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Research Article

EVA in Economic Feasibility Study of Agricultural Water Project Investment in Crop Production Bases

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Abstract: There are many different methods and ways in terms of agricultural water project investment, but how to establish an efficient and scientific system to review the economic value is most important practically for investors. This study analyzes advantages and disadvantages of NPV index in current agricultural water project investments in crop producation bases, expounds in detail the EVA, which can measure the investment decision and operation performance, discusses the interconnection of EVA and common NPV, approves the equivalency between MVA and NPV in investment decision making and the equivalency of EVA and after-tax NAV and with comparison it is shown that EVA is more rational than NPV. Taking a agricultural water project as an example, it displays the EVA active function in project decision making and performance review and, further, it provides references in application of EVA system in future investment decision making.

Keywords: Agricultural water project, crop producation bases, EVA, investment decision, operation performance review

INTRODUCTION

Nowadays, China has its economic development on a fast run stage, indicating a huge energy demands, especially the need of recycling and non-pollution water resources energy, which is in the ascendant in development of all kinds of agricultural water project. So, with such a background, it is most significant currently to establish an economic evaluation system for agricultural water project investment. Conventionally, in the economic assessment, the most commonly used system is based on the NPV index of cash flow and through computation, if the result is larger than zero, it shows that it is feasible to investment the project, or versa, investment is no good. The weak point of that system lies in the execution of the project, i.e., NPV unable to review scientifically the performance of the project manager. That leads to another set of review system, including net profit and investment rate. So, the project management is easy to fall in confusion, just for the mismatches and inconsistence in systems of investment decision indexes and operation performance indexes. Therefore, EVA (economic value added) as an index for both investment decision making and operation performance has no doubt a good application future in field of agricultural water project.

It can be seen from relative documents that most studies on investment decisions is based on theories of accounting income or Discount Cash Flow (DCF). The former stresses main business results of an enterprise and provides tools for investment decision making and financial prediction. And during calculation, operation efficiency is often measured with use of net profit (NF) and return Rate of Investment (ROI) or some other accounting income indexes. DCF theory is an important evidence in investment decision making. For instance, New Present Value (NPV) or Internal Return Rate (IRR) established based upon DCF criterion, provides reference for decision making, predicting cash flow of different periods and giving out a discount with an appropriate discount rate.

EVA concept was put forward as early as in the last 1990s, with its connotation as the final deference value got from deduction of capital cost from NOPAT. Arzac and Glosten (2005) and Balachandran (2006) derived a capitalized EVA and did regression analysis with EVA as an independent variable and the market value as a dependant variable. He found that EVA could interpret 31% of market value change and 17% of NOPAT. But, when only EVA and market value changes, EVA could explain 55% of market value change and 33% of the NOPOAT. Baldenius (2003) and Cigola and Peccati (2005) considered that stockholder's value could be raised if investment put in

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projects whose Net Present Value (NPV) was positive while gave up projects or programs which costs would be larger than their capital return. Desrosiers *et al.* (2007) pointed out in 《EVA Based on Current Data》 that a research direction had been presented before scholars that enterprise value obtained using EVA computation, according to a study on variables, had much more explanatory power than that of conventional accounting profits, although EVA calculation uses only current and previous data and Discounted Cash Flow (DCF) needs to know cash flow in future.

With development of theories on capital market and management, study on enterprise value has gone deeper and deeper. Dutta and Reichelstein (2005) and Dutta and Zhang (2002) used two methods, i.e., the cash flow return rate and the economic profits to evaluate four circumstances of investments, one by one, say, those of a single program, multiple programs, multiple programs of positive increase and the multiples of both positive increase and inflation. Fernandez (2005, 2007) considered that from the angle of market change enterprise value is determined by its ability for future profit and it is a sum of discounted value of net cash flow at different periods.

This indicator is much different from the conventional profit index, because EVA covers not only debt capital cost like that of conventional profit index but also equity capital cost in the cost calculation system, that is to say, covering the opportunity cost in the equity capital (Friedl, 2005, Magni, 2004, 2005, 2006, 2007c, 2008a, 2008b, 2009). So, EVA has a cost system that is an economic cost, whose corresponding performance indicators reflect the economic profit of an enterprise in a certain period.

Application of EVA indicator benefits coordination of the decision making system for a project so as to have a rational budgeting and performance evaluation, good for capital appreciation (Mohnen and Bareket, 2007; O'Byrne and Young, 2006). When EVA is larger than zero, indicating that project revenue greater than the capital cost, additional wealth and value made for investors. But when EVA is smaller than zero, the result is on the contrary. The EVA indicator system has been used in many investment projects and even portfolio investments, also because it has been adopted in the interior management system of enterprise and got wonderful results. That is why EVA method has obtained more and more attention in fields of agricultural water project investments (Dutta and Zhang, 2002).

This study first discusses in detail the EVA indicator system, reveals the internal relationship between EVA and the conventional NPV and explores EVA economic implications under different circumstances. Secondly, it takes a agricultural water project investment for example to review the project in terms of decision making and performance evaluation. Thirdly, this study puts forward some advices and comments on practical application of EVA system in agricultural water project investment assessment.

EVA CRITERIA AND PROS AND CONS ANALYSIS OF NPV AND NAV

Before going into the EVA function in decision making in agricultural water project investment, the study first tells something about the criteria and comparison of the EVA system with NPV and NAV (Ohlson, 2003, 2005).

Assuming the investment operation period has T timeframes and cash flow appears at the end of each frame. So, according to the definition, the basic equation of EVA goes like this:

$$EVA_t = NOPAT_t - CC_t \tag{1}$$

In which,

EVA_t = The economic value added of "t" time;
$NOPAT_t$ = The net operation profit after tax of "t" time
CC_t = The capital cost of "t" time:

$$NOPAT_t = (R_t - E_t - D_t)(1 - T_m) \tag{2}$$

$$CC_t = kB_{t-1} \tag{3}$$

In which,

R_t = The revenue of "t" time
E_t = Expense of "t" time
D_t = Depreciation of "t" time
T_m = Marginal income tax rate
k = Weighted mean capital cost rate
t-1 = Accounted value at the ending investment

Therefore:

$$EVA_t = (R_t - E_t - D_t)(1 - T_m) - kB_{t-1} \tag{4}$$

During "T", if considering capital asset sale, then:

$$EVA_t = (R_t - E_t - D_t)(1 - T_m) - (S_t - B_t)(1 - t_c) - kB_{t-1} \tag{5}$$

In which,

S_t = The residual value at the end of "T"'
t_c = The capital gains tax rate

EVA is a value data of a time frame. When EVA is larger than zero, the capital investment has gains. And when the invested project lasts over several time periods, EVA has multiple annual values (Penman, 2005; Pfeiffer, 2004), they all ever used Market Value Added (MVA) to describe the EVA of different time frames:

$$MVA = \sum_{t=1}^{T} \frac{EVA_t}{(1+r)^t} \tag{6}$$

In which, "r" is the market discount rate.
Equations (4) and (5) are substituted into Eq. (6):

$$MVA = \sum_{t=1}^{T} \frac{(R_t - E_t - D_t)(1-T_m) - kB_{t-1}}{(1+r)^t} + \frac{(S_T - B_T)(1-t_c)}{(1+r)^T} \tag{7}$$

Regarding the equivalence relation of EVA and NPV under certain conditions, there are many studies (Ruback, 2002; Schueler and Krotter, 2004) and this study will not talk any more about it, but more efforts is given to the relation EVA and the after-tax Net Annual Value (NAV). It should be pointed out that it is known according to the NAV definition, the NAV is based upon a given discount rate and through an equivalent conversion, to distribute the net cash flow of different time points to the equal annual value of computation time frames:

$$NAV = NPV(A/P, i_0, t) \tag{8}$$

In which, (A/P, i_0, n) represents coefficient of capital recovery and its value is the reciprocal of enterprise annuity:

$$(A/P, i_0, n) = [i/1 - /(1+i)^t]$$

Then, there will be:

$$NAV = NPV\,[1 - /(1+i)^t] \tag{9}$$

Therefore, to study the relation between NAV and NPV, it is first to determine the computation method and based on that it is possible to explore the relation of EVA and NAV. For one project, the NPV can be expressed like this:

$$NPV = -I + \sum_{t=1}^{T} \frac{R_t - E_t - R_t T_m + E_t T_m - D_t T_m}{(1+r)^t} + \frac{S_T - (S_T - B_T)t_m}{(1+r)^T} \tag{10}$$

In which, I is the initial investment of project.
It is known from (7) and (8) that when k = r and I $\sum_{t=1}^{T} \frac{D_{t+} kB_{t-1}}{(1+r)^t} + \frac{B_T}{(1+r)^T}$, MAV = NAP is established. Then:

$$\begin{aligned} NPV &= -\sum_{t=1}^{T} \frac{D_t + kB_{t-1}}{(1+r)^t} + \frac{B_T}{(1+r)^T} + \sum_{t=1}^{T} \frac{R_t - E_t - R_t T_m + E_t T_m - D_t T_m}{(1+r)^t} + \frac{S_T - (S_T - B_T)t_m}{(1+r)^T} \\ &= \sum_{t=1}^{T} \frac{R_t - E_t - R_t T_m + E_t T_m + D_t - D_t T_m - kB_{t-1}}{(1+r)^t} + \frac{(S_T - B_T)(1-t_m)}{(1+r)^T} \\ &= \sum_{t=1}^{T} \frac{(R_t - E_t - D_t)(1-T_m) - kB_{t-1}}{(1+r)^t} + \frac{(S_T - B_T)(1-t_m)}{(1+r)^T} \\ &= MVA = \sum_{t=1}^{T} \frac{EVA}{(1+r)^t} \end{aligned}$$

In consideration of $1 + \frac{1}{1+i} + \frac{1}{(1+i)^2} + \ldots + \frac{1}{(1+i)^{t-1}} = [1-1/(1+i)^t]/i$, i.e., capital recovery factor is the reciprocal of enterprise annuity. It can then be determined that when i = k = r the project will have an EVA equal to the after-tax NAV for a same time frame. Quite similar to the NAV determination principle, if EVA is larger than zero, the project is acceptable and otherwise it should be abandoned. In the following, this study focuses on a specific project in terms of analyzing its investment decision making based upon the above.

EVA APPLICATION EXAMPLE OF AGRICULTURAL WATER PROJECT DECISION MAKING ON INVESTMENT

Assuming a agricultural water project that has an initial investment of 1 billion RMB and a time frame of 5 years, with a predicted 0.8 billion RMB/year revenue and operation fee 0.45 billion RMB plus 25% of enterprise

Table 1: NPV and EVA investment decision analysis of agricultural water project (unit: 10 thousand RMB)

	Time (year)	1	2	3	4	5
Initial investment	100000					
Operation income		80000	80000	80000	80000	80000
Operation cost		45000	45000	45000	45000	45000
Depreciation		20000	20000	20000	20000	20000
Income taxation		3750	3750	3750	3750	3750
NOPAT		11250	11250	11250	11250	11250
After-tax cash flow		31250	31250	31250	31250	31250
NPV	18462					
Capital cost		10000	10000	10000	10000	10000
EVA		1250	1250	1250	1250	1250
MVA	18462					

income tax. If to adopt the straight-line depreciation method, the weighted mean capital cost is 10%. According to the corresponding equations mentioned above, the project can get its investment NPV, EVA and accumulative economic value added (MVA) (Table 1).

From the angle of NPV, NPV = 184620000, much greater than zero, indicates the project is necessary to be invested in the project timeframe. From the result of MVA, MVA = 184620000, it is shown that the project is acceptable. Therefore, in decision making period, both NPV and EVA tells feasibility of the project. But from view point of performance evaluation, the two have a big difference. Generally speaking, there wasn't an identical criterion to measure the project performance. And bonus level of project management may be different from one project to another. So when there should be an upper limit of bonus level, budgeting will become the game. Under that circumstance, project management, by controlling the budget scale, likes to make a budget in favor of their bonus assurance. Normally, a certain profit scale must be stabilized on one hand and the set budget will not exceeded, on the other, to leave a room for next year budgeting (Sugden, 2000; Tham and Velez-Pareja, 2004). Hence, the project management will have no enough momentum to push for a higher economic benefit and so the project could not have an effective expansion of its economic value. On the contrary, the EVA index system has an advantage because it can combine the investment decision making with its future operation, to evaluate those two things the same time within an identified index system (Pfeier and Schneider, 2007; Stoughton and Zechner, 2007). Specifically, in determining the management performance, its bonus limit can be decided, according to EVA calculation criterion, by computing its yearly performance and the bonus limit can be adjusted based upon the EVA change, during the project period, which reflects the performance. That performance measuring system, targeting the objective on economic value, can lock the management on looking for positive and continuous EVA value, so as to make the investment decision with a far reaching purpose, while incentive compatibility of management individual income and the project economic value.

KEY ROLE OF EVA CRITERION IN INVESTMENT DECISION MAKING FOR A AGRICULTURAL WATER PROJECT

EVA right orientation of investment making: In EVA calculation method, EVA value grows steadily, indicating a continuous increase of the project's economic value. So, adoption of EVA index system is completely in conformity with the project objective----- economic value maximization. Because the EVA system standards provide scientific and correct evidence for capital investment for a rational project investment, it is beneficial to rational flow and resource allocation of investment capital in different industries (Yee, 2005; Erasmus, 2008). At present, because there exists soft constraint before state-own enterprises, the feasibility analysis calculates simply and formally the net present value of the project life and there is no description on whether the project can generate economic value, so that previous investments in field of water engineering results in bias investment. However, EVA system can avoids such a mistakes and especially, when EVA is smaller than zero, it tells the investment is unnecessary, so as to prevent the blindness when only the net present value is larger than zero, prevent capital loss and waste.

EVA displays emphasis of equity capital in investment decision making: Equity capital is the other type of capital, corresponding to debt capital, both are very important capitals. Conventionally, the accountant profit is calculated only taking account of the debt capital cost but without equity capital cost. Capital profiting features that use of capital should take opportunity cost. Therefore, use of either debt capital or equity capital should consider their cost characteristics (Dagogo and Ollor, 2009). Normally, the employment cost of debt capital is represented by interests paid at a fixed time, or it is called obvious capital cost, or financing cost in the financing statement. Equity capital, although it requires a certain capital return rate, is a hidden capital cost, without fixed time frame and a return not so definite like the debt capital. Regarding agricultural water project investment, most of the projects are state own and constructed by state-own enterprises and so normally the equity capital is used freely, say, the opportunity cost is ignored. That is unfair (Issham, 2011). In fact, when equity capital generates profits, such a profit can be treated as opportunity cost. However, the conventional accountant profit calculation method does not take into account equity capital cost, so that it makes some projects profitable only in name but they are actually negative if put the equity capital cost in concern, practically, damaging the investment income of enterprise. EVA employment considers fully the factor of equity capital cost, making the profit calculation more scientifically rational and much closer to the real profit of the project. In short, by that way, the issue of equity capital cost can be completely presented and addressed in investment decision making.

EVA beneficial to coordinate indicators of investment and performance evaluation: As mentioned before, investment takes normally NPV method to carry out an analysis and that concept is to obtain a decision making of investment based upon cash flow distribution in the whole project life. Cash flow analysis is very applicable in later performance evaluation for that evaluation is based on civil year. If a project is decided to be invested when EVA presents a positive value, calculation will result in a greater negative value of net cash flow at the early stage of project when investment scale is larger. That would lead to a difficulty to get a rational evaluation of every year performance. So, in practice, many projects, when it comes into construction period, adopt investment return rate, net profit and other indicators to assess performance (Sharma and Kumar, 2010). That practice is easy to result in discordance of indicators of the early stage to evaluate the investment decision and the later to assess the performance. But EVA can realize measure both investment possibility and performance under a unified indicator system. It is known from previous proves that EVA and NPV are of the same function in initial evaluation of the invested project, but EVA can link the later performance with the early investment decision making, so as to realize the consistence of the whole project process. And stimulation and supervision mechanism is assured in review the performance, for there is no upper limit of bonus, which keeps positive proportion to wealth creation of enterprise.

CONCLUSION

EVA indicator system can effectively avoid the weakness of conventional performance evaluation and emphasize the opportunity cost of equinity capital. So, scientific rationing of capital arrangement can be assured to agricultural water projects, whose builders are normally state-own enterprises. Investment decision will have much stronger evidence in resources allocation, supporting the performance evaluation. As a management model, EVA method should be used more and more, to push is to the public.

EVA has certain weak points in application, including issues in operation feasibility, for instance, its system has modified some of the well established accountant criteria, so that not all the users of external financial information can determine the invested capital cost.

In practice, that limits the EVA application. EVA pays much attention to the value expressed in terms of cash flow, i.e., the tangible assets of investment, almost without consideration of intangible assets, those non-financial factors functioning greatly in value creation. So, either EVA or conventional investment making indicators has its own strong and weak points. Future development in decision making and performance evaluation should apply comprehensively multiple indicators to review and analyze systematically an investment making, leading from a single dimension to multi-dimension indicators and to rational system frame as a systematic engineering, resulting in a perfect selection for a project.

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