Design and Validation of an Implementation Model for Modern Public Sector Accounting

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Abstract: This study aimed to design, structurally organize, prioritize, and empirically validate an implementation model for modern public sector accounting. This applied study employed an exploratory sequential mixed-methods design. In the qualitative phase, semi-structured interviews were conducted with 14 experts in governmental and public sector accounting selected through purposive and snowball sampling until theoretical saturation was reached. Interview data were analyzed using thematic analysis with open, axial, and selective coding in MAXQDA 2018. The extracted indicators were screened through the fuzzy Delphi method, and the confirmed components were structured using Interpretive Structural Modeling and MICMAC analysis. SWARA was subsequently used to prioritize the factors. In the quantitative phase, a researcher-developed questionnaire based on the qualitative findings was administered to 291 respondents. The measurement and structural models were evaluated using PLS-SEM in SmartPLS 4 through factor loadings, Cronbach's alpha, composite reliability, average variance extracted, discriminant validity, coefficients of determination, predictive relevance, model-fit indices, and bootstrapped path coefficients. The final model consisted of two overarching factors, four dimensions, 15 components, and 46 validated indicators. All structural paths were statistically significant at $p<.001$. Modern public sector accounting showed strong associations with internal factors ($\beta=.968$, $t=149.489$) and external factors ($\beta=.884$, $t=51.568$). External factors strongly predicted economic-social factors ($\beta=.971$) and legal-regulatory factors ($\beta=.865$), while internal factors strongly predicted organizational factors ($\beta=.950$) and managerial factors ($\beta=.913$). The model showed substantial explanatory power for most endogenous constructs, including economic-social factors ($R^2=.942$), societal expectations ($R^2=.938$), internal factors ($R^2=.937$), and organizational factors ($R^2=.902$). Predictive relevance was positive for all modeled endogenous constructs. Overall fit was acceptable, with SRMR=.063 and NFI=.919. SWARA ranked internal factors above external factors, with organizational structure receiving the highest final priority. Modern public sector accounting should be implemented as an integrated organizational and governance reform in which structural, cultural, managerial, technological, legal, and socioeconomic components are coordinated to strengthen transparency, accountability, efficiency, and decision-making.

Keywords: Modern Public Sector Accounting; Accounting Reform; Public Sector; PLS-SEM; Fuzzy Delphi; Interpretive Structural Modeling; SWARA; Accountability

1. Introduction

Public sector accounting has undergone a profound transformation in recent years as governments have faced growing demands for transparency, accountability, efficiency, fiscal sustainability, and evidence-based decision-

making. Traditional governmental accounting systems were primarily designed to record financial transactions, demonstrate compliance with budgetary rules, and document stewardship over public funds. Although these functions remain essential, contemporary public administration increasingly requires accounting systems that can generate timely, reliable, multidimensional, and decision-useful information for managers, legislators, oversight bodies, citizens, investors, and other stakeholders. The expansion of public services, complexity of governmental programs, increasing use of public-private partnerships, digitalization of administrative processes, and heightened societal expectations have created conditions in which conventional accounting approaches are often insufficient for managing the informational and accountability needs of modern public organizations. Public sector accounting must therefore move beyond a narrow recording function toward an integrated management and governance system capable of supporting resource allocation, performance evaluation, risk management, strategic planning, and public accountability [1-3]. This shift highlights the need for an executable model that not only identifies the dimensions of modern public sector accounting but also clarifies how organizational, managerial, technological, legal, economic, and social factors should interact in practice.

One of the most important drivers of this transformation is the digitalization of accounting processes. The increasing incorporation of artificial intelligence, blockchain, advanced analytics, cloud-based systems, integrated accounting information systems, and automated reporting platforms has changed the nature of accounting work in both private and public organizations. Digital accounting can reduce manual error, accelerate data processing, improve traceability, facilitate continuous monitoring, and enhance the timeliness and accessibility of financial information. Recent research has emphasized that the transition from traditional to digital accounting increasingly depends on artificial intelligence-driven models, organizational readiness, and the ability to redesign accounting processes around digital technologies rather than merely adding technology to traditional procedures [4, 5]. Likewise, integrated digital accounting systems have been examined through technology acceptance perspectives, showing that the successful adoption of such systems depends not only on technological usefulness but also on facilitating conditions, user expectations, behavioral acceptance, and institutional support [6]. Emerging work on blockchain and AI-enhanced accounting systems further demonstrates that technological innovation creates important opportunities for transparency, automation, and fraud control while simultaneously generating legal, ethical, governance, and implementation challenges that organizations must manage carefully [7]. Consequently, information systems and information technology should be regarded as fundamental infrastructural components of modern public sector accounting rather than peripheral technical tools.

The digital transformation of public sector accounting is also closely connected to changes in the nature of public assets, organizational value creation, and decision-making. Public organizations increasingly manage intangible assets, digital infrastructures, knowledge resources, databases, and technologically mediated service processes that may not be adequately represented through traditional accounting categories. The growth of intangible and digital resources therefore requires accounting frameworks capable of recognizing new forms of value and providing managers with more comprehensive information for planning and stewardship [8]. At the same time, management accounting increasingly relies on accounting information systems to respond to environmental uncertainty and organizational pressures, indicating that the usefulness of accounting depends on the strategic integration of information systems with management processes [9]. Evidence on management accounting practices also suggests that accounting techniques achieve greater value when they are aligned with contingency factors, institutional arrangements, and the broader organizational environment rather than being implemented as isolated technical procedures [10]. Similarly, strategy-oriented applications of artificial intelligence in accounting, auditing, and

management accounting show that emerging technologies can contribute to analytical capacity, forecasting, control, and decision support only when they are embedded within a coherent organizational strategy [11]. These developments indicate that modernization in public sector accounting must be designed as an integrated organizational transformation rather than a purely technological upgrade.

Another central dimension of modern public sector accounting is accountability. Public institutions manage resources collected from citizens and therefore operate under stronger accountability expectations than many private organizations. Accounting systems are expected to provide transparent explanations regarding the acquisition, allocation, use, and outcomes of public resources. Empirical evidence indicates that taxpayers' perceptions of public sector accountability are associated with behavioral responses such as voluntary tax compliance, demonstrating that the quality of governmental accountability can influence public trust and cooperation [1]. This means that the effectiveness of public sector accounting should not be evaluated only by technical accuracy but also by its ability to communicate credible and understandable information to society. Societal expectations increasingly include timely disclosure of expenditures, transparency in public projects, access to information about governmental performance, and evidence that public resources have been used effectively. These expectations increase the strategic importance of financial reporting, public communication, and user-oriented information design. The role of professional accountants is therefore also changing. Accounting professionals increasingly operate as intermediaries between technical financial systems, public decision-making, judicial or regulatory institutions, and wider social expectations. Research on the social status and professional role of certified public accountants in expert and judicial contexts underscores the importance of professional legitimacy, institutional trust, and the evolving societal position of accountants [12]. Accordingly, modern public sector accounting must be understood as a governance mechanism through which technical information, institutional accountability, and public legitimacy are connected.

Ethics is similarly inseparable from the modernization of public sector accounting. The quality of accounting information depends not only on systems and standards but also on the ethical dispositions of those who produce, interpret, authorize, and use that information. Ethical failures can undermine transparency even when sophisticated information systems are available. Studies of professional accounting ethics have emphasized the importance of moral responsibility, integrity, honesty, and professional judgment as foundations of reliable accounting practice [13]. Research on accounting students likewise indicates that ethical predispositions can be influenced by professional ethics education, suggesting that the ethical capability of accounting systems partly depends on the development of individuals who operate within them [14]. Cultural context can further shape professional ethics and the meaning of public service, as demonstrated by research on the incorporation of local cultural values into the ethical conduct of public accountants [15]. In the context of public organizations, ethical leadership is also important because managerial behavior influences employees' perceptions of responsibility, service orientation, and appropriate use of public resources. Studies on the characteristics of Jihadi managers in the Iranian administrative setting emphasize commitment, responsibility, service orientation, and value-based management as important features of managerial effectiveness [16]. Thus, a modern accounting implementation model should incorporate leadership, organizational culture, human resource competencies, and professional ethics alongside technical accounting dimensions.

The control and assurance functions of public sector accounting constitute another major component of modernization. Public entities are exposed to risks of fraud, misappropriation, weak internal controls, inefficient expenditure, and inaccurate reporting. As financial processes become increasingly complex and digitized,

accounting systems must be capable of identifying unusual transactions, strengthening audit trails, and supporting preventive as well as detective controls. Research in the public sector has shown that forensic accounting techniques can play an important role in fraud detection and the reduction of reporting risk [17, 18]. Models specifically developed for fraud prevention in public institutions further emphasize the value of forensic accounting as an integrated part of governance and accountability systems rather than an activity used only after misconduct has occurred [19]. Likewise, evidence from the Nigerian public sector indicates that forensic accounting and internal control mechanisms contribute to fraud prevention and strengthen the integrity of public financial management [20]. Internal audit also depends on institutional, organizational, and professional conditions; its effectiveness is influenced by structural support, professional competence, managerial commitment, and the broader public-sector environment [21]. Performance auditing provides an additional layer of accountability by assessing whether public programs and resources are managed economically, efficiently, and effectively, making performance-oriented indicators essential to contemporary public financial governance [22]. These findings collectively suggest that monitoring, evaluation, internal control, auditability, and risk management should be treated as integral components of modern public sector accounting.

At the same time, public sector accounting is increasingly expected to incorporate sustainability and environmental considerations. Public organizations are responsible not only for financial stewardship but also for environmental, social, and intergenerational consequences of policy and resource use. Environmental accounting research has identified components related to waste management and environmental performance that can extend accounting beyond conventional monetary measures [23]. Green management accounting has similarly been proposed as a mechanism for enhancing sustainability performance, indicating that accounting systems can influence organizational behavior by integrating environmental costs, resource consumption, and sustainability indicators into management decisions [24]. Broader reviews of sustainability research in accounting reveal a growing convergence between accounting, environmental responsibility, governance, and long-term organizational performance [25]. These developments are highly relevant to the public sector because governments are responsible for managing common resources, infrastructure, environmental programs, and public investments with long time horizons. Therefore, modern public sector accounting should be capable of incorporating nonfinancial performance, sustainability information, and environmental implications into financial and managerial reporting.

The increasing importance of risk-oriented and strategic accounting further strengthens the argument for an integrated implementation framework. Public-sector projects frequently involve long-term commitments, complex financing arrangements, policy uncertainty, and interaction with private partners. Public-private partnership projects, for example, require careful assessment of investment risk because public entities must balance financial viability with public interest, service continuity, and fiscal responsibility [3]. Strategic management accounting can support such decisions by connecting accounting information to investment planning, organizational strategy, and long-term value creation [26]. In addition, the use of artificial intelligence and big data analytics has been associated with improved risk management and accounting transparency, demonstrating the increasing potential of data-driven accounting to strengthen decision quality [27]. Nevertheless, technological capacity alone cannot guarantee improved governance. Public policy processes frequently suffer from structural, institutional, implementation, and coordination problems that can weaken the effectiveness of otherwise well-designed systems [2]. Accordingly, an executable model for modern public sector accounting must address not only the technical generation of accounting

information but also the organizational capacity to use that information in planning, policy implementation, and decision-making.

The modernization of public sector accounting is therefore inherently multidimensional. Organizational structure determines how responsibilities, authority, communication, and financial functions are distributed; organizational culture influences willingness to accept innovation and accountability; human resources determine whether accounting systems can be implemented competently; information technology provides the infrastructure for accurate and timely data; budgets and financial resources enable sustained implementation; leadership provides direction and commitment; planning establishes the implementation pathway; monitoring and evaluation provide feedback and correction; and financial reporting connects internal processes to external stakeholders. These internal requirements operate simultaneously with external conditions, including accounting laws and regulations, public sector accounting standards, executive guidelines, economic conditions, societal expectations, and the information needs of users. Research across contemporary accounting domains supports this integrated perspective. For example, digital accounting acceptance research highlights technological and behavioral conditions [6], AI-based accounting research emphasizes transformation and strategic adaptation [4, 11], sustainability studies point to environmental and long-term performance dimensions [24, 25], and fraud-control research underscores the importance of oversight and internal control [19, 20]. Taken together, these strands of literature imply that isolated reform efforts are unlikely to produce sustainable modernization unless they are integrated into a coherent operational architecture.

Despite the growing body of research on digital accounting, artificial intelligence, accounting information systems, forensic accounting, public accountability, sustainability accounting, professional ethics, internal auditing, and strategic management accounting, a significant practical gap remains. Much of the literature focuses on individual technologies, specific accounting techniques, distinct risks, or isolated organizational conditions. Less attention has been paid to how these diverse dimensions should be assembled into a validated and prioritized implementation model specifically for modern public sector accounting. This gap is important because public-sector reforms often fail not because the individual components are unknown, but because their relationships, sequencing, relative priorities, and operational dependencies are insufficiently understood. A practical implementation model should therefore determine which factors form the foundational structure of modernization, how organizational and environmental elements influence one another, which components possess stronger driving or dependence power, which indicators should be retained after expert screening, and which factors should receive higher priority when decision-makers allocate limited managerial and financial resources. Such a model can provide a more systematic basis for moving from conceptual discussions of modernization to an executable public sector accounting framework. The need for this integrated approach is further reinforced by the evolving professional environment of accounting, in which accountants are expected to combine technical competence, ethical responsibility, technological literacy, risk awareness, and public accountability [5, 12, 14], while organizational accounting systems must increasingly support sustainability, investment decisions, transparency, and public service outcomes [8, 10, 26].

Accordingly, the aim of the present study was to design, structurally organize, prioritize, and empirically validate an implementation model for modern public sector accounting.

2. Methods and Materials

The present study was an applied research project conducted using an exploratory sequential mixed-methods design with the primary aim of designing and validating an implementation model for modern public sector accounting. The mixed-methods approach was selected because the development of a comprehensive implementation model required both an in-depth exploration of the underlying dimensions of modern public sector accounting and an empirical assessment of the relationships among the identified components. Accordingly, the study was implemented in two interconnected qualitative and quantitative phases. In the qualitative phase, relevant concepts, dimensions, components, and indicators were identified through a comprehensive review of the theoretical and empirical literature and through semi-structured interviews with experts in public sector and governmental accounting. The qualitative findings were subsequently subjected to expert screening and refinement through the fuzzy Delphi technique. Interpretive Structural Modeling was then applied to determine the hierarchical structure and influence relationships among the confirmed factors, and the Step-wise Weight Assessment Ratio Analysis method was employed to establish the relative importance and priority of the identified components. Based on the qualitative results and the resulting conceptual framework, a researcher-developed questionnaire was constructed for the quantitative phase. The quantitative phase followed a descriptive-survey and correlational design and was used to evaluate the measurement properties of the instrument, examine the structural relationships among the study constructs, assess model fit, and validate the proposed implementation model.

The qualitative study population consisted of theoretical and experiential experts with specialized knowledge of governmental and public sector accounting. The theoretical experts included university faculty members with recognized expertise in governmental accounting, a record of academic research or publications in this field, at least 10 years of relevant teaching or professional experience, and an academic appointment at a university or higher education institution. The experiential experts consisted primarily of senior managers and practitioners with extensive experience in governmental or public sector accounting, particularly individuals with more than 10 years of relevant professional experience and postgraduate academic qualifications. A combination of purposive judgmental sampling and snowball sampling was employed because the population of specialists with sufficiently deep knowledge of modern public sector accounting was limited and no comprehensive sampling frame was available. Initial participants were selected according to predetermined expertise criteria, and subsequent experts were identified through recommendations made by previously interviewed participants. On the basis of the predefined eligibility criteria, 14 experts who possessed both substantial professional experience and postgraduate qualifications were retained as the core expert panel. Semi-structured interviews were continued until theoretical saturation was reached, that is, until additional interviews no longer produced substantively new concepts, components, or relationships relevant to the implementation of modern public sector accounting. The duration of each interview was approximately 15 to 20 minutes. Interviews were conducted at locations convenient to the participants, typically their workplaces, and were audio-recorded after obtaining their explicit permission. Immediately after each interview, the recordings were transcribed and examined so that emerging codes could inform subsequent interviews and theoretical sampling decisions.

The quantitative population consisted of individuals considered sufficiently familiar with accounting processes, governmental accounting systems, public sector financial management, and the operational requirements of modern public sector accounting. The quantitative phase was designed to provide empirical validation of the model

developed from the qualitative findings. Considering recommendations for factor analysis and structural equation modeling, as well as power-related considerations associated with partial least squares structural equation modeling, 300 questionnaires were distributed to eligible respondents. Of these, 291 questionnaires were returned fully completed and suitable for statistical analysis, producing the final quantitative sample of 291 respondents. Random sampling was used in the quantitative phase to increase representativeness and reduce systematic selection bias among eligible members of the study population. The achieved sample size exceeded the commonly recommended minimum of approximately 200 participants for confirmatory factor analysis and structural modeling and was considered adequate for estimating the measurement and structural components of the proposed model. Throughout both phases, ethical principles were observed. Participation was voluntary, the purpose and stages of the study were explained to participants before data collection, informed permission was obtained before recording interviews, participant identities were protected through coding and anonymization, all information was treated confidentially, and participants were informed that they could withdraw from the study or request access to the study findings.

Data were collected through documentary review, semi-structured expert interviews, expert-evaluation questionnaires, and a researcher-developed quantitative questionnaire. In the first stage, a comprehensive review of books, scholarly articles, dissertations, specialized reports, electronic databases, professional documents, and relevant theoretical and empirical studies was conducted to identify preliminary concepts associated with the design and implementation of modern public sector accounting. The literature review provided an initial pool of potential factors and indicators and informed the construction of the interview protocol. Semi-structured interviews were subsequently used to explore experts' interpretations of the foundational conditions, causal relationships, priorities, structural requirements, and validation criteria associated with the proposed implementation model. The interview protocol focused on questions concerning the underlying determinants of modern public sector accounting implementation, the pattern of causal or structural relationships among the relevant factors, the relative importance of those factors, and the extent to which the proposed model could be considered valid and applicable in the public sector. Although a common interview guide was used to maintain comparability across interviews, probing questions were employed whenever further clarification was required. Examples of probes included requests for participants to elaborate on the meaning of a concept, provide practical examples, or clarify how a particular accounting-related factor influenced another component of the proposed model. During the interviews, the researcher summarized selected statements and interpretations and requested confirmation from participants in order to minimize interpretive error.

The qualitative interview data were analyzed with the support of MAXQDA 2018. Following transcription, the interview texts were repeatedly reviewed and coded to identify initial concepts, categories, subcategories, and broader thematic dimensions. Coding was performed iteratively, and newly identified codes were compared with codes derived from previous interviews. In addition to the principal researcher, an academic expert and a statistical or methodological specialist reviewed selected coding decisions to increase analytical consistency and reduce individual interpretive bias. Trustworthiness of the qualitative phase was addressed using several complementary procedures, including credibility assessment, member checking, triangulation of data sources, examination of divergent or negative cases, and attention to transferability. Member checking was conducted by presenting selected interpretations, categories, or summaries of the preliminary findings to several interviewees and requesting their assessment of whether the findings accurately reflected their views. Data-source triangulation was achieved through comparison of evidence obtained from academic literature, professional documentation,

interviews, and expert questionnaires. Transferability was facilitated by clearly defining the characteristics of participating experts and the contextual features of the study so that readers could assess the relevance of the findings to comparable public sector accounting environments.

Following the qualitative coding process, the preliminary indicators were subjected to fuzzy Delphi evaluation in order to obtain structured expert consensus and screen the identified components. Experts evaluated the importance of each indicator using five linguistic categories ranging from very unimportant to very important. These linguistic judgments were represented by triangular fuzzy numbers. Very important was represented by the triangular fuzzy number (0.75, 1, 1), important by (0.50, 0.75, 1), moderately important by (0.25, 0.50, 0.75), unimportant by (0, 0.25, 0.50), and very unimportant by (0, 0, 0.25). For each indicator, the fuzzy evaluations of the experts were aggregated and converted into a crisp value using the defuzzification expression in which the lower, modal, and upper fuzzy values were combined as ((l+2m+u)/4). A threshold value of 0.70 was used for retaining indicators. Indicators with values at or above the threshold were retained, whereas indicators falling below the threshold were reconsidered or removed. Consensus was considered to have been achieved when the difference between the defuzzified mean scores across two consecutive fuzzy Delphi rounds was less than 0.20 for all retained criteria. Calculations related to the fuzzy Delphi process were performed in Microsoft Excel.

After the components were finalized through the fuzzy Delphi process, Interpretive Structural Modeling was used to determine the hierarchical relationships among them. An expert questionnaire was prepared in the form of a structural self-interaction matrix in which each pair of factors was compared according to the direction of their conceptual influence. Expert judgments were integrated according to the logic of the ISM procedure. The structural self-interaction matrix was transformed into an initial binary reachability matrix using values of zero and one, after which transitivity was examined. Where a factor influenced a second factor and the second factor influenced a third, the indirect relationship between the first and third factors was incorporated into the final reachability matrix when theoretically and structurally appropriate. For each factor, reachability and antecedent sets were determined, and their intersections were used to identify hierarchical levels. Factors whose intersection set corresponded to their reachability set were assigned to the highest available level, removed from subsequent iterations, and the procedure was repeated until all factors had been assigned to a structural level. Driving power and dependence power were additionally calculated from the final reachability matrix to clarify the relative structural position of each component within the implementation model.

The relative weighting and prioritization of the identified components were determined using the Step-wise Weight Assessment Ratio Analysis method. Experts first ranked the criteria from the most to the least important. The relative importance of each criterion compared with the criterion immediately preceding it was then determined and expressed as (S_j). A coefficient (K_j) was calculated as ($K_j = S_j + 1$). The initial weight of the highest-ranked criterion was set equal to one, and the preliminary weight of each subsequent criterion was obtained by dividing the preliminary weight of the preceding criterion by its corresponding (K_j). Finally, the weights were normalized by dividing each preliminary weight by the sum of all preliminary weights. This procedure provided normalized final weights reflecting the relative importance of the different organizational, managerial, economic-social, legal, and other components identified during the qualitative stage.

The final quantitative instrument was a researcher-developed questionnaire constructed from the themes, components, and indicators generated in the qualitative phase and refined through expert evaluation. The questionnaire consisted of a demographic section and a specialized section measuring the dimensions of the modern public sector accounting implementation model. Demographic questions addressed characteristics such as

gender, age, and educational attainment. Specialized items were scored using a five-point Likert scale ranging from 1 for very low or strongly limited importance to 5 for very high or very strong importance, depending on the wording of the item. Prior to the main survey, preliminary reliability was evaluated using responses from 14 participants. Cronbach's alpha coefficients were 0.927 for organizational factors, 0.817 for managerial factors, 0.796 for economic and social factors, 0.837 for legal factors, and 0.908 for the total instrument, indicating satisfactory to excellent internal consistency.

The validity of the quantitative instrument was assessed using content validity, face validity, and construct validity procedures. Content validity was examined with the Content Validity Ratio and Content Validity Index based on evaluations by subject-matter experts. For the Content Validity Ratio, experts classified each item as essential, useful but not essential, or unnecessary, and items were retained according to the minimum acceptable value corresponding to the number of evaluators. For the Content Validity Index, experts assessed the relevance, clarity, and simplicity of each item using a four-point rating scale. Face validity was evaluated among representatives of the target population using the item-impact method. Respondents rated the importance of each questionnaire item on a five-point scale ranging from not important at all to completely important, and the impact score was calculated from the percentage frequency of respondents assigning high importance multiplied by the mean importance score. Items with an impact score greater than 1.50 were considered acceptable. Construct validity was subsequently evaluated statistically through confirmatory factor analysis and the assessment of the measurement model in partial least squares structural equation modeling.

Qualitative data analysis was conducted through a systematic and iterative coding process combining open, axial, and selective coding with thematic analysis. After each interview was transcribed, the researcher repeatedly read the transcripts to become deeply familiar with the content and to identify meaningful statements relevant to the implementation of modern public sector accounting. During open coding, the interview texts were examined line by line and meaningful words, phrases, sentences, and conceptual units were extracted and assigned preliminary codes. Similar codes were compared and grouped into initial categories. During axial coding, relationships among the preliminary categories were examined, conceptually related codes were consolidated, subcategories were distinguished, and broader analytical categories were formed. During selective coding, the major categories were integrated and their conceptual interrelationships were examined to construct an overall explanatory framework. The thematic analysis process was recursive rather than strictly linear. It involved repeated movement between the raw data, coded extracts, candidate themes, and the emerging conceptual structure. The analytical procedure therefore included familiarization with the data, generation of initial codes, searching for candidate themes, reviewing and refining themes, defining and naming themes, and producing the final analytical narrative. MAXQDA 2018 was used to organize transcripts, codes, code families, categories, and thematic relationships.

After the qualitative themes and indicators were extracted, the fuzzy Delphi method was applied to establish expert consensus regarding the relevance and importance of the identified indicators. Triangular fuzzy values were aggregated and defuzzified, and indicators meeting the predetermined threshold of 0.70 were retained. Stability of expert judgments between consecutive rounds was examined using changes in defuzzified mean values, with differences below 0.20 interpreted as sufficient consensus. Microsoft Excel was used for the fuzzy calculations. The finalized components were then entered into Interpretive Structural Modeling to identify their hierarchical arrangement and structural influence. The structural self-interaction matrix was converted into binary reachability matrices, transitivity was checked, reachability and antecedent sets were determined, and successive hierarchical

levels were extracted until all criteria had been assigned to a structural level. Driving and dependence powers were calculated to facilitate interpretation of the strategic position of the factors within the model. The SWARA method was subsequently employed to calculate the normalized importance weights of the factors and to establish their final priorities.

Quantitative data were analyzed using descriptive and inferential statistics. Descriptive analyses included frequencies and percentages for demographic variables and means, standard deviations, skewness coefficients, and related distributional indices for the principal study variables. The distribution of quantitative variables was examined using the Kolmogorov-Smirnov test, together with descriptive distributional indices where appropriate. Inferential analyses included correlation and regression-based procedures, confirmatory factor analysis, evaluation of the measurement model, and structural equation modeling. The principal validation analysis was performed using partial least squares structural equation modeling in SmartPLS. The measurement model was examined to determine whether the observed questionnaire items adequately represented their intended latent constructs. This assessment included examination of indicator loadings, internal consistency reliability, convergent validity, discriminant validity, and construct-level measurement quality. Cronbach's alpha and composite reliability coefficients were used to assess internal consistency, while convergent validity was examined through factor loadings and average variance extracted. The structural model was then assessed to determine the magnitude and statistical significance of the hypothesized relationships among the latent constructs and to evaluate the explanatory capability of the proposed implementation framework.

The structural equation model was used to test both the measurement and structural components of the proposed model. In the measurement component, relationships between observed questionnaire indicators and their corresponding latent constructs were assessed to determine whether each indicator adequately represented the theoretical dimension assigned to it. In the structural component, relationships among latent variables were examined to determine the direct and indirect influence of organizational, managerial, economic-social, legal, and other identified factors on the implementation of modern public sector accounting. Path coefficients and their significance levels were estimated using the resampling procedures available in SmartPLS. Model explanatory power was examined through coefficients of determination for endogenous constructs, and predictive and goodness-of-fit criteria appropriate to partial least squares modeling were used to evaluate overall model quality. Collectively, the qualitative coding, fuzzy Delphi screening, ISM hierarchical modeling, SWARA weighting procedure, and PLS-SEM validation constituted an integrated methodological process through which the final implementation model for modern public sector accounting was developed, prioritized, structurally organized, and empirically validated.

3. Findings and Results

The findings were derived sequentially from the qualitative interviews, fuzzy Delphi screening, Interpretive Structural Modeling, MICMAC analysis, quantitative validation using PLS-SEM, and final prioritization using SWARA.

Fourteen experts participated in the qualitative phase. All experts were men. Five participants (35.71%) were aged 31–40 years, five (35.71%) were aged 41–50 years, and four (28.57%) were older than 50 years; none was younger than 30 years. Regarding academic qualifications, six experts (42.86%) held master's degrees and eight (57.14%) held doctoral degrees. In terms of professional experience, three experts (21.43%) had 5–10 years of experience, five (35.71%) had 11–15 years, and six (42.86%) had 16–20 years of experience. Therefore, all participants

had postgraduate qualifications and substantial professional experience relevant to governmental and public sector accounting.

The qualitative analysis followed an iterative thematic process. Interview transcripts were repeatedly reviewed to ensure immersion in the data, after which preliminary codes and subthemes were extracted. Closely related codes were integrated into secondary themes, themes were repeatedly reviewed against the original interview data, and the resulting categories were defined and named. Open, axial, and selective coding were conducted in MAXQDA 2018. Constant movement between raw interview material, extracted concepts, subthemes, and main themes enabled refinement of the conceptual structure until no substantively new codes were identified. The analysis eventually yielded four dimensions comprising 15 components. The organizational and managerial dimensions represented internal factors, whereas legal-regulatory and economic-social dimensions represented external factors.

Table 1. Qualitative Dimensions and Components of the Modern Public Sector Accounting Model

Factor	Dimension	Component	Code Frequency	Main Content Identified in the Interviews
Internal	Organizational factors	Organizational structure	13	Forward-looking and accountability-oriented strategy; structural flexibility; decentralized decision-making; facilitative organizational arrangements; efficiency and effectiveness
Internal	Organizational factors	Organizational culture	12	Internal integration; innovation and development; transmission of appropriate perceptions and values; ethical accountability; attention to processes and outcomes
Internal	Organizational factors	Human resources	10	Knowledge and skills; employee motivation; adaptability; continuous training; teamwork; merit-based employment and competency development
Internal	Organizational factors	Information systems and information technology	14	Accurate recording; timely reporting; communication and payment mechanisms; information circulation; cost reduction; online reporting; data protection; decision support
Internal	Organizational factors	Budget and financial resources	9	Adequate financial resources; continuity of budget allocation; transparency; coordination of plans; implementation capacity; employee motivation
Internal	Managerial factors	Leadership and senior management	13	Leadership support; communication of organizational objectives; sustained leadership; appropriate leadership styles; employee cohesion; conflict resolution; innovation
Internal	Managerial factors	Planning and implementation	12	Formal planning; clear objectives and schedules; coordination; efficient resource utilization; preparation for contingencies; successful implementation
Internal	Managerial factors	Monitoring and evaluation	9	Continuous supervision; identification of strengths and weaknesses; transparency; information security; productivity; accountability; corrective action
Internal	Managerial factors	Financial reporting	12	Reliable reporting; public disclosure; transparency; timely information; accountability; identification of trends; organizational sustainability
External	Legal and regulatory factors	Public sector accounting laws and regulations	10	Regulatory independence; legal compliance; transparency; reduction of accounting errors; improved control over resources
External	Legal and regulatory factors	Public sector accounting standards	12	Compliance with standards; improved reporting quality; accountability; benchmarks for performance; stimulation of professional effort and innovation
External	Legal and regulatory factors	Implementation guidelines	8	Coordinated implementation; practical guidance; operational discipline; prevention of deviation; clarification of implementation steps

External	Economic and social factors	Economic conditions	13	Reporting under inflationary conditions; economic indicators; public welfare; public expenditure; economic consequences of programs
External	Economic and social factors	Societal expectations	12	Public accountability; transparent expenditure reporting; reality-based reports; disclosure of development expenditures; timely public reporting
External	Economic and social factors	Information needs of public sector accounting users	10	Disclosure of major contracts; reporting details; timely and accurate information; responsiveness to information users

The qualitative coding showed that information systems and information technology received particularly strong emphasis, followed by leadership and senior management and economic conditions. The interviews further indicated that modern public sector accounting was not viewed simply as a technical accounting system. Instead, implementation was considered contingent on organizational structure and culture, competent employees, sustained financial support, leadership, planning, monitoring, reporting mechanisms, legal standards, economic conditions, societal expectations, and user information requirements.

Theoretical saturation was reached by the fourteenth interview. No genuinely new open, axial, or selective codes emerged from the final interview, and the newly coded material represented repetition or reinforcement of categories already identified. At the dimensional level, organizational factors appeared in 11 coded documents, managerial factors in 10, and economic-social and legal-regulatory factors in nine each. At the component level, all 15 final components had already become stable within the interview set.

Table 2. Theoretical Saturation and Frequency of Identified Dimensions and Components

Level	Dimension/Component	Frequency	Percentage of All Interviews (%)
Dimension	Organizational factors	11	78.57
Dimension	Managerial factors	10	71.43
Dimension	Economic and social factors	9	64.29
Dimension	Legal and regulatory factors	9	64.29
Component	Information systems and information technology	13	92.86
Component	Leadership and senior management	13	92.86
Component	Economic conditions	13	92.86
Component	Financial reporting	12	85.71
Component	Organizational structure	11	78.57
Component	Planning and implementation	11	78.57
Component	Public sector accounting standards	11	78.57
Component	Societal expectations	10	71.43
Component	Information needs of public sector accounting users	10	71.43
Component	Organizational culture	10	71.43
Component	Monitoring and evaluation	9	64.29
Component	Public sector accounting laws and regulations	9	64.29
Component	Human resources	9	64.29
Component	Budget and financial resources	8	57.14
Component	Implementation guidelines	8	57.14

Accordingly, the qualitative stage produced a conceptual architecture consisting of two overarching factors, four dimensions, 15 components, and an initial pool of indicators. The internal factor comprised organizational and managerial dimensions, whereas the external factor comprised legal-regulatory and economic-social dimensions.

The initial indicators identified through the qualitative phase were submitted to the 14-member expert panel. Experts evaluated each item using five fuzzy linguistic categories: Very Important, Important, Moderately

Important, Unimportant, and Very Unimportant, represented respectively by the triangular fuzzy numbers (0.75, 1, 1), (0.50, 0.75, 1), (0.25, 0.50, 0.75), (0, 0.25, 0.50), and (0, 0, 0.25). Expert responses demonstrated generally high levels of agreement, although several indicators received substantial numbers of moderate, unimportant, or very unimportant judgments. After aggregation, triangular fuzzy means were defuzzified using the specified weighted formula. A score of 0.70 was used as the retention threshold.

Table 3. Fuzzy Delphi Screening Results

Code	Final Score	Decision	Code	Final Score	Decision
A1	0.77	Retained	A2	0.64	Removed
A3	0.79	Retained	A4	0.88	Retained
A5	0.79	Retained	B1	0.66	Removed
B2	0.80	Retained	B3	0.89	Retained
B4	0.86	Retained	C1	0.87	Retained
C2	0.76	Retained	C3	0.78	Retained
D1	0.73	Retained	D2	0.75	Retained
D3	0.76	Retained	D4	0.52	Removed
E1	0.63	Removed	E2	0.79	Retained
E3	0.74	Retained	E4	0.65	Removed
F1	0.84	Retained	F2	0.72	Retained
F3	0.79	Retained	F4	0.64	Removed
G1	0.80	Retained	G2	0.73	Retained
G3	0.80	Retained	G4	0.63	Removed
H1	0.63	Removed	H2	0.80	Retained
H3	0.83	Retained	H4	0.73	Retained
I1	0.57	Removed	I2	0.72	Retained
I3	0.85	Retained	I4	0.76	Retained
J1	0.46	Removed	J2	0.84	Retained
J3	0.77	Retained	J4	0.82	Retained
K1	0.74	Retained	K2	0.83	Retained
K3	0.76	Retained	K4	0.46	Removed
L1	0.73	Retained	L2	0.82	Retained
L3	0.55	Removed	L4	0.75	Retained
M1	0.77	Retained	M2	0.55	Removed
M3	0.49	Removed	M4	0.79	Retained
M5	0.86	Retained	N1	0.83	Retained
N2	0.81	Retained	N3	0.51	Removed
N4	0.80	Retained	N5	0.90	Retained
O1	0.61	Removed	O2	0.88	Retained
O3	0.79	Retained	O4	0.77	Retained

Items with scores below 0.70 were deleted following expert feedback. The eliminated indicators were A2, B1, D4, E1, E4, F4, G4, H1, I1, J1, K4, L3, M2, M3, N3, and O1. Thus, 16 indicators were removed and 46 were retained for the final operational model. The highest fuzzy Delphi scores were observed for N5 (0.90), B3 (0.89), A4 and O2 (0.88 each), C1 (0.87), and B4 and M5 (0.86 each).

Table 4. Final Indicators Retained after Fuzzy Delphi Screening

Component	Retained Indicators
Organizational structure (A)	A1: Forward-looking and accountability-oriented organizational strategy; A3: decentralized decision-making for proper implementation of programs; A4: organizational structure facilitating public sector accounting; A5: emphasis on efficiency and effectiveness

Organizational culture (B)	B2: internal integration, creation, discovery, and development; B3: accountability for collected public resources; B4: attention to both details and outcomes
Human resources (C)	C1: employee knowledge and skills; C2: employee motivation, enthusiasm, flexibility, and system efficiency; C3: competency development to improve individual and organizational performance
Information systems and IT (D)	D1: accurate recording and timely reporting; D2: rapid mechanisms for communication, transactions, and payments; D3: effective use of information systems and IT to reduce costs
Budget and financial resources (E)	E2: financial support and appropriate budgeting to coordinate program components; E3: greater transparency through adequate financing
Leadership and senior management (F)	F1: sustained leadership to improve employee implementation performance; F2: leadership-based empathy and effective communication; F3: leadership behavior improving productivity and workforce retention
Planning and implementation (G)	G1: consideration of all implementation elements through proper planning; G2: coordination and cooperation across units; G3: economic efficiency through appropriate planning and implementation
Monitoring and evaluation (H)	H2: improved performance quality through monitoring; H3: productivity, performance tracking, accountability, and responsibility through evaluation; H4: monitoring the desired implementation process
Financial reporting (I)	I2: financial reporting enhances transparency; I3: accurate and timely reports enhance effectiveness; I4: financial reporting promotes progress, adaptation, and successful implementation
Laws and regulations (J)	J2: legal framework for improved implementation; J3: financial transparency through compliance with regulations; J4: reduction of errors and improvement of accuracy through legal compliance
Public sector accounting standards (K)	K1: accounting quality improvement through standards; K2: greater employee accountability and responsibility; K3: greater effort and innovation through specified standards
Implementation guidelines (L)	L1: coordinated performance of activities through guidelines; L2: action-oriented employee behavior; L4: guidelines facilitating an appropriate implementation path
Economic conditions (M)	M1: reporting resource expenditures under differing inflationary conditions; M4: consideration of exchange rates, economic growth, and GDP; M5: public communication of programs intended to improve economic conditions
Societal expectations (N)	N1: accountability for acquired and expended resources; N2: factual public reports; N4: efficient reporting system for society; N5: importance of timeliness in reporting to society
User information needs (O)	O2: disclosure of detailed accounting reports; O3: accurate and timely information; O4: appropriate responsiveness to users of public sector accounting information

The 15 final components were next examined through ISM. The 14 experts completed pairwise comparisons using the V, A, X, and O relational symbols, where V represented influence from component *i* to component *j*, A represented the reverse direction, X indicated mutual influence, and O represented no substantive relationship. The modal response among the 14 experts was used to construct the final Structural Self-Interaction Matrix. The SSIM was subsequently transformed into a binary initial reachability matrix by replacing V, A, X, and O according to the ISM transformation rules. Transitivity was then applied: when component *i* influenced *j* and *j* influenced *k*, an indirect relationship between *i* and *k* was incorporated where appropriate. This procedure produced the final reachability matrix and enabled extraction of reachability sets, antecedent sets, intersections, hierarchical levels, driving power, and dependence power.

The resulting structure had two levels. Organizational structure, organizational culture, information systems and IT, leadership and senior management, public sector accounting laws and regulations, public sector accounting standards, implementation guidelines, and economic conditions were assigned to Level 1. Human resources, budget and financial resources, planning and implementation, monitoring and evaluation, financial reporting, societal expectations, and user information needs were assigned to Level 2.

Table 5. ISM Levels, Driving Power, Dependence Power, and MICMAC Classification

Component	Code	Level	Driving Power	Dependence Power	MICMAC Classification
Organizational structure	A	1	15	15	Linkage
Organizational culture	B	1	15	15	Linkage
Human resources	C	2	12	15	Dependent
Information systems and IT	D	1	15	15	Linkage

Budget and financial resources	E	2	14	13	Independent
Leadership and senior management	F	1	13	15	Dependent
Planning and implementation	G	2	15	13	Independent
Monitoring and evaluation	H	2	14	12	Independent
Financial reporting	I	2	15	14	Linkage
Laws and regulations	J	1	15	15	Linkage
Public sector accounting standards	K	1	14	15	Linkage
Implementation guidelines	L	1	15	15	Linkage
Economic conditions	M	1	13	15	Dependent
Societal expectations	N	2	15	13	Independent
User information needs	O	2	13	14	Dependent

The MICMAC results showed no prominent autonomous component. Economic conditions, user information needs, leadership and senior management, and human resources were classified primarily as dependent variables because they exhibited relatively strong dependence on the broader system. Organizational structure, organizational culture, information systems and IT, implementation guidelines, public sector accounting laws and regulations, public sector accounting standards, and financial reporting were linkage variables, indicating simultaneously high driving and dependence powers. These variables were therefore particularly sensitive because changes in them could propagate across the system and generate feedback effects. Budget and financial resources, planning and implementation, monitoring and evaluation, and societal expectations were identified as independent or driving variables.

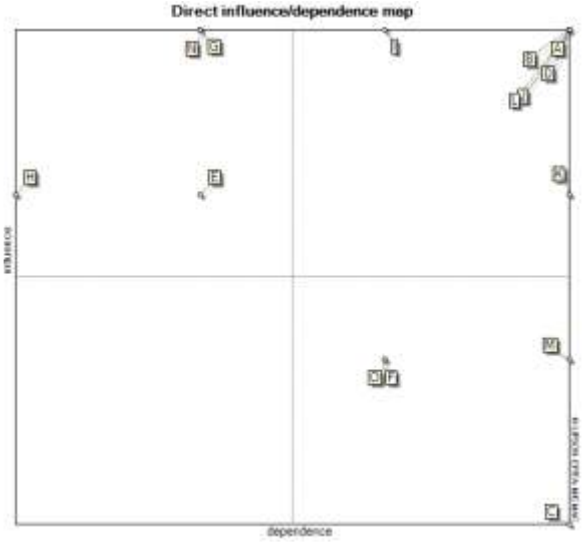

Figure 1. MICMAC Results

A total of 291 complete questionnaires were obtained in the quantitative phase. Of these respondents, 180 (61.9%) were men and 111 (38.1%) were women. Regarding age, 151 respondents (51.9%) were aged 31–40 years, 100 (34.4%) were aged 41–50 years, and 40 (13.7%) were aged 51 years or older. In terms of education, 158 respondents (54.3%) held bachelor's degrees, 90 (30.9%) held master's degrees, and 43 (14.8%) held doctoral degrees. Regarding professional experience, 17 respondents (5.8%) had 1–5 years of service, 24 (8.2%) had 6–10 years, 60 (20.6%) had 11–15 years, 56 (19.2%) had 16–20 years, 91 (31.3%) had 21–25 years, 40 (13.7%) had 26–30 years, and three respondents (1.0%) had more than 30 years of service.

Because PLS-SEM is distribution-free and does not require multivariate normality in the same manner as covariance-based SEM, formal normality was not treated as a prerequisite for estimation. The measurement and

structural models were estimated in SmartPLS 4. Evaluation proceeded through indicator reliability, internal consistency, convergent validity, discriminant validity, explanatory power, predictive relevance, global model diagnostics, and structural path testing.

Indicator loadings were generally high and statistically significant. All reported bootstrap *t* statistics substantially exceeded 1.96, and all corresponding significance levels were below .001. Although one financial reporting item had a loading of 0.637, it remained statistically significant and was retained within the measurement model; all other loadings were approximately 0.735 or higher.

Table 6. Indicator Loadings of the Measurement Model

Indicator	Construct	Loading	SD	t	p
Q1	Organizational structure	0.898	0.015	58.544	<.001
Q2	Organizational structure	0.789	0.040	19.613	<.001
Q3	Organizational structure	0.888	0.018	48.676	<.001
Q4	Organizational structure	0.782	0.031	25.240	<.001
Q5	Organizational culture	0.943	0.010	92.503	<.001
Q6	Organizational culture	0.933	0.013	70.719	<.001
Q7	Organizational culture	0.937	0.012	78.859	<.001
Q8	Human resources	0.829	0.025	33.084	<.001
Q9	Human resources	0.850	0.023	37.049	<.001
Q10	Human resources	0.870	0.019	46.450	<.001
Q11	Information systems and IT	0.851	0.030	28.324	<.001
Q12	Information systems and IT	0.856	0.034	25.405	<.001
Q13	Information systems and IT	0.862	0.013	64.632	<.001
Q14	Budget and financial resources	0.926	0.012	79.811	<.001
Q15	Budget and financial resources	0.798	0.043	18.586	<.001
Q16	Leadership and senior management	0.818	0.030	27.639	<.001
Q17	Leadership and senior management	0.892	0.019	47.932	<.001
Q18	Leadership and senior management	0.811	0.029	27.590	<.001
Q19	Planning and implementation	0.872	0.019	46.937	<.001
Q20	Planning and implementation	0.855	0.023	36.886	<.001
Q21	Planning and implementation	0.852	0.026	32.182	<.001
Q22	Monitoring and evaluation	0.745	0.039	19.102	<.001
Q23	Monitoring and evaluation	0.804	0.033	24.422	<.001
Q24	Monitoring and evaluation	0.912	0.013	71.532	<.001
Q25	Financial reporting	0.892	0.016	56.160	<.001
Q26	Financial reporting	0.909	0.015	62.514	<.001
Q27	Financial reporting	0.637	0.078	8.180	<.001
Q28	Laws and regulations	0.878	0.028	31.376	<.001
Q29	Laws and regulations	0.850	0.026	32.220	<.001
Q30	Laws and regulations	0.869	0.021	41.074	<.001
Q31	Public sector accounting standards	0.880	0.016	55.703	<.001
Q32	Public sector accounting standards	0.888	0.015	58.032	<.001
Q33	Public sector accounting standards	0.735	0.039	19.039	<.001
Q34	Implementation guidelines	0.865	0.021	40.764	<.001
Q35	Implementation guidelines	0.897	0.016	56.034	<.001
Q36	Implementation guidelines	0.858	0.021	41.711	<.001
Q37	Economic conditions	0.904	0.024	38.073	<.001
Q38	Economic conditions	0.950	0.007	137.924	<.001
Q39	Economic conditions	0.924	0.012	77.976	<.001
Q40	Societal expectations	0.876	0.021	42.595	<.001

Q41	Societal expectations	0.860	0.024	36.541	<.001
Q42	Societal expectations	0.873	0.026	34.151	<.001
Q43	Societal expectations	0.843	0.036	23.383	<.001
Q44	User information needs	0.900	0.012	72.959	<.001
Q45	User information needs	0.809	0.039	20.505	<.001
Q46	User information needs	0.875	0.021	42.344	<.001

Internal consistency was examined through Cronbach's alpha and composite reliability. All Cronbach's alpha values exceeded 0.70. Composite reliability was also above 0.70 for all reported constructs. Convergent validity was examined using AVE, with all reported AVE values exceeding the 0.50 criterion.

Table 7. Reliability and Convergent Validity of the Constructs

Construct	Cronbach's α	Composite Reliability	AVE
Modern public sector accounting	0.939	0.973	0.948
Internal factors	0.957	0.961	0.961
Organizational factors	0.941	0.947	0.949
Organizational structure	0.860	0.862	0.906
Organizational culture	0.931	0.933	0.956
Human resources	0.807	0.808	0.886
Information systems and IT	0.822	0.845	0.892
Budget and financial resources	0.776	0.777	0.854
Managerial factors	0.920	0.928	0.933
Leadership and senior management	0.792	0.798	0.879
Planning and implementation	0.824	0.826	0.895
Monitoring and evaluation	0.757	0.768	0.862
Financial reporting	0.760	0.838	0.859
External factors	0.930	0.934	0.943
Legal and regulatory factors	0.903	0.905	0.921
Laws and regulations	0.833	0.834	0.900
Public sector accounting standards	0.782	0.787	0.875
Implementation guidelines	0.845	0.847	0.906
Economic and social factors	0.847	0.855	0.898
Economic conditions	0.918	0.925	0.948
Societal expectations	0.886	0.888	0.921
User information needs	0.826	0.830	0.897

Discriminant validity was additionally examined using the Fornell-Larcker criterion. The diagonal values representing the square roots of AVE were compared with the correlations among the principal higher-order constructs. Based on the reported matrix, the diagonal values were generally greater than the corresponding inter-construct correlations, providing support for discriminant validity.

Table 8. Fornell-Larcker Matrix for the Higher-Order Constructs

Construct	MPSA	ES	External	Internal	Organizational	Legal-Regulatory	Managerial
Modern public sector accounting (MPSA)	0.714						
Economic and social factors (ES)	0.684	0.829					
External factors	0.684	0.771	0.822				
Internal factors	0.668	0.719	0.762	0.762			
Organizational factors	0.625	0.689	0.736	0.650	0.746		
Legal and regulatory factors	0.473	0.314	0.365	0.360	0.342	0.751	
Managerial factors	0.674	0.647	0.678	0.613	0.739	0.326	0.735

The explanatory power of the structural model was evaluated using R^2, while predictive relevance was assessed using Stone-Geisser's Q^2. Most endogenous constructs displayed moderate to very high explained variance. The strongest coefficients of determination were observed for economic and social factors ($R^2 = .942$), societal expectations ($R^2 = .938$), internal factors ($R^2 = .937$), and organizational factors ($R^2 = .902$). Although the legal-regulatory higher-order construct had a substantially lower $R^2 = .133$, most remaining constructs demonstrated considerable explanatory power. All reported Q^2values for modeled endogenous constructs were above zero, supporting predictive relevance.

Table 9. Explanatory Power and Predictive Relevance of the Structural Model

Endogenous Construct	R^2	Adjusted R^2	Q^2
Public sector accounting standards	0.894	0.893	0.620
Societal expectations	0.938	0.937	0.690
Planning and implementation	0.772	0.771	0.562
Budget and financial resources	0.505	0.503	0.358
Implementation guidelines	0.682	0.681	0.512
Leadership and senior management	0.795	0.794	0.557
Organizational structure	0.836	0.836	0.579
Information systems and IT	0.658	0.656	0.457
Economic conditions	0.758	0.757	0.643
Economic and social factors	0.942	0.942	0.640
External factors	0.782	0.781	0.522
Internal factors	0.937	0.936	0.441
Organizational factors	0.902	0.902	0.493
Legal and regulatory factors	0.133	0.129	0.073
Managerial factors	0.833	0.832	0.442
Organizational culture	0.785	0.784	0.680
Laws and regulations	0.733	0.732	0.542
Human resources	0.827	0.826	0.586
Monitoring and evaluation	0.830	0.829	0.553
User information needs	0.721	0.720	0.526
Financial reporting	0.705	0.704	0.453

The overall model assessment also produced favorable indices. Based on the reported calculations, the mean AVE was 0.694 and the mean $R^2$was 0.760, yielding a GOF value of 0.726. Using the conventional interpretation employed in the study, this represented strong overall fit. Because GOF is not generally recommended as the primary goodness-of-fit criterion in contemporary PLS-SEM, SRMR and NFI were also considered. SRMR was 0.063, below commonly applied cutoffs of 0.08–0.10, and NFI was 0.919, exceeding the 0.90 criterion.

Table 10. Overall Model Fit Indices

Index	Obtained Value	Interpretation
Mean AVE	0.694	Adequate
Mean R^2	0.760	Strong explanatory capacity
GOF	0.726	Strong according to the study's criterion
SRMR	0.063	Acceptable
NFI	0.919	Acceptable

Bootstrapping results demonstrated that all direct structural relationships specified in the model were statistically significant. Modern public sector accounting showed a particularly strong association with internal

factors ($\beta = .968$) and a substantial association with external factors ($\beta = .884$). External factors were strongly represented by economic-social factors ($\beta = .971$) and legal-regulatory factors ($\beta = .865$), while internal factors were strongly represented by organizational ($\beta = .950$) and managerial factors ($\beta = .913$).

Table 11. Direct Effects in the Structural Model

Structural Path	β	SD	t	p	Result
Modern public sector accounting → External factors	0.884	0.017	51.568	<.001	Supported
Modern public sector accounting → Internal factors	0.968	0.006	149.489	<.001	Supported
Economic-social factors → Societal expectations	0.968	0.004	266.985	<.001	Supported
Economic-social factors → Economic conditions	0.871	0.018	47.746	<.001	Supported
Economic-social factors → User information needs	0.849	0.022	37.808	<.001	Supported
External factors → Economic-social factors	0.971	0.004	219.925	<.001	Supported
External factors → Legal-regulatory factors	0.865	0.052	16.634	<.001	Supported
Internal factors → Organizational factors	0.950	0.007	128.508	<.001	Supported
Internal factors → Managerial factors	0.913	0.014	65.110	<.001	Supported
Organizational factors → Budget and financial resources	0.711	0.043	16.505	<.001	Supported
Organizational factors → Organizational structure	0.914	0.014	66.912	<.001	Supported
Organizational factors → Information systems and IT	0.811	0.026	31.656	<.001	Supported
Organizational factors → Organizational culture	0.886	0.022	39.967	<.001	Supported
Organizational factors → Human resources	0.909	0.014	64.635	<.001	Supported
Legal-regulatory factors → Public sector accounting standards	0.945	0.007	131.422	<.001	Supported
Legal-regulatory factors → Implementation guidelines	0.826	0.026	31.187	<.001	Supported
Legal-regulatory factors → Laws and regulations	0.856	0.026	32.980	<.001	Supported
Managerial factors → Planning and implementation	0.879	0.020	43.116	<.001	Supported
Managerial factors → Leadership and senior management	0.892	0.016	54.421	<.001	Supported
Managerial factors → Monitoring and evaluation	0.911	0.011	82.236	<.001	Supported
Managerial factors → Financial reporting	0.840	0.019	43.439	<.001	Supported

Because every reported t statistic exceeded 1.96 and all p values were below .05, all structural relationships specified in the model were statistically supported at the 95% confidence level.

In the final analytical stage, the 14 experts evaluated the relative importance of the factors, dimensions, and components using SWARA. At the highest level, internal factors received an average relative importance score of 1.00 and external factors 0.8643. Their normalized weights were 0.6509 and 0.3491, respectively, indicating substantially greater importance for internal determinants. Among the four dimensions, organizational factors received the highest normalized weight (0.483), followed by managerial factors (0.269), legal-regulatory factors (0.158), and economic-social factors (0.089).

At the component level, organizational structure had the highest priority. Organizational culture ranked second, laws and regulations third, human resources fourth, public sector accounting standards fifth, and implementation guidelines sixth. The lowest weights were obtained for financial reporting, monitoring and evaluation, and planning and implementation within the final SWARA hierarchy.

Table 12. Final SWARA Weights and Ranking of Factors, Dimensions, and Components

Higher-Order Factor	Factor Weight	Dimension	Dimension Weight	Component	Code	Final Weight	Rank
Internal factors	0.650873	Organizational factors	0.483165	Organizational structure	A	0.293788	1
Internal factors	0.650873	Organizational factors	0.483165	Organizational culture	B	0.160665	2

External factors	0.349127	Legal-regulatory factors	0.157863	Laws and regulations	J	0.154457	3
Internal factors	0.650873	Organizational factors	0.483165	Human resources	C	0.088366	4
External factors	0.349127	Legal-regulatory factors	0.157863	Public sector accounting standards	K	0.088261	5
External factors	0.349127	Legal-regulatory factors	0.157863	Implementation guidelines	L	0.050027	6
Internal factors	0.650873	Organizational factors	0.483165	Information systems and IT	D	0.049092	7
External factors	0.349127	Economic-social factors	0.089477	Economic conditions	M	0.028355	8
Internal factors	0.650873	Organizational factors	0.483165	Budget and financial resources	E	0.027273	9
External factors	0.349127	Economic-social factors	0.089477	Societal expectations	N	0.017335	10
Internal factors	0.650873	Managerial factors	0.269495	Leadership and senior management	F	0.015521	11
External factors	0.349127	Economic-social factors	0.089477	User information needs	O	0.010691	12
Internal factors	0.650873	Managerial factors	0.269495	Planning and implementation	G	0.008657	13
Internal factors	0.650873	Managerial factors	0.269495	Monitoring and evaluation	H	0.004868	14
Internal factors	0.650873	Managerial factors	0.269495	Financial reporting	I	0.002641	15

Taken together, the qualitative, fuzzy Delphi, ISM/MICMAC, PLS-SEM, and SWARA findings converged on a multidimensional implementation model for modern public sector accounting. The final framework consisted of internal and external factors, four principal dimensions, 15 components, and 46 validated indicators. Internal factors received greater priority than external factors, and organizational factors emerged as the most influential dimension. At the component level, organizational structure was the highest-priority determinant, followed by organizational culture and public sector accounting laws and regulations. Quantitative validation further showed statistically significant structural relationships throughout the proposed model, acceptable reliability and validity indices, substantial explanatory and predictive power for most endogenous constructs, and acceptable overall model fit.

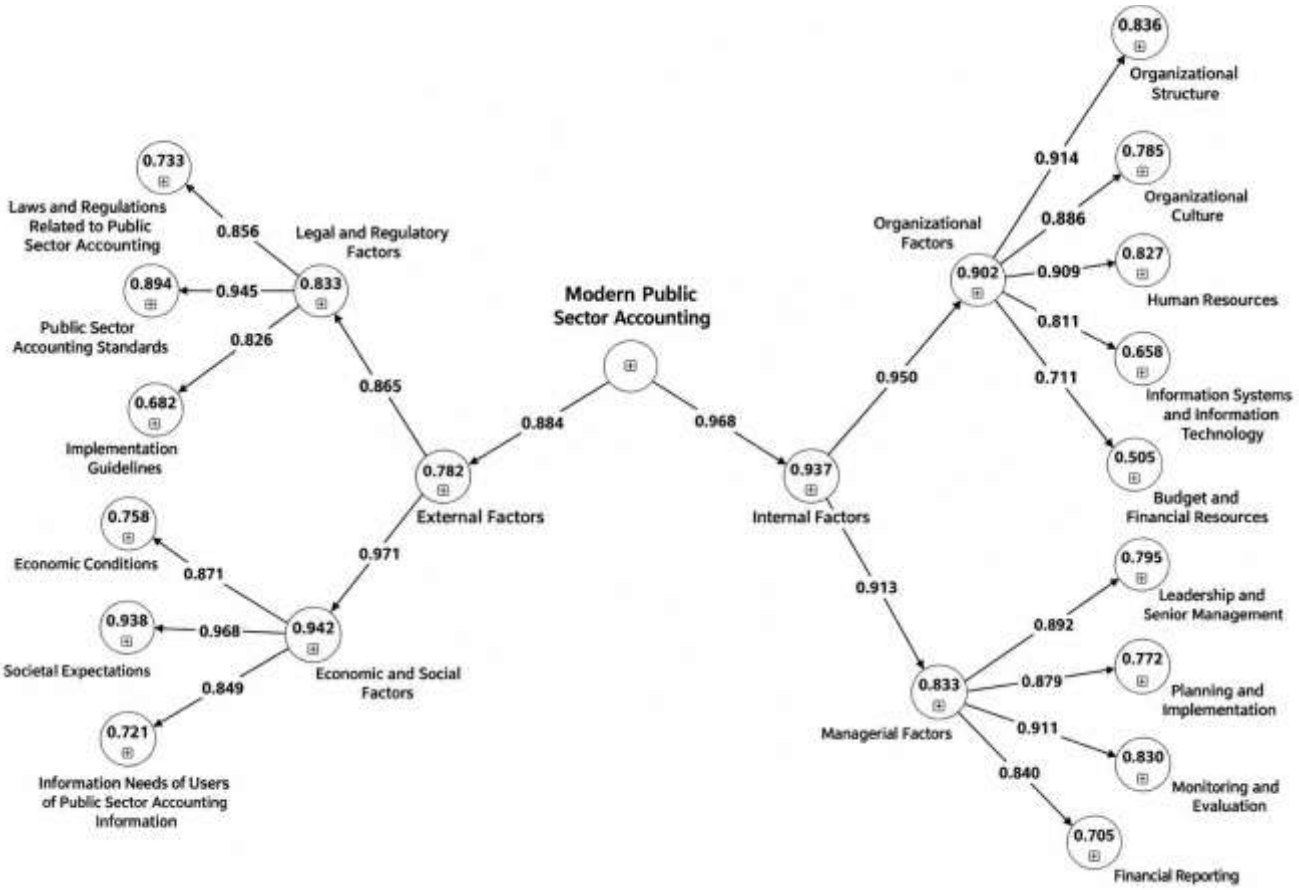

Figure 2. Model with Factor Loadings

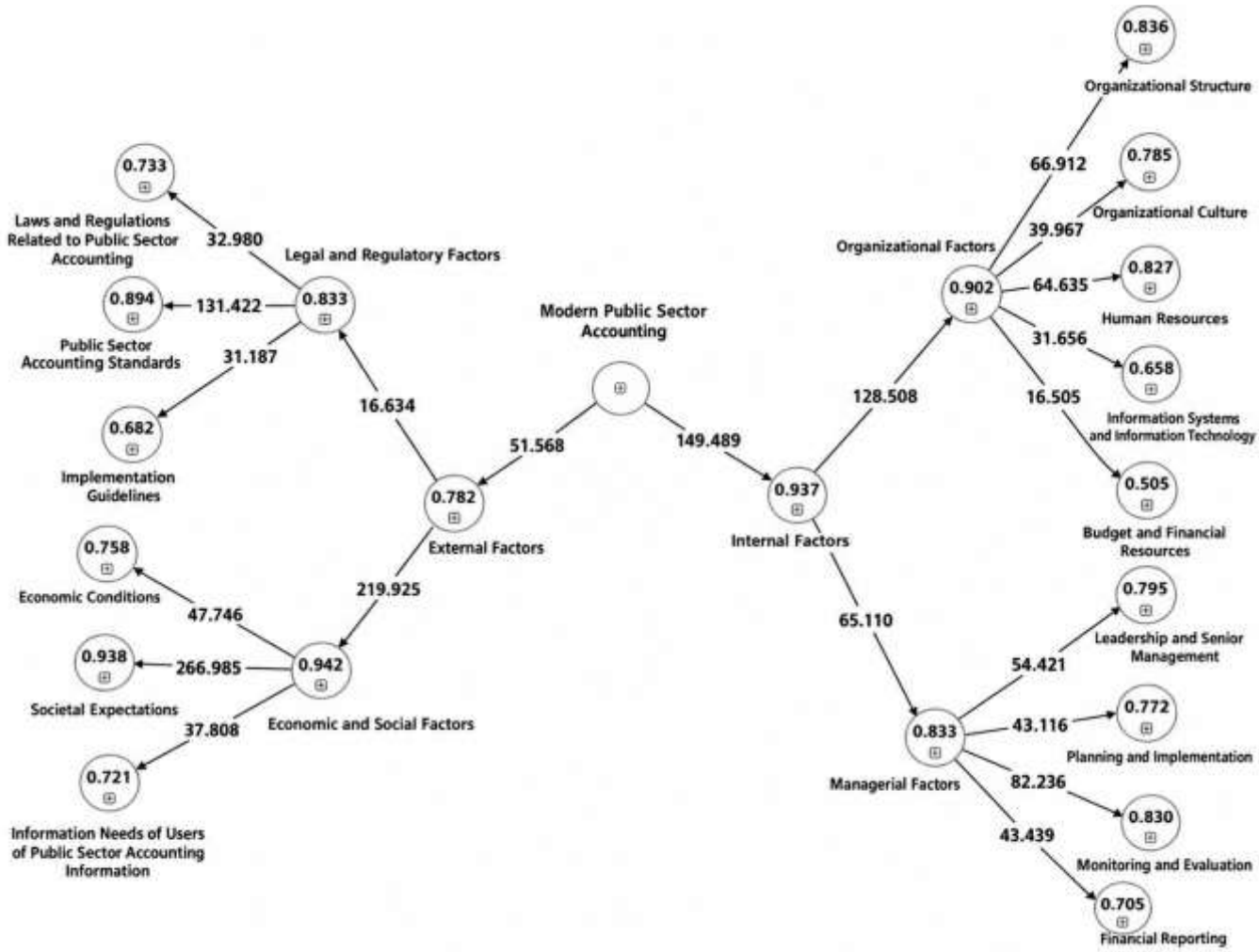

Figure 3. Model with T-Values

4. Discussion and Conclusion

The present study was conducted to design and validate an implementation model for modern public sector accounting through an exploratory mixed-methods approach integrating qualitative thematic analysis, fuzzy Delphi, Interpretive Structural Modeling, MICMAC analysis, PLS-SEM, and SWARA prioritization. The findings demonstrated that modern public sector accounting is a multidimensional system shaped by two overarching categories of internal and external factors, four major dimensions, 15 components, and 46 validated indicators. Internal factors included organizational and managerial dimensions, whereas external factors comprised legal-regulatory and economic-social dimensions. The quantitative findings further confirmed the structural relationships among these dimensions and components, and all direct paths in the proposed model were statistically significant. The final prioritization showed that internal factors had a substantially greater weight than external factors, while organizational factors were more important than managerial, legal-regulatory, and economic-social dimensions. At the component level, organizational structure ranked first, followed by organizational culture, laws and regulations related to public sector accounting, human resources, public sector accounting standards, and implementation guidelines. These results indicate that the successful modernization of public sector accounting depends primarily on the organizational environment in which accounting reform is implemented rather than merely on the formal adoption of new accounting techniques.

One of the principal findings was the dominant role of internal factors, which obtained a higher SWARA weight than external factors and also showed a very strong structural association with modern public sector accounting. This finding suggests that institutional reforms in public sector accounting cannot be implemented effectively unless public organizations possess appropriate structures, managerial commitment, skilled personnel, technological infrastructure, financial resources, monitoring mechanisms, and effective reporting processes. This result is consistent with research emphasizing that modernization in accounting is fundamentally an organizational transformation rather than a purely technological change. The transition from traditional accounting to digital accounting requires organizational readiness, strategic alignment, process redesign, and the ability to integrate emerging technologies into routine accounting activities [4]. Similarly, the adoption of digital accounting systems depends not only on the technical characteristics of the system but also on facilitating conditions, user acceptance, organizational support, and implementation capacity [6]. Research on the strategic use of artificial intelligence in accounting also shows that technological innovations are more effective when embedded within an explicit organizational and managerial strategy [11]. Therefore, the prominence of internal factors in the present model can be interpreted as evidence that accounting modernization is dependent on organizational capability to absorb, institutionalize, and sustain change.

Among internal dimensions, organizational factors had the highest priority. Organizational structure emerged as the highest-ranked component in the entire model, and its structural path coefficient was also strong. This finding indicates that the design of responsibilities, authority, communication channels, decentralization, and coordination mechanisms strongly conditions the implementation of modern public sector accounting. A flexible and supportive organizational structure can facilitate timely information flow, accelerate decision-making, clarify responsibilities, and create conditions for the effective use of accounting information. This interpretation is aligned with the broader literature on management accounting, which suggests that the effectiveness of accounting practices depends on their fit with organizational and contingency characteristics [10]. Strategic management accounting similarly requires coordination between accounting functions and broader organizational processes if accounting information is to influence investment and managerial decisions [26]. In addition, accounting information systems become more valuable when they are integrated with organizational decision structures and environmental requirements rather than treated as stand-alone technical systems [9]. The present findings therefore reinforce the view that organizational structure is a foundational condition for modern public sector accounting because it determines how information, authority, accountability, and resources are distributed throughout the institution.

Organizational culture was the second-ranked component, which further confirms that successful modernization depends on behavioral and normative conditions. A culture supporting accountability, innovation, learning, integration, ethical conduct, and responsiveness can reduce resistance to accounting reform and increase willingness to use new systems. This finding is consistent with research showing that professional accounting behavior is shaped by ethical values, cultural norms, and professional identity. Ethical accounting models emphasize integrity, responsibility, and moral commitment as central to reliable accounting practice [13]. Likewise, research concerning the ethical predispositions of accounting students indicates that professional attitudes and ethical reasoning are important determinants of future accounting behavior and can be strengthened through education and institutional development [14]. The influence of cultural values on the professional ethics of public accountants has also been demonstrated, suggesting that accounting behavior is not independent of the social and cultural environment in which professionals operate [15]. Thus, the high priority given to organizational culture in

the present study is theoretically meaningful because modern public sector accounting requires not only formal procedures but also shared values supporting transparency, responsibility, innovation, and public service.

Human resources also emerged as an important component, ranking fourth in the final prioritization. The qualitative findings emphasized knowledge, skills, motivation, adaptability, continuous learning, and competency development. This result reflects the fact that digital and modern accounting systems require new professional competencies, including data analysis, technological literacy, understanding of information systems, risk assessment, and the ability to interpret complex financial and nonfinancial information. Research on artificial intelligence in accounting has identified both significant opportunities and substantial professional challenges, particularly the need for accountants to acquire new analytical and technological competencies [5]. Similarly, the digital transformation of public sector accounting and the increasing importance of intangible and technology-related assets require accountants to develop new forms of expertise and judgment [8]. The findings of the present study therefore suggest that investment in accounting technology without corresponding investment in employee competencies may produce limited results. The modernization of public sector accounting depends heavily on human capability to operate systems, interpret outputs, identify problems, and transform accounting data into useful managerial and public information.

Information systems and information technology constituted another important organizational component and showed a substantial relationship with organizational factors. The qualitative results highlighted accurate recording, timely reporting, communication mechanisms, transaction processing, cost reduction, and improved decision-making as central functions of information technology. This finding strongly corresponds with previous research showing that accounting information systems are increasingly necessary for strategic management accounting and organizational responsiveness [9]. Digital accounting systems have also been associated with greater efficiency, automation, accuracy, accessibility, and timeliness of accounting information [6]. Furthermore, blockchain and artificial intelligence can strengthen accounting system integrity and improve transparency, although they simultaneously create new regulatory, legal, and governance requirements [7]. The present findings therefore support the interpretation that information technology is not simply an operational tool; rather, it is an enabling infrastructure that links accounting, management, oversight, and public reporting.

Managerial factors also demonstrated a strong relationship with the modern public sector accounting model. Leadership and senior management, planning and implementation, monitoring and evaluation, and financial reporting were all statistically significant components. Leadership was particularly important because modernization requires managerial commitment to communicate objectives, allocate resources, resolve conflicts, encourage innovation, and support employees during organizational change. This result is compatible with research emphasizing characteristics such as commitment, responsibility, service orientation, and value-based leadership in effective public management [16]. Leadership support is also likely to influence the effectiveness of internal control and audit functions, which depend on organizational independence, managerial support, professional capability, and appropriate institutional conditions [21]. Consequently, modern public sector accounting should not be regarded as a project confined to accounting departments; it requires leadership at the organizational level.

Planning and implementation, monitoring and evaluation, and financial reporting also played significant roles in the structural model. These components suggest that modernization must be treated as a continuous management cycle rather than a one-time reform. Planning provides direction and resource allocation, implementation translates accounting reforms into operating processes, monitoring identifies deviations and

weaknesses, and financial reporting communicates outcomes to stakeholders. The importance of monitoring is consistent with evidence demonstrating that internal control and forensic accounting mechanisms strengthen fraud prevention in the public sector [20]. Forensic accounting techniques have also been shown to improve fraud detection and reduce reporting risks in public entities [17, 18]. Similarly, fraud prevention models developed for public organizations emphasize the integration of accounting, control, monitoring, and institutional oversight [19]. Performance audit research further supports the importance of evaluation indicators in determining whether public resources are used economically, efficiently, and effectively [22]. These studies provide support for the present finding that monitoring, evaluation, and financial reporting are essential for operationalizing accountability within modern public sector accounting.

Regarding external factors, legal and regulatory factors formed an important dimension of the model, and laws and regulations were ranked third among all 15 components. Public sector accounting operates within a highly regulated environment in which compliance requirements, standards, reporting obligations, fiscal rules, and accountability arrangements significantly influence accounting practice. The strong importance of legal-regulatory factors is consistent with research showing that modern technologies such as blockchain and artificial intelligence create new accounting opportunities but must operate within appropriate legal and regulatory frameworks [7]. The present study also found that public sector accounting standards and implementation guidelines were important components. Standards establish minimum expectations for consistency, comparability, accountability, and reporting quality, while implementation guidelines translate broad requirements into operational procedures. This combination is especially important because the existence of formal accounting standards does not automatically guarantee effective implementation. Institutions require detailed procedures, organizational capacity, competent employees, and management support to translate standards into routine practice.

Economic and social factors also had a significant structural role. Economic conditions, societal expectations, and the information needs of public sector accounting users were all retained and confirmed in the model. The importance of economic conditions reflects the fact that accounting information must capture and communicate the implications of inflation, resource constraints, economic growth, public investment, and fiscal pressures. Public-private partnership research, for example, demonstrates the importance of rigorous assessment of investment and financial risks in public projects [3]. At the same time, accounting systems must increasingly respond to societal expectations regarding transparency, accountability, and public value. The finding that societal expectations had one of the strongest path coefficients in the structural model indicates that modern public sector accounting should be outward-looking and responsive to stakeholders. This is consistent with evidence that perceptions of public sector accountability can influence citizens' behavioral responses, including voluntary tax compliance [1]. The social role of accounting professionals also extends beyond technical reporting, as accountants increasingly contribute to institutional legitimacy, public trust, and expert judgment [12]. These findings reinforce the argument that public sector accounting should be designed not only for internal administrative control but also for citizens, oversight bodies, policymakers, and other information users.

The significance of economic and social considerations is also supported by the expanding role of sustainability and environmental accounting. Modern public sector accounting increasingly needs to account for environmental costs, waste management, sustainability performance, and long-term social consequences. Environmental accounting research has identified specific components that can be integrated into accounting systems to improve the measurement and management of environmental performance [23]. Green management accounting practices have similarly been linked to improved sustainability performance [24], while broader analyses of sustainability

research demonstrate that accounting is increasingly connected to environmental responsibility and long-term value creation [25]. These trends support the present study's inclusion of economic and social factors within the external environment of modern public sector accounting.

The structural model also demonstrated strong explanatory and predictive power for most endogenous constructs. The high R^2values for internal factors, organizational factors, economic-social factors, and societal expectations indicate that the proposed framework successfully explains substantial portions of variance in its principal dimensions. Similarly, positive Q^2values supported predictive relevance. Measurement-model results also showed acceptable internal consistency, convergent validity, and overall structural performance. These findings indicate that the model is not merely an exploratory categorization but possesses empirical coherence. This is particularly important because previous studies have often examined digital accounting, AI, internal control, sustainability, or forensic accounting in isolation [4, 20, 25, 27]. By integrating these areas into a single implementation framework, the present study extends prior literature and provides a more comprehensive explanation of the organizational and environmental requirements of public sector accounting modernization.

The study has several limitations that should be considered when interpreting its findings. The qualitative phase was based on a relatively small group of highly specialized experts, and although theoretical saturation was achieved, the participants may not represent the full diversity of perspectives within all public organizations. The expert panel was also entirely male, which limits demographic diversity in the qualitative phase. The quantitative findings were based on self-reported questionnaire data and may therefore be affected by common-method bias, social desirability, or respondents' subjective understanding of modern public sector accounting. The cross-sectional nature of the quantitative phase prevents assessment of how the proposed relationships evolve over time. In addition, although the model integrates multiple analytical approaches, the weighting and structural relationships partly reflect expert judgments within a specific institutional context and may require recalibration before being generalized to other countries or administrative systems.

Future studies could validate the proposed model in different governmental sectors, provinces, and national settings to evaluate its external validity and institutional sensitivity. Comparative studies between central government, municipalities, public universities, health organizations, and state-owned enterprises could identify whether the relative importance of organizational, managerial, legal, and socioeconomic dimensions varies across administrative environments. Longitudinal research could examine how implementation of modern public sector accounting changes organizational performance, transparency, accountability, audit quality, and decision-making over time. Future studies could also incorporate objective administrative data, audit findings, financial indicators, and digital-system usage records alongside questionnaires. Additional research may examine mediating or moderating roles of organizational readiness, digital maturity, leadership style, professional competence, ethical climate, and environmental uncertainty. Cross-country studies could further investigate whether the structural priorities identified in this model are stable across different legal traditions and public financial management systems.

Public sector decision-makers should treat accounting modernization as an organizational reform program rather than a software implementation project. Priority should first be given to establishing flexible organizational structures, strengthening an accountability-oriented culture, clarifying responsibilities, and developing employee competencies. Managers should ensure that accounting information systems are integrated with planning, budgeting, reporting, monitoring, and decision-making processes and that sufficient financial resources are allocated for continuous implementation rather than temporary adoption. Public organizations should strengthen

legal compliance, operational guidelines, and alignment with public sector accounting standards while preserving sufficient managerial flexibility for implementation. Leadership development, continuous professional training, internal control, performance monitoring, and timely financial reporting should be institutionalized as permanent elements of the accounting system. Finally, reporting systems should be designed around the needs of both internal managers and external stakeholders so that modern public sector accounting contributes simultaneously to operational efficiency, public accountability, transparency, and informed decision-making.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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