# Software for Capital Investment Analysis: A Case Study on Walking Aid for Stroke Patients

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**Abstract:** This research presents the development of a software for capital investment analysis, using a case study of a walking aid machine development for stroke patients. The software was created with Visual Basic for Applications (VBA) and Microsoft Access for database management and features a graphical user interface (GUI) for intuitive data input and result display. To support online use and collaboration, the system was also integrated with Microsoft SharePoint for cloud-based data storage and multi-device access. The software processes key financial inputs, including investment costs, annual income, operating expenses, and discount rates. It automatically computes major economic indicators such as NPV, IRR, DPB, and BCR. It also includes a sensitivity analysis function to assess project risk from changes in costs and revenues. Testing with actual project data showed an NPV of 33,822,276.50 THB, an IRR of 65.81%, a payback period of 2.19 years, and a BCR of 1.88, which confirms the project's economic feasibility. The developed software is suitable for use in health-related or technology-based projects requiring accurate and flexible financial analysis in both standalone and networked.

***Index Terms*— Fundamental economic tools, Sensitivity analysis, Investment decision making, Investment feasibility assessment.**

## I. INTRODUCTION

A stroke occurs when blood flow to the brain is obstructed, causing oxygen and nutrient deprivation that can lead to permanent brain damage and impair essential functions such as movement, speech, and memory. There are two primary types: ischemic and hemorrhagic strokes, with major risk factors including hypertension, diabetes, and unhealthy lifestyle choices [1]. Stroke is one of the leading causes of adult mortality worldwide, affecting millions of people each year in 2023 [2], Thailand recorded over 358,062 stroke cases [3], a number expected to rise due to the aging population [4]. Effective treatment involves both medical intervention and rehabilitation, where assistive walking devices play a key role in restoring patient independence [5]. However, the high cost and limited accessibility of imported devices, especially in rural hospitals, have driven efforts to develop affordable, domestically produced alternatives with a focus on economic feasibility [6].

This study aims to address these challenges by developing a specialized software tool tailored for capital investment analysis in the context of walking aids for stroke patients. The core research objectives include: (1) designing a user-friendly interface for healthcare professionals, (2) implementing robust financial models such as IRR and NPV, and (3) ensuring accuracy and reliability through comparative validation. The proposed approach advances existing work by integrating domain-specific parameters, automating complex calculations, and providing real-time feedback.

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## II. RELATED THEORIES

### A. Fundamentals of economic analysis tools

Economic evaluation methods are essential tools for investment decisions, providing key indicators like *NPV*, *IRR*, *BCR*, and *DPB* to assess a project's financial viability and performance.

- Net present value: (*NPV*) indicates the net profit of a project over its entire duration. The value may be negative, zero, or positive, depending on the present value of benefits and costs. A positive *NPV* suggests that the project is financially viable and profitable. [7]

$$NPV=\sum_{n=1}^{N}\left[\frac{(I_n-E_n)}{(1+r_n)^n}\right]-E_0 \quad (1)$$

where:
- $I_n$ = profit income of the project in $n$ year
- $E_n$ = cost of the project in $n$ year
- $E_0$ = cost of the project in $n$ year
- $r_n$ = discount rate of the project
- $n$ = project duration ($n$ = 1, 2, 3, …, $N$)
- $N$ = project age of the investment

- Internal rate of return: (*IRR*) is a financial metric used to evaluate the profitability of an investment. It represents the discount rate at which the present value of future cash inflows equals the initial investment, making the net present value equal to zero. *IRR* is calculated using projected annual returns and investment costs to identify the rate that balances income and expense over the project's life. [7]

$$\sum_{n=1}^{N}\left[\frac{(I_n-E_n)}{(1+IRR)^n}\right]-E_0=0 \qquad (2)$$

- <u>Benefit-Cost Ratio:</u> (*BCR*) is the ratio of the present value of a project's total expected benefits to its initial investment cost. It compares future income streams with upfront costs, where a *BCR* greater than 1 indicates that the project is economically viable. [7]

$$\mathrm{BCR}=\frac{\sum_{n=1}^{N}[I_n/(1+r_n)^n]}{\sum_{n=1}^{N}[E_n/(1+r_n)^n]+E_0} \qquad (3)$$

- <u>Discounted Payback Period:</u> (*DPB*) is an investment analysis method that calculates the time required to recover the initial investment while accounting for the time value of money. Unlike the traditional Payback Period, the value of *DPB* discounts future cash flows, providing a more accurate assessment of investment recovery.

$$\mathrm{DPB}=Y+\frac{\left|\sum_{n=1}^{Y}[(I_n-E_n)/(1+r_n)^n]-E_0\right|}{(I_{(Y+1)}-E_{(Y+1)})/(1+r_n)^{(Y+1)}} \qquad (4)$$

Assume that *Y* is corresponding to the year which the cumulative cash flow is less than "0".

### *B. Sensitivity analysis*

Sensitivity Analysis is a technique used in engineering economics to evaluate how changes in input variables such as investment cost, interest rate, or project revenue affect key financial outcomes like *NPV*, *IRR*, *DPB*, *BCR*. This method involves varying one or more inputs from their base-case values within realistic ranges to assess the extent of their impact. It helps identify the most influential factors (key drivers) and supports informed decision-making under uncertainty. Sensitivity analysis is particularly valuable when assessing high-risk projects, such as those involving innovation or new technologies [8]-[9].

### *C. Incorporating risk and inflation into discount rate*

In financial and investment analysis, the discount rate plays a vital role in determining the present value of future cash flows. Usually, the discount rate is not merely a reflection of the borrowing interest rate, but rather an adjusted rate that accounts for project-specific risk and anticipated inflation. The inclusion of a risk premium ensures that uncertainties associated with the investment are properly recognized, while adjusting for inflation captures the declining purchasing power of money over time. Without these adjustments, financial evaluations may either underestimate or overestimate a project's true economic viability. Therefore, accurate discount rate determination incorporating both risk and inflation factors is essential for making informed and reliable investment decisions. [10]-[11]

Discount rate = (1+*IRR*) x (1+*RPR*) x (1+*IAR*) – 1 (5)

where the *RPR* represents the risk premium rate, and also *IAR* is the inflation adjustment rate, respectively.

## III. EXPERIMENTAL SETUP

This research focuses on the development of a software for capital investment analysis and support decisions. The software applies to Microsoft Access and Microsoft share point to use in this research. Its structure can be divided into 4 main steps as shown in Fig. 1.

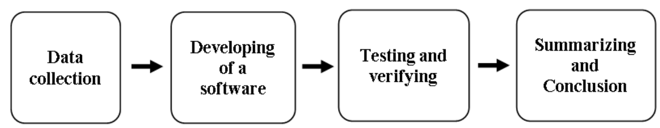


**Fig. 1.** Process flowchart of research work

### *A. Data collection and financial analysis*

This process involves collecting data from various sources, including textbooks and related research studies. The collected financial data encompasses initial investment costs, operating costs, labor costs, maintenance costs, and the projected benefits of the project. These data are then utilized as input for feasibility analysis using economic evaluation tools such as *NPV, IRR, BCR, DPB* and Sensitivity analysis [12]. Finally, the analysis results are presented both numerically and graphically through the program's graphical user interface (GUI).

### *B. Design and software development*

This step is the process of designing the user interface as shown in Fig. 2. The proposed system manages projects through the integration of Microsoft Access and Microsoft SharePoint [13]. The concept consists of the following steps:

<u>*Step 1*</u>: Project Management:

Users can add, edit, delete, and perform sensitivity analysis on projects, directly interacting with the database.

<u>*Step 2*</u>: Data Storage:

*Database 1*: Project information such as project name, description, discount rate, risk rate, inflation rate, creation date, and project duration [14].

*Database 2*: Yearly cash inflows and outflows linked to each project.

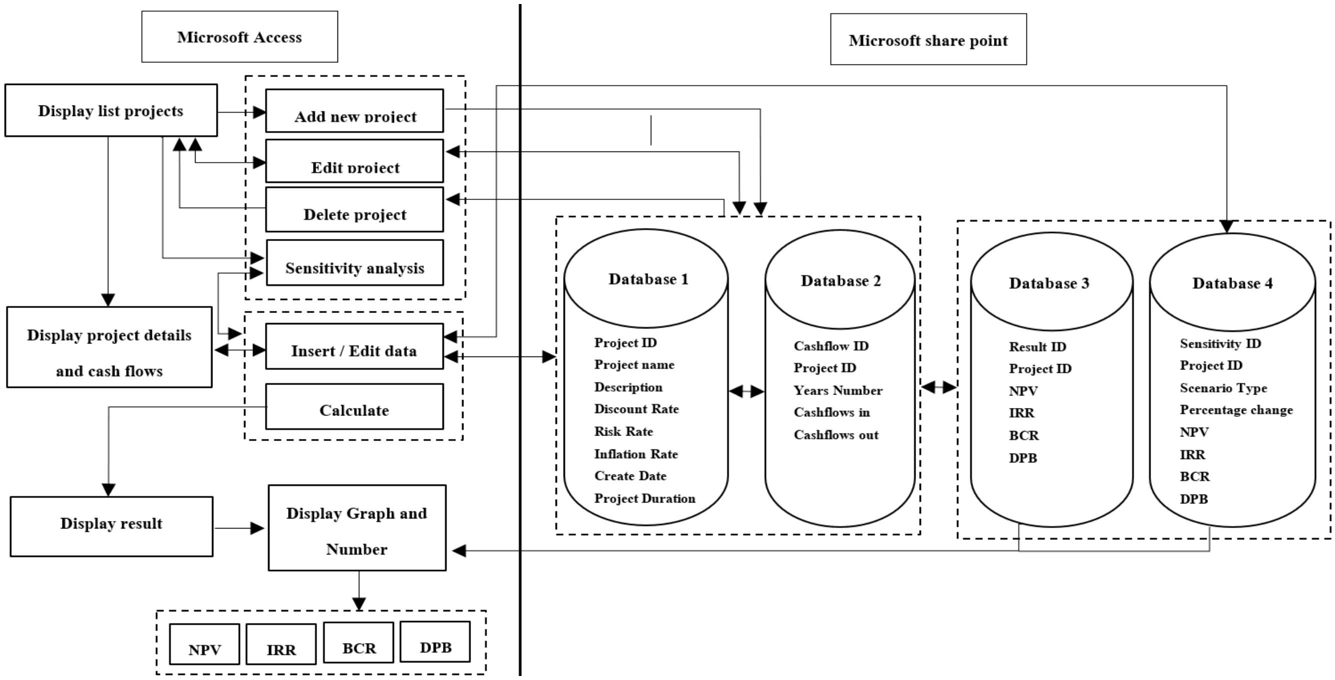


**Fig. 2.** Algorithm of developed application software

*Database 3*: Calculated financial results including *NPV*, *IR*R, *BCR*, and *DPB*

*Database 4*: Sensitivity analysis scenarios and their impacts on financial indicators [15]-[16].

<u>*Step 3*</u>: Computation and Analysis:

Financial metrics, *NPV, IRR, BCR, DPB*, are calculated and stored systematically.

<u>*Step 4*</u>: Result Presentation:

Outcomes are displayed in both numerical and graphical formats for interpretation.

<u>*Step 5*</u>: Data Synchronization:

SharePoint ensures centralized access and real- time collaboration across users.

This system facilitates efficient project evaluation, dynamic data handling, and comprehensive financial analysis.

### *C. Testing and verifying*

This step focuses on testing and validating the developed software to ensure the accuracy of the investment analysis [17]-[18]. To verify its effectiveness, the software must undergo a thorough evaluation process. A case study of a walking aid machine development for stroke patients are employed to assess the software's performance.

Additionally, the analytical results were cross-verified with calculations performed using Microsoft Excel and publicly available online tools to identify potential discrepancies and quantify associated errors. A flowchart illustrating the complete testing and comparison procedure between these analytical methods is presented in Fig. 3.

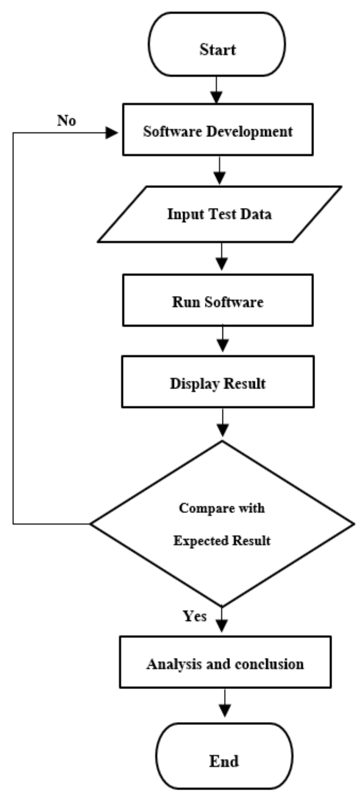


**Fig. 3.** Validation and comparison of developed Software against MS-Excel and public online tools

The process for testing and validating the developed software is illustrated in Fig 3. The procedure begins with software development, after which test data are entered into the system. Once the data has been input, the software is executed to perform the necessary calculations. The results generated are then displayed for evaluation. These results are compared to the expected outcomes, typically derived from MS Excel or publicly available online tools. If discrepancies are found, the development process is revisited for correction and improvement. If the results match, the analysis and conclusion phase is conducted, summarizing the findings and verifying the software's reliability. This iterative approach ensures the accuracy and effectiveness of the software developed.

## IV. EXPERIMENTAL RESULTS AND DISCUSSION

The software developed, designed to assist in capital investment, incorporates a user interface as illustrated in Fig. 4.

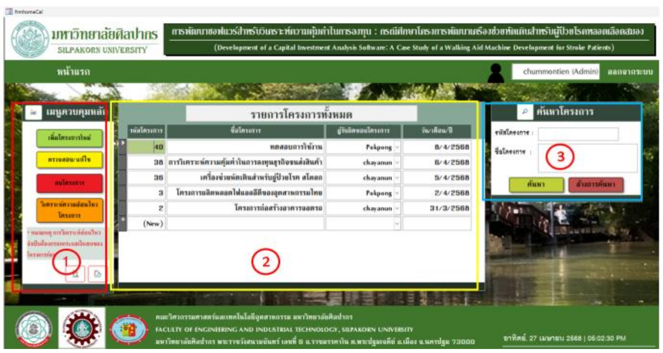

**Fig. 4.** User interface design of developed software system

According to Fig. 4, this window serves as the main interface for displaying all project data within the software. It is divided into three functional sections

Windows1: The main control menu, which allows users to add, review, delete projects, and perform sensitivity analysis on selected projects.

Windows2: The project list display, which shows all registered projects in the system.

Windows3: The project search panel, which enables users to search for projects by project code or project name.

After adding or reviewing a project, the system navigates to the project detail window, which displays the project's information as shown in Fig. 5.

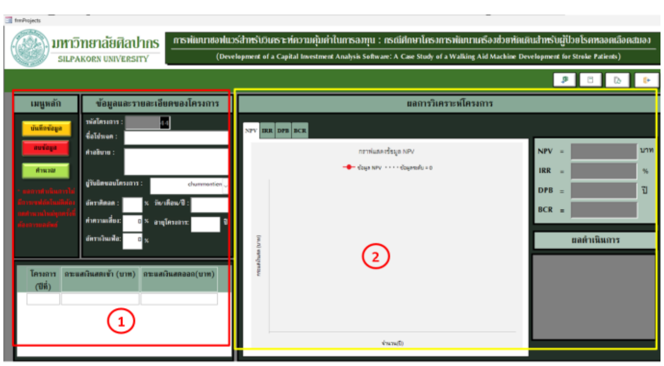

**Fig. 5.** Project details windows

As shown an example in Fig. 5, this windows displays project information, which is divided into two sections:

*Windows1:* This section is designated for entering various data, including the project name, project manager, discount rate, risk premium, inflation rate, project duration, and cash flow information [19].

*Windows2:* This section displays the results of the analysis, including graphical representations, numerical figures, and key analytical outcomes.

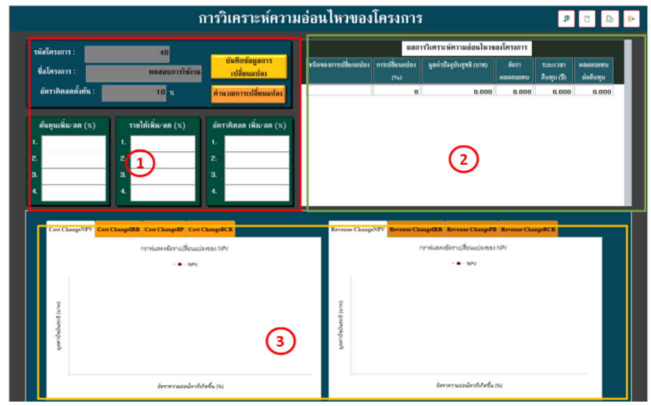

**Fig. 6** Sensitivity information windows

As illustrated in Figure 6, this user interface presents sensitivity analysis information for projects, organized into three sections:

*Windows1:* This section displays project information and provides input fields for adjusting the percentage changes of key variables, such as cost and discount rate. It also includes a calculation button to generate sensitivity analysis results.

*Windows2:* This section presents the numerical results of the sensitivity analysis, showing the calculated values of *NPV, IRR, BCR*, and *DPB* according to different types of changes.

*Windows3:* This part displays graphical representations of the overall sensitivity analysis outcomes. After the software development was completed, the next step involved testing the accuracy of its calculations. The results were compared with those obtained from other software platforms, such as Microsoft Excel and publicly available online tools. However, the comparison results are summarized in Table 1.

TABLE I

COMPARISON RESULTS AMONG ACCESS SOFTWARE

| Parameter | OUTPUT FROM ACCESS | Output from Excel | Output from online tools |
|---|---|---|---|
| *NPV* | 33,822,276.49 | 33,822,276.49 | 33,822,276.49 |
| *IRR* | 65.81 | 65.81 | 65.81 |
| *BCR* | 2.186 | 2.18 | 2.186 |
| *DPB* | 1.88 | 1.88 | 1.88 |

According to the comparison results presented in Table I, the developed software using MS Access was evaluated against MS Excel and publicly available online tools [20]-[21]. It was found that the calculated values of *NPV*, *IRR*, *BCR*, and *DPB* were identical across all platforms. Therefore, it can be concluded that the software developed is as effective as the referenced tools. Moreover, a notable advantage of the developed software is its user-friendly interface [22], which allows users to manage multiple projects simultaneously, perform sensitivity analysis for each project, and collaborate online through an integrated platform.

## V. Conclusion

This research focuses on the development of a management software tool to support capital investment decision-making, utilizing MS Access programming in conjunction with MS SharePoint for online collaboration. The system facilitates easier and more efficient investment decisions. The software was tested by comparing its performance with MS Excel and publicly available online tools, calculating key financial indicators including *NPV*, *IRR*, *BCR*, and *DPB*. The test utilized data from a case study on the development of a walking aid machine for stroke patients. The results of all three applications were found to be identical. Therefore, it can be concluded that the software developed is as effective as MS Excel. In addition, the software offers a user-friendly interface, provides sensitivity analysis functionality for individual projects, and enables collaborative online work.

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