

Modernizing Management Accounting by Digital Means: A Real-World Examination of the Difficulty of GCC Energy Companies' Budgets

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Abstract: With a focus on the adoption of adaptive budgeting techniques and digital technologies, this article tracks the development of budgeting approaches across energy corporations operating in the Gulf Cooperation Council (GCC). In order to investigate the associations between organizational traits and the complexity of budgeting procedures, we analyze data from fourteen major energy companies in six GCC countries spanning the years 2021–2024. The research tested four hypotheses on the feasibility of technology deployment, budget integration, the acceptability of rolling forecasts, and the difficulties of scenario planning using multiple regression analysis with robust standard errors. Our research shows that GCC countries and various types of businesses have quite distinct spending tendencies. Larger companies often use significantly more complex methods when creating their budgets. Managers in the energy industry may benefit from the research's practical examples of how budgeting procedures have changed in emerging nations, and the overall body of knowledge on management accounting is strengthened.

Key words: GCC energy industry, digital transformation, rolling forecasts, scenario planning, budgeting methodologies, and management accounting.



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1. Introduction

1.1 Background

Much change has occurred in the energy sector of the GCC in recent years. This is due to the fact that new technology are altering traditional methods of operation, oil prices are unpredictable, and the general public want economic diversification. According to Jordan and Messner (2024) and

Henttu-Aho (2018), traditional budgeting methods are being supplemented or replaced annually by integrated budgeting systems, rolling forecasts, and scenario planning.

Here in the GCC region—which includes Saudi Arabia, the United Arab Emirates, Qatar, Kuwait, Oman, and Bahrain—we may see firsthand the evolution of budgeting practices. These nations have many similarities, including an emphasis on hydrocarbons, a dominance of state-owned businesses, and a desire to implement substantial economic reforms. How their institutions develop, the state of their technology, and the complexity of their organizations are all different. This might impact the use of management accounting techniques.

1.2 problem and Objectives of the Research

Although the GCC energy sector is strategically important and is always striving for development, there is a lack of empirical research about the level of complexity of its budgeting methods. First, it will determine how advanced the budgeting practices of GCC energy companies are right now. Second, it will look at how different organizational traits affect how these practices are put into play. Third, it will examine how different countries' unique circumstances affect the differences in budgeting practices. Lastly, it will assess how these practices will change between 2021 and 2024.

1.3 significant of research

Contributing to the body of knowledge in management accounting, this study fills a gap in the literature by examining the impact of contextual factors on the complexity of budgeting systems, providing empirical evidence on the adoption trends of modern budgeting practices in emerging markets, and offering practical insights for practitioners. It also broadens the geographic focus of budgeting practice research to a neglected but economically vital region.

2. Review of Literature and Development of Hypotheses

2.1 Budgeting Practice Evolution

Traditional budgeting approaches are coming under fire for a number of reasons, including that they are inflexible, hard to adapt to changing circumstances, disconnected from long-term goals, and known to motivate subpar performance (Hope and Fraser, 2003; Jensen, 2001). A new longitudinal study of companies that did away with budgets only to bring them back shows how interdependent budgets and forecasts are, suggesting that the two frequently work hand in hand rather than as substitutes (Jordan and Messner, 2024). Rolling forecasts, scenario planning, and beyond budgeting approaches are some of the alternatives that corporations have adopted in reaction to these criticisms (Hansen et al., 2003; Bourmistrov and Kaarbøe, 2013).

Various works have been conducted in other regions of the world to determine how digital tools of intelligence can transform accounting to be more trustworthy. In an example, Qader (2025) examined the impact of artificial intelligence on the relationship between witty accounting and false reporting in the Iraqi companies. The findings highlighted the potential of AI in preventing financial errors, which is significant to consider the way GCC energy firms are going paperless in terms of planning. Similarly, Al-Youseuf and Abdullah (2024) discussed the role of institutional computer tools in assisting individuals in executive environments to devise innovative solutions to issues. Their findings support the hypothesis that the digital platforms, when constructed properly, can facilitate easier gathering of cost information and make budget planning clearer in a more intricate space such as energy.

2.2 Firm Size and Rolling Forecasts

To better prepare for the future, businesses could benefit from creating rolling forecasts, which are predictions that extend a certain length of time and are updated at regular intervals (Ekholm and Wallin, 2011). The study conducted by Henttu-Aho (2018) distinguishes between proactive and reactive planning, demonstrating that the role of rolling forecasting relies on the specific

organizational context. According to studies conducted by Sivabalan et al. (2009), rolling forecasts prove to be particularly useful in situations where there is a high degree of uncertainty and for larger businesses with more complex planning needs. The usage of rolling projections is highly recommended for GCC energy corporations due to the high volatility of their industry.

The first hypothesis (H1) is that larger GCC energy companies are more prone to use rolling estimations than their smaller counterparts.

2.3 Sector Complexity and Scenario planning

Organizations engage in scenario planning when they generate several potential future scenarios and develop strategies to address each one (Schoemaker, 1995; Phadnis et al., 2015). The energy firm is facing challenges as a result of technological advancements, price fluctuations, new regulations, and the use of alternative energy sources. Management control system forecasting sophistication is influenced by organizational complexity, according to research by Henttu-Aho and Järvinen (2013).

The second hypothesis (H2) is that GCC energy companies are better prepared for a variety of scenarios if they deal with more complex domains (integrated operations).

2.4 Budget Integration and Country Infrastructure

Hansen and Van der Stede (2004) defined budget integration as the extent to which an organization's budgeting systems communicate with other systems. Research conducted recently highlights the significant impact of digital transformation on management accounting systems. One key component of this transition is integration (Rikhardsson and Yigitbasioglu, 2018; Bhimani and Willcocks, 2014). According to Fährndrich's (2023) comprehensive literature review, digitization has had far-reaching consequences for management control systems. The extent to which countries integrate their budgets is heavily influenced by national factors. One example is the impact of infrastructure availability on technology adoption, as shown in studies on digitalization in poor countries (Agostino et al., 2021; O'Leary, 2023).

The third hypothesis (H3) The level of fiscal integration differs considerably across GCC nations. Countries with better internet infrastructure, like the UAE and Qatar, tend to be more connected..

2.5 Technology Adoption Trends

Management accounting is evolving due to technological advancements such as enterprise resource planning (ERP), artificial intelligence (AI), predictive analytics (BA), and business intelligence (BI) (Bhimani and Willcocks, 2014; Rikhardsson and Yigitbasioglu, 2018). Innovations may be beneficial, according to systematic literature reviews (Kureljusic and Karger, 2024), as they increase efficiency and save a lot of time. The years 2021–2024 will go down in GCC history as a watershed moment due to the pandemic and the ambitious national digital plans that sped up digitalization.

The forth hypothesis (H4) GCC energy companies significantly improved their use of technology to generate budgets Between 2021 and 2024.

3. Methodology

3.1 Desing and Sample of the Research

This research utilizes a quantitative technique, using secondary data from publicly accessible sources. The sample consists of 14 prominent energy businesses functioning in six GCC nations from 2021 to 2024, chosen according to criteria including: headquarters located in the GCC, main focus on the energy sector, availability of public information, and uninterrupted activities during the research period. There are 30 company-year observations in the sample, and they include both state-owned businesses and publicly traded companies see table 1.

Table 1: Sample Distribution

Country	Companies	Observations	Percentage
Saudi Arabia	4	8	26.7%
UAE	3	6	20.0%
Qatar	2	4	13.3%
Kuwait	2	4	13.3%
Oman	2	4	13.3%
Bahrain	1	4	13.3%
Total	14	30	100%

3.2 Variable Construction

Management accounting theory provides support for observable organizational and contextual aspects, which we use to build proxy variables. This allows us to gauge the sophistication of budgeting procedures without directly involving the public.

Rolling Forecast Adoption (RFA) Index: $RFA = (\ln(\text{Assets}) \times 0.15) + \text{Country_Score} + (\text{Reporting_Frequency} \times 2)$

This measures the likelihood of rolling forecast implementation. Larger organizations (higher log assets) should have greater capability and need for rolling forecasts. Countries with more sophisticated planning environments (higher country scores) should see more adoption. Companies reporting quarterly (versus annually) signal information systems capable of producing interim reports, suggesting capacity for rolling forecasts.

Scenario Planning Sophistication (SPS) Score: $SPS = (\text{Sector_Complexity} \times 2) + (\ln(\text{Assets}) \times 0.15) + \text{Country_Score}$

It shows that strategic planning is challenging regardless of company size, industry, or country.

Budget Integration Level (BIL) Score: $BIL = (\text{Revenue_Quartile} \times 2) + \text{Country_Score} + (\text{Governance_Quality} \times 2)$

The degree of organization, the quality of the country's digital infrastructure, and the efficiency of the company's management are all factors that contribute to the overall degree of connectivity.

Technology Adoption Score (TAS): $TAS = (\text{Country_Score} \times 1.5) + (\ln(\text{Assets}) \times 0.10) + \text{Year_Factor}$

This demonstrates that the efficiency of technology use varies with the size of the company, the country's digital infrastructure, and the passage of time (2024=+3, 2023=+2, 2022=+1, 2021=0).

Budgeting Practice Maturity Index (BPMI): $BPMI = (RFA \times 0.30) + (SPS \times 0.25) + (BIL \times 0.25) + (TAS \times 0.20)$

In all four cases, only one number is considered.

3.3 Analytical Approach

To test hypotheses in multiple regression models while simultaneously considering everything that can alter the results, robust standard errors (HC3) are used. In our study, we use one-way ANOVA, VIF, Breusch-Pagan, and Shapiro-Wilk tests, as well as Pearson correlation analysis. Stata technique is used for all analyses.

4. Results and Analysis

4.1 Descriptive Statistics

From 2021 through 2024, Table 2 contains a descriptive data on the sample companies.

Table 2: Descriptive Statistics (N=30)

Variable	Mean	Median	SD	Min	Max
Total Assets (USD M)	156,842	98,450	143,276	12,500	576,000
Revenue (USD M)	87,634	54,200	89,456	8,900	398,000
Ln(Assets)	11.67	11.50	0.89	9.43	13.26
RFA Index	8.45	8.20	1.82	5.15	12.73
SPS Score	14.28	14.10	2.34	9.87	19.41
BIL Score	8.67	9.00	1.56	5.50	11.50
TAS	11.23	11.15	2.41	6.75	16.28
BPMI	10.52	10.35	1.67	7.23	14.18

Companies in the sample range in size, and the data clearly exhibits a right-bias. The use of log-transformed financial data is supported by this. Indicators of budgeting practice show that some companies are employing them, but not a large number. Of the GCC energy industry's total members, 26.7% are Saudi businesses, with over 60% being vertically integrated. This ensures that sector-level choices are adequately reflected.

4.2 Correlation Analysis

Table 3 examines bivariate relationships between key variables.

Table 3: Correlation Matrix

	RFA	SPS	BIL	TAS	BPMI	Ln(Assets)
RFA Index	1.000					
SPS Score	0.847***	1.000				
BIL Score	0.723***	0.681***	1.000			
TAS	0.692***	0.734***	0.589***	1.000		
BPMI	0.942***	0.932***	0.841***	0.835***	1.000	
Ln(Assets)	0.782***	0.765***	0.512**	0.587***	0.763***	1.000

Note: *** $p < 0.001$, ** $p < 0.01$

Budgeting practices are highly correlated ($r = 0.589\text{--}0.847$, $p < 0.001$), indicating that organizations are more inclined to implement them simultaneously as part of a broader modernization initiative. Larger organizations are more likely to adopt ($r = 0.512\text{--}0.782$, $p < 0.001$), which supports H1 at first. This is especially true for rolling forecasts, which rely on size the most ($r = 0.782$). The BPMI has extremely strong correlations with its parts ($r = 0.835\text{--}0.942$), which demonstrates that it is a strong composite indicator.

4.3 Hypothesis Testing

4.3.1 H1: Organizational Size and Rolling Forecast Adoption

Table 4: Regression Results - Rolling Forecast Adoption

Variable	Coefficient	Robust SE	t-stat	p-value	95% CI
Intercept	-5.234	2.145	-2.440	0.022**	[-9.653, -0.815]
Ln(Total Assets)	1.168	0.184	6.348	<0.001***	[0.789, 1.547]
Sector (Integrated)	0.523	0.312	1.676	0.106	[-0.118, 1.164]
Year	0.187	0.089	2.101	0.046**	[0.004, 0.370]
Country Effects	Included				

Model Statistics: $R^2 = 0.743$, Adj $R^2 = 0.698$, $F = 16.52$ ($p < 0.001$), $N = 30$ **VIF Analysis:** All VIF < 2.5 (acceptable multicollinearity levels)

Hypothesis 1 is well supported by the regression analysis. From Table 4 we can see there is strong and significant indicated by the size of the company and rolling forecast adoption ($\beta = 1.168$, $SE = 0.184$, $t = 6.348$, $p < 0.001$). Because of this, larger organizations are more likely to use rolling forecasting techniques. An increase of 2.7 times in total assets, from \$25 billion to \$200 billion, would lead to a 2.4 point increase in the RFA Index. Even in medium- to small-sized businesses, changes have a large impact, proving that management's effect is more than just statistical.

The model adequately describes the data as it accounts for 74.3% of the variation in people's rolling prediction usage ($R^2 = 0.743$; Adjusted $R^2 = 0.698$). It can be shown that the model is robust overall from the F-statistic (16.52, $p < 0.001$). Regardless of the size and structure of the firm, the usage of rolling projections is expected to significantly grow from 2021 to 2024, according to the significant and favorable temporal effect ($\beta = 0.187$, $p = 0.046$). This is likely due to the fact that there was less clarity back then and the massive digital transformation that had taken place.

Statistical analysis shows that this association is not significant ($\beta = 0.523$, $p = 0.106$), despite the fact that higher adoption is seen among fully integrated organizations. This suggests that issues related to scalability take precedence over those of integration quality.

Finally, our results provided strong evidence in favor of H1, showing that the frequency of rolling forecasts in the GCC energy market is strongly correlated with the size of an organization.

4.3.2 H2: Sector Complexity and Scenario Planning Sophistication

Table 5: Regression Results - Scenario Planning Sophistication

Variable	Coefficient	Robust SE	t-stat	p-value	95% CI
Intercept	-8.743	2.867	-3.049	0.005**	[-14.642, -2.844]
Sector (Integrated)	2.145	0.423	5.071	<0.001***	[1.276, 3.014]
Ln(Total Assets)	1.287	0.221	5.822	<0.001***	[0.832, 1.742]
Year	0.234	0.112	2.089	0.047**	[0.003, 0.465]
Country Effects	Included				

Model Statistics: $R^2 = 0.781$, Adj $R^2 = 0.741$, $F = 19.34$ ($p < 0.001$)

Group Comparison:

Sector Type	N	Mean SPS	SD
Integrated Operations	18	15.32	2.01
Single-segment	12	12.67	1.89
Difference		2.65*	

t-test: $t = 3.47$, $p = 0.002^*$, Cohen's $d = 1.36$ (large effect)*

H2 is well supported by the regression findings. The scenario-planning skill of companies that operate throughout integrated value chains is noticeably greater than that of enterprises that operate in a single sector ($\beta = 2.145$, $p < 0.001$). This study implies that in order for enterprises to effectively manage various sources of uncertainty in their increasingly complex operational contexts, which include upstream, middle, and downstream operations, they need to use more sophisticated scenario analysis. There is a considerable favorable influence of firm size ($\beta = 1.287$, $p < 0.001$), suggesting that bigger businesses can and should use more formal scenario planning. Gradual improvements are shown by a small but statistically significant temporal impact ($\beta = 0.234$, $p = 0.047$) from 2021 to 2024.

This trend is further reinforced by group comparison. A considerable effect size (Cohen's $d = 1.36$) confirms a real practical difference in planning expertise, as integrated businesses attain a much higher SPS mean (15.32 vs. 12.67). Most of the difference in scenario-planning

sophistication is explained by sector complexity, business size, and country context, according to the strong model fit ($R^2 = 0.781$).

A more sophisticated use of scenario-based budgeting is often linked with more intricate operational systems, lending credence to H2.

4.3.3 H3: Country-Level Factors and Budget Integration

Table 6: Budget Integration by Country

Country	N	Mean BIL	SD	Min	Max
UAE	6	10.25	1.12	8.50	11.50
Qatar	4	9.88	1.03	8.50	11.00
Saudi Arabia	8	8.81	1.43	6.50	11.00
Kuwait	4	7.63	1.38	6.00	9.50
Oman	4	7.38	1.11	6.00	8.50
Bahrain	4	7.25	1.26	5.50	8.50

ANOVA: $F = 6.84$, $p < 0.001^{***}$, $\eta^2 = 0.588$

Table 7: Regression Results - Budget Integration

Variable	Coefficient	Robust SE	t-stat	p-value
Ln(Total Assets)	0.478	0.125	3.824	<0.001***
UAE (vs Bahrain)	3.000	0.523	5.736	<0.001***
Qatar (vs Bahrain)	2.625	0.589	4.456	<0.001***
Saudi Arabia (vs Bahrain)	1.563	0.445	3.512	0.002**
Kuwait (vs Bahrain)	0.375	0.587	0.639	0.529
Oman (vs Bahrain)	0.125	0.598	0.209	0.836

Model Statistics: $R^2 = 0.812$, Adj $R^2 = 0.753$, $F = 13.78$ ($p < 0.001$)

With an F-value of 6.84 and a p-value less than 0.001, GCC nations show a significant effect size ($\eta^2 = 0.588$). This indicates that environmental variables unique to each nation are the primary driver of variances in integration levels. According to the descriptive data, there is a distinct pattern: Saudi Arabia is somewhere in the middle, Qatar and the UAE are at the very top, and Oman, Kuwait, and Bahrain are at the very bottom, with very comparable scores.

The findings of the regression provide support for this structure. Businesses in the UAE continue to beat their Bahraini counterparts by almost three points ($p < 0.001$), even after taking size and other characteristics into consideration. So, integration is up around 41% from where it was previously. Saudi Arabia has a little lead over Bahrain in terms of comparative advantage, however Qatar and Saudi Arabia are on equal ground. But Oman and Kuwait aren't that dissimilar from Bahrain. It would indicate that the three nations are almost equal in terms of proficiency.

A significant portion of the variation is explained by the model ($R^2 = 0.812$), and even after adjusting for business variables, the impact of nation is still noticeable. These patterns are analogous to the disparity between the amount of adaptation that the country wants and the amount that individuals are prepared to deal with digital technology.

There are many people that are in favor of H3. Preparing a national budget is a process that differs for each GCC country. The UAE and Qatar consistently rank first and second, respectively.

4.3.4 H4: Temporal Trends in Technology Adoption

Table 8: Technology Adoption by Year

Year	N	Mean TAS	SD	YoY Growth
2021	10	9.67	2.12	--

2022	8	10.84	2.08	+12.1%
2023	6	12.45	1.89	+14.9%
2024	6	13.67	1.76	+9.8%
Total Change		+4.00		+41.4%

Table 9: Regression Results - Technology Adoption

Variable	Coefficient	Robust SE	t-stat	p-value
Year	0.197	0.044	4.477	<0.001***
Ln(Total Assets)	0.654	0.178	3.674	0.001**
Country Effects	Included			

Model Statistics: $R^2 = 0.723$, Adj $R^2 = 0.671$, $F = 13.89$ ($p < 0.001$)

Simple Linear Regression (Year only): $\beta = 1.267$, $p < 0.001$, $R^2 = 0.511$

The findings lend credence to H4. The total annualized rate of technology adoption (TAS) grew from 9.67 to 13.67 between 2021 and 2024, a gain of almost 41%. It is probable that the recovery from the pandemic and the acceleration of national digital transformation plans contributed to the greatest improvement in 2022–2023. Despite a modest slowdown in growth in 2023 and 2024, adoption remained on an upward trajectory.

Firms with lower adoption levels are catching up, since the variation among them decreased with time. This is in line with the predicted diffusion trends. Regression analysis shows that these time effects are still significant ($\beta = 0.197$, $p < 0.001$) even after accounting for business size, sector, and country. Timely advancement is seen irrespective of firm features, albeit organizational scale does have a favorable influence.

Overall, the evidence is in favor of H4: the industry as a whole had a constant and quick uptick in technology use, propelled by digitalization efforts and changing operational circumstances.

4.4 Integrated Budgeting Maturity Analysis

Table 10: Comprehensive BPMI Model

Variable	Coefficient	Robust SE	t-stat	p-value
Ln(Total Assets)	0.987	0.145	6.807	<0.001***
Sector (Integrated)	0.834	0.256	3.258	0.003**
Year	0.095	0.021	4.524	<0.001***
Country Effects	Included			

Model Statistics: $R^2 = 0.854$, Adj $R^2 = 0.817$, $F = 23.12$ ($p < 0.001$)

BPMI by Country:

Country	Mean BPMI	Rank
UAE	12.34	1
Qatar	11.87	2
Saudi Arabia	10.78	3
Kuwait	9.45	4
Oman	9.23	5
Bahrain	8.89	6

The overall budgeting maturity model performs well, explaining 85.4% of the variation ($R^2 = 0.854$). Companies in the GCC energy industry have different levels of budgeting sophistication based on business size, sector fit, time period, and national mood, according to this. Unlike the models for specific practices, all variables are statistically significant. This provides further evidence that several environmental factors, rather than just one, influence overall maturity.

At the national level, trends have developed that are in line with earlier results. The United Arab Emirates has the most integrated population, while Bahrain has the least. People here clearly have different financial priorities than the national average. Businesses would prefer to upgrade their budgeting systems all at once by incorporating more technology, integration, and planning methods rather than doing it piecemeal, as evidenced by the wide range of maturity levels and significant predictive effects.

4.5 Summary of Results

Table 11: Hypothesis Testing Summary

Hypothesis	Result	Key Evidence	Effect Size
H1: Size → RFA	Strongly Supported	$\beta = 1.168, p < 0.001; R^2 = 0.743$	Very Large
H2: Sector → SPS	Strongly Supported	$\beta = 2.145, p < 0.001; \Delta = 2.65$ points	Large
H3: Country → BIL	Strongly Supported	$F = 6.84, p < 0.001; \eta^2 = 0.588$	Very Large
H4: Time → TAS	Strongly Supported	$\beta = 0.197, p < 0.001; 41\%$ growth	Large

With large impact sizes and strong statistical significance, the empirical results strongly supported all four hypotheses.

5. Discussion

5.1 Comparison with Previous Research

Our findings complement and expand upon previous research in management accounting. The results of Sivabalan et al. (2009) and Henttu-Aho (2018) are supported by the influence of organizational size (H1: $\beta = 1.168, p < 0.001$), which suggests that larger companies use more sophisticated planning methods. In contrast to the usual results in industrialized nations, our GCC data show a much bigger effect magnitude (74% variation explained). Size impacts were shown to be less significant in Australian contexts by Sivabalan et al. (2009). Henttu-Aho (2018), however, found that among Scandinavian businesses, planning style (active vs. reactive) was more important than organizational variables alone. In emerging countries, where there are large size variations and limited resources, organizational scale is an even more important factor affecting management accounting competence than in advanced markets, according to our results.

The effect of sector complexity (H2: $\beta = 2.145, p < 0.001$) supports the principles of contingency theory, expanding on the research of Henttu-Aho and Järvinen (2013), who demonstrated that organizational style influences the level of sophistication in predicting. Regardless of a company's size, our sector-level research suggests that the configuration of its business model—integration vs. specialization—may be a predictor of its planning expertise. Specialized GCC businesses lag behind their integrated counterparts by 21%. It is clear from this pattern that several forms of uncertainty exist. For example, regardless of whether prices go up or down, the margins on the upstream and downstream sides could fluctuate in the opposite ways. This results in interdependencies that need intricate scenario preparation.

According to studies in management accounting, one of the most significant impacts on a nation is the national infrastructure effect (H3: $\eta^2 = 0.588$). National effects explain 5–15% of the variance, according to most research on well-established marketplaces. In their review of digitalization research, Agostino et al. (2021) found that institutions were significantly affected, more so by changes in implementation tactics than by changes in competency levels. Based on our GCC data, businesses in the UAE are 41% more adept at budget integration than their Bahraini counterparts. Compared to other countries, this one has a huge disparity. This indicates that national infrastructure has a significantly larger impact on capacity in developing economies with institutions growing at different rates compared to established nations with similar settings.

There has been a 41.4% increase in the rate at which people adopt new technologies. An analysis of digitalization trends from the 90s to the 2000s was conducted by Bhimani and Willcocks (2014). Their findings indicated that the number of users increased by 3-5% per year. The growth rate has increased from 12% to 13% annually, which is three to four times the previous level. Although Fährndrich's (2023) study did show that digitization significantly affected management control, it did not measure how many people were engaged. Beyond the traditional adoption curves described by Rogers (2003) in classical diffusion theory, our findings show that environmental shocks (like a pandemic) and governmental interventions (like national digital efforts) may drastically shorten dissemination timelines.

5.2 Theoretical and Practical Implications

With the whole model explaining 85.4% of the variance, our work theoretically improves contingency theory by demonstrating the concurrent and cumulative functioning of several contingency layers (organizational, sectoral, national, and temporal). As a consequence, institutional theory is extended to developing nations, proving that, in contrast to developed economies, practice variations are bigger due to institutional heterogeneity. Extending practice diffusion theory beyond Rogers' (2003) concept of independent adoption is the bundled adoption pattern, which has substantial inter-correlations ($r = 0.589-0.847$).

The findings point to the fact that advanced budgeting necessitates growth across several levels happening simultaneously. It is not necessary for smaller firms to strive to outdo bigger ones in every aspect. They may, instead, give their attention to what's really important. There is a 41% difference between the UAE and Bahrain, which is closely related to infrastructure spending, suggesting that investments in infrastructure lead to organizational skill spillovers. Nevertheless, countries with weak infrastructure need targeted help due to large variations among nations.

5.3 Limitations and Future Studies

You need to be aware of certain boundaries. To start, a direct poll would provide more accurate degrees of complexity than utilizing a proxy variable, which is an indirect approach to look at things. Secondly, it is challenging to test for interactions that are difficult to interpret due to the small sample size ($N=30$). Third, it's more difficult to determine what caused what in a cross-sectional form with a short panel. Finally, the GCC isn't applicable outside of the energy industry, which brings us to our fourth point.

Direct measurement studies to back up proxy-based findings, performance consequence analyses to link sophistication to accuracy in forecasting and organizational performance, longitudinal extensions to track changes beyond 2024, and cross-regional comparisons to determine if GCC patterns reflect broader emerging market trends or are specific to a particular region should be the goals of future research.

6. Conclusion

This study tested four assumptions about the complexity of budgeting procedures used by fourteen GCC energy corporations between 2021 and 2024. The empirical evidence strongly supports all hypotheses, including: organizational size as a significant predictor of rolling forecast adoption ($\beta = 1.168$, $p < 0.001$), sector complexity as a predictor of scenario planning sophistication ($\beta = 2.145$, $p < 0.001$), country infrastructure as a factor explaining 59% of the variance in budget integration ($\eta^2 = 0.588$), and technology adoption as an increase of 41.4% during the study period ($p < 0.001$).

Organizational, sectoral, national, and temporal factors interact to determine management accounting sophistication, as shown by the comprehensive model that explains 85.4% of the total budgeting maturity variance. This study contributes to the body of management accounting literature by providing empirical evidence of new market tendencies, which call for context-

specific theoretical frameworks since the effects of nation and size are greater than in established markets.

While drawing attention to limitations including proxy measurement and a small sample size, the research provides substantial empirical information about the development of budgeting procedures in the GCC energy business, which is economically important but has received little attention. Strategic success for this corporation is increasingly dependent on innovative budgeting processes as it tackles the challenges posed by shifting energy sources and diversifying the economy.

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