

Review of Capital Budgeting Techniques: Where Can Research Add Value in the Omani Context?

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Abstract

This paper surveys research on capital budgeting techniques (CBTs) with special attention to the Sultanate of Oman, an emerging market within the Persian Gulf region striving towards a more sustainable post-carbon economy. CBTs represent organisations' aggregate activities undertaken for approving capital investments in pursuance of growth strategies. Given global oil prices' volatility and public finance deficit pressures, oil-dependent countries like Oman aim to diversify their economies by investing in strategic projects that produce a flow of benefits over the long term. Content analysis tool is deployed along with authors' involvement in various projects in Oman and elsewhere to provide some integrated conceptual and theoretical perspectives. The relevance of traditional non-discounted cash flow (DCF) approaches, the DCF models, and alternative capital budgeting techniques (ACBTs) such as modified internal rate of return, real options valuation and Monte Carlo simulation are highlighted while recognizing the growing desire for proper integration of financial and non-financial considerations across the markets. Multiple capital budgeting approaches are used in several economies, but the empirical evidence of capital budgeting applications in the Omani context is rather sparse; ACBT application appears to be rare as managers prefer to rely largely on the non-DCF techniques. DCF approaches such as net present value (NPV) and internal rate of return (IRR) are more favoured in the developed economies, thus pointing to the resilience of the capital-income theory. The need for further research in the Omani context and its overall implications for the country's strategic research and knowledge development are stressed.

Keywords: Alternative Capital Budgeting Techniques (Acbts), Capital-Income Theory, Oman Manufacturing Sector, Risk Analysis.

Introduction

Capital budgeting techniques (CBTs) refer to the plethora of analytical management tools for making capital investment decisions under conditions of risk and uncertainty. Capital investment involves a large sum of cash outlay in expectation for future stream of benefits/income/return. Thus, robust capital

budgeting would entail a proper understanding of the financial market dynamics, business environment, funding sources, financial mathematics and consideration of non-financial factors (Umoh, 1997). Whatever capital appraisal model the manager chooses should align with corporate strategy, save time, money, optimize resources and guarantee sustainable benefits or income realisation.

Multiple capital budgeting approaches are used across the globe (Ross et al, 2004; Desai, 2019; Pandey, 2004, Parasuraman, 2019), but research has yet to reach an accepted comprehensive model that effectively describes the processes a capital budgeting must go through in order to transition from idea, information, to decision and funded implementation (Cleland, 2004). Moreover, empirical evidence of applications in the Omani context looks rather sparse (Al-Ani, 2015), particularly in the non-oil manufacturing sector, a capital-intensive sector requiring significant capital investment. Previous research so far has paid little attention to critically examining the degree to which managers utilize advanced or sophisticated techniques such as real options valuation in making capital budgeting decisions. Answers to this enquiry are considered to be fundamental to crafting a desirable innovation strategy (Drucker, 2007).

Overall, it is expected that the findings obtained from a contextual research would provide useful empirical guide on the practice of private-sector capital budgeting in a wide variety of applications in Oman, considering the government's drive towards sustainable economic diversification, the success which arguably rests on robust private enterprise decision-making process/models that adequately reflects optimal capital allocation dynamics (The World Bank, 2018; IMF, 2018; Hindle, 2008; Nagarajan, 2014; Desai, 2019; SCP, 2016).

Two key perspectives highlight the range of economic management issues motivating this review. First is the significance of wealth, risk and capital and the problems associated with measuring them (Piketty, 2014). Second, capital investment as a significant part of a country's gross domestic product (GDP) (Piketty, 2014). Previous studies have focused rather more on the oil sector and basic CBTs like payback period (Al-Ani, 2015). Other contributions have reflected varying practices in different jurisdictions such as the Middle East (Chazi *et al*, 2010), Canada (Bennouna & Meredith, 2010), Nordics (Brunzelli *et al*, 2013), or India (Batri & Verma, 2017). Thus, given that CBT body of knowledge has implications for industrialisation drive of a nation and quality of managerial decision-making process, research has significant role to play in bridging higher education-industry knowledge, particularly in the Oman case where robust CBT knowledge and expertise might be invaluable for reducing the country's high (49%) youth unemployment rate (The World Bank, 2018).

As part of a larger project (TRC, 2019) currently investigating capital budgeting practices in Oman manufacturing sector (CBPOMS) in support of the country's new economic diversification agenda (Oman Vision 2040), this paper is designed to provide an overview of the current state of capital budgeting research in the country. This contextual review is expected to facilitate further research at the subsequent phase of the project by bring out the key elements for further empirical investigation and analysis, with special attention to the manufacturing sector where research seems to be currently sparse.

The specific objectives are:

1. To critically review the major aspects of global capital investment techniques that managers use for screening and selecting project options.
2. To evaluate the relative role of financial and non-financial considerations in managers' choice of capital budgeting techniques.
3. To explore the development of a coalescent capital budgeting decision model for improving the quality of capital expenditure decision-making.

The paper is divided into five sections, starting with this introduction. This will be followed by section 2 where key underlying theories and concepts in capital budgeting practices are briefly highlighted. Section 3 highlights the outcome of the global literature survey including an outline of the potential

contribution of further research in the Omani context. Section 4 highlights the project's methodology and limitations, while the paper ends with some concluding remarks in section 5.

Overview of capital budgeting theories and concepts

There is a raft of theories dealing with the evolving question of 'capital' and the 'income' or benefit associated with it. At the root of our understanding is the economist idea of capital as a 'stock' or 'real assets' as distinct from "income" which is a flow or "financial assets" (Capital and Interest, 1976). Capital budgeting is grounded in the production and time structure of the economic process, suggesting there is a time-lapse between decisions and its consequences. The time value of money is long related to the classical thoughts of Adam Smith, David Ricardo, Nassau Senior and John Stuart Mill in the "annual agricultural cycle" era. Perhaps, Picketty (2014: 114 & 800) has summed up the whole capital-income idea aptly thus: "what could be more natural to ask of a capital asset than that it produces a reliable and steady income", and "the value of a piece of physical capital should be less than the total of the future values that are expected to accrue from it". The Austrian theorists ("latest thinkers"), notably, Eugen Von Bohn-Bawerk, P. H. Wicksteed, Knut Wicksell, and Irving Fisher, along with the "Marginalists" provided the mathematical expression to the time factor associated with modern capital budgeting ideas. From an economic standpoint, interest as a reward to providers of capital giving up immediate use of their funds, is regarded as the gross rate of growth of capital. This informs the liquidity preference theory of J. M. Keynes of the people's tendency to hold most of their assets in the form of money. However, the flip side is the time-preference theory which urges moderating interest rate in order to motivate people to postpone enjoyments to the future, with possible fiscal policy / political implications.

Other key explanations include pecking-order theory, risk-return trade-off hypothesis, agency cost theorem, shareholder-stakeholder trade-off, and shareholder wealth maximization, but it is yet unclear the extent to which these and other related theories can be said to validate capital budgeting practices in the Omani context.

Capital budgeting is a pivotal topic in the realm of corporate finance because of its high usefulness for project evaluations, tool for achieving strategic organisational success, and to maintaining market position or competitiveness (Nishat & Haq, 2009; Chen, 2008; Bukvic *et al.* 2016). As earlier noted, there is a plethora of quantitative (investment analysis, setting the discount rate, risk analysis) and qualitative actors distilled from the literature (De Souza & Lunkes, 2016). Qualitative approaches seem to be gaining some research attraction. For example, in responding to the challenge of differing risk perceptions among managers, Karanovic and Gjosevska (2012) provided a fuzzy logic concept for modelling the linguistic variables, in order to provide a robust quantification of the manager's opinion.

Research to date has identified three categories of capital budgeting techniques (CBTs). The first group relates to non-discounted cash flow (non-DCF) practices that do not incorporate the concepts of time value of money and business uncertainty, such as payback period (PBP) and return on investment (ROI). The second category is the DCF practices premised on the use of time value of money and business uncertainty concepts, such as internal rate of return (IRR), discounted payback period, net present value (NPV), Profitability Index (PI), accounting rate of return (ARR) and etc. The third category refers to alternative capital budgeting practices (ACBTs) which do not utilize either of these two concepts (Neelakantam, 2015). Some of such ACBTs include the Game theory, Monte Carlo simulation, Capital Asset Pricing Model (CAPM) Economic Value Added (EVA), and various integer linear programming models (ILPM) (Gustafsson *et al.* 2000; Horn *et al.*, 2015; Nagarajan, 2014).

The widely-used methods for screening projects are the payback period (PBP), the accounting rate of return (ARR), and Benefits-Cost Ratio (BCR). Screening investment practices are less robust, since they do not use the concept of the time value of money and they are described to be accounting measures such as the payback period and accounting rate of return. Furthermore, the payback period disadvantages small projects that have the potential of growth beyond the initial investment recovery period. Simply, the payback period disregards the information beyond the recovery period. To

overcome the drawbacks of the payback period, the introduction of discounted payback period at the present time offers the chance of better investment decision.

Project options are typically ranked according to a chosen criteria –pay-back period (PBP), profitability index (PI), net present value (NPV), internal rate of return (IRR), etc.; projects with the highest criterion is assigned a topmost rank, followed by the next highest value, and so on. Some mathematical models for addressing identified ranking problems are documented in the literature (Nagarajan, 2014). The DCF approaches – notably, discounted PI, NPV, IRR - basically accounts for the time value of money, that is, a unit of money is more value in the present time than the same unit in the future. The NPV approach allows you to discount all future cash inflows and cash outflows using a particular discount rate to the present date, while the IRR is concerned about the rate of return whereby the future cash inflows equal the future cash outflows; that is when the NPV equals to zero.

There is evidence that the use of IRR could result in the problem of having multiple IRRs within a single investment appraisal (Gitman & Smith, 2010). To overcome such a problem, the use of modified IRR (MIRR) is often suggested as a suitable alternative. However, some authors (Ross et al 2004) have suggested that the NPV could be more robust technique than IRR, since NPV eliminates the issue of reinvestment assumption. Thus, other advanced techniques such as real option value and modified rate of return (MIRR) are evolving to complement the DCF methods (Souza & Clemente, 2008), but the actual deployment of these capital appraisal tools varies from one industry to another and even from one country to another.

A major parameter in the DCF method is the selection of discount rate (or cost of capital), the percentage used by companies to discount future cash flows over a period of time. The different ways of calculating the cost of capital include cost-debt (CD) model, weighted average cost of capital (WACC), considered the most favoured method used by firms to discount the cash flow (Batra & Verma, 2017; Graham & Harvey, 2001), the cost of equity models such as Gordon Dividends Model and Capital Asset Pricing Model (CAPM) (Damodaran, 2002; Brigham & Ehrhardt, 2002; Block, 2011).

How to effectively handle capital investment decisions under conditions of uncertainty has attracted notable research into non-deterministic, alternative approaches to capital budgeting. Risk-taking and risk management remain at the core of a finance manager's job (Gitman & Smith, 2010). Risk management practices include sensitivity analysis, scenario analysis, decision tree and Monte Carlo simulation, among others. These risk analysis practices are typically based on the probabilistic technique to estimate the risk associated with a particular investment decision (De Souza & Lunkes, 2016). Moreover, the use of real option value (ROV) for capital projects received a wide theoretical support (Pandey, 2004), as such technique offers the flexibility to the managers to either expand or abandon the project at any point of time during the project implementation.

The effect of variation in a parameter on project viability is examined in what is called sensitivity analysis, (Nagarajan, 2014). Scenario analysis works on the same principle; with this type of risk analysis, you pre-judge the viability of a capital investment proposal in a simultaneous variation of key investment parameters. Similarly, decision tree analysis, a graphical depiction of different probability of a certain event to happen, can provide you with different consequences under different consideration of risk factors (Ross *et al.*, 2004). Additionally, the Monte Carlo simulation, a stochastic simulation that covers wider applications and areas, can be deployed to analyse the effects of uncertainty (Hromkovic, 2001; Friedenthal et al, 2015; Parasuraman, 2019).

There are other complex risk-analysis techniques such as real options valuation (ROV), modified internal rate of return (MIRR), earnings multiple approach (EMA), and economic value added (EVA) that could be theoretically sound project evaluation techniques, but they might not frequently be used in practice (Block, 2007; Gustafsson *et al*, 2000; Siziba & Hall, 2019). In fact, for example, only some 8 per cent of sample firms use the more advanced ROV method in Canada (Bennouna & Meredith, 2010).

There is a large amount of research pointing to a relatively less usage of real option valuation (ROV) across economies (Siziba & Hall, 2019; Batra and Verma, 2017; Block, 2007; Graham & Harvey, 2001; Baker *et al.*, 2011; Hanaeda & Serita, 2014). Horn *et al.* (2015) argued that ROV encourages managers to think broadly, and the practice offers to the managers the flexibility to evaluate the future investment return at any point of time during the project implementation. However, it was admitted that alternative capital budgeting techniques (ACBTs) including ROV are complex and that the practitioners are not familiar enough to use them when compared to a simple DCF approach, such as NPV and IRR. The use of ROV requires extensive computation, whereas practitioners desire more understandable and convenient practices having relative ease of formulation and interpretation (Cheng *et al.*, 1994). While ACBTs could cost time and effort, the sound decision therefrom might bring good returns that offset such costs (Verbeeten, 2006), hence, Baduns (2013) has proposed a comprehensive ROV model aligned with the DCF techniques.

In essence, while ACBTs such as modified internal rate of return (MIRR), earnings multiple approach (EMA), economic value added (EVA) and other complex risk techniques such as Monte Carlo simulation analysis, predictive analytics (Davenport, 2014), decision tree analysis and linear programming (Gustafsson *et al.*, 2000), could be theoretically sound project evaluation techniques, they are not frequently used among practitioners around the world.

Global capital budgeting practices– Mixed findings

Ample studies suggest a variety of CB practices are in use in developing and developed countries of Europe, U.S, Canada, the UK, Japan, Finland, Sweden, Australia, East Asia, Brazil, India, Pakistan, and South Africa. Hastie (1974) advised firms to be prudent on their investment decision by avoiding the use of a single capital budgeting technique. However, most firms in the developed countries are more favourably disposed to using DCF techniques (IRR and NPV) over the non-DCF; average rate of return approaches (ARR) are still used but far less than the DCF techniques for firms due to the former's slowness, among other possible reasons (Siziba & Hall, 2019).

Capital budgeting research in the developing economies such as Malaysia, India, Pakistan, Brazil, Indonesia and other Latin American countries, appears to be relatively sparse compared to the developed countries (Nishat & Haq, 2009; Al-Mutairi *et al.*, 2018; Mubashar & Tariq, 2019). It is a noteworthy evidence in the developing countries' context that multiple use of CBTs are common and the NPV and IRR seem to be the most popular among managers, while ACBTs appear uncommon. This tendency towards using more DCF techniques was confirmed by various contributions in the Indian context (Batra & Verma, 2017; Bennouna, *et al.* 2010; Cherukuri, 1996).

However, studies conducted in the more developed countries have somewhat shifted from a mere description or cross-sectional surveys to longitudinal analysis of CBTs limitations so as to capture the changes happened over the time in using CBTs in the same firms (Rigopoulos, 2014; Kengatharan, 2016; Siziba & Hall, 2019). Thus, in terms of descriptive models designed to ease knowledge of the relationship among selected entities, (Friedenthal *et al.* 2015), current research in the Omani context has been indicated for non-DCF techniques (Al-Ani, 2015). Yet, given the increased uncertainties in the global oil markets, there might be opportunities to explore risk-analytics models such as integrated ROV-DCF approaches (Baduns, 2013) and ILPM (Nagarajan, 2014).

Overall, financial factors including DCF PBP, NPV, IRR, EVA, CAPM, CD model, WACC hurdle rates, Monte Carlo simulation, and so on appear to be prominent in Canada (Bennouna & Meredith, 2010), Pakistan (Mubashar & Tariq 2018; Nishat & Haq, 2009), Brazil (De Souza & Lunkes 2016), and South Africa (Correia & Cramer, 2008). However, non-financial considerations such as age, educational qualification, management levels, years of experience, company size, and CEO education, have also been reported among managers in the US (Gitman & Forrester, 1977) and Kuwait (Al-Kulaib *et al.*, 2016). Notably, mixed considerations of both financial and non-financial factors have been reported among Nordic and Indian firms (Brunzell *et al.*, 2013; Batra & Verma, 2017).

Overall, the following inferences could be drawn from the research to date regarding general capital budgeting applications:

- i. Managers use multiple CBTs when evaluating capital projects, but, despite the divergent views on the relative utility of the NPV-IRR (Al-Awaid, 2014), the DCF techniques are more commonly applied than the non-DCF techniques. Managers still rely on non-DCF techniques such as PBP, to screen the capital project options. The use of alternative CBTs (ACBTs) is rare and to some extent not applicable, particularly in the Omani context (Siziba & Hall, 2019; Bennouna & Meredith, 2010).
- ii. Capital budgeting research in the Omani context looks rather limited largely to the oil and gas sector (Chazi *et al*, 2010; Al-Ani, 2015), thus presenting the need for further research to support evidence-based capital investment policy and practices, particularly in the country's priority manufacturing sector.
- iii. The adopted research design is generally cross-sectional, suggesting the prevalence of wide range of practices, but limited knowledge on trends or changes in CBT applications. It is therefore noteworthy that longitudinal surveys and modelling systems are gaining traction in trying to capture the emerging dynamics in capital budgeting (Gustafsson *et al*, 2000; Friedenthal *et al*, 2015; Siziba & Hall, 2019)

Thus, further CBT research documenting baseline data, policies and contextual decision-making models, is expected to support Oman's transition from oil-based to a knowledge-based economy by connecting the country's manufacturing sector with the growing global capital budgeting practices knowledge.

The imperatives for industrial capital budgeting research in the Omani context

The Omani context is deserving of special attention because of the country's new economic diversification strategy which places private-sector capital investments at the centre of the country's reform efforts to deal with the challenges of oil-dependency, notably its relatively high (49%) youth unemployment rate (The World Bank, 2018).

Moreover, scientific and professional consensus appear to be lacking regarding the use of some CBTs as evidenced by the paucity of empirical studies in the Omani context (Al-Ani, 2015; Chazi *et al*, 2010). This paper has also hinted on the continuing divergent view regarding the use of NPV and IRR among academics and executives, and it remains unclear what the situation really is in the Omani context (Cheng *et al*, 1994; Al-Awaid, 2014).

The present project focuses on the Oman's manufacturing sector, particularly firms providing packaged foods and basic construction / building materials, because industrialization has been a top priority for Oman's sustainable development. The manufacturing sector is rather capital-intensive and remains crucial for attaining the country's Vision 2040 agenda towards achieving sustainable revenue diversification and post-carbon prosperity (TANFEEDH, 2017; IMF, 2018; Kamoopuri, 2016; MoCI, 2014).

Methodological Aspects and Limitations

The present aspect of the research has not employed any empirical approach as it is only conceptual in nature, the study being part of a larger project designed to provide an overview of the current state of capital budgeting research in Oman. This paper is therefore designed to facilitate the identification of possible scope of future studies in the Omani context, bearing in mind the country's renewed emphasis on the manufacturing sector where empirical research seems to be currently lacking.

The empirical phase of the research project is expected to adopt a mix-method approach to achieve CBPOMS' diverse objectives. Using a combination of primary and secondary data collection methods

to investigate both quantitative and qualitative factors surrounding the complex management activity that is capital budgeting would be apposite. For instance, a descriptive quantitative study would be helpful to establish some useful baseline data and the extent to which ACBTs are used by corporate managers and investors in the manufacturing sector. Furthermore, following the insights gained from previous studies (notably, Brunzell et al 2013; Batra & Verma, 2017), such cross-sectional approach would also be useful in investigating future advances in CBTs in Oman. Qualitative research design is expected to feature online questionnaires, focus group discussions and interviews with corporate managers. This is necessary, not only to better understand the prevalent non-financial elements thought to be influencing the choice of capital budgeting techniques by managers in Oman, but also to document the current state of underlying policies and procedures designed to ensure a systematic approach to CBT selection and application, as well as gauging sustainability implications.

Consequently, using the non-probability purposive sampling technique, the study will focus on the listed manufacturing firms at the Muscat Securities Market (MSM), notably those companies in the industrial sector of the MSM30 index. The MSM30 index contains a combination of services and industrial firms that have a common characteristics, such as comparatively high profit levels, high liquidity, and largest market capitalization. Using the purposive sampling technique would enable expert capital budgeting practitioners, strategy managers, CFOs, and other stakeholders to be the primary target respondents of this project. Thus, following standard practices to minimize bias (Kothari & Garg, 2014), the use of trained and experienced investigators assigned to this project would ensure that the selected samples are tolerably reliable.

Conclusions and Recommendations

This paper represents the first step of the methodology for a larger project currently investigating capital budgeting practices in Oman manufacturing sector (CBPOMS). It has attempted to provide an overview of the current state of global capital budgeting research in order to identify the scope for further research supportive of the government's new vision for a more diversified, post-carbon industrial market and sustainable economic growth. By so doing, the paper has also provided a kind of global conceptual framework for reviewing the implementation progress of the next phase of Omani capital budgeting research project: empirical investigations.

While the relevance of non-DCF approaches, the DCF models, and alternative capital budgeting techniques such as modified internal rate of return, and real options valuation has continued to attract research globally, current results point to the need for further evidence regarding the relative influence of financial and non-financial considerations in the choice of CBTs, among other knowledge gaps in the Omani manufacturing sector context. Notably, the use of alternative capital budgeting techniques such as real options valuation models appears to be non-existent. Reinforcing academic-industry collaboration to develop robust, evidence-based industrial capital investment practices towards achieving Oman's National Research Strategy to support her Vision 2040's sustainable income-diversification agenda thus becomes imperative.

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