
Research Articles

The Impact of Financial Planning, Debt Management, and Liquidity on University Financial Effectiveness and Sustainability

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Abstract

This study examines the effects of three core financial management practices financial planning and budget control (FPBC), debt management and financing (DMF), and liquidity management (LM) on university sustainability and financial management effectiveness (FME). It further investigates the effect of FME on university sustainability and examines whether FME mediates the relationships between financial management practices and sustainability. A quantitative, cross-sectional survey design was employed, with data collected from 488 financial administrators at universities in China. A structured questionnaire was used as the primary research instrument to measure FPBC, DMF, LM, FME, and university sustainability. The collected data were analyzed using partial least squares structural equation modeling (PLS-SEM), including assessments of the measurement model's reliability and validity and hypothesis testing of the structural relationships.

The findings indicate that FPBC, DMF, and LM each have significant and positive direct effects on university sustainability. These three financial management practices also significantly enhance FME. However, FME does not have a significant effect on university sustainability and, consequently, does not mediate the relationships between financial management practices and sustainability. These findings suggest that strengthening internal financial management practices can directly contribute to sustainable university development, whereas improvements in financial management effectiveness alone may be insufficient to

generate sustainability outcomes. The study contributes to the literature on financial governance by highlighting the strategic importance of financial management practices and emphasizing the need for complementary mechanisms, such as financial early warning systems, to enhance universities' long-term financial resilience and sustainability.

Keywords: Financial Management, Sustainability Development, Liquidity Management, Debt Management, PLS-SEM

Introduction

University sustainability has emerged as a critical global concern in response to persistent financial constraints, demographic transformations, and intensifying competition within the higher education sector (Johnstone, 2004). These challenges are particularly pronounced in developing regions, where constrained financial and institutional resources may limit universities' capacity to achieve their long-term educational, research, and societal objectives. Consequently, strengthening financial resilience has become an essential component of institutional sustainability. In China, and particularly in Sichuan Province, universities are increasingly confronted with declining public subsidies, greater dependence on internally generated revenue, and escalating expenditures associated with quality assurance, technological advancement, and academic innovation (Liu & Zhao, 2020). Within this context, effective financial management has become increasingly important for maintaining institutional stability and supporting sustainable development.

Several financial management practices may contribute to universities' capacity to respond effectively to these challenges. Financial planning and budget control (FPBC) provide a framework for allocating resources strategically, monitoring expenditures, and aligning financial decisions with institutional priorities. Similarly, debt management and financing (DMF) can support universities in securing appropriate funding while maintaining manageable levels of financial risk. Liquidity management (LM), meanwhile, is essential for ensuring that institutions possess sufficient short-term financial resources to meet operational obligations and maintain financial stability. Despite the importance of these practices, the mechanisms

through which they influence university sustainability remain insufficiently examined, particularly within the context of Chinese higher education.

This study addresses this research gap by investigating the effects of FPBC, DMF, and LM on university sustainability, with financial management effectiveness (FME) examined as a mediating variable. Using empirical data collected from financial officers and university administrators in Sichuan Province, China, the study employs partial least squares structural equation modeling (PLS-SEM) to evaluate the proposed relationships. The study contributes to the literature by demonstrating the potential role of FME as a key mechanism through which financial management practices influence university sustainability across economic, academic, environmental, and social dimensions.

Objective

1. Examine the direct effects of FPBC, DMF, and LM on university sustainability.
2. Assess the effects of FPBC, DMF, and LM on financial management effectiveness (FME).
3. Determine whether FME contributes to university sustainability.

Literature Review

Financial Planning and Budget Control (FPBC) and Financial Management Effectiveness (FME)

Financial planning and budget control (FPBC) constitute fundamental components of institutional governance and operational efficiency in higher education. Effective FPBC enhances resource predictability, strengthens expenditure control, and facilitates the alignment of financial resources with institutional strategic objectives. Previous studies conducted in the United States and Europe have demonstrated that robust budgeting systems are associated with greater financial transparency and improved operational performance. In developing countries, participatory budgeting and long-term financial forecasting have likewise been found to strengthen stakeholder confidence, enhance resource allocation, and reduce financial

inefficiencies. Within the Chinese higher education context, FPBC practices have gradually shifted from rigid, input-oriented systems toward more performance-based frameworks that emphasize cost efficiency, accountability, and financial flexibility (Chen et al., 2020). Liu and Zhou (2021) further argue that well-structured FPBC mechanisms strengthen internal financial controls and promote managerial accountability. In addition, strategic budget control can enhance institutions' capacity to reallocate financial resources and facilitate more timely and informed financial decision-making (Wang & Li, 2020). Accordingly, effective financial planning and budget control are expected to contribute positively to the overall effectiveness of university financial management.

H1: Financial planning and budget control (FPBC) positively affect financial management effectiveness (FME).

Debt Management and Financing (DMF) and Financial Management Effectiveness (FME)

Universities increasingly utilize debt financing and alternative financing mechanisms to support infrastructure development, innovation, and institutional expansion. Effective debt management and financing (DMF) involve maintaining appropriate debt levels, diversifying financing sources, and mitigating the financial risks associated with borrowing. International evidence indicates that institutions with clearly defined debt-management strategies are better positioned to balance long-term capital investment requirements with short-term liquidity and financial stability. In the Chinese context, DMF has become particularly important as universities seek to diversify their financial resources and reduce excessive dependence on direct government transfers, especially in less economically developed regions. Zhang and Liu (2020) suggest that transparent debt-management policies can strengthen financial reporting practices and improve institutions' access to credit. Moreover, innovative financing mechanisms, such as public-private partnerships (PPPs) and education bonds, may contribute to stronger internal auditing, greater managerial discipline, and more effective financial oversight. Therefore, sound

debt management and diversified financing strategies are expected to enhance the effectiveness of university financial management.

H2: Debt management and financing (DMF) positively affect financial management effectiveness (FME).

Liquidity Management (LM) and Financial Management Effectiveness (FME)

Liquidity management (LM) refers to an institution's capacity to maintain sufficient cash flows and reserve resources to meet its short-term financial obligations while sustaining ongoing operations. The international literature emphasizes the importance of effective liquidity management in helping universities respond to fluctuations in student enrollment, delays in funding disbursement, unexpected policy changes, and other financial emergencies. Inadequate liquidity management may result in delayed salary payments, interruptions to infrastructure and academic projects, and deterioration in institutional credibility. Within China, liquidity management has become increasingly important because universities may experience fluctuations in the timing and availability of financial resources. Effective LM practices, including dynamic cash-flow analysis, systematic monitoring of liquid assets, and the establishment of emergency reserves, can strengthen financial control and improve institutional financial stability (Liu et al., 2021; Wang et al., 2021). Zhao and Zhou (2020) further demonstrate that effective liquidity planning improves the efficiency of resource deployment and strengthens financial monitoring. Consequently, universities with effective liquidity management are expected to demonstrate higher levels of financial management effectiveness.

H3: Liquidity management (LM) positively affects financial management effectiveness (FME).

Direct Effects of FPBC, DMF, and LM on University Sustainability (SDU)

Although financial management effectiveness (FME) may serve as an important mediating mechanism, the direct contributions of financial management practices to university

sustainability should not be overlooked. Effective financial planning and budget control can support forward-looking investments in teaching facilities, research capacity, infrastructure, and other strategic institutional priorities (Zhang & Wu, 2021). Similarly, diversified and appropriately managed debt portfolios can facilitate long-term capital development while reducing excessive exposure to default and refinancing risks. Effective liquidity management may also have a direct stabilizing effect on institutional sustainability by ensuring the availability of financial resources during periods of uncertainty or crisis, thereby supporting the continuity of academic and administrative operations (Wu & Li, 2019). These arguments are consistent with international research suggesting that prudent and risk-sensitive financial practices can strengthen organizational resilience, financial stability, and institutional reputation. Therefore, FPBC, DMF, and LM are expected to contribute directly to university sustainability.

H4: Financial planning and budget control (FPBC) positively affect university sustainability (SDU).

H5: Debt management and financing (DMF) positively affect university sustainability (SDU).

H6: Liquidity management (LM) positively affects university sustainability (SDU).

Financial Management Effectiveness (FME) and University Sustainability (SDU)

Financial management effectiveness (FME) reflects a university's capacity to utilize financial resources efficiently, transparently, and strategically in support of institutional objectives. Effective financial management can contribute to institutional sustainability by improving cost efficiency, strengthening resource utilization, supporting innovation, and enhancing the university's capacity to respond to long-term financial challenges (OECD, 2019; Johnstone, 2019). In the Chinese higher education context, FME can be conceptualized as an important link between financial risk management and the effective implementation of institutional strategies. Universities with effective financial management systems may be better equipped to allocate resources strategically, maintain financial stability, and sustain their academic and administrative activities over the long term. Nevertheless, previous empirical findings regarding the direct relationship between financial management effectiveness and

institutional sustainability remain mixed. This suggests that the relationship may depend on complementary mechanisms, including financial early-warning systems, risk-monitoring mechanisms, and strategic financial decision-making processes (Omar et al., 2023; de Oliveira & Avelino, 2024). Despite these mixed findings, the theoretical and empirical evidence provides sufficient grounds for expecting a positive relationship between FME and university sustainability.

H7: Financial management effectiveness (FME) positively affects university sustainability (SDU).

Conceptual Framework

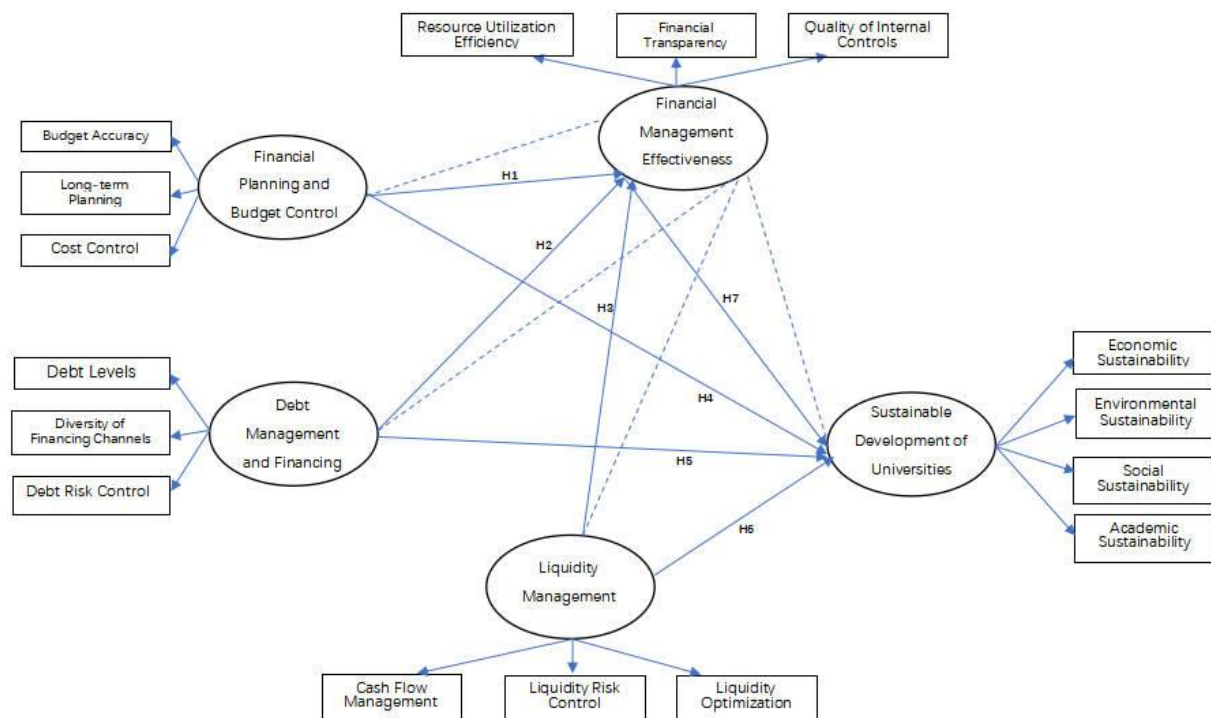


Figure 1 Conceptual Framework

Research Methodology

Research Design

This study adopts a quantitative, cross-sectional research design to examine the relationships among financial planning and budget control (FPBC), debt management and financing (DMF), liquidity management (LM), financial management effectiveness (FME), and university sustainability (SDU). Data were collected at one point in time using a structured questionnaire. The proposed model and seven hypotheses, including the mediating role of FME, were tested using partial least squares structural equation modeling (PLS-SEM).

Population, Sample, and Sampling Technique

The target population consisted of financial administrators, managers, and university-level finance policymakers in public universities in Sichuan Province, China. Stratified sampling was used to ensure representation of financial managers and university finance policymakers. A total of 488 valid responses were obtained, which was sufficient for PLS-SEM analysis and exceeded the recommended minimum sample size.

Research Instrument

Data were collected using a structured questionnaire adapted from validated scales in previous studies. Five constructs were measured: FPBC, DMF, LM, FME, and SDU. All items used a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Data Collection Procedure

The questionnaire was distributed through online survey platforms, professional networks, and institutional contacts. Participation was voluntary, and respondents provided informed consent. Completed questionnaires were screened for completeness, resulting in 488 valid responses for analysis.

Data Analysis

Data were analyzed using SmartPLS 4.0 and PLS-SEM. The analysis followed two stages:

Measurement model: Convergent validity was assessed using outer loadings and AVE, while reliability was evaluated using Cronbach's alpha and composite reliability. Discriminant validity was assessed using the Fornell-Larcker criterion and HTMT ratio.

Structural model: Hypotheses were tested using path coefficients and 5,000 bootstrap samples. R^2 , f^2 , Q^2 , and VIF were examined to assess explanatory power, effect sizes, predictive relevance, and multicollinearity. Mediation analysis was conducted to determine the role of FME in the proposed relationships.

Common Method Bias and Ethical Considerations

Common method bias was minimized through anonymous responses, reverse-coded items, and clear survey instructions. Harman's single-factor test indicated that no single factor accounted for more than 40% of the variance. Ethical approval was obtained from the relevant research ethics board, and all participants provided informed consent. Respondent information was kept confidential and used only for academic purposes.

Results

Reliability and Validity

As reported in Tables 1 and 2, the measurement model demonstrates satisfactory reliability and convergent validity at both the first- and second-order levels. At the first-order level, indicator loadings range from 0.802 to 0.856 and are statistically significant ($p < 0.001$). Cronbach's alpha, rho_A, and composite reliability values range from 0.880–0.899, 0.881–0.899, and 0.913–0.925, respectively, all exceeding the 0.70 threshold. AVE values range from 0.677 to 0.712, confirming adequate convergent validity. Similarly, at the second-order level, indicator loadings range from 0.852 to 0.897 and are significant ($p < 0.001$). Cronbach's alpha, rho_A, and composite reliability values range from 0.836–0.884, 0.837–0.885, and 0.902–0.920, respectively,

while AVE values range from 0.742 to 0.788. Overall, both measurement models meet the recommended reliability and convergent validity criteria and are suitable for subsequent structural model assessment.

Table 1 Reliability and validity analysis of first order dimensions

	loadings	T	P	Cronbach's alpha	rho_a	rho_c	AVE
FPBC1 <- BA	0.837	54.737	0.000	0.896	0.897	0.923	0.707
FPBC2 <- BA	0.842	57.125	0.000				
FPBC3 <- BA	0.848	65.564	0.000				
FPBC4 <- BA	0.845	62.126	0.000				
FPBC5 <- BA	0.833	53.006	0.000				
FPBC6 <- LTP	0.828	53.186	0.000	0.891	0.892	0.920	0.697
FPBC7 <- LTP	0.836	57.468	0.000				
FPBC8 <- LTP	0.836	60.296	0.000				
FPBC9 <- LTP	0.846	64.419	0.000				
FPBC10 <- LTP	0.829	58.085	0.000				
FPBC11 <- CC	0.830	52.799	0.000	0.886	0.886	0.916	0.687
FPBC12 <- CC	0.840	62.287	0.000				
FPBC13 <- CC	0.817	54.331	0.000				
FPBC14 <- CC	0.821	53.175	0.000				
FPBC15 <- CC	0.836	60.365	0.000				
DMF1 <- DL	0.824	48.053	0.000	0.891	0.891	0.920	0.696
DMF2 <- DL	0.838	54.773	0.000				
DMF3 <- DL	0.846	63.188	0.000				
DMF4 <- DL	0.832	52.748	0.000				
DMF5 <- DL	0.831	59.124	0.000				
DMF6 <- DFC	0.842	66.372	0.000	0.880	0.881	0.913	0.677
DMF7 <- DFC	0.831	59.302	0.000				
DMF8 <- DFC	0.824	53.983	0.000				



	loadings	T	P	Cronbach's alpha	rho_a	rho_c	AVE
DMF9 <- DFC	0.802	46.810	0.000				
DMF10 <- DFC	0.814	54.603	0.000				
DMF11 <- DRC	0.824	57.904	0.000	0.882	0.882	0.914	0.679
DMF12 <- DRC	0.816	52.574	0.000				
DMF13 <- DRC	0.845	62.363	0.000				
DMF14 <- DRC	0.825	55.706	0.000				
DMF15 <- DRC	0.810	47.996	0.000				
LM1 <- CFM	0.820	57.509	0.000	0.889	0.889	0.918	0.692
LM2 <- CFM	0.842	62.820	0.000				
LM3 <- CFM	0.822	50.467	0.000				
LM4 <- CFM	0.846	62.112	0.000				
LM5 <- CFM	0.829	57.077	0.000				
LM6 <- LRS	0.832	54.817	0.000	0.894	0.894	0.922	0.703
LM7 <- LRS	0.833	57.261	0.000				
LM8 <- LRS	0.836	58.425	0.000				
LM9 <- LRS	0.842	63.518	0.000				
LM10 <- LRS	0.848	66.071	0.000				
LM11 <- LO	0.840	62.335	0.000	0.894	0.895	0.922	0.703
LM12 <- LO	0.843	63.411	0.000				
LM13 <- LO	0.856	65.327	0.000				
LM14 <- LO	0.812	46.892	0.000				
LM15 <- LO	0.840	61.004	0.000				
FME1 <- RUE	0.847	63.026	0.000	0.894	0.894	0.922	0.702
FME2 <- RUE	0.839	59.720	0.000				
FME3 <- RUE	0.851	65.697	0.000				
FME4 <- RUE	0.829	54.882	0.000				
FME5 <- RUE	0.822	52.809	0.000				
FME6 <- FT	0.844	63.221	0.000	0.891	0.891	0.920	0.696



	loadings	T	P	Cronbach's alpha	rho_a	rho_c	AVE
FME7 <- FT	0.829	51.684	0.000				
FME8 <- FT	0.822	51.054	0.000				
FME9 <- FT	0.845	63.308	0.000				
FME10 <- FT	0.832	57.492	0.000				
FME11 <- QIC	0.812	46.834	0.000	0.885	0.885	0.915	0.684
FME12 <- QIC	0.834	58.841	0.000				
FME13 <- QIC	0.836	57.648	0.000				
FME14 <- QIC	0.824	52.830	0.000				
FME15 <- QIC	0.831	55.749	0.000				
SDU1 <- ECS	0.840	55.356	0.000	0.896	0.896	0.923	0.706
SDU2 <- ECS	0.840	56.456	0.000				
SDU3 <- ECS	0.821	47.389	0.000				
SDU4 <- ECS	0.848	61.090	0.000				
SDU5 <- ECS	0.853	61.738	0.000				
SDU6 <- ENS	0.844	56.956	0.000	0.892	0.892	0.920	0.698
SDU7 <- ENS	0.843	60.923	0.000				
SDU8 <- ENS	0.829	52.401	0.000				
SDU9 <- ENS	0.814	45.794	0.000				
SDU10 <- ENS	0.846	66.943	0.000				
SDU11 <- SS	0.813	47.117	0.000	0.883	0.883	0.914	0.680
SDU12 <- SS	0.823	53.187	0.000				
SDU13 <- SS	0.840	56.850	0.000				
SDU14 <- SS	0.829	55.130	0.000				
SDU15 <- SS	0.819	49.271	0.000				
SDU16 <- AS	0.832	56.004	0.000	0.899	0.899	0.925	0.712
SDU17 <- AS	0.853	61.512	0.000				
SDU18 <- AS	0.839	63.351	0.000				
SDU19 <- AS	0.848	64.193	0.000				

	loadings	T	P	Cronbach's alpha	rho_a	rho_c	AVE
SDU20 <- AS	0.846	63.504	0.000				

Table 2 Reliability and validity analysis of second order variables

	loadings	T	P	Cronbach's alpha	rho_a	rho_c	AVE
BA <- FPBC_2nd	0.888	88.613	0.000	0.855	0.855	0.912	0.775
LTP <- FPBC_2nd	0.885	77.720	0.000				
CC <- FPBC_2nd	0.869	70.081	0.000				
DL <- DMF_2nd	0.878	73.798	0.000	0.850	0.852	0.909	0.769
DFC <- DMF_2nd	0.869	71.176	0.000				
DRC <- DMF_2nd	0.883	81.357	0.000				
CFM <- LM_2nd	0.871	73.733	0.000	0.836	0.837	0.902	0.753
LRS <- LM_2nd	0.870	72.939	0.000				
LO <- LM_2nd	0.863	65.555	0.000				
RUE <- FME_2nd	0.874	64.866	0.000	0.865	0.867	0.917	0.788
FT <- FME_2nd	0.897	93.475	0.000				
QIC <- FME_2nd	0.891	100.488	0.000				
ECS <- SDU_2nd	0.879	76.911	0.000	0.884	0.885	0.920	0.742
ENS <- SDU_2nd	0.860	63.526	0.000				
SS <- SDU_2nd	0.852	61.954	0.000				
AS <- SDU_2nd	0.853	62.135	0.000				

Discriminant validity

Discriminant validity was assessed using the Fornell–Larcker criterion and the heterotrait–monotrait (HTMT) ratio. As shown in Tables 3 and 4, the square root of AVE for all first- and second-order constructs exceeded their respective inter-construct correlations, satisfying the Fornell–Larcker criterion. The HTMT results in Tables 5 and 6 further confirmed discriminant validity. HTMT values ranged from 0.158 to 0.786 for first-order constructs and from 0.310 to 0.722 for second-order constructs, all below the 0.85 threshold. Overall, both criteria confirm satisfactory discriminant validity at the first- and second-order levels.

Table 3 Fornell and Larcker Distinguishing Effect for First Order Dimensions

	AS	BA	CC	CFM	DFC	DL	DRC	ECS	ENS	FT	LO	LRS	LTP	QIC	RUE	SS
AS	0.844															
BA	0.479	0.841														
CC	0.438	0.647	0.829													
CFM	0.419	0.229	0.203	0.832												
DFC	0.417	0.194	0.239	0.172	0.823											
DL	0.493	0.202	0.269	0.243	0.636	0.834										
DRC	0.461	0.185	0.175	0.212	0.670	0.653	0.824									
ECS	0.672	0.498	0.484	0.445	0.421	0.494	0.456	0.840								
ENS	0.631	0.452	0.452	0.468	0.396	0.430	0.435	0.683	0.835							
FT	0.484	0.442	0.439	0.425	0.407	0.457	0.421	0.497	0.502	0.835						
LO	0.425	0.211	0.232	0.633	0.170	0.227	0.196	0.415	0.409	0.417	0.838					
LRS	0.411	0.269	0.241	0.633	0.140	0.234	0.193	0.429	0.471	0.445	0.624	0.838				
LTP	0.415	0.691	0.651	0.185	0.210	0.209	0.219	0.472	0.442	0.438	0.219	0.206	0.835			
QIC	0.478	0.440	0.440	0.402	0.432	0.467	0.438	0.517	0.505	0.698	0.406	0.411	0.434	0.827		
RUE	0.428	0.403	0.400	0.359	0.400	0.434	0.429	0.488	0.460	0.682	0.348	0.372	0.414	0.664	0.838	
SS	0.636	0.499	0.458	0.399	0.367	0.418	0.394	0.662	0.648	0.497	0.389	0.410	0.478	0.486	0.445	0.825

Table 4 Fornell and Larcker Distinguishing Validity for Second Order Variables

	DMF_2nd	FME_2nd	FPBC_2nd	LM_2nd	SDU_2nd
DMF_2nd	0.877				
FME_2nd	0.556	0.887			
FPBC_2nd	0.274	0.548	0.881		
LM_2nd	0.263	0.518	0.291	0.868	
SDU_2nd	0.574	0.632	0.612	0.568	0.861

The HTMT results confirm strong discriminant validity at both first- and second-order levels. All HTMT values are below the conservative 0.85 threshold (Henseler et al., 2015). First-order values range from 0.158 to 0.786, while second-order values remain below 0.85, with the highest at 0.722. Thus, all constructs are empirically distinct, confirming that discriminant validity is well established in the measurement model.

Table 5 First order dimension HTMT discriminant validity

	AS	BA	CC	CFM	DFC	DL	DRC	ECS	ENS	FT	LO	LRS	LTP	QIC	RUE	SS
AS																
BA	0.534															
CC	0.490	0.725														
CFM	0.469	0.257	0.229													
DFC	0.467	0.219	0.270	0.194												
DL	0.550	0.226	0.302	0.272	0.718											
DRC	0.518	0.209	0.198	0.240	0.760	0.736										
ECS	0.749	0.555	0.543	0.498	0.473	0.553	0.513									
ENS	0.704	0.505	0.509	0.526	0.447	0.483	0.490	0.763								
FT	0.540	0.495	0.493	0.477	0.458	0.512	0.474	0.556	0.563							
LO	0.474	0.235	0.260	0.710	0.191	0.253	0.220	0.463	0.457	0.467						
LRS	0.459	0.301	0.270	0.710	0.158	0.261	0.217	0.480	0.528	0.497	0.697					
LTP	0.465	0.772	0.732	0.208	0.237	0.234	0.247	0.528	0.495	0.491	0.245	0.231				
QIC	0.536	0.494	0.496	0.453	0.490	0.525	0.496	0.581	0.569	0.786	0.456	0.462	0.489			
RUE	0.478	0.451	0.449	0.403	0.450	0.486	0.483	0.546	0.515	0.763	0.389	0.415	0.464	0.747		
SS	0.713	0.560	0.518	0.449	0.416	0.470	0.447	0.744	0.730	0.560	0.438	0.461	0.538	0.550	0.501	

Table 6 HTMT discriminant validity of second order variables

	DMF_2nd	FME_2nd	FPBC_2nd	LM_2nd	SDU_2nd
DMF_2nd					
FME_2nd	0.647				
FPBC_2nd	0.321	0.636			
LM_2nd	0.310	0.608	0.343		
SDU_2nd	0.660	0.722	0.704	0.660	

Structural Model

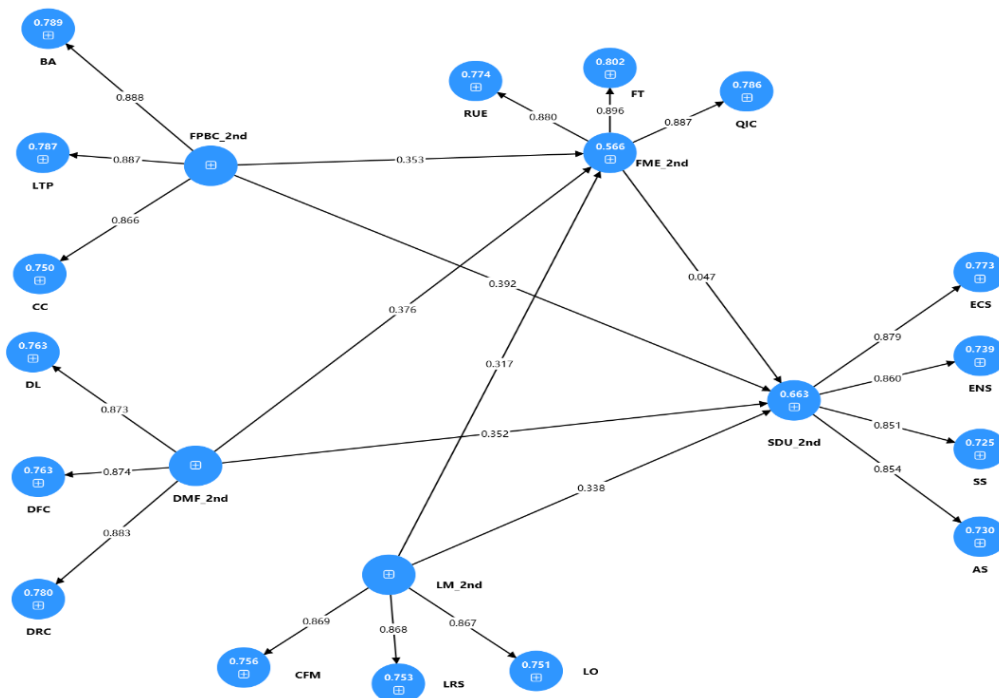


Figure 2 The path coefficients of the structural model

The three financial management practices also demonstrate significant positive effects on university sustainability. FPBC has the strongest effect on SDU ($\beta = 0.392$, $t = 12.226$, $p < 0.001$), followed by DMF ($\beta = 0.352$, $t = 10.378$, $p < 0.001$) and LM ($\beta = 0.337$, $t = 10.766$, $p < 0.001$). These findings suggest that proactive financial planning, responsible financing decisions, and effective liquidity management contribute directly to the long-term sustainability of universities.

In contrast, FME does not have a statistically significant direct effect on SDU ($\beta = 0.047$, $t = 1.034$, $p = 0.301$). Therefore, although the three financial management practices significantly improve financial management effectiveness, higher financial management effectiveness alone does not necessarily translate into greater university sustainability. This finding suggests that the relationship between financial management effectiveness and sustainability may depend on additional organizational or strategic mechanisms.

Table 7 PLS structural equation modeling path coefficient

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T	P
DMF_2nd -> FME_2nd	0.376	0.375	0.034	11.037	0.000
DMF_2nd -> SDU_2nd	0.352	0.353	0.034	10.378	0.000
FME_2nd -> SDU_2nd	0.047	0.045	0.045	1.034	0.301
FPBC_2nd -> FME_2nd	0.353	0.353	0.030	11.853	0.000
FPBC_2nd -> SDU_2nd	0.392	0.393	0.032	12.226	0.000
LM_2nd -> FME_2nd	0.317	0.317	0.029	10.895	0.000
LM_2nd -> SDU_2nd	0.337	0.338	0.031	10.766	0.000

Analysis of Mediating Effect

The bootstrapping results in Table 8 show that Financial Management Effectiveness (FME) does not significantly mediate the relationships between FPBC, DMF, LM, and University Sustainability (SDU). The indirect effects are not significant for FPBC ($\beta = 0.016$, $p = 0.306$), DMF ($\beta = 0.018$, $p = 0.300$), or LM ($\beta = 0.015$, $p = 0.308$), as their confidence intervals include zero.

In contrast, all three constructs have significant direct effects on SDU: FPBC ($\beta = 0.392$), DMF ($\beta = 0.352$), and LM ($\beta = 0.337$), with $p < 0.001$. Their total effects are also significant ($\beta = 0.409$, 0.370 , and 0.352 , respectively). Thus, the findings indicate that FPBC, DMF, and LM influence university sustainability primarily through direct effects rather than through FME.

Table 8 Bootstrap mediation effect test

	Effect	(O)	(M)	STDEV	T	P	2.50%	97.50%
FPBC_2nd -> SDU_2nd	Direct effect	0.392	0.393	0.032	12.227	0.000	0.328	0.453
FPBC_2nd -> FME_2nd -> SDU_2nd	Indirect effect	0.016	0.016	0.016	1.025	0.306	-0.015	0.049
FPBC_2nd -> SDU_2nd	Total effect	0.409	0.409	0.027	15.149	0.000	0.355	0.461
DMF_2nd -> SDU_2nd	Direct effect	0.352	0.353	0.034	10.378	0.000	0.283	0.416
DMF_2nd -> FME_2nd -> SDU_2nd	Indirect effect	0.018	0.017	0.017	1.037	0.300	-0.016	0.050

DMF_2nd -> SDU_2nd	Total effect	0.370	0.370	0.029	12.902	0.000	0.312	0.424
LM_2nd -> SDU_2nd	Direct effect	0.337	0.338	0.031	10.766	0.000	0.275	0.398
LM_2nd -> FME_2nd -> SDU_2nd	Indirect effect	0.015	0.014	0.015	1.019	0.308	-0.014	0.044
LM_2nd -> SDU_2nd	Total effect	0.352	0.352	0.028	12.643	0.000	0.298	0.406

Path Analysis

The PLS-SEM results support six of the seven hypothesized relationships at the 0.001 significance level. FPBC, DMF, and LM have significant positive effects on both FME and SDU. Specifically, $FPBC \rightarrow FME$ ($\beta = 0.353$), $DMF \rightarrow FME$ ($\beta = 0.376$), and $LM \rightarrow FME$ ($\beta = 0.317$) are supported. Similarly, $FPBC \rightarrow SDU$ ($\beta = 0.392$), $DMF \rightarrow SDU$ ($\beta = 0.352$), and $LM \rightarrow SDU$ ($\beta = 0.337$) are significant and positive.

However, H7 is not supported, as FME has no significant direct effect on SDU ($\beta = 0.047$, $t = 1.034$, $p = 0.301$). This suggests that financial management effectiveness alone may not be sufficient to improve university sustainability and that other strategic factors may also be required.

Discussion

Effects of FPBC, DMF, and LM on University Sustainability

The findings demonstrate that Financial Planning and Budget Control (FPBC), Debt Management and Financing (DMF), and Liquidity Management (LM) all have significant positive effects on university sustainability. FPBC has the strongest effect ($\beta = 0.392$, $p < 0.001$), followed by DMF ($\beta = 0.352$, $p < 0.001$) and LM ($\beta = 0.337$, $p < 0.001$). These results indicate that systematic financial planning, effective budget control, prudent financing, and adequate liquidity management contribute significantly to long-term university stability. The stronger effect of FPBC highlights the importance of forward-looking financial planning and disciplined budgeting in supporting sustainability. Effective budgeting helps universities align resources with strategic priorities, anticipate financial challenges, and respond proactively to changes in revenues and expenditures. This finding is consistent with Bianchi and Bartolini (2023), Wang

and Zhang (2021), and Zhang and Zhang (2023), who emphasize strategic financial management, long-term budgeting, financial monitoring, and resource planning in higher education. The significant effects of DMF and LM further suggest that sustainability depends on effective management of financial obligations and short-term resources. Prudent debt management reduces financial risk, while effective liquidity management supports operational continuity. Overall, the findings confirm that university sustainability requires an integrated approach to financial governance.

Effects of FPBC, DMF, and LM on FME

The results show significant positive relationships between FPBC, DMF, LM, and Financial Management Effectiveness (FME). DMF has the strongest effect on FME ($\beta = 0.376$, $p < 0.001$), followed by FPBC ($\beta = 0.353$, $p < 0.001$) and LM ($\beta = 0.317$, $p < 0.001$). This indicates that effective financing decisions, systematic budgeting, and continuous liquidity monitoring contribute significantly to university financial management effectiveness. The strong effect of DMF highlights the importance of balancing borrowing, financing costs, repayment obligations, and investment needs while maintaining financial flexibility. This finding supports Wang and Zhang (2021) on efficient budgeting and resource management and Guan and Li (2021) on financial risk management and early-warning mechanisms. Effective financing decisions also help universities manage risks while preserving resources for teaching, research, and infrastructure (Johnstone, 2004). Overall, integrating budgeting, financing, and liquidity management into a coordinated financial governance framework can strengthen financial management effectiveness.

Effect of FME on University Sustainability

Contrary to the proposed relationship, Financial Management Effectiveness (FME) does not have a significant direct effect on University Sustainability ($\beta = 0.047$, $p = 0.301$). This suggests that effective financial administration alone may not be sufficient to achieve broader, long-term sustainability outcomes. University sustainability is influenced by wider organizational, environmental, and strategic factors. FME may improve financial processes without directly

addressing funding uncertainty, financial risks, investment needs, or changes in the higher education environment. Therefore, universities should complement financial management with risk management, revenue diversification, long-term planning, strategic investment, and financial resilience. This is consistent with Guan and Li (2021) and Bianchi and Bartolini (2023), who emphasize that financial resilience and sustainability depend on broader strategic management mechanisms. Overall, FPBC, DMF, and LM contribute directly to university sustainability while improving FME. However, FME neither directly contributes significantly to sustainability nor mediates these relationships. Universities should therefore adopt a broader financial governance approach that integrates financial effectiveness with proactive planning, prudent financing, liquidity protection, risk management, and long-term strategic decision-making.

Conclusion

This study addresses its research objectives by demonstrating that Financial Planning and Budget Control (FPBC), Debt Management and Financing (DMF), and Liquidity Management (LM) are significant positive predictors of both University Sustainability and Financial Management Effectiveness (FME). The findings highlight the importance of systematic financial planning, responsible financing decisions, and effective liquidity management in strengthening universities' financial stability and supporting their long-term institutional development. However, the analysis reveals that Financial Management Effectiveness does not have a significant direct effect on University Sustainability and does not mediate the relationships between FPBC, DMF, LM, and sustainability. This finding suggests that improving the effectiveness of routine financial management alone may not be sufficient to achieve broader sustainability outcomes. Instead, financial management practices may contribute to sustainability primarily through direct and strategic mechanisms.

The study contributes to the existing literature by clarifying the limited mediating role of FME and demonstrating the direct importance of core financial management practices for university sustainability. The findings further suggest that universities should complement financial efficiency with proactive financial governance, risk management, financial early-warning systems, revenue diversification, and long-term strategic planning. Such an integrated

approach can strengthen institutional resilience, preserve financial stability, and support sustainable development in an increasingly uncertain higher education environment.

Suggestions

Theoretical Contributions

Model Innovation: This study develops a refined model linking financial planning and budget control (FPBC), debt management and financing (DMF), and liquidity management (LM) to university sustainability, with financial management effectiveness (FME) as a potential mediator. The model excludes FREWS to provide a more focused and parsimonious analysis.

Financial Mechanisms: FPBC, DMF, and LM significantly contribute to FME and university sustainability. However, FME did not significantly mediate the relationship, suggesting that other mechanisms may be needed to explain how financial practices improve sustainability.

Future Theory: The findings support future research that reintegrates FREWS and other mediators to better explain financial resilience and sustainability in higher education.

Practical Implications

Universities should improve budget planning and control, strengthen debt monitoring, maintain adequate liquidity reserves, and establish financial risk warning systems. Integrating these practices can improve financial resilience, support strategic objectives, and protect the continuity of teaching and research.

Research Limitations and Future Research

The study focuses on universities in Sichuan, China, which may limit generalizability. Future research should include different regions and institution types. External factors such as policy and socio-political risks should also be considered. Future studies could reintroduce

FREWS, use longitudinal or case-study methods, and examine digital financial tools and AI-based forecasting to improve financial risk detection and sustainability.

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