

AI IN PREDICTIVE BUSINESS ANALYTICS: EVIDENCE AND IMPLICATIONS FOR PRIVATE HIGHER EDUCATION IN THAILAND

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Abstract

Digital transformation has driven higher education institutions to adopt data-driven approaches to support strategic decision-making, performance measurement, and improvements in the quality of academic services. This study aims to synthesize developments in *data-driven business analysis* in higher education, focusing on the use of *Key Performance Indicators* (KPIs), the *Balanced Scorecard* (BSC), *learning analytics*, artificial intelligence (AI), internationalization, and data governance, particularly at private universities in Thailand and the ASEAN region. The study employed a *narrative scoping review* of relevant academic literature, drawing on sources from various databases and scholarly publications in the fields of management, education, and analytics. The synthesis results reveal five main themes: aligning KPIs with institutional strategies; utilizing *learning analytics* to enhance student success; the dynamics of internationalization and competition in the higher education market; the need to strengthen data governance and ethics; and the use of AI to support business analysis and decision-making. Integrating the BSC with *learning analytics* enables universities to link strategic objectives with operational indicators more systematically. However, the effectiveness of this approach depends on data quality, analytical capacity, data-driven leadership, digital infrastructure, and responsible AI governance. This study underscores the importance of an integrated, data-driven decision-making ecosystem to enhance the effectiveness, competitiveness, accountability, and sustainability of higher education institutions.

Keywords: *data-driven decision making, higher education, learning analytics, key performance indicators, Balanced Scorecard, artificial intelligence, Thailand.*

Abstrak

Transformasi digital telah mendorong perguruan tinggi untuk mengadopsi pendekatan berbasis data dalam mendukung pengambilan keputusan strategis, pengukuran kinerja, dan peningkatan kualitas layanan akademik. Penelitian ini bertujuan untuk mensintesis perkembangan *data-driven business analysis* dalam pendidikan tinggi dengan menitikberatkan pada penggunaan *Key Performance Indicators* (KPI), *Balanced Scorecard* (BSC), *learning analytics*, kecerdasan buatan (AI), internasionalisasi, dan tata kelola data, khususnya pada perguruan tinggi swasta di Thailand dan kawasan ASEAN. Penelitian menggunakan *narrative scoping review* terhadap literatur akademik yang relevan, dengan sumber dari berbagai basis data dan publikasi ilmiah bidang manajemen, pendidikan, serta analitik. Hasil sintesis menunjukkan lima tema utama, yaitu penyelarasan KPI dengan strategi institusi, pemanfaatan *learning analytics* untuk meningkatkan keberhasilan mahasiswa, dinamika internasionalisasi dan persaingan pasar pendidikan tinggi, kebutuhan penguatan tata kelola dan etika data, serta pemanfaatan AI untuk mendukung analisis dan pengambilan keputusan bisnis. Integrasi BSC dengan *learning analytics* memungkinkan perguruan tinggi menghubungkan tujuan strategis dengan indikator operasional secara lebih sistematis. Namun, efektivitas pendekatan tersebut bergantung pada kualitas data, kapasitas analitik, kepemimpinan berbasis data, infrastruktur digital,

dan tata kelola AI yang bertanggung jawab. Penelitian ini menegaskan pentingnya ekosistem pengambilan keputusan berbasis data yang terintegrasi untuk meningkatkan efektivitas, daya saing, akuntabilitas, dan keberlanjutan perguruan tinggi.

Kata kunci: *pengambilan keputusan berbasis data, pendidikan tinggi, analitik pembelajaran, indikator kinerja utama, Balanced Scorecard, kecerdasan buatan, Thailand*

Introduction

Business analysis has increasingly evolved from a function concerned primarily with financial performance and operational efficiency into a strategic capability for organizational decision-making. At its core, business analysis involves the systematic use of evidence to identify organizational problems, evaluate alternative solutions, assess performance, and determine how resources can generate sustainable stakeholder value. This transformation is particularly consequential in higher education, where institutional performance cannot be adequately represented by financial indicators alone. Universities simultaneously pursue educational quality, student success, research productivity, graduate employability, stakeholder satisfaction, social inclusion, and financial sustainability. Consequently, higher education institutions (HEIs) increasingly require analytical systems capable of connecting strategic objectives with measurable operational outcomes. Data-driven leadership has therefore emerged as an important mechanism for strengthening institutional effectiveness because it enables leaders to move beyond intuition toward evidence-based diagnosis, performance monitoring, predictive modeling, and continuous feedback (Chigbu & Makapela, 2025).

The increasing importance of data-driven decision-making reflects a broader transformation in the governance of higher education. Digitalization has generated unprecedented volumes of institutional data from student information systems, learning management systems (LMS), admissions platforms, financial systems, human-resource databases, research repositories, student surveys, and graduate-tracking systems. These heterogeneous data sources create opportunities for institutions to understand academic performance and organizational processes with considerably greater granularity than conventional reporting systems. However, the existence of large amounts of data does not automatically generate better decisions. Stojanov and Daniel (2024), in a systematic review of research on big data and analytics in higher education, demonstrated that the principal rationale for analytics adoption is its capacity to support data-driven decision-making across teaching, learning, and administration, while also emphasizing that the actual institutional application of analytics remains uneven. Thus, the central challenge is shifting from data availability to organizational analytical capability—the capacity to transform fragmented data into valid information, actionable knowledge, institutional decisions, and measurable outcomes.

Within this transformation, business analysis provides a conceptual bridge between organizational strategy and data analytics. Rather than treating analytics as a purely technical activity, business analysis asks whether the information generated by an analytical system addresses a

strategically meaningful institutional problem. For HEIs, this means determining which indicators matter, why they matter, how they interact, and how managers should respond when performance deviates from strategic targets. Gaftandzhieva et al. (2023) emphasize that data-driven decision-making in HEIs increasingly involves educational data mining, learning analytics, and business intelligence to monitor student enrollment, academic performance, staff performance, and institutional development. The implication is that universities require an integrated analytical architecture in which strategic objectives, key performance indicators (KPIs), operational data, analytical models, and managerial interventions are connected rather than operating as independent reporting mechanisms.

One established framework for establishing such strategic alignment is the Balanced Scorecard (BSC). Traditionally, the BSC integrates financial, customer, internal-process, and learning-and-growth perspectives to translate organizational strategy into measurable performance objectives. Although originally developed in a corporate environment, the framework has demonstrated conceptual relevance to higher education because universities are multidimensional organizations whose performance requires simultaneous consideration of financial sustainability, stakeholder value, internal processes, and organizational learning. Recent scholarship confirms that BSC research has evolved substantially beyond its original configuration. Kumar et al. (2024), through a systematic and bibliometric review of 1,294 BSC-related studies, identified the increasing prominence of sustainability, stakeholder orientation, strategic performance management, integrated reporting, and systems thinking. This evolution is particularly relevant to universities because student success, employability, social responsibility, sustainability, and research impact increasingly constitute strategic rather than peripheral institutional outcomes.

The contemporary BSC should therefore not be interpreted simply as a static dashboard of institutional indicators. Instead, it can function as a strategic management architecture through which HEIs translate mission and strategic priorities into interconnected performance measures. For example, a university may define graduate employability as a strategic outcome, student engagement and curriculum relevance as intermediate outcomes, and LMS participation, internship completion, career-service utilization, and employer satisfaction as operational indicators. Such a configuration allows leaders to examine potential relationships between institutional resources, academic processes, student experiences, and final outcomes. Recent literature on sustainability-oriented BSCs similarly indicates a movement toward multidimensional performance systems that incorporate social and environmental considerations alongside conventional economic indicators (Chehimi & Naro, 2024). For higher education, this suggests that performance measurement should encompass not only institutional efficiency but also educational quality, equity, inclusion, employability, stakeholder value, and societal contribution.

However, BSC-based performance measurement faces an important limitation when implemented without real-time or high-frequency operational data. Strategic KPIs may indicate *what* is happening but not necessarily explain *why* it is happening or identify emerging risks early enough for intervention. This limitation creates a strong rationale for integrating BSC with learning analytics and institutional analytics. Learning analytics extends performance measurement by collecting, processing, and interpreting learner-generated and institutional data to understand learning processes and predict educational outcomes. Its development has progressed from descriptive reporting toward predictive and increasingly prescriptive applications. Predictive models can identify students who are at risk of failure or withdrawal, while prescriptive systems can support decisions about appropriate interventions. Alalawi et al. (2025), for example, examined a learning analytics intervention framework designed to identify academically at-risk students early and connect prediction with intervention rather than treating prediction as an end in itself.

This distinction between prediction and intervention is crucial for business analysis in higher education. A predictive model that accurately identifies at-risk students has limited institutional value if academic advisors do not possess the resources, authority, or information necessary to respond. Dai et al. (2025) similarly argue that learning analytics for early identification becomes more meaningful when predictive models are connected to theoretically informed feedback and intervention mechanisms. Consequently, the value of analytics should not be evaluated solely through model accuracy. From a business-analysis perspective, analytical value depends on whether insights change organizational behavior and improve measurable outcomes. This shifts attention from the technological sophistication of an analytical model toward the broader data-to-decision-to-action chain.

Recent advances in machine learning and generative artificial intelligence further expand this analytical potential. Machine learning can identify nonlinear patterns in student behavior, detect risk trajectories, segment learners according to engagement patterns, and support scenario-based decision-making. The emergence of generative AI adds possibilities for automated explanation, personalized feedback, natural-language querying, and decision support. Nevertheless, the increasing sophistication of AI also creates new governance challenges. Recent systematic evidence indicates that learning analytics systems increasingly combine machine learning and generative AI to facilitate early-risk detection and personalized educational support, but questions concerning model transparency, explainability, data quality, privacy, and human oversight remain central (2025). Therefore, an institutionally responsible analytics strategy must avoid equating technological sophistication with decision quality.

This issue is especially important because higher education data are inherently sensitive. Student records contain academic histories, demographic characteristics, behavioral traces, financial

information, and potentially psychological or socioeconomic indicators. The use of these data for predictive analytics can generate significant benefits but may also create risks associated with privacy, surveillance, algorithmic bias, misclassification, and unequal treatment. A student classified as “high risk” by an algorithm, for example, may experience consequences that extend beyond the original analytical purpose. Therefore, data-driven business analysis in HEIs requires governance mechanisms that specify data ownership, access rights, quality standards, ethical boundaries, model validation procedures, and accountability for decisions generated with analytical support. Importantly, data-driven leadership should not replace professional judgment; rather, analytics should augment institutional judgment by providing systematically generated evidence that can be interpreted within organizational and educational contexts (Chigbu & Makapela, 2025).

The governance challenge is particularly relevant when considering private HEIs, where performance measurement has direct implications for institutional survival. Unlike large public universities with relatively stable government funding, private universities may depend more heavily on tuition revenue, student persistence, recruitment, reputation, and market responsiveness. Consequently, student recruitment, retention, satisfaction, employability, and operational efficiency can become business-critical indicators. The situation is especially salient in Thailand, where demographic change, increasing competition, internationalization, and changing student expectations have placed pressure on private institutions. Scott and Guan (2024), examining two small private Thai universities, emphasize that smaller institutions are particularly vulnerable because they have limited enrollment capacity and depend heavily on student persistence and tuition revenue for operational continuity. Their findings further demonstrate that academic integration, instruction, institutional support, satisfaction, and emotional distress are associated with important student outcomes such as persistence, withdrawal, and institutional transfer.

The Thai context also illustrates why institutional KPIs should not be selected exclusively from generic corporate performance models. Student persistence, satisfaction, academic integration, international student experience, and institutional support may have particularly strong strategic implications for private universities. Internationalization provides another dimension. Poedloknimit and Punnanan (2025) demonstrate that Thai private HEIs increasingly employ strategies to recruit and support Chinese international students, illustrating how international student markets have become strategically relevant to institutional sustainability. Similarly, Zhong et al. (2025) examined the international competitiveness of Thai higher education through the satisfaction of Chinese international students, using mixed methods involving interviews and a survey of 718 students. Their study reinforces the importance of student experience as a strategic dimension of international competitiveness.

These developments indicate that business analysis in Thai private HEIs should incorporate

both internal performance intelligence and external market intelligence. Internal intelligence may include student engagement, course completion, retention, academic progression, faculty workload, resource utilization, and financial performance. External intelligence may include demographic trends, international student demand, competitor positioning, employer expectations, tuition sensitivity, and student satisfaction relative to competing institutions. A sophisticated KPI system should therefore distinguish between *lagging indicators*, which describe achieved outcomes, and *leading indicators*, which signal emerging opportunities or risks. For example, graduation rates are important lagging indicators, but declining LMS engagement, reduced class attendance, academic advising utilization, or lower student satisfaction may function as leading indicators of future attrition.

Despite the growing literature, three interconnected research gaps remain. First, an integration gap persists between strategic performance measurement and operational learning analytics. BSC studies generally focus on strategic alignment and KPI architecture, whereas learning analytics research often focuses on student-level prediction or instructional optimization. Relatively fewer studies conceptualize how strategic indicators—such as employability, retention, internationalization, or stakeholder satisfaction—can be systematically connected with operational data generated through LMSs, student information systems, and institutional platforms. The literature therefore remains fragmented between “strategy-level measurement” and “student-level analytics” (Kumar et al., 2024; Stojanov & Daniel, 2024).

Second, a contextual gap exists in relation to private HEIs in Thailand and the broader ASEAN region. Although research on higher education internationalization, student satisfaction, retention, and institutional competitiveness is expanding, evidence concerning the systematic use of integrated KPI and analytics frameworks in small and medium-sized private HEIs remains comparatively fragmented. Scott and Guan (2024) demonstrate the distinctive vulnerability of small private Thai universities, while Zhong et al. (2025) illustrate the strategic importance of international student satisfaction. However, these strands of research do not yet provide a comprehensive framework connecting business trends, strategic KPIs, institutional data, predictive analytics, and managerial action.

Third, a governance and ethics gap remains. The rapid development of predictive analytics, machine learning, and generative AI increases the analytical capacity of HEIs but simultaneously raises questions about data governance, transparency, explainability, privacy, fairness, and human oversight. Recent learning analytics research emphasizes that prediction alone is insufficient without appropriate intervention and institutional capacity (Dai et al., 2025). Thus, future-oriented business analysis must address not only *what institutions can predict* but also *what they should measure, who should access the data, how decisions should be validated, and how analytical interventions should be evaluated*.

Against this background, this review conceptualizes data-driven business analysis in higher education as a strategic socio-technical capability rather than merely an analytical technology. The proposed perspective integrates four interconnected dimensions: strategic alignment, performance measurement, analytical intelligence, and governance. Strategic alignment determines institutional priorities; BSC-based KPI architecture translates those priorities into measurable outcomes; learning analytics and business intelligence transform operational data into actionable insights; and governance mechanisms ensure that analytical decisions remain valid, ethical, transparent, and institutionally accountable. This conceptual integration represents the principal novelty of the review because it moves beyond treating BSC, learning analytics, and AI as separate research streams and instead positions them as interconnected components of an institutional decision system.

From this perspective, the BSC provides the strategic logic, learning analytics provides the operational evidence, business intelligence provides the analytical integration, and governance provides the institutional safeguards. Such a framework can enable private HEIs to establish a continuous feedback cycle in which strategic objectives generate KPIs, KPIs determine data requirements, data generate analytical insights, insights inform managerial action, and outcomes feed back into strategic revision. This approach is consistent with recent evidence that analytical maturity depends not only on the availability of predictive technologies but also on organizational capabilities, data ecosystems, governance, explainability, and human oversight.

Accordingly, this review aims to (1) synthesize contemporary evidence on data-driven business analysis in higher education, with particular attention to Thailand and ASEAN; (2) map emerging business and institutional trends onto actionable KPI categories relevant to private HEIs; (3) integrate Balanced Scorecard, learning analytics, business intelligence, and data-driven leadership perspectives into a coherent analytical framework; (4) identify the organizational capabilities required to convert data into institutional action; and (5) examine governance, ethical, and policy implications associated with advanced analytics and AI-supported decision-making. The review ultimately argues that the strategic value of data in higher education does not reside in the volume of information collected or the sophistication of analytical models alone. Rather, value emerges when institutions possess the organizational capability to connect data, strategy, interpretation, action, and feedback within a responsible governance framework.

For private HEIs in Thailand, this perspective has particular practical significance. Institutions operating under enrollment constraints and competitive market conditions require KPI systems that simultaneously monitor financial viability, student success, academic quality, stakeholder satisfaction, internationalization, employability, and organizational learning. The integration of strategic performance measurement with learning analytics can provide leaders with a more timely and multidimensional understanding of institutional health. However, such integration must be

accompanied by investment in analytical literacy, interoperable data infrastructure, leadership capacity, ethical governance, and human-centered decision routines. Therefore, the future of business analysis in higher education should not be framed as a choice between managerial judgment and artificial intelligence. Instead, it should be understood as the development of evidence-informed institutional intelligence, in which human expertise and advanced analytics operate together to improve strategic responsiveness, educational quality, equity, and sustainable institutional performance.

Research Method

A narrative scoping review was conducted to synthesize evidence concerning data-driven business analysis in higher education, with particular attention to KPI frameworks, learning analytics, artificial intelligence (AI), stakeholder value, internationalization, and institutional decision-making. The review covered studies published between 2015 and 2025, while greater interpretive emphasis was placed on recent evidence published during 2020–2025. The review was designed to identify patterns across management, education, and educational analytics research rather than to estimate a pooled intervention effect. The literature search covered Springer, SAGE, MDPI, ThaiJO, and ERIC. Studies were considered eligible when they focused on higher education and explicitly addressed at least one of the following domains: data-driven decision-making, key performance indicators (KPIs), performance measurement systems, learning analytics, AI, stakeholder value, or internationalization. Priority was given to empirical and review studies examining Thailand and the broader ASEAN higher education context. Studies published before 2015 were excluded unless they represented foundational theoretical works cited in major contemporary reviews. Non-scholarly commentaries and publications lacking substantive relevance to higher education management or analytics were also excluded.

For each eligible study, data were extracted regarding the research context, methodological approach, analytical focus, principal findings, and implications for institutional decision-making and performance. The extracted evidence was then subjected to thematic synthesis. Five analytical themes were developed: (1) KPI frameworks and strategic alignment, (2) learning analytics and student outcomes, (3) internationalization and market dynamics, (4) governance, institutional capacity, and data ethics, and (5) AI-enabled business analysis and decision-making. The synthesis emphasized relationships among strategic indicators, operational data, organizational capabilities, and stakeholder outcomes. Interpretation was guided primarily by Balanced Scorecard (BSC) and stakeholder theory, enabling the review to connect institutional strategy and performance measurement with student, organizational, financial, and societal value. This approach also facilitated identification of research gaps concerning the integration of strategic KPIs with learning analytics, the limited consolidation of evidence from private higher education institutions in Thailand and ASEAN, and the governance and

ethical capabilities required for responsible data-driven decision-making.

Results and Discussion

This narrative review identifies five interrelated themes that characterize data-driven business analysis in higher education: (1) KPI frameworks and strategic alignment, (2) learning analytics and student learning outcomes, (3) internationalization and market dynamics, (4) governance, institutional capacity, and data ethics, and (5) AI-supported business analytics and decision-making. Overall, evidence from the reviewed literature indicates a gradual transition from conventional performance reporting toward integrated, data-intensive management systems, in which institutional leaders combine strategic indicators, student-level information, operational metrics, and predictive analytics to support organizational decision-making. These findings also indicate that the value of data-driven management depends not only on the availability of data but also on an institution's ability to transform data into actionable insights, foster organizational learning, and create value for stakeholders.

1. KPI Framework and Strategic Alignment

The first theme concerns the transformation of performance measurement from a predominantly financial monitoring approach toward a multidimensional institutional performance system. The literature indicates that the Balanced Scorecard (BSC) remains relevant to higher education because universities pursue a variety of objectives that cannot be adequately represented by financial indicators alone. Student success, teaching quality, research productivity, employability, stakeholder satisfaction, organizational learning, and financial sustainability increasingly need to be considered simultaneously within an institution's performance system. Recent studies also emphasize the evolution of the BSC toward sustainability, digital transformation, and stakeholder-oriented performance measurement (Kumar et al., 2024).

Evidence suggests that the effectiveness of KPIs is determined by the extent to which these indicators are aligned with institutional strategy, rather than by the number of indicators adopted. Strategic KPIs are most beneficial when they establish logical relationships between institutional goals, operational activities, measurable outcomes, and managerial interventions. In this regard, data-driven business analysis transforms the function of KPIs from merely a static reporting tool into a mechanism for organizational learning and strategic feedback. This interpretation aligns with contemporary discussions on data-driven leadership, which emphasize the systematic use of evidence to enhance institutional effectiveness and educational decision-making (Chigbu & Mbah, 2025).

A particularly important finding is the growing need to link strategic and operational indicators. For example, employability may represent a strategic institutional KPI, while student attendance, engagement with the LMS, course completion, assessment performance, and academic advising interactions represent operational indicators that can explain variations in those outcomes. The

integration of these levels creates a more sophisticated performance architecture, in which university leaders can shift from identifying *what* is happening to analyzing *why* it is happening and *what actions* should be taken. Therefore, the BSC and learning analytics should not be viewed as competing management approaches; rather, they can function as complementary components within an integrated institutional intelligence system.

2. Learning Analytics and Student Learning Outcomes

The second theme highlights the growing importance of learning analytics (LA) as an operational component of data-driven university management. The reviewed literature indicates a shift from descriptive analytics toward predictive applications and, increasingly, prescriptive applications. Institutional analysis in the past primarily answered questions about what had happened, whereas contemporary systems increasingly aim to identify at-risk students, predict academic outcomes, cluster engagement patterns, and support timely interventions (Zhidkikh et al., 2024; Sosa-Alonso et al., 2025).

Evidence suggests that learning analytics holds particular strategic value when analysis results are integrated with institutional support systems. For example, the predictive identification of students at risk of failing or dropping out has limited managerial value if academic advisors and student support units lack the authority, resources, or procedures necessary to intervene. Consequently, the effectiveness of analytics does not depend solely on technology; it depends on the institution's capacity to translate predictions into targeted actions. These findings reinforce the broader proposition that data-driven management requires an organizational feedback loop linking data collection, analysis, interpretation, intervention, and evaluation.

Further reviewed evidence indicates that LMS activity, assessment performance, attendance, and student engagement can provide important operational signals for understanding student progress. However, these indicators should not be interpreted in isolation. Student learning outcomes are multidimensional and can also be influenced by socioeconomic conditions, academic readiness, psychological factors, teaching quality, and institutional support. Therefore, high-quality learning analytics must integrate various data sources while avoiding deterministic interpretations of algorithmic predictions.

3. Internationalization and Market Dynamics in Thailand and ASEAN

The third theme relates to internationalization and ever-changing market dynamics, particularly in Thailand and the broader ASEAN higher education landscape. The literature indicates that private higher education institutions are increasingly operating in an environment characterized by demographic shifts, intensifying competition, international student mobility, and financial pressures. International students can be an important source of revenue for institutions and contribute to campus internationalization; however, reliance on international markets also creates strategic vulnerabilities

when geopolitical, economic, or demographic conditions change (Poedloknimit & Punnanan, 2025).

For private higher education institutions (HEIs), these developments underscore the importance of evidence-based market analysis. Institutional leaders require reliable information regarding student demand, recruitment channels, retention, tuition revenue, program appeal, graduate outcomes, and international partnerships. Therefore, KPIs must go beyond conventional enrollment figures and include indicators that reflect the quality, sustainability, and strategic value of internationalization. The ASEAN context also demonstrates that KPI systems cannot simply be transferred from one institution or national system to another. Institutional size, governance structures, funding models, regulatory environments, and market conditions influence which indicators are meaningful. Consequently, these findings support a context-sensitive approach, in which private universities develop a KPI framework that reflects both global competitiveness and local institutional priorities. This is particularly important for smaller institutions, which may lack the financial and technical resources required to implement advanced analytical infrastructure on the same scale as large universities.

4. Governance, Institutional Capacity, and Data Ethics

The fourth theme reveals that governance and institutional capacity are critical prerequisites for the success of data-driven business analytics. The increasing availability of student and institutional data creates opportunities for more accurate decision-making, but at the same time raises concerns regarding privacy, data ownership, transparency, algorithmic bias, security, and accountability. Consequently, digital transformation cannot be evaluated solely through the lens of technology adoption. The reviewed literature indicates that institutions require clear governance frameworks that define who can access data, how data is collected and validated, how analytical models are evaluated, and how decisions based on algorithmic results are reviewed. This is particularly important when predictive analytics are used to classify students based on academic risk. Predictive models may identify statistical correlations, but institutional stakeholders remain responsible for determining how those classifications are interpreted and acted upon. Institutional capacity also emerges as a key determinant of implementation. Data-driven management requires not only software and databases but also data literacy, analytical expertise, leadership commitment, cross-unit collaboration, and organizational readiness. Thus, investing in technological infrastructure without a commensurate investment in human resource capabilities can result in fragmented dashboards rather than meaningful institutional intelligence. These findings ultimately position data governance as both a technical and an organizational capability.

5. AI-Supported Business Analysis and Decision-Making

The fifth theme concerns the expanding role of artificial intelligence and machine learning in higher education business analysis. The literature indicates that AI can enhance institutional capacity

in terms of prediction, classification, pattern recognition, scenario analysis, and decision-making support. Specifically, machine learning approaches can process large and heterogeneous datasets that would be difficult to analyze using conventional reporting systems (Zhidkikh et al., 2024; Sosa-Alonso et al., 2025). However, evidence suggests that AI should be viewed as a tool to support decision-making, not as a substitute for institutional judgment. The strategic value of AI depends on data quality, model validity, interpretability, and the decision-maker's ability to place analysis results in the appropriate context. Overreliance on automated predictions can give rise to new forms of organizational risk if the models reinforce historical inequalities or if decision-makers interpret probabilistic predictions as definitive judgments. From a BSC perspective, AI can improve the timeliness and level of detail in KPI monitoring. However, from a stakeholder perspective, AI implementation must be evaluated based on whether it creates sustainable value for students, faculty, administrators, employers, and the community. Therefore, technological sophistication should not be the primary measure of digital transformation. Rather, the key question is whether AI improves the quality, fairness, responsiveness, and accountability of institutional decisions.

Integrated Findings Overall, these five themes indicate that data-driven business analytics in higher education is evolving from fragmented metrics toward an integrated model of institutional intelligence. The BSC provides a strategic framework for defining what an institution aims to achieve, while learning analytics and AI provide increasingly sophisticated mechanisms for monitoring and explaining operational performance. Internationalization introduces market and stakeholder considerations, while governance and institutional capacity determine whether these technologies can be implemented responsibly. Therefore, the key finding of this review is that data availability alone is insufficient to achieve data-driven management. Institutional value emerges when strategic KPIs, operational analytics, organizational capabilities, and governance mechanisms are interconnected within a continuous decision-making cycle. For private higher education institutions (HEIs) in Thailand and ASEAN, this integrated approach offers a potential pathway to strengthen competitiveness while remaining focused on student success, value for stakeholders, institutional sustainability, and ethical responsibility. This synthesis also identifies key research directions: future studies should empirically examine how BSC-based strategic indicators can be integrated with learning analytics and AI within private HEIs and determine which organizational capabilities mediate the relationship between data utilization and institutional performance.

Discussion

The findings of this exploratory narrative review indicate that data-driven business analysis in higher education is increasingly shifting from conventional performance reporting functions toward integrated strategic management capabilities. Through the five identified themes—KPI frameworks and strategic alignment, learning analytics and student learning outcomes, internationalization and

market dynamics, governance and ethics, and artificial intelligence (AI) for business analytics—the overarching pattern is that institutional data creates value only when it is linked to strategic priorities and translated into actionable decisions. These findings align with the latest evolution of the Balanced Scorecard (BSC), which has expanded beyond traditional financial and operational indicators toward stakeholder orientation, sustainability, integrated reporting, and strategic performance management (Kumar et al., 2024). In the field of higher education, this development is particularly important because an institution’s success cannot be adequately represented by financial indicators alone; student achievement, retention, graduate employment rates, research productivity, stakeholder satisfaction, and social impact must also be included in performance assessments.

The first key finding relates to the strategic function of Key Performance Indicators (KPIs). This review indicates that KPI systems are most valuable when they serve as strategic translation mechanisms, rather than merely administrative reporting tools. This interpretation aligns with the BSC logic, in which organizational strategy is translated into measurable and monitorable objectives through interconnected performance indicators. Recent scholarly reviews indicate that BSC research has gradually incorporated customer or stakeholder orientation, strategic performance management, sustainability, and systems thinking—suggesting that performance measurement is increasingly conceptualized as a multidimensional strategic system (Kumar et al., 2024). For private higher education institutions (HEIs), these findings hold particular relevance because institutional sustainability depends simultaneously on financial performance, student recruitment and retention, educational quality, graduate outcomes, and relationships with stakeholders. Therefore, the KPI architecture must establish explicit causal or logical relationships between strategic objectives and operational metrics, rather than merely presenting isolated indicators. Such an approach can help university leaders identify whether, for example, a decline in student retention is related to academic engagement, service quality, curriculum relevance, financial barriers, or other organizational factors.

The second finding highlights the growing importance of strategic learning analytics. The review indicates that higher education institutions are shifting from descriptive dashboards toward predictive and increasingly prescriptive analytics. Recent research confirms that learning analytics has become a crucial mechanism for identifying patterns in student engagement, platform behavior, and learning outcomes. Hernández-Campos et al. (2025), for example, found that engagement and platform behavior are among the most frequently studied factors related to learning outcomes, although the literature remains fragmented in its theoretical conceptualization of these outcomes. These findings suggest that universities should not treat LMS data merely as technical information. Login frequency, submission of assessment assignments, participation patterns, access to learning resources, and interaction trajectories have the potential to serve as early indicators of academic risk. Consequently, learning analytics can transform student management from reactive interventions—

where institutions respond after academic failure has occurred—to proactive interventions, in which academic advisors and managers identify risk patterns before students actually lose engagement.

However, these findings also indicate that data analysis alone does not lead to institutional improvements. The value of learning analytics depends on its integration into decision-making processes and professional practices. Kotorov et al. (2024) emphasize that the quality and availability of appropriate information are central to data-driven decision-making, and they examine how dashboards and data analysis can support innovation in teaching and learning. Similarly, a recent systematic review by Hernández-Campos et al. (2025) indicates that much of the existing literature still focuses on final grades and other relatively narrow outcome measures. This implies important managerial implications: private universities must develop analytical systems that integrate academic performance with engagement, mentoring interactions, student well-being, academic progress, employability, and other strategic indicators. The goal is not to collect more data, but to generate better decision-making insights.

The third finding relates to the relationship between KPI systems and learning analytics, which constitutes an important conceptual contribution of this review. The existing BSC literature primarily emphasizes strategic performance measurement, whereas research on learning analytics tends to focus on learning processes and outcomes at the student level. These findings suggest that the two fields should not be treated as separate management systems. Instead, learning analytics can provide the operational data needed to populate and continuously update strategically oriented KPIs. For example, strategic objectives related to student success can be operationalized through indicators such as first-year retention rates, course completion, engagement with the LMS, academic progress, utilization of academic advising, and graduation rates. The BSC then provides the strategic framework, while learning analytics provides detailed evidence for monitoring and intervention. This integration expands the conventional application of performance measurement in higher education by linking institutional strategy with student-level evidence in real time or near real time. Previous reviews of BSC implementation in higher education have also highlighted its potential to align institutional goals with dimensions of quality assurance and organizational performance (Sinuany-Stern & Sherman, 2021).

The fourth theme relates to internationalization and market dynamics, particularly for private universities in Thailand and the broader ASEAN region. This review indicates that internationalization should be understood not merely as an enrollment strategy, but as a multidimensional business process involving market positioning, student mobility, academic partnerships, curriculum internationalization, service quality, and institutional reputation. This is important because private universities operate in an increasingly competitive environment, where demographic shifts, cross-border education, digital learning, and international student mobility

impact institutional sustainability. From a business analytics perspective, these pressures require institutions to monitor KPIs that encompass both market and educational dimensions. International student enrollment, conversion rates, retention, student satisfaction, partnership productivity, graduate employment rates, and revenue diversification can be integrated into a strategic dashboard. This integration will enable university leadership to distinguish between short-term market expansion and sustainable internationalization.

The fifth finding relates to governance, institutional capacity, and ethics. The increasing use of learning analytics and AI poses substantial governance challenges related to data quality, privacy, transparency, accountability, algorithmic bias, and institutional capacity. Recent research on AI-based learning analytics emphasizes that institutions are shifting toward systems supported by machine learning and generative AI, while simultaneously facing concerns regarding privacy, transparency, and responsible implementation. Alfredo et al. (2025) further emphasize the importance of involving students and faculty in the co-design of AI-based learning analytics, rather than treating analytics as a purely technological intervention. These findings are particularly relevant for private universities because advanced analytics systems can create substantial organizational value, but also have the potential to exacerbate inequalities if data is incomplete or algorithms are poorly designed. Therefore, data-driven business analytics must be guided by the principles of proportionality, transparency, human oversight, and responsible data management.

The sixth finding relates to the evolving role of AI as an institutional business analytics capability. The reviewed literature indicates that machine learning and generative AI are expanding universities' analytical capacities from retrospective reporting toward prediction, scenario modeling, personalization, and decision-making support. Recent systematic evidence points to a growing interest in combining machine learning and generative AI with learning analytics to facilitate early risk detection and personalized feedback (2025). However, this evidence also requires careful interpretation. AI-generated predictions are not automatically causal explanations, and predictive accuracy does not necessarily mean that an intervention will improve student learning outcomes. Therefore, AI should serve as a support mechanism for managerial assessment, not as a substitute for academic and organizational expertise. This distinction is crucial to avoid what might be termed algorithmic managerialism, in which institutional decisions become overly reliant on computational predictions without adequate contextual interpretation.

From the perspective of stakeholder theory, these findings further demonstrate that the meaning of institutional performance extends beyond organizational efficiency. Students, faculty members, employers, government regulators, parents, alumni, industry partners, and local communities constitute distinct stakeholder groups with potentially conflicting expectations. Consequently, the selection of KPIs must reflect the various dimensions of value creation. A university may achieve

strong financial performance while simultaneously experiencing a decline in student satisfaction or graduate competitiveness in the job market; conversely, high student satisfaction may coexist with unsustainable financial conditions. The BSC provides a useful framework for reconciling these conflicting dimensions because it encourages organizations to evaluate performance through various interconnected perspectives, rather than through a single dominant metric. Recent developments in BSC research toward stakeholder orientation and sustainability reinforce this interpretation (Kumar et al., 2024).

Overall, these findings support a data-driven, integrated business analytics model for private colleges, in which strategic objectives, KPIs, learning analytics, stakeholder intelligence, and AI-supported analytics form a continuous decision-making cycle. In this model, strategic priorities determine the selection of KPIs; KPIs determine the types of institutional and learning data that must be collected; analytics transform that data into evidence; managers interpret that evidence within the institutional and stakeholder context; and decisions result in interventions whose outcomes are then fed back into the measurement system. Such a cycle guides universities from static performance measurement toward dynamic strategic intelligence. This conceptual integration is a key contribution of this review because it connects two fields of study that are often researched separately: strategic performance management and educational analytics.

However, these findings reveal several limitations in the existing evidence base. Most learning analytics research remains concentrated at the individual or course level, while BSC research is often conducted at the institutional level. Furthermore, recent evidence points to methodological weaknesses in much of the learning analytics literature, including an overreliance on single-institution studies and non-probability samples. A 2026 systematic review, for example, identified substantial methodological vulnerabilities in studies examining LMS, learning analytics, and student learning outcomes, and called for stronger multi-institutional and causal research designs. Therefore, future research must investigate whether integrated KPI–analytics systems yield measurable improvements in institutional performance, rather than merely demonstrating correlations between data indicators and outcomes.

Overall, this discussion underscores that data-driven business analytics should be conceptualized as an organizational capability, not merely a collection of digital tools. Its effectiveness depends on the alignment of strategic objectives, meaningful KPIs, reliable data infrastructure, analytical competencies, stakeholder participation, ethical governance, and managerial capacity. For private universities in Thailand and ASEAN, this integrated approach offers a path to respond to competition, internationalization, changing student expectations, and technological disruption while maintaining educational quality and value for stakeholders. The most important theoretical implication is the integration of the Balanced Scorecard framework with learning analytics

and stakeholder-oriented governance, which transforms institutional data from a mere source of reporting into a mechanism for strategic learning, continuous improvement, and a sustainable competitive position.

Conclusion

This narrative review indicates that data-driven business analytics have become an increasingly important mechanism for strengthening strategic decision-making and institutional effectiveness in higher education, particularly in private higher education institutions (PHEIs) operating in a competitive and rapidly changing environment. This synthesis demonstrates that the effective use of key performance indicators (KPIs), learning analytics, artificial intelligence (AI), and stakeholder-oriented performance metrics can help universities transition from intuition-driven management toward evidence-based planning, monitoring, and continuous improvement. Integrating Balanced Scorecard principles with learning analytics provides a highly useful framework by linking the institution's strategic objectives to operational indicators related to student engagement, academic achievement, retention, employability, financial sustainability, and stakeholder satisfaction.

This review also indicates that private higher education institutions in Thailand and the broader ASEAN region face unique challenges related to internationalization, demographic shifts, market competition, digital transformation, and limited institutional resources. Consequently, KPI systems should not be adopted as standard measurement tools but must be contextually designed to reflect the institution's mission, stakeholder expectations, and local market conditions. Learning analytics and predictive artificial intelligence offer significant opportunities to identify at-risk students, enhance academic advising, optimize resource allocation, and support evidence-based institutional planning. However, technological capabilities alone do not guarantee better decision-making.

The key conclusion is that an institution's data maturity, leadership capacity, governance structure, data quality, and ethical safeguards are critical prerequisites for the success of data-driven management. Therefore, universities require clear data governance policies, staff analytical competencies, responsible AI practices, and mechanisms to protect student privacy and prevent algorithmic bias. Overall, this review suggests that sustainable data-driven business analytics in higher education requires an integrated ecosystem in which strategy, KPIs, learning analytics, AI, stakeholder values, organizational capabilities, and ethical governance operate as interconnected components. This perspective provides a foundation for private universities in Thailand and ASEAN to develop management systems that are more adaptive, accountable, and strategically responsive.

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