

## Modeling academic leadership in secondary schools: evidence from northeastern Thailand

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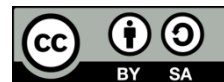
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### ABSTRACT

This study aimed to develop and empirically test a structural equation model of academic leadership among secondary school administrators in northeastern Thailand. Data were collected from 480 administrators using a structured questionnaire and analyzed through confirmatory factor analysis (CFA) and structural equation modeling (SEM). The results indicate that leadership personality and organizational context significantly influence curriculum leadership and innovation culture, which subsequently shape academic leadership outcomes. The proposed model explains 73.8% of the variance in academic leadership, demonstrating strong explanatory power. These findings contribute to the literature by providing an integrated structural framework that highlights the interplay between leadership capacity and contextual support in enhancing instructional quality and school effectiveness. However, the findings should be interpreted with caution due to the cross-sectional design and reliance on self-reported data.

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## 1. INTRODUCTION

The rapid transformation of education in the 21st century has been driven by digital technology, globalization, and increasing societal complexity [1], [2]. Educational institutions are no longer static organizations but dynamic learning systems that must continuously adapt to technological disruption and evolving societal expectations [3], [4]. Consequently, school administrators are required to develop academic leadership capacities that extend beyond traditional managerial roles to effectively guide educational change and sustain institutional development in uncertain environments [5]. Global trends, including digital transformation and the COVID-19 pandemic, have further reinforced the critical role of academic leadership in maintaining educational quality and institutional resilience [6]–[9]. Academic leadership encompasses curriculum development, instructional improvement, and teacher professional growth, and has been consistently associated with school effectiveness and student achievement [10]–[12]. These developments highlight the increasing importance of leadership practices that are both adaptive and instructionally focused in contemporary education systems. Despite these expectations, many secondary schools continue to face challenges in effectively implementing academic leadership, particularly in aligning leadership capacity with organizational support systems [10], [12]. In Thailand, educational reforms under the National Strategy 2018–2037 and Thailand 4.0 policy emphasize the development of 21st century competencies and improvements in instructional quality [13]–[16]. However, persistent challenges remain, especially in northeastern Thailand, where socioeconomic disparities and resource limitations create additional constraints on leadership practices [17]–[20]. These contextual conditions suggest that leadership effectiveness cannot be

fully understood without considering the interaction between internal leadership capacity and external organizational environments.

Previous studies have identified leadership characteristics, organizational context, and instructional management as key determinants of academic leadership [5], [10], [19]. However, much of this research has examined these factors independently, with limited integration within a comprehensive structural framework [21], [22]. In particular, the mediating mechanisms through which leadership capacity and contextual support are translated into academic leadership outcomes remain insufficiently explored. This limitation highlights a critical gap in the literature, especially in the context of secondary education systems in developing and regionally diverse settings. To address this gap, the present study develops and empirically tests a structural equation model of academic leadership among secondary school administrators in northeastern Thailand. The model integrates leadership personality and contextual support as exogenous variables, with curriculum leadership and innovation culture functioning as mediating constructs that translate leadership capacity into academic leadership outcomes. By adopting an integrative and structural approach, this study aims to provide a more comprehensive understanding of the mechanisms underlying academic leadership in contemporary educational contexts.

The conceptual framework of this study was developed through a systematic synthesis of relevant theoretical perspectives and empirical studies to explain the structural relationships underlying academic leadership among secondary school administrators in northeastern Thailand. The framework provides a comprehensive explanation of how internal leadership capacity and external organizational conditions interact to shape academic leadership outcomes. Academic leadership is conceptualized as a dynamic outcome emerging from these interactions, rather than a static individual attribute. Leadership personality and contextual support are specified as exogenous variables that influence academic leadership both directly and indirectly through two mediating constructs: curriculum leadership and innovation culture. These mediating mechanisms play a critical role in translating leadership capacity and contextual support into effective instructional practices and school improvement outcomes.

The framework consists of five latent variables—leadership personality, contextual support, curriculum leadership, innovation culture, and academic leadership—as illustrated in Figure 1. Leadership personality represents internal leadership capacity, including professional competence, ethical orientation, and leadership self-efficacy, while contextual support reflects organizational conditions such as policy alignment, resource availability, and institutional climate. Together, these foundational factors establish the conditions necessary for effective leadership practices. Curriculum leadership and innovation culture are conceptualized as key mediating mechanisms within the model. Curriculum leadership encompasses instructional management, curriculum alignment, and teacher development processes, whereas innovation culture reflects the capacity of schools to promote collaborative learning, adaptability, and continuous improvement. These constructs function as institutional processes through which leadership capacity and contextual conditions are operationalized into academic leadership outcomes.

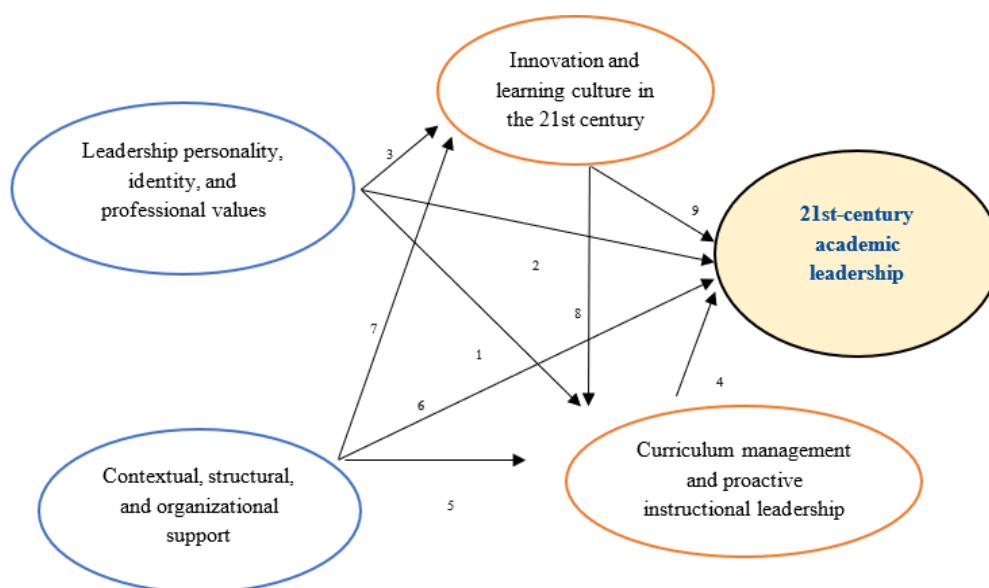


Figure 1. Proposed structural model of 21st-century academic leadership

Academic leadership is defined as a multidimensional construct integrating instructional management, curriculum development, and the creation of supportive learning environments. The model assumes that leadership personality and contextual support influence academic leadership both directly and indirectly through the mediating roles of curriculum leadership and innovation culture. This integrated structural perspective provides a theoretically grounded basis for empirical testing using structural equation modeling (SEM). The framework integrates perspectives from leadership theory, organizational theory, and instructional leadership research [5], [22], [23], supporting a systemic understanding of academic leadership as an outcome of dynamic interactions among leadership attributes, organizational conditions, and innovation-oriented practices. Furthermore, the alignment between the conceptual framework (Figure 1) and Table 1 ensures both theoretical coherence and empirical testability.

Table 1. Synthesis of references supporting the conceptual framework

Model path no.	Key supporting references
1	Fairholm [24]; Fry [25]; Chen and Yang [26]; Marques <i>et al.</i> [27]; Hongsachai [28]; Saengsri-ngam [29]; Japa <i>et al.</i> [30]; Atchawat [31]
2	Greenleaf [32]; Huong [33]; Petpanwong <i>et al.</i> [34]; Aossuwan <i>et al.</i> [35]
3	Hallinger [5]; Malik [36]; Kleysen and Street [37]; King and DeCicco [38]; Leithwood [39]; Janthasaeng [40]
4	Petpanwong <i>et al.</i> [34]; Grobler [41]; Dorukbaşı and Cansoy [42]; Khetking <i>et al.</i> [43]
5	Bass and Avolio [44]; Hoy and Miskel [45]; Office of the Basic Education Commission (OBEC) [46]; Office of the Education Council [47]; Ponghanyut [48]; Phonprathum [49]
6	Huong [33]; Grobler [41]; Leithwood <i>et al.</i> [50]; Brauckmann and Schwarz [51]; Cooray [52]; Wichiansan <i>et al.</i> [53]
7	Davis and Newstrom [54]; Koontz and Wehrich [55]; Hengjaiboon [56]; Ukham [57]; Siphambun <i>et al.</i> [58]
8	Bass and Avolio [44]; Hoy and Miskel [45]; Yukl [59]; Marshall [60]; Prathum [61]; Jansila [62]
9	Huong [33]; Dorukbaşı and Cansoy [42]

## 2. METHOD

### 2.1. Research design

This study employed a quantitative cross-sectional research design using SEM to examine the relationships among factors influencing academic leadership. The research design was selected to enable the simultaneous analysis of multiple relationships among latent constructs within a theoretically specified model. Confirmatory factor analysis (CFA) was conducted to validate the measurement model, followed by SEM to test the hypothesized structural relationships among latent variables. Given the cross-sectional nature of the data, the estimated relationships are interpreted as theoretically specified directional paths rather than causal effects.

### 2.2. Population and sample

The population comprised secondary school administrators under the Secondary Educational Service Area Offices in northeastern Thailand. A multi-stage stratified sampling technique was employed based on geographic region and school size to ensure representative coverage across diverse educational contexts. This approach enhanced the generalizability of the findings within the regional setting. Data were collected from 480 administrators (393 principals and 87 vice-principals), representing schools across 11 provinces. A 100% response rate was achieved through systematic follow-up procedures and coordination with educational authorities, thereby minimizing non-response bias. The sample size exceeded commonly recommended thresholds for SEM, ensuring adequate statistical power and model stability.

Prior to analysis, the dataset was screened for completeness and distributional assumptions. No missing data were detected. Skewness and kurtosis values were within acceptable thresholds ( $|\text{skewness}| < 2$ ;  $|\text{kurtosis}| < 7$ ), indicating that the assumption of normality was satisfied and supporting the use of maximum likelihood estimation.

### 2.3. Research instrument

Data were collected using a structured questionnaire developed through an extensive review of international and national literature on academic leadership, instructional leadership, organizational behavior, and innovation-oriented educational management. The instrument was designed to operationalize the conceptual framework proposed in this study. The questionnaire comprised five latent constructs: leadership personality (PERS), contextual support (CONTEXT), curriculum leadership (CURR), innovation culture (INNOV), and academic leadership (ACADL). Each construct consisted of four observed variables, yielding a total of 20 observed variables. Each observed variable was measured using multiple items on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Content validity was established through expert evaluation using the index of item congruence (IOC), with values ranging from 0.67 to 1.00 (mean=0.89), exceeding acceptable criteria. A pilot study (n=50) was conducted to assess clarity and preliminary reliability, yielding high internal consistency (Cronbach's alpha=0.93–0.97). Following full-scale data collection (n=480), reliability was reassessed, with Cronbach's alpha coefficients ranging from 0.95 to 0.97 and an overall reliability of 0.98, indicating excellent internal consistency. The relatively large number of items per construct was intended to ensure comprehensive domain coverage and strengthen construct validity, reflecting the multidimensional nature of academic leadership. CFA further supported the measurement structure through statistically significant factor loadings and satisfactory model fit indices. Control variables included administrator position (principal or vice-principal) and school size to account for structural differences among schools.

#### **2.4. Common method bias**

To minimize common method variance, both procedural and statistical remedies were applied. Procedural measures included anonymity assurance, clear item wording, and careful questionnaire design to reduce social desirability bias and response patterns. Harman's single-factor test indicated that a single factor accounted for less than 40% of the total variance, suggesting that common method bias (CMV) was not a serious concern. However, the use of single-source self-reported data remains a limitation.

#### **2.5. Instrument validation**

Construct validity was assessed using CFA. The measurement model demonstrated satisfactory fit to the empirical data ( $\chi^2=557.778$ ,  $df=160$ , CFI=0.963, Tucker–Lewis index or TLI=0.956, root mean square error of approximation or RMSEA=0.072, standardized root mean square residual or SRMR=0.051). All standardized factor loadings were statistically significant ( $p<0.001$ ) and exceeded 0.70, indicating strong indicator reliability. Composite reliability (CR) values ranged from 0.94 to 0.97, while average variance extracted (AVE) ranged from 0.72 to 0.85, supporting convergent validity. Discriminant validity was confirmed using the Fornell–Larcker criterion, indicating that all constructs were empirically distinct.

#### **2.6. Data collection**

Data were collected over a two-month period using online questionnaires and coordinated communication with educational offices. Participation was voluntary, and confidentiality was assured in accordance with ethical research standards. All responses were complete, resulting in no missing data.

#### **2.7. Data analysis**

Data were analyzed using Mplus version 8.3 with maximum likelihood estimation. CFA was conducted to validate the measurement model, followed by SEM to test the hypothesized relationships among variables. Model fit was evaluated using multiple goodness-of-fit indices, including  $\chi^2$ ,  $df$ , CFI, TLI, RMSEA, and SRMR, based on established criteria (CFI and TLI  $\geq 0.90$ ; RMSEA and SRMR  $\leq 0.08$ ). These indices were selected to provide a comprehensive assessment of model adequacy.

### **3. RESULTS**

#### **3.1. Preliminary analysis**

Descriptive statistics indicated consistently high levels across all constructs, with mean scores ranging from 4.06 to 4.08. Skewness (−0.12 to 0.10) and kurtosis (−0.97 to −0.04) values were within acceptable thresholds ( $|\text{skewness}|<2$ ;  $|\text{kurtosis}|<7$ ), indicating no violations of normality assumptions. These results confirm the suitability of the data for CFA and SEM.

#### **3.2. Measurement model evaluation**

CFA demonstrated satisfactory model fit to the empirical data ( $\chi^2=557.778$ ,  $df=160$ , CFI=0.963, TLI=0.956, RMSEA=0.072, SRMR=0.051). All standardized factor loadings were statistically significant ( $p<0.001$ ) and exceeded 0.70, indicating strong indicator reliability. CR values ranged from 0.94 to 0.97, and AVE ranged from 0.72 to 0.85, supporting convergent validity. Discriminant validity was confirmed using the Fornell–Larcker criterion, indicating that all constructs were empirically distinct. Overall, these results demonstrate that the measurement model is both reliable and valid for subsequent structural analysis.

#### **3.3. Structural model analysis**

SEM was conducted to examine the hypothesized relationships among the latent constructs. The structural model demonstrated excellent fit to the empirical data ( $\chi^2=149.849$ ,  $df=160$ ,  $p=0.706$ , CFI=1.000, TLI=1.001, RMSEA=0.000, SRMR=0.018). Although the model exhibited near-perfect fit indices, such

results may reflect high model parsimony or close correspondence between the hypothesized structure and empirical data. Therefore, these fit indices should be interpreted with caution despite the absence of post-hoc model modifications. Leadership personality (PERS) significantly influenced innovation culture ( $\beta=0.574$ ,  $p<0.001$ ) and curriculum leadership ( $\beta=0.392$ ,  $p<0.001$ ). Similarly, contextual support (CONTEXT) demonstrated significant effects on innovation ( $\beta=0.545$ ,  $p<0.001$ ) and curriculum leadership ( $\beta=0.367$ ,  $p<0.001$ ). Innovation culture further contributed to curriculum leadership ( $\beta=0.286$ ,  $p<0.001$ ).

Both curriculum leadership and innovation culture exerted significant direct effects on academic leadership (ACADL), with curriculum leadership showing the strongest effect ( $\beta=0.315$ ,  $p<0.001$ ), followed by innovation culture ( $\beta=0.271$ ,  $p<0.001$ ). In addition, leadership personality ( $\beta=0.228$ ,  $p<0.001$ ) and contextual support ( $\beta=0.267$ ,  $p<0.001$ ) also had significant direct effects on academic leadership. Indirect effects were substantial. Leadership personality demonstrated an indirect effect of 0.356 and a total effect of 0.584 on academic leadership, while contextual support showed an indirect effect of 0.325 and the strongest total effect (0.592). The model explained 61.7% of the variance in curriculum leadership, 63.1% in innovation culture, and 73.8% in academic leadership, indicating strong explanatory power. Figure 2 presents the structural equation model with standardized path coefficients, while Table 2 summarizes the direct, indirect, and total effects among variables. All hypothesized paths were statistically significant ( $p<0.001$ ), confirming the proposed structural relationships.

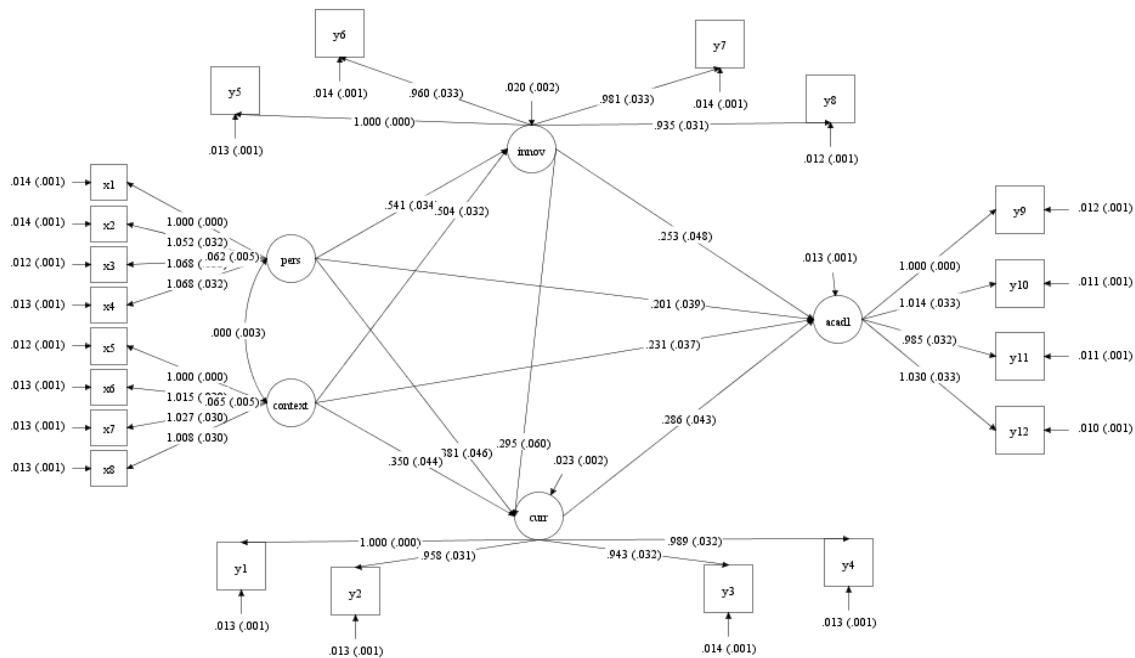


Figure 2. Structural equation model of factors influencing 21st-century academic leadership

Table 2. Direct, indirect, and total effects in the structural model

Path	Direct effect	Indirect effect	Total effect
PERS→CURR	0.392***	–	0.392
CONTEXT→CURR	0.367***	–	0.367
INNOV→CURR	0.286***	–	0.286
PERS→INNOV	0.574***	–	0.574
CONTEXT→INNOV	0.545***	–	0.545
PERS→ACADL	0.228***	0.356	0.584
CONTEXT→ACADL	0.267***	0.325	0.592
CURR→ACADL	0.315***	–	0.315
INNOV→ACADL	0.271***	0.090	0.361

Note: \*\*\* $p<0.001$

#### 4. DISCUSSION

The findings of this study provide strong empirical support for a structural model explaining academic leadership among secondary school administrators in northeastern Thailand. The results confirm that both internal leadership capacity and external organizational conditions significantly influence academic

leadership through the mediating roles of curriculum leadership and innovation culture [5], [22], [23]. The model explained 73.8% of the variance in academic leadership, indicating substantial explanatory power and suggesting that the proposed framework captures key mechanisms underlying leadership effectiveness in contemporary educational contexts. Leadership personality emerged as a significant predictor of both curriculum leadership and innovation culture, reinforcing theoretical perspectives that emphasize professional competence, ethical orientation, and leadership self-efficacy as foundational elements of effective educational leadership [12], [44], [59]. This finding suggests that leadership effectiveness is not merely a function of formal authority but is deeply rooted in internal leadership capacity, which shapes instructional direction, innovation readiness, and organizational engagement. These results are consistent with prior studies highlighting leadership self-efficacy and value-based leadership as critical drivers of academic leadership [24], [25]. Contextual and organizational support demonstrated the strongest total effect on academic leadership, underscoring the critical role of policy alignment, resource availability, and organizational climate in enabling effective leadership practices [19], [20], [50]. This finding extends existing research by suggesting that leadership effectiveness is structurally conditioned rather than solely individually determined. In resource-constrained environments such as northeastern Thailand, where disparities in infrastructure, access to professional development, and institutional support remain evident, leadership effectiveness becomes highly dependent on contextual enablers. Therefore, supportive organizational conditions are essential for translating leadership capacity into meaningful educational outcomes and sustaining long-term school improvement.

Curriculum leadership and innovation culture functioned as key mediating mechanisms linking leadership capacity and contextual support to academic leadership outcomes. Curriculum leadership demonstrated the strongest direct effect, highlighting the central role of instructional management, curriculum alignment, and teacher development in shaping school effectiveness [5], [10], [22], [50]. At the same time, innovation culture contributed both directly and indirectly, indicating that adaptive, collaborative, and innovation-driven practices are essential for sustaining academic leadership in rapidly changing educational environments. These findings suggest that leadership effectiveness is operationalized through structured institutional processes rather than direct individual action alone. These mediation patterns suggest that academic leadership is not simply an individual attribute but is institutionally constructed through organizational processes and innovation-oriented practices. This finding advances a systemic perspective of leadership development, emphasizing the dynamic interaction between leadership competence and contextual conditions rather than isolated individual traits [20], [50]. From a theoretical standpoint, the results support and extend contemporary perspectives on adaptive and context-responsive leadership by demonstrating how leadership capacity is translated into practice through mediating mechanisms within a structural framework.

This study contributes to the literature by integrating leadership personality, contextual support, curriculum leadership, and innovation culture into a unified structural framework [5], [22]. By demonstrating how these factors interact through mediating mechanisms, the findings extend current theoretical understanding of academic leadership as a context-responsive and structurally embedded process within complex educational systems [11], [50]. The relatively high explanatory power of the model further suggests that integrative approaches capturing both individual and organizational dimensions are essential for understanding leadership effectiveness. From a practical perspective, the findings suggest that efforts to strengthen academic leadership should address both leadership development and organizational support systems. Professional development programs should emphasize leadership self-efficacy, ethical leadership, and innovation-oriented competencies [2], [44], [59], while policy initiatives should focus on enhancing institutional support, resource allocation, and school-level autonomy [20], [50]. In addition, fostering professional learning communities and innovation-driven school cultures may further enhance leadership effectiveness and promote sustainable educational improvement. Overall, the findings highlight the multidimensional and systemic nature of academic leadership in contemporary education. The validated structural model provides a theoretically grounded and empirically supported framework for understanding how leadership capacity and contextual conditions jointly shape academic leadership outcomes, offering valuable implications for future research, policy development, and educational practice.

This study extends existing leadership models by integrating multiple dimensions of leadership and organizational context into a unified structural framework of academic leadership [5], [11], [22], [50]. The findings support a systemic and context-responsive perspective of leadership development, in which leadership effectiveness emerges from dynamic interactions between internal leadership capacity and external organizational conditions [20], [50]. Importantly, this perspective advances current theoretical understanding by positioning academic leadership as a structurally embedded and interaction-driven process rather than an outcome of isolated individual attributes. Although the model was empirically tested in northeastern Thailand, the identified structural relationships reflect broader patterns observed in educational systems undergoing transformation in the digital and knowledge-based era [1], [6], [9]. The mediating roles of curriculum

leadership and innovation culture provide a transferable conceptual mechanism for explaining how leadership capacity is translated into effective instructional and organizational outcomes across diverse contexts [8], [23]. This suggests that the proposed framework has broader applicability beyond the specific regional setting.

By demonstrating how leadership personality and organizational context jointly influence academic leadership through mediating institutional processes, this study contributes to the advancement of integrative and adaptive leadership models in contemporary education [2], [5], [59]. The findings provide a theoretically grounded foundation for future research to further examine leadership dynamics within complex, rapidly evolving, and resource-constrained educational environments.

## 5. CONCLUSION

This study developed and validated a structural equation model of academic leadership among secondary school administrators. The findings indicate that academic leadership is shaped by the interaction between leadership personality and organizational context, mediated by curriculum leadership and innovation culture. The results highlight that academic leadership is structurally embedded within organizational processes rather than solely an individual attribute. This study provides an integrated framework explaining how internal and external factors jointly influence academic leadership, with implications for leadership development and educational policy. However, the findings should be interpreted with caution due to the cross-sectional design and reliance on self-reported data. Future research should validate the model across contexts using longitudinal and multi-source approaches.

This study has several limitations that should be considered. First, the research was conducted among secondary school administrators in northeastern Thailand; therefore, the generalizability of the findings to other educational contexts should be interpreted with caution. Second, the use of self-reported questionnaire data may introduce response bias and social desirability effects. Future studies could strengthen methodological rigor by incorporating multiple data sources, such as teacher and student perspectives, administrative data, or observational measures. Third, the cross-sectional design limits the ability to examine causal relationships over time. Given the dynamic nature of academic leadership, longitudinal research is needed to better understand its development and sustainability.

Finally, the model focused on selected internal and organizational factors. Additional variables, such as community engagement, digital transformation capacity, and student learning outcomes, may further enhance the explanatory power of the model. Future research should examine the proposed model across different regions and educational systems to assess its generalizability and theoretical robustness. Comparative studies may provide insights into contextual differences influencing leadership practices. Longitudinal research designs are recommended to explore how leadership personality, contextual support, curriculum leadership, and innovation culture interact over time. In addition, integrating multi-source and mixed-method approaches would provide a more comprehensive understanding of academic leadership in practice. Future studies may also incorporate emerging factors such as digital transformation readiness, artificial intelligence in education, and community partnerships to further develop adaptive and innovation-oriented models of academic leadership.

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## AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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Nawee Udorn	✓	✓		✓			✓			✓		✓		✓
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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : **O**riting - **O**riginal Draft

E : **E**riting - **R**eview & **E**ditting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

## CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

## INFORMED CONSENT

Informed consent was obtained from all participants. Participation was voluntary, and confidentiality and anonymity were ensured.

## ETHICAL APPROVAL

This study was approved by the Human Research Ethics Committee of Nakhon Phanom University, Thailand (HE16968; 26 August 2025) and conducted in accordance with relevant ethical standards.

## DATA AVAILABILITY

Data are not publicly available due to confidentiality restrictions but may be obtained from the corresponding author, [DB], upon reasonable request and institutional permission.

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