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ENABLERS OF RESEARCH CULTURE FORMATION AMONG TEACHERS: A STRUCTURAL EQUATION MODELING

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Abstract:

This study investigates the factors influencing the development of research culture in Malaysian secondary schools, focusing on the roles of transformational leadership, monetary backup, research equipment, and teachers' instructional load. Grounded in the Resource-Based View (RBV) framework, the research conceptualizes schools as organizations reliant on both tangible and intangible resources to promote sustainable innovation. Using a quantitative cross-sectional survey design, data were collected from 198 secondary school teachers across various regions of Malaysia. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to test the hypothesized relationships. The results reveal that transformational leadership is the most significant and positive predictor of research culture among teachers. In contrast, monetary backup and instructional load did not exhibit statistically significant direct effects. Research equipment demonstrated a marginally significant positive influence, suggesting that adequate infrastructure may play a supporting role. The model explained 64.8% of the variance in research culture, highlighting the importance of leadership-driven strategies in cultivating inquiry-based practices. These findings contribute to theory by extending RBV into school settings and offer practical insights for education policymakers and administrators seeking to strengthen research engagement in schools.

Keywords:

Research Culture, Research Equipment, Reward, School Management, Secondary Education, Teacher Instructional Load

Introduction

The development of research environment within educational institutions is gaining recognition as essential for transforming teaching practices, advancing educator expertise, and promoting creative instructional approaches. Defined as the methodical pursuit of discovering, examining, and confirming knowledge (Enyioko, 2016), research activities enables teachers to critically examine their methods, assess results, and implement discoveries in their teaching environments. Through action research, educators can investigate their own instructional approaches, respond to learner requirements, and exchange insights with colleagues, thereby promoting cooperative learning and questioning (O'Connor et al., 2006). This type of environment stimulates professional advancement, ongoing enhancement, and teaching innovation.

Nevertheless, creating and maintaining a strong culture of research in educational settings, especially in schools, is a complex undertaking complicated by a combination of structural, mindset-related, and logistical barriers (Šorgo & Heric, 2020). A significant obstacle is the widespread perception that educational research conducted in schools is marginal and fragmented, typically limited in scope and participation, and considered overly demanding of time and resources (Chua et al., 2013; Ebbutt, 2002; Spada et al., 2008). The situation worsens due to insufficient time provided to teaching staff and school administrators for conducting research, interpreting data, or rigorously assessing existing scholarship, thereby creating additional barriers to embedding inquiry-oriented methods into routine instructional activities (López-lópez et al., 2024).

In addition, inadequate financial backing and limited access to current, highly-indexed scholarly articles further constrain teachers' ability to undertake rigorous investigations and stay abreast of evolving pedagogical research (Castulo et al., 2025; Schuelka & Sherab, 2019). As a result, this lack of available resources substantially hinders the growth of research skills and capabilities among teachers, restricting their capacity to implement research-based approaches in their teaching and make meaningful contributions to the wider field of educational scholarship (Luo et al., 2022). Compounding these barriers, many educators regard research as inaccessible or irrelevant to their classroom experiences, a perspective reinforced by the increasing methodological sophistication of educational research which, while beneficial for academic careers, deters practitioner engagement (Chua et al., 2013).

Despite this challenges, nations such as Finland and Singapore have demonstrated that embedding research culture into the educational framework leads to sustained improvements in teaching quality and student achievement (Anna et al., 2023; Tan & Caleon, 2023). Transformational leadership, adequate resourcing, and professional learning communities normalize research as part of educators' identities (Gericke et al., 2023). This shared responsibility among principals, policymakers, and teachers has laid the foundation for a culture of evidence-based practice and inquiry in schools.

Within Malaysia's educational landscape, the development of research culture at the secondary school level has shown only modest progress (Tangkui et al., 2024). Although tertiary institutions have demonstrated significant improvements in research output and institutional backing (Sharif et al., 2024), secondary schools continue to grapple with constraints including insufficient financial resources, inadequate infrastructure, and a lack of motivational mechanisms (Suppiah Shanmugam & Mee, 2017). Additionally, Malaysian school

administrators predominantly embrace instructional leadership styles that emphasize traditional curriculum implementation, an approach that proves less conducive to nurturing innovative thinking and investigative practices (Ail et al., 2015; Hassan et al., 2019). Conversely, transformational leadership distinguished by its emphasis on strategic vision, motivational influence, and cognitive engagement has demonstrated greater effectiveness in promoting research-driven practices among teaching staff (Alainati et al., 2023).

The 2023 Annual Report of Malaysia's Education Development Plan (PPPM) 2013–2025 highlights the critical importance of fostering higher-order thinking skills (HOTS) by implementing reflective and evidence-based pedagogical approaches (Jamaluddin et al., 2019; Pantas & Hasruddin, 2020). Such pedagogical transformation requires establishing a robust research culture that allows educators to explore innovative teaching methods, develop practices grounded in evidence, and enhance student learning outcomes. Nevertheless, cultivating this research culture effectively requires more than adequate institutional leadership and available resources, it also necessitates motivational strategies that drive teacher involvement. Within this framework, incentive systems encompassing both internal and external motivators have been identified as pivotal elements that can influence how administrative support and resource allocation impact educators' research participation (Akin, 2017; Coccia, 2019).

Although earlier research has investigated the separate impacts of school administration, financial resources, and teacher workload on teaching effectiveness, limited empirical studies have examined the interplay among these factors, especially considering how rewards serve as a mediating mechanism. Theoretical perspectives like the Resource-Based View (RBV) suggest that efficient resource deployment, combined with robust school leadership and suitable incentive systems, can cultivate an enduring environment of research and innovation within educational institutions (Chis-Manolache, 2022; Zhang et al., 2022). However, concrete empirical data within the context of Malaysian secondary schools continues to be limited.

This research fills an existing void by investigating how transformational leadership, monetary backup, research equipment, and instructional load influence the development of a research culture in educational settings. The study examines both direct relationships and indirect pathways through rewards as an intermediary factor. Employing Partial Least Squares Structural Equation Modeling (PLS-SEM) as the analytical approach, the research seeks to offer a comprehensive perspective on the factors that motivate teachers to engage in research activities. The results are anticipated to make dual contributions: advancing theory by applying the Resource-Based View (RBV) framework to school contexts and providing practical guidance for educational administrators and policymakers who aim to cultivate dynamic, research-oriented learning institutions.

Literature Review

There is growing acknowledgment that establishing a strong research-oriented culture in secondary schools plays a vital role in improving teaching methods and promoting students' academic development (Godfrey, 2017; Loch, 2024; Wan Ibrahim et al., 2024). Such a culture, characterized by collegiality and shared attitudes toward the value of inquiry, requires a long-term commitment to development, often spanning several years (Hinnenkamp et al., 2019). Moreover, this involves cultivating an environment where educators not only participate in research-related activities but also perceive these endeavours as integral to improving

educational practice and student development (Luo et al., 2022). To accomplish this goal, it is crucial to thoroughly comprehend the fundamental factors and circumstances that promote research participation, especially within the teaching community and among prospective teachers (Mamytbayeva et al., 2024). Table 1 presents a comprehensive summary of previous research studies that identify the factors influencing the development and growth of a research culture in educational institutions

Table 1: Factors Influencing Research Culture

No	Factors	Author/s
1	Rewards	(Al-Maamari et al., 2017; Alison et al., 2017; Bland et al., 2002; Chakraborty & Biswas, 2020; Hesli & Lee, 2011; Hogan & Coote, 2014; Park et al., 2014; Roberge-Dao et al., 2019; Song et al., 2014)
2	School management	(Al-Maamari et al., 2017; Bhatti et al., 2022; Birdi, 2005; Bland et al., 2002; Galy, 2020; Sahputri et al., 2022)
3	Research equipment	(Choi et al., 2016; Hesli & Lee, 2011; Hogan & Coote, 2014; Hui Min & Rashid Mohamed, 2015)
4	Monetary	(Alison et al., 2017; Bolejko et al., 2022; Hesli & Lee, 2011; Jameel & Ahmad, 2020; Roberge-Dao et al., 2019)
5	Instructional load	(Chakraborty & Biswas, 2020; Kwiek, 2020; Li & Zhang, 2022; Tadesse & Khalid, 2023)

In conclusion, a flourishing research culture within educational institutions does not stem from any isolated factor but rather develops through an interconnected system of mutually reinforcing elements. Organizational leadership establishes the crucial strategic direction and organizational infrastructure. This groundwork requires adequate funding and tangible resources to transform aspirations into reality. At the same time, practical workload distribution is essential to provide both the time and mental capacity needed for scholarly inquiry. Lastly, a well-designed framework of rewards and acknowledgment helps sustain and strengthen continued participation. The mutual dependence among these components highlights that deficiencies in any single area can substantially hinder the creation of a viable, institution-based research culture.

Underpinning Theory
This study is underpinned by the Resource-Based View (RBV), a strategic management theory that conceptualizes organizations as collections of tangible and intangible resources, which, when effectively deployed, can create sustained competitive advantage (Barney, 1991; Wernerfelt, 1982). According to RBV, the success of an organization is contingent upon the possession and strategic use of resources that are valuable, rare, inimitable, and non-substitutable, often referred to as the VRIN criteria (Barney, 1991; Peteraf & Barney, 2003).

Within the educational context, the RBV provides a useful theoretical framework for understanding how schools can leverage internal capabilities, particularly school management, financial resources, physical infrastructure, and teacher workload, to foster a vibrant research culture. These resources, when strategically managed, are central to institutional performance, particularly in terms of enabling innovation and professional development (Ferreira et al., 2022; Kaufman, 2015).

Human capital, particularly in the form of effective school management and teacher expertise, is a critical intangible resource that meets the VRIN criteria. Transformational leadership for instance, enhances teacher motivation, cultivates a shared vision, and facilitates the integration of research practices into everyday school functions (Holz, 2024; Sofo et al., 2013). As such, school leaders act as strategic assets who can influence cultural transformation by mobilizing internal capacities, mentoring staff, and promoting evidence-informed practices (Krause, 2015).

In addition to school management, monetary backup and research equipment represent essential physical resources that can directly influence the development of research culture. The availability of grants, funding for training, and infrastructure such as libraries and ICT tools are indispensable in facilitating teacher engagement in research activities (Barney, 1991; Bobe & Kober, 2015). However, the mere presence of these resources is insufficient; their effective configuration and alignment with institutional goals are equally crucial (Felin et al., 2023).

Moreover, instructional load constitutes a key organizational resource that can either enable or hinder research engagement. Excessive teaching and administrative duties have been linked to decreased job satisfaction, increased stress, and reduced participation in scholarly activities (Ibrahim et al., 2020). Conversely, when workloads are managed effectively to allow time for inquiry and reflection, teachers are more likely to engage in meaningful research practices, contributing positively to the school's overall research culture (Al-Qahtani et al., 2024).

RBV also distinguishes between tangible and intangible resources. Tangible assets, such as buildings, laboratories, and ICT infrastructure, are observable and measurable, whereas intangible resources, including leadership capacity, school culture, and teacher expertise, are more difficult to quantify but are often more strategically significant (Barney, 1991; Zahra & Das, 1993). In the school setting, these intangible elements often determine the extent to which a research-supportive culture can be established and sustained.

Ultimately, the RBV suggests that schools that strategically utilize their internal resources, especially those that are difficult to replicate, are better positioned to build and sustain a research-oriented culture. This framework supports the present study's focus on transformational leadership, monetary backup, facilities, and workload as predictors of research culture, and rewards as a potential mechanism that enhances the value of these core resources.).

School management and Research Culture

Both theoretical frameworks and empirical investigations have examined the relationship between transformational leadership and the cultivation of research-oriented environments in educational settings (Day et al., 2016; Vu, T. H., Vu & Hoang, 2020). Transformational leadership is broadly recognized for its ability to promote innovation, creativity, and the professional development of educators, elements fundamentally connected to building a robust research culture (Alainati et al., 2023; Kilag et al., 2024). However, despite this conceptual connection, quantitative evidence remains limited, especially within school environments, to clearly articulate the specific mechanisms through which transformational leadership influences research culture development.

A substantial portion of current research examining the relationship between transformational leadership and innovation originates from non-educational sectors, including industrial management, telecommunications, and small to medium-sized business contexts (Choi et al., 2016; Mahmood et al., 2019; Sandhu & Al Naqbi, 2022; Sattayaraksa & Boon-itt, 2016). This body of research demonstrates a consistent pattern: transformational leaders inspire their teams by articulating compelling visions, providing personalized support, and fostering intellectual challenge, which in turn increases employees' propensity to engage in experimentation, pursue innovative approaches, and participate in organizational knowledge development. Consequently, the hypothesis presented below is formulated:

H1: Transformational Leadership has a positive relationship on Research Culture.

Monetary backup and Research Culture

Monetary backup is broadly acknowledged as a critical factor in cultivating a research-focused environment within organizations. Sufficient resources enable the conversion of concepts into practical research initiatives by providing access to necessary tools, supplies, and experimental possibilities. Azoulay & Li (2021) highlighted that insufficient funding adversely affects innovation results, whereas adequate financial resources allow scientists to concentrate on creating and evaluating new concepts without the stress of resource scarcity.

Research evidence confirms this idea. De Jesus Wong-Galvez & Libaque-Saenz (2023) identified a robust positive relationship between financial support and innovation within academic institutions ($\beta = 1.117$, $p < 0.01$), indicating that universities with more substantial funding demonstrate elevated levels of research productivity. In a parallel study, He & Zhou (2022) investigated AI-driven small and medium enterprises and discovered that financial support from both governmental policies and market sources significantly promoted the creation of superior innovations (PC = 0.307 and 0.384, respectively).

While the research discussed concentrates mainly on university and corporate settings, the findings can be applied to educational institutions at the school level. Schools that secure external financial resources are more capable of fostering teacher-driven inquiry, enabling professional growth opportunities, and encouraging the sharing of scholarly work. Within secondary school environments, this type of monetary backup is crucial for maintaining an active and thriving research-oriented culture. Therefore, the hypothesis presented below is suggested:

H2: There is a positive relationship between monetary backup with school research culture.

Research equipment and Research Culture

While previous studies often use the term research equipment, this study adopts the term research equipment to better align with the secondary school context. Research equipment includes physical infrastructure, access to databases, research tools, and technological support that collectively enable teachers to engage in research activities.

Empirical research in various domains has shown that the availability of such facilities positively influences the development of a research culture. In higher education, health, and ICT sectors, research equipment have been linked to increased research participation and innovation (Doulani & Hossaini, 2023; Wang et al., 2020). Alison et al. (2017) reported that well-equipped research environments signal institutional support, thereby motivating staff to engage in research. Similarly, Chakraborty & Biswas (2020), using PLS-SEM, found a

significant positive effect of facilities on research culture (β = 0.100, p = 0.002). Jameel & Ahmad (2020) also observed a positive relationship in the ICT sector (β = 0.233, p = 0.044).

While such evidence exists, scholarly inquiry remains sparse regarding the effects of research equipment on research involvement, particularly in the context of Malaysian schools. The present investigation bridges this research gap by exploring the direct effects of physical facilities on research culture via structural equation modelling. Consequently, the following hypothesis is proposed:

H3: There is a positive relationship between research equipment with school research culture.

Instructional load and Research Culture

Excessive instructional load is widely recognized as a critical barrier to teacher engagement in research. Teachers who spend substantial time on administrative duties, such as monitoring student attendance and managing coursework, may find limited opportunities to pursue scholarly inquiry (Sharifah Shafie et al., 2014). In Malaysia, this challenge is particularly pronounced, as teachers face heavy workloads that far exceed standard expectations, severely limiting time for research (Amzat et al., 2021).

Hui Min & Rashid Mohamed (2015) identified insufficient time and heavy teaching responsibilities as the primary barriers to research productivity among university lecturers, with 66.7% of respondents citing time constraints and 23.8% noting workload-related stress. Similarly, Kenny & Fluck (2017) found that 62% of Australian university teachers work over 50 hours weekly, highlighting a systemic imbalance in time allocation between teaching, research, and administrative duties. These challenges are often compounded by institutional policies that prioritize measurable outputs over research development, affecting both the quality and sustainability of research culture.

Alison et al. (2017), in a study of allied health professionals, found a positive correlation (r = 0.34, p < 0.01) between research orientation and team-level research culture, emphasizing the importance of protected research time and flexible workloads in fostering a culture of inquiry. Thus, the following hypotheses is proposed:

H4: There is a positive relationship between instructional load with school research culture

Research Methodology

This study employs a quantitative cross-sectional survey design to examine the direct relationships between transformational leadership, monetary backup, school facilities, teacher workload, and the development of research culture in Malaysian secondary schools. Guided by the Resource-Based View (RBV) theory, the research conceptualizes schools as organizations reliant on internal resources, both tangible and intangible, for sustainable performance, including the cultivation of a research-oriented environment. A quantitative approach is selected for its capacity to yield measurable insights, enable statistical hypothesis testing, and ensure generalizability across a wider population of educators (Creswell & Creswell, 2023). The analytical framework for this study is based on Partial Least Squares Structural Equation Modeling (PLS-SEM), which is particularly suited for complex models with multiple latent variables and does not require strict normality assumptions (Hair et al., 2019).

The target population comprises secondary school teachers across various regions of Malaysia. A stratified random sampling technique is adopted to ensure that the sample reflects diversity in geographical zones (North, Central, East, and South) and school characteristics (urban/rural, high performing/average). Based on a power analysis using G*Power software with a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and statistical power of 0.95, the recommended minimum sample size is 129. To enhance robustness and ensure adequate power for structural modelling, a target sample size of 300 to 400 respondents is planned.

Data are collected using a structured questionnaire comprising two major sections. Section A gathers demographic data, including respondents' gender, age, teaching experience, and school type. Section B measures five latent constructs aligned with the study variables. Transformational leadership is assessed using items adapted from the Multifactor Leadership Questionnaire (MLQ) developed by Bass and Avolio (Ismail et al., 2021). Monetary backup is measured using indicators based on prior work by De Jesus Wong-Galvez & Libaque-Saenz (2023) and He & Zhou (2022), while research equipment are evaluated through items adapted from Chakraborty & Biswas (2020) and Jameel & Ahmad (2020). Teacher workload is measured using scales from Hui Min and Rashid Mohamed (2015), and Kenny and Fluck (2017), and research culture is assessed through items based on Alison et al. (2017). All items are rated on a 5-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree").

To ensure the validity and reliability of the instrument, expert reviews are conducted to evaluate content relevance. A pilot study involving 30 respondents is carried out to test item clarity and internal consistency. Reliability is evaluated using Cronbach's Alpha and Composite Reliability (CR), while convergent validity is assessed through Average Variance Extracted (AVE). Discriminant validity is determined using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT).

Data collection is conducted through both online and paper-based surveys to accommodate schools with varying levels of technological access. Necessary approvals are obtained from the Ministry of Education (MOE), State Education Departments, and relevant school administrators. Participants are assured of the voluntary and anonymous nature of their participation, and informed consent is obtained prior to data collection.

For data analysis, the study employs SmartPLS 4.0 to conduct PLS-SEM, beginning with the evaluation of the measurement model followed by hypothesis testing through the structural model. Ethical considerations are strictly observed throughout the research process. All procedures comply with research ethics protocols, and ethical approval is obtained from the respective university research ethics committee. Participants are informed of their right to withdraw at any time, and all data are stored securely for academic use only.

Result And Discussion

Demographic Profile
As shown in Table 1 below, A total of 198 secondary school teachers participated in this study. The gender distribution showed that most respondents were female (63%), while male participants comprised 37%. In terms of age, the respondents ranged from 21 to 60 years old, with the highest concentration in the 41–45 age group (14%), followed by those aged 46–50

(13%) and 36–40 (10%). Teachers aged 21–25 represented only 1% of the sample, indicating that most participants were experienced educators. Regarding ethnicity, the sample was predominantly Malay, accounting for 91% of respondents, while Indians made up 3%, Chinese 2%, and those categorized as "Others" represented 4%. Most participants held non-administrative teaching positions, with 66% identified as teachers, 28% as Head of Unit (Panitia), and 7% as Head of Department. In terms of academic qualifications, the majority held a bachelor's degree (71%), followed by 29% with a Master's degree. Only one respondent (1%) held a PhD, suggesting a limited presence of doctoral-level qualifications among secondary school teachers in this study. As for teaching experience, most participants were mid- to late-career educators, with 34% having 16–20 years of experience, 20% with 21–25 years, and 16% with 26–30 years. Only 6% of respondents had less than five years of teaching experience, highlighting a workforce with substantial professional tenure.

Table 2: Demographic Profiles of the Respondents (n = 198)

Information		Frequency (n)	Percentages (%)
Gender	Female	124	63
	Male	74	37
Age	21 - 25	2	1
	26 - 30	9	5
	31 - 35	5	3
	36 - 40	20	10
	41 - 45	27	14
	46 - 50	26	13
	51 - 55	14	7
	56 - 60	9	5
Race	Chinese	4	2
	Indian	6	3
	Malay	181	91
	Others	7	4
Position	Head of Department	13	7
	Head of Unit (Panitia)	55	28
	Teacher	130	66
Highest Qualification	Degree	140	71
	Master	57	29
	PhD	1	1
Teaching Experiences (Year)	1 - 5	12	6
	6 - 10	11	6
	11 - 15	30	15
	16 - 20	67	34
	21 - 25	39	20
	26 - 30	31	16
	31 - 35	8	4

Measurement Model Analysis
The reliability and validity of the measurement model were evaluated using Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). These assessments were conducted in accordance with established guidelines by Hair et al. (2019), who recommend

Cronbach's Alpha and CR values above 0.70 for internal consistency and AVE values above 0.50 for convergent validity.

As shown in Table 2, all constructs met these thresholds. Cronbach's Alpha values ranged from 0.905 (Instructional load) to 0.970 (Transformational Leadership), indicating high internal reliability. Similarly, Composite Reliability (CR) values ranged from 0.933 to 0.973, surpassing the minimum recommended value of 0.70 (Fornell & Larcker, 2016; Hair et al., 2019), thus confirming construct reliability. In terms of convergent validity, all constructs demonstrated AVE values above the critical value of 0.50, ranging from 0.655 (Research Culture) to 0.811 (Monetary backup). This indicates that, on average, each construct explains more than 50% of the variance of its indicators, fulfilling the requirement for convergent validity (Hair et al., 2021).

Moreover, all indicator loadings exceeded the recommended threshold of 0.70 (Chin, 1998), reinforcing the reliability of individual measurement items. The highest loading was observed in FS02 (0.928), while all others remained within acceptable ranges. These findings demonstrate that the measurement model possesses adequate internal consistency, convergent validity, and construct reliability, and is thus suitable for further analysis within the structural equation modelling framework (Hair et al., 2021).

Table 3: Reliability and Validity

Second Order Construct	Item Code	Loading	Reliability & Validity		
			Cronbach Alpha	CR	AVE
Research culture	RC01	0.801	0.924	0.938	0.655
	RC02	0.734			
	RC03	0.849			
	RC04	0.876			
	RC05	0.740			
	RC06	0.831			
	RC07	0.854			
	RC08	0.779			
Transformational leadership	TLI01	0.871	0.970	0.973	0.704
	TLI02	0.847			
	TLI03	0.854			
	TLI04	0.825			
	TLO01	0.879			
	TLO02	0.730			
	TLO03	0.819			
	TLP01	0.801			
	TLP02	0.823			
	TLP03	0.829			
	TLP04	0.884			
	TLV01	0.835			
	TLV02	0.882			
	TLV03	0.827			

Second Order Construct	Item Code	Loading	Reliability & Validity		
			Cronbach Alpha	CR	AVE
	TLV04	0.870			
Monetary backup	FS01	0.881	0.922	0.945	0.811
	FS02	0.928			
	FS03	0.911			
	FS04	0.881			
Research equipment	SF01	0.837	0.924	0.940	0.724
	SF02	0.874			
	SF03	0.803			
	SF04	0.868			
	SF05	0.847			
	SF06	0875			
Instructional load	AWC	0.903	0.905	0.933	0.777
	AWF	0.842			
	AWI	0.857			
	AWP	0.923			

Next, discriminant validity was assessed using the Heterotrait-Monotrait Ratio (HTMT), as recommended by Henseler et al. (2015). The HTMT values indicate the extent to which constructs are distinct from one another, with values below 0.90 generally considered acceptable for establishing discriminant validity (Gold et al., 2001; Henseler et al., 2015). As presented in Table 3, all HTMT values were below the 0.90 threshold. The highest HTMT value was observed between Monetary backup and School management (HTMT = 0.806), followed by research equipment and Monetary backup (HTMT = 0.766). The relationship between Research Culture and School management yielded an HTMT value of 0.705, while other construct comparisons remained well below 0.70. The lowest HTMT value was between Instructional load and Research equipment (HTMT = 0.215), confirming their distinctiveness. These results confirm that all constructs exhibit adequate discriminant validity, validating the structural independence of each latent variable in the model (Franke & Sarstedt, 2018). This supports the integrity of the conceptual framework and justifies further analysis of the structural model.

Table 4: HTMT Criterion

	Instructional load	Monetary backup	School management	Research Culture	Research equipment
Instructional load	-				
Monetary backup	0.249	-			
School management	0.290	0.806	-		
Research Culture	0.242	0.645	0.705	-	
Research equipment	0.215	0.766	0.743	0.625	-

Structural Model Analysis

The structural model was evaluated using Partial Least Squares Structural Equation Modeling (PLS-SEM), with bootstrapping of 5,000 subsamples to test the significance of hypothesized relationships. Among the four predictors, transformational leadership was found to have a significant and positive effect on research culture ($\beta = 0.451$, $p < 0.001$), indicating that school management is a key driver in cultivating research engagement among secondary school teachers. This finding aligns with previous studies that emphasize the critical role of visionary and supportive school management in promoting innovation and professional learning (Bhatti et al., 2022). In contrast, monetary backup showed a positive but non-significant effect ($\beta = 0.124$, $p = 0.216$), suggesting that funding alone may not be sufficient to drive research culture without complementary factors like school management and motivation. Similarly, research equipment exhibited a marginally significant influence ($\beta = 0.172$, $p = 0.065$), indicating a potential but inconclusive role in shaping research culture. Instructional load, on the other hand, had a negative and statistically non-significant effect ($\beta = -0.042$, $p = 0.471$), suggesting that teaching load does not directly impact teachers' engagement in research within this context. Overall, the model explained 64.8% of the variance ($R^2 = 0.648$) in research culture, indicating a moderate level of explanatory power. These results highlight transformational leadership as the most influential factor, while also suggesting that institutional support mechanisms like facilities and funding may require integration with school management and motivational strategies to be effective (Refer Table 4 and Figure 1).

Table 5: Bootstrapping Result

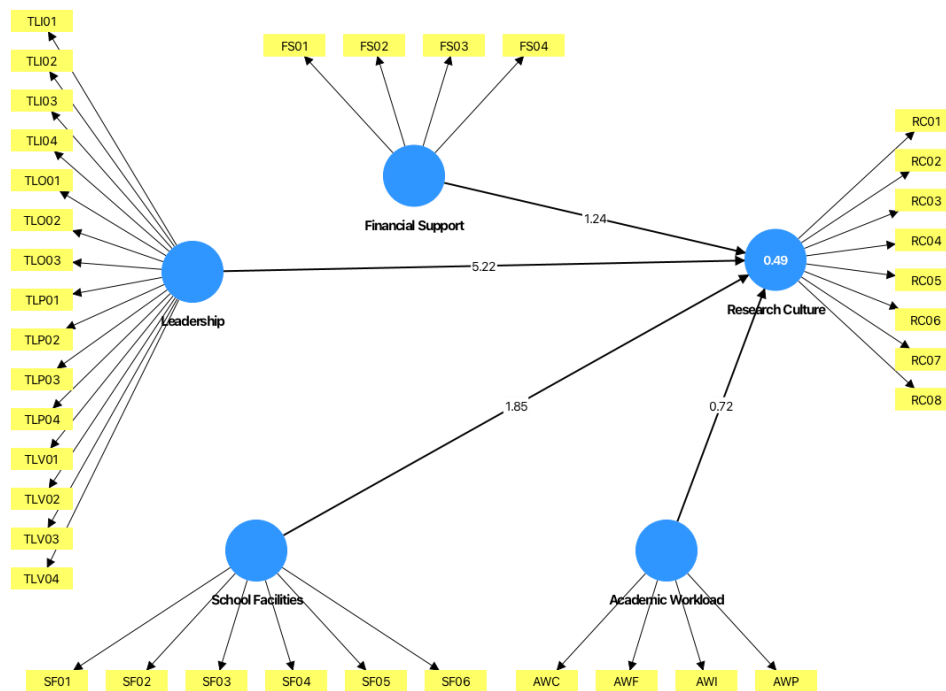| Hypotheses	Path Coefficient, β	Standard deviation	T-values	P values	Decision
Instructional load -> Research Culture	-0.042	0.058	0.721	0.471	Rejected
Monetary backup -> Research Culture	0.124	0.100	1.238	0.216	Rejected
School management -> Research Culture	0.451	0.086	5.223	< 0.001	Accepted
Research equipment-> Research Culture	0.172	0.093	1.845	0.065	Accepted

Figure 1: Structural Model

Conclusion

This study explored the structural relationships between transformational leadership, monetary backup, school facilities, instructional load, and the development of a research culture in Malaysian secondary schools. Guided by the Resource-Based View (RBV), the findings emphasize that transformational leadership is the most influential factor, significantly shaping teachers' engagement in research practices. This underscores the importance of visionary, supportive school management in fostering a culture of inquiry and continuous professional growth.

Conversely, monetary backup and instructional load did not show significant direct effects on research culture. This suggests that simply providing resources or reducing workload is insufficient without strong school management and strategic alignment. Research equipmentshowed a marginally positive effect, indicating that infrastructure plays a supporting role but may require integration with other institutional drivers to be impactful.

The findings contribute to theory by reinforcing the RBV perspective that intangible assets, particularly school management, can enhance the value of tangible resources when deployed strategically. From a practical standpoint, the study offers important insights for educational policymakers and school administrators: building research culture requires more than funding, it demands intentional school management development, recognition systems, and institutional support that inspire and empower teachers to engage in scholarly activities.

Future research should examine mediating or moderating variables, such as motivation or reward mechanisms, to better understand the indirect pathways through which institutional factors shape research engagement. Longitudinal or mixed-method approaches may also enrich the understanding of how research culture evolves over time within school systems.

Acknowledgement

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