

# ***Literature Review on the Net Present Value Method of Project Investment Decision***

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**Abstract:** Net present value method is one of the most commonly used evaluation methods in enterprise investment decision, which has great influence on the success of investment. Its research has important theoretical reference significance for enterprise investment decision. This article provides the current status of NPV in actual investment practice and decision making. This paper summarizes the similarities and differences of the definition of net present value from the related theories, concepts, formulas and economic significance. This paper further discusses the advantages and limitations of its application in theory and practice, and draws a relatively widely accepted conclusion about the advantages and limitations of net present value by elaborating the viewpoints of many scholars. Then, the potential optimization measures of net present value method are introduced. Finally, on the basis of summarizing the main viewpoints and contents of the existing research, the possible future research trends and directions of NPV are put forward.

**Keywords:** investment decision, net present value, NPV

## **1. Introduction**

Is a project worthy to invest in? How to invest? For this problem, there are financial evaluation standards, among which net present value (NPV) is one of the most scientific and reasonable indicators to measure the feasibility of enterprise project investment decisions. It is essential in evaluating whether a project is worth investing in and is widely used in many industries. There are many factors that determine whether a company can make profits in the future, such as whether the market is booming or whether the country has introduced favorable policies. And an investment that brings positive returns is one of the many important factors for a business to capture profits. On the contrary, the wrong project will not only put pressure on cash flow, reduce revenue, and even in extreme cases, cause the company to go bankrupt. In that case, studying the evaluation indicators of investment decisions is very necessary.

The academic circles have widely concerned the net present value method, and many scholars have studied it from different angles and aspects. This paper uses journals in Zhangqiao Scientific Research (a formal scientific research service data platform that has established a stable cooperative relationship with various authoritative Chinese and foreign literature databases) and the CNKI database as literature sources. The time is up to September 2023. Through the keywords "net present value" and "investment decision", the relevant journal literature in Zhangqiao Scientific research and

CNKI database is combed and studied, the research status is analyzed, and the future research trend is forecasted.

## 2. Overview of Net Present Value Theory

### 2.1. Concept of Net Present Value

In the research report on “Discussion on the Net Present Value Method of Project Investment Decision”, Zhan Feng Lu proposed that for a given project, NPV refers to the present value of the difference between cash expected to be received and cash likely to be spent in the future [1]. Using a predetermined benchmark discount rate (the project's yield rate or the project's cost of capital), The annual cash flow generated by the project is discounted to the present value of the investment plan implementation (i.e. decision point) throughout the entire calculation period.

According to the research on the relevant literature of Zhangqiao Scientific Research and CNKI database, the academic circle generally defines NPV in these two modes, either from the perspective of difference or from the perspective of the sum of present value, that is, taking into consideration the time value of funds and the whole process of investment.

To sum up, this paper gives the definition of net present value is as follows: net present value is the present value of future cash inflows and the difference between the present value of future cash outflow. The future capital inflow and net present value are determined by estimating the present value of the capital outflow period and capitalizing the present value by the discount rate coefficient. It is the financial evaluation indicators of investment project value.

### 2.2. The Formula of Net Present Value

$$\sum_{t=0}^n \frac{CI-CO}{(1+i)^{t+1}} \quad (1)$$

Where: CI represents cash inflow, CO represents cash outflow, (CI-CO) represents net cash flow in year t, and I represents the basic rate of return, t=0 when calculating the first input, and t=1 when calculating the cash flow in the first year after input

### 2.3. Steps for Calculating Net Present Value

Xuechao Duan proposed in the “Comparison of Real Options Approach and Net Present Value Approach in Investment Strategy” that the use of net present value in practical applications can be summarized in three steps [2]. First of all, some methods, such as historical experience or big data analysis, are used to predict the net cash flow that the project may generate in the continuous validity period, generally in units of years. Secondly, the appropriate discount rate is selected considering the investment risk. Finally, the net value obtained from the first step is discounted at this discount rate to determine the net present value of the investment.

According to the relevant journal literature of Zhangqiao scientific research and CNKI database, the academic circles have similar views on the calculation steps of net present value, which are manifested in the following steps:

Firstly, investor can estimate net operating cash flow that will occur every year. Then project annual net cash flows are discounted to current value; and added up to obtain the summation of the present value of future earnings. If the net cash flow provided by the project remains consistent each year, the annuity method can be used, which is discounted to present value by formula. If the NCFS for each year are not equal, the NCFS for each year are discounted and added together.

## 2.4. The Economic Significance of Net Present Value

First, if  $NPV > 0$ , it indicates that the investment will bring a positive return. If the actual return on investment is higher than the rate of return required by the investor, then the investment is considered to be an excellent project. Second, if  $NPV < 0$ , it means that the investment makes the investor lose money, and investors should avoid these projects as much as possible. Third,  $NPV = 0$ , the net present value is zero, that scheme is feasible, and the scheme of investment income meet the requirements of investment returns.

## 3. Current Research on Net Present Value

By using the keywords "net present value", "net present value", and "investment decision", the author conducted a search and research on relevant journal literature in Zhuqiao Scientific Research (a formal scientific research service data platform that has established stable cooperative relations with various authoritative Chinese and foreign literature databases, for example, the National Engineering Digital Library) and CNKI database (as of September 2023). It is found that the current academic circle has conducted much in-depth research on the NPV method, which mainly focuses on three aspects: The first is the advantages of the net present value method in the evaluation of project investment decision-making. The second is its limitations in the evaluation of project investment strategy. Thirdly, the improvement measures for this defect.

### 3.1. The Advantage of the Net Present Value Method in Investment Decision Evaluation

Yonghong Deng points out in the "Comparison of Three Basic Methods of Investment Decision" that the traditional method of investment decision is Discounted cash flow (Discounted cash - FEW, referred to as DCCF). [3] Among them, the Net Present Value (NPV for short) is the representative. Because of the value additivity of net present value (NPV) and its consistency in maximizing shareholder wealth, NPV has become the most representative capital investment decision-making method.

Caixia Yan pointed out in "On the Application of NPV Method in Capital Budget" that the NPV method takes all net cash flows into account during the calculation period of the project plan. [4] Compared with other methods, it is simple and easy, and the subjective will of the leader will not transfer it. The plan is feasible as long as NPV is more significant than zero calculated according to the formula under the model. This is why it is easy to be promoted and accepted and is welcomed by enterprises in their investment decisions. Xuzhao Duan pointed out in the "Comparison of Real Option Method and Net Present Value Method in Commercial Real Estate Investment Decision". [2]

The main advantages of the NPV method for project evaluation are (1) simple and easy to understand, convenient and fast, and easy to accept and master. (2) Have the time value of funds and reflect the specific amount that commercial real estate investment projects can earn. To a certain extent, the risk of the project is reflected by the size of the discount rate.

In short, according to the relevant journal literature of Zhangqiao Scientific Research and CNKI database, the academic circles agree that the advantages of the NPV method in investment decision evaluation are mainly reflected in (1) strong applicability, thinking about the time value of capital, and enhancing the assessment of investment economy. (2) The net cash flow of the whole process is considered. (3) Investment risk is considered, that is, higher discount rate is adopted for high-risk projects and smaller discount rate is adopted for low-risk projects

### 3.2. The Limitation of the Net Present Value Method in Investment Decision Evaluation

In "Is the NPV Index Better than the IRR Index?" In this research paper, Yu Zhang points out that under some conditions, NPV performs better than IRR when used to make investment decisions, but there are also some shortcomings. NPV is an absolute positive indicator, which does not reflect the degree of return that a plan can achieve in practice. Moreover, when the investment amount of each alternative scheme is different, the profit level of the investment project scheme cannot be objectively evaluated just by comparing the net present value. In short, when the investment amount of each project is not equal, only the net present value cannot judge the merits of the independent investment scheme.

Xiang Li and Bipeng Zeng pointed out in "A Brief Analysis of the Application and Limitations of the Financial Evaluation Method of Net Present Value in the Investment Decision of Hydropower Station" that the net present value method is a dynamic analysis method, which only considers the time value of funds and ignores the flexible value of investment. [5] At the beginning of the investment decision, the net present value method assumes the changes that may occur in the future based on the established circumstances at the time, but this is likely to be not completely accurate. It can be said that the net present value method lacks timely adjustment for future changes. It neglects the choice of investment timing and does not evaluate the physical investment project from the development perspective.

In Research on the "Net Present Value Method of Enterprise Project Investment Decision", Pingxiang Zhang pointed out that, due to its assumptions, net present value has certain limitations: ① The net present value approach is more suitable for the comparison of projects in which enterprise funds are not limited, while in the case of limited funds, this method cannot be used. ② The net present value criterion does not consider the cost factor or the recyclability of the investment project. ③ In some cases, companies will invest in projects with negative NPV because the NPV method ignores the value of options.[6]

Zhou Qishen and Qiu Ying proposed in "Improvement of Traditional Net Present Value Method": Taking Jade Mine Investment as an Example": Although the net present value approach has been widely used in the practice of long-term capital investment decision-making of enterprises [7]. As Nalin in "The Strategy Value of Flexibility: Reducing the Ability to Compromise " pointed out, although the net present value method to consider the time value and risk factors, the actual application process is relatively simple and easy to operate, but it does not conform to the current implicit assumption, that is, the assumption that the investment is reversible and underfurred. [8] This contradicts the irreversibility and transitivity of most investments in real capital markets. Furthermore, Lenos in "A Conceptual Options Framework for Capital Budgeting" [9] pointed out that it is difficult to measure the real long-term value of investment projects when enterprises make capital budget decisions (that is, long-term capital investment strategies) with a single net present value method under highly uncertain conditions.

In short, according to the relevant journal literature of Zhangqiao Scientific research and CNKI database, the academic circles agree that the limitations of net present value method in investment decision evaluation are mainly reflected in (1) the net present value calculation of trouble, difficult to master. (2) It is never easy to accurately estimate future cash flows and determine the appropriate discount rate because investors have limited knowledge of what may happen in the future. (3) the method is not flexible enough to reflect the actual income level of the project investment in a timely manner.

### 3.3. Suggestions on Measures to Optimize the Net Present Value Method

Zhanfeng Lu proposed the correct discount rate selection in "Discussion on Net Present Value Method of Project Investment Decision". The discount rate has a more significant impact on investments with longer maturities than those with shorter maturities, so it is very important to choose the discount rate correctly for the project investment decision. [1] There are three main ways to deal with the discount rate in China: ① Use the capital cost as the discount rate; ② Use opportunity cost as the discount rate; ③ Take the rate of Return required by the investor as the discount rate.

Meiling Zhang and Yong Xu proposed in the "Evaluation Method of Net Present Value of Investment Projects" that the accuracy of cash flow prediction should be improved. [10] One is the use of financial forecasting models. A detailed financial forecast model is made through Excel tables, and the direct cash flow forecast is transformed into a forecast of various influencing factors. The influencing factors of cash flow are quantified instead of cash flow to improve the accuracy of the forecast of the project's future cash flow. The second is the use of Monte Carlo simulation technology. The most significant difficulty of using a net present value forecast project is that it is difficult to accurately estimate the project's future cash flow, and Monte Carlo simulation technology can effectively solve this problem. Its working principle is to simulate every possible cash flow situation and calculate the corresponding discounted present value. Then, the probability of each cash flow occurrence is obtained through market research. Then, according to the probability of cash flow occurrence, the project valuation is obtained by the weighted average of the simulation results.

Pingxiang Zhang proposed in "Research on the Net Present Value Method of Enterprise Project Investment Decision" that the exact option method should be introduced to assist the NPV method. Practical option method to estimate the project actual value for the net present value and option value, net present value can be referred to as the extension [6]. Practical option method focuses on the timely according to the market volatility reflects the investment value, applicable to the cycle is long, uncertain factors more investment projects in the future. However, the practical option rule takes into account the future uncertainty of investment decisions. It predicts the chances of asset value, makes up for the net present value method is a reflection of uncertainty about the future, to reduce the risk of investment projects, greatly improving the decisions more scientific.

Baoxiang Wei proposed in the "Research on Improving the Application of Net Present Value in Project Investment Evaluation" that various evaluation indicators should be integrated. [11] Generally speaking, the net present value indicator can be regarded as a universal rule for the evaluation of investment projects, but it is lack of accuracy to evaluate the merits of the whole investment project by using only one net present value indicator. The current evaluation system has many analysis indicators, the financial evaluation indicators when evaluate the project has its unique role, such as net present value rate and can reflect the investment project from the perspective of dynamic of the relationship between capital investment and net output. Profitability index, is the relative index, can reflect the purpose of investment efficiency, conducive to the comparison between different investors in initial investment. Internal rate of return, which can reflect the real return rate of investment projects, and is not affected by the industry benchmark yields, is advantageous to the different project investment decision-making, and so on. But sometimes according to different evaluation index of investment conclusions will be different. The index of evaluating project financial viability standard is how much, the current evaluation index is not giving a guidance. Enterprises may, according to the importance of each index in financial evaluation of the weight of each index set up certain, how much is the weight of each financial index, what is standard of feasibility, which measures as the main criteria of the project, which indexes as the secondary standard, and the state or industry authorities can formulate a practical evaluation method and comparison standard for indicator weights. According to the economic situation change, the index weight is updated regularly or irregularly, and



the evaluation results are quantified. The overall situation and financial feasibility of the project can be reflected comprehensively through the comprehensive results.

#### **4. The Research Prospect of the Net Present Value Method**

In summary, the academic community has studied the advantages, limitations and improvement measures of net present value through comparative analysis with other financial evaluation indicators such as internal rate of Return and natural options or specific practical application cases of various industries. However, the implementation process of a project is a process with many uncertainties. It is a complex, one-time, innovative process involving many relationships and variables. Enterprise project investment is a comprehensive management activity; therefore, it is necessary to optimize the content and the method in financial evaluation of project investment decision-making to further deepen the study of net present value method.

Positive innovation and optimization of dynamic index calculation. Considering the existing shortcomings in the process of dynamic index calculation, the application of dynamic index were improved. Under the condition of feasibility, should as far as possible, shorten the project calculation period of the net cash flow discount period, the discounted cash flow close to the actual situation. The main factors affecting cash flow are regarded as a system, and the future net cash flow of investment projects is guessed from the viewpoint of the system.

Ensure that project risk factor analysis is permanently integrated into the financial evaluation process. Risk runs through the whole process of project implementation, and risk cost is the essential factor under the discount method. Each index value should fully consider the influence of various uncertain factors and can genuinely reflect the project's financial feasibility.

Expand the scope of attention and increase the analysis of influencing factors. Due to the constant changes in the external environment and the uncertainty of the future, financial analysis indicators often encounter more problems in actual application. Investors should be fully focused on the future of the project life cycle, therefore, it is necessary in the original increasing influence factors in the evaluation system of indicators, such as project profitability, solvency and continuous operation ability and development capacity analysis, etc.

The investment activities of enterprises are affected by many factors, With the development of economy, the project investment environment will become more and more complicated. The analysis and improvement of the project investment decision system is also a process that needs long-term continuous research. He evaluation indicators of investment decision-making should be continuously optimized to serve enterprises' project investment decision-making better.

#### **5. Conclusion**

In short, through the research of relevant literature in the two databases of Zhangqiao Scientific Research and CNKI, this paper systematically elaborates the research viewpoints of the academic circle on the concept connotation, calculation formula, steps, advantages, limitations and optimization measures in practical application, etc. On this basis, the research trend of the net present value method is forecasted, and the following points are put forward: Although the current academic research on the net present value method has made great achievements, because the investment activities of enterprises are affected by many factors, the environment of project investment will become more and more complex with the development of economy, and the research on the net present value method is a long-term process of continuous optimization and improvement. The research on its connotation and extension category needs to be further deepened: we should pay attention to multi-angle analysis, actively innovate the evaluation index of investment decision, and constantly deepen the connotation of net present value; At the same time, in the face of the dynamic development and

change of external investment environment, it is necessary to expand the scope of attention, for example, flexibly introduce the method of intrinsic return rate, real option method, risk factors and other methods, increase the analysis of influencing factors, and constantly expand the scope of the extension research of net present value. To optimize the connotation and extension research of net present value continuously, so that it can better serve the project investment decision of enterprises.

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