

# Advances in Industrial Capital Budgeting Practice: An Overview of Responses and Discussions in Oman

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*Abstract* - The paper reports on the extent to which the capital investment approaches discussed in many American and European textbooks widely used in the advanced western economies are practised in the context of an emerging market economy as the Sultanate of Oman in the Arab Gulf region. The largest oil-exporting economy outside the petroleum exporting countries (OPEC), Oman is pursuing an economic diversification strategy for its more sustainable, industrialised future well-being under its Vision 2040. Capital allocation is regarded as one of the most critical decisions facing organisations across the globe, and there are varieties of tools and techniques for managers to make the appropriate investment decision. The study adopted focus group discussions in the research webinar methodology to document a synthesis of results and lessons from expert responses and discussions on capital budgeting in Oman, emphasising areas for possible innovation or extension. The expert interactions focused on four capital budgeting themes; namely, the traditional capital investment methods such as the payback period (PB) and the net present value (NPV), the application of non-financial considerations, the use of more advanced approaches such as real options, and how all these factors are linked to sustainable manufacturing investments and performance. A critical analysis of the expert presentations shows that mixed (discounted cash flow and non-discounted cash flow) appraisal practices are used but with a preference for the payback period method. The paper concludes that one model is insufficient to gauge the viability of a capital investment proposal. The imperatives for distinguishing discrete uncertainty from continuous uncertainty in valuation practice and deploying robust approaches to risk management and measurement of ESG factors in project appraisal are also documented.

*Index Terms* - Capital budgeting, Non-financial performance, Oman, Real options valuation.

## 1. INTRODUCTION

Across the globe, capital budgeting – the planning process involved in appraising the organisation's long-term investments for funding – plays a pivotal role in economic growth by providing the platform for mobilising long-term funds for economic development.

Capital budgeting is crucial to sustainable business and economic development, but many questions remain unanswered regarding using capital budgeting techniques in

Oman. How sustainable is the selection and application of capital budgeting techniques by manufacturing firms in Oman? To what extent are managers using advanced or sophisticated techniques such as real options valuation in their capital budgeting decisions, and what are the critical challenges of using these methods? What financial and non-financial factors influence the choice of capital budgeting techniques by managers in Oman? What is the nature of current policy, strategies, practices, and how consistent are these and other critical features of the formal capital evaluation process with academic theory? What sensible can capital budgeting decision be designed to improve the modelling of capital expenditure decision-making, particularly in the Oman manufacturing sector? What lessons for theory, strategy and practice can be drawn from the research to enhance capital budgeting practices and research development in Oman and other countries? Noting the sparse scholarly work in the Omani context, the present paper attempts to provide insights into the realities of capital budgeting practices (CBPs) in the Oman non-oil sector, leveraging the country's drive towards a post-carbon economy.

Extant CBP research has produced mixed results. The empirical literature on the Oman context is relatively sparse, and the available contributions so far are pointers to the enormous opportunities for research in the field. Research has provided some perspectives from Oman energy/oil and gas sector using the survey method to evaluate the views of managers and investors in this sector. Risk, liquidity, profitability, market obstacles (ease of doing business), market competition, and firm size were among the six strategic variables investigated by the researcher. Executive compensation was also noted as impactful on CBP options, but whether this is also true with the manufacturing sector in Oman is unknown [1]. Some related studies have also examined CBPs in the Arab Gulf region and found CBPs comparable with their counterparts in Western Europe and North America [2]. The Middle East CBP research has observed the widespread influence of cost of capital, firm value, profitability, and strategy in choosing CBTs, emphasising the situation in Oman, Bahrain, and UAE. In essence, academic papers have so far shown mixed results regarding capital investment evaluation methods; the available research papers have reflected the situation in the oil and gas sector, but very few have examined the non-oil industries, and this knowledge gap formed part of the motivation for this research project [1][2]. The frequency of using a particular project appraisal varies from one jurisdiction to another. Several factors seem to interplay in the mind of contemporary

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financial managers, and the capital budgeting science and practice need some rigorous empirical investigation.

Exploring the development of a coalescent capital budgeting decision model is imperative for improving the quality of capital expenditure decision-making in Oman and other developing economies with similar conditions. Project management has yet to define an accepted comprehensive model that effectively describes the processes a capital budgeting must undergo to transition from idea, information to decision and funded implementation [3]. This is perhaps due to the multidisciplinary nature of CBP. In sum, as Oman moves towards a knowledge-based post-carbon economy, there is a need to generate current information on the selection and application of global capital budgeting techniques by Oman manufacturing firms who will play significant roles in realising the objectives and benefits of economic growth diversification strategy [4][5]

Also, the previous research so far has paid little attention to critically examining the degree to which managers utilise advanced or sophisticated techniques such as real options valuation in making capital budgeting decisions. Answers to this inquiry are fundamental to crafting a desirable innovation strategy [6]. Additionally, research findings have been mixed regarding the impact of financial and non-financial considerations in choosing capital budgeting techniques from Oman's managers' perspectives. The question of the sustainability of current policy, strategies, practices, and the extent to which other vital features of the formal capital evaluation process are consistent with academic theory, have also mainly remained unaddressed in the Oman context. This means that researchers have probably not explicitly distinguished between 'techniques' and 'practices' of capital budgeting. There are divergent views regarding NPV and IRR between academics and executives [7]. NPV leads to robust decisions, while IRR may lead to incorrect conclusions. But IRR is more straightforward to interpret because of its comparability with the cost of capital or discount rate. This proposal is designed to address these 'practice' aspects of CBT research for the benefit of Omani students, practitioners, and other researchers.

Overall, it is hoped that the findings obtained from this Research Project would lead to making specific recommendations for capital budgeting policy, strategy, and practice and eliciting areas for further research. Specifically, the paper is expected to provide a practical empirical guide on the method of private-sector capital budgeting in a wide variety of applications in the Oman context. Hopefully, a new blueprint for more successful capital allocation with a potential impact on overall project planning and execution would emanate from this project's findings.

Based on multiple objectives postulations and integrated research design appropriate for the present complex era, this proposal could be the first comprehensive study of capital budgeting practices in the Oman context that uses only non-oil listed firms to make for better comparison to many global studies in the field. Country's oil dependence vis-a-vis sustainable economic diversification – the success of diversification strategy rests mainly on private enterprise decision-making process/models, making this paper reasonably timely and crucial. Sustainability is thus a key point – robust CBPs are needed to be integrated into business

training and operations to ensure the steady purchase of a future stream of prosperity for Omanis.

Thus, a range of challenges and issues form the motivation for this paper. First is the significance of wealth and capital and the problems associated with measuring them [8], bearing in mind advanced technologies for international business competitiveness and large sums of money involved in firms' capital investments with a high impact on corporate profitability/survival. Macroeconomics, volatility of the global economy, changing business practices, and the manufacturing sector's influence on infrastructure, job creation, and contribution to GDP provide the imperatives for critical review of capital budgeting practices in a transitional economy like Oman. Second, capital budgeting is widely recognised as a valuable concept for economic development, owing to its long-term implication – a capital investment, once made, is usually difficult to reverse without significant loss of invested capital – sunk capital. Capital investment is a substantial part of the GDP. However, literature about CBTs in the Oman context is scarce. Previous studies have focused on the oil sector and basic CBTs like payback [1]. Other contributions have focused on managers in different jurisdictions such as the Middle East or India [2][9]. Given that knowledge of CBT has implications for the industrialisation drive of a nation and quality of managerial decision-making process, research has a significant role to play in bridging the higher education-industry knowledge gap of CBTs, particularly in the Oman case where robust CBT knowledge and expertise can be invaluable for reducing the country's high youth unemployment rate (49%) [4][5].

#### *Study significance*

This research report is expected to provide governmental and private sector authorities and policymakers with a guideline to establish a more efficient capital budgeting system towards sustainable industrial capital investment in line with the economic diversification strategy Vision 2040, which is anchored on sustainable industrialisation [4][10]. The originality of this expert report lies in the critical findings and novel capital budgeting framework that underscore the need for forward-looking organisations to retain a multifaceted approach to capital budgeting and embrace new emerging techniques geared towards increased capital deployment efficiency and robust risk analysis in the emerging fast-paced digital business environment.

The social value of this contribution will be evident from the potential multiplier effects derivable from sustainable industrialisation in terms of enhancing the knowledgebase, and advances in human capital capacity, capital budgeting skills and indirect employment opportunities. Sustainable Development Goal (SDG) Goal 9 is about "industry, innovation and infrastructure" and is one of the 17 Sustainable Development Goals adopted by the United Nations General Assembly in 2015. SDG 9 aims to build resilient infrastructure, promote sustainable industrialisation, and foster innovation.

Furthermore, as earlier noted, research findings so far have been mixed regarding the impact of financial and non-financial considerations in choosing capital budgeting techniques from the managers' perspectives in Oman. The sustainability of current policy, strategies, practices, and the

extent to which critical elements of the formal capital evaluation process are consistent with academic theory have mainly remained unaddressed in the Oman context. Understanding capital allocation is crucial to robust economic planning, sustained investment and economic prosperity [11][12]. However, there is no consensus on the capital budgeting decision-making model, hence the need for continuing a rigorous CBP research agenda. The project aims to evaluate practical approaches practised in Oman's priority manufacturing sector project selection techniques, in line with the Ministry of Higher Education, Research and Innovation (MoHERI), knowledge-based development missions.

### Objectives

Given the preceding background, this paper aims to review theory and observe the extent of the linkage to the practice towards exploring innovation and possible extension areas [2][6]. The overarching purpose of this paper is the need for more practical research to determine the justification for the existence of theory-practice gaps in capital budgeting. Thus, the specific objectives of the research include (i) generating original central data and collecting information on the selection and application of global capital budgeting techniques by Oman manufacturing firms, (ii) critically examining how managers utilise more advanced or sophisticated techniques such as the real options valuation and decision tree analysis (DTA) in making capital budgeting decisions (iii) investigate and evaluate the impact of financial and non-financial considerations in choosing capital budgeting techniques from Oman's managers' perspectives, (iv) critically examine the sustainability of current policy, strategies, practices, and the extent to which other vital features of the formal capital evaluation process are consistent with academic theory. The project is also expected to explore the development of a coalescent capital budgeting decision model necessary for improving the quality of capital expenditure decision-making in Oman and other developing economies with similar conditions and to use these results to make specific recommendations for capital budgeting policy, strategy, and practice and elicit areas for further research.

The remainder of the paper is organised as follows: Section 2 reviews the conceptual aspects of capital budgeting against the contextual backdrop of Oman's manufacturing sector. Section 3 highlights the research methodology, while Section 4 presents the expert reports and discussion. The conclusion and scope for future capital budgeting research are presented in section 5.

## 2. LITERATURE REVIEW

This section reviews general concepts from scholarly discussion economy management, accounting, finance, and project management writings. An attempt has been made to develop a holistic framework of contemporary capital budgeting practices, and this has been inserted in the last pages of this report. First, we begin with an outline of the discussions relating to financial and non-financial considerations in project appraisal, the more advanced techniques in the realms of mathematical programming models, real options, and risk analysis, as well as a snapshot of Oman's manufacturing sector, are outlined towards the end.

### 2.1 Overview of financial factors

The literature establishes that the finance manager maximises the shareholders' net worth. This requires that the firm's project selection policy revolve around clear-headed value-addition. Hence, it is widely known that only projects that meet t positive net present value (NPV) criterion (V) may be considered for selection. One such criterion is the expected rate of return from the investment. Here, we use the capital asset pricing model (CAPM), which postulates that in a perfect market, where assets are correctly priced, every security will give a return commensurate with its risk; this is mathematically expressed thus [12][13]:

$$\text{Expected Return} = \text{Risk-free return} + \text{Beta of the security} \times [\text{Market return} - \text{Risk-free return}] \quad (1)$$

### 2.2 NPV and Adjusted Present Value (APV)

The traditional NPV method assumes the project's expected life and has its expected free cash flow discounted at the cost of capital. From the resulting present value (PV), we deduct the initial investment [12][13][14]; mathematically:

$$\text{NPV} = -C_0 + \sum_{i=1}^T \frac{C_i}{(1+r)^i} \quad (2)$$

Like the equity DCF approaches, in APV, we seek to choose a discount rate that consistently adjusts for the tax benefit of interest expense. There seems to be no consensus regarding whether to use unlevered cost of equity or to go for the cost of debt based on the argument that the uncertainty about the company's ability to realise tax shield is best measured by the rate at which creditors are willing to lend to the company [14].

### 2.3 Capital rationing, and mathematical programming models, ranking, and methods of feasible combinations

Capital budgeting involves recognising the interdependencies and independencies in project portfolios to achieve maximum optimality in project selection. Thus, we have 'mutually exclusive' projects in which selecting an acceptable project A means you cannot implement any other project option B due to budgetary/funding constraints. However, there could be a scenario of 'independent' projects. All positive NPV projects are eligible for implementation, and the major problem is not about funding but primarily how to optimise the combination of tasks to be executed. In this context, linear programming is a mathematical technique used to allocate scarce resources to achieve the desired goal or set of objectives.

It should be noted that there are various modes of 'programming' models in the project management context: these include Linear programming, dynamic programming, non-linear programming, stochastic programming, goal programming, and O-programming [12][15]. The objective usually takes the form of cost minimisation or benefits maximisation, as in profitability or revenue. The LPM is based on a range of assumptions, among which are additivity, divisibility (but without negativity), proportionality, deterministic (known variables), linearity (inputs and output have constant return to scale), finiteness, non-negativity, and single objective function. The constraints must be stated mathematically.

Thus, the linear programming model (LPM) solution to the problem of capital rationing among 'n' projects is given by [12],

$$\text{Maximise } \sum_1^n X_1 NPV_1 \quad (3)$$

Subject to:

$$\text{Subject to } \sum_1^n I_1 X_1 \leq C \quad (4)$$

And the following constraint:

$$0 \leq X_1 \leq 1, 0 \leq X_2 \leq 1, \dots \dots \dots 0 \leq X_n \leq 1, \quad (5)$$

Where,

NPV is the objective function, the dependent variable to be maximised.

$X_1 \dots X_n$  is a non-negativity constraint; the fraction of capital investment in the different projects cannot be more than 1.00 and cannot be less than zero.

$I_1 I_2 \dots etc$ , are the initial capital investments required for projects A, B, C, ....; the constraints here is that the total investment in the chosen projects (that maximises the NPV) should not exceed the total budgeted funds (C) available for the capital investment.

It should be noted that while the LPM theoretical permits fractional (that is, any value between '0' and 1.00) investment in projects, a somewhat unrealistic assumption, it will nonetheless give us the optimum project combination. However, we have an integer linear programming model (ILPM) that permits only two values, '0' or '1', both inclusive. ILPM will trigger a project's rejection for which the budget is inadequate and acceptance of the project for which the required capital outlay is available. The ILPM is mathematically expressed as in Equation (3), subject to the constraints expressed in Equation (5) that is, the total investment in the chosen projects (that maximises the NPV) should not exceed the total budgeted funds (C) available for the capital investment, but subject to the following constraint,

$$X_1, X_2, X_3, X_4, \dots \dots \dots X_n, = (0, 1) \quad (6)$$

In ranking the projects from your portfolio, projects are rated according to the results of their profitability index (PI), benefit-cost ratio (BCR), net present value (NPV), internal rate of return (IRR), etc., with the project having the highest score is assigned the top rank, followed by the next value, and so on, until the budget has been exhausted. With the following formula [12], you can be able to choose a feasible combination of projects ( $NC_r$ ) that has the highest NPV:

$$NC_r = \frac{n!}{r!(n-r)!} \quad (7)$$

Where,

$n$  is the total number of projects, and  
 $r$  is the number of projects you want to select out of  $n$ .

#### 2.4 Real options valuation methods

The weakness of the traditional NPV method is that it fails to recognise options such as the possibilities that (i) the project may not start immediately, (ii) the project may start and get shut down at some point and restarted afterwards, (iii) the project goes wrong, scaled back, expanded, abandoned, or extend beyond the NPV-fixed project life span, or there may be all kinds of other options such as the compound options, switching options, and rainbow options [14]. The options pricing methods have long been acknowledged as superior to the traditional DCF methods because they explicitly capture the value of the flexibility that 'uncertainties' offer [16]. It is worth stressing that the value of a project using option pricing will always be greater than the value of the same project using NPV because the awareness and exercise of flexibility inherently release the investment value otherwise 'lucked-up' in the traditional NPV concept. The use of event trees and decision tree analyses (DTAs) are associated with the real options valuation methods, and understanding their applications with the appropriate skills and expertise could represent the difference between project success and failure [17].

#### 2.5 Monte Carlo analysis

Annualised volatility of the value of a project is impossible to observe directly due to numerous exogenous sources and the effects of uncertainty. For example, the manufacturer's sources of concern regarding costs of inputs could arise from the volatility in oil prices, Covid-19 pandemic, and global supply chain issues. Monte Carlo analysis is recommended to detect better the variances and the general nature of the interrelationships existing among various dynamic project options, possibilities, and variables.

#### 2.6 The new net positive model (NPM) and non-financial factors in capital budgeting

In its economic sense, 'capital' or 'wealth' comprises both financial and non-financial assets and investments, including all kinds of domestic and net foreign capital. Thus, capital is a stock that should correspond to the total wealth owned at a given point in time. The growing interest in non-financial issues around environmental, social and governance (ESG) factors is supported by the argument that the main driver of inequality is the tendency of returns on capital to exceed the economic growth rate [8]. Hence, much has been written about the role of non-financial performance (NFP) in achieving the firm's strategic goals, but there is no acceptable definition available on NFP. A study [18] has proposed three types of NFPs: the profit-driven one and the second for the business's long-term competitive advantage.

In contrast, the third type of NFP is independent; they have no

bearing on its purpose. An interesting observation from the study is the evidence of the close association between NFP and financial performances. In the same vein, another study uses a questionnaire survey to investigate companies' capital budgeting practices in Lebanon, a country characterised by a high level of political risk. [10]. It was found that Lebanese companies tend to use more than one method of investment appraisal, and, increasingly, they are using sophisticated DCF techniques alongside the PB. The most widely used methods to evaluate risk include scenario and sensitivity analysis. The study further observes that PB substitutes the NPV method when political risk is significantly high. The obvious implication is to dry up the capital funds needed for longer-term industrialisation. Today, some ESG ratings providers have emerged, with opportunities to revisit the longstanding use of balanced scorecard and activity-based management (ABM) in a qualitative analytical environment [19], [20], [21], [22], [27], [28], [30].

A recent article [24] has suggested a new idea called the net positive model (NPM) that portends to change how business is conducted proactively, choosing to improve the well-being of all – shareholders and stakeholders, customers, suppliers, investors, communities, above all our planet. This means that an NPV project evaluation in the emerging world may be incomplete without the NPM index showing how the project proposal improves or worsens the globe. Companies like Siemens AG are already showcasing new forms of collaboration and innovative technologies labelled a 360-degree sustainability framework [23]. Similarly, while no company is yet net positive, hundreds of companies aim to be 100% renewable energy by 2030 [24][35].

### 2.7. Risk analysis and insurance

Any capital investment decision involves risk, a tendency for the expected return to vary with time. Research and practice have developed the scenario approach to managing risk. This involves estimates of the probability (ranging from zero to 1.0) of different scenarios of the states of an economy. Generally, projects having a higher level of variability has a higher risk. The standard deviation is the most used measure for measuring the risk [13]. The discount rate is adjusted to reflect the project risk, and the expected cash flows are discounted at the risk-adjusted rate to account for the risk involved in the project [12]. The CAPM (Equation 1) and some of its variants are available as solutions to the need to ensure that the expected rate of return reflects the systematic risk in the economy at the time of project appraisal.

Insurance is a practical risk management tool that converts uncertainty into certainty through a creative risk-sharing mechanism [25]. Subject to the insurability factor, the risk is generally insurable; managers should avoid a risk exposure that is uninsurable, that is, where the loss potential is considerably high.

It is also a documented best practice to use sensitivity analysis to observe the effect on the project proposal, of changes in revenues on the one hand, and changes derivable from costs; depending on the nature of the project, you can also evaluate the effects of inflation and government subsidy, if applicable.

### 2.8. Oman's manufacturing sector and sustainable capital budgeting imperatives

The manufacturing sector is widely regarded as an economy's durable growth engine because of its capital intensity. Its multiplier effects on the economy are usually higher than the equivalent impact from other sectors [8]. The manufacturing sector typically offers indirect employment, 4th industrial revolution (4IR) automation and process integration and innovation. About 40% of all research and development (R&D) takes place in the manufacturing sector. Oman's manufacturing sector has witnessed rapid growth over the years, recording 10.7% between 1999 and 2016, with the hope that a "more advanced manufacturing sector will drive further development [4]. Currently, high-tech manufacturing industries account for less than 1 per cent; in the future, it is planned to scale up to 30% by 2040, which will entail a capital investment of about US\$12 billion, especially in digitalisation infrastructure, artificial intelligence, machine learning, robotics, skills formation, and environmentally sustainable practices. It is noted that capital-intensive industries constitute about 11% of the industrial sector. Hence, labelled 'manufacturing for wellbeing', the government of Oman is pursuing an economic diversification strategy (Vision 2040). It seeks to reduce the contribution of oil activities and increase the manufacturing sector's share in GDP. Well integrated with other sectoral development plans such as the 2050 health strategy and the education strategy 2040, the overarching strategy has categorised the emerging industries in Oman into four broad classes:

The natural resource-based industries comprise oil and gas (this sector might still be critical to Oman for the next 20 years), refined petroleum products, plastic products, cement and lime, steel and glass, other metals, furniture, etc.

Structural metals, shipbuilding, small boats, trawler construction, electric motors, generators, switch gears, electrical panels, and the like are capital-intensive-based industries.

Food industries comprise the healthy food sector, food processing, fish processing and dairy products, to mention a few.

Knowledge-based industries consist of the health sector, notably pharmaceuticals, medical equipment/instruments, fragrance, and the environment sector, notably, waste recycling.

The outcome of the 26th climate change in Glasgow (COP 26) has increased the importance of environmental sustainability in Oman manufacturing sector and the idea of green industrialisation. Hence, harnessing renewable energy is already part of Vision 2040. This includes diversifying energy sources and investing in energy efficiency and greenhouse gas mitigation technologies in line with the United Nations Framework Convention on Climate Change.

The United Nations' seventeen sustainable development goals (SDGs) are expected to guide the global community's sustainable development priorities until 2030. Alongside governments, companies and investors are increasingly aligning with SDGs. (SDG) Goal 9 ("industry, innovation and infrastructure") aims to build resilient infrastructure, promote sustainable industrialisation, and foster innovation. Organisations that integrate ESG performance may be able to

increase shareholder value in three dimensions; through better management of risks related to sustainable capital investment, by anticipating regulatory changes or consumer trends, and by exploring new markets or reducing costs such as the renewable energy opportunities and new technologies [34][35].

### 3. RESEARCH METHODOLOGY

#### 3.1. Capital budgeting research methodology – CBPOMS approach

Preceded by a systematic review and meta-analysis documented elsewhere [26], a first virtual international workshop was conducted as part of the larger research project on “Capital Budgeting Practices in Oman Manufacturing Sector” (CBPOMS) funded by the Ministry of Higher Education, Research, and Innovation (MoHERI) and executed by researchers from Muscat College and other external institutions. Additionally, through the MoHERI, the project received the government’s further support to the virtual workshop through prior approval processes for regulatory authorities to conduct the workshop. More than 200 participants from Oman and other countries registered to attend the first virtual international workshop on capital budgeting; however, about 131 targeted respondents, CFOs, project and investment executives from Oman and elsewhere attended the virtual research seminar.

In essence, the study’s methodological approach aligns with similar approaches in similar studies, such as those in the references [29], [31], and [32]. Furthermore, the justification for focused group interactions is that participants can provide historical, contextual reflections to obtain the needed responses to the research questions [33][36].

To gain more detailed industrial capital budgeting practice perspectives from the field (CFOs, finance managers, project managers, financial analysts, project analysts, and other practitioners), the research team has physically distributed the survey questionnaire (covid-19 protocols applied) electronically. The data will be analysed using SPSS and AMOS software.

The survey instruments were developed from the literature and updated from inputs provided by international research partners drawn from Oman, the UK, and India. The final set of questionnaires was generated in September 2020 and was distributed to voluntary participants. The key research questions were broken down into 15 specific enquiries to create valuable insights into capital budgeting practices in the Oman manufacturing sector.

#### 3.2 The rationale for choosing capital budgeting techniques

Questions relating to the rationale for choosing capital budgeting techniques include (i) the overall cost of applying the method is considered for capital investment appraisal, (ii) the technique’s simplicity, (iii) availability of in-house expertise in using a capital budgeting technique is essential, (iv) regulatory factor (v) the project’s profitability (vi) the project’s liquidity, (vi) risk and uncertainty, (vii) executive compensation, (viii) capital structure consideration, and (ix) time value of money/discounting concept application.

#### 3.3 Capital budgeting practice: A bouquet of approaches

The respondent managers were expected to indicate the frequency with which the following capital budgeting techniques were used in their organisation: (i) Heuristic – the rule of thumb, (ii) average rate of return (ARR), Payback period (PBP), (iii) Discounted payback period (DPB), (iv) Net present value (NPV), (v) Profitability index (PI), (vi) Internal rate of return (IRR), (vii) Adjusted net present value (ANPV), (viii) Real options valuation (ROV)/Decision tree analysis (DTA), (ix) Linear programming models (LPMs), (x) Sensitivity analysis (SA), and (xi) Simulation/ Monte Carlo scenario analysis [13][43].

#### 3.4 Challenges of using more advanced Capital budgeting methods

It is perhaps well known that dynamic, uncertain, and complex environments demand innovative approaches. Yet, we also know there could be barriers to moving in the direction of innovation as solutions to efficient and effective management practices [6]. Given this, the respondent managers were asked a couple of questions along the following lines: (i) the weakness of the NPV approach is often ignoring the importance of inherent future changes in project costs and benefits (ii) the weakness of the IRR method in giving us multiple rates of return, (iii) the extent to which senior management recognises the imperatives for more advanced/sophisticated approaches, (iv) whether capital budgeting policy recognises that the real options valuation (ROV) method offers the flexibility of evaluating future investment returns at any point in time during project implementation, (v) availability of capital budgeting training, (vi) the view that the advanced techniques are “complex” and “difficult” to understand and apply, (vii) the willingness of the senior management to adopt and implement more advanced project appraisal techniques, (viii) the role of data-driven organisational culture, (ix) the view that using the more advanced techniques is costly and time-consuming, and (x) the organisation’s willingness to adopt new technologies (e.g. AI, Big Data, Robotics, etc.) to enhance its capital budgeting practices.

#### 3.5 Financial and non-financial performance factors

The respondent managers were expected to indicate which financial and non-financial factors are predominant in their capital budgeting policy, practice, rules, and procedures. The economic factors for investigation include the weighted average cost of capital (WACC), the capital asset pricing model (CAPM), availability of government subsidy for the project, cash flow, Salvage/residual value, NPV and IRR.

Non-financial factors include Environmental, Social & Governance (ESG) issues (e.g., Sustainable Development Goals and Oman Vision 2040), HR issues such as expertise, safety and health, corporate investor/customer image, CEO’s tenure, board opinion, salesforce opinion, outside expert’s scenario inputs, and application of “fuzzy logic” to derive the cost of capital

#### 3.6 Five critical components in capital budgeting policies and processes

One of the key objectives of the CBPOMS research is to critically examine the sustainability of current policy, strategies, practices, and the extent to which other vital features of the formal capital evaluation process are consistent

with academic theory. Table 3.2 shows the scope of CBPOMS researchers' enquiries in this regard.

Table 3.2

Scope of enquiries regarding components of capital budgeting policies and processes

1	The company recognises the role of capital budgeting in developing a project plan.
2	The company has a clear business policy/blueprint that adequately describes the processes a capital budgeting must go through to transition from idea to implementation.
3	The company's capital budgeting system comprises of at least five phases: [I]: identification of investment opportunities; [II]: Developing cash flow estimates (benefits & costs); [III]: Project evaluation; [IV]: Project authorisation; and [V]: Control and monitoring of capital projects.
4	The company has a Management Information System that facilitates the estimation of cash flows from quantitative and qualitative sources.
5	The company conducts a post-audit process.

#### 4. EXPERTS' REPORTS AND DISCUSSIONS

A pioneering virtual international workshop was conducted as part of the larger research project on "Capital Budgeting Practices in Oman Manufacturing Sector" (CBPOMS) funded by the Ministry of Higher Education, Research, and Innovation (MoHERI) and executed by researchers from Muscat College and other external institutions. The workshop's primary purpose was to enhance our knowledge of the latest developments in capital budgeting along with four thematic aspects, namely (i) industrial capital budgeting practices: a systematic review in the Omani context, (ii) management science view of capital budgeting, (iii) capital budgeting under conditions of uncertainty – innovative approaches in focus, (iv) capital budgeting techniques in Oman: musings of a practitioner.

##### 4.1 Industrial Capital Budgeting Practices: A Systematic Review in the Omani Context

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The CBPOMS research project, which started in December 2019, is designed to achieve specific objectives bordering on determining the extent to which managers select and apply textbook capital budgeting techniques, emphasising the emergent Omani industrial context. Critically examining how managers utilise more advanced or sophisticated techniques such as the real options valuation and decision tree analysis (DTA) in making capital budgeting decisions and the relative degree to which financial and non-financial considerations influence managers' choice of appraisal techniques are also of critical interest to the researchers because the results of the empirical survey will determine the nexus, if any, between capital budgeting theory and what is obtainable in practice. The outcome of this type of industry-academia engagement may yield an evidence-based coalescent capital budgeting

decision model that capital investment project managers and policymakers may find helpful for improving the quality of capital expenditure decision-making in Oman and other developing economies, especially given the critical global uncertainties associated with the coronavirus pandemic.

Other sources of uncertainties potentially impact the approaches to capital investment and evaluation. These include the macroeconomic concerns for the level of unemployment, climate change, unstable oil prices, accelerating the development of technologies and automation of jobs, financial technology, and the trending digital currencies. Similar concerns are bordering on low rate of returns of savings and implications for capital budgeting, increasing inequality, and budget deficit and what implications this could have for country risk and multilateral agency (International Monetary Fund, IMF) 's responses.

A few observations could be made in the Omani context. First, according to Oman Vision 2040, non-oil activities are expected to grow to more than 90% of the GDP by the year 2040. Second, the manufacturing sector, the focus study area for the current CBPOMS project, is one of the key five priority sectors, including tourism, logistics, fisheries, and mining. Third, foreign direct investment (FDI) is expected to reach 10% of the GDP due to Oman's advantageous geographical location for ease of global trade. Fourth, Oman Investment Authority ([www.oia.gov om](http://www.oia.gov.om)) has been established by a royal decree which will adopt a comprehensive and unified approach towards the economic feasibility of significant investment projects including, for example, strategic projects initiatives, such as Oman's Tawazun (offset) programme.

As noted in this paper's methodology section, the virtual international capital budgeting workshop held in November 2020 was preceded by a systematic review of previous studies and knowledge on capital budgeting [26]. A couple of observations emanating from the literature are noteworthy. First, it was noted that multiple capital budgeting approaches are used in several economies. Still, the empirical evidence of capital budgeting applications in the Omani manufacturing context appears to be relatively sparse. Second, there are mixed findings regarding applying more advanced techniques, as managers prefer to rely on non-DCF methods; this may be attributed to the level of awareness of the more sophisticated approaches earlier noted in this paper [Section 3.4]. Due to high uncertainties, managers are cautious if/when applying more advanced and sophisticated techniques for capital budgeting. Third, DCF approaches such as net present value (NPV), and internal rate of return (IRR) appear to be more favoured in developed economies. Fourth, the relative role of non-financial factors vis-a-viz the firm's financial shareholder value maximisation goal remains the subject for continuing the capital budgeting research.

##### A case analysis of Oman Flour Mills Company

To help give some company-specific perspectives of the industrial sector in the Sultanate of Oman, Oman Flour Mills has more than ten subsidiaries in the Food sector – flour mills, oilseeds, poultry, etc. The company's capital investments include the Sohar Flour Mills Grain Silo project (160mt capacity) ongoing – this will enhance the sector's productivity and help the firm to return to profitability, Cool Poultry project – expected to be delivered Q1-2021, Gulf Poultry Farms

Project, new ERP (enterprise resource planning) system and Lean management and several CSR projects – society and environment. The critical challenges of the company border on the impact of a covid-19 pandemic, demand and supply changes, volatility in oil prices

In sum, successful migration into a sustainable, diversified post-carbon economy rests mainly on private enterprise investment decision-making processes/models, making the ongoing CBPOMS research timely and crucial [4][5]. The research has identified four key areas where Oman could rethink capital budgeting for a sustainable post, and in respect of which the qualitative responses are presented in this report.

#### *4.2 Capital Budgeting under Conditions of Uncertainty – Innovative Approaches in Focus*

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One of the objectives of the CBPOMS project is to critically examine the extent to which managers apply more advanced or sophisticated techniques such as the real options valuation and decision tree analysis (DTA) in making capital budgeting decisions. The study also set out to explore the development of a coalescent capital budgeting decision model necessary for improving the quality of capital expenditure decision-making in Oman and other developing economies with similar conditions and to use these results to make specific recommendations for capital budgeting policy, strategy, and practice and elicit areas for further research. To this end, the segment of expert discussions highlights the key and emerging issues in capital budgeting from both practical and academic perspectives and the recent changes in this field. Specifically, this session discusses the importance of capital budgeting, the key drivers of uncertainty, the Real Options as an innovative tool, and the key steps to be followed in capital budgeting.

Capital budgeting is one of the critical factors for the success of every company due to its inherent susceptibility to risks and uncertainties; thus, it is imperative to examine "uncertainty" in project appraisal critically. The term "uncertainty" is an inclusive term; for example, 'uncertainty' can be categorised into three possibilities: (i) clear future, (ii) reasonably uncertain future, and (iii) insecure/uncertain. Furthermore, it is essential to consider discrete uncertainty versus continuous uncertainty. An example of continuous uncertainty could be the political risk of a new government taking over. In this case, some policies will be different; some agreements might not work, and contracts with other companies might or might not occur. This situation, therefore, raises 'continuous' political risk.

On the other hand, the critical drivers in discrete uncertainty may include raw material price, labour price and taxation. All these drivers will lead to tension. Hence, some scholars encourage to use "what-if analysis" approach to dealing with uncertainty in general. It is essential to keep different scenarios in mind to deal with uncertainty rather than paying attention to one specific system. Developing spreadsheets can help us do "Scenario Analysis" and give us accurate parameters. For example, MS Excel can help managers provide all the possible scenarios. If you have multiple scenarios, you will be able to check the mean, standard

deviation, and other essential aspects to know how particular or uncertain a specific plan would be.

The third category of 'uncertainty' (purely uncertain) is concerned with situations where we do not know what will happen. For example, two years ago, we did not expect the whole world to be so heavily impacted by the Covid-19 pandemic, which killed more than 5 million people and about 300 million cases globally. However, we also know that such a global crisis might create more opportunities for individuals, businesses, and governments. Reference [37]. Reminds us of our mistakes in combating uncertainty. Sometimes, in spreadsheets, we start to believe numbers and forget that these are basic assumptions and not exact predictors of the future. Companies need to have generic strategies such as developing a polity on how much of those 'unknowns' companies should cover. This can be done by insurance, diversification, or other business management techniques. For example, purchasing a suitable insurance policy for identified insurable risks may not 'prevent' uncertainty, but the investment is primarily covered when paying a commensurate premium in return. We all know that we run a risk in doing any business. Thus, the company needs to diversify to unrelated areas to reduce risks.

In capital budgeting, business needs to view the "Real Options" technique as a strategic rather than a financial measure. The "Real Options" concept is not as complicated as many managers think. In simple terms, let us consider that we are doing a project, the success of which is inherently uncertain. If the conditions of uncertainty are favourable, then we will proceed. If we look at it this way, we make capital budgeting under conditions of uncertainty look too easy. Some companies do projects deliberately to see the changes in the market though they know that there will be negative consequences. Such a game is only played by companies doing very well. Companies should be able to afford such a game to be successful.

Nonetheless, when it comes to the "Real Options" tool, it is essential to look at three aspects: identification, frame working, and evaluation. There are two main criteria for designation: First, there should be enough time to make decisions and observe. If you start a project today, you know that you could lose your money (investment capital). You should know how much time you have before moving to the next project. It might take two years or three years, depending on the type of project.

Moreover, it should be uncertain. You may be surprised to know that, from a real options perspective, the more significantly uncertain you are, the better! Fate and time for exercise should be there, and then, we can say that the project becomes valuable.

Secondly, we could use it for abandonment. For example, you will start a new project somewhere abroad; you might think it will cost 100 million dollars. You are not sure about the government policies, labour policies, etc. Then, you will start negotiating with the government and other agencies in that country. You might stay there for one year. You might not feel happy with the environment as it is not supporting you

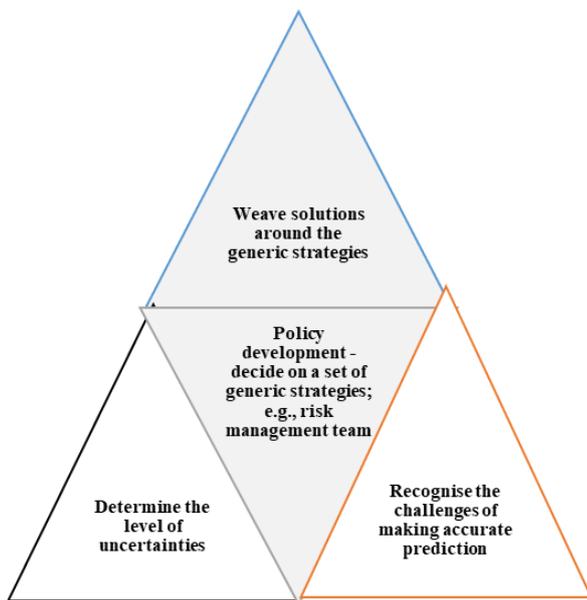
adequately. Then, you might sell the project and leave the country even though you know that you will lose, perhaps, 5 million dollars

After identifying your “Real Options”, you must build a framework. Some people think we must follow the prescriptions in the “Black Scholes” options valuation model widely used in the financial derivatives market [12]. Others believe that we must begin to look at some other models. Some say that we should not have a framework, and we need to look at it strategically. There is a scope for research to throw more light on which options models work well in the marketplace. Once the framework is considered, then you can go for an evaluation.

Thinking about what tools the practitioner might consider in dealing with uncertainty, Fig. 4.1 summarises the four comprehensive tools for capital budgeting under uncertain conditions. First, acknowledge your organisation’s challenges in making accurate predictions of the in-house team’s technical capabilities. Second, determine the level of uncertainties facing your organisation using the probability models along with appropriate expert inputs and scenario analysis. Third, review and decide on a set of generic strategies using a dedicated expert risk management team, data analysis approach, extent of internationalisation, and so on.

Fig. 4.1:

A quartet model for dealing with capital budgeting under conditions of uncertainty



Source: Developed by the authors (2021)

The fourth point is to weave practical solutions (actions needed under various specific moves) around your chosen generic strategies, given your expert understanding of the future scenarios. The required actions could border on (i) clarity of risk identification, frame-working, and evaluation, (ii) identifying the original/baseline projections and critical drivers, (iii) determining the effect of changes in the key

drivers by conducting “what if” simulations, (iv) establishment of expert risk management team, and (v) deployment of real options valuation as an innovative tool. The risk management strategies that could be considered include the nature of research management systems, budget and support, internationalisation, and a dedicated team of experts and observers

There are some critical steps that we must consider while doing “Capital Budgeting” as follows: Step 1: Identification of original projections and necessary drivers, Step 2: Considering the effect of changes in the key drivers, Step 3: Considering “what-if” scenario and simulation, Step 4: Having a risk management team, Step 5: Developing a policy.

In an international projects scenario (where project inputs and outputs move across national boundaries), the capital investment appraisal needs to consider the influential factors such as transaction exposure, economic exposure, new hedging instruments and how all these might impact the company accounts and baseline projections. In this regard, the appraisal analysts may need to adopt a flexible weighted average cost of capital (WACC) and be aware of the ‘occasional fallacy of NPV.’ Yet, as evident from HP’s failed acquisition of Autonomy in 2011, overlooking positive NPV projects can be as problematic as seeking size over value [38].

A participating CFO and investment manager commented and agreed that when uncertainty is unclear, it is much better and is also a good indication for the project and tied this insight with the mechanisms and models implemented in Oman concerning capital budgeting and how those achieve achieving Oman Vision 2040. The country has a virile banking system, especially with notable growth in the Islamic banking industry. The covid-19 pandemic and the volatility of oil prices recently impacted the national economy, affecting the global economy. However, under the new leadership of His Majesty, Sultan Haitham bin Tariq, Oman has demonstrated stable political risk and a high level of investment potentialities with lots of opportunities like Duqm and to the tourism sector. The ongoing vigorous pursuit of Oman Vision 2040 will add value to the country by bringing more foreign investment and enhancing liquidity and the overall economy, leading to a bright future.

To sum up, in a fast-paced, dynamic environment, the organisation should maintain resilient and agile risk management, aligning corporate strategy with the organisation’s risk profile, exploring the application of real options modelling system and developing “what if” scenarios and simulating them if required. In all of these, investment in advanced capital budgeting skills training and development will be imperative for project success, as other recent studies have noted [17][34][39].

#### 4.3 Capital Budgeting Techniques in Oman: Musings of a Practitioner

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This segment critically examines the sustainability of current policy, strategies, processes, and the extent to which other vital features of the formal capital evaluation process are consistent with academic theory in the Omani industrial environment. The importance of capital budgeting, the techniques and challenges of capital budgeting in Oman using actual cases and experience and the CFO's role in capital budgeting are outlined against the backdrop of uncertainty, limited financial resources, project management complexity, shareholder value maximisation, capital intensity, accountability, and measurability. It is noted that capital budgeting practices vary according to the organisation's location and size. The standard process is as follows: Step 1: Strategy / Business Plan, Step 2: Initiation, Step 3: Estimation (cost/benefit), Step 4: Evaluation, Step 5: Project portfolio: the essential consolidation of all the proposed projects in one portfolio to enhance the transparency among the decision-makers, and to ensure robust economic diversification and capital rationing, Step 6: Approval, and Step 7: Control / Report. Much of these processes are consistent with project management literature [40][43].

Capital budgeting is vital for sharing and transferring information from one layer to another, which helps people understand more about projects and how they are going. Additionally, the corporate value of effective capital budgeting derives from its irreversible decision, thereby raising its inherent investment and leverage risk. Oil price volatility impacts an oil-dependence economy like Oman. This may have implications for the level of the risk-free rate in the financial market and ultimately affects the WACC. Thus, capital investment decisions need to be taken carefully, and good models should be considered.

#### *4.3.1 The widely used capital budgeting techniques in the Omani context*

From the expert experience in different non-oil industrial sectors, notably, aviation, infrastructure, and mining, the most common techniques used in Oman for capital budgeting are: (i) Payback period (PBP): relatively easy to calculate and understand by management having little or no financial education/training background; plus, PBP targets quicker recovery with less exposure to future uncertainty, (ii) Net present value (NPV): the NPV recognises the time value of money and the risk-return market relationship; it seems that larger companies adopt NPV rather than small companies, (iii) Internal rate of return (IRR): IRR is the preferred approach for managers who may be more familiar with percentage rather project viability amounts.

One of the textbook disadvantages of the Payback period technique is that it ignores the cash generated after the payback period. However, project delivery speed has been correlated with project success because extended timelines increase risk and uncertainty [39]. Some shareholders are keener for faster recovery of their capital investment because they want to reinvest their capital in other projects. In addition, it has mitigated uncertainty when it comes to longer investments. However, it is essential to emphasise the need to use multiple techniques and models for capital budgeting. One model itself might not give the whole picture; you must

consider other perspectives offered by NPV, IRR, and the Payback Period.

It is noteworthy that some sophisticated techniques such as real options valuation and decision tree analysis are rarely used in the Sultanate of Oman. Overall, the selected methods depend on the organisation's size, uncertainty, industry, culture, senior management, and the nature of the project. The modern mining industry in Oman is relatively in its infancy. There are more processes in the mining sector, and it takes a long time to finish the exploration ranging from three to ten years. Most of the mining projects are at the exploration stage. During this stage, there is limited information to develop the financial model. Perhaps, the profitability index can be applied in the mining sector.

In the area of challenges to capital budgeting practice, the following five aspects could be investigated further: (i) Theory-practice gap: this has been attributed to lack of awareness and the required skills to do more sophisticated and advanced techniques, (ii) Gold plated: The phenomenon of high specification and overdesigned projects that may lead to scope creeping and related challenges for project success, (iii) Make or buy: The need for outsourcing expert analysis as an alternative to using in-house staff, (iv) OPEX or CAPEX: The need to balance OPEX (operational expenses) and CAPEX (capital expenditure). This often arises when senior management invests capital in certain areas within the same project, with more operational costs. Thus, it may be advisable to deal with likely operational challenges before project initiation, and (v) non-financial measures: There may be measurement issues regarding projects under the labels of sustainable capital, risk management, compliance, or customer service, although recent research hints on emerging solutions [41].

#### *4.3.2 Non-financial considerations – some experience from the Sultanate of Oman*

Aviation: The Old Muscat International airport car parking expansions with an estimated cost of 10 million dollars may not have had a "positive NPV", but it was a strategic investment with macroeconomic multiplier benefits, e.g., improved customer/tourism service. Similarly, the aircraft recovery kit (ARK) project has been related to a risk mitigation initiative that may not yield the textbook return on investment. In 2015, two different incidents simultaneously caused considerable losses to the airport due to the closure of the runway; this has prompted the capital investment in an ARK, which is a relatively huge investment. Though there is no typical financial return on investment, the 'social' investment has helped to avoid or minimise any future losses. Another interesting example is the additional airport closed-circuit television (CCTV) which is a security compliance requirement for the local and international trade, but, at the same time, a relatively expensive investment: The management insisted that this is a compliance requirement.

Infrastructure: Sewage treatment plant: This may be an example of gold-plated capital investment for which perhaps a different cost estimation might have achieved some savings.

Mining: Uncertainty is another major challenge facing the mining sector, exploration for minerals costing millions of pre-investments in prospecting. Due to the lack of information available, it is difficult to build accurate financial models; perhaps scenario analysis (Monte Carlo or Real Options) could be explored in such cases. However, until now, uncertainty is still a big issue when exploring minerals.

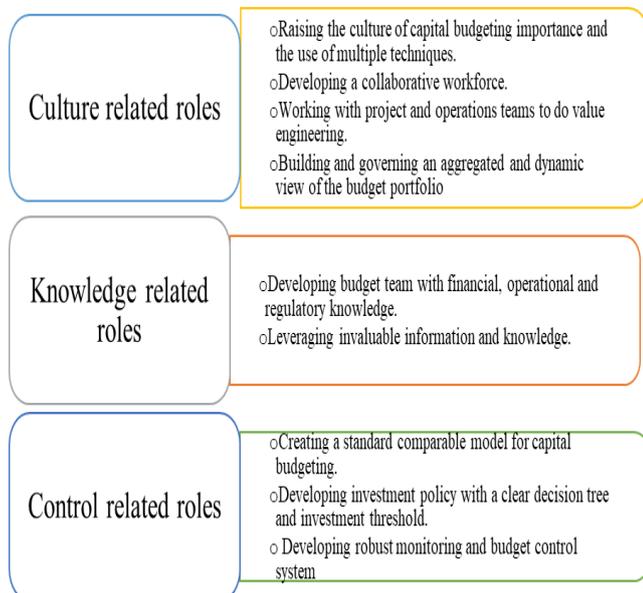
In essence, it is relatively challenging to measure non-financial factors, primarily because of certain elements that are mainly related to global compliance and regulatory requirements.

#### 4.3.3 CFOs' emerging capital budgeting roles

Fig 4.2 depicts the emergent capital budgeting roles of the CFO across three organisational development dimensions, namely, inclusive culture building, knowledge-based expansion, and

Fig 4.2.

CFOs' emerging capital budgeting roles



Source: Developed by the authors (2021)

Overall, the three main techniques used for capital budgeting in Oman; include the Payback period, IRR and NPV. The choice of any method is influenced by managerial knowledge, the nature of the project, and the company's culture. Some challenges remain mainly in the public sector projects, where strictly a financial measurement of their viability could be difficult. In such cases, some qualitative considerations (social benefits such as employment) confirm their investment value despite the negative NPV. Perhaps, what is essential is to ensure the senior management commitment to robust planning and control of the projects to meet the stakeholders' expectations. While the covid-19 pandemic might be affecting the whole world socially and economically, some companies are taking advantage of it to recalibrate their capital budgeting system through advances in artificial intelligence, machine learning, and big data analytics in the decision-making process. Putting all the preceding aspects together, building a data-driven optimal capital budgeting culture becomes

imperative. Still, in the end, as reference [17] asserts, projects are as good as the people who run them.

## CONCLUSION AND IMPLICATIONS

Capital budgeting is pivotal to sustainable business and economic development, but many questions remain unanswered regarding using capital budgeting techniques in Oman. The previous contribution has been somewhat restricted to the oil sector of Oman; hence, the present gift is beginning to enhance our understanding of the non-oil industrial context, and the promises it holds for promoting the country's diversification strategy through robust capital investment is imperative. The present results are derived from the qualitative research segment of the larger project. The methodology adopted in this proposal aligns with similar studies in the emerging markets of India, Oman, Kuwait, and Lebanon [1][2][7][9]. Additionally, the present expert report has gone some way further to using a qualitative approach to providing further knowledge and insights into the emerging capital budgeting practice, especially in the Omani context. The qualitative methodological approach has shown that a systematic partnership between the industry and academia can be productive for applied research and knowledge development. Further, this report has been demonstrated that managers still find measuring non-financial factors in capital budgeting challenging because several elements are mainly related to global ESG compliance and regulatory requirements. While the traditional DCF and non-DCF methods for capital budgeting, namely, the payback period, IRR and NPV, are used by organisations in Oman, the future direction of project appraisal is pointing towards more innovative, agile, flexible approaches represented by real options and the like [2][12].

Three significant implications are noteworthy from the expert perspectives reported in this paper:

First, managers need to have intense training and knowledge about the application and limitations of the traditional DCF and non-DCF approaches, which are deterministic models for evaluating projects under conditions of certainty. At the minimum, managers should adopt multiple approaches in evaluating new project proposals. In this regard, it is hoped that the coalescent capital budgeting framework (appendix) emanating from the current study may be helpful.

Second, linear approaches may produce sub-optimal organisation results under the heightened complex and uncertain business environment of technological advances coupled with the Covid-19-crisis [32]. Capital budgeting strategy, policy and practice need to be recalibrated to incorporate more advanced and sophisticated project appraisal and risk management techniques such as real options, decision tree analysis and insurance.

Third, mindful of the knowledge intensity and susceptibility to non-financial, environmental risks attached to the emerging manufacturing sector, the need for a well-educated, trained, and qualified risk management team in modern organisations

become imperative. This paper has noted that the options pricing methods are superior to the traditional DCF methods because they explicitly capture the value of the flexibility that ‘uncertainties’ offer [16]; a systematic training in real options methods is apposite for a sustainable industrial capital budget under increasingly uncertain environment.

### FUTURE SCOPE OF THE RESEARCH

The research scope could be extended to consider the effects of post-covid-19 inflation on modernisation projects having unequal lives and to include more interactions with experts from other economic sectors such as tourism and logistics to complement or validate the current findings.

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