Financial Risk Management and Sustainable Development of Universities in Remote Sichuan: A Theoretical and Empirical Analysis

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Abstract

This study explores the role and mechanisms of financial risk management in the sustainable development of universities in remote areas of Sichuan. Using a mixed-methods approach that integrates quantitative surveys and qualitative interviews, this research examines key financial risk factors, including Financial Planning and Budget Control, Debt Management and Financing, and Liquidity Management. Additionally, financial management effectiveness and financial risk early warning systems are analyzed as mediating factors in enhancing financial sustainability. Structural equation modeling (SEM) is employed for data analysis to verify theoretical assumptions and relationships. The results highlight the importance of comprehensive financial governance and risk management strategies to ensure the sustainable development of universities. This study contributes to both theory and practice by providing a model for financial risk management tailored to the unique challenges of universities in underdeveloped regions.

Keywords: Financial Risk Management, Sustainable Development, Budget Control, Debt Management, Liquidity Management, University Sustainability

Introduction

Higher education plays a vital role in regional development, particularly in remote areas of Sichuan, where universities provide essential educational opportunities and drive socioeconomic growth. However, these institutions face sustainability challenges due to

geographic isolation, limited financial resources, and constrained government support. Effective financial risk management is crucial to ensuring their long-term viability.

Universities in remote Sichuan are highly vulnerable to macroeconomic risks, economic disparity, and declining enrollment (Agarwala et al., 2021; Litwin, 2023; Sanders, 2024). Low rankings further weaken financial stability, limiting their ability to attract students, faculty, and funding (Baltaru et al., 2022). Additionally, outdated infrastructure, faculty retention issues, and inefficient resource allocation exacerbate operational challenges (Liu & Chen, 2022; Xu, 2020). Financial constraints also hinder digital transformation, impacting research and teaching capabilities (Gryson et al., 2024).

To address these challenges, universities must strengthen financial governance, optimize resource allocation, and implement tailored risk management strategies. Key areas for improvement include infrastructure, faculty development, research capacity, and community engagement (Junges et al., 2023). Aligning financial governance with sustainability goals, such as the UN SDGs, can further enhance resilience (Gornostaeva et al., 2024). Focusing on Financial Planning and Budget Control, Debt Management and Financing, and Liquidity Management. By integrating financial risk management with sustainability frameworks, it provides theoretical insights and practical recommendations to improve financial governance in underfunded higher education institutions. Through empirical analysis, the study aims to support policymakers and administrators in strengthening financial resilience and ensuring the sustainable development of universities in remote Sichuan. This study examines financial risk management in university sustainability,

Objective

To develop a model of the mediating effect of financial risk management strategies, including financial planning and budget control, debt management and financing, and liquidity management, on the sustainability of universities in remote areas of Sichuan.

Literature Review and Hypothesis Development

1 Financial Planning and Budget Control

Definition and Dimensions of Financial Planning and Budget Control

Financial planning and budget control refer to the structured management of financial resources to balance short-term efficiency and long-term sustainability (Horngren et al., 2014). This involves revenue forecasting, cost control, and maintaining financial discipline (Anthony & Govindarajan, 2007). Modern approaches emphasize adaptability, risk management, and stakeholder involvement, particularly in universities facing financial uncertainties (Agostino & Arnaboldi, 2018; Kim & Lee, 2022). Effective financial planning aligns financial strategies with institutional goals and sustainability, enhancing overall resilience (Adams, 2020; Papadakis, 2020).

Financial planning and budget control include three key dimensions, including budget accuracy, long-term financial planning, and cost control. Budget accuracy ensures that universities can precisely forecast revenues and expenditures, reducing financial risks and optimizing resource allocation (Horngren et al., 2014). Accurate budgeting minimizes discrepancies and enhances financial stability (Agostino & Arnaboldi, 2018). Long-term financial planning focuses on aligning short-term financial decisions with institutional strategic goals, allowing universities to navigate uncertainties and sustain operations (Mintzberg, 1994; Kim & Lee, 2022). Cost control, as another crucial aspect, enables universities to manage expenditures efficiently while maintaining academic quality. Effective cost control strategies optimize expenses without compromising institutional objectives, contributing to financial stability and stakeholder trust (Papadakis, 2020; Merchant & Van der Stede, 2017).

2 Debt Management and Financing

Debt management and financing involve strategically handling financial obligations to ensure institutional stability and sustainable growth (Kraus & Litzenberger, 1973). Universities rely on diverse funding sources—government aid, tuition fees, and loans—to support capital-intensive projects (Pratt et al., 2021). The Trade-Off Theory balances tax benefits and financial risks (Modigliani & Miller, 1958), while the Pecking Order Theory favors internal over external financing (Myers & Majluf, 1984). Effective debt management integrates risk assessments, financial transparency, and FinTech tools to optimize borrowing strategies (Kim & Lee, 2022; Wu & Kuo, 2021).

Debt management comprises three key dimensions: debt levels, financing diversity, and debt risk control. Debt levels reflect a university's financial obligations, requiring prudent management to balance growth and stability. While theoretical models suggest capital structure neutrality (Modigliani & Miller, 1958), real-world conditions demand cautious debt policies to prevent financial distress (Kraus & Litzenberger, 1973). Transparent reporting strengthens financial stability and stakeholder confidence (Pratt et al., 2021). Financing diversity reduces reliance on single revenue sources, enhancing resilience. Institutions with strong credit ratings access broader funding options, ensuring long-term sustainability (Diamond, 1991; Adams, 2020; Papadakis, 2020). Debt risk control mitigates default and market risks through refinancing, fixed interest rates, and stress testing (Wu & Kuo, 2021). Transparent debt disclosure further enhances institutional credibility and financing terms (Pratt et al., 2021).

3 Liquidity Management

Liquidity management ensures universities maintain sufficient liquid assets to meet short-term obligations and unexpected financial demands, supporting operational continuity and long-term sustainability (Keynes, 1936; Kim & Lee, 2020). Theoretical foundations include Liquidity Preference Theory (Keynes, 1936), Baumol's Inventory Model (1952), and Diamond & Dybvig's financial crisis model (1983). Effective strategies balance cash reserves, enhance fiscal flexibility, and enable strategic investments (Pratt et al., 2021; Adams, 2020). Modern advancements, such as real-time monitoring and FinTech solutions, further strengthen liquidity control (Wu & Kuo, 2021; Kim & Lee, 2022).

Liquidity management comprises three dimensions: cash flow management, liquidity risk control, and liquidity optimization. Cash flow management ensures universities maintain sufficient inflows while minimizing disruptions. Liquidity Preference Theory emphasizes holding liquid assets for unforeseen needs, while Baumol's model highlights balancing liquidity with investment opportunities (Keynes, 1936; Baumol, 1952). Effective management strengthens resilience against external shocks (Kim & Lee, 2020; Pratt et al., 2021). Liquidity risk control mitigates instability from insufficient liquid assets, using stress testing, scenario analysis, and real-time monitoring to enhance financial adaptability (Diamond & Dybvig,

1983; Papadakis, 2020; Kim & Lee, 2022). Liquidity optimization balances liquid asset holdings with institutional investments, ensuring financial stability while supporting research and infrastructure (Baumol, 1952; Kim & Lee, 2022; Adams, 2020; Wu & Kuo, 2021).

4 Financial Management Effectiveness

Financial Management Effectiveness (FME) refers to an institution's ability to efficiently manage resources, ensure transparency, and implement internal controls to align financial activities with strategic goals and sustainability (Anthony, 1965; Simons, 1995). In universities, FME optimizes resource allocation, enhances accountability, and mitigates financial risks (Atrill & McLaney, 2020).

FME is influenced by Financial Planning & Budget Control, Debt Management & Financing, and Liquidity Management. Financial Planning ensures structured budgeting and adaptability, enhancing stability (Horngren et al., 2014; Simons, 1995). Debt Management aligns borrowing policies with revenue capacity to maintain financial discipline and creditor confidence (Papadakis, 2020; Kim & Lee, 2020). Liquidity Management strengthens cash flow monitoring and risk control to support stability amid revenue volatility (Keynes, 1936; Pratt et al., 2021). Financial Transparency, and Quality of Internal Controls. Resource Utilization Efficiency ensures optimal allocation of funds to enhance institutional performance and reduce waste, supported by structured planning and digital financial systems (Chen et al., 2021; Wu & Kuo, 2021). Financial Transparency fosters stakeholder trust and credibility, aiding long-term funding and sustainability alignment (Simons, 1995; Adams, 2020; Kim & Lee, 2020). Quality of Internal Controls involves financial oversight mechanisms that prevent mismanagement, ensure compliance, and safeguard assets, with AI-driven systems improving accountability and fraud detection (Anthony, 1965; Pratt et al., 2021; Wu & Kuo, 2021). FME comprises three key dimensions: Resource Utilization Efficiency,

5 Financial Risk Early Warning System

The Financial Risk Early Warning System (FREWS) is a proactive mechanism that identifies, assesses, and signals financial risks, enabling institutions to take preventive measures for stability (Beaver, 1966; Altman, 2000). Modern FREWS integrates AI and real-

time data for dynamic risk detection, enhancing financial oversight and decision-making (Gao et al., 2023; Davis & Wilson, 2022).

FREWS is linked to Financial Planning & Budget Control, Debt Management & Financing, and Liquidity Management. It improves budget control by detecting deviations early, enhancing resource allocation and discipline (Chen et al., 2020). In Debt Management, it monitors debt ratios, providing early distress warnings and improving financial transparency (Papadakis, 2020; Smith & Green, 2021). For Liquidity Management, it enables real-time monitoring and predictive analytics, preventing shortages and strengthening stability (Pratt et al., 2021; Xu et al., 2023).

FREWS consists of three dimensions: Financial Risk Identification, Risk Assessment, and Risk Pre-warning Mechanism. Financial Risk Identification detects early signs of instability using AI-driven models and external indicators (Beaver, 1966; Altman, 2000; Liao & Wei, 2018). AI frameworks enhance detection accuracy by analyzing real-time financial conditions (Liu & Chen, 2022; Zhang et al., 2023). Risk Assessment evaluates financial threats through scenario analysis and dynamic modeling, integrating market trends for a comprehensive risk profile (COSO, 2004; Brown & Lee, 2020; Wang & Zhang, 2023). Risk Pre-warning Mechanism issues proactive alerts based on financial thresholds, liquidity indicators, and predictive analytics, enabling timely corrective actions (Guo & Cheng, 2020; Kim & Lee, 2021; Davis & Wilson, 2022). AI-enhanced systems improve real-time anomaly detection and reduce financial distress probabilities (Zhao et al., 2020; Gao et al., 2023).

6 Sustainable Development of Universities

As higher education institutions play a vital role in shaping future generations, ensuring their sustainable development has become an essential priority. Universities must balance economic viability, environmental responsibility, social inclusivity, and academic excellence to achieve long-term resilience and impact. To effectively assess sustainability efforts, a comprehensive measurement framework is necessary, integrating financial performance, ecological footprint, community engagement, and research innovation.

The Sustainable Development of Universities refers to the capacity of higher

education institutions to maintain long-term viability by balancing economic, environmental, social, and academic responsibilities. The concept is rooted in the broader sustainability framework established in the Brundtland Report (1987), which defines sustainability as meeting present needs without compromising future generations' ability to meet their own. In the context of universities, sustainable development is essential for ensuring institutional resilience while promoting environmental stewardship, social equity, financial stability, and academic excellence.

Measuring Sustainable Development in Universities requires a comprehensive, multidimensional approach that assesses financial health, ecological responsibility, social engagement, and academic innovation. The Triple Bottom Line (Elkington, 1994) framework emphasizes the importance of evaluating sustainability across economic, environmental, and social dimensions, while scholars like Wright (2010), Scott et al. (2012), and Fadeeva & Mochizuki (2013) argue that universities must lead by example, incorporating sustainability into their governance, curriculum, and research.

Integrating the Triple Bottom Line (Elkington, 1994) and Academic Sustainability Theory (Wright, 2010; Scott et al., 2012; Fadeeva & Mochizuki, 2013), this study examines the sustainable development of universities from four dimensions: economic, environmental, social, and academic sustainability.

Economic Sustainability

Economic sustainability in universities is crucial for financial stability and long-term growth. Research indicates that revenue diversification, cost efficiency, and strategic investments enhance resilience. Lynch (2018) found that universities with diverse income streams withstand economic downturns better. Jones and Kim (2021) confirmed that budgetary control and cost management improve financial sustainability. Papadakis (2020) highlighted the benefits of energy-efficient infrastructure in reducing operational costs. Similarly, Horngren et al. (2014) emphasized strong financial management for resource optimization. Smith and Lee (2022) noted that endowment growth and revenue diversification reduce

reliance on government funding. These findings underscore the need for strategic planning and investment in cost-saving initiatives.

Environmental Sustainability

Universities play a key role in environmental sustainability by reducing carbon footprints, enhancing energy efficiency, and adopting green technologies. Research shows that sustainability initiatives yield both environmental and financial benefits. Lozano et al. (2015) found that universities investing in renewable energy significantly lowered carbon emissions. Shriberg (2002) highlighted that recycling and waste management programs reduced costs while promoting sustainability. Barth and Timm (2011) demonstrated that integrating sustainability education improved institutional sustainability metrics. Zhao et al. (2020) reported financial and environmental gains from energy-efficient technologies in Chinese universities. The MIT Sustainability Report (2020) further confirmed the effectiveness of renewable energy investments. These findings emphasize the need for holistic sustainability strategies, including operations, curricula, and infrastructure investments.

Social Sustainability

Social sustainability in universities centers on inclusivity, equity, and community engagement. Research shows that proactive policies enhance stakeholder satisfaction and societal impact. Wright et al. (2021) found that strong diversity and accessibility programs improve social sustainability outcomes. Tilbury (2011) highlighted the link between community outreach and sustainability performance. Freeman's (1984) Stakeholder Theory supports broad engagement for long-term inclusivity. Michelsen (2016) reported that stakeholder participation strengthens social sustainability, while Cortese (2003) confirmed the benefits of social justice and equity initiatives. These findings emphasize the importance of diversity, community involvement, and socially responsible policies in fostering social sustainability.

Academic Sustainability

Academic sustainability is crucial for fostering innovation in teaching, research, and collaboration. Studies show that investment in academic excellence strengthens long-term

sustainability. Clark (1998) found that interdisciplinary collaboration boosts academic output and innovation. Mulder et al. (2012) reported that integrating sustainability education improves graduation rates and research contributions. Boyle (2015) demonstrated that student success programs enhance long-term academic performance. Lozano (2015) highlighted that interdisciplinary sustainability programs drive innovation and research productivity. Wang and Liu (2022) confirmed that strong external funding strategies improve academic resilience. These findings underscore the importance of collaboration, sustainability-focused curricula, and research funding in maintaining academic sustainability.

Development of Hypothesis

This study examines key financial management practices that contribute to university sustainability. The independent variables include Financial Planning and Budget Control, ensuring efficient resource allocation; Debt Management and Financing, balancing financial leverage for operational stability; and Liquidity Management, optimizing cash flows and risk management. These practices influence two mediating variables: Financial Management Effectiveness (FME), which supports financial stability and resilience, and the Financial Risk Early-Warning System (FREWS), which enhances risk identification and mitigation. The dependent variable, Sustainable Development of Universities, encompasses economic, social, environmental, and academic sustainability. This study explores the link between financial stability, risk management, and long-term institutional sustainability. The hypotheses are developed accordingly.

H1: Financial planning and budget control have a positive impact on the financial management effectiveness of universities in remote regions.

H2: Effective debt management positively influences the financial management effectiveness of universities in resource-constrained environments.

H3: Strong liquidity management practices positively affect the financial management effectiveness of universities with limited financial resources.

H4: Financial planning and budget control positively contribute to the effectiveness of financial risk early-warning systems in universities in remote regions.

H5: Effective debt management enhances the financial risk early-warning systems in universities with limited access to diverse financing sources.

H6: Liquidity management positively influences the effectiveness of financial risk early-warning systems in universities facing cash flow constraints.

H7: Improved financial management effectiveness positively impacts the sustainable development of universities in remote regions, supporting economic, social, and academic sustainability.

systemspositively contributes to the sustainable development of universities in financially constrained regions.

H9: Financial planning and budget control positively influence the sustainable development of universities by ensuring long-term financial stability and resource optimization.

sustainabldevelopment of universities by supporting long-term financial health and reducing financial risk.

H11: Liquidity management positively contributes to the sustainable development of universities in resource-constrained environments by maintaining financial stability and enabling long-term growth.
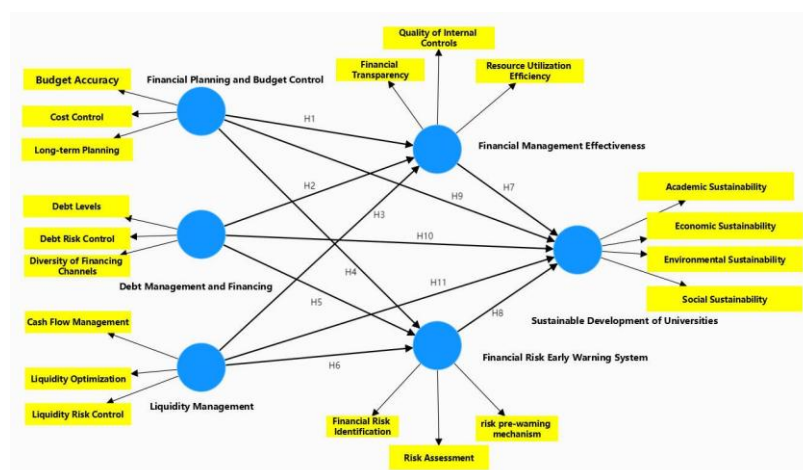
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Figure 1 Overall Research Hypothesis Framework Diagram

Methodology

Research Approach - Quantitative and Qualitative Mixed

This study adopts a mixed-methods approach, combining quantitative and qualitative analyses to examine the impact of financial risk management on the sustainable development of universities in remote areas of Sichuan. By integrating financial data analysis with insights from key stakeholders, it aims to provide a comprehensive understanding of the relationship between financial risk management and university sustainability.

For the quantitative research, structured questionnaires will be used to collect data on key financial management variables, including financial planning and budget control, debt management and financing, and liquidity management. Mediating variables such as financial management effectiveness and the financial risk early-warning system will be analyzed, with university sustainability—encompassing economic, environmental, social, and academic dimensions—serving as the dependent variable. The data will be analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in Smart PLS, which is suitable for complex models, small sample sizes, and non-normal distributions. Regression analysis, correlation models, and path analysis will be applied to validate the hypotheses and conceptual framework. The qualitative research component involves semi-structured interviews with university administrators, financial managers, and policymakers to explore their perceptions of financial risk management. Thematic analysis will be used to identify key patterns in responses, providing contextual insights that complement the quantitative findings.

By employing this mixed-methods approach, the study ensures methodological rigor, enhances data triangulation, and offers a nuanced understanding of how financial risk management influences the sustainable development of universities in resource-constrained environments.

Conclusion

This study establishes a comprehensive model linking Financial Planning and Budget Control, Debt Management and Financing, and Liquidity Management to Financial

Management Effectiveness (FME) and Financial Risk Early-Warning System (FREWS), both of which mediate the impact of financial strategies on the Sustainable Development of Universities. The findings confirm that effective financial management enhances institutional resilience, mitigates financial risks, and fosters long-term sustainability in universities.

At the same time, this research provides theoretical insights into how financial governance influences economic, social, environmental, and academic sustainability within higher education institutions. By integrating empirical evidence with statistical analysis using Structural Equation Modeling (SEM) and Smart PLS, the study offers valuable recommendations for universities, policymakers, and financial administrators. It contributes to the field by highlighting the significance of proactive financial risk management in supporting the sustainable development of universities, particularly in resource-constrained regions.

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