A Review of Discounting Natural Resources

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Texas Water Resources Institute
Technical Report TR-473
February 2015

Texas Water Resources Institute
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Abstract

With increasing population and global economic growth, the pressure on natural resources becomes more intense. Water is a prime example of increasing demand among many users, including environmental priorities. A typical approach for increasing water availability is to look to conservation and/or alternative technological developments for water supply. These strategies involve issues with investment, recurring costs, and a temporal evaluation. Capital budgeting methodology of discounting future streams of costs and benefits to estimate a present value is well established. Applying capital budgeting techniques to water management strategies is an effective method to account for and compare alternative annual water saving levels and expected useful lives. This methodology includes 'normalizing' such flows by calculating the respective alternative projects' net present values and associated annuity equivalents using a discount rate. The issue of "appropriate discount" rate is not the point of this paper, but rather, if dollars are discounted, what are the perspectives on discounting future water savings to a present value. The issue does not lend itself to a consensus, but rather, provides interesting implications, particularly when prioritizing alternative projects. Presented herein are attitudes across resource specialists with arguments related to what to include in a discount rate, private sector versus public sector, and the impact of also discounting physical units such as water on the priority of alternative projects. A case study of three alternative water conservation projects and how the ranking is impacted by alternative assumptions in financial and physical water discounting is presented.

Acknowledgements

A team of resource economists worked during 2001-2011 with the Irrigation Districts in South Texas to estimate the economic implications of alternative water conservation projects. We are deeply indebted to the managers of the Irrigation Districts for their willingness to share information and review the draft reports on expected investment, recurring operating costs, and potential benefits of these programs. Much of the work that was abstracted herein was done by graduate students as part of a degree program. We are appreciative to Callie (Rogers) Hamilton, Megan (Stubbs) Armenti, Chris Boyer, Emily Seawright, Andrew Leidner, Shana (Yow) Collins, Naveen Adusumilli, Michael Popp, Ellen Pennington, and Brant Wilbourn for their work. The project presented in this report was directed to gaining insight from resource experts relative to the concept of discounting a physical resource (water). To the 20 experts that participated in the survey, we express our gratitude. Final preparation of the manuscripts for publication was done by Ms. Michele Zinn and to her our thanks plus appreciation for her assistance with all of the aforementioned students throughout their time of their study. Lastly, we recognize the source of the funding as follows:

This research was supported in part by the Rio Grande Basin Initiative, which is administered by the Texas Water Resources Institute of Texas A&M AgriLife of the Texas A&M University System with funds provided by the U.S. Department of Agriculture – National Institute of Food and Agriculture (USDA–NIFA) (http:/www.nifa.usda.gov/) under Agreement Numbers 2005-45049-03209, 2005-34461-15661, 2006-503772-93041, 2007-628460-9902, 2009-34461-19772, and 2009-45049-05492. Additional funding provided by USDA under Hatch project numbers H-9050 and TEX09161.

A Review of Discounting Natural Resources[1]

Introduction

Background

The scarcity of natural resources is an increasing concern for many diverse stakeholders. Population growth and changing water demands are interacting with various supply-side influences, including climate change, to bring about continually-changing water scarcity issues (Griffin 2006; Lacewell et al. 2010). In evaluating alternative water conservation/new water potable supply projects, substantial initial and some recurring capital expenditures are required to facilitate saving and/or development across a future time continuum. With respect to identifying the most economical water management strategies associated with alternative annual water saving levels and expected useful lives, 'normalizing' such flows by calculating the respective alternative projects' net present values, and associated annuity equivalents using a discount rate appears necessary (Rister et al. 2009).

While discounting of financial streams is commonly accepted, there are substantial differences of opinion as to whether or not it is appropriate to discount future streams of natural resources when evaluating alternative projects (Rister et al. 2009). Additional complexities exist in regard to whether the principal agents are in the private or public sector. Accounting for these issues invariably involves identifying the "correct" discount rate to apply. The focus of this research is to spotlight and bring the nuances of these complex issues into a paradigm understandable to both academicians and lay stakeholders, and provide a platform for suitable real-world applications of appropriate methods when evaluating alternative strategies with

[1] This is a companion article to a detailed description of responses to a survey of water scientists related to the question of discounting natural resources (Dutton, Rister, and Lacewell 2015).

differing magnitudes of investments, annual natural resources streams, and length (time) of the investment's productivity period.

Problem Statement

Regardless of profession (e.g., academic researchers, public agency mangers, business owners, and other professionals), there are varied views with respect to the importance or lack thereof on the use of discounting in project analysis. Perhaps lack of understanding of the several dimensions of discounting and their individual and joint impacts on project analyses contributes to this broad and diverse spectrum of views regarding the validity of using discounting as an integral feature in project analysis. This research is targeted toward identifying the relevant issues of importance, with particular applications to projects involving natural resources (e.g., water) and discounting of the future streams of associated consequences.

Hypothesis

The hypotheses of this research are:

H_O: Discounting is unnecessary/inappropriate when conducting project analyses for projects involving natural resources; and

H_A: Discounting is necessary/appropriate when conducting project analyses for projects involving natural resources.

Three components comprise this research:

(1) a literature review;

(2) personal interviews with natural resource and other economists plus selected other individuals; and

(3) analysis of three water conservation projects to examine the effects of alternative discounting assumptions including discounting or not discounting water.

The combined set of information assimilated in these three topical areas is presented and readers are left to determine their perspectives on use (or non-use) of discounting.

Literature Review

Discounting

Discounting is a procedure for recognizing individuals' preference for items realized now versus in the future. With the rate of time preference, there are both private and social versions of the discount rate, and it is normally argued that the private discount rate is higher than the social discount rate (Griffin 2006).

Economic analysis relies heavily on discounting as a means for comparison because it allows effects occurring at different future times to be compared by converting each future dollar amount into equivalent present dollars (Weitzman 2001). The exact discount rate to be used has always been an issue for benefit-cost analysis; however, it has recently gained renewed relevance because economists are now being asked to analyze environmental projects with effects that will occur over decades and even hundreds of years, meaning that the results are extremely sensitive to the discount rate that is chosen (Weitzman 2001).

Finance

The discount rate is comprised of three different components, which include a risk premium, an inflation premium, and a rate of time preference:

- The further away in time (i.e., the more distant into the future) an event is expected to occur, the less predictable it becomes; therefore, by adding a risk premium to the discount rate, analysts allow for an increase in the consequences of risk through time (Malcolm 2006).
- An inflation premium is included in the discount rate as a means of counteracting (i.e., adjusting for) the inflation that is occurring in the economy and affecting the relevant costs and benefits during the life of the investment or resource(s) in question (Malcolm 2006).

- Time preference is an individual's willingness to trade the present for the future. The social rate of time preference is the rate at which society as a whole is willing to trade the present for the future (Shaw 2005).

The private sector is expected to place a higher value on today (i.e., reduced value on the future) while the public sector will place a higher value on the future. A private discount rate can assign extraordinarily little weight to the future (meaning a high discount rate); therefore, it is considered "unfair" [by some], because it would treat the present more important than the future (Griffin 2006).

Natural Resources

With continued water scarcity, water is becoming an increasingly precious commodity. Ever-increasing emphasis is being placed on new water supplies and/or investments in conservation technologies and practices. Agricultural-producer owners of water rights are increasingly being confronted/challenged with the long-run decision of at what point does water become valuable enough that it is actually beneficial to cease irrigating and sell or lease water to alternative users, e.g., municipal, industrial.? Discounting may be an appropriate option for dealing with the future and uncertainty for this issue (Shaw 2005).

Discounting natural resources (i.e., water) brings up the matter of equal treatment among generations. This perspective suggests that it would be unfair to place a discount rate on water, because the present generation might receive a greater allocation of water than future generations (Rogers 2008). In addition, there is the issue of private versus public goods, and private versus social time preferences. It is difficult to choose which perspective of time preference is appropriate for discounting natural resources to realize short-run efficiencies while remaining "fair" to future generations.

Arguably, placing a discount rate on natural resources allows for more accurate planning and analysis of water management projects. Because water does not physically change over time (except for evaporation and potentially quality effects), an inflation premium is unnecessary to consider when discounting future amounts of water. The rate of time preference is typically the only factor utilized in the public discounting process for natural resources (Lacewell and Rister 2011-2014).

One journal literature reference other than work by three of this paper's authors in collaboration with others[2] was identified where discounting physical quantities of water has been done. In the 1960 contract for the Metropolitan Water District of Southern California, under the payment provisions, it states that all water contractors will make payments for project water, which will include an annual charge designated as the Delta Water Charge (State of California Department of Water Resources 1960). The contract states that "each component of the Delta Water Charge shall be computed on the basis of a rate which, when charged during the project repayment period for each acre-foot of the sum of the yearly totals of annual entitlements of all contractors, will be sufficient, together with that portion of the revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities, which is allocated by the State to repayment of the respective category of costs, to return to the State during the project repayment period all costs included in the respective category of costs covered by that component." The rate is computed as follows as a quote (State of California Department of Water Resources 1960):

[2] There is additional evidence in published research papers indicating the use of discounted physical resources such as water (Rister, Sturdivant, Lacewell, and Michelsen 2011), (Lee, Rister, Narashimhan, Srivivasan, Andrews, and Ernst 2010), (Seawright, Rister, Lacewell, McCorkle, Sturdivant, Yang, and Goolsby 2009), and (Sturdivant, Rogers, Rister, Lacewell, Norris, Leal, Garza, and Adams 2007).

$$\frac{(c_1-r_1)(1+i)^{-1}+(c_2-r_2)(1+i)^{-2}+\ldots+(c_n-r_n)(1+i)^{-n}}{e_1(1+i)^{-1}+e_2(1+i)^{-2}+\ldots+e_n(1+i)^{-n}}$$

where,

i: the project interest rate;

c: the total costs included in the respective category of costs and incurred during the respective year of the project repayment period;

r: that portion of the revenues derived from the sale or other disposal of electrical energy allocated by the State to repayment of the costs included in the respective category and incurred during the respective year of the project repayment period;

1, 2, and n appearing below c and r: the respective year of the project repayment period during which the costs included in the respective category are incurred, n being the last year of the project repayment period;

e: with respect to the capital cost and minimum operation, maintenance, power, and replacement components, the total of annual entitlements to project water of all contractors for the respective year of the project repayment period;

e: with respect to the variable operation, maintenance, power, and replacement component, the total of the amounts of project water delivered to all contractors for the respective year of the expired portion of the project repayment period, together with the total of annual entitlements to project water of all contractors for the respective year of the unexpired portion of the project repayment;

1, 2, and n appearing below e: the respective year of the project repayment period in which the annual entitlements or project water deliveries occur, n being the last year of the project repayment period; and

n used as an exponent: the number of years in the project repayment period.

As illustrated in the equation above, the entitlements of project water (a physical quantity) for all contractors are being discounted by being multiplied by one plus the project interest rate and then being raised to the power of the respective year. This fifty-year old contract is still in place today where water is being discounted

Nominal versus Real Perspectives

Real values are values that do not include inflation while nominal values are values that are inflated or “undiscounted.” Removing inflation from all costs and benefits before beginning any discounting calculations allows for expressing the future values in real terms. However, the calculations could be conducted in nominal terms consistently for all values so long as inflation is included in the discount rate (Pannell and Schilizzi 2006).

Net Present Value

The process of discounting provides for a "real" versus "nominal" (i.e., undiscounted) perspective. The real perspective involves calculating the net present value of a proposed project, representing thus the sum, over the chosen planning horizon, of all annual net benefits accruing to an action and discounted to current value terms (Griffin 2006):

$$\text{NPV}=\sum_{t=0}^{T} \frac{NB_t}{(1+d)^t},$$

where:

t: time period;

T: planning horizon;

NB_t: net benefits in period t; and

d: discount rate.

In the formula above, net benefits in time t can be calculated as the total cash inflow (benefit) in time t, minus the total cash outflows (costs) in time t. Each year's net benefits are discounted for each year that they occur in the future. The determining factor of whether or not a project is worthwhile is that the NPV must exceed zero. Positive NPV figures indicate that a project is producing greater benefits in present value terms than the present value of all costs, leaving a positive value (Brent 2006).

Many times, alternative projects are being compared that have different lives. The process of discounting annual net flows into an NPV and then converting that NPV value into an annuity equivalent allows a comparison of projects that have different expected lives by comparing NPV’s (Rister et al. 2009).

Private versus Public Goods

In private decision making, discounting can be considered as a method whereby an investor could compare alternatives. One example is using a benchmark for comparison and analyzing the ‘opportunity cost’ of redirecting the resources to an alternative. For this example, an investment worth pursuing must be superior to the investor’s previous plan or benchmark. Another way to view this issue is if an individual chooses to buy a good rather than leaving the money in the bank to grow, it is because that individual believes the overall private benefits of owning the good are greater than the benefits of leaving the money in the bank to accumulate interest. The benchmark for this decision maker is that buying a good is seen as a more desirable option than using the bank to accumulate interest. Therefore, the benchmark rate of growth from the purchased good of benefits over time would be greater than accumulated interest in the bank, suggesting the discounted future benefits to the present of the good would be higher (Pannell and Schilizzi 2006).

For public decision making, it is clear that no consensus exists for discounting investments that have long-term payoffs. A discount rate of zero has been suggested by some, but this option poses issues because it suggests that present generations should give up everything now to (potentially) prevent consequences in the future (Pannell and Schilizzi 2006). Pannell and Shilizzi (2006) believe that if the answer is in fact a particular discount rate, then that discount rate falls somewhere between zero and the commercial rate.

Another proposed idea for social discounting is to discount at the expected rate of growth of the world economy; although, like many other alternatives, this idea runs into intergenerational concerns as well (Pannell and Schilizzi 2006). Another question for consideration with regard to social discounting is whether or not the discount rate should be a constant rate over time. A constant discount rate essentially ignores the issues of intergenerational equity and the awareness of risk as individuals age. There are conflicting opinions, with some suggesting that a modified form of discount rate be used such as a function argument of the expected elasticity of marginal consumption, growth rate of per capita consumption, population growth, and expected life expectancies (Young and MacDonald 2006). Conversely, others such as Weitzman's (2001) gamma discounting approach find it appropriate to use a constant discount rate of four percent, for example.

Generally, private real discount rates include a margin to account for risk and required rates of return, meaning that for private projects, the discount rate will reflect the opportunity cost of money adjusted for the possibility that it will be regained and to capture the risk preference of the investor. For public funds, there is undoubtedly an opportunity cost, but it has not been established if it is necessarily the same as that of the private cost. Because of how risk and intergenerational equity are treated in public projects, it is assumed that the public discount rate should be lower than the private discount rate (Young and MacDonald 2006).

Methodology

The intended approach of this research is to present an expanded perspective of the various factors of importance in valuing both monetary and natural resource streams through time. Alternative approaches to setting the respective time value, inflation, and risk premium components of the discount rate are considered. Case studies are used to examine and illustrate the potential implications of different approaches to incorporating these issues into natural resources economics research. Delphi interviews with noted resource economists and varied stakeholders were pursued to obtain their perspectives of the different approaches. Subsequently, pros and cons of the different approaches are assembled and assessed.

Results

Discounting Natural Resources Survey

A total of 20 expert resource economists and stakeholders were surveyed for an array of issues regarding the discounting of natural resources (Dutton, Rister, and Lacewell 2015). The targeted respondents were subjectively chosen based on their knowledge and involvement with natural resources economics research and agricultural finance. A general summary of the responses suggesting support, non-support, or neither supporting nor not supporting discounting of natural resources is outlined in the following section.

Discounting Natural Resources: Overview

Approximately forty-four percent of the respondents supported the discounting of natural resources at some level (Table 1). The range of support varied from those who discount natural resources in their own research to those who have not, but believe that it is possible and an area that merits further research. Detailed remarks and quotes for supporting discounting of natural resources is provided in the discussion of responses for each question in the survey paper (Dutton, Rister, and Lacewell 2015).

Table 1. Response to Concept of Discounting Natural Resources, Dutton Survey, 2011

	Supporting	Non-Supporting	No Opinion
	Percent		
Discounting Natural Resources (Water)	44	34	22

Approximately thirty-four percent of the respondents disagreed with discounting future streams of natural resources (Table 1). The level of disagreement varied from those respondents who had other ideas for how to address allocating physical quantities of future resources to those respondents who completely disagreed with the idea and demanded that physical quantities be monetized first before being discounted. Detailed remarks and quotes from the respondents who do not support discounting natural resources are discussed in the context of the individual question responses found in the survey paper.

The remaining twenty-two percent of the respondents were neither supporting nor non-supporting of the concept of discounting natural resources, indicating their uncertainty as to whether or not such analytical procedures are appropriate. Detailed remarks and quotes from this group of respondents are discussed in the review of the individual questions comprising the survey in the survey paper.

Discounting Natural Resources: Summary of Responses

Results of the Dutton survey (2011) are suggestive that discounting physical quantities of natural resources is worthy of consideration. There is no reason to believe that non-monetary trade-offs essentially produce the same rates of time preferences for individuals. In order to appropriately plan and manage future needs and uses of natural resources, technology advancement and availability in the future must be taken into consideration. Increased technology will allow for greater efficiency in the future, which must be taken into consideration when determining the appropriate discount rate to use. The future will undoubtedly have more advanced technology, which will allow for greater efficiency; therefore, more weight should be allocated to the future. A cumbersome issue is determining what the proper rate to use is and whether a positive, negative, or zero discount rate is appropriate for the project in question.

Given the need to include different factors for the discount rate, it is not clear what the appropriate discount rate should be. There will be many different rates for all of the different possible projects and situations, which may be different over the life of a project. The appropriate discount rate will vary based on the project, and will not be considered absolute until all influencing factors have been identified and given a weighted value based on foreseen impact (Dutton, Rister, and Lacewell 2015).

Case Studies Results

In some instances, discounting (or not discounting) can potentially affect the ranked order of multiple projects. It follows, therefore, that whichever approach an analyst follows has implications for the resulting set of information provided to decision-makers. Below is a table that uses the RGIDECON model (Rister et al. 2009) to acquire the calculated cost of saving water in dollars per acre-foot for three different pipeline rehabilitation water conservation projects using various discount rates.

RGIDECON[3] is a spreadsheet model that facilitates the analyses of capital improvement projects for irrigation districts and other entities. Because the analyses involve federally-funded projects, a risk premium component is not included in the discount rate for dollars.

[3] The RGIDECON spreadsheet was used by Allen Sturdivant to assist in illustrating the discounting impacts for the various capital improvement projects.

Table 2. Selected Case Studies of Texas Rio Grande Valley Irrigation District Rehabilitation Projects –The Effects of Alternative Discounting Approaches, 2011

Item	Discount Rate Components	Comprehensive Discounting Rate [a]	Dollars -- full discount & Water -- no discount	Dollars -- discount inflation only & Water -- no discount	Dollars -- no discount & Water -- no discount
	Selected Alternative Discounting Regimes				
$	Inflation	2.043	2.043	2.043	0.000
	Time Preference	4.000	4.000	0.000	0.000
	Risk	-	-	-	-
	Total Discount Rate	6.125	6.125	2.043	0.000
H_2O	Inflation	-	-	-	-
	Time Preference	4.000	0.000	0.000	0.000
	Risk	-	-	-	-
	Total Discount Rate	4.000	0.000	0.000	0.000
	Project[b]	Calculated Cost ($/ac-ft) of Saving Water and [Rank Across Columns with Same Row][c]			
	Curry Pipeline (72" reinforced concrete pipe)	$12.16 [1]	$11.86 [1]	($ 3.13) [2]	($ 9.33) [2]
	N. Branch, E. Main Pipeline (multi-size reinforced concrete pipe -- 60", 54", 48", 24", and 15")	24.42 [2]	23.80 [2]	(14.86) [1]	(31.05) [1]
	Lateral A (open with a geomembrane liner and shotcrete cover)	49.47 [3]	48.22 [3]	20.21 [3]	9.51 [3]

a. Both inflation and time preference are included for discounting dollars and only time preference is included for discounting water.
b. Sources: Lacewell et al. 2005; Rister et al. 2003.
c Calculations and rankings are based on use of a spreadsheet designed by Allen Sturdivant to illustrate the impacts of various discount rates on multiple capital projects.

The top half of Table 2 is a report of the components of the discount rate (i.e., inflation, time preference, and risk) for both dollars and water used in this preliminary experimental case study. It is important to mention that the discount rate for saved water also includes any saved energy (i.e., electricity, natural gas, diesel, etc.) used to pump the saved water. Four different scenarios were selected to illustrate the alternative calculated cost of saving water. The first scenario includes comprehensive discounting where consideration of both inflation and time preference are included for discounting dollars and only time preference is included for discounting water. The next scenario fully discounts dollars using both inflation and time preference, but uses a zero discount rate for water. The third scenario only discounts dollars using inflation and uses a zero discount rate for water. The fourth scenario includes a zero discount rate for both dollars and water. These four scenarios are used to discount the cost of saving water for three different irrigation district rehabilitation projects: Curry Pipeline, N. Branch, E. Main Pipeline, and Lateral A on a dollar per acre-foot basis (Rister et al. 2003; Lacewell et al. 2005).

For the Curry Pipeline project, the cost of saving water using the comprehensive discount rate was $12.16 per acre-foot. In the next scenario, the discount rate on dollars remains the same while the discount rate on water was zero, resulting in a cost of $11.86 per acre-foot of water saved, i.e., a lower cost estimate was realized due to the full nominal value of the water saved being included in the denominator. In the third scenario, where only inflation was used in the discount rate for dollars and the discount rate on water remained zero, the cost of saving water was ($3.13) per acre-foot; the negative value suggests that it is a gain rather than a cost (attributed to the net saving of energy costs and reduction in periodic maintenance). Last, in scenario four with a discount rate of zero for both dollars and water, the cost of saving water was again negative, ($9.33) per acre-foot. For economists who support use of robust discounting procedures, the decreasing cost per acre-foot as discount rate components are extracted from the calculation in each scenario demonstrates the diminishing accuracy in project cost evaluations that do not contain all of the appropriate components of the discount rate for both money and water.

The N. Branch, E. Main Pipeline was analyzed under the same four discounting scenarios. Under the first scenario, the cost of saving water was $24.42 per acre-foot. For the second scenario, the cost was $23.80 per acre-foot. Like the third scenario for the Curry Pipeline in which the cost was negative, the cost per acre-foot of saving water in the third scenario for N. Branch E. Main was ($14.86) when dollars were discounted using only inflation and water was not discounted. Again in scenario four, the cost of saving water, ($31.05) per acre-foot represents a gain when using a zero discount rate for both dollars and water. The decreasing cost per acre-foot as discount rate components are extracted from the calculation in each scenario again demonstrates the impacts on project cost evaluations that contain all, some, or none of the appropriate components of the discount rate for both money and water. The effects of including all necessary discount rate components are illustrated in Table 2 above. For the first two scenarios, the Curry Pipeline project appears to be the most economical project; however, when discounting becomes minimal, the N. Branch, E. Main Pipeline became more economical.

The third and last project, Lateral A, was also analyzed using the same four discounting scenarios. In the first scenario, the cost of saving water was $49.47 per acre-foot, and in the second scenario, the cost was $48.22 per acre-foot. For the third scenario, the cost was $20.21 per acre-foot, and using the fourth scenario, the cost per acre-foot was $9.51. Unlike the first two projects, the cost of saving water under all four scenarios for the Lateral A project were positive costs. The decreasing cost per acre-foot as discount rate components are extracted from the calculation in each scenario again demonstrates the varying project cost evaluations depending on which components of the discount rate are used for both money and water, respectively.

For all three projects investigated, the calculated cost per acre-foot of saving water decreased as discount rate components for both money and water were removed from the calculation, even creating essentially negative costs in some cases. What is discounted and what is not discounted and the respective choice of discount rates affects the costs per acre-foot, which determines project evaluations. Comparison of the relative costs of saving water across the three projects for the different discount rate scenarios also indicates the relative rankings change across scenarios. That is, the Curry Pipeline project appears to be the most economical project in the first two discount rate scenarios whereas the N. Branch E. Main project is the superior project in the last two scenarios. Obviously, level and related components of discount rates utilized do matter in regards to the results forthcoming from analyses.

Conclusions

There is no consensus among resource specialists and other experts relative to appropriateness of discounting a natural resource where there is a temporal analysis. Results of the Dutton Survey (2011) (i.e., Dutton, Rister, and Lacewell 2015) suggest that it is not clear what the appropriate discount rate should be and that there will be many different rates for the multitude of possible projects and situations, given the need and lack thereof of different factors that are necessary to be included in the determination. Based on the results of the Dutton Survey (2011), it was concluded that the appropriate discount rate will vary based on the project itself, and will not be considered absolute until all influencing factors have been identified and given a weighted value based on foreseen impact.

The purpose of this paper was descriptive and subjective in nature relative to the concepts and presentation of the implications of alternative projects and selection of discount rates. To discount future streams of water savings for estimating cost per unit of saved water results in an increase in estimated costs. The ranking across projects was not impacted by discounting water, but the rankings were highly sensitive to selection of which discount factors to apply.

In summary, this reflective and introspective research is suggestive that the debate should continue in more depth. The admittedly few case studies conducted and reported on in this paper reveal that discounting water has a minimal overall impact in terms of the ordinal ranking of projects, although the absolute cost values are substantially affected. Although, no unity of responses was revealed on what the appropriate discount rate is and the correct discount rate components to be utilized; the combination of survey results and case studies results emphasize the need and importance of discounting for project evaluation.

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