land rent, pesticides, seeds, land processing labor, and fertilizers. Meanwhile, operational costs are the costs needed to support the needs during the cultivation process, namely fertilizers, pesticides, and labor.

The total cost (investment and operational) in Table 1 was used for farming water apple with a land area of 2000 m^2. The most considerable costs are incurred in the first year. This is because there are two cost components at once in the first year, namely, investment costs incurred at the beginning of the planting process and operational costs incurred when water apple farming begins. The investment cost consists of the cost of land lease per 2000 m^2, the cost of seedlings, labor costs for land preparation, planting, and fertilizing early. While operational costs consist of fertilizer costs, pesticide maintenance labor costs, and transportation costs. The highest cost is for labor, both domestic and non-family labor for maintenance and harvesting [11,13,14].

3.2 Benefits of Water Apple Farming

Benefits are the result of multiplying the amount of production with the price. These results began to be obtained by farmers when farmers entered the early harvest period, namely the fruit was harvested at the age of 5 years. The price used is the highest price obtained by the

farmer. Furthermore, for the purposes of analysis, this benefit will be calculated at the present value by discounting it at an interest rate of 12%. The benefits of water apple farming in Demak district are shown in Table 2.

Table 1. Investment, Operational and Total costs of water apple farming in Demak Regency

Year	Investment Cost (IDR)	Operational Cost (IDR)	Total Cost (IDR)
0	715,822,520	-	715,822,520
1	-	16,612,467	16,612,467
2	-	3,545,774	3,545,774
3	-	22,195,143	22,195,143
4	-	2,119,477	2,119,477
5	-	8,382,328	8,382,328
6	-	19,274,889	19,274,889
7	-	14,737,100	14,737,100
8	-	26,062,500	26,062,500
9	-	3,628,900	3,628,900
10	-	2,510,692	2,510,692
11	-	65,590,000	65,590,000
12	-	62,452,727	62,452,727
13	-	17,414,769	17,414,769
14	-	10,958,000	10,958,000
15	-	37,034,000	37,034,000
16	-	22,465,000	22,465,000
17	-	7,867,273	7,867,273
18	-	10,708,333	10,708,333
19	-	7,620,000	7,620,000
20	-	22,138,947	22,138,947
21	-	13,434,600	13,434,600
22	-	22,582,667	22,582,667
23	-	24,907,333	24,907,333
24	-	6,365,000	6,365,000
25	-	4,895,080	4,895,080
Amount	**715,822,520**	**455,502,999**	**1,171,325,519**

Water apple production in Demak district pad a Table 2, very fluctuating and productive between the 8th year to the 18th year after that there was a fluctuating decline in production. The fluctuating production of water apple is influenced by many factors, one of which is climate change, namely a prolonged dry season. Productivity and fruit quality will decrease due to climate change, environmental pressures such as increased temperatures, floods, and others [13]. The importance of standard operating procedures for Good Agriculture Practices Application to be able to increase the production of water apple to the maximum and quality [15].

Based on Table 3, the farmers have not received benefit value from the first year until the 4th year. The highest benefit value is obtained when the apple plant is 11 and 12 years old. Until the 25th year, the benefit value fluctuates and tends to decrease. It also can be seen in Figure 1, where the fluctuation of the benefit are quite dynamics. This fact shows that the costs incurred, and the results obtained from the water apple farming in the district of Demak have not been balanced. Because the data collection approach uses the age of the plant in the same year, it is to estimate the NPV by discounting the costs and benefits at the prevailing interest rate. In this study, the prevailing interest rate is 6% per year.

Table 2. Benefits of water apple farming in Demak Regency

Year	Production (Kg)	Price (IDR/kg)	Total (IDR)
1	-	-	-
2	-	-	-
3	-	-	-
4	-	-	-
5	6,724	15,000	100,862,069
6	11,000	15,000	140,000,000
7	12,000	15,000	180,000,000
8	20,000	15,000	300,000,000
9	4,200	15,000	63,000,000
10	5,169	15,000	77,538,462
11	19,000	15,000	285,000,000
12	27,273	15,000	409,090,909
13	5,538	15,000	83,076,923
14	6,000	15,000	90,000,000
15	12,000	15,000	180,000,000
16	18,000	15,000	270,000,000
17	8,182	15,000	122,727,273
18	21,000	15,000	315,000,000
19	9,000	15,000	135,000,000
20	11,368	15,000	170,526,316
21	6,000	15,000	90,000,000
22	5,000	15,000	75,000,000
23	12,444	15,000	186,666,667
24	8,400	15,000	126,000,000
25	4,800	15,000	72,000,000
Amount			**3,571,488,618**

Table 3. Net Present Value of water apple farming in Demak Regency

Year (year)	Total Cost (IDR)	Benefit (IDR)	BC (IDR)	Df (6%)	NVP (IDR)
0	715,822,520		(715,822,520)	1	(715,822,520)
1	16,612,467		(16,612,467)	0.94	(15,672,138)
2	3,545,774		(3,545,774)	0.89	(3,155,726)
3	22,195,143		(22,195,143)	0.84	(18,635,470)
4	2,119,477		(2,119,477)	0.79	(1,678,824)
5	8,382,328	100,862,069	92,479,741	0.75	69,106,243
6	19,274,889	240,000,000	220,725,111	0.7	155,602,494
7	14,737,100	180,000,000	165,262,900	0.67	109,909,267
8	26,062,500	300,000,000	273,937,500	0.63	171,871,776
9	3,628,900	63,000,000	59,371,100	0.59	35,141,663
10	2,510,692	77,538,462	75,027,769	0.56	41,895,114
11	65,590,000	285,000,000	219,410,000	0.53	115,582,451
12	62,452,727	409,090,909	346,638,182	0.5	172,268,557
13	17,414,769	83,076,923	65,662,154	0.47	30,784,980
14	10,958,000	90,000,000	79,042,000	0.44	34,960,353
15	37,034,000	180,000,000	142,966,000	0.42	59,654,717
16	22,465,000	270,000,000	247,535,000	0.39	97,441,233
17	7,867,273	122,727,273	114,860,000	0.37	42,654,917
18	10,708,333	315,000,000	304,291,667	0.35	106,606,696
19	7,620,000	135,000,000	127,380,000	0.33	42,100,747
20	22,138,947	170,526,316	148,387,368	0.31	46,267,883
21	13,434,600	90,000,000	76,565,400	0.29	22,522,126
22	22,582,667	75,000,000	52,417,333	0.28	14,546,077
23	24,907,333	186,666,667	161,759,333	0.26	42,348,150
24	6,365,000	126,000,000	119,635,000	0.25	29,547,279
25	4,895,080	72,000,000	67,104,920	0.23	15,635,354
Amount	**1,171,325,519**	**3,571,488,618**	**2,400,163,099**	**13.78**	**701,483,399**

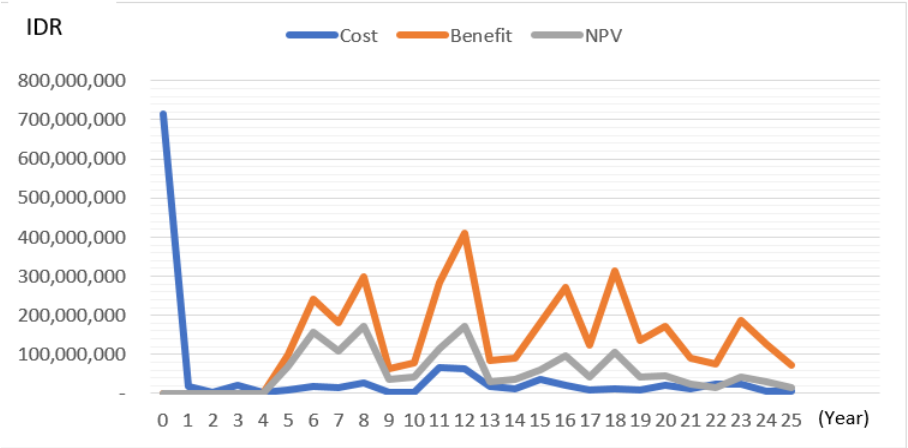

Fig. 1. Cost, Benefit and NPV water apple farm in Demak regency

3.3 Feasibility Analysis of Water Apple Farming

Water apple in Demak Regency is an annual plant with an economic life of 25 years. Actually, water apple can bear fruit up to the age of 30 years. However, farmers in Demak Regency consider that water apple farming that have an age of more than 25 years, the quality and quantity of the fruit are decreasing productions, so the investment analysis period in this study is annual. The eligibility criteria used to analyze the feasibility are NPV, Net B/C, IRR, and Pay Back Period.

The net present value (NPV) of farming in Demak district based on Table 3 with an interest rate of 6% is IDR 701,483,399 (Table 4). This value shows the net benefits obtained from water apple farming in Demak Regency over the business's life with an interest rate of 6% per year for a production period of 25 years. The NPV value, which shows a number greater than zero, indicates that the farm is profitable and feasible to run.

Table 4. Feasibility value of water apple farming in Demak Regency

Investment Indicator	Value
NPVat i=6%/year (IDR)	701,483,399
Net B/C	1.93
IRR (%)	12.23
Payback Period (years)	14.8

The Table 4 show, Net B/C value of 1.93 at the prevailing interest rate of 6% greater than one means it is feasible to cultivate or every IDR1 of costs incurred during farming activities apple will generate IDR 1.93 units of net benefit. This value indicates that it is economically feasible to run water apple farming.

The internal rate of return, investment costs, operational costs, and benefits are calculated from the first year to the 25th year according to the age of the water apple farming, as shown in the previous table. NPV flow is obtained by using negative and positive values according to the difference between costs and benefits in each year. The IRR value of 12.23% means that water apple farming in Demak Regency can provide benefits of 12.23% of the capital costs incurred so that farming can return the capital that has been used. In addition, with an IRR value of 12.23%, it shows that farmers can take loan opportunities with interest rates below this value. Based on the eligibility criteria, the IRR of 12.23% indicates that the farm is feasible to run because the value is greater than the prevailing bank interest rate, which is 6% per year. This value is the interest rate for local BRI bank loans, which are used as a

source of capital for farmers. The IRR value from this study is lower than the IRR value for water apple farming in Haryana, India, which is 28.5% for organic water apple and 26.5% for non-organic water apple, but the age of the plant analyzed is only seven years [9].

The Pay Back Period (PBP) value is 14.8 years, indicating that water apple farming in Demak Regency can return investment costs in 14.8 years. According to the feasibility analysis, the water apple has the potential to be developed by expanding the planting area. This action will increase in harvesting water apples throughout the season. These findings also demonstrate that this increasingly popular fruit has significant potential for future development in the agricultural sector [16]. On the other hand, standard operating procedures are required for apple cultivation to produce high-quality fruit.

4 Conclusions

All agriculture sectors are getting impact from climate change, including water apple. It makes the water apple production become more challenging. But it seems not stop farmer to produce water apple. The investment cost needed in farming activities with the water apple land area 2,000 m^2 is IDR 751,822,420 operational costs IDR 1,171,325,519, the benefit generated for 25 years is IDR 3,571,488,618. Water apple farming in Demak Regency is feasible to cultivate. Viewed from several investment criteria, including Net Present Value (NPV) with an interest rate of 6% per year is IDR 701,483,399, Net B/C is 1.93, Internal Rate of Return (IRR) is 12.23%, and Pay Back Period (PBP) of 14.8 years.

Based on the feasibility analysis, water apple is a prevalent fruit and has the potential to be developed by rejuvenating it so that the apple harvest can be throughout the season. To support this, standard operating procedures are needed for apple cultivation so as to produce maximum and quality production.

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