

Cost engineering for sustainable universities: Pricing policy design enabled by strategic management accounting

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Abstract

Pricing of academic programs is one cost engineering and policy development challenge for universities seeking to enhance their sustainability performance in an environment of scarce resources and value-based stakeholder interests. This research proposes and empirically investigates a decision support model that examines how strategic management accounting practices enable the development of pricing policy and, hence, enhance the sustainability performance of Saudi Arabian universities. Data were collected from senior academic decision-makers of public and private sector universities and analyzed through structural equation modeling to establish direct and indirect effects. Findings revealed the direct effect of strategic management accounting on the sustainability performance of universities and the partial mediating role of pricing policy design, thereby confirming the critical role that pricing policy plays as a conduit through which the analytical capabilities of strategic management accounting practices can be leveraged to enhance the sustainability performance of Saudi Arabian universities. Implications of the findings are that Saudi Arabian universities can enhance their sustainability performance through the adoption and application of strategic management accounting-driven cost and value analytics to inform pricing policy and governance, thereby enhancing the effectiveness of resource allocation and the quality of service to the wider community and the environment.

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1. Introduction

Higher Education Institutions (HEIs) have been recognized as instrumental in attaining the Sustainable Development Goals (SDGs) through the production and dissemination of knowledge, human resource development, and innovation [1]. Within this framework, the importance of Technical and Educational Institutions is emphasized by the United Nations through the SDG4, which states: “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” [2]. With reference to HEIs, the objective is emphasized through the importance of performance management, underlining the

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importance of quality, efficiency, and flexibility within this particular domain [3]. With reference to the sustainability of the performance of the HEIs, it is of vital importance that the performance is aligned with the economic, social, and technical changes of the external environment [4]. The sustainability of HEIs can be evaluated based not only on academic criteria, but also through social criteria and the achievement of the triple bottom line, which refers to financial, social, and environmental criteria [5]. In this context, HEIs must develop work models that are adaptive and enable the integration of academic and economic concepts to access resources without impairing cognitive and human functions [6]. Accordingly, HEIs must develop effective, transparent, and strategic resource management models to ensure the sustainability of outputs and outcomes with respect to the higher education system as a whole [7].

However, the long-term sustainability of HEIs also depends on their financial sustainability [8], [9]. This necessitates developing appropriate pricing policies with a sound analytical foundation that reflects the actual costs of provision while balancing financial efficiency with economic affordability for students [10]. HEIs with poorly conceived pricing policies may find it difficult to maintain a precarious balance between equity in access to education and financial sustainability [11]. The gap between the costs incurred in the delivery of academic programs and the fees charged to students creates a major challenge to the viability of the performance of HEIs [12]. The absence of cost-based pricing policies with an objective and exact measure of service provision costs will most likely result in the lack of congruence between resource allocation and performance quality [13], [14], as well as the erosion of trust in the community [15] and increased competition [16]. Pricing policies must be formulated in the context of an overall strategic plan that establishes the identity and long-term goals of the HEI, as well as incorporating the impact of changes in demand, costs, and students' purchasing power on stability and growth. In this regard, strategic management accounting practices are conceptualized as analytical tools in support of the development of an accurate and dynamic pricing scheme based on the concept of perceived costs of activities and reengineering financial systems in alignment with the objectives of the institution and considerations of sustainability [17]. The use of strategic management accounting systems allows the organization to make accurate cost estimates, justify the pricing of services through the value of services rendered [18], optimize resource utilization efficiency [19], and focus spending on high-value activities [20]. Strategic accounting practices provide managers with exact quantitative and qualitative information [21], thereby promoting transparent and accountable systems and the achievement of economic efficiency and social justice objectives in a balanced manner [22]. Therefore, it is not appropriate to perceive strategic management accounting practices as tools that are used in the evaluation of the financial performance of an organization in isolation from one another, but rather as an integral part of the development of strategic HEIs, connecting the operational efficiency of the organization to the vision of the organization. In such an approach, it is recognized that strategic management accounting practices are the fundamental mechanism through which the performance of HEIs is made sustainable, along with the developmental role that it is expected to play in the realization of SDG 4 in the context of increasing complexity and competition in the global arena. Therefore, the purpose of the study is to investigate the role that pricing policy design plays as a mediator in the relationship between strategic management accounting practices and sustainable performance in Saudi Arabia.

This study is of great significance in the Saudi Arabian context, especially with regard to the recent developments in the Saudi Arabian higher education system. In addition, Vision 2030 recognizes university education as an essential part of Saudi Arabia's transformation agenda. This agenda includes increasing competitiveness within the global economy, promoting human development, empowering Saudi citizens, preparing to address future needs, and establishing a dynamic society with a prosperous economy [23], [24]. Moreover, Vision 2030 recognizes the need to develop models for university funding, improve the efficiency of public expenditures, and develop flexible and sustainable approaches to operate university education in Saudi Arabia. In particular, there is a need to raise internally generated funds and minimize dependence on government expenditures within the context of Saudi Arabian HEIs [25]. In this context, the need to recognize strategic management accounting as an essential part of Saudi Arabian HEIs is challenged by resource management constraints while maintaining quality and financial performance.

This issue is more relevant as several HEIs in Saudi Arabia, universities are becoming more autonomous in administrative and financial affairs, with some adopting the non-profit university model within the entrepreneurial framework [26]. This has been accompanied by high demands in terms of transparency and accountability in the financial decision-making process, particularly in relation to pricing mechanisms. Thus, the present study has scientific and applied importance in terms of examining the integration of strategic management accounting and pricing mechanisms in relation to university programs and the performance of sustainable HEIs. The present study becomes more pertinent in relation to the achievement of the national objectives of Vision 2030, including the expansion of university education, quality, the financial viability of HEIs, and the maximization of their contribution to the development of the country.

2. Literature review and hypothesis development

According to the resource-based perspective, the main factor that distinguishes and sustains organizational performance extends beyond the possession of material and monetary resources to the potential for developing intangible resources that cannot be imitated by others [27]. These resources include knowledge, advanced accounting information systems, and analytical tools to support decisions for strategy formulation [28], [29]. In the context of strategic management accounting resources, value chain analysis, value engineering, target costing, and total quality management are considered critical resources to support the improvement of internal efficiency within university institutions [30], [31].

These resources not only help in the measurement of costs, especially in the context of the university, but also contribute to the development of a dynamic mechanism for assessing value within the context of the organization. This can, therefore, become a basis of competitive advantage for university institutions, which can be used to deter imitation by competitors in an increasingly demanding environment characterized by excellence and sustainability in HEIs [32]. However, the ability to leverage strategic resources from the accounting discipline, which can be used to attain tangible results, especially with regard to organizational performance, depends on the development of mechanisms and processes within the framework of strategic decision-making, especially with the objective of preserving resources within university institutions [33]. In line with the dynamic capabilities perspective with regard to attaining sustainability in organizational performance, performance within the context of the university depends not only on the development of strategic resources with regard to the accounting function but also on the ability to respond to emergent dynamics with regard to the external environment [34]. Under these conditions, strategic management accounting practices are considered knowledge resources, providing HEIs with relevant knowledge about the costs of academic programs and activities, the quality of operational performance, and opportunities to improve organizational performance [35]. Resources are considered to indirectly influence organizational performance unless they are mobilized and utilized through dynamic organizational and strategic processes, as reflected in the pricing efficiency of academic programs.

Pricing is a dynamic, ongoing process involving multifaceted variables such as costs, value, and the organization's social goals, among others, that influence the final outcome [36]. Price effectiveness is, therefore, an active competency that helps HEIs to convert the information provided by strategic accounting systems into flexible and informed decisions that can effectively respond to the changing higher education market, balancing the need to attract students with the need to ensure the viability of the organization [37]. Pricing efficacy, therefore, as a dynamic capability, helps HEIs to utilize their resources, such as management accounting systems, to effectively and dynamically respond to turbulence in the environment, to develop the educational business model to produce financial revenues, to improve the quality of the services provided, and to increase social legitimacy, all of which contribute to the sustainable performance of HEIs [38]. Within the context of stakeholder theory, pricing is a complex interplay among market, equity, and social factors [39]. Accordingly, an effective process of pricing allows HEIs to react appropriately to information provided by the strategic management accounting system, and to develop strategies for pricing that fulfill the criteria of competitiveness, cost efficiency, and quality [40]. At the same time, it is possible to create an increase in the level of acceptance

of students and to ensure the self-financing of HEIs, which is a prerequisite for their viability. Agency theory also supports the proposed approach, focusing attention on the need to acquire appropriate information to reduce information asymmetry between administrative bodies (agents) and decision-makers and funders (principals) [41]. Strategic management accounting systems assist with quality decision-making by providing appropriate and accurate quantitative and qualitative information with regard to program costs and profitability, as well as the social implications of programs [42]. In addition to this, strategic management accounting systems provide a scientific basis for determining the optimal pricing strategies for programs, which could assist with the resolution of issues of inefficiencies and deviations from strategic plans, thus promoting accountability in university management and administration [43]. The aforementioned argument could plausibly be linked to sustainability issues and the achievement of SDG 4, which includes the provision of inclusive and equitable quality education and promotion of lifelong learning opportunities for all [44].

2.1. Strategic management accounting and sustainable performance

Strategic management accounting practices operate as an analytical tool for optimizing resource utilization in an organization and for leading strategic initiatives along more sustainable paths of development [45]. The integration of cost-value analysis and an institutional orientation is expected to increase the flexibility, innovativeness, and effectiveness of HEIs in a complex environment [46]. Strategic management accounting practices play an important role in leading an organization towards the most appropriate strategic initiatives for increasing its effectiveness and success in economic and social domains. Strategic management accounting may also contribute to organizational sustainability, as observed in the case of HEIs [47], [48]. The literature presents a proposition regarding strategic management accounting, which states that “strategic management accounting includes such practices as analysis of the external environment, gathering information about competitors and customers, carrying out strategic cost analysis, and using forward-looking information” [45]. These tools are applicable not only to complex systems but also to traditional universities to address the need to respond to dynamic environments where timely responses to changing circumstances and innovation are critical [49]. The need for strategic management accounting to analyze the external environment has been shown to be useful to HEIs that seek to identify trends within society, economy, and technology to inform their ability to develop academic programs to respond to changing needs [50]. The ability to analyze the external environment can enable HEIs to develop strategies to address changing funding and staffing needs to sustain academic and developmental purposes.

Furthermore, strategic management accounting enables the organization to concentrate on information that is relevant to its competitors, thus making it easier to evaluate strategic position in national and regional educational markets, as well as creating competitive advantages based on relative strengths and weaknesses [51]. This, in turn, can help HEIs build more relevant and innovative educational programs and maintain academic attractiveness in a sustainable way. In the same context, the analysis of the students and the community, which is related to the customer analysis, is considered one of the capabilities related to strategic management accounting practices [52]. These factors can clarify the expectations of educational process beneficiaries and assist in re-engineering educational programs and services, thereby increasing the added value for beneficiaries and enhancing institutional loyalty [53]. In addition, these factors can contribute to the social sustainability of the HEIs. Strategic cost analysis can assist the HEIs to analyze the cost structure over a long period, identify inefficiencies and waste, and thus direct resources to the development of the programs, so that sustainable economic efficiency can be achieved and the capacity to provide quality educational services can be sustained. On the other hand, the strategic use of forward-looking information can assist the organization to transcend the conventional accounting analysis based on historical data and develop a prospective image of the organization, so that strategic planning can be achieved over a long period and decisions can be made proactively to ensure the stability of the organization and the flexibility of the university to respond to crises and sudden environmental changes [54], [55]. Based on the above discussion, we assume that:

H1. Strategic management accounting practices affect sustainable performance in HEIs.

2.2. Strategic management accounting and the effectiveness of pricing policies

The effectiveness of service pricing policies, including academic program pricing policy design, is no longer a simple calculation based on cost coverage, but rather a multi-dimensional strategic choice that requires accurate information [56], a comprehensive analysis of perceived value, and close integration with internal accounting and financial analysis systems [57]. According to [32], strategic management accounting practices, including analysis of the external environment, competitor and customer analyses, strategic costing, and the use of strategic information, constitute cognitive resources that give organizations greater flexibility in building pricing models that respond to environmental complexities and enhance their competitive advantage. Taking this into consideration, pricing education programs can no longer be justified on a cost-recovery basis or as equaling competitors' prices [38]; they must be value-based. Pricing in HEIs should take into account students' views of the program's academic and social value [58], stakeholders' views of long-term benefits, and the program's usefulness for their societal or professional future [59]. Therefore, this type of pricing requires institutions to have an upper-management information and analytics system capable of understanding student behavior, assessing value models, and remaking programs to provide concrete, measurable value. To this end, the function of strategic management accounting is a main source. For example, value chain analysis helps an HEI identify the academic and non-academic work that creates value for the student [60], and therefore the program's price is valued rather than costed. Customer analysis helps identify different student segments and their expectations, enabling the development of differentiated pricing policies that account for variations in willingness to pay and perceived value [61]. Strategic management accounting enables HEIs to build the dynamic capabilities necessary to adapt pricing policies to a rapidly changing environment. Strategic management accounting enables HEIs to build the dynamic capabilities necessary to adapt pricing policies to a rapidly changing environment [35]. Based on the above discussion, we assume that:

H2: Strategic management accounting practices affect the effectiveness of pricing policies in HEIs.

2.3. The effectiveness of pricing policies and sustainable performance

As HEIs commit to SDG 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, the pricing of academic programs has become an institutional factor that intersects with educational quality, social justice, competitiveness, and long-term sustainability [1]. From the perspective of stakeholder theory, pricing policies establish the legitimacy of a university institution and its adaptation to its external environment [62], and tuition fee decisions are deemed to directly indicate the commitment of the university to its social responsibility towards the students and society [63]. Consequently, HEIs with transparent and equitable pricing policies consistent with the financial capabilities of the students will be more likely to sustain their financial resources [64]. Pricing policies appropriate for HEIs can also build trust among different segments of society and HEIs themselves, which will make them more attractive to potential students [65]. This can be viewed as a clear indicator of the sustainability of their financial, academic, and social performance [66]. These strategies also play a role in building effective relationships with the appropriate authorities and organizations towards ensuring the provision of quality education to society in general. Using the theory of perceived value, the pricing of education in the context of the university can be understood in terms of the perceived value of the beneficiaries, where students will be able to assess the quality of education provided, the prestige of the university, the quality of the opportunities provided in their careers, and the quality of assistance provided in the services related to education [38]. Pricing strategies that not only prove to be effective but also rigorously tested in terms of perceived value help to ensure that the university in question is competitive in the market of higher education and that pricing strategies adopted are sustainable in relation to the value of the service provided; it is expected to bring about satisfaction to the students and provide a social return on education [64]. This argument is also in line with the dynamic capabilities theory, which posits that HEIs whose pricing policies are developed with flexibility in adapting to the environmental, economic, and technological uncertainties are likely to sustain their performance over the long term [67]. Pricing policies that are tactically supported, together with cost and market information, allow HEIs to develop an adaptive structure for pricing

that will respond to changes in demand [68] and government subsidies [69], thus increasing the capacity of the institution to sustain and fulfill its functions. Based on the above discussion, we assume that:

H3: The effectiveness of pricing policies affects sustainable performance in HEIs.

2.4. The mediating role of the effectiveness of pricing policies

The ability of HEIs to balance their financial and social obligations is achieved by the implementation of pricing policies that are informed by exact knowledge of the costs and perceived value by students and the broader society, thus increasing the level of trust from the stakeholders and the sustainability of the HEIs [38]. The implementation of sound pricing policies is essential to the sustainability of HEIs since it increases the overall enrollment and retention rates [70]. The effectiveness of pricing policies, as informed by strategic management accounting, represents an important dynamic capability for HEIs to extract relevant insights from their competitive environment and subsequently translate these insights into adaptive strategies to respond to changing patterns of demand for their services [34]. Pricing policies aggregate analytical tools derived from strategic management, accounting disciplines, and evaluation strategies to develop useful measures to address important criteria such as financial performance, educational quality, and social justice. The relationship between strategic management accounting practices and sustainability is mediated by organizational and strategic factors to make such practices operational in nature [71]. In this context, the pricing policies of academic programs play the role of a means to leverage the analytical capabilities of strategic management accounting to achieve the sustainability of the academic institution [72]. From the perspective of dynamic capabilities theory, pricing effectiveness is a dynamic capability that leverages future information generated by strategic management accounting practices to align the financial strategies of higher learning institutions with environmental/competitive factors [73]. Based on the above discussion, we assume that:

H4: The effectiveness of pricing policies mediates the relationship between strategic management accounting practices and sustainable performance in HEIs.

3. Materials and methods

This study adopted a descriptive, correlational, and predictive approach to examine the effectiveness of pricing policies (EPP) in mediating the relationship between strategic management accounting practices (SMAP) and sustainable performance (SP) in HEIs in Saudi Arabia. This approach is suitable for examining the nature of relationships between variables and for testing theoretical models using structural equation modeling (SEM) with the PLS SEM program.

3.1. Sampling

The study population consists of deans and deputies of business colleges at Saudi universities (both public and private). Purposive sampling was used because the target population consists of individuals with direct experience and knowledge of the study topic. This, in turn, influences their ability to provide relevant data. The final sample consisted of individuals who held the academic titles of "Doctor," "Professor," and "Assistant Professor." A total of 212 questionnaires were distributed, all of which were completed. The sample of 212 participants was deemed adequate for structural equation modeling (SEM). Based on recommendations, it was sought to have more than 10 participants per indicator variable. It is recommended that at least 10 participants be available per measurement item to ensure the reliability of statistical results, such as those obtained in SEM studies [74]. The final sample had 212 participants, significantly higher than the ten participants per measurement item.

Data were collected through a self-administered online survey. An online survey has a number of advantages for researchers. First, it helped researchers collect data simultaneously from Saudi Arabian higher learning centers (public and private universities) at a low cost. This is because internet accessibility is high in Saudi Arabia. Online surveys are regarded as a cost-effective and easily accessible method for collecting data from a diverse consumer segment at multiple sampling locations. Secondly, the forced response survey design

technique was adopted to ensure that all the respondents provided responses to all the items. A survey design technique was used to ensure that all respondents answered all the items on the questionnaire. This method reduces non-response errors. The independent variable, strategic management accounting practices, and the dependent variable, sustainable performance, were derived from Source [32], which examines the relationship between strategic accounting analysis and institutional performance in the context of higher education. The mediating variable, the effectiveness of pricing policies, was derived from Source [38], which analyzes the dynamics of pricing policies in academic institutions in relation to financial and social sustainability. The demographic profile of the respondents is shown in Table 1.

Table 1. Demographic profile

		Percent
Gender	Male	66.04%
	Female	33.96%
Type of Institution	Private	45.28%
	Government	54.72%
Academic Rank	Doctor	46.70%
	Assistant Professor	31.60%
	Professor	21.70%
Years of Experience	Less than 5 years	17.45%
	5–10 years	55.19%
	More than 10 years	27.36%

Table 1 displays the demographic composition of the sample, consisting of 212 faculty members from various business colleges in HEIs in Saudi Arabia. The findings revealed that the majority of the participants were male (66.04%), compared to the female participants who made up a smaller proportion (33.96%). Moreover, the majority of the sample members were from private universities (45.28%), while fewer members were from public universities (54.72%). Finally, it was found that the majority of the sample members held the rank of Doctoral (46.70%), followed by Assistant Professors (31.60%), then Professors (21.70%). Moreover, the majority of the respondents (55.19%) had 5-10 years of experience, while a significant number had less than 5 years (17.45%) and more than 10 years (27.36%). This is likely to lend the study greater credibility, given the wide range of experience.

3.2. Measurement instrument & data analysis

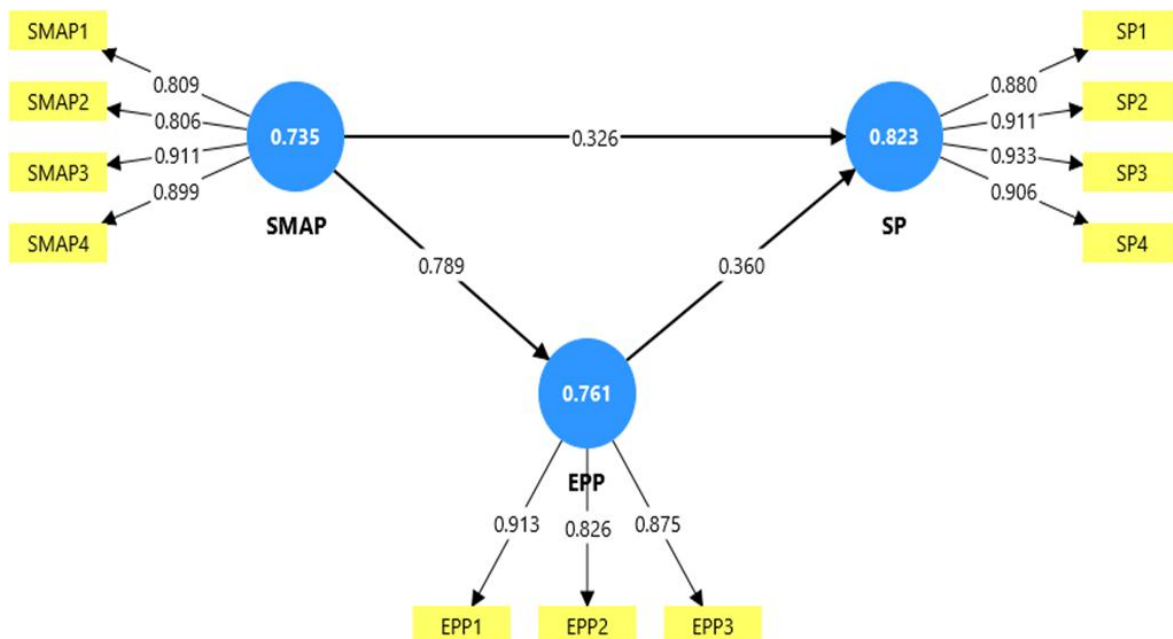


Figure 1. Measurement model of the strategic management accounting practices (SMAP), sustainable performance (SP), and effectiveness of pricing policies (EPP)

An SEM graph constructed with SmartPLS4, a PLS analysis software tool, is presented in the Figure 1. SEM is a robust statistical instrument to analyze complicated relationships between latent and observable variables. The outer model assesses how well the latent constructs are measured by the observed variables. The model's validity is ensured by high outside loadings (above 0.7). Path coefficient values indicate that the constructs are positively associated.

In Smart-PLS, measurement model assessment involves evaluating internal consistency reliability. Cronbach's Alpha, Composite Reliability (CR), and Dijkstra-Henseler's Rho (ρ_A) should all be at least 0.7, with CR ideally between 0.7 and 0.9. The strength of each indicator's correlation with its latent construct is then the main focus of the indicator's reliability evaluation. Although values between 0.4 and 0.7 can be tolerated if both the Average Variance Extracted (AVE) and CR are robust, it is advised that outer loadings be ideally above 0.7. Generally speaking, indicators with loadings below 0.4 should be excluded unless there is a compelling theoretical argument for their inclusion.

Reliability tests should verify that constructs successfully explain half or more of the indicator variation while maintaining a minimum Average Variance Extracted value of 0.5 to demonstrate sound convergent validity. Similarly, discriminant validity needs confirmation by demonstrating construct uniqueness. A construct maintains good discriminant validity when the Fornell-Larcker Criterion shows that its square root of AVE exceeds interconstruct correlations. Also, Users should ensure that the Variance Inflation Factor (VIF) remains below 5.

The provided Fornell-Larcker matrix helps analysts assess discriminant validity in Smart-PLS SEM, making it an important tool for research. Discriminant validity confirms that model-based latent constructs are uniquely identified from other constructs in the analysis.

Table 2. Fornell-Larcker criterion

	EPP	SMAP	SP
EPP	0.872		
SMAP	0.789	0.857	
SP	0.617	0.610	0.907

The Strategic Management Accounting Practices (SMAP), Sustainable Performance (SP), and Effectiveness of Pricing Policies (EPP) are the three Items for measurement properties are examined in Table 2 using outer loading, average variance extracted (AVE), discriminant validity assessment, and reliability index evaluation. According to [77], these measures are required in a structural equation modelling setting to evaluate construct validity and reliability.

Table 3. Measurement properties of (Strategic Management Accounting Practices (SMAP), Sustainable Performance (SP), and Effectiveness of Pricing Policies (EPP))

Construct	Items	Convergence validity		Discriminant validity	Reliability		
		Outer loading	Average variance extracted (AVE)	Fornell-Larcker Criterion: Is the square root of AVE for each construct greater than its correlations with other constructs?	Composite reliability (ρ_a)	Composite reliability (ρ_c)	Cronbach's alpha
EPP	EPP1	0.913					
	EPP2	0.826	0.761	YES	0.866	0.905	0.844
	EPP3	0.875					
SMAP	SMAP1	0.809	0.735	YES	0.884	0.917	0.879

Construct	Items	Convergence validity		Discriminant validity	Reliability		
		Outer loading	Average variance extracted (AVE)	Fornell-Larcker Criterion: Is the square root of AVE for each construct greater than its correlations with other constructs?	Composite reliability (rho_a)	Composite reliability (rho_c)	Cronbach's alpha
	SMAP2	0.806					
	SMAP3	0.911					
	SMAP4	0.899					
	SP1	0.880					
SP	SP2	0.911	0.823	YES	0.929	0.949	0.928
	SP3	0.933					
	SP4	0.906					

Table 3 shows that all the variables studied in the model (strategic management accounting practices, effectiveness of pricing policies, and sustainable performance) have strong measurement properties. In terms of convergent validity (AVE), the values exceeded the minimum acceptable limit (0.5), confirming the homogeneity of the items measuring each variable. Cronbach's alpha and composite reliability coefficient (CR) values ranged between 0.844 and 0.949, all of which exceeded the minimum acceptable limit (0.7). These results indicate the quality of the measurement tools and the suitability of the items to accurately and reliably measure the targeted variables.

Table 4 shows the variance inflation factor (VIF) values for the measurement model variables: Strategic Management Accounting Practices (SMAP), Sustainable Performance (SP), and Effectiveness of Pricing Policies (EPP). Assessing multicollinearity using VIF values protects the structural model results from potential distortions caused by high correlations among indicators [74]. Therefore, multicollinearity problems will not affect the results when the VIF value is less than 5.

Table 4. Variance inflation factor (VIF) of the Strategic Management Accounting Practices (SMAP), Sustainable Performance (SP), and Effectiveness of Pricing Policies (EPP) model

Items	VIF
EPP1	2.466
EPP2	1.934
EPP3	1.941
SMAP1	1.855
SMAP2	1.879
SMAP3	3.372
SMAP4	3.122
SP1	2.568
SP2	3.497
SP3	4.569
SP4	3.573

We can see from the table above that all coefficient-of-variation measures in the model are below 5, indicating low multicollinearity that does not affect the analysis. The Strategic Management Accounting Practices (SMAP) and Effectiveness of Pricing Policies (EPP) scales possess a low risk of multicollinearity, having a 1.855 to 3.372 coefficient of variation, while the Sustainable Performance (SP) scale possesses a medium coefficient of

variation of 2.568 to 4.569, in that the characteristic indicators of their constructs are preserved. The results indicate that the measurement model meets all conditions for reliability and applicability in SEM analysis.

Table 5 presents the PLS-SEM analysis, including the model fit indices for the estimated and saturated models. Data analysis using these indices enables the researcher to validate the accuracy of the model in structural analysis [74]. The major indexes used are standardized root mean square residuals (SRMR), d_ULS (unweighted least squares variance), d_G (geodesic variance), chi-square index, and normed fit index.

Table 5. Model fit indices for both the saturated model and the estimated model

	Saturated model	Estimated model
SRMR	0.068	0.068
d_ULS	0.305	0.305
d_G	0.190	0.190
Chi-square	240.910	240.910
NFI	0.872	0.872

A battery of goodness-of-fit measures was used to assess structural and standard model fits within the framework of structural equation modeling (SEM) using the partial least squares (PLS-SEM) method. The indices were reproduced as indicated in the extant literature, particularly as presented in [74]. The goodness-of-fit indices indicate that the model has attained a reasonable fit. The SRMR is 0.068, which is below the acceptable limit of 0.08 reported in [75]. The (d_ULS, d_G) indices are the same for both models and equal to (0.305, 0.190). The NFI index reached 0.872, indicating a moderate fit for the model (acceptable), with an acceptable range of 0.80-0.90 [75]. Thus, the model quality can be considered acceptable. Most indices fall within or near the recommended limits, supporting the model's validity in analyzing relationships between variables.

The Figure 2 shows the relationships among Strategic Management Accounting Practices (SMAP), Sustainable Performance (SP), and the Effectiveness of Pricing Policies (EPP) using PLS-SEM structural modeling. The relationships between variables become visible through path coefficients as well as R² values, and their significance is indicated by p-values in brackets.

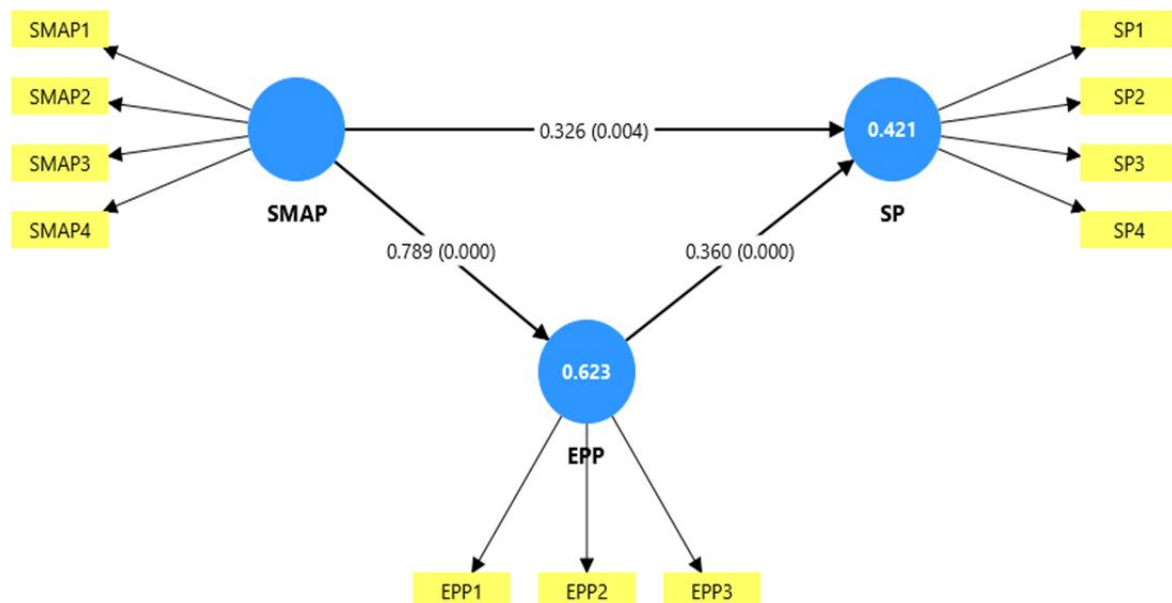


Figure 2. Structural (strategic management accounting practices (SMAP), sustainable performance (SP), and effectiveness of pricing policies (EPP)) model

Table 6 presents the relationships among Strategic Management Accounting Practices (SMAP), Sustainable Performance (SP), and the Effectiveness of Pricing Policies (EPP). Where both direct and indirect effects appear from SMAP to SP through EPP as the role of the mediator.

Table 6. Structural (strategic management accounting practices (SMAP), sustainable performance (SP), and effectiveness of pricing policies (EPP)) model

Hypothesis	Path	Direct effect	indirect effect	Total effect	R ²	T statistics (O/STDEV)	P values	Hypothesis decision
H1	SMAP -> SP	0.326	0.284	0.610	0.421	2.857	0.004	Supported
H2	SMAP -> EPP	0.789		0.789	0.623	26.658	0.000	Supported
H3	EPP -> SP	0.360		0.360		3.918	0.000	Supported
H4	SMAP -> EPP -> SP							Supported
	EPP -> SP	0.360	0.284			10.017	0.000	Partial mediation
	SMAP -> EPP	0.789						
	SMAP -> SP	0.326						

Table 6 includes the results of the structural analysis of the influence relationships between the variables. These revealed a significant direct effect of strategic management accounting practices (SMAP) on sustainable performance (SP) ($\beta = 0.610$, $p = 0.004$), supporting the first hypothesis (H1). The results also showed a strong direct effect of strategic management accounting practices on the effectiveness of pricing policies (EPP), with a value of 0.789 ($p < 0.001$), confirming the second hypothesis (H2). Furthermore, pricing strategies have a direct effect on sustainable performance (0.360, $p < 0.001$), confirming the third hypothesis (H3). The analysis also showed an indirect (partial) effect of strategic management accounting on sustainable performance via pricing effectiveness ($p < 0.001$), supporting the fourth hypothesis (H4) regarding the mediating role of pricing policies. These results indicate that effective pricing policies are a vital channel for translating strategic accounting practices into sustainable performance.

3.3. Analysis of differences between types of university

After verifying the model's suitability and the presence of statistically significant relationships among the variables, this study sought to test whether these relationships differed by university type (private or government).

The Z-test for differences between two independent variables was used to compare relationships by university type (public vs. private) [74]. Table 7 results indicated that the relationship between SMAP and EPP was stronger at private universities ($\beta = 0.829$) than at public universities ($\beta = 0.748$), whereas the relationship between SMAP and SP was stronger at public universities ($\beta = 0.664$) than at private universities ($\beta = 0.573$). Similarly, the relationship between EPP and SP was stronger in public universities ($\beta = 0.409$) than in private universities ($\beta = 0.304$). The value of ($|Z|$) for all relationship coefficients was (< 1.96), indicating that the differences were not statistically significant. Based on the above, the results indicate that the type of university (public or private) does not significantly affect the causal relationships in the model. This enhances the generalizability of the results to all types of Saudi universities and indicates that strategic management accounting practices and pricing policies affect sustainable performance similarly across both sectors.

Table 7. Analysis of differences between types of university

Predictor	Target	$\beta_{\text{Government}}$	β_{Private}	Z	Decision
SMAP	EPP	0.748	0.829	1.315	no significant differences
SMAP	SP	0.664	0.573	0.804	no significant differences
EPP	SP	0.409	0.304	0.001	no significant differences

4. Discussion of results

The structural analysis revealed a direct, positive, and statistically significant relationship between strategic management accounting practices and sustainable performance ($\beta = 0.326$, $p = 0.004$). This result is in line with the arguments of [42], [44], who emphasize that accounting practices with a strategic focus are essential for the

efficient allocation of resources, as well as for the improvement of organizational performance. From the perspective of the resource-based view (RBV) of the firm, strategic management accounting practices are an intangible organizational resource, which is hard to imitate, and are related to the creation of sustainable competitive advantage [27], [30]. The data thus collected is of great importance to decision-makers who seek to balance financial, social, and environmental performance. Furthermore, the practices align well with the stakeholder theory, as they increase transparency in the decision-making process, thus meeting the university's social responsibility to its stakeholders.

The results show that the pricing policies of the institution are significantly influenced by the adoption of strategic management accounting practices. The results support the key role of management accounting practices as the primary source of information for formulating value-based, cost-based, and market-based approaches to pricing. In addition, the results support the arguments in [32] and [38] that management accounting practices, including value chain analysis, customer analysis, and strategic costing, play an important role in formulating accurate and fair pricing policies for HEIs. The results also support the arguments in [36], which proposed a multidimensional model for formulating pricing policies for HEIs. From the perspective of dynamic capabilities theory, the results support the arguments of [34] and [37] that management accounting practices, including strategic management accounting, play an important role in the formulation of pricing policies for HEIs that respond to the dynamic environment of the educational and economic sectors.

In this analysis, the reorientation of pricing models has been identified as an important factor driving strategic change in HEIs. The results indicate a significant direct relationship between the formulation of pricing policies and sustainability, with a coefficient of 0.360 ($p < 0.001$). This underscores the importance of pricing models for sustainability. This study confirms previous studies [1], [62] that identified the impact of fair pricing models on the social acceptability of learning institutions and, therefore, their sustainability. The results also support the Perceived Value Theory, which suggests that learners are willing to pay for the program based on the perceived value, thus suggesting the need for pricing and financial models based on value rather than price. The results also support the dynamic capabilities theory, which suggests that pricing and financial models represent adaptive capabilities for HEIs.

The findings of the model clearly show the presence of a statistically significant indirect effect ($\beta = 0.284$, $p < 0.001$), thus supporting the partial mediation of pricing effectiveness in the relationship between strategic accounting and sustainable performance. The findings show that the effect of strategic accounting on organizational performance is not achieved directly but through optimization via the use of effective pricing policies. The findings are in support of the assertion of reference [71] that tools of accounting must have conduits of an organizational and strategic nature in order to produce tangible results. From the point of view of the theory of dynamic capabilities, the pricing effectiveness acts as an enabling factor in the translation of knowledge produced through the use of accounting tools into effective and responsive organizational behavior, thus positively influencing sustainability, as asserted in reference [38]. This is consistent with the Agency Theory framework, which suggests that accounting systems are designed to address information asymmetry between the organization's management (agents) and funding entities (principals). Reducing information asymmetry promotes transparency and accountability, as seen in the development of equitable pricing policies, as suggested in [41]. Such findings have significant implications for decision-makers in HEIs. The findings show that enhancing sustainable performance is not possible through the adoption of strategic management accounting unless the pricing policy is informed by an analysis of strategic value and costs. The connection between sustainable performance and strategic management accounting is established by linking strategic management accounting with the developmental dimension of education as defined by SDG4.

5. Conclusion

The main objective of the study is to examine the impact of the strategic management accounting practice on sustainable performance from the broader perspective of HEIs in Saudi Arabia, with specific reference to the mediating effect of pricing policy design. The study reveals the existence of a statistically significant

relationship between strategic accounting practice, pricing policy design, and sustainable performance. The study is of significant importance to HEIs in Saudi Arabia due to the sector's broader alignment with the Vision 2030 framework. With reference to the need for the development of innovative organizational models, the study is of specific importance to HEIs in Saudi Arabia. It is the contention of the study that the pricing policy of the program should be based on value orientation as opposed to a cost-oriented approach. Such an approach is expected to improve the price acceptability of the program while ensuring the desired balance between efficiency and attractiveness. In the value-oriented framework, the study highlights strategic accounting results that would facilitate the formulation of sustainability strategies, which would require HEIs to review their current resource allocation to accommodate value-added initiatives as well as the social and environmental dimensions of the sustainability agenda. Further, the study suggests that capacity building of academic and administrative leadership would be required to enable the effective utilization of financial analysis tools for strategic decision-making with regard to pricing policy and sustainability, as well as the development of governance structures that promote accountability and transparency.

5.1. Theoretical implications

The theoretical contributions of this study are threefold. First, this research contributes to the development of strategic management accounting by extending the discipline beyond a sole focus on efficiency and cost management in operations management practice. Additionally, the study contributes to understanding the potential to develop dynamic capabilities by applying strategic management accounting to strategic pricing decisions, thereby linking the accounting system to the firm's overall strategic success. Second, this study contributes to the body of knowledge on the role and scope of strategic management accounting by advancing the notion that the discipline should be conceived as both a decision-support tool within the firm and a driver of corporate value with both financial and social dimensions. Finally, this study contributes to the theoretical discussion on the integration of dynamic capabilities theory and perceived value theory by advancing the notion that pricing competence not only functions as a financial tool but rather as a dynamic capability that can be leveraged by the firm to change the focus of its analytical capabilities and accounting data to the development of dynamic pricing models that are founded on the concept of the perceived value of the firm's stakeholders.

This theoretical argument suggests that the sustainability of institutional performance is not only dependent on the resource endowment; rather, the university is also required to reallocate its resources to enhance competitiveness and achieve the SDGs. Secondly, the study makes a substantial theoretical contribution by incorporating stakeholder theory with the theory of the strategic function of pricing policies. The results of the study revealed that HEIs and related institutions are capable of utilizing their "pricing power" to seek legitimacy by meeting the different demands of heterogeneous stakeholder groups through the application of strategic management accounting practices. The combination of these theoretical perspectives helps to build a multidimensional conceptual framework that links accounting analysis, institutional action, and response to external pressures. The current study also proposes a theoretical framework that integrates the sustainability and management accounting literature with the emphasis on strategic accounting tools and value-based pricing as key inputs to strategic decision-making and the attainment of SDG 4.

5.2. Managerial and practical implications

The managerial and practical implications that have been articulated in the study are aimed at ensuring that the relevant decision-makers in HEIs are made aware of the need to develop more efficient and sustainable practices. Firstly, the research results imply that the implementation of strategic management accounting practices should be viewed as a strategic, as opposed to an operational, issue, due to the ability to provide precise and comprehensive information pertaining to costs, value, competition, and customers. As such, various HEIs across the globe would be encouraged to invest in the development of sophisticated strategic accounting systems, as well as undertake the relevant staff training in the application of such systems. Furthermore, the findings indicate that the development of pricing policies is the key way in which the benefits of strategic accounting systems are translated into sustainable performance.

It is suggested that the current pricing policies in HEIs be made redefinable for greater responsiveness and relevance within a value-added framework. The analysis suggests the need for a value-based pricing system, which can make use of strategic accounting information for the reconciliation of the dual objectives of financial viability and social justice in the provision of educational services. It is suggested by the analysis that the ultimate objective of pricing is the management of relationships with stakeholders, rather than the generation of revenues. It is suggested that fair and transparent pricing, based on good accounting principles, is more likely to generate confidence among students, parents, and the community at large in the university, hence providing a relative competitive advantage.

HEIs are encouraged to incorporate stakeholder participation into their pricing strategies, an aspect which is likely to improve legitimacy and commitment to sustainable development. Further, this study argues that Saudi Arabian HEIs, in seeking to achieve financial independence in line with the objectives and targets of Vision 2030, should adopt a value-based strategic management accounting system to price, which includes financial, educational, and social objectives. This, in turn, calls for the development of new financial governance mechanisms in HEIs, which are expected to be aligned to sustainable development practices as well as the Sustainable Development Goals (SDGs), especially Goal 4, which focuses on quality and equitable education for all.

5.3. Limitations and future research

This study contributes to the body of knowledge in the following way: it proposes an integrated theoretical and practical model linking strategic management accounting practices with the efficiency of pricing policies and sustainable performance in HEIs. However, it is vital to recognize some of the limitations identified in the course of the investigation. Firstly, the current study is limited to HEIs in Saudi Arabia; hence, its generalization to other fields might be limited. Secondly, the study may have been influenced by subjective cognitive biases inherent in questionnaire-based data collection, which relied upon academic and administrative heads in the institutions. Thirdly, the study's cross-sectional design does not allow a causal inference of the relationship between the variables of interest. Fourthly, while pricing policy efficacy emerges as the key mediator between strategic management accounting practices and sustainable performance, the study fails to take into consideration the impact of a number of potentially significant mediating or moderating variables, such as corporate governance, managerial innovation, and the use of advanced analytical techniques.

Following the current set of constraints, several paths can be explored by future research: First, extending the research scope to various HEIs in different countries would allow for cross-cultural and cross-organizational analysis, hence improving generalizability. Second, the employment of longitudinal designs would allow for the analysis of the developmental dynamics of the relationship between strategic management accounting practices and sustainability, and then their subsequent effects on pricing. Finally, other variables can be introduced as either moderators or mediators, like digital transformation in accounting, financial decision-making systems based on artificial intelligence, or the maturity level of the implementation of governance rules by institutions. Fourth, various models that integrate strategic management accounting activities with analytical marketing techniques can be tested to assess the impact of combining these activities on pricing strategy and decision quality. Finally, the research can be broadened to address the social and ethical dimensions of pricing, particularly how it helps ensure equitable access to education and achieve SDG 4.

Conflict of interest

The authors declare that they have no conflicts of interest and agree to publish this paper in accordance with academic ethics.

Author contributions

Omar Zraqat: Conceptualization, methodology, Writing, review & editing, original draft. Khalid Mujahid Alharbi: Methodology, formal analysis, investigation, visualization, and project administration. Ahmed

Almohaimeed: Funding Acquisition, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Ethical statement

This research was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Declaration of Helsinki and its later amendments, or with analogous ethical standards. All participants in the quantitative surveys provided informed consent, and their privacy and confidentiality were strictly maintained. Ethical approval was obtained from the appropriate ethics review board prior to the commencement of the study.

Data availability statement

In accordance with Jordanian data privacy regulations and the Jerash University Economic and Management Sciences Research Ethics Committee’s data access restrictions, the dataset used in this study is not publicly available. However, the corresponding author can provide the relevant data upon reasonable request, in compliance with the applicable legal and ethical guidelines.

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