Feasibility Analysis of an Automatic Mechanical Spray Arm Development for Orchid Farm

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บทคัดย่อ—บทความนี้การวิเคราะห์ความเป็นไปได้ในการพัฒนาแขนกลพ่นน้ำอัตโนมัติสำหรับฟาร์มกล้วยไม้ถูกนำเสนอขึ้น โดยเครื่องมือวิเคราะห์ข้อมูลทางการเงินพื้นฐานร่วมกับโปรแกรมกูเกิลชีท ถูกนำมาใช้สำหรับการวิเคราะห์ข้อมูล อย่างไรก็ตามยังมีพารามิเตอร์ที่สำคัญได้แก่ มูลค่าปัจจุบันสุทธิ (*NPV*), อัตราผลตอบแทนภายในโครงการ (*IRR*), อัตราส่วนค่าใช้จ่ายต่อต้นทุน (*BCR*), และระยะเวลาคืนทุน (*PB*) ได้ถูกนำมาใช้เป็นปัจจัยในการตัดสินใจลงทุนในโครงการ โดยใช้รายได้ของโครงการ ต้นทุนเริ่มแรก ต้นทุนในการดำเนินการและต้นทุนการบำรุงรักษา เป็นตัวแปรนำเข้า (Input parameters) ส่งผลให้มูลค่าปัจจุบันสุทธิ *NPV* ได้ผลลัพธ์เท่ากับ 36,848.66 บาท นอกจากนั้นค่าพารามิเตอร์อื่น ๆ เช่น *IRR*, *BCR* และ *PB* จะแสดงค่าผลลัพธ์เท่ากับ 22.47%, 1.21, และ 1.87 ปี ตามลำดับ ซึ่งผลลัพธ์ดังกล่าว สามารถสรุปได้ว่าโครงการที่นำเสนอนั้นมีความเป็นไปได้ในการลงทุน นอกจากนั้นโปรแกรมกูเกิลชีท ยังสามารถใช้เป็นเครื่องมือในทางการวิเคราะห์ข้อมูลทางการเงินได้อย่างดี

คำสำคัญ: การประเมินความเป็นไปได้, เครื่องมือพื้นฐานทางการเงิน, โปรแกรมตารางทำการ, งบลงทุน

Abstract—In this paper, a feasibility analysis of an automatic mechanical spray arm development for the orchid farm has been proposed. A fundamental of economic tools cooperated with a *Google Sheets programming* has, consequently, been utilized for data analysis. However, the important parameters such as the net present value (*NPV*), internal rate of return (*IRR*), benefit-cost ratio (*BCR*), and also payback period (*PB*) have been used as the factors for deciding the project investment. By using the project income, initial costs, production costs, maintenance costs, and marketing costs as input data, the output result of *NPV* is indicated of 36,848.66 THB. Moreover, the *IRR*, *BCR* and also *PB* are resulted of 22.47%, 1.21, and also 1.87 years respectively. According to the results as mentioned above, we might summarized that the proposed project is feasible to invest and also the *Google sheets program* is a capable to use as a financial tool of the project.

Keywords-component; Feasibility analysis; economic tools; spreadsheet program, investment cost

I. INTRODUCTION

Nowadays, the orchid industry especially in Thailand is growing [1]. The agricultural sector is growing and also the value of exports has increased steadily. The orchid industry is an economic crop that makes money to Thailand and is a plant that is known around the world and like the Thai orchid as well. Thailand is the first exporter of orchids in the world [2], [3]. The climate is conducive to the breeding of orchids and a lot of orchids are beautiful and durable. The orchid is very popular especially in European countries such as the Netherlands and Italy. It causes to the terrain cannot plant orchid leading to increase the value of the Thai people who work at the factory. As a result, entrepreneurs have to hire foreign workers. However, it causes of the limited legal hiring process. The industry has developed of innovative spray arms. To solve the shortage of labor for the orchid industry due to the investment is risky, we, therefore, might to analyze the project with economics tools to reduce the risk and failure of investment [4], [5].This paper presents the investment decision-making for the development of mechanical spray arm in the orchid farm. The fundamental of economic tools, such as the net present value (*NPV*), internal rate of return *(IRR*), benefit-cost ratio (*BCR*) and also payback period (*PB*) have been used for the feasibility study. The calculation results are then a factor to predict the possibility for the feasibility investment to the investors.

II. RELATED THEORIE

A. Fundamental of economic tools

Economic tools are used in analysis of financial data that will lead to conclusion in deciding the project that should invest or not by calculating some parameters such NPV, IRR, BCR and PB etc. The calculation details of these parameters can thus be summarized below [6].

- *Net present value* (*NPV*) is a basic parameter that presents the difference between the present value of benefit and the present value of costs. NPV value is used to consider the capital investment decision. However, when the NPV value is greater than "0" or positive, it means that the project can be profitable, which calculated by:[7], [8]

$$NPV = \sum_{t=0}^{n} \frac{\left(B_t - C_t\right)}{\left(1+r\right)^t} \quad (1)$$

Where:

B_t = the benefit during the period t
C_t = the costs during the period t
r = the discount rate or interest rate
t = a number of year (1, 2, 3, … n)
n = the time period of the project

- *Internal rate of return (IRR)* is an economic parameter that the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal to zero. However, the internal rate of return is used to evaluate the attractiveness of a project or investment. If the *IRR* of a new project exceeds a company's required rate of return, that project is desirable. If *IRR* falls below the required rate of return, the project should be "*rejected*" [9].

$$IRR = r_a + \left[\left(\frac{NPV_{r_a}}{NPV_{r_a} + NPV_{r_b}}\right) \times (r_b - r_a)\right] \quad (2)$$

Where:
r_a = the discount rate that NPV_{ra} is positive rate
r_b = the discount rate that NPV_{rb} is negative rate

- *Benefit cost ratio (BCR)* is a parameter that the total present value of benefit divided by the total present value of costs. However, the investment project should be invested when the *BCR* value is greater than "1". Consequently, this parameter can thus be calculated as follows:[10], [11]

$$BCR = \frac{\sum_{t=0}^{T} (\mathrm{B}_t / (1+\mathrm{r})^t)}{\sum_{t=0}^{T} (\mathrm{C}_t / (1+\mathrm{r})^t)} \quad (3)$$

- *Payback period (PB)* is a financial parameter which used to find out the time period (year) of a returning project benefit. Normally, it must equals to the invested money [12].

$$PB = (t-1) + \frac{\left(\sum CF_{t-1}\right)}{CF_t} \quad (4)$$

Where:

t = last year that indicated a negative cumulative cash flow
$\sum CF_{t-1}$ = Cumulative cash flow at period t
$CF_{(T+1)}$ = Net cash flow at the period t

B. Decision making

Decision making on investment is a tool that used for considering the project which is acceptable by deciding through the criteria as following: [6]

- *NPV* is greater than "0" or positive value
- *IRR* is greater than discount rate or interest rate
- *BCR* is greater than "1"
- *PB* is less than the time period of the project

III. EXPERIMENTAL SETUP

In this research, the economic feasibility of the mechanical spray arm development for the orchid farm has been conducted, of which methodology can be described according to Figure 1.

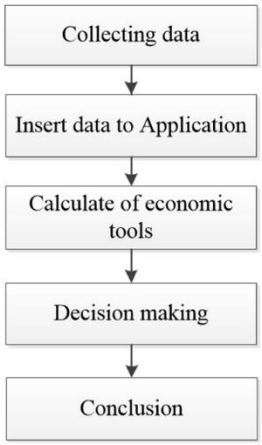

Figure 1. Research methodology precesses

As shown in Figure 1, we first entering the input data from the initial cost such as metrials, equipment, labour cost etc. to the calulation program (spreadshet program), and called these data as "*data collection*". Consequently, it would then be calculated the financial parameters such as *NPV*, *IRR*, *BCR* and *PB* values for decision making.

Finally, the output calculaitons would thus be predicted the economic feasibility in two ways "*feasible to invest*" and "*non-feasible to invest*" respectively.

A. Collecting data process

The collecting data is the first step for investment decision-making. In this paper, we, however, classify such data into 4 categories; initial cost data, production cost data, maintenance cost data, and also marketing cost data respectively. Moreover, the details of data are illustrated in Figure 2.

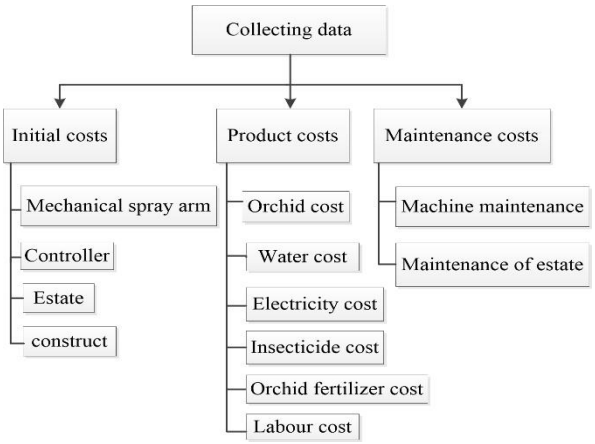

Figure 2. Collecting data process

According to Figure 2, the data collected is, normally, used for the feasibility analysis of the studied project. The financial data is a numeral of benefit and also costs that are assumed as cost of equipment i.e. programmable logic controller (PLC), mechanical spray arm, water usage cost, electricity usage cost etc.

B. Calculation via spreadsheet program process

In this research, the calculation function is developed on a spreadsheet program by *Google Sheets application program*. We have built the formulas within such program and design the user interface (UI) to be simple for the data entering and editing. However, the user interface windows and displaying of the program are shown in Figure 3

According to Figure 3 (a), it is a part of UI that the user or analyzer can insert or edit the raw data, the investment costs as mentioned above, into the section A, and B respectively. In addition, the details of each section are explained below:

Section: A Show the duration period (year) of the investment project.

Section: B Insert the cost values consisting of the total benefit, total cost, cash flow, and accumulated cash flow respectively.

In addition, the costs that put into section B are related to the 4 categories costs that mentioned before. After completely all inserting data into the section A and B, the calculation results of decision-making would automatically be displayed the output values on the decision result display as can be seen in Figure 3 (b). Moreover, the outputs of financial results would then be indicated in section C and D. These sections are performed as the output display of the developed program where the user can considers the results from such windows.

Section: C Show the calculation values of *NPV*, *IRR*, *BCR* and *PB*. Moreover, the results of investment decision-making would be "*accepted*" when the output values match. In the opposite way, the output would be "*ignored*" when the values do not match respectively.

Section: D Show the criteria of investment decision-making.

Figure 3. Example of windows display from spreadsheet program: (a) user interface (b) format of result display

IV. Experimental Results and Discussion

As computing the data with the developed program, the outputs of *NPV*, *IRR*, *BCR* and *PB* are appeared in the same values compared with the calculator as shown the results in table 1.

TABLE I. OUTPUT CALCULATION FROM SPREADSHEET PROGRAM

Parameters	Calculation results
NPV	36,848.66 THB
IRR	22.47%
BCR	1.21
PB	2.83 Years

As mentioned in Table I, the analysis results shown that the *NPV*, *IRR*, *BCR*, and *PB* have met the decision-making criteria. The output calculation result shown that the *NPV* value is indicated of 36,848.66 THB, while *IRR* value is reported 22.47%. In addition, the *BCR* and *PB* are exploited of 1.21, and 2.83 years respectively. Therefore, we can summarize that the development of mechanical spray arm of the orchid farm is economically feasible, and also is suggested for the practical investment.

V. Conclusion

A cost analysis study of mechanical spray arm development in orchid farm using the *Google Sheets program* has been conducted with the project duration of 5 years. The calculation results showed the economic feasibility results that is the payback period of 2.83 year, the net present value of 36,848.66 THB, the internal rate of return of 22.47%, and the benefit-cost ratio of 1.21. Therefore, we have decided that the investment project is economically feasible and is appropriated for the practical investment. However, this research has utilized the fundamental of financial analysis tools. As such, we recommended that any future improvement of the analysis process to evaluate more realistic results, which would make the decision-making easier and more precise for the investors.

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