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Techno-Enablement in School Data Management: Policy Practices and Inter-Agency Governance in Malaysia

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Abstract

This study explores the implementation of data-driven decision-making (DDDM) within the Malaysia Education Blueprint (MEB), focusing on why it has not effectively enhanced educational delivery and outcomes as intended. Despite the MEB's clear key outcomes, the reasons for the shortfall in achieving these goals through DDDM have not been thoroughly examined. This research critically investigates the underlying issues in School Data Management (SDM) practices and proposes a solution through the lens of techno-enablement, a framework that integrates power and potential.

Drawing from Foucault's relational power, Heidegger's potentiality, and Valsiner's enablementism, this study critiques the assumption that empowerment alone ensures effective SDM. It adopts a structural-relational perspective, recognising that governance structures (policy, bureaucracy, and institutional hierarchies) shape but do not fully determine decision-making autonomy. Rather than viewing SDM failures as either technocratic inefficiencies (structural) or human limitations (relational), this study examines how structural constraints and relational agency interact to enable or constrain DDDM practices.

This research used a sequential qualitative methodology and multiple phases of data collection to uncover the disconnect between policy and practice in SDM. The study investigated the experiences of 40 headteachers as school-level data managers, using online questionnaires and consultation sessions. Additionally, it focused on educational officers from District Education Offices (DEO), the Ministry of Education (MOE), and the Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), engaging them through focus groups and interviews to understand the challenges of policy implementation at the district and ministry levels.

The findings revealed a significant disconnect between the policy narratives of the MEB and the lived experiences of educators, highlighting ambivalence in SDM practices. In response, this study introduced techno-enablement, a theoretical framework that explains how governance conditions determine whether SDM empowers institutions or constrains decision-making autonomy. From this foundation, the Techno-Enabler Framework is developed, identifying five

interrelated enabling conditions for SDM effectiveness: Techno-Governance (policy coherence), Techno-Competency (data literacy), Techno-Networking (inter-agency collaboration), Techno-Decisioning (institutional autonomy), and Techno-Integration (policy adaptability).

Rather than an empirical test of causality, this study provides a theoretical exploration of SDM governance, aligning with interpretive social science traditions. While informed by empirical findings, its goal is not to prove direct cause-effect relationships but to explore why SDM remains compliance-driven rather than participatory. Instead of isolating variables for causal testing, it examines governance structures, policy translation, and institutional agency to identify enabling conditions for SDM effectiveness.

This study advocates for a new way of thinking about the role of technology and human agency in SDM. Techno-enablement offers a cohesive approach for leveraging data technologies in tandem with human capacities to enhance educational outcomes. The findings and the proposed Techno-Enablement Framework not only aim to improve educational delivery and outcomes within Malaysia but also offer a model for other countries with similar centralised-decentralised educational structures, potentially transforming how data-driven decision-making is approached in global educational contexts. Future research should empirically test the Techno-Enabler Framework through a longitudinal study, assessing how SDM governance evolves over time and whether governance conditions adapt to institutional needs.

Table of Contents

Abstract	ii
List of Tables	ix
List of Figures	x
Preface	xi
Acknowledgement	xiv
Author's Declaration	xv
Definitions/Abbreviations	xvi
Chapter 1 Introduction	19
1.1 Introduction: Rethinking Data, Power, and Governance in Education ..	19
1.2 Dataism and the Worldview of Data Management in Education	21
1.3 The Research Problem: SDM Governance in Malaysia	25
1.4 Theoretical Positioning: A Multi-Layered Framework for Understanding SDM Governance Failures	31
1.5 Introducing Techno-Enablement: A Conceptual Framework for SDM Governance	35
1.6 Significance	40
1.7 Limitations	41
1.8 Objectives	42
Chapter 2 Literature Review	46
2.1 Introduction	46
2.2 The Systematic Process of Constructing This Literature Review	47
2.3 The Landscape of SDM	50
2.3.1 Understanding SDM as a Transactional Tool in Education	53
2.4 SDM from a Techno-Agential Ontology: Balancing Determinism and Realism	56
2.5 Techno-Agential Ontology in Distributed Leadership for SDM	61
2.6 SDM as Information Inter-Agency Coordination	64
2.7 Structural-Relational Perspective: Towards a Techno-Agential Understanding of SDM	66
2.8 SDM from Structural Perspectives	68
2.8.1 Policy and Public Agencies as Capacity Enablers	69
2.8.2 Structural Constraints from Infostructure and Infosystem	72
2.8.3 Theoretical Frameworks for Understanding Structural Issues	75

2.8.4	Techno-Agential Condition: Interplay of Isomorphism, RDT, and Occam's Razor in SDM Research	79
2.9	Bridging Structural and Relational Perspectives in SDM Research	82
2.9.1	Technology and Agencies in Socio-Materiality Networks	85
2.9.2	Ambivalences within/between Technology and Agencies	86
2.9.3	Mobilising Tokens of Agencies and Technology	87
2.9.4	Translations of Technology and Agencies in SDM	88
2.10	Synthesis of Literature and Theoretical Gaps in Techno-Agential SDM Framework	92
2.11	SDM as a Techno-Agential Condition: The Need for a New Framework.	97
2.12	Addressing Theoretical Gaps through Research Questions: A Framework for Investigating SDM in Malaysia	102
Chapter 3	Methodology	107
3.1	Introduction	107
3.2	Research Design: A Sequential Qualitative Methodology	107
3.3	Population and Sampling Strategy	112
3.3.1	Population Sampling in a Centralised-Decentralised Educational System	112
3.3.2	Sampling Techniques and Participant Selection	113
3.3.3	Convenience and Purposive Sampling for Headteachers	114
3.3.4	Purposive and Snowball Sampling for DEO, MOE, and MAMPU Officers	115
3.4	Research Timeline and Ethical Approval	116
3.4.1	Research Timeline	116
3.4.2	Ethical Approval and Considerations	118
3.4.3	Justification for Not Using Coded Identifiers for MOE, MAMPU, and DEO Officers	120
3.5	Data Collection Methods	121
3.5.1	Policy Document Analysis: Establishing Institutional Narratives ..	122
3.5.2	Systematic Review for Themes Identification	125
3.5.3	Online Questionnaire: Capturing Headteachers' Perspectives	129
3.5.4	Consultation Session: Collaborative Validation of Emerging Findings	136
3.5.5	Focus Groups and Interviews: Institutional and Policy-Level Perspectives	144
3.5.6	Researcher Reflexivity and Positionality	152
3.6	Data Analysis Approach	157

3.6.1	Thematic Analysis Framework.....	159
3.6.2	Coding Process and Data Management	163
3.6.3	Ensuring Trustworthiness and Analytical Rigour	166
3.6.4	Data Triangulation: Cross-Validating Findings from Multiple Sources to Enhance Trustworthiness	170
3.7	Analytical Generalisation: Extending Findings Beyond the Research Context.....	173
3.7.1	Theoretical Contribution: Developing an Analytical Framework for Digital Governance in Education.....	174
3.7.2	Transferability: Applying Key Findings to Other Digital Education Reforms	175
3.7.3	Limitations and Reflexivity in Analytical Generalisation	177
3.8	Limitations of the Study: Critical Engagement and Mitigation Strategies	178
Chapter 4	Structural Findings – The Compliance Cycle Trap in SDM Governance	183
4.1	Introduction	183
4.2	Infostructural Challenges: Inter-Agency Data Flows.....	185
4.2.1	Struggles in Collaboration.....	186
4.2.2	Conflicting Directives	188
4.2.3	Poor Resource Allocation.....	190
4.3	Infosystemic Challenges: Interconnected Data Systems	191
4.3.1	Policy-System Alignment	192
4.3.2	Human-Tech Interaction	203
4.3.3	Enablement of Advocated Approaches	209
4.4	Comparative Analysis: Divergence in Perspectives	220
4.4.1	Divergent Perspectives of Data Technology	221
4.4.2	Contradicting Statement of School Data Flow	224
4.4.3	Perceptual Disparities between Policy Planning and Policy Implementation	228
Chapter 5	Relational Findings - The Ghost Network of SDM Leadership	231
5.1	Introduction	231
5.2	Shared Anecdotes of SDM Networks.....	232
5.2.1	Problematisation (Issues)	233
5.2.2	Interessement (Interest)	235
5.2.3	Enrolment (Engagement).....	236
5.2.4	Mobilisation (Action).....	239

5.2.5	Addressing the Research Questions.....	240
5.2.6	Network Issue: The Fragmented Will in Human Agency	241
5.3	Assemblage of SDM Networks	242
5.3.1	Moment: Preparation Meeting.....	242
5.3.2	Moment: Consultation Session.....	244
5.3.3	Network Issue: Technological Overemphasis	246
Chapter 6	Discussion: Techno-Enablement.....	250
6.1	Introduction: From Findings to Solutions.....	250
6.2	Addressing the Research Questions Through the Findings	251
6.3	Rethinking SDM Through Techno-Enablement	254
6.4	Systematic Development of Techno-Enablement as a Synthesis of the Techno-Agential Condition	255
6.5	Theoretical Discourses on SDM Governance	259
6.5.1	Institutional Theory and Policy Standardisation in SDM	259
6.5.2	Isomorphism in SDM Adoption	263
6.5.3	Public Policy Capacity in SDM Implementation	266
6.5.4	Resource Dependence Theory (RDT) in SDM Implementation.....	270
6.5.5	Data Autocracy vs. Data Democracy in SDM Governance.....	278
6.5.6	Policy Translation Theory in SDM Implementation	282
6.5.7	Socio-Material Networks in SDM Governance.....	286
6.5.8	Data Power Hierarchies in SDM Governance	293
6.5.9	Technological Determinism in SDM Governance	297
6.5.10	Enablementism and the Techno-Agential Condition in SDM Governance	301
6.6	The Novelty of Techno-Enablement and the Techno-Enabler Framework: A 4Cs Analysis	310
6.7	Constructing the Techno-Enabler Framework for SDM	312
6.7.1	Summary of the Techno-Enabler Framework for SDM.....	319
6.7.2	S.P.I.R.E. Canvas as a Practical Leadership and Decision-Making Tool	320
6.8	The Implications of Techno-Enablers for SDM Reform	322
6.8.1	Theoretical Implications: Repositioning SDM as an Enabler of Institutional Autonomy	323
6.8.2	Policy and Governance Implications: The Role of Middle-Tier Leadership in Distributed Leadership through Techno-Enablement	325
6.9	Conclusion: The Future of SDM Reform Through Techno-Enablers	328

References.....	330
Appendices	363
Online Questionnaire	363
a. Questionnaire	363
b. Thematic analysis for Online Questionnaire	369
c. Generated Questions for Consultation Session	370
Consultation Session.....	373
a. Participants' Attendance Record.....	373
Interviewees' Profile	374
Refined Interview Questions	377
Triangulation of Thematic Analysis	380
a. Infostructural challenges	380
b. Infosystemic challenges.....	380
c. Enablement for Advocated Approaches	380
d. Divergent in Perspectives	380

List of Tables

TABLE 2.1 SYNTHESIS OF LITERATURE IN THE TECHNO-AGENTIAL FRAMEWORK92

TABLE 3.1 SYSTEMATIC REVIEW RELATED TO SDM.....127

TABLE 4.1 PROGRESS STATUS OF GOALS IN THE MEB197

TABLE 4.2 COMPARATIVE ANALYSIS OF SDM PERCEPTIONS AMONG AGENCIES227

TABLE 6.1 4CS ANALYSIS FOR TECHNO-ENABLEMENT AND THE TECHNO-ENABLER FRAMEWORK311

List of Figures

FIGURE 4-1 THE COMPLIANCE TRAP CYCLE.....	184
FIGURE 4-2 NETWORK ANALYSIS FINDINGS OF SDM IN MALAYSIA	194
FIGURE 4-3 PROMINENT AGENCIES IDENTIFIED IN POLICY NETWORK ANALYSIS.....	202
FIGURE 5-1 I MODERATED THE CONSULTATION SESSION	238
FIGURE 5-2 A HEADTEACHER VOICED OUT HIS CONCERNS RELATING TO SDM PRACTICES	239
FIGURE 6-1 TECHNO-ENABLEMENT: INTERSECTION OF POWER, POTENTIALITY, AND ENABLEMENTISM	324

Preface

This research began with a fundamental question: why has data-driven decision-making (DDDM) in Malaysia's education system failed to achieve its intended impact? As an IT specialist working with school data under the Ministry of Education (MOE) Malaysia for eight years, I initially set out to explore how School Data Management (SDM) could be optimised to better support education governance under the Malaysia Education Blueprint (MEB) 2013-2025. The MOE approved my initial research focus, Critical Sense-Making for Meaningful Use of School Digital Data, with the expectation that the study would offer practical insights into improving SDM implementation. However, as my analysis of research problem progressed, I realised that SDM's challenges were not merely technical but deeply embedded in governance structures, institutional dynamics, and policy frameworks.

While the MEB envisions SDM as a tool for data-driven governance, designed to enhance accountability, inform policy decisions, and empower educational institutions, its practical implementation has deviated from these objectives. Instead of fostering school-led decision-making, SDM has been relegated to a compliance-driven mechanism, where schools act as passive data providers rather than active decision-makers. The centralised control of SDM governance has resulted in an infrastructure that demands data compliance rather than institutional engagement, leaving teachers and administrators trapped in endless cycles of data collection, input, and validation. Instead of leveraging SDM insights to improve student learning and school management, educators are compelled to prioritise bureaucratic reporting requirements over meaningful data interpretation.

This paradox mirrors the tale of the sorcerer's apprentice, who, in attempting to harness magic for efficiency, loses control over the very forces meant to serve him. In the case of SDM, data—intended as a governance tool—has instead become the master, dictating school functions rather than responding to institutional needs. Teachers, school leaders, and policymakers—who should be at the heart of data-driven governance—find themselves governed by the data infrastructure itself, compelled to meet performance indicators, complete

reporting cycles, and validate accuracy, often without questioning the actual impact on student learning. As a result, schools have been reduced to data-processing units, ensuring numerical targets are met while educational outcomes remain secondary.

Recognising this imbalance in SDM governance led me to shift my perspective. Instead of viewing SDM as a standalone technical issue, I began to see it as a larger governance challenge—one that required a macroscopic approach. Much like an orchestra depends on the coordination of its conductor, musicians, and stage managers to produce harmony, SDM governance relies on the synchronisation of education agencies, digital infrastructures, and human decision-makers. However, my research revealed that Malaysia's SDM framework operated like an orchestra out of sync, marked by fragmented policy translation, uneven institutional engagement, and a top-down governance model that restricted localised decision-making.

Through this realisation, it became evident that SDM's effectiveness was contingent not just on technical improvements but on enabling conditions for institutional agency, inter-agency collaboration, and policy adaptability. This led to the development of Techno-Enablement, a conceptual framework that examines how technology, when embedded within governance structures, can either enhance or constrain decision-making authority. Drawing from Heidegger's concept of potentiality, Foucault's notion of power, and Valsiner's enablementism, Techno-Enablement argues that technology alone does not drive education reform—its effectiveness depends on whether governance conditions enable institutions to translate data into meaningful action.

Techno-Enablement provides a new perspective on SDM, not as a passive data repository but as an active governance mechanism that requires a balance between regulatory oversight, institutional autonomy, and digital capacity. From this foundation, I developed the Techno-Enabler Framework, a theoretical construct that identifies five interrelated conditions necessary for SDM to function as an effective governance tool:

Techno-Governance: Ensuring policy coherence while maintaining institutional flexibility.

Techno-Competency: Strengthening data literacy and professional development in SDM usage.

Techno-Networking: Enhancing inter-agency collaboration to reduce fragmentation.

Techno-Decisioning: Empowering school leaders and district officers with decision-making authority over SDM.

Techno-Integration: Creating adaptive SDM policies that respond to localised needs rather than rigid, top-down directives.

Rather than offering a prescriptive solution, this study presents a theoretical framework to analyse SDM governance as a dynamic system shaped by structural and relational conditions. By conceptualising SDM through Techno-Enablement, this research contributes to a deeper understanding of education data governance within Malaysia's centralised-decentralised system. This study is not the conclusion but the beginning of a broader inquiry into how SDM governance evolves over time, how institutional engagement with education data shifts, and whether governance structures can adapt to emerging challenges in education policymaking.

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Your constant cheer has helped my dreams ascend,
In every moment, you are my guide and friend.

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With your support, I have reached this higher height.

Author's Declaration

“I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.”

Printed Name: NUR AIMAN BIN ZAINUDIN

Signature: _____

Definitions/Abbreviations

a. Techno-enablement	Techno-Enablement refers to the governance conditions, institutional capacities, and structural mechanisms that allow technology to function as an enabler of decision-making rather than a passive data collection tool. It emphasises that technology alone does not drive education reform—its effectiveness depends on how institutional agency, policy structures, and relational networks interact to translate data into meaningful action.
b. School Data Management (SDM)	SDM is defined as the process of inter-agency coordination and information sharing among various educational stakeholders, including schools, district education offices, state education departments, and the Ministry of Education. This process involves the systematic collection, storage, analysis, and utilisation of data to support decision-making, policy implementation, and the overall improvement of educational outcomes.
c. Policy practices	The set of actions, strategies, and guidelines implemented within the educational system to achieve the outcomes outlined in the MEB and to prepare for the post-MEB period.
d. Inter-Agency Governance	The coordinated and collaborative management, oversight, and regulation of SDM practices among various educational agencies including schools, district education offices, state education departments, and the Ministry of Education.
e. Malaysia	Malaysia for this study refers to the nation's educational system and governance structures within the context of the MEB and SDM practices. This definition encompasses various dimensions of Malaysia's educational landscape, including its centralised-decentralised structure, the roles of different educational agencies, and the sociopolitical contexts that influence policy implementation and educational outcomes.
f. MOE	Ministry of Education, Malaysia (MOE) is the federal government agency responsible for formulating, implementing, and overseeing educational policies and programs in Malaysia. It plays a central role in ensuring the country's educational system meets national goals and international standards, promoting access, quality, equity, unity, and efficiency in education. The MOE's responsibilities encompass all levels of education, from early childhood to higher education, and include both public and private institutions.
g. SEDs	State Education Departments (SEDs) in Malaysia are the intermediary governmental agencies operating under the MOE. They are responsible for implementing national educational policies, strategies, and programs at the state level. SEDs serve as a vital link between the MOE and DEOs, ensuring that the central directives are effectively executed and tailored to meet regional and local needs.
h. DEOs	District Education Offices (DEOs) in Malaysia are administrative units operating under the SEDs and the MOE. They serve as the local authority for managing and supporting public schools within a specific district, ensuring the effective implementation of educational policies and programs at the grassroots level. DEOs act as a critical link between schools and higher educational authorities, facilitating communication, coordination, and resource allocation.

i. MAMPU	Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) is a key government agency under the Prime Minister's Department in Malaysia. MAMPU is tasked with driving administrative reforms and enhancing public sector efficiency through modernisation and strategic planning. The agency plays a pivotal role in improving the quality, productivity, and effectiveness of the public service delivery system, ensuring it meets the needs and expectations of the citizens.
j. MEB	Malaysia Education Blueprint (MEB) is a comprehensive policy document developed by the Ministry of Education, Malaysia, aimed at transforming the national education system. Launched in 2013, the MEB outlines strategic goals, initiatives, and performance targets to be achieved over a 13-year period, spanning from 2013 to 2025. The blueprint addresses various aspects of education, from early childhood education to higher education, with a focus on ensuring equitable access, enhancing quality, and improving overall educational outcomes.

Upon completing this research and thesis, the following milestones were achieved:

- a. The systematic review was peer-reviewed, presented, and published in the “Imagining Better Education” conference proceedings on October 20, 2022. The publication, titled “Data-Driven Practices in Malaysian Education Blueprint (2012-2025): What Can Malaysia Learn from Europe?” by Nur Aiman bin Zainudin, can be found in Bennion, H., Broadfoot, H., Fan, K., Meng, T., Zhang, Y., & Zhou, Q. (Eds.), *Imagining Better Education* (pp. 130 - 149). University of Durham: Conference Proceedings 2022.
- b. The “Leadership in the Digital Era for School in Action” (LENSA) conference was organised on March 15-16, 2023. This collaborative effort involved the researcher, and officers from Educational Leadership Institute A and District Education Office A, targeting 40 selected headteachers from across Malaysia.
- c. The research methods and findings were presented by the researcher in 2024 at the Sustainable Visions Postgrad Research Poster Challenge. The presentation, titled “Data-Driven Sustainability: Enhancing Data Literacy Among Headteachers,” was part of the event hosted by the College of Social Science at the University of Glasgow. The reference for this presentation is: Nur Aiman bin Zainudin. (2024, May 5). *Data-Driven Sustainability: Enhancing Data Literacy Among Headteachers* [Poster presentation]. Sustainable Visions Postgrad Research Poster Challenge, College of Social Science, University of Glasgow.

Chapter 1 Introduction

1.1 Introduction: Rethinking Data, Power, and Governance in Education

In an era where quantification, metrics, and algorithmic governance are shaping how societies function, education systems are increasingly governed by the logic of data-driven decision-making (DDDM). The assumption that data, when properly collected and analysed, will lead to more effective policies, greater institutional efficiency, and improved learning outcomes has become a dominant narrative in education reform (Williamson, 2017). The belief that quantifiable data provides objective, neutral, and predictive insights—a key tenet of what Mayer-Schönberger and Cukier (2013) term *dataism*—has led to the widespread institutionalisation of School Data Management (SDM) systems as central components of modern education governance. But can data, in and of itself, truly transform education systems? Or does its effectiveness depend on who controls it, how it is interpreted, and whether governance structures enable meaningful engagement with data insights?

These questions are particularly significant in Malaysia, a country that has actively pursued education reforms aligned with international benchmarking standards such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). As a country striving to position itself among high-performing global education systems, Malaysia has consistently aligned its education reforms with OECD-led frameworks that emphasise international comparability, performance benchmarking, and standardised education metrics (Perera & Asadullah, 2019).

The introduction of SDM under the Malaysia Education Blueprint (MEB) 2013-2025 was part of a larger vision to modernise education governance, improve system-wide accountability, and enhance decision-making at multiple levels of education administration (MOE, 2013). The blueprint positioned SDM as a key mechanism for evidence-based policymaking, allowing national policymakers, district education offices (DEOs), and school administrators to access real-time education insights to support resource allocation, institutional planning, and student performance tracking.

At the same time, Malaysia operates within a centralised education system, where decision-making authority is concentrated within the MOE, with schools and district offices functioning primarily as implementers rather than as autonomous decision-makers (Bush et al., 2023). This centralisation raises critical questions about whether SDM is being used to facilitate school autonomy, promote policy adaptability, and support decentralised governance—or whether it primarily serves as a compliance mechanism for top-down performance monitoring.

This study argues that data does not govern—people do. The mere availability of education data does not automatically lead to improved education outcomes; rather, its impact is shaped by how institutions engage with data, how governance structures frame its use, and how policymakers translate its insights into actionable strategies. While Malaysia’s SDM framework has successfully expanded digital access to education data, its effectiveness depends on whether schools, district education offices, and education policymakers have the autonomy, capacity, and structural support to engage meaningfully with SDM insights (Bush et al., 2023). If SDM is to function as an enabler of participatory governance rather than as a bureaucratic performance-tracking tool, it must be examined not only as a technological system but as an institutional and political mechanism embedded within governance structures, policy frameworks, and decision-making cultures.

To critically examine how SDM governance has been structured, implemented, and utilised in Malaysia’s education system, this study integrates multiple theoretical perspectives. Institutional Theory (Meyer & Rowan, 1977) explains how bureaucratic structures shape decision-making authority and policy implementation. Policy Capacity Theory (Wu, Ramesh & Howlett, 2015) explores the challenges associated with data literacy, institutional readiness, and cross-agency coordination. Policy Translation Theory (Callon, 1986) and Isomorphism (DiMaggio & Powell, 1983) examine how SDM policies are interpreted, adapted, and redefined at different levels of governance.

Beyond institutional and policy perspectives, Data Power Hierarchies (Kelly et al., 2010) and Socio-Material Networks (Fenwick & Edwards, 2010) provide insights into how SDM functions as a governance ecosystem, shaping the

interaction between technology, data, and institutional actors. Finally, enablementism (Valsiner, 2014) and Occam's Razor contribute to this analysis by assessing whether rigid compliance-based SDM policies limit institutional adaptability and school-level decision-making authority.

Malaysia's experience with SDM governance is particularly relevant in the context of global education governance debates, where education systems worldwide are increasingly shaped by big data, predictive analytics, and algorithmic decision-making. The governance challenges identified in SDM implementation—the centralisation of data control, the limitations of institutional capacity, the fragmentation of policy translation, and the reinforcement of data power hierarchies—reflect broader concerns about the role of data in education policymaking, institutional autonomy, and participatory governance.

This study goes beyond analysing SDM policies; it critically examines the governance of education in the era of data-driven policymaking. The core issue is not simply the collection and analysis of education data, but who controls the data, how it is used, and whether it drives meaningful improvements or perpetuates bureaucratic inertia. As Malaysia advances its data-driven education agenda, the central question becomes not how much data is gathered, but whether it is leveraged to promote institutional flexibility, strengthen governance responsiveness, and enable participatory decision-making.

1.2 Dataism and the Worldview of Data Management in Education

The global shift toward data-driven decision-making (DDDM) in education governance, as introduced in the previous section, is rooted in a broader ideological framework known as dataism (Mayer-Schönberger & Cukier, 2013). Dataism represents the belief that quantitative data can provide objective, transparent, and predictive insights into human behaviour, enabling better decision-making across various domains, including education (Williamson, 2017). This ideology has led to a widespread reliance on big data analytics, algorithmic governance, and performance-tracking systems to improve education outcomes, ensure accountability, and guide policy reforms (Selwyn, 2021). However, while

dataism assumes that data-driven processes are inherently neutral and beneficial, scholars have increasingly critiqued this view, arguing that education data, when misapplied, can reinforce technocratic control, obscure systemic inequalities, and prioritise compliance over substantive learning improvements (Sjøberg & Jenkins, 2020)

Dataism has shaped the development of SDM systems, positioning them as key enablers of education reform. The rise of learning analytics, standardised testing, and real-time performance monitoring has reinforced the idea that student achievement, teacher effectiveness, and school quality can be objectively measured and improved through systematic data collection and analysis (Mandinach & Gummer, 2016). However, this view has been met with growing scepticism, particularly in relation to how education data is used to drive policy decisions at national and institutional levels.

One of the most profound manifestations of dataism in education is the global reliance on international benchmarking assessments such as PISA and TIMSS. These assessments have become the dominant reference points for evaluating national education systems, influencing how governments develop and implement education policies (Sellar & Lingard, 2013). The argument underpinning these assessments is that cross-country comparisons of student performance provide policymakers with empirical evidence to improve their education systems (OECD, 2019). However, critics argue that PISA and TIMSS promote a narrow view of education success, reinforcing statistical biases, standardising education governance, and limiting policy autonomy for national governments (Goldstein, 2017; Rizvi & Lingard, 2009).

For instance, Goldstein (2017) critiques the statistical bias inherent in PISA and TIMSS, arguing that these assessments privilege certain pedagogical models over others, disregarding the socio-cultural, political, and economic contexts in which education systems operate. Similarly, Williamson (2017) and Sjøberg & Jenkins (2020) highlight that the global education governance structure, shaped by the OECD, encourages nations to prioritise rankings over locally relevant education reforms, reinforcing a performance-driven culture that favours short-term statistical improvements rather than long-term systemic transformation.

This worldview has deeply influenced Malaysia's education policies, including its approach to SDM governance. The MEB explicitly adopted a data-centric approach to improving education performance, using SDM as a tool to monitor student progress, enhance teacher accountability, and support school leadership through evidence-based interventions (MOE, 2013). However, the emphasis on international benchmarking has led to an education system that prioritises measurable outcomes, reinforcing a data-driven governance model that is more focused on compliance than on meaningful institutional engagement with education data (Bush et al., 2023).

A critical issue with dataism in education governance is that while data collection has become more sophisticated, the ability to interpret and apply this data meaningfully remains limited. In many cases, education policymakers assume that simply having access to vast amounts of data will lead to better decision-making (Mandinach & Gummer, 2016). However, as Ball (2012) and Williamson (2017) argue, data without context can reinforce bureaucratic inefficiencies, deepen existing inequalities, and shift decision-making power away from educators toward centralised data-processing agencies. This raises concerns about the extent to which education systems, particularly in developing nations, have the institutional capacity to use SDM data effectively.

Malaysia presents a compelling example of the risks associated with an overreliance on dataism in education governance. While the MEB's SDM framework was designed to enhance school autonomy and improve policy efficiency, its implementation has largely mirrored the challenges faced by other education systems that have prioritised big data analytics over localised governance adaptability. These challenges include limited institutional agency in data-driven policymaking. For instance, teachers and school leaders, who are closest to the data, are often not given the autonomy to engage with SDM insights in ways that reflect their local needs (Bush et al., 2023). Instead, data is processed at higher bureaucratic levels, where it is used primarily for compliance and reporting purposes (Bush et al., 2023).

These concerns highlight a fundamental contradiction in dataism—while it promotes efficiency and objectivity in decision-making, it often leads to a more centralised, top-down approach to governance that limits institutional

flexibility. This contradiction is particularly evident in Malaysia's SDM governance, where the focus on international benchmarking and compliance has overshadowed the need for localised, adaptive education policies.

Given these limitations, this study challenges the assumption that digitalisation alone improves SDM governance. Instead, it argues that data-driven education reforms must be embedded within governance structures that enable institutional engagement, leadership adaptability, and policy flexibility. This requires a shift away from overly centralised, compliance-driven SDM models toward participatory governance frameworks that empower schools, district offices, and education policymakers to actively engage with education data.

Evolution of Malaysian Education Policy: From National Development to Global Benchmarking

To understand Malaysia's adoption of SDM and its alignment with global benchmarking frameworks, it is necessary to examine the country's education policy evolution. Malaysia's education policy has historically been shaped by its nation-building agenda, particularly in the post-independence period. Early policies such as the Razak Report (1956) and the Education Act (1961) were designed to unify Malaysia's diverse population through a centralised education system. These policies positioned education as a mechanism for promoting national identity, social cohesion, and economic development. Emphasis was placed on the Malay language as the national medium of instruction while accommodating mother tongue education for minority groups. The education system during this period reflected the state's strong role in driving social integration and development, embedding centralised governance as the dominant model for policy implementation and resource allocation.

By the 1990s, Malaysia's education policy began incorporating technological advancements and data systems, signalling a gradual shift towards performance-driven governance. The introduction of the Smart School Blueprint marked an early attempt to modernise education delivery and improve administrative efficiency through digital infrastructure. This period saw the beginnings of data collection for school performance monitoring, although the primary focus remained national development. Education policies continued to align with

domestic socio-economic priorities, including affirmative action under the New Economic Policy (NEP), which sought to address ethnic imbalances in education access and outcomes.

The launch of the Malaysian Education Blueprint (MEB) 2013-2025 represents a significant turning point, marking Malaysia's explicit shift towards global benchmarking and data-driven decision-making (DDDM) as central to education governance. The MEB introduced centralised databases, real-time performance dashboards, and predictive analytics aimed at enhancing accountability and driving quality improvements. Crucially, it aligned Malaysia's education system with international assessment frameworks such as PISA and TIMSS, reflecting the growing influence of global standards on national policy objectives. This evolution illustrates a clear transition in Malaysia's education governance—from an inward-looking, nation-building focus to an outward-facing model that prioritises international competitiveness, evidence-based policymaking, and alignment with global education quality indicators.

1.3 The Research Problem: SDM Governance in Malaysia

Recognising my positionality as an insider-researcher within Malaysia's Ministry of Education, I approached the 5 Whys analysis with deliberate methodological caution to mitigate potential bias and avoid premature problem closure. Rather than allowing my own professional experiences or preconceptions to shape the findings, the 5 Whys served as an exploratory tool to critically unpack the multi-layered governance challenges of SDM. By systematically interrogating each level of inquiry—tracing surface-level inefficiencies back to structural, institutional, and policy-driven factors—I reduced the risk of overemphasising individual or technical failures.

This recursive questioning helped reveal the deeper convergence of national policy priorities, international benchmarking pressures, and digital infrastructure limitations. Importantly, the framework prevented me from attributing causality to a single source, reinforcing a techno-agential perspective where power, potential, and human agency interact dynamically. This approach not only supports a balanced understanding of the research problem but also positions the study to interrogate both macro-level policy design and micro-level

institutional practices without reinforcing deficit narratives about specific actors or institutions.

The first level of inquiry asked why SDM governance was ineffective. I observed that while schools and district education offices (DEOs) collected vast amounts of data—ranging from student performance indicators to administrative efficiency metrics—this data did not consistently translate into meaningful policy implementation. Instead, SDM appeared to serve a reporting function rather than facilitating institutional engagement with data. This led to the second level of inquiry: why did SDM fail to influence decision-making at the institutional level? The emerging pattern suggested that SDM governance remained highly centralised, restricting schools and DEOs from making independent, data-driven decisions.

Further interrogation into why SDM was centralised revealed that decision-making authority was concentrated within the Ministry of Education (MOE), which controlled policy design, data analysis, and governance frameworks. Schools and DEOs acted primarily as data providers with limited access to interpretive tools or autonomy to act on the data they collected. This governance model reflected a hierarchical system of education data management, where decision-making flowed from the top down, rather than being distributed among institutional stakeholders.

At this stage, I questioned why MOE prioritised national over local decision-making. The answer lay in Malaysia's focus on international benchmarking, particularly in global assessments such as PISA and TIMSS. Since the MEB aimed to elevate national rankings in global education indicators, SDM had been structured primarily to track standardised performance metrics rather than to support context-specific, school-driven policymaking. This led to the realisation that SDM was designed more as a monitoring tool than an instrument for educational governance, reinforcing a top-down, compliance-oriented approach to data collection.

The final level of inquiry examined why global benchmarking took precedence over localised decision-making. The root cause was embedded in policy design, which prioritised national reporting and compliance over school-level

instructional planning. Since SDM was integrated into a broader framework of performance monitoring, the data it generated was primarily used for national and international comparisons, limiting its relevance for schools seeking to develop contextualised, data-driven strategies. The emphasis on standardised indicators constrained SDM's potential as a flexible, school-centred governance tool, reinforcing a rigid, top-down data culture.

Through this ontological exploration, it became clear that the research problem was not simply about SDM inefficiencies, but about the structural and policy constraints that shaped its governance. Centralisation, alignment with global benchmarking priorities, and a compliance-driven governance model had all contributed to a system where data was collected for oversight rather than institutional empowerment.

Summary Table: 5 Whys Analysis of SDM Governance Challenges

Level of Inquiry	Key Issue Identified	Underlying Cause
1. Why was SDM governance ineffective?	Data collection did not lead to policy implementation.	SDM was used primarily for reporting, with little impact on institutional decision-making.
2. Why did SDM fail to influence decision-making?	Schools and DEOs had no decision-making authority over SDM data.	SDM governance remained highly centralised, limiting institutional autonomy.
3. Why was SDM governance centralised?	MOE retained full control over SDM policy and data management.	Schools and DEOs acted as data contributors rather than decision-makers.
4. Why did MOE prioritise national over local decision-making?	SDM focused on national education targets rather than local policy needs.	Malaysia's education system emphasised international benchmarking (PISA, TIMSS), requiring standardised data tracking.
5. Why was SDM designed for compliance rather than governance?	Schools collected data for national monitoring rather than institutional decision-making.	Education policies prioritised national reporting and compliance over school-level autonomy.

By applying the 5 Whys analysis, this study systematically explored the root causes of SDM governance challenges in Malaysia while remaining aware of potential confirmation bias. As an insider-researcher, my interpretations were informed by firsthand experience and observations; however, to maintain objectivity, the analysis was used as an exploratory tool rather than a

prescriptive framework. The 5 Whys method facilitated a critical examination of governance inefficiencies, acknowledging that SDM challenges stem from a convergence of policy, institutional, and technological factors rather than a singular cause.

To further substantiate this problem and provide a comprehensive empirical foundation, the next section offers a contextual explanation of the research problem, supported by relevant literature, examining how institutional structures, technological systems, and governance priorities have influenced SDM implementation in Malaysia.

Contextual Explanation

As Malaysia approaches the final years of the MEB, the nation's progress toward achieving its ambitious education targets invites critical reflection. The MEB sought to position Malaysia among the top third of countries in international assessments such as PISA and TIMSS, ensure universal literacy and numeracy by the first three years of schooling, and establish a data-driven governance system to enhance education policymaking (MOE, 2013). However, as we near the 2025 deadline, empirical evidence suggests that many of these goals remain unmet, necessitating a re-evaluation of the data-driven decision-making (DDDM) strategies that have underpinned Malaysia's education reforms (Bush et al., 2023; Perera & Asadullah, 2019).

At the core of these strategies is the role of SDM governance, which has been institutionalised as a mechanism for tracking student performance, monitoring policy effectiveness, and ensuring resource optimisation across the education system. The MEB positioned SDM as an enabler of evidence-based decision-making, emphasising the creation of an integrated national education database, real-time key performance indicator (KPI) dashboards, and streamlined data reporting mechanisms (MOE, 2013). These initiatives reflect a strategic effort to reduce administrative burdens, enhance teacher efficiency, and improve the Ministry of Education's (MOE) policymaking capacity. However, despite these well-intentioned reforms, persistent gaps between data collection and actual policy implementation raise concerns about whether SDM governance has

effectively supported Malaysia's education aspirations or whether it has reinforced bureaucratic inefficiencies and compliance-driven reporting.

A key concern is the extent to which SDM has enabled schools and district education offices (DEOs) to engage meaningfully with education data. While SDM provides quantitative indicators of student achievement, school effectiveness, and national education performance, its usage at the institutional level remains uneven. The dominance of international benchmarking frameworks, particularly PISA and TIMSS, has shaped Malaysia's education policies in ways that emphasise standardised performance metrics rather than localised, school-driven policymaking (Perera & Asadullah, 2019). The challenge lies in determining whether Malaysia's SDM system has been leveraged as a tool for school-centred decision-making or whether it primarily serves as a compliance mechanism for tracking national education performance against global standards.

One of the most pressing issues is the centralisation of SDM governance, which limits institutional flexibility and local-level agency in decision-making. The MOE retains significant control over SDM policy design, data analysis, and education system evaluation, creating a hierarchical model where schools and district offices act as data providers rather than active participants in education governance (Bush et al., 2023). This governance structure mirrors broader challenges in centralised education systems, where education data is primarily collected for national reporting rather than for informing school-level interventions (Williamson, 2017). Consequently, SDM data often flows upward to policymakers but is underutilised in school-based planning and decision-making, reinforcing a passive data culture rather than fostering an environment where schools engage with data to improve instructional and administrative practices (Perera & Asadullah, 2019).

Technology and the Role of Digital Infrastructure in SDM Governance

While digital transformation has been a core component of Malaysia's education governance strategy, the role of technology in SDM governance presents both opportunities and challenges. The MEB envisioned a comprehensive, technology-enabled SDM ecosystem, integrating platforms such as 1BestariNet, the Smart School Blueprint, and centralised education databases to support data-driven

policymaking (MOE, 2013). These initiatives aimed to streamline data collection processes, enhance access to education insights, and facilitate real-time decision-making at multiple levels of governance. However, the effectiveness of these digital platforms remains an area of debate, particularly concerning issues of data accessibility, interoperability, and institutional capacity to engage with education technologies (Perera & Asadullah, 2019).

One of the major challenges in Malaysia's technology-driven SDM governance is the gap between digital infrastructure and institutional readiness. While cloud-based data systems and automated reporting mechanisms have expanded access to education data, many schools and district education offices lack the necessary technical expertise, data literacy, and decision-making autonomy to integrate SDM insights into governance processes (Bush et al., 2023). This reflects a broader issue in education technology implementation—where digital platforms are introduced to modernise governance structures, but their effectiveness is contingent upon the institutional conditions that shape their use (Williamson, 2017).

Another concern is the fragmentation of Malaysia's SDM technology ecosystem, where multiple platforms operate in parallel without full integration. The introduction of various digital education management systems, enterprise portals, and web-based applications has resulted in overlapping data collection efforts, redundancies in reporting, and inefficiencies in data sharing across different agencies (Mandinach & Gummer, 2016). The lack of standardised data governance frameworks further complicates efforts to ensure that SDM data is collected, stored, and utilised effectively across different levels of administration.

Moreover, while Malaysia's SDM policies have prioritised digital transformation, they have not necessarily addressed the human and institutional factors that determine the success of education data governance. As Hargreaves (2014) notes, education data is not static—it moves through multiple institutional layers, where it is interpreted, repurposed, and sometimes misaligned with its original intent. In Malaysia, SDM data collected at the school level often undergoes multiple transformations before reaching policymakers, raising

concerns about whether it retains its relevance and accuracy in informing education policies (Bush et al., 2023).

The transactional nature of SDM data mobility presents another challenge. As data moves from teachers to district officers, from district officers to state education departments, and from state departments to the MOE, its meaning and purpose often shift. Schools may collect data for instructional improvement, but by the time it reaches policymakers, it is frequently repurposed for national performance tracking rather than localised education reforms (Kallemeyn, 2014). This raises fundamental concerns about whether SDM functions primarily as a bureaucratic reporting tool rather than as an enabler of decision-making at multiple levels of governance.

Thus, the research problem can be framed as follows:

Despite efforts to modernise SDM governance in Malaysia, its centralised structure, alignment with global benchmarking, and technology-driven but institutionally underdeveloped framework have limited its effectiveness in supporting localised, school-centred decision-making. Instead of functioning as an enabler of participatory education governance, SDM governance primarily serves as a compliance tool for national reporting, raising concerns about its role in improving instructional quality and administrative autonomy at the institutional level.

1.4 Theoretical Positioning: A Multi-Layered Framework for Understanding SDM Governance Failures

The governance critique of SDM in Malaysia cannot be attributed solely to technological shortcomings; instead, it is deeply rooted in structural, institutional, and relational constraints that systematically limit its effectiveness. While the MEB positioned SDM as a transformative tool for DDDM, its implementation has reinforced hierarchical control, compliance-driven reporting, and policy fragmentation, preventing it from functioning as an enabler of localised education governance. Despite extensive investments in digital data infrastructures, including 1BestariNet, national education dashboards, and integrated performance reporting mechanisms (MOE, 2013),

SDM has remained underutilised as a governance tool and has instead become an additional bureaucratic burden rather than a facilitator of school-based decision-making (Bush et al., 2023).

A major flaw in Malaysia's SDM implementation is the misguided assumption that simply providing access to digital education data will inherently lead to better decision-making. This premise overlooks the critical role of institutional agency, governance structures, and policy coherence in shaping how education data is interpreted and used (Perera & Asadullah, 2019). Rather than empowering schools and district education offices (DEOs) to integrate data into their localised governance processes, SDM has largely been implemented as a reporting mechanism for top-down accountability, reinforcing bureaucratic oversight rather than participatory decision-making.

To critically analyse why SDM has remained ineffective in Malaysia's education governance and what reforms are necessary to enhance its role, this study integrates multiple theoretical perspectives. Drawing from Institutional Theory, Policy Capacity Theory, Policy Translation Theory, Socio-Material Networks, and enablementism, this research constructs a multi-layered analytical framework that explains the structural, relational, and technological barriers to SDM effectiveness. These theoretical lenses provide insights into why SDM governance has remained a bureaucratic tool rather than an enabler of data-driven decision-making at the school and district levels and how it can be transformed to fulfill its intended role.

The Structural Constraints of SDM Governance: Over-Centralisation and Bureaucratic Control

The centralisation of SDM governance in Malaysia is a key structural constraint that prevents institutional flexibility, limits school autonomy, and reinforces a hierarchical decision-making model. Institutional Theory (Meyer & Rowan, 1977) explains how bureaucratic structures create rigid governance mechanisms that emphasise compliance rather than adaptability. SDM was introduced as a national education data system designed to provide real-time performance tracking (MOE, 2013), yet its centralised governance model ensures that schools serve primarily as data providers rather than active decision-makers.

This governance failure is closely tied to institutional isomorphism (DiMaggio & Powell, 1983), which explains how national education systems often adopt global models of best practice without necessarily adapting them to local needs. Malaysia's SDM governance has been shaped by OECD-led education policies, particularly those emphasising centralised data monitoring and standardised performance benchmarking through PISA and TIMSS. However, instead of fostering school-driven decision-making, SDM implementation in Malaysia has reinforced top-down performance monitoring, limiting its role as a participatory governance tool (Bush et al., 2023).

The over-centralisation of SDM governance has resulted in a policy paradox: while SDM was designed to enhance decision-making through digital data integration, its implementation has instead created a rigid bureaucratic structure where schools and district offices have little control over how SDM insights are interpreted and applied. To address this, SDM reform must focus on decentralising data interpretation authority, establishing independent SDM oversight bodies, and granting schools greater decision-making power over how education data is utilised. Without these institutional reforms, SDM will remain a bureaucratic compliance tool rather than a meaningful enabler of education decision-making.

The Limitations of Policy Capacity in SDM Implementation

Even when SDM platforms provide access to education data, institutional actors often lack the policy capacity to engage with it in meaningful ways. Policy Capacity Theory (Wu, Ramesh & Howlett, 2015) highlights that policy effectiveness depends on three critical capacities: analytical capacity (data literacy), operational capacity (institutional structures for policy integration), and political capacity (cross-agency coordination to ensure policy coherence).

Malaysia's SDM governance is constrained by significant weaknesses in all three areas. Schools, district offices, and state education departments frequently lack structured training programs that develop data literacy among educators and administrators (Perera & Asadullah, 2019). While SDM platforms provide quantitative indicators of student performance and school effectiveness, institutional actors lack the expertise or governance authority needed to apply

this data for evidence-based decision-making. The absence of structured professional development in education data governance means that schools primarily comply with reporting mandates rather than actively integrating SDM insights into school-based decision-making (Bush et al., 2023). Without significant capacity-building initiatives, SDM will remain a passive reporting tool rather than a functional enabler of institutional decision-making

Policy Fragmentation and the Translation of SDM Across Governance Levels

The governance critique of SDM is not solely a result of institutional constraints or capacity limitations but also a product of policy fragmentation and inconsistencies in how SDM policies are translated across different levels of governance. Policy Translation Theory (Callon, 1986) explains how policies are not simply transferred from policymakers to implementers but are continuously reinterpreted, negotiated, and modified based on institutional interests, constraints, and power dynamics.

As SDM policies move from the national level (MOE) to state education departments (SEDs), district education offices (DEOs), and schools, they are transformed into fragmented reporting mandates that emphasise bureaucratic efficiency over participatory decision-making (Bush et al., 2023). This leads to inconsistencies in SDM policy implementation, where different education agencies operate under misaligned data requirements, limiting SDM's role as an integrated governance tool.

This study argues that establishing multi-agency collaboration frameworks is necessary to ensure that SDM policies are consistently adapted across different levels of the education system. Without policy coherence, SDM governance will remain fragmented, reinforcing institutional silos rather than fostering inter-agency cooperation in education data management.

The Role of Socio-Material Network

SDM does not exist in a neutral policy space—it is embedded within institutional power structures that determine how education data is controlled, interpreted, and used. Socio-Material Network Theory (Fenwick & Edwards, 2010) highlight

how education institutions are often positioned as passive data providers rather than as active decision-makers.

At the national level, SDM policies prioritise centralised control over data collection, with little emphasis on school-level autonomy in decision-making (MOE, 2013). Schools are expected to submit data for national reporting, but they rarely have opportunities to interpret SDM insights for localised policy adaptation (Bush et al., 2023). enablementism (Valsiner, 2014) provides a framework for understanding why education governance must prioritise institutional adaptability over rigid standardisation. If schools and district offices are not given the flexibility, agency, and support to engage with SDM data, education data will remain an instrument of bureaucratic control rather than a tool for participatory governance.

By integrating Institutional Theory, Policy Capacity Theory, Policy Translation Theory, Socio-Material Networks, and enablementism, this study constructs a comprehensive analytical framework for understanding SDM governance failures and proposing reforms to improve institutional engagement with education data. These theories inform the development of the Techno-enablement, which aims to balance regulatory oversight with institutional autonomy and localised decision-making.

1.5 Introducing Techno-Enablement: A Conceptual Framework for SDM Governance

While existing theories provide insights into the governance challenges surrounding SDM in Malaysia, they do not fully explain why SDM has remained a compliance-driven mechanism rather than an enabler of participatory decision-making. This study did not begin with techno-enablement as a predefined framework; rather, it emerged as a theoretical response to governance gaps identified through systematic theoretical synthesis and empirical findings.

Initial investigations explored how Institutional Theory, Policy Capacity Theory, and Policy Translation Theory could explain SDM governance challenges, but as the study progressed, it became evident that these frameworks alone could not fully capture the complex interplay between governance structures, institutional

agency, and technological mediation in SDM governance. Recognising this gap, this study systematically integrated insights from multiple governance and policy theories, leading to the development of techno-enablement as a novel conceptual framework.

The process of developing techno-enablement was iterative and grounded in both theoretical and empirical inquiry. Initially, Institutional Theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983) was considered to explain how SDM governance became ritualistic, with schools conforming to policy mandates for legitimacy rather than substantive improvement. Institutional isomorphism further illustrated how Malaysia's SDM adoption followed global benchmarking pressures, such as PISA and TIMSS, rather than being tailored to national governance needs. However, these perspectives did not explain why institutional actors struggled to utilise SDM data meaningfully despite digital advancements.

To move beyond a structural-institutional lens, Policy Capacity Theory (Wu, Ramesh & Howlett, 2015) was incorporated to examine how technical, operational, and political competencies affect SDM governance. This theory explained why actors often lacked the ability to leverage SDM data effectively, but it still did not fully account for why policy misalignment and rigid reporting mechanisms persisted despite improvements in digital infrastructure. Further exploration of Policy Translation Theory (Callon, 1986) revealed that SDM governance is not static but continuously reshaped at different administrative levels, often leading to policy fragmentation and unintended bureaucratic burdens.

As these theories provided partial but insufficient explanations, the study expanded to include Socio-Material Network Theory (Fenwick & Edwards, 2010) to position SDM not merely as a technological tool but as a governance system embedded in human-technology interactions. Socio-materiality highlighted the power dynamics in SDM engagement, demonstrating how technological infrastructures, policy directives, and institutional agency must be aligned for SDM to function as an enabling tool rather than a restrictive compliance mechanism.

At this stage, the study identified the need for a theoretical approach that not only explains governance constraints but also conceptualised the enabling conditions necessary for SDM to transition from bureaucratic oversight to participatory decision-making. Existing theoretical frameworks explained why SDM remains compliance-driven but fall short in proposing how governance structures can be reconfigured to enable institutional actors to meaningfully engage with digital systems. This gap led to the development of techno-enablement, a framework that emerges from the synthesis of the techno-agential condition and enablementism, providing a critical lens to examine governance, power, and institutional agency in the digitalisation of education governance.

Techno-enablement builds upon the techno-agential condition, which integrates:

- Heidegger's (1927) concept of potentiality, which critiques the assumption that technology is an inherent enabler of governance improvements. Instead, Heidegger argues that technology's role is contingent on the conditions that allow it to be realised—suggesting that SDM, as a digital system, does not inherently enable decision-making unless governance structures create the conditions for institutional actors to engage with data meaningfully. The risk of uncritical technological adoption, often assumed in SDM governance policies, is that data systems become self-perpetuating bureaucratic instruments rather than tools for institutional agency.
- Foucault's (1977) notion of power, which challenges the perception of governance structures as neutral. Power is embedded in governance mechanisms, regulating who has the authority to act and whose knowledge is legitimized. SDM governance reflects this dynamic by reinforcing centralised control rather than enabling distributed decision-making, where data primarily serves bureaucratic visibility rather than localised autonomy. SDM, therefore, operates as a tool for disciplinary power, where schools and district offices are surveilled through performance metrics rather than empowered as decision-making bodies.

While the techno-agential condition highlights the interaction between technology, institutional actors, and governance structures, it does not fully

account for the conditions that enable or constrain this interaction. This is where Valsiner's (2014) enablementism becomes critical—it argues that human agency alone is insufficient; for SDM to function as an enabler rather than a compliance mechanism, institutions must actively create the structural, cultural, and policy conditions necessary for decision-making autonomy. Unlike deterministic models of governance, enablementism recognises that institutional actors must not only be granted agency but also be supported by systems that make meaningful decision-making possible.

Techno-Enablement as a Critique of Heidegger and Foucault

While Heidegger's potentiality rightly problematizes the assumption that digital infrastructures inherently improve governance, it remains philosophically abstract and does not provide a model for governance transformation. Techno-enablement extends Heidegger's critique by operationalising the conditions necessary for technology to transition from potentiality to meaningful application in governance. Similarly, Foucault's analysis of power explains why centralised control persists but does not provide a framework for overcoming structural constraints. Foucault effectively critiques governance structures but leaves open the question of how institutions can actively reconstruct power relations to enhance participatory governance.

Techno-enablement bridges these gaps by not only critiquing existing governance constraints but also conceptualising how SDM governance can evolve toward participatory, institutionally responsive decision-making. It moves beyond critical analysis of power asymmetries to propose an alternative governance model that integrates digital infrastructures with institutional autonomy. While Heidegger identifies the problem of unrealised technological potential and Foucault critiques centralised governance as a system of control, Techno-enablement argues that the solution lies in constructing governance conditions that enable decision-making authority to be distributed rather than concentrated.

Thus, Techno-enablement is not simply a theoretical synthesis but a response to the failure of existing frameworks to move beyond critique toward structural transformation. By integrating the techno-agential condition and

enablementism, it offers a governance framework that does not merely describe SDM failures but explains the conditions necessary for its reform. It is not enough to recognise the potentiality of technology or the pervasiveness of power structures; governance must be actively reconfigured to create institutional environments where decision-making is enabled rather than constrained.

Building upon Techno-enablement, this study introduces the techno-enabler Framework, which operationalises the enabling conditions necessary for SDM to function as a governance tool. The framework identifies five key dimensions:

- a. Techno-Governance: Ensuring policy coherence and regulatory oversight while maintaining institutional flexibility.
- b. Techno-Competency: Developing capacity-building initiatives to enhance data literacy and professional engagement with SDM.
- c. Techno-Networking: Strengthening inter-agency collaboration and data-sharing protocols to reduce fragmentation.
- d. Techno-Decisioning: Empowering school leaders and district officers with decision-making authority over SDM utilisation.
- e. Techno-Integration: Creating adaptive SDM policies that respond to localised school needs rather than rigid top-down directives.

The relationship between techno-enablement and the Techno-Enabler Framework is essential, as the former provides the conceptual foundation while the latter offers a structured application for analysing governance conditions. While this chapter introduces techno-enablement and its theoretical foundations, a more detailed discussion of its role in explaining SDM governance issues will be presented in Chapter 6, where empirical findings are directly linked to the theoretical contributions of this study.

1.6 Significance

The significance of this study lies in its contribution to both theoretical development and practical understanding of digital governance in education, particularly in the context of School Data Management (SDM). By introducing the Techno-Enablement Framework, this research moves beyond traditional perspectives that view SDM either as a purely technological solution or a compliance-driven reporting tool. Instead, it offers a comprehensive explanation of how policy structures, digital infrastructures, and institutional agency interact to shape decision-making processes within education governance. This framework critically engages with Heidegger's concept of potentiality, Foucault's notion of power, and Valsiner's enablementism, positioning SDM within broader debates about how technology influences institutional power dynamics and agency.

Crucially, the study challenges the assumption that digital systems inherently lead to improved governance outcomes. It demonstrates that without the necessary enabling conditions—such as decentralised data access, professional capacity-building, and participatory policy frameworks—technology risks reinforcing centralised control rather than empowering schools and educators. The Techno-Enabler Framework, developed from this theoretical synthesis, provides a structured model for identifying and analysing these enabling conditions, offering valuable insights for policymakers, educational leaders, and researchers concerned with data-driven governance reforms. In doing so, this research contributes to wider global discussions on how digital technologies should be designed and governed to balance accountability with institutional autonomy, ensuring that data systems serve as tools for empowerment rather than instruments of control.

Beyond its specific focus on Malaysia, this study is designed to be replicable and adaptable across diverse contexts where digital governance faces similar challenges. The Techno-Enablement Framework and the Techno-Enabler Framework are transferable and can be applied to other education systems or public sectors—such as healthcare, environmental management, or local government—where centralised-decentralised dynamics shape the use of data systems. Replication would involve a systematic examination of how digital

infrastructures, policy frameworks, and institutional actors interact, employing similar methods such as policy document analysis, expert interviews, and governance network mapping.

Future researchers could apply the techno-enabler dimensions—techno-governance, techno-competency, techno-networking, techno-decisioning, and techno-integration—to assess whether enabling conditions support participatory decision-making in their chosen context. Additionally, they could critically examine how digital systems mediate power relations, drawing on the theoretical insights of Heidegger, Foucault, and Valsiner to explore whether governance structures empower institutional actors or perpetuate bureaucratic control. This study also paves the way for longitudinal research, enabling future scholars to observe how digital governance evolves over time as technologies advance and institutional capacities shift.

1.7 Limitations

While the Techno-Enabler Framework provides a structured approach to SDM reform, its implementation is not without challenges. One of the primary obstacles is institutional resistance to change, particularly within the Ministry of Education (MOE), which has historically maintained centralised control over SDM governance. Transitioning towards a decentralised model may encounter resistance from policymakers who prioritise centralised accountability over localised flexibility. Bureaucratic inertia and reluctance to delegate SDM decision-making authority to schools and district offices could slow down reform implementation, limiting the effectiveness of institutional autonomy in SDM utilisation.

Another significant challenge lies in the variability of institutional capacity across schools and district education offices. The success of the Techno-Enabler Framework depends on the ability of institutions to actively engage with SDM insights, yet findings indicated that many teachers and school leaders lack professional training in data-driven decision-making. Without sustained investment in data literacy and professional development programmes, SDM reforms may remain unevenly distributed, benefiting institutions with greater technological and human resource capacity while leaving others behind.

Balancing standardisation with flexibility also remains a critical challenge. While Techno-Integration ensures that SDM policies align with institutional needs, policymakers must still maintain standardised education performance metrics to ensure national policy coherence. Striking a balance between localised autonomy and national accountability frameworks requires a governance model that allows institutions to tailor SDM strategies to their specific needs while maintaining alignment with national education objectives. Without careful policy calibration, excessive decentralisation could lead to fragmented SDM practices, undermining the broader goals of education governance reform.

Additionally, infrastructure and technological constraints pose a significant limitation, particularly in rural and underserved areas where schools lack adequate digital infrastructure and connectivity. While SDM digitalisation has streamlined data collection and reporting, findings suggest that many institutions remain unable to fully engage with SDM platforms due to unreliable internet access and outdated technology. Addressing these disparities is essential to ensuring equitable SDM implementation across all educational institutions, preventing further digital divides in data-driven decision-making.

These limitations highlight the need for a phased implementation of SDM reform, allowing institutions to gradually transition towards participatory, school-centred data governance frameworks. Successfully overcoming these challenges will require collaborative engagement between policymakers, school leaders, educators, and technology providers to ensure that SDM governance structures remain adaptive, inclusive, and institutionally relevant. By fostering a cohesive approach to governance reform, the Techno-Enabler Framework can serve as a sustainable model for integrating SDM into evidence-based educational decision-making while maintaining policy coherence at the national level.

1.8 Objectives

Building upon the theoretical synthesis in Section 1.4, this study aimed to critically examine the governance structures, institutional mechanisms, and policy conditions that shape SDM in Malaysia. As outlined in Section 1.5, techno-enablement emerged as a novel theoretical contribution in response to the empirical and theoretical gaps identified in SDM governance. However, it was

not a preconceived framework but rather an outcome of a systematic inquiry into SDM's structural, relational, and technological challenges.

The process of developing techno-enablement was guided by the study's objectives, which were designed to analyse SDM governance without assuming its effectiveness or limitations. Through these objectives, this study critically explores why SDM remains compliance-driven, how institutional agency interacts with policy translation, and what governance conditions enable meaningful engagement with education data. By addressing these questions, the research not only assesses SDM's governance trajectory but also provides a conceptual framework that extends beyond the existing, offering a structured exploration for how technology, policy, and institutional agency must align to optimise SDM as a decision-making tool.

The following objectives reflect this process of inquiry, systematically leading to the emergence of techno-enablement as a theoretical lens for understanding SDM governance:

- a. To analyse the governance structures and institutional mechanisms that shape SDM in Malaysia, critically assessing how centralised control, policy translation, and international benchmarking influence education data management and its role in decision-making.

This objective investigates how SDM has been structured within Malaysia's education system, how governance frameworks regulate its implementation and influence SDM policy priorities. By examining the relationship between education data governance, institutional agency, and global benchmarking frameworks, this study explores whether SDM functions as a tool for top-down policy enforcement or whether it enables decentralised, school-led decision-making.

- b. To explore the conditions that affect how different education institutions engage with SDM, focusing on the relational, structural, and technological factors that shape the effectiveness of data-driven decision-making in Malaysia.

This objective examines how schools, district education offices (DEOs), and policymakers interact with SDM, assessing the enablers and constraints that affect their capacity to interpret and apply education data in governance processes. Rather than assuming that data flows seamlessly from collection to implementation, this study investigates how policy translation, data mobility, and inter-agency coordination impact SDM engagement at different levels of education administration (Bush et al., 2023). Additionally, this objective critically evaluates the role of digital infrastructures, AI-driven analytics, and ICT capacity in supporting or limiting SDM utilisation, recognising that technological systems are not neutral tools but embedded in broader governance structures (Williamson, 2017).

- c. To develop a theoretical model that conceptualises SDM as a governance mechanism, drawing on insights from Institutional Theory, Policy Capacity Theory, Policy Translation Theory, Socio-Material Networks, and enablementism to provide a framework for understanding education data governance.

This objective seeks to provide a conceptual framework that accounts for the structural, institutional, and technological dimensions of SDM governance, avoiding preconceived assumptions about whether SDM is inherently effective or ineffective. Rather than prescribing a predefined solution, this study systematically synthesises existing theoretical perspectives to construct an analytical model that explains how SDM governance operates and how it might evolve in different governance contexts. The framework aims to provide a conceptual lens for future research on education data governance, allowing for further theoretical development and empirical testing.

By addressing these objectives, this study contributes to the theoretical discourse on education data governance by examining how SDM has been framed, implemented, and engaged with in Malaysia. Rather than assuming that data automatically enhances education governance, this research investigates the governance conditions, institutional agency, and technological infrastructures that shape SDM's effectiveness as a decision-making tool.

Following these objectives, the next chapter will synthesise existing literature on education governance, policy translation, and data-driven policymaking to refine the research questions that will guide this study. By systematically engaging with theoretical debates on institutional governance, policy coherence, and data power structures, the next chapter will develop a research framework that critically examines SDM governance in Malaysia without a preconceived judgment on its effectiveness or limitations.

Chapter 2 Literature Review

2.1 Introduction

The motivation for this literature review arises from the increasing complexities of School Data Management (SDM) governance, particularly within centralised-decentralised education systems where policy enforcement, institutional agency, and technological mediation intersect in ways that remain insufficiently theorised. While there is a global push for data-driven decision-making in education, SDM implementation continues to be uneven, with policy expectations often misaligned with institutional realities. Schools, district offices, and education ministries engage with SDM frameworks in ways that are neither uniform nor straightforward, yet existing literature has not fully explained why SDM policies succeed in some contexts while failing in others. Furthermore, the role of governance structures in conditioning the effectiveness of technological solutions remains an unresolved issue.

At the core of this study is a critical interrogation of the power asymmetries embedded in SDM governance. Much of the existing research on SDM is divided into two dominant perspectives: the structuralist approach, which frames SDM as a regulatory mechanism designed to standardise data governance across institutions, and the relationalist approach, which understands SDM as an adaptive process shaped by institutional actors who negotiate policy constraints in everyday practice. However, few studies have attempted to synthesise these perspectives into an integrated conceptualisation of SDM as both a governance tool and a site of negotiated power and agency. This gap necessitates a systematic and critically engaged literature review, which does not merely compile existing research but actively interrogates theoretical assumptions, challenges deterministic perspectives, and synthesises diverse governance models into a more nuanced understanding of SDM.

This chapter adopts a structured and theoretically rigorous approach to reviewing the literature, ensuring that SDM is examined from multiple perspectives, rather than being reduced to a singular governance paradigm. Instead of presenting theories in isolation, this review engages in dialogue between structural, relational, and techno-agential perspectives, testing their

applicability to SDM governance and questioning their underlying assumptions. By critically evaluating governance frameworks and integrating insights from policy theory, networked decision-making, and technological mediation, this chapter provides the conceptual foundation for the techno-agential framework. The objective is not merely to summarise existing studies but to construct a conceptual framework that actively responds to gaps in SDM scholarship and positions this study as a contribution to ongoing debates about data governance, institutional autonomy, and technological agency in education.

2.2 The Systematic Process of Constructing This Literature Review

A methodologically rigorous and critically engaged literature review does not begin with a preselected theoretical framework but emerges through a structured interrogation of research gaps, conceptual blind spots, and unresolved debates in existing scholarship. In constructing this literature review, a systematic and iterative process was followed to ensure that SDM governance is examined in its full institutional, technological, and relational complexity, rather than being reduced to a single theoretical lens or governance model.

The first stage involved a comprehensive evaluation of existing SDM research, leading to the identification of several pressing gaps and theoretical limitations. One major gap in the literature is theoretical fragmentation, where studies tend to focus on either structural policy enforcement or stakeholder agency, but rarely integrate these perspectives into a unified governance framework. SDM is often conceptualised either as a compliance mechanism dictated by policy structures or as an adaptive system shaped by institutional actors, leading to a lack of theoretical cohesion in understanding how SDM functions across different levels of governance.

Additionally, there is a significant under-theorisation of institutional agency, as many studies assume that SDM is implemented as intended, without critically examining how institutional actors negotiate, resist, or reinterpret policy directives. This is particularly evident in centralised education systems, where decision-making authority is unevenly distributed across bureaucratic hierarchies.

Another critical gap in the literature is the over-reliance on technological determinism, which assumes that digital tools inherently enhance decision-making and governance efficiency. While SDM policies are often designed with the expectation that technology will improve data-driven decision-making, research has not sufficiently explored how governance structures, institutional expertise, and organisational culture mediate SDM adoption and use. This deterministic view fails to account for the institutional conditions necessary for technology to function effectively, leading to oversimplified assumptions about the role of digital infrastructures in educational governance. Finally, research on SDM has not sufficiently explored the interaction between policy structures and networked decision-making, leading to an incomplete understanding of how institutional actors engage with data-driven education policies beyond mere compliance.

To address these gaps, theoretical perspectives were systematically introduced and critically evaluated based on their ability to explain SDM governance at multiple levels. The integration of theories followed a structured process, ensuring that SDM was conceptualised as both a governance framework and a site of negotiation between institutional actors and policy directives. Structural theories were first incorporated to examine how SDM policies are designed, enforced, and institutionalised within bureaucratic education systems. Isomorphism, as theorised by DiMaggio and Powell (1983), was integrated to explain how educational institutions adopt SDM practices in response to external pressures, leading to standardisation but also limiting adaptability. Resource Dependence Theory (Pfeffer & Salancik, 1978) was introduced to analyse how SDM implementation is shaped by institutional access to financial, technological, and human resources, emphasising the role of external dependencies in shaping governance structures. Occam's Razor was incorporated to question whether SDM policies are unnecessarily complex, arguing that simpler, more flexible models may be more effective in decentralised decision-making environments.

While these structural theories provided insights into the regulatory mechanisms that shape SDM governance, they were insufficient for explaining the adaptive and negotiated aspects of SDM implementation. Therefore, relational theories were systematically introduced to account for how SDM is enacted through

institutional interactions and stakeholder negotiations. Policy Translation Theory (Callon, 1986; Mifsud, 2020) was integrated to demonstrate that SDM policies are not merely implemented as intended but are actively reinterpreted, contested, and reconfigured at different levels of governance. Socio-material network theory (Fenwick & Edwards, 2010) was introduced to highlight how data infrastructures, governance protocols, and institutional relationships interact in ways that shape the effectiveness of SDM systems. Mobilising Tokens Theory (Murdoch, 1998) was incorporated to analyse how data governance produces new forms of institutional power, influencing how SDM frameworks are adopted, adapted, or resisted by various stakeholders.

Given that SDM governance involves both structural enforcement and relational adaptation, this literature review required a final theoretical integration that could bridge these perspectives. The techno-agential condition was developed as a conceptual framework that moves beyond binary understandings of SDM as either structurally determined or purely adaptive. To ground this framework in existing scholarship, enablementism (Valsiner, 2014) was introduced to argue that power—whether technological or institutional—remains latent unless conditioned by governance structures that facilitate its enactment. This perspective provided a foundation for reconceptualising SDM not as a fixed policy instrument but as an evolving governance process that depends on the alignment of policy mandates, institutional capacity, and stakeholder engagement.

Beyond merely importing theories, this literature review critically evaluates their assumptions, contradictions, and applicability to SDM governance. Many studies apply theories in isolation, failing to integrate structural and relational dimensions into a cohesive model. This study ensures theoretical rigor by positioning theories in dialogue with one another, demonstrating how policy compliance models interact with stakeholder agency to shape SDM governance in practice. Furthermore, theoretical assumptions were tested against SDM realities, challenging deterministic models of data governance and emphasising techno-agential interdependencies. Ultimately, this study advances a novel conceptual framework that explains both the constraints imposed by policy

structures and the enabling conditions necessary for SDM to function as a co-produced governance system.

By following this structured and methodologically robust approach, this literature review establishes a theoretical foundation for the study while also advancing a new way of thinking about SDM governance. Rather than treating SDM as a static compliance mechanism, this study positions it as an evolving governance process that is conditioned by technological mediation, policy frameworks, and institutional agency, ensuring a more comprehensive understanding of SDM as a governance tool in contemporary education systems.

2.3 The Landscape of SDM

SDM has emerged as a critical component of modern educational systems, enabling institutions to manage the growing complexity and volume of student data. In the United States, for instance, significant investments have been made in data management systems to provide school principals with access to diverse datasets for decision-making (Johnston & Hamilton, 2020). However, these systems reflect varied implementation approaches, revealing underlying tensions in data governance that influence their effectiveness.

Central to this discourse is the concept of data governance, which Kelly et al. (2010) frame as a continuum between data dictatorship and data democracy. In a data dictatorship, control over data is centralised, with access restricted to senior administrators who dictate its usage. This centralised approach, while ensuring standardisation, often results in a lack of transparency and limited engagement among teachers and other frontline educators. By contrast, a data democracy emphasises broad-based access and collaborative use of data, empowering educators at all levels to leverage data for meaningful educational improvements.

As technology advances, schools are compelled to upgrade their data management systems to handle increasingly diverse datasets. These innovations include the development of sophisticated school management systems aimed at enhancing student management efficiency (Syla, 2014). While such systems theoretically enable better decision-making, they also raise critical questions

about control and accessibility. The centralised nature of many systems often reflects a data dictatorship model, where administrators serve as gatekeepers, determining who can access data and for what purposes (Kelly et al., 2010).

Literature emphasises the necessity of integrating advanced information architectures to manage diverse data types, such as test scores, grades, discipline reports, and attendance records (Meng, 2019). However, research by Bowers et al. (2014) critiques this focus on technological upgrades, arguing that these systems often prioritise efficiency over equity. For instance, the exclusion of teachers from meaningful engagement with raw data reduces their ability to tailor interventions to specific classroom needs, further reinforcing hierarchical power dynamics (Heath, Fuller, & Paton, 2008).

SDM as a Socio-Technical System

SDM is not merely a technical tool but a socio-technical system, deeply embedded in the organisational and social practices of schools. This aligns with Selwyn's (2021) view that technology in education is not a neutral actor but one shaped by power dynamics and institutional priorities. In systems leaning toward data dictatorship, SDM can perpetuate a culture of compliance, where data is used primarily for accountability rather than for instructional improvement (Kelly et al., 2010).

This critique resonates with findings from Johnston and Hamilton (2020), who argue that the effectiveness of SDM depends not only on the technology itself but also on the professional development and data literacy of its users. The failure to address these socio-technical dynamics risks creating a system where data becomes an instrument of surveillance, further marginalising teachers and reinforcing top-down control.

Schools today face the challenge of effectively utilising diverse data types to inform leadership and instructional practices. While data analysis is regarded as crucial for continuous improvement (Bowers et al., 2014), its implementation often skews toward quantitative metrics, such as standardised test scores, at the expense of qualitative dimensions like student well-being and teacher-student relationships. This aligns with critiques from Kelly et al. (2010), who highlight

how data dictatorship models prioritise measurable outcomes, often leading to reductive interpretations of student potential.

Moreover, Meng (2019) emphasises that the integration of automated processes and information architectures, while improving efficiency, often marginalizes the relational and contextual aspects of teaching. This critique aligns with Månsson and Langmann's (2011) view that SDM must consider the relational dynamics within schools, as the success of these systems hinges on the engagement and collaboration of all stakeholders.

An important critique in the literature is the equity gap in data management practices. The data democracy model, as described by Kelly et al. (2010), advocates for equitable access to data and collaborative engagement among educators. However, research shows that this ideal is far from realised. For instance, Sylva (2014) and Meng (2019) highlight the disproportionate exclusion of early-career teachers and non-administrative staff from meaningful engagement with data, a gap that reflects broader systemic inequities in professional development and decision-making.

Heath, Fuller, and Paton (2008) further argue that the exclusion of frontline educators from data processes not only undermines their professional autonomy but also limits the contextual relevance of data-driven interventions. This exclusion is particularly problematic in centralised systems, where decision-making authority is concentrated among administrators, leaving teachers to implement top-down directives without the opportunity to adapt them to their local contexts.

The literature on SDM reveals a critical tension between centralisation and decentralisation in data management practices. While centralised systems offer efficiency and standardisation, they often embody the characteristics of a data dictatorship, limiting the participatory potential of SDM. On the other hand, the aspirational model of data democracy highlights the importance of equitable access, professional development, and collaborative decision-making.

As Johnston and Hamilton (2020) suggest, the future of SDM lies in addressing these tensions by fostering a culture of inclusivity and empowerment. Such a

culture requires not only technological advancements but also a commitment to building the capacity of all stakeholders to engage meaningfully with data. This literature review provides a foundation for understanding these dynamics, setting the stage for a more critical exploration of SDM practices within the specific context of Malaysia's education system.

2.3.1 Understanding SDM as a Transactional Tool in Education

This study positions SDM as extending beyond the basic use of technology for data storage to encompass the strategic analysis, management, and application of data in decision-making. SDM plays a critical role in refining instructional practices and enhancing overall school performance. In today's data-driven educational landscape, it serves as a foundation for institutional improvement, offering a systematic framework to understand and respond to the evolving needs of students and the education system. However, the potential impact of SDM is shaped by the distribution of power and control over data, which influences how effectively stakeholders can access, interpret, and use data to inform meaningful decisions.

As a transactional tool, SDM facilitates exchanges and interactions within the educational ecosystem. These transactions involve the transfer of data between teachers, administrators, students, and educational authorities, reflecting a dynamic interplay of decision-making and accountability (Johnston & Hamilton, 2020). For instance, teachers input student performance data into systems that administrators use to assess overall school performance and identify areas needing improvement. This data is also used to personalize learning plans, enhancing the efficiency and targeting of the learning process (Zhan & Cao, 2023). Additionally, SDM supports compliance with educational standards by streamlining the reporting of key performance indicators to education authorities (Kelly, 1987), thereby improving communication and operational effectiveness within institutions (Meng, 2019; Jin & Yao, 2022).

The Dual Nature of Power and Control in SDM

While SDM facilitates the seamless exchange of information, it also raises critical questions about who controls the data, who has access to it, and for what

purposes. These issues resonate with the continuum of data dictatorship and data democracy (Kelly et al., 2010), which distinguishes between centralised control of data (data dictatorship) and inclusive, collaborative access to data (data democracy).

In systems aligned with data dictatorship, SDM becomes a tool for top-down enforcement, where administrators and policymakers exercise unilateral control over data collection, interpretation, and application. This centralised control may streamline decision-making and ensure accountability to external authorities but often excludes teachers and frontline educators from meaningful engagement with the data. By contrast, data democracy emphasises equitable access and collaborative engagement, empowering educators to use data not just as a tool for compliance but as a resource for localised decision-making and innovation.

Despite its transactional benefits, the literature indicates that SDM often leans toward data dictatorship in practice, prioritising efficiency and accountability at the expense of inclusivity (Kelly et al., 2010). This critique highlights the need for a shift in focus—from merely using SDM for compliance to leveraging it as a relational tool for empowerment.

SDM's transactional role raises a deeper philosophical question: Why does the power provided by SDM systems not always lead to their expected potential for improving educational outcomes? Despite substantial investments in SDM technology and the availability of comprehensive student data, the gap between the power to act and the realization of actual improvements persists. This issue is particularly salient in the context of Malaysia's MEB, which aims to achieve ambitious targets for educational reform through data-driven decision-making by 2025.

Heidegger's concept of potentiality and actuality (1927) offers a lens for understanding this gap. Potentiality refers to the possibility of action, but this remains unrealised unless the appropriate conditions are present. Educational leaders may possess the power conferred by SDM systems—access to comprehensive data—but without enabling conditions, this potential remains dormant. This raises the critical question of what these enabling conditions are

and how they can be created to bridge the gap between ambition and achievement.

Foucault's analysis of power and knowledge (1975) further illuminates this issue by emphasising that power is relational and exercised through structured practices. While educational leaders may possess the authority to interpret and apply SDM data, their ability to transform this power into meaningful action depends on institutional frameworks, collaborative practices, and relational dynamics. For example, centralised systems often fail to recognise the relational dimensions of power, where teachers' ability to engage with and interpret data meaningfully is critical for achieving systemic improvements.

In the Malaysian context, data systems are expected to serve as a key enabler of data-driven decision-making and improve educational outcomes nationwide as clearly stated in the MEB. However, Sylva (2014) argues that the presence of data management systems alone is insufficient to ensure better outcomes unless the data is effectively analysed and utilised. This reflects the distinction between power (the ability to access and manage data) and potential (the capacity to achieve meaningful outcomes). The persistent gap between these two dimensions suggests that critical conditions for success—such as leadership engagement, capacity-building, and institutional support—are either underdeveloped or absent.

The challenges Malaysia faces in meeting its MEB targets by 2025 are indicative of this broader issue. While SDM systems have been introduced to support ambitious goals, the absence of enabling conditions—such as professional development for educators, equitable access to data, and collaboration between stakeholders—has limited their impact. As Heidegger's concept of potentiality and actuality suggests, the power provided by SDM systems remains unrealised unless the right conditions are in place.

Foucault's work underscores that power is not inherent but exercised through the relationships, practices, and structures that govern their use. In the case of SDM, the potential of data to drive improvement depends on how it is interpreted and applied within a structured framework of leadership and collaboration. For example, while centralised SDM systems may ensure

compliance and accountability, they often fail to foster the participatory culture needed for sustainable reform.

This critique aligns with the principles of data democracy, which emphasise that the success of SDM hinges not only on technological capacity but also on relational dynamics, such as trust, transparency, and teacher engagement. Without addressing these dynamics, the transactional benefits of SDM are limited, perpetuating a gap between policy ambitions and practical outcomes.

2.4 SDM from a Techno-Agential Ontology: Balancing Determinism and Realism

Building on the discussion of SDM as a transactional tool in education, the interaction between technology and human agency emerges as a central theme in understanding its effectiveness. While SDM systems promise transformative potential for decision-making and educational improvement, the extent of their impact is shaped by the interplay between technological infrastructure and the human actors engaging with these systems. This interaction reflects a balance between technological determinism, which views technology as an autonomous driver of change, and techno-realism, which emphasises human agency and context in mediating technology's influence.

The concept of the techno-agential ontology arises as a framework that integrates these perspectives, positioning technology and human actors as co-constitutive forces in shaping educational outcomes.

Technological determinism asserts that technological advancements inherently drive societal, cultural, and behavioural transformations. Early theorists, including Marx and Veblen, emphasised the deterministic role of technology in reshaping social structures (Tsoulfidis, 2024; Veblen, 1904). Later, Winner (1977) and Postman (1992) extended this view, critiquing the autonomy of technological systems and their capacity to impose values such as efficiency and control at the expense of humanistic considerations.

In education, this perspective suggests that tools like Learning Management Systems (LMS) and data analytics platforms fundamentally reshape teaching and

administrative practices (Wayman et al., 2006). However, critiques of determinism highlight its limitations, particularly the tendency to overlook the socio-cultural and relational dynamics that influence how technology is adopted and used. For instance, SDM systems may offer powerful data-driven tools, but their effectiveness depends on whether educators can interpret and act on this data, a process shaped by training, resources, and institutional culture.

Techno-realism emerged as a counterbalance to deterministic narratives, advocating for a critical and contextual engagement with technology. Shapiro (1999) and Selwyn (2021) argue that technology's outcomes are neither inevitable nor autonomous but are mediated by human decisions, ethical considerations, and institutional contexts. In the educational realm, techno-realism underscores the importance of factors like digital equity, professional development, and ethical data practices.

For example, while SDM systems can streamline administrative processes and provide actionable insights, their success hinges on the ability of stakeholders—teachers, administrators, and policymakers—to critically engage with these tools. As Selwyn (2021) highlights, data systems are only as effective as the human actors who interpret and apply the information. This perspective calls for greater attention to relational dynamics, including collaboration, trust, and shared accountability, in realizing the potential of SDM.

The techno-agential ontology integrates insights from both determinism and realism, positing that technology and human agency are mutually constitutive. In educational settings, this ontology emphasises that while technological systems provide the infrastructure for SDM, human actors shape how these systems are used, interpreted, and integrated into practice (Latour, 1996; Fenwick & Edwards, 2010).

This perspective is particularly relevant in the context of distributed leadership, where decision-making responsibilities are shared among educators, administrators, and policymakers. SDM systems, under a techno-agential lens, are not autonomous drivers of reform but tools that depend on human capacity-building and relational networks to achieve their potential. For instance, Ikram et al. (2021) highlight that the effectiveness of data systems in schools relies on

educators' ability to interpret and act on data insights, a process requiring training, support, and collaboration.

Applying the techno-agential ontology to SDM reveals its dual nature: while technology facilitates data-driven decision-making, its outcomes are deeply contingent on human agency. Technological determinism might suggest that advanced SDM systems inherently improve educational outcomes by providing real-time analytics and predictive capabilities. However, techno-realism tempers this view by emphasising the socio-technical conditions—such as equity, professional development, and trust—necessary for these systems to be effective.

For example, Malaysia's MEB highlights ambitious goals for leveraging SDM to improve educational outcomes, yet the gap between its aspirations and achievements reflects the challenges of creating enabling conditions for SDM. Without addressing factors like leadership engagement and teacher capacity, SDM risks becoming a tool for compliance rather than empowerment. This concern aligns with critiques from Selwyn (2021) and Kelly (1987), who caution against over-reliance on technology without sufficient attention to its human and relational dimensions.

Historical Context of SDM in Global Education

The historical evolution of SDM illustrates how technological advancements and human agency have co-evolved to shape educational practices. Analysing SDM's progression through the dual lenses of technological determinism and techno-realism reveals not only the transformative potential of data systems but also their inherent limitations. This critical examination highlights the nuanced dynamics of technological adoption, including unintended consequences, ethical concerns, and structural inequalities.

Transition to Digital Records (1970s-1980s)

The transition from paper-based record-keeping to digital systems in the 1970s and 1980s marked a significant milestone in SDM's history. Early systems revolutionized administrative workflows by automating tasks like student

records, attendance tracking, and grade management (Ehman, 1980). From a technological determinism perspective, this shift underscores technology's role in compelling institutional change, optimising operations, and providing foundational infrastructure for modern SDM (Starko et al., 2022).

However, adopting digital records was not without challenges. A techno-realist critique emphasises that these advancements required substantial human effort, including the development of new competencies among teachers and administrators. Ehman (1980) notes that successful implementation depended on educators' willingness to integrate digital tools into their workflows. This highlights a critical gap: while digital systems introduced efficiencies, they also exposed disparities in technological literacy, particularly among less resourced schools. These disparities reinforced existing inequalities, raising questions about the equity of technological adoption in education.

School Management Information Systems (SMIS) Era (1990s)

The 1990s introduced School Management Information Systems (SMIS), which centralised various data points critical to school operations, such as academic performance, teacher records, and financial data (Visscher et al., 2001). From a deterministic perspective, SMIS drove a paradigm shift in how schools managed data, enabling more systematic and efficient practices (Selwyn, 2021). These systems standardised data collection, providing school leaders with a clearer picture of institutional performance.

Yet, techno-realism reveals a more complex narrative. While SMIS enhanced administrative efficiency, they also introduced significant challenges. Visscher (1996) highlights issues such as data privacy concerns, unequal access to training, and resistance to change among educators. Furthermore, centralising data amplified power imbalances, often marginalising teachers who lacked the resources or skills to engage with these systems effectively. This critique aligns with the broader data dictatorship model, where control over data remains concentrated among administrators, limiting the participatory potential of SMIS to empower frontline educators (Kelly et al., 2010).

Data-Driven Decision-Making (2000s)

The early 2000s saw a shift toward data-driven decision-making, with policies such as the No Child Left Behind Act (2002) in the United States institutionalizing the use of data for accountability and performance monitoring (Campbell, 2002). From a technological determinism perspective, this era reinforced the idea that data systems could transform education by driving policy reforms and improving student outcomes (Wayman et al., 2006).

However, this data-centric approach was not without its critics. Techno-realism emphasises the risks of over-reliance on quantitative metrics, such as neglecting qualitative aspects of education like student well-being and teacher creativity (Gale, 2006). This period also saw the rise of a compliance-driven culture, where data became a tool for surveillance rather than improvement. These critiques challenge the assumption that more data inherently leads to better outcomes, calling for a more holistic approach that integrates both numerical insights and contextual human narratives.

The Analytics Revolution and Learning Management Systems (2010s)

By the 2010s, the integration of data analytics and Learning Management Systems (LMS) marked a new phase in SDM, enabling schools to process vast datasets and derive actionable insights (Selwyn, 2021). Predictive analytics and visualisation tools offered unprecedented opportunities for proactive interventions, such as identifying at-risk students and optimising resource allocation (Baker & Yacef, 2009). From a deterministic lens, these technologies represented a leap forward in education's data-driven capabilities.

However, techno-realism critiques the ethical and practical implications of this reliance on analytics. Namvar and Intezari (2021) argue that while predictive tools offer clarity, their effectiveness depends on human interpretation and ethical application. For instance, schools with limited digital infrastructure or staff training may misinterpret analytics, leading to misguided interventions or exacerbated inequities. Additionally, data-driven practices raise concerns about privacy and the commodification of student information, emphasising the need for regulatory safeguards.

AI-Driven Data Analytics (2015-Present)

The emergence of artificial intelligence (AI) in SDM has brought both transformative potential and significant challenges. AI-powered systems can analyse complex patterns, offering insights into student performance and predicting future outcomes with unprecedented accuracy (Saa et al., 2020). From a deterministic perspective, these tools have the potential to redefine educational practices, enabling personalized learning and real-time decision-making.

Yet, as techno-realism highlights, the integration of AI must be approached cautiously. Intezari and Pauleen (2018) emphasise that AI-driven insights must be contextualised through human judgment to ensure relevance and ethical alignment. For example, while AI can identify patterns, it lacks the capacity to account for socio-cultural factors that influence education. Furthermore, AI systems risk perpetuating biases embedded in their algorithms, raising critical questions about fairness and inclusivity in educational decision-making.

The historical evolution of SDM illustrates the dual forces of technological determinism and techno-realism, highlighting both the opportunities and challenges presented by technological advancements. While deterministic narratives emphasise technology's transformative potential, techno-realism tempers this optimism by foregrounding the importance of human agency, ethical considerations, and systemic inequities. Understanding these dynamics provides critical insights into how SDM can be leveraged to address the complexities of contemporary education while avoiding the pitfalls of over-reliance on technology.

2.5 Techno-Agential Ontology in Distributed Leadership for SDM

Building on the concept of the techno-agential ontology, which emphasises the interplay between technology and human agency, this section examines its relevance within distributed leadership for SDM. Distributed leadership highlights shared responsibility and collaborative decision-making among multiple stakeholders (Spillane, 2006). This approach is particularly significant in SDM, where technological tools and human actors must work in tandem to collect, analyse, and apply educational data. However, the dynamics of centralised

control (data dictatorship) and participatory access (data democracy) create systemic challenges that influence the effectiveness of distributed leadership in practice.

Distributed leadership shifts the focus from individual, hierarchical leadership to a shared model where leadership tasks are distributed among teams, systems, and individuals (Spillane, 2006). In the context of SDM, this model ensures that the complexities of data management—ranging from data collection to interpretation—are addressed collectively by school administrators, teachers, and district officials (Hubers, 2016). Collaborative leadership is particularly relevant for managing data in Malaysia's education system, where inter-agency coordination is required across the Ministry of Education (MOE), District Education Offices (DEOs), and schools (Bush et al., 2018).

While shared responsibility fosters inclusivity, the literature critiques its limitations in practice. Data systems are often designed with centralised control, where administrators act as gatekeepers, limiting teacher engagement in data-driven decision-making (Kelly et al., 2010). This aligns with the data dictatorship model, where decision-making is concentrated at higher levels of authority, creating a disconnect between policy and practice. To move toward data democracy, distributed leadership must prioritise equitable access and collaborative engagement, ensuring that all stakeholders are empowered to contribute to SDM processes.

Techno-agential ontology provides a framework for understanding how leadership functions are distributed between technology and human agency in SDM. In this view, technology acts as a facilitator, enabling leaders to process and analyse vast amounts of data efficiently, while human actors contextualise and apply these insights to educational settings (Ikram et al., 2021). Tools such as Learning Management Systems (LMS) and data analytics platforms exemplify this dynamic, offering infrastructure for decision-making but requiring human judgment to interpret outputs (Nair, 2022).

Critically, the literature highlights challenges in achieving this balance. While centralised systems provide consistency and scalability, they often marginalize those with limited technological access or expertise, exacerbating existing

inequities (Bush et al., 2018). This critique reflects broader concerns about the data dictatorship model, where control over data systems reinforces hierarchical structures rather than fostering collaboration. Effective distributed leadership, therefore, requires not only technological tools but also investments in human capacity to engage with these tools meaningfully.

Inter-agency coordination is a cornerstone of distributed leadership in SDM, particularly in centralised-decentralised systems like Malaysia's. Collaborative interaction, as described by Gronn (2002), emphasises the importance of ongoing exchanges between human actors and technological systems. In SDM, this involves sharing data and insights across agencies such as the MOE, DEOs, and schools to inform policy and practice (Bush et al., 2018).

However, the literature identifies significant challenges in fostering effective collaboration. Centralised control often creates bottlenecks in communication, where data access and interpretation are restricted to administrators, leaving teachers and other frontline educators excluded from decision-making (Kinjawan et al., 2020). This reflects a reality closer to data dictatorship, where power dynamics inhibit participatory leadership. To promote data democracy, distributed leadership must address these relational gaps by building trust, fostering transparency, and encouraging shared accountability among stakeholders.

Capacity building is integral to the success of distributed leadership in SDM, as it equips educators and administrators with the skills needed to engage meaningfully with data systems (Harris & Spillane, 2008). This includes fostering data literacy, ensuring equitable access to technology, and creating opportunities for professional development. Ikram et al. (2021) argue that building capacity enhances both technological proficiency and leadership effectiveness, enabling stakeholders to interpret and apply data insights in ways that align with national policies and local contexts.

Critiques of capacity-building efforts highlight persistent gaps in training and resources, particularly in under-resourced schools. For example, while advanced data systems are increasingly available, their potential often remains underutilised due to insufficient professional development (Bush et al., 2018).

This disparity undermines the participatory potential of distributed leadership, as educators without adequate training are less likely to engage with SDM systems effectively. Addressing these gaps requires systemic efforts to ensure that capacity-building initiatives reach all stakeholders, promoting equity and inclusivity in SDM practices.

2.6 SDM as Information Inter-Agency Coordination

SDM functions as a critical mechanism for inter-agency coordination within education systems, particularly in centralised-decentralised governance contexts like Malaysia. At its core, SDM facilitates the exchange of data and insights between schools, District Education Offices (DEOs), and the Ministry of Education (MOE), positioning itself as both a technical infrastructure and a relational framework for decision-making. However, the capacity of SDM to serve this coordinating function is deeply influenced by the distribution of power and authority over data—shaping who accesses, interprets, and utilises information for action. Literature increasingly critiques the tension between centralised data control, often described as data dictatorship, and the aspiration for participatory, democratic data use, or data democracy (Kelly et al., 2010). This tension underlines the challenges of achieving equitable coordination where all stakeholders meaningfully engage with data to drive educational improvement.

Malaysia's education system exemplifies “centralised decentralisation”—a model where formal autonomy is granted to local agencies but ultimate control remains concentrated at the centre (Lee, 2006; Mok, 2004). While centralisation enables standardisation in policy implementation and data practices, it often reinforces rigid top-down control, limiting the capacity of DEOs and schools to innovate or respond to localised needs (Sandström & Carlsson, 2008). In contrast, decentralisation potentially empowers local actors, allowing them to tailor strategies to context-specific challenges. Yet, as DeBoer (2012) cautions, decentralisation without adequate capacity and oversight risks exacerbating regional disparities and fragmenting policy execution. This dilemma reflects a broader governance paradox: central control promotes uniformity and accountability, but often at the expense of responsiveness, flexibility, and local agency in data use.

Critically, SDM centralisation operates on two interconnected dimensions: data infrastructure and decision-making authority. Nationally standardised data systems, while streamlining collection and analysis, inherently privilege central actors—consolidating control over how data is interpreted and applied (Blau & Presser, 2013; Celio & Harvey, 2005). Such structures enable education authorities to monitor trends and allocate resources efficiently but simultaneously marginalise local stakeholders, particularly school leaders and teachers, who are reduced to passive data providers (Bush et al., 2021). This reinforces hierarchical decision-making, where the MOE maintains dominance over policy direction, often sidelining local knowledge and needs (DeBoer, 2012). Empirical studies (Gill & Berezina, 2021) confirm that Malaysian school leaders frequently lack the discretion to translate data insights into contextually relevant interventions, exemplifying how centralised SDM can undermine the participatory potential of distributed leadership models.

In response, Malaysia's Education Blueprint (MEB) 2013–2025 advocates for greater decentralisation, framing localised data use and decision-making as key reform goals. By empowering DEOs and schools to interpret data for region-specific challenges—such as improving student attendance or learning outcomes—the MEB gestures toward a more democratic model of data engagement. Yet, the literature remains sceptical about the effectiveness of this shift. Capacity gaps among schools and districts, uneven access to data systems, and limited data literacy continue to undermine local agency (Bush et al., 2018; DeBoer, 2012). Without deliberate efforts to strengthen relational dynamics and inter-agency trust, decentralisation risks becoming symbolic rather than substantive. Bureaucratic inertia, power asymmetries, and fragmented accountability mechanisms further erode the possibility of collaborative governance (Gill & Berezina, 2021), raising concerns that decentralisation in SDM may reinforce rather than resolve existing inequities.

Overall, the literature reveals that SDM sits at the intersection of technical capability and relational governance—where data is not neutral but embedded in power structures that determine who acts, who benefits, and who remains marginalised. The persistent lean towards centralised control reflects a data dictatorship, where local actors are tasked with data compliance rather than

empowered for decision-making. Achieving a genuine data democracy requires more than technological upgrades; it demands systemic reforms to redistribute data access, build local capacity, and foster meaningful inter-agency collaboration. Only by addressing these underlying power dynamics can SDM fulfil its potential as a tool for equitable, responsive, and context-sensitive education governance.

2.7 Structural-Relational Perspective: Towards a Techno-Agential Understanding of SDM

Emerging debates in educational governance suggest that SDM cannot be fully understood through structural or relational perspectives alone. Instead, SDM systems function as dynamic spaces where structural power and relational agency interact, producing both opportunities and constraints. From a structural lens, SDM represents the formalisation of hierarchical authority—centralised decision-making, standardisation, and compliance mechanisms designed to enforce consistency and accountability. Meanwhile, relational perspectives draw attention to the networked, collaborative, and context-sensitive interactions that shape how data is interpreted, shared, and used at multiple levels. Together, these perspectives provide the necessary foundation for a techno-agential ontology, where technology is not neutral but embedded within socio-political power relations and human agency.

The structural view frames SDM as an instrument of centralised governance, where data infrastructures consolidate control at higher administrative levels. As theorised by Nirr (1998) and Bray (1991), education systems often resemble pyramidal bureaucracies where information flows upward while authority cascades downward. Centralised SDM systems enable ministries or education authorities to monitor performance, allocate resources, and enforce accountability through uniform metrics and reporting standards (Blau & Presser, 2013; Selwyn, 2021). While such standardisation enhances data reliability and comparability, it also risks reproducing “data dictatorship” (Kelly et al., 2010)—where schools and teachers become passive data providers, stripped of the autonomy to interpret or act upon the data they generate. This hierarchical concentration of power often marginalises local insights, limiting the system’s

capacity to respond to context-specific educational needs (Sandström & Carlsson, 2008).

Relational perspectives challenge these top-down tendencies by foregrounding the role of networked interactions, trust, and collaboration in shaping data use. Drawing from Actor-Network Theory (Latour, 2005), SDM can be seen as a web of human and non-human actors—including databases, dashboards, teachers, principals, and policy units—where influence is negotiated rather than imposed. Such a lens reveals that power in SDM is not simply held but constantly mobilised through relationships, communication flows, and shared meaning-making (Gaskell & Hepburn, 1998; Gronn, 2002). Relational approaches advocate for data democracy, where schools, districts, and local actors co-construct knowledge from data, tailoring strategies to the unique needs of students and communities (Bush et al., 2018). However, critics argue that relational dynamics alone are insufficient in hierarchical systems like Malaysia's, where weak communication channels, bureaucratic inertia, and capacity gaps prevent true collaboration (Gill & Berezina, 2021).

Critically, neither perspective alone fully captures the techno-agential nature of SDM, where technology both structures governance and mediates human action. Structural models overlook the micro-level dynamics of how actors engage with data, while relational approaches risk romanticising collaboration without acknowledging the material constraints of centralised systems. The integrated structural-relational framework proposed in this study addresses this gap by analysing how SDM operates at the intersection of power and potential. Structural flows of authority, represented by directive data pipelines, ensure coherence and national accountability. Simultaneously, relational networks, conceptualised as mobilising tokens, create space for local agency, collaborative decision-making, and adaptive data use (Latour, 2005).

This framework is essential for interrogating SDM not merely as a technical system but as a governance apparatus shaped by competing forces of control and collaboration. Centralised structures safeguard quality control but risk entrenching data dictatorship, while relational dynamics foster distributed leadership but are fragile without systemic support. The techno-agential view thus demands a critical examination of how structural power can be leveraged—

not to dominate—but to create the conditions that enable relational agency, capacity building, and meaningful local engagement with data.

In Malaysia's context, where SDM is deeply embedded in a centralised-decentralised governance paradox, this framework provides a lens to explore when and how power can be converted into potential. It allows investigation into the conditions that move SDM beyond compliance-driven reporting toward a system that empowers schools and local actors as active data users and decision-makers. Ultimately, this structural-relational perspective advances the conceptualisation of SDM as a techno-agential system—where governance, technology, and human agency are inseparable and must be harmonised to achieve effective, equitable, and responsive education data governance.

The next section applies this framework to examine specific cases where these dynamics manifest, critically analysing how SDM's structural and relational forces shape educational leadership and decision-making practices.

2.8 SDM from Structural Perspectives

Building on the structural-relational synthesis of SDM in the previous sections, this section critically examines the structural aspects of SDM, focusing on the formal organisational frameworks that define its implementation, governance, and systemic challenges. A structural perspective is essential in understanding how hierarchical governance structures, policies, and standardised procedures shape the functionality and effectiveness of SDM (Bray, 1991; Selwyn, 2021). By analysing SDM through this lens, this section explores key dimensions such as capacity, agency, systemic constraints, and the bureaucratic mechanisms that influence data management within centralised education systems.

The literature emphasises that structured frameworks provide stability, standardisation, and policy coherence, ensuring consistent implementation of educational data management practices across institutions (Nirr, 1998; Kallemeyn, 2014). Centralised SDM enables oversight, quality control, and national-level policymaking, which are crucial for maintaining equity and comparability across educational settings (Blau & Presser, 2013). However,

critiques of this approach highlight its rigidity, limited adaptability, and the marginalization of local agency (Mok, 2004).

A structural analysis of SDM is necessary to question the extent to which centralised frameworks facilitate or hinder effective data utilisation. While policies and hierarchical governance structures aim to enforce compliance and accountability, they often create bureaucratic inefficiencies and fail to accommodate the nuanced, context-specific needs of schools and districts (Sandström & Carlsson, 2008). This critique aligns with the argument that SDM must balance top-down control with decentralised agency, allowing stakeholders at different levels to engage in meaningful data-driven decision-making.

By engaging critically with the structural dimensions of SDM, this section provides a foundation for assessing the systemic constraints that impact the operationalisation of data management in education. Understanding these structural mechanisms is essential for evaluating whether SDM functions as an enabler of educational innovation or a tool for administrative control. Furthermore, this analysis serves as a precursor to the subsequent discussion in 2.8, which examines relational perspectives, offering a counterpoint to the limitations of centralised control by exploring the role of collaboration, networked interactions, and stakeholder engagement in SDM.

2.8.1 Policy and Public Agencies as Capacity Enablers

Policy frameworks provide the regulatory foundation and strategic direction, while public agencies act as policy intermediaries and implementers (Bray, 1991; Mok, 2004). These two components—policy capacity and institutional agency—work in tandem to facilitate the diffusion, operationalisation, and sustainability of SDM initiatives (Wu, Ramesh & Howlett, 2015). However, despite their complementary roles, both policy-driven capacity building and institutional execution face structural constraints, including bureaucratic inefficiencies, resource limitations, and systemic rigidity (Sandström & Carlsson, 2008; Bush et al., 2018).

Policy frameworks serve as the formal structures that regulate, standardise, and institutionalize data management practices. These policies are designed to

ensure compliance, enhance data literacy, and create standardised mechanisms for data collection, analysis, and application (Wu, Ramesh & Howlett, 2015). By establishing clear guidelines and reporting requirements, policy documents provide a structural foundation for data-driven decision-making, ensuring that schools and administrators integrate SDM into strategic planning, performance evaluation, and policy execution (Abrams et al., 2021).

However, while policy frameworks are intended to enhance data governance, their effectiveness is often limited by bureaucratic constraints and a lack of localised adaptability (Mok, 2004). The top-down nature of policy implementation reinforces hierarchical control, where compliance takes precedence over practical engagement with data for educational improvement (Bush et al., 2018). Scholars argue that excessive reliance on policy mandates without adequate capacity-building measures can lead to data collection being treated as an administrative obligation rather than an opportunity for informed decision-making (Kallemeyn, 2014). This dynamic aligns with the critique of data dictatorship, where centralised control over data prioritises oversight rather than empowerment, limiting the ability of local educational institutions to use data meaningfully for contextual problem-solving (Kelly et al., 2010).

Public agencies serve as key institutional actors in the implementation of SDM policies, functioning as policy mediators, data managers, and administrative regulators (Peters, 2015). Agencies such as the Ministry of Education (MOE), State Education Departments (SEDs), and District Education Offices (DEOs) are responsible for operationalising policy frameworks, ensuring that schools comply with data mandates while facilitating inter-agency coordination, training, and support mechanisms (UNICEF, 2019).

The effectiveness of public agencies in translating policy into practice depends on their policy capacity, which encompasses their analytical, operational, and political capabilities (Wu, Ramesh & Howlett, 2015). Agencies with strong analytical capacity can interpret and contextualise policy directives, ensuring that data management systems are tailored to institutional needs rather than implemented as rigid compliance measures. Operational capacity ensures that the necessary digital infrastructures and administrative support systems are in place to facilitate efficient data management and reporting (Kallemeyn, 2014).

Political capacity plays a critical role in stakeholder engagement and policy diffusion, ensuring that data-driven reforms receive sustained support at different levels of governance (Gill & Berezina, 2021).

Despite their critical role, public agencies often face structural barriers that limit their effectiveness in data management practices. Bureaucratic inertia, resource disparities, and competing institutional priorities hinder the ability of agencies to diffuse policy mandates efficiently and equitably (Bray, 1991; Bush et al., 2018). As policy intermediaries, agencies are often constrained by rigid administrative structures, where compliance with top-down directives takes precedence over local adaptation (Peters, 2015). This restricts the agency of schools and district-level actors, reinforcing the dominance of centralised control in SDM governance.

The relationship between policy frameworks and public agencies is central to understanding the structural enablers of data management practices. While policy frameworks establish regulatory and strategic objectives, public agencies act as the institutional machinery responsible for executing these policies (Rogers, 1995). However, their interaction is often characterised by tensions between standardisation and flexibility, raising concerns about whether SDM policies enable innovation or reinforce administrative control.

From a policy diffusion perspective, Rogers (1995) highlights that public agencies function as "key opinion leaders" in the adoption of new technologies and administrative practices. Their ability to guide schools and local agencies through SDM implementation is essential for ensuring that data-driven innovations are effectively embedded in the education system (Peters, 2015). However, when agencies operate within highly centralised governance models, their role is often reduced to compliance enforcement rather than strategic capacity-building (Sandström & Carlsson, 2008).

Moreover, resource constraints and hierarchical reporting structures reinforce inefficiencies in data governance, where schools and district offices become passive data collectors rather than active users of data (Honig & Venkateswaran, 2012). This reflects the broader issue of bureaucratic fragmentation, where

policy frameworks emphasise standardisation, but institutional barriers prevent localised engagement and adaptability (Bush et al., 2018).

The structural perspective highlights that SDM capacity is shaped by the interplay between policy frameworks and public agencies, each with its own enabling functions and structural constraints. While policy frameworks establish the legal and strategic foundation for SDM, public agencies function as the institutional conduit for policy implementation. However, bureaucratic rigidity, inter-agency fragmentation, and resource disparities remain significant barriers to effective data governance (Mok, 2004; Gill & Berezina, 2021). This analysis raises broader concerns about whether SDM policies are fostering capacity-building or reinforcing bureaucratic control mechanisms. Are public agencies empowering schools to engage with SDM, or are they reinforcing administrative control mechanisms? Are policy-driven SDM mandates designed for capacity-building, or are they structured as compliance-based mechanisms that limit local agency?

2.8.2 Structural Constraints from Infostructure and Infosystem

Building on the discussion of capacity enablers in Section 2.7.1, this section critically examines the structural issues and constraints that hinder the effective implementation of SDM. Drawing upon the synthesis of Bray (1991) and Mok (2004), it can be inferred that SDM functions within structured governance frameworks, technological infrastructures, and bureaucratic hierarchies, all of which influence the efficiency and effectiveness of data systems. These interconnected elements dictate how data is managed, accessed, and utilised, thereby shaping the overall functionality of SDM processes. However, these structures often introduce barriers to data accessibility, inter-agency coordination, and policy execution, reinforcing bureaucratic inefficiencies and systemic fragmentation (Sandström & Carlsson, 2008; Bush et al., 2018).

To analyse these challenges, this section distinguishes between infostructure—the foundational framework supporting information flow—and infosystem—the operational mechanisms for data processing and decision-making. Understanding the interplay between these two components is critical to assessing how

structural limitations impact SDM's effectiveness in supporting data-driven decision-making, policy implementation, and educational governance.

Infostructure refers to the technological and organisational foundations that enable the efficient flow of information within an educational system. It encompasses network infrastructures, policy frameworks, and procedural mechanisms that govern data collection, storage, dissemination, and security (Zurkowski, 1984; Mutch, 2010). In educational contexts, infostructure ensures that data repositories, communication channels, and digital platforms function as integrated systems, facilitating seamless information exchange across agencies (Selwyn, 2021).

A well-developed infostructure strengthens SDM by standardising data practices, enhancing data reliability, and supporting policy compliance (Kallemeyn, 2014). However, structural constraints—such as insufficient digital infrastructure, inconsistent policy enforcement, and inadequate inter-agency coordination—often undermine the efficiency of SDM (Bray, 1991). For example, technological disparities between urban and rural schools create inequities in data accessibility, system interoperability, and digital literacy, reinforcing existing gaps in educational policy execution (Bush et al., 2018).

Moreover, excessive centralisation in infostructure governance risks creating data bottlenecks, where schools and local agencies become dependent on centralised authorities for data access and analysis (Gill & Berezina, 2021). This hierarchical control aligns with data dictatorship, limiting stakeholder agency and local adaptability in data-driven decision-making (Kelly et al., 2010). Consequently, while centralised infostructure ensures policy coherence and compliance, it may simultaneously hinder localised problem-solving, innovation, and responsiveness.

Infosystem refers to the technological and procedural mechanisms used to collect, process, manage, and analyse data within an educational organisation (Camarinha-Matos & Afsarmanesh, 2003). It includes data management platforms, analytics tools, and administrative software that facilitate data-driven decision-making, student performance tracking, and policy evaluation (Orlikowski & Robey, 1991). Infosystems bridge the gap between policy

intentions and practical execution, enabling schools, administrators, and policymakers to utilise data for educational planning and performance monitoring (Selwyn, 2021).

However, structural inefficiencies in infosystems often undermine their intended purpose. Systemic constraints such as outdated data policies, fragmented databases, and inconsistent data governance frameworks disrupt the effectiveness of SDM (Obilikwu & Ogbuju, 2020). Bureaucratic delays in data reporting, analysis, and feedback loops further exacerbate these challenges, reducing stakeholder trust in data accuracy and relevance (Bush et al., 2018). Additionally, the overemphasis on compliance-driven reporting shifts SDM from a tool for innovation to a mechanism of administrative control, reinforcing data dictatorship rather than participatory data governance (Gill & Berezina, 2021).

Infosystem constraints are also compounded by capacity limitations among educational personnel. Studies highlight that insufficient data literacy among educators and administrators often results in mechanistic data collection without meaningful analysis or application (Srivastava & Venkatasubramanian, 2010). Without adequate training and professional development, infosystem users may struggle to leverage data effectively, leading to data misinterpretation, policy misalignment, and suboptimal decision-making (Kallemeyn, 2014).

The relationship between infostructure and infosystem is fundamental to understanding how structural constraints impact SDM functionality. A robust infostructure provides the necessary technological and organisational backbone, ensuring that infosystems can operate efficiently. Conversely, infosystems rely on well-established infostructures to facilitate data management, communication, and policy execution (Camarinha-Matos & Afsarmanesh, 2003). The effectiveness of SDM depends on the harmonization of these two components, ensuring that data systems are not only technically functional but also aligned with institutional needs and governance structures.

However, the literature highlights persistent gaps in integrating infostructure and infosystem in educational settings. Resource constraints, fragmented data policies, and weak inter-agency collaboration create barriers that inhibit the

scalability and sustainability of SDM systems (Orlikowski & Robey, 1991). Moreover, the disjointed implementation of digital infrastructures and policy frameworks results in data silos, where educational agencies operate in isolation rather than as interconnected networks (Obilikwu & Ogbuju, 2020). This lack of integration exacerbates inefficiencies, delays in decision-making, and inconsistencies in data-driven policy execution.

Critically, the centralised-decentralised governance dilemma remains a key challenge in SDM implementation. While central authorities establish standardised data policies and infrastructures, local agencies must navigate the complexities of adapting these policies to their specific contexts (Bush et al., 2018). The literature suggests that decentralised governance models, supported by relational approaches, could enhance SDM efficiency by fostering greater stakeholder engagement, shared accountability, and adaptive problem-solving (Latour, 2005; Gaskell & Hepburn, 1998). However, achieving this balance requires systemic reforms to enhance inter-agency coordination, improve data literacy, and bridge digital infrastructure disparities.

The structural challenges associated with SDM highlight the tensions between standardisation and flexibility, centralised control and localised agency, and policy enforcement and stakeholder autonomy. While infostructure provides the necessary backbone for data governance, it must be designed to support rather than constrain localised data use and decision-making (Mok, 2004). Similarly, infosystems must be developed not merely as reporting tools but as interactive platforms that enable collaborative, real-time data engagement (Selwyn, 2021).

2.8.3 Theoretical Frameworks for Understanding Structural Issues

Building on the previous discussions in Section 2.7.1 and Section 2.7.2, this section incorporates theoretical perspectives to critically examine the structural factors influencing SDM. While capacity-building efforts (2.7.1) and structural constraints (2.7.2) highlight policy-driven standardisation, bureaucratic limitations, and institutional inefficiencies, a more nuanced understanding of these challenges requires theoretical lenses that explain why and how these structural patterns emerge.

Theories such as isomorphism, resource dependence theory (RDT), and Occam's Razor offer critical insights into the uniformity of SDM practices, resource constraints that shape institutional behaviour, and the role of simplicity in policy implementation. These perspectives provide a structural exploration of SDM, analysing how educational agencies, bureaucratic systems, and technological infrastructures interact in shaping data-driven governance.

By integrating these theories, this section aims to move beyond descriptive accounts of SDM challenges to analytical interpretations of power, constraints, and strategic adaptations in policy implementation. This approach also positions SDM within broader discussions of governance, institutional stability, and efficiency, reinforcing the need for critical engagement with structural perspectives in SDM research.

Isomorphism and SDM Standardisation

Isomorphism explains why organisations, particularly in bureaucratic environments, adopt similar structures, policies, and practices due to institutional pressures (DiMaggio & Powell, 1983). In SDM, isomorphism manifests through policy standardisation, regulatory mandates, and systemic uniformity, ensuring consistency across educational institutions (Meyer & Rowan, 1977).

In the Malaysian context, national education policies establish centralised SDM frameworks, compelling schools to conform to uniform data collection, reporting, and analysis procedures. This alignment aims to ensure data consistency, comparability, and regulatory compliance across the system (Selwyn, 2021). However, the rigid application of standardised SDM frameworks can lead to reduced adaptability and responsiveness to local educational needs (DiMaggio & Powell, 1983).

The HEAD Foundation's Policy Brief No. 7 (2019) critically examined Malaysia's education policy implementation and identified inter-agency communication failures and hierarchical inefficiencies as barriers to effective SDM. The centralisation of data policies has created structural bottlenecks, where information flows are disrupted by weak feedback loops, bureaucratic layering, and power imbalances between ministry officials, state education departments,

and school administrators (Bush et al., 2019). This top-down policy enforcement, while ensuring standardisation, may also reinforce siloed organisational behaviour, limiting cross-agency collaboration and policy flexibility (Katz & Kahn, 1978; Lencioni, 2012).

This critique of isomorphism in SDM raises a fundamental question: Does policy-driven standardisation enhance educational governance, or does it suppress localised innovation and context-specific decision-making? While policy consistency is necessary for national accountability, excessive uniformity may lead to institutional rigidity, misaligned priorities, and operational inefficiencies.

Resource Dependence Theory (RDT) and Institutional Constraints

Resource Dependence Theory (RDT) explains how organisations navigate power dynamics and resource limitations to sustain operations and maintain influence (Pfeffer & Salancik, 2015). In SDM, technological infrastructure, administrative support, and financial investments serve as critical resources that educational institutions depend on for effective data governance.

Educational institutions, particularly public schools and district education offices, operate within resource-constrained environments, making them reliant on external funding, government directives, and policy frameworks to sustain SDM systems (Rao, Brown & Perkins, 2007). However, this reliance also creates power dependencies, where schools must comply with government-imposed SDM regulations to secure resources and maintain legitimacy (Hillman, Withers & Collins, 2009).

In Malaysia, disparities in technological access, digital literacy, and funding allocations exacerbate SDM inequalities across schools, reinforcing hierarchical dependencies on central education authorities (Obilikwu & Ogbuju, 2020). Schools with stronger technological capacity can leverage SDM tools for data-driven decision-making, while under-resourced institutions may struggle with outdated systems, insufficient technical expertise, and poor data management practices (Farley-Ripple & Buttram, 2015).

RDT highlights how schools and agencies adopt strategic adaptations to manage their resource dependencies, including institutional collaborations, inter-agency agreements, and data-sharing partnerships (Drees & Heugens, 2012). However, when resource control remains concentrated in central authorities, schools may face limited autonomy in SDM adoption, reinforcing data dictatorship rather than participatory data governance (Kelly et al., 2010).

This perspective raises critical concerns about whether SDM policies empower educational institutions or reinforce hierarchical dependencies. While centralised governance models ensure uniformity and accountability, they may also reduce schools' ability to innovate, adapt, and effectively manage their data systems.

Occam's Razor and the Search for Simplicity in SDM Implementation

Occam's Razor, a principle advocating for simplicity in decision-making and policy execution, provides an analytical lens for evaluating SDM efficiency (Domingos, 1999). In SDM, simplified data governance models can enhance usability, accessibility, and implementation feasibility, reducing administrative burden and technological complexity (Selwyn, 2021).

Applying Occam's Razor to SDM suggests that streamlined, user-friendly data management systems may yield greater effectiveness than complex, bureaucratically layered infrastructures. However, over-simplification risks neglecting critical institutional factors, such as contextual adaptability, stakeholder engagement, and ethical considerations (Domingos, 1999).

From a technological perspective, automation in SDM can reduce data processing errors, standardise reporting mechanisms, and enhance real-time decision-making (Rao, Brown & Perkins, 2007). However, reliance on technological fixes without investing in human agency and institutional capacity may lead to detached, top-down governance models that prioritise data compliance over meaningful engagement (Hubers, 2016).

Similarly, while Occam's Razor suggests that technological systems offer the simplest solution to SDM inefficiencies, the human factor in educational

decision-making remains crucial. Without proper training, professional development, and localised support, data management systems may be underutilised, misinterpreted, or viewed as an administrative burden rather than a strategic asset (Mandinach et al., 2015).

This perspective raises a critical debate: Should SDM reforms prioritise technological efficiency, or should they integrate human-centric approaches that enhance stakeholder agency in decision-making? While Occam's Razor supports streamlined SDM solutions, the risk of over-centralisation, lack of contextual adaptation, and technocratic control highlights the need for a balanced approach that integrates both technological and institutional strategies.

2.8.4 Techno-Agential Condition: Interplay of Isomorphism, RDT, and Occam's Razor in SDM Research

Building on the theoretical discussions in Section 2.7.3, this section synthesises Isomorphism, Resource Dependence Theory (RDT), and Occam's Razor to develop the Techno-Agential Condition, a conceptual framework that explains the structural dynamics influencing SDM governance and practice. While existing research has examined these theories in isolation, their integration provides a more nuanced approach to understanding how SDM policies are enforced, how institutions navigate resource constraints, and how decision-making processes balance complexity and efficiency.

By merging these perspectives, this study moves beyond traditional policy implementation discussions to analyse the intricate relationships between standardisation, institutional dependencies, and technological rationalization in SDM. This synthesis does not merely reaffirm existing knowledge but instead opens avenues for exploring how SDM policies shape institutional behaviour, how agencies position themselves within SDM networks, and what structural factors enable or hinder effective data governance. These considerations will be further examined in subsequent sections.

Theoretical Intersection: Synthesising Structural Constraints and Strategic Adaptations

The Techno-Agential Condition emerges from the interplay between institutional conformity (Isomorphism), resource dependencies (RDT), and decision-making efficiency (Occam's Razor). Each theory offers a unique but interdependent perspective on how SDM governance is structured, constrained, and adapted.

Theoretical Lens	Key Contribution to SDM	Structural Constraints	Strategic Adaptations
Isomorphism (DiMaggio & Powell, 1983)	Standardisation and uniformity in SDM practices	Bureaucratic rigidity, lack of local adaptability, potential for innovation stagnation	Policy adaptations that allow flexibility while maintaining regulatory compliance
Resource Dependence Theory (RDT) (Pfeffer & Salancik, 2015)	Power dynamics in securing SDM resources (technological, financial, institutional)	Unequal access to technology and training, hierarchical dependencies in decision-making	Strategic collaborations, inter-agency agreements, alternative funding models
Occam's Razor (Domingos, 1999)	Simplicity in SDM implementation and decision-making	Over-complexity in data systems, excessive reporting requirements, user resistance	Streamlined data governance, automation, user-friendly platforms

By synthesising these perspectives, the Techno-Agential Condition proposes that effective SDM governance requires a balance between standardisation, strategic resource management, and technological simplicity. While isomorphic pressures shape institutional alignment with national policies, resource dependencies create power imbalances that influence access to SDM infrastructure, and decision-making models determine whether SDM remains a functional tool or an administrative burden.

Reconceptualising SDM: The Role of Policy, Resources, and Decision-Making

Isomorphism: Standardisation as a Structural Imperative

Isomorphism explains why educational institutions align with centralised SDM policies, ensuring uniformity in data collection, reporting, and analysis (Meyer & Rowan, 1977). While this reduces discrepancies in data governance, it also

introduces rigidity that limits schools' ability to customise SDM practices to their specific needs (DiMaggio & Powell, 1983).

However, empirical findings from The HEAD Foundation (Bush et al., 2019) highlight inter-agency communication failures, rigid administrative hierarchies, and fragmented policy enforcement as barriers to SDM effectiveness in Malaysia. The centralisation of SDM policies has created structural bottlenecks, where information flows are disrupted by weak feedback loops, bureaucratic layering, and institutional misalignment. The Techno-Agential Condition recognises that while standardisation ensures consistency, rigid frameworks can weaken local agency, reducing schools' ability to make independent data-driven decisions. These considerations lead to broader questions about how standardisation affects SDM networks, what agencies drive policy enforcement, and how institutions negotiate compliance with local needs.

RDT: Resource Dependencies and Power Imbalances in SDM Implementation

RDT provides a structural explanation for why SDM adoption varies across institutions. Schools rely on centralised funding, digital infrastructures, and administrative support to sustain SDM operations, making them dependent on government policies and external technology providers (Pfeffer & Salancik, 2015). This hierarchical dependency limits local autonomy, as schools must comply with national data mandates to secure financial and technological resources (Hillman, Withers & Collins, 2009).

While this centralised approach ensures resource allocation, it also highlights disparities in SDM access and usage. Schools with stronger technological capacity and administrative support can leverage data-driven decision-making, whereas under-resourced institutions struggle with outdated systems, insufficient training, and fragmented data infrastructures (Farley-Ripple & Buttram, 2015). The Techno-Agential Condition suggests that SDM should not only be viewed as a compliance mechanism but as a strategic resource that institutions actively negotiate and manage. These challenges raise questions regarding which agencies control SDM resources, how institutions collaborate to manage technological dependencies, and what alternative models can reduce reliance on hierarchical resource distributions.

Occam's Razor: The Role of Simplicity in SDM Design

Occam's Razor underscores the importance of simplicity in SDM implementation, arguing that overly complex data systems increase administrative burdens, reduce usability, and create resistance among stakeholders (Domingos, 1999). While automation and standardisation improve efficiency, they must be balanced with human agency and institutional flexibility (Selwyn, 2021). The Techno-Agential Condition proposes that SDM should prioritise usability and accessibility, ensuring that technological solutions align with the skill levels and operational realities of educational institutions. This perspective invites reflection on how SDM can be simplified without oversimplifying data governance, how institutions navigate the challenges of complex reporting structures, and whether existing SDM frameworks facilitate or hinder meaningful data engagement.

The Techno-Agential Condition extends existing research by critically examining the intersection of standardisation, resource dependencies, and decision-making rationality in SDM governance. This study highlights the need for a more flexible, resource-conscious, and usability-driven approach to SDM policies. By analysing policy impact, agency interactions, network formation, and systemic challenges, this research contributes to understanding the enabling and constraining factors in SDM implementation.

2.9 Bridging Structural and Relational Perspectives in SDM Research

Building on the theoretical synthesis in Section 2.7, this section incorporates relational perspectives to complement the structural lens used to analyse SDM governance and implementation. While structural theories such as Isomorphism, RDT, and Occam's Razor provide insights into policy standardisation, institutional dependencies, and decision-making efficiency, they do not fully account for the dynamic, interactive, and evolving nature of SDM networks. The integration of relational perspectives, therefore, allows for a more understanding of how SDM policies are enacted, contested, and negotiated across institutional and technological networks.

Traditional structural perspectives explain how SDM policies shape institutional behaviour but often assume a linear, top-down implementation process. However, the reality of SDM governance is far more complex, as policy enactment is influenced by relationships between multiple stakeholders, including agencies, schools, educators, and technology providers. SDM implementation is not merely an administrative or technical process but an evolving interaction among actors within a network. Recognising this, this study integrates Actor-Network Theory (ANT) as a pragmatic analytical tool, bridging the gap between structural determinism and relational agency. This thesis conceptualises ANT in SDM as a network of interdependent actors and technological infrastructures where power, agency, and collaboration dynamically shape data governance

While ANT serves as a useful lens for analysing relational interactions (Latour, 2005), this study does not fully adopt its framework but instead uses it selectively to explore how SDM functions as both a hierarchical system and a network of dynamic interactions. ANT challenges the notion that agency is located solely in human actors and instead proposes that technologies, policies, and data systems exert influence alongside institutional and human actors (Fenwick & Edwards, 2010). Thus, by incorporating ANT as an analytical tool, this study examines how SDM technologies mediate power dynamics, how inter-agency collaboration or conflict affects policy implementation, and how reforms evolve through interactions rather than mere top-down enforcement.

To further bridge structural and relational perspectives, this study introduces the concept of mobilising tokens, which function as mechanisms to facilitate inter-agency discourse and reduce hierarchical barriers (Latour, 2005). Mobilising tokens serve as translational devices that help educational institutions adapt top-down policies into localised practices, enabling horizontal communication across agencies, schools, and policymakers. The mobilising token concept aligns with findings from The HEAD Foundation (Bush et al., 2019), which identified weak feedback loops and inter-agency misalignment as key challenges in SDM implementation. By fostering mobilising tokens as connectors within SDM networks, this study proposes that policy actors, educators, and technology

providers must actively engage in shared knowledge-building to improve SDM effectiveness.

A key reason for incorporating relational perspectives into SDM research is the need to move beyond static policy enforcement models and recognise SDM as a dynamic process shaped by power hierarchies and agency interactions. Bartels and Turnbull (2020) argue that public administration should not be viewed solely through a hierarchical lens but as an interconnected system of relationships where authority is co-produced through interactions among multiple actors. In the SDM context, this means that the success of policy implementation is dependent on the degree of collaboration, negotiation, and trust-building among stakeholders. Without these relational elements, structural constraints may reinforce silos, leading to ineffective policy enactment and limiting the capacity of educational institutions to leverage SDM for decision-making.

The intersection of structural and relational dimensions in SDM governance is best understood through a framework that integrates both institutional standardisation and networked interactions. Isomorphism explains why educational institutions align with centralised SDM policies, ensuring uniformity in data collection, reporting, and analysis (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). However, this uniformity can also create rigidity, reducing the ability of schools and agencies to adapt SDM practices to their specific needs.

RDT further highlights the role of resource dependencies, showing how schools and public agencies must strategically manage their technological, financial, and administrative resources to sustain SDM operations (Pfeffer & Salancik, 2015). However, RDT alone does not explain how institutions navigate these dependencies within networks of power and influence, which is where relational approaches become particularly relevant. Occam's Razor, which advocates for simplicity in SDM design, underscores the importance of efficient data governance models that reduce administrative burdens while maintaining analytical depth (Domingos, 1999). However, even simplified SDM systems must be embedded within networks of interaction to ensure effective data use and decision-making.

By integrating these theoretical lenses, the Techno-Agential Condition as mentioned in 2.7.4 expands the existing literature by recognising that SDM is both a structured governance mechanism and a dynamic relational network.. The need for a relational perspective is particularly critical in addressing the challenges of power asymmetries, network fragmentation, and inter-agency coordination in SDM implementation.

This relational expansion leads to further discussions about how SDM networks function, how different agencies collaborate or compete for control, and how SDM policies are translated into practice across multiple institutional levels. These considerations will be further examined in the upcoming sections, which will explore how SDM operates within networked environments, what agencies drive its implementation, and how relational engagement influences the effectiveness of SDM governance.

2.9.1 Technology and Agencies in Socio-Materiality Networks

The relational perspective in this SDM research acknowledges that technology and human actors are not separate entities but co-constructors of educational experiences within socio-material networks. Traditional approaches to technology in education often treat it as a neutral, external tool facilitating human agency. However, socio-material perspectives challenge this assumption, emphasising how technology is deeply embedded in institutional, social, and material contexts, influencing and being influenced by human actors (Fenwick & Edwards, 2010). Within SDM, this means that data management systems do not simply exist as static infrastructures but actively shape governance structures, decision-making processes, and institutional relationships.

Johri (2011) introduces socio-material bricolage, a concept that underscores the mutual shaping of technology and educational practice. From this perspective, SDM systems are not just tools for storing and analysing data but also actants—entities that actively mediate and transform institutional behaviours, administrative workflows, and policy enforcement mechanisms. This challenges the conventional view that technological adoption is a linear process of implementation, instead revealing how technologies are integrated, resisted, and adapted within institutional settings.

Building on this, Mulcahy and Perillo (2011) extend the socio-material framework to educational leadership and institutional governance, arguing that leadership should be viewed not as a fixed role but as an enacted practice that emerges through interactions between human and non-human actors. This has profound implications for SDM governance, as it suggests that data-driven leadership is not merely about decision-making at the administrative level but is contingent upon the interactions between policy frameworks, digital infrastructures, and stakeholder engagement.

However, previous applications of socio-material perspectives, particularly Actor-Network Theory (ANT), present limitations in centralised educational structures. ANT often assumes fluidity in networks and the distributed nature of agency (Latour, 2005), which does not fully account for the hierarchical, bureaucratic, and policy-driven nature of SDM governance. Likewise, while ANT posits that networks are dynamic and that actors—both human and non-human—continuously shape each other (Latour, 2005), it does not adequately address the rigid structures, power asymmetries, and top-down policy enforcement that characterise centralised education systems. Therefore, this study integrates relational insights from ANT while retaining an acknowledgment of structured agency, recognising that while SDM is shaped by relational dynamics, it also operates within institutionally entrenched hierarchies that regulate data governance.

2.9.2 Ambivalences within/between Technology and Agencies

Ambivalence is a defining characteristic of relational interactions in SDM governance, reflecting the tensions, contradictions, and competing interests that emerge in socio-material networks (Fenwick & Edwards, 2010). These ambivalences arise from policy contradictions, misaligned institutional priorities, and the dual role of technology as both an enabler and a constraining force in data-driven decision-making. While technology is often positioned as a solution to improve efficiency, transparency, and accountability in SDM, its integration also introduces complex power dynamics, conflicting institutional interests, and resistance from stakeholders.

Heath, Fuller, and Paton (2008) highlight that ambivalence is not an isolated phenomenon but is deeply embedded within social networks and institutional decision-making practices. Within SDM, this manifests as tensions between policy compliance and innovation, between centralised control and localised autonomy, and between data-driven efficiency and professional discretion. Administrators may be required to adhere to rigid data mandates while also recognising the need for flexibility in applying insights from SDM systems, leading to conflicting pressures that complicate decision-making.

Månsson and Langmann (2011) trace the historical roots of ambivalence in education, arguing that modern educational systems are structured around rational order and predictability. However, the growing reliance on data-driven decision-making introduces new forms of uncertainty, as educational institutions must reconcile the objectivity of data with the subjective realities of teaching, learning, and institutional governance. This results in scepticism toward SDM, where data systems are perceived both as essential governance tools and as instruments of bureaucratic control.

A key source of ambivalence is the status quo bias in educational institutions, where technological advancements are viewed with both optimism and suspicion. While digital infrastructures promise greater accountability and informed decision-making, their implementation often disrupts established routines, challenges existing power structures, and raises concerns about data ethics, security, and professional autonomy (Heath et al., 2008). Understanding these ambivalences is crucial for designing SDM policies and technologies that align with institutional needs while also addressing stakeholder concerns about control, surveillance, and decision-making transparency.

2.9.3 Mobilising Tokens of Agencies and Technology

The concept of mobilising tokens, originating from ANT, refers to entities that facilitate communication, negotiation, and the movement of knowledge within networks (Fenwick & Edwards, 2010). Within SDM, mobilising tokens can take the form of data-sharing platforms, policy documents, technological artifacts, and performance indicators, all of which serve as mediators of power and influence in educational governance.

Thomas and Villiers (2002) apply ANT to higher education, illustrating how policies, digital tools, and performance metrics act as mobilising tokens that shape institutional interactions. In SDM, this is evident in how data dashboards, reporting tools, and compliance metrics structure relationships between schools, policymakers, and technology providers. Gaskell and Hepburn (1998) similarly highlight how curricula function as mobilising tokens, shaping the behaviours of educators, students, and institutional actors.

A critical dimension of mobilising tokens in SDM is their role in creating or overcoming communication barriers within hierarchical organisations. Murdoch (1998) introduces the concept of "spaces of negotiation", where mobilising tokens enable dialogue between actors in structured networks. In SDM, this suggests that policy mechanisms must not only dictate compliance but also facilitate institutional discourse, enabling bottom-up feedback to shape top-down mandates.

However, the effectiveness of mobilising tokens in SDM is contingent upon the power relations embedded within the network. In centralised governance structures, mobilising tokens may function as instruments of compliance rather than enablers of agency, reinforcing hierarchical control rather than fostering genuine collaboration. Thus, for SDM to be effective, mobilising tokens must be designed not just as tools of policy enforcement but as facilitators of inter-agency dialogue, trust-building, and adaptive governance.

2.9.4 Translations of Technology and Agencies in SDM

The concept of translation within ANT provides a crucial lens for analysing how SDM policies, technologies, and human actors negotiate their roles and functions within educational governance networks. Unlike traditional implementation models that assume linear policy diffusion, translation theory emphasises the negotiation, adaptation, and contestation involved in aligning different actors and interests (Callon, 1986). This perspective challenges top-down policy models by recognising that SDM is not merely imposed upon institutions but is actively reshaped through stakeholder interactions, institutional constraints, and technological mediation.

Translation is not a passive transfer of information; it is a dynamic process where actors—including policymakers, educators, administrators, and data systems—constantly negotiate meanings, power relations, and institutional commitments (Fenwick & Edwards, 2010). This is particularly relevant to SDM, where educational institutions must align standardised policies with localised needs, negotiate technological dependencies, and navigate bureaucratic hierarchies to ensure effective implementation. Understanding how SDM policies, agencies, and technological infrastructures are translated across institutional settings is key to identifying both the barriers and opportunities for meaningful data-driven governance.

Callon (1986) identifies four key moments in the translation process that illustrate how actors mobilise, align, and contest roles in networked governance structures:

Problematization - Actors define a core issue, positioning specific solutions (e.g., SDM) as essential for addressing educational governance challenges. In this stage, policymakers and data systems are framed as indispensable for improving accountability, efficiency, and decision-making. However, problematization often ignores how institutional resistance, technological constraints, and power asymmetries shape the adoption of SDM systems.

Interessement - Stakeholders are recruited and convinced to adopt the proposed solutions. Within SDM, this involves securing school administrators, educators, and data managers as active participants in data-driven decision-making. However, interessement is not always voluntary (Pfeffer & Salancik, 2015); institutions may comply due to funding dependencies, policy pressures, or performance evaluation mandates rather than genuine belief in SDM's efficacy.

Enrolment - Actors stabilise their roles within the SDM network, committing to institutionalised routines and workflows. However, enrolment does not guarantee meaningful participation (Mifsud, 2020); teachers and administrators may be included in SDM systems as passive data collectors rather than as active agents in shaping governance decisions.

Mobilisation - The final stage involves stabilising SDM networks to ensure sustainability. Yet, mobilisation often remains uneven (Law, 1992), as power hierarchies, bureaucratic inertia, and technological disparities might limit SDM's long-term impact across different institutional settings.

By applying these translation moments to SDM governance, this study questions the assumption that SDM implementation is a straightforward process of compliance and efficiency. Instead, it argues that SDM success depends on how well actors negotiate, resist, or strategically adapt data policies to fit their institutional contexts.

Power, Agency, and the Politics of Translation in SDM

A critical dimension of translation theory is how power is negotiated within SDM networks. Unlike hierarchical models that assume power is concentrated within central agencies, ANT conceptualises power as an effect of network interactions—it is not possessed by individual actors but is continuously enacted, contested, and reshaped through relational engagements (Latour, 2005).

Law (1992) argues that power in a network is not a fixed attribute but a fluid process that emerges through alliances, interactions, and material dependencies. This perspective is essential for understanding SDM governance, as policies, digital infrastructures, and institutional actors do not function in isolation but co-construct governance practices. The translation of SDM across different institutions thus reveals how power asymmetries shape access to technology, data control, and decision-making authority.

Mifsud (2020) examines the complexities of power relations in educational governance, arguing that policy translation is often contested through negotiations between central agencies, local institutions, and frontline educators. This reflects a key tension in SDM governance: while top-down mandates impose uniform data governance models, bottom-up adaptation reshapes how SDM policies function in practice. This study extends Mifsud's argument by exploring how SDM actors—including policymakers, administrators, and data managers—navigate institutional constraints and negotiate their roles within educational data networks.

Baron and Gómez (2016) further demonstrate that translation moments are central to understanding power in networked governance, emphasising that power emerges from associations rather than from singular institutional authority. This challenges the assumption that SDM compliance equates to policy success, as power struggles between agencies and institutions determine whether SDM systems function as tools for efficiency or as mechanisms of bureaucratic control.

Why Translation Matters for Understanding SDM Networks?

The concept of translation in SDM governance offers a critical perspective on how policies, technologies, and institutional actors interact within educational networks. By moving beyond static policy implementation models, translation theory highlights the ongoing negotiations, adaptations, and resistances that shape SDM adoption and effectiveness.

Three key insights emerge from applying translation theory to SDM:

First, SDM governance is not simply enacted from the top down but is continuously reshaped by localised interactions. This challenges the assumption that policy directives function uniformly across institutions (Callon, 1986), revealing how SDM implementation is subject to negotiations, reinterpretations, and contested agency.

Second, power asymmetries in SDM governance determine whose interests are prioritised in data-driven decision-making. While policymakers may frame SDM as a tool for educational accountability, as educators and administrators may experience it as a bureaucratic mechanism for surveillance and control (Mifsud, 2020).

Third, translation processes highlight the role of agency in shaping SDM policies beyond compliance-driven frameworks. Actors within networks do not simply comply with mandates but actively negotiate their roles within systems (Law, 1992). Recognising how SDM is translated across different institutional settings provides a more realistic account of its governance and effectiveness.

2.10 Synthesis of Literature and Theoretical Gaps in Techno-Agential SDM Framework

The previous chapters critically examined structural and relational techno-agential perspectives in SDM (see Table 2.1), exploring how policy enforcement, leadership frameworks, technological mediation, and institutional agency interact to shape SDM governance. The literature reveals that while structural theories (e.g., isomorphism, resource dependence, policy standardisation) provide robust explanations for SDM compliance mechanisms, they often fail to account for agency, negotiation, and adaptive governance. Conversely, relational approaches (e.g., policy translation, mobilising tokens, networked governance) emphasise how SDM policies are dynamically interpreted and reconfigured but do not sufficiently explain the structural constraints that define institutional decision-making.

Despite these contributions, existing research lacks a cohesive framework that integrates both perspectives, creating critical gaps in how SDM functions as a techno-agential system that operates within structured constraints while allowing for relational adaptability. This chapter synthesises the literature, identifies key theoretical limitations, and lays the groundwork for a new techno-agential framework that bridges policy enforcement, stakeholder negotiation, and technological mediation in SDM governance.

Table 2.1 Synthesis of Literature in The Techno-Agential Framework

Chapter Section	Author(s) & Year	Theory/Concept	Key Contribution	Structural-Relational Techno-Agential Exploration
2.2	Perera & Asadullah (2019); Bush et al. (2023)	MEB policy effectiveness; SDM as a governance tool	Critiques the assumption that MEB policies inherently lead to better SDM outcomes, highlighting implementation failures due to contextual misalignment.	Shows how MEB structurally enforces SDM, creating compliance pressures while limiting local adaptations (Structural Techno-Agential).
2.2.1	Johnston & Hamilton (2020);	SDM as a transactional tool; decision-making frameworks	Challenges traditional decision-making frameworks by demonstrating how SDM functions as a	Demonstrates that SDM is not merely transactional but contingent on organisational culture

	Zhan & Cao (2023)		socio-technical system requiring human interpretation.	and interpretation (Structural Techno-Agential).
2.3	Tsoufidis (2024); Winner (1977); Postman (1992)	Technological determinism vs. techno-realism	Deconstructs deterministic narratives around technology, arguing that SDM adoption depends on governance structures, not just innovation.	Critically evaluates the power of technological systems in shaping SDM governance, emphasising regulatory oversight (Structural Techno-Agential).
2.3.1	Ehman (1980); Starko et al. (2022); Visscher et al. (2001)	Historical evolution of SDM; digital transformation	Traces the historical resistance to digital SDM systems, emphasising the role of institutional inertia in shaping current limitations.	Examines how the history of SDM digitization reflects broader socio-political transformations in education (Structural Techno-Agential).
2.4	Spillane (2006); Harris & Spillane (2008)	Distributed leadership in SDM	Expands distributed leadership theory to argue that SDM implementation is ineffective unless leadership is genuinely decentralised.	Explores how SDM leadership must account for both institutional structures and relational agency for effective data use (Relational Techno-Agential).
2.5	Bray (1991); Mok (2004); Sandström & Carlsson (2008)	Centralisation-decentralisation tension in SDM governance	Unpacks how centralised SDM frameworks create data silos, limiting school-level flexibility and adaptation.	Analyses how SDM implementation is impacted by centralisation (Structural Techno-Agential).
2.5.1	Nirr (1998); Latour (2005)	Structural-relational perspectives in SDM	Proposes a hybrid structural-relational framework to understand SDM, showing that effective adoption requires both systemic conditions and individual agency.	Bridges policy control and networked governance influences, showing that SDM is co-constructed at multiple levels (Structural-Relational Techno-Agential).
2.6	Wu, Ramesh & Howlett (2015); Kallemeyn (2014)	Policy frameworks as capacity enablers	Examines how policy frameworks enable SDM adoption but also constrain agency through bureaucratic rigidity.	Argues that while policy frameworks structure SDM adoption, they also introduce rigid constraints on school autonomy (Structural Techno-Agential).

2.7	Meyer & Rowan (1977); Pfeffer & Salancik (2015); Domingos (1999)	Isomorphism, RDT, and Occam's Razor in SDM	Synthesises structural theories to reveal hidden institutional biases that affect SDM standardisation.	Examines standardisation forces and SDM efficiency trade-offs (Structural Techno-Agential).
2.7.1	Wu, Ramesh & Howlett (2015); Hillman et al. (2009)	Public agencies as SDM policy enforcers	Exposes how public agencies act as enforcers rather than enablers of SDM policies, reinforcing hierarchical control.	Demonstrates how public agencies regulate SDM through enforcement mechanisms (Structural Techno-Agential).
2.8.1	Johri (2011); Mulcahy & Perillo (2011); Crossley (2022)	Technology as an actant in socio-materiality; relational agency	Challenges the neutrality of technology in SDM, arguing that its role is contingent on institutional conditions and stakeholder engagement.	Reconceptualises technology as a key relational factor in SDM policy execution (Relational Techno-Agential).
2.8.2	Heath, Fuller & Paton (2008); Månsson & Langmann (2011); Selwyn et al. (2020)	Ambivalence and institutional resistance; critical-materialist approach	Critiques the assumption that resistance to SDM stems from ignorance, showing instead that it reflects legitimate concerns over control and autonomy.	Shows that resistance to SDM is not irrational but rooted in concerns over autonomy and control (Relational Techno-Agential).
2.8.3	Fenwick & Edwards (2010); Gaskell & Hepburn (1998); Murdoch (1998); Pischet	Mobilising tokens and stakeholder engagement; reimagining digital technology	Explores how mobilising tokens function as sites of contestation where SDM policies are debated, negotiated, and redefined.	Explores mobilising tokens' role in stakeholder engagement and policy success (Relational Techno-Agential).

	ola (2021)			
2.8.4	Callon (1986); Law (1992); Mifsud (2020); Crossley (2022); Roe & Perkins (2024)	Translation processes and power asymmetries; relational approaches to structure and agency; generative AI and agency in education	Argues that SDM translation is a continuous process of negotiation, shaped by political struggles and institutional interests.	Examines SDM translation as a contested process shaped by institutional power struggles (Structural-Relational Techno-Agential).

The Structural-Relational Divide in SDM Theories

A recurring theme across the literature is the tension between structural enforcement and relational adaptation in SDM. Structural perspectives (e.g., Meyer & Rowan, 1977; Pfeffer & Salancik, 2015) emphasise how policy frameworks, regulatory bodies, and hierarchical structures create standardised SDM systems, ensuring data uniformity and institutional accountability. These theories argue that centralised SDM policies enhance efficiency and scalability, particularly in large education systems where compliance, standardisation, and oversight are key governance priorities (Bray, 1991; Mok, 2004).

However, while structural approaches provide macro-level explorations for SDM implementation, they often neglect the micro-level negotiations that shape how policies are enacted at the school or district level. Research on policy translation (Callon, 1986; Law, 1992; Mifsud, 2020) reveals that policy directives are rarely adopted as intended but are instead negotiated, contested, and reconfigured by institutional actors. Mobilising tokens (Murdoch, 1998; Pischetola, 2021) further illustrate that digital infrastructures and policy tools do not merely enforce compliance but also serve as sites of resistance, adaptation, and localised innovation.

Yet, while relational perspectives highlight the interpretive flexibility of SDM policies, they fail to account for the structural constraints that limit institutional agency. There is no clear theoretical model that explains how SDM can function simultaneously as a policy enforcement mechanism and a negotiated governance

system. This gap necessitates a hybrid approach that integrates both structural enforcement and relational adaptability, acknowledging that SDM is not just a technical process, but a socio-political system shaped by hierarchical authority and networked agency.

Power Asymmetries and SDM Translation

A further gap in the literature concerns the role of power in shaping SDM policy translation. While research on policy standardisation (Peters, 2015; Hillman et al., 2009) and public agency enforcement (Wu, Ramesh & Howlett, 2015) emphasises how SDM frameworks create centralised control over data governance, studies on policy translation (Callon, 1986; Fenwick & Edwards, 2010) suggest that power is not monolithic but negotiated through institutional interactions.

However, existing research does not adequately explore how power asymmetries influence SDM decision-making at different institutional levels. Questions remain about how schools, district agencies, and policymakers navigate conflicting SDM mandates, how policy actors leverage institutional resources to modify or resist data-driven governance, and how digital infrastructures mediate power imbalances between centralised policymakers and decentralised school administrators.

Although policy translation research provides insights into how SDM policies evolve through negotiation, it does not sufficiently explain why certain institutions have more influence over SDM adaptation than others. The lack of empirical studies on how SDM power asymmetries impact resource allocation, data interpretation, and leadership autonomy limit the applicability of relational theories in structured education systems. This study seeks to address this gap by examining how power struggles shape SDM governance, particularly in environments where data-driven decision-making is promoted as a tool for institutional oversight rather than stakeholder empowerment.

The Limits of Technological Determinism in SDM Research

A major limitation in SDM research is the dominance of technological determinism, which assumes that technological advancements inherently improve educational governance. Early techno-centric models (Tsoulfidis, 2024; Winner, 1977; Postman, 1992) argue that digital SDM systems enhance data accuracy, streamline administrative workflows, and increase institutional efficiency. However, this perspective overlooks the complexities of data interpretation, socio-material dependencies, and the unintended consequences of data-driven decision-making (Johri, 2011; Roe & Perkins, 2024).

Several studies (Selwyn et al., 2020; Pischetola, 2021) reveal that AI-driven SDM governance introduces ethical, surveillance, and privacy concerns, yet these considerations remain largely absent from mainstream SDM research. Moreover, while digital infrastructures provide scalable solutions for data management, they also create new layers of bureaucracy and administrative burden, as data systems often require extensive training, maintenance, and contextual adaptation (Gaskell & Hepburn, 1998).

This study moves beyond deterministic assumptions by positioning SDM as a techno-agential system, where technology is not a neutral tool but an actant that interacts with institutional agency. A techno-agential approach (Fenwick & Edwards, 2010) reconceptualises SDM as a co-produced governance mechanism, shaped by the affordances of digital tools, policy constraints, and institutional actors' capacity to engage with data systems.

2.11 SDM as a Techno-Agential Condition: The Need for a New Framework

The governance of SDM in Malaysia is shaped by both structural constraints and relational dynamics, yet existing research often treats SDM either as a rigid policy mechanism for data governance or as a system shaped by institutional actors' interactions. While these perspectives offer preconceived insights, they do not sufficiently explain how SDM simultaneously functions as a compliance tool, a data-driven decision-making system, and a networked governance model. The gap in literature lies in the absence of a unified techno-agential framework—one that integrates the enforcement of policy structures with the agency of institutional actors engaging with digital infrastructures.

This study synthesises a techno-agential condition from a structural-relational perspective to develop a governance framework that explains how SDM operates across centralised and decentralised governance levels. The structural perspective examines how institutional policies, regulatory frameworks, and governance mechanisms shape SDM implementation, while the relational perspective explores how institutional actors interpret, negotiate, and engage with SDM systems across different governance levels. The techno-agential condition emerges from this synthesis, explaining how digital infrastructures mediate governance power, institutional agency, and policy adaptation in SDM governance. By integrating these perspectives, this study advances SDM research beyond deterministic views of technology or policy-centric approaches, offering a holistic model that explains the interplay between technology, governance, and institutional agency.

Enablementism and the Techno-Agential Condition

The integration of technology and human agency in SDM governance requires a framework that accounts for both structural constraints and relational agency within educational institutions. The Structural-Relational Perspective has been instrumental in analysing SDM, particularly within centralised-decentralised governance structures such as Malaysia's education system. Existing theories, such as institutional isomorphism (DiMaggio & Powell, 1983), resource dependence theory (Pfeffer & Salancik, 1978), and Occam's Razor, explain how institutional constraints influence SDM governance, while relational theories such as socio-material networks (Fenwick & Edwards, 2010) and policy translation (Callon, 1986) help account for how institutional actors dynamically engage with governance structures.

However, while these theories explain why SDM governance is shaped by institutional constraints and relational interpretations, they do not operationalise how digital infrastructures mediate power and decision-making autonomy. This gap highlights the need for a techno-agential condition, a framework that moves beyond technological determinism and human-centred agency by explaining how governance outcomes emerge from the interaction between technology, institutional actors, and policy enforcement.

Unlike perspectives that assume technology either enables governance improvements (technological determinism) or is simply a tool used by institutional actors (human-centred approaches), the techno-agential condition argues that governance outcomes depend on how digital infrastructures, institutional actors, and policy frameworks co-evolve. However, for this interaction to be effective, governance structures must provide the necessary enabling conditions. This is where enablementism (Valsiner, 2014) becomes relevant, as it highlights that agency alone is insufficient—institutions must create conditions that allow agency to be exercised effectively.

In the context of SDM, no matter how advanced digital systems become, without enabling conditions such as institutional autonomy, capacity-building, and policy adaptability, technology remains an administrative tool rather than an enabler of governance transformation. This study, therefore, bridges the techno-agential condition with enablementism, ensuring that SDM is not only understood as a governance mechanism but as a system that must be supported by enabling conditions to fulfill its potential as a decision-making tool.

Enablementism as a Framework for Understanding Conditional Reality

The concept of enablementism, as developed by Valsiner (2014), offers a theoretical foundation for understanding how social structures not only constrain action but also provide the necessary conditions for innovation and development. Enablementism challenges traditional structuralist perspectives, which often emphasise how institutions dictate behaviour, by asserting that power (whether in the form of human authority or technological capability) remains latent unless the necessary conditions for activation exist.

This theoretical framework is particularly relevant to SDM, where data technology holds the potential to enhance educational decision-making. However, without adequate training, collaborative networks, and institutional support, these technologies remain underutilised or misapplied. The failure of many SDM policies to achieve their intended outcomes is not due to a lack of technological capacity but the absence of enabling conditions that allow human agency to interact meaningfully with technology.

Enablementism also aligns with Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978), which suggests that organisations must navigate dependencies on external resources (such as SDM technologies) while maintaining autonomy. Schools do not operate in isolation; their ability to leverage data management tools is contingent upon institutional support, financial resources, leadership commitment, and professional capacity-building efforts. From an SDM governance perspective, enablementism thus reframes technology not as a self-sufficient solution but as a system embedded within interdependent socio-organisational networks.

Moreover, Valsiner's enablementism aligns with socio-material network theory (Fenwick & Edwards, 2010), which emphasises how policy implementation is not simply a matter of adopting a tool but a process of conditioning human and material relationships to ensure that the tool serves its intended function. The implication of this perspective for SDM is clear: technological systems cannot be simply deployed; they must be integrated within a supportive environment that allows for collaboration, adaptability, and meaningful agency

The Techno-Agential Condition in SDM

The techno-agential condition emerges as a conceptual response to the limitations of both deterministic technological models and human-centred agency theories. While technological determinism suggests that digital tools alone drive educational transformation (Winner, 1977; Postman, 1992), this study argues that technology remains powerless unless structured within enabling conditions. Similarly, while agency-based perspectives emphasise human control over technology, they often overlook the ways in which institutional constraints and digital infrastructures shape decision-making capacity.

This study defines the techno-agential condition as the necessary alignment of structural and relational factors that allow technology and human agency to function synergistically in SDM governance. It challenges the false dichotomy between empowerment and restriction, arguing that both technology and human actors are limited in their capabilities unless conditioned by institutional, infrastructural, and policy-based enablers.

For example, while Malaysia's Integrated Data Management Environment (IDME) and Ministry of Education Information System (MOEIS) platforms represent centralised SDM solutions aimed at standardising data management practices across schools, their effectiveness does not solely depend on the sophistication of their features. Instead, these systems require training programs, feedback loops, and inter-agency collaboration to become meaningful tools for data-driven decision-making. Without these enabling conditions, IDME and MOEIS exist only as repositories of untapped data rather than as active instruments of educational governance.

Furthermore, the techno-agential condition recognises that SDM adoption is not merely about technological access. Schools often receive digital infrastructure but lack the institutional culture and collaborative frameworks necessary to make effective use of these systems. This aligns with public policy research (Pfeffer & Salancik, 1978; Wu, Ramesh & Howlett, 2015), which emphasises that access to resources alone does not drive change—institutions must also foster an ecosystem that facilitates their use.

Theoretical Justification

The literature reviewed in Chapters 2.2 to 2.9 demonstrates that SDM implementation is not simply a technological problem but a structural-relational challenge. This review has revealed that while SDM tools are designed for efficiency, they often increase administrative burden due to a lack of operational alignment between technology and institutional workflows (Orlikowski & Robey, 1991; Zurkowski, 1984). Similarly, while public agencies enforce compliance-driven SDM policies, their enforcement frequently overlooks the need for bottom-up agency and adaptation (Wu, Ramesh & Howlett, 2015).

This study builds upon Valsiner's enablementism to argue that SDM systems can only fulfill their purpose if policy, institutional readiness, and professional agency are conditioned to interact meaningfully with technology. The techno-agential condition thus provides a conceptual lens to investigate how structural constraints and relational dependencies must align for SDM to be effective.

A techno-agential condition provides an opportunity to rethink SDM beyond deterministic, one-size-fits-all models. It recognises that:

- Technology alone does not guarantee data-driven governance—institutions must cultivate an organisational culture that integrates digital tools into decision-making.
- Human agency remains constrained without enabling conditions—teachers, administrators, and policymakers require training, access, and collaborative frameworks to leverage SDM effectively

Power is negotiated, not imposed—rather than viewing SDM as a top-down compliance system, this framework positions it as a co-produced governance structure, where both technology and human actors must be conditioned for success.

2.12 Addressing Theoretical Gaps through Research Questions: A Framework for Investigating SDM in Malaysia

The research questions for this study have been carefully designed to directly address the theoretical gaps identified in Sections 2.9 and 2.10, particularly the absence of an integrated structural-relational perspective in SDM, the under-theorisation of agency within hierarchical governance structures, and the insufficient exploration of techno-agential conditions that shape SDM effectiveness.

Building on these research gaps, this study was structured to bridge the divergence between policy enforcement and institutional agency by critically examining how technology, governance frameworks, and stakeholder interactions condition SDM implementation. The techno-agential condition, grounded in enablementism (Valsiner, 2014) and complemented by structural and relational theories, serves as the foundation for addressing these gaps through a set of six research questions. These questions aim to ensure a holistic

investigation into SDM governance in Malaysia, covering policy impacts, institutional dynamics, network complexities, and structural enablers.

Justification for the Research Questions

The research questions in this study are not arbitrarily formulated; they are derived from the gaps identified in the literature and guided by the techno-agential framework. The lack of integration between structural and relational perspectives necessitates research questions that explore both institutional constraints and the agency of actors within SDM governance structures. Similarly, the need to better understand the interaction between technology and human agency demands a set of inquiries that go beyond simplistic cause-effect relationships, instead emphasising how SDM is enacted within specific techno-agential conditions.

Each research question plays a critical role in addressing these gaps, contributing to a theoretical model that integrates policy, governance, and relational networks in SDM. Below, each research question is outlined with its theoretical justification and its role in advancing SDM research.

RQ1: How does the Malaysia Education Blueprint (MEB) impact the implementation of SDM?

This question investigates the influence of national policy frameworks on SDM implementation. The MEB is central to education governance, dictating how data-driven decision-making is institutionalised, enforced, and operationalised. Given the structural determinism embedded in centralised education policies (Meyer & Rowan, 1977), this question seeks to critically evaluate how policy directives shape SDM practices in Malaysian schools.

The importance of this inquiry lies in its ability to examine whether policy objectives align with the realities of SDM implementation. Existing research has not sufficiently explored the disjuncture between SDM policy expectations and the conditions required for their enactment (Wu, Ramesh & Howlett, 2015). By investigating this relationship, this study addresses the gap between SDM policy

frameworks and institutional constraints, ensuring that the analysis extends beyond policy intentions to actual operational effectiveness.

RQ2: What are the prominent agencies identified in Malaysian public policies related to SDM?

Identifying the key agencies involved in SDM policy implementation is crucial for understanding the institutional and bureaucratic structures that govern educational data management. While previous studies have analysed SDM as a centralised governance tool, there has been limited exploration of how multiple agencies interact, collaborate, and sometimes compete within the SDM ecosystem.

This research question seeks to map out the institutional landscape of SDM, addressing gaps in the literature related to how governance structures shape data-driven education policies. By uncovering the roles, influence, and interactions of various agencies, this study contributes to a more comprehensive understanding of institutional decision-making and power asymmetries in SDM governance.

RQ3: What constitutes the network of SDM?

The third research question shifts the focus from institutional structures to relational dynamics, asking how SDM functions as an interconnected network rather than a series of isolated bureaucratic units. Given that data governance in education requires inter-agency collaboration, stakeholder engagement, and cross-institutional coordination, understanding how SDM networks are formed, maintained, and challenged is a key area of inquiry.

This question directly addresses the lack of relational perspectives in SDM research, particularly in understanding how policy directives translate into practice through inter-agency interactions. By analysing the relational aspects of SDM, this study moves beyond structural analyses to investigate how actors mobilise resources, exchange data, and navigate bureaucratic constraints within SDM networks.

RQ4: What are the challenges faced in SDM from the perspective of these agencies?

Although numerous studies have discussed technical challenges in SDM adoption, there is a lack of research examining how institutional actors perceive these challenges from within the governance structure. SDM is not simply a technical issue but an institutional, organisational, and socio-political phenomenon.

This research question focuses on how agencies experience, interpret, and respond to the barriers they face in SDM implementation. These challenges may include:

- Data security and privacy issues, reflecting global concerns about ethical data governance (Williamson, 2017).
- Infrastructure limitations, particularly in under-resourced institutions that lack technological capacity (Gaskell & Hepburn, 1998).
- Human resource constraints, emphasising the role of training, expertise, and professional development in SDM success (Selwyn, 2020).

By examining these challenges from the perspective of institutional actors, this study bridges the gap between theoretical discussions of SDM governance and practical realities faced by decision-makers.

RQ5: What are the network issues within SDM practices?

A significant gap in SDM literature concerns network failures—how communication barriers, power imbalances, and coordination issues disrupt effective SDM governance. Previous research has focused on policy structures and technological infrastructures, but little attention has been given to how relational factors shape SDM outcomes.

This research question directly engages with policy translation theory (Callon, 1986) and actor networked interactions (Fenwick & Edwards, 2010) to investigate how:

- Hierarchical decision-making affects information flow within SDM networks.
- Power dynamics create barriers to effective collaboration.
- Stakeholder misalignment leads to fragmented or ineffective SDM policies.

By exploring these issues, this study seeks to advance network-based understandings of SDM and contribute to models of relational governance in education.

RQ6: What are the enabling factors and hindering causes of SDM?

The final research question provides a holistic synthesis of structural and relational constraints, examining how SDM governance is conditioned by both institutional enablers and systemic barriers. Previous studies have either examined a policy compliance perspective (Meyer & Rowan, 1977) and explored a relational process between actors without considering its governance limitations (Fenwick & Edwards, 2010). This study, therefore, investigates how both structural conditions and agency shape SDM effectiveness. It identifies the enabling conditions that allow SDM to function successfully and the hindering factors that obstruct its potential.

Chapter 3 Methodology

3.1 Introduction

Building upon the literature review, this chapter outlines the methodological choices underpinning this study, which moves from empirical data to theoretical development. Unlike traditional empirical studies that primarily seek to validate pre-existing theories through data collection, this research adopts a theory-building approach informed by qualitative inquiry. The motivation for this methodological choice stems from the complex, multi-layered nature of SDM in Malaysia, where policy implementation and digital infrastructures interact with distributed leadership, socio-material dynamics, and techno-agency.

This chapter provides a systematic justification for the study's interpretivist paradigm, outlining its ontological and epistemological underpinnings while establishing a clear link between empirical observations and theoretical abstraction. The research methodology was carefully selected to enable the construction of techno-agential condition as a novel theoretical contribution, addressing the identified gaps between policy narratives and practical SDM experiences.

Unlike traditional studies that adopt deductive hypothesis testing, this research follows an inductive, iterative approach—leveraging empirical insights to inform and refine a conceptual framework. The methodological design does not seek generalisability in the positivist sense but instead aims for analytical generalisation (Yin, 2018), offering theoretical insights that can be applied across similar educational contexts.

3.2 Research Design: A Sequential Qualitative Methodology

This study employed a qualitative sequential methodology to explore and theorise SDM in Malaysia through an empirical-to-theoretical research approach. The research was designed to move beyond descriptive accounts of SDM challenges, instead contributing to theoretical advancement by conceptualising techno-enablement. The literature review highlighted that SDM has often been

approached either from a technological determinist perspective, which overemphasises infrastructural efficiency (Wayman, Jimerson, & Cho, 2012), or from a human agency lens, which prioritises leadership and decision-making without accounting for technological constraints (Spillane, 2006). In response, this study was methodologically structured to capture the interactions between digital infrastructures, institutional policies, and leadership agency in SDM, ensuring that findings contributed to both practical insights and theoretical development.

A qualitative sequential methodology was chosen because it allowed for a stepwise exploration of how different actors and institutions interact within the SDM framework, uncovering the enablers and constraints that shape data governance in schools. Given that the study was concerned with meaning-making rather than causality (Creswell & Poth, 2018), an interpretivist qualitative approach was the most appropriate, allowing the research to capture nuanced perspectives on SDM across different governance levels. The sequential design ensured that each phase of research built upon previous findings, refining conceptual understandings at each stage (Merriam, 2009). This iterative process allowed the study to remain empirically grounded, ensuring that the theory of techno-enablement emerged as an outcome of systematic inquiry rather than theoretical speculation.

While multiple case study research is often used to explore policy implementation and institutional decision-making (Yin, 2018), this study did not adopt a case study approach. Case study research typically focuses on specific, bounded contexts, producing findings that are context-dependent rather than theoretically generalisable (Stake, 1995). The objective of this study, however, was to develop a conceptual framework applicable beyond specific institutional settings, making an analytical generalisation approach (Yin, 2014) more appropriate than context-bound case study methodology. Furthermore, case study designs often rely on static data collection methods that analyse predefined cases, whereas this research followed an adaptive, evolving design, where findings were progressively refined through iterative data collection and analysis. By avoiding rigid case boundaries, the study was able to continuously

enhance its conceptual insights, ensuring that techno-enablement was developed as a robust theoretical contribution to SDM governance research.

The research was conducted in four sequential phases, each designed to add depth and theoretical refinement. The first phase involved policy document analysis, which established the formal discourse surrounding SDM governance in Malaysia. This phase was crucial in identifying key policy narratives, institutional priorities, and assumptions about data-driven decision-making (Braun, Maguire, & Ball, 2010). It also provided an initial framework for understanding how leadership structures and technological infrastructures were positioned within the national education system.

This document analysis informed the development of a qualitative questionnaire for headteachers, which formed the second phase of the study. The questionnaire was designed to capture practitioner perspectives on SDM implementation, focusing on the real-world challenges and constraints faced by school leaders (Farley-Ripple & Buttram, 2015). The decision to use a qualitative open-ended questionnaire rather than a structured survey was based on the need to allow respondents to provide rich, reflective accounts of their experiences, rather than being confined to predetermined response categories (Patton, 2015).

The third phase involved consultation sessions with headteachers, which served as a mechanism for validating emerging findings and refining research themes. These sessions enabled the study to engage in collaborative meaning-making, ensuring that headteachers' voices were actively incorporated into the research process. Rather than treating headteachers as passive respondents, this phase positioned them as co-constructors of knowledge, aligning with distributed leadership epistemologies that emphasise collaborative governance in education (Spillane, 2006).

The consultation sessions also played a critical role in refining the final phase of data collection, which involved focus groups and individual interviews with policy actors. These interviews provided insights into the administrative and policy dimensions of SDM, capturing the perspectives of MOE officers, DEO administrators, and representatives from MAMPU. The engagement with

policymakers allowed the research to examine how SDM policies were formulated, interpreted, and implemented across different institutional levels, revealing the disconnects and alignments between policy intent and practical execution (Honig, 2006).

The methodological choices in this study were carefully considered to ensure that findings were both theoretically insightful and empirically robust. Each method was selected to contribute to a progressive deepening of analytical insights, ensuring that the research remained rigorously structured while maintaining flexibility for theoretical refinement (Denzin & Lincoln, 2018). The combination of policy document analysis, qualitative questionnaires, consultation sessions, and interviews provided a multi-perspective understanding of SDM governance, allowing for triangulation of findings across different stakeholder groups (Flick, 2014). Unlike a single-method study, which might have been limited in scope, the multi-method approach enabled the study to develop a comprehensive, empirically grounded theoretical model.

To enhance clarity and methodological coherence, the following table illustrates the rationale for the qualitative sequential methodology, the progressive structure of the research phases, and the analytical approach used to develop techno-enablement as a theoretical framework. Given the complexity of SDM governance, the table provides a structured justification for the qualitative sequential methodology, ensuring that each methodological choice—from philosophical positioning to data collection techniques—is logically aligned with the study’s objectives.

Research Layer	Justification for this Study
Philosophical Paradigm	Interpretivism – the study explores meaning-making in SDM governance, recognising that policy narratives and school-level practices are socially constructed.
Research Approach	Inductive – the study does not impose a predefined theory but develops the Techno-Enablement Framework from empirical findings.
Methodological Choice	Qualitative – the study focuses on deep, context-rich insights into governance challenges, policy-practice gaps, and leadership agency.
Research Design	Sequential Qualitative – ensures progressive theme development, allowing for iterative refinement of findings.
Data Collection Methods	Policy Document Analysis, Qualitative Questionnaires, Consultation Sessions, and Interviews – provide multi-perspective insights from both policy and practitioner levels.

Despite the strengths of this research design, it is important to acknowledge certain methodological limitations. One significant challenge was the reliance on self-reported data, which can be subject to interpretive bias and social desirability effects (Maxwell, 2013). Participants' reflections on SDM implementation were shaped by their personal experiences and institutional positions, making it necessary to validate findings through multiple data sources.

To address this, the study employed methodological triangulation, comparing policy discourses with practitioner accounts and administrative perspectives, ensuring that findings were substantiated by converging evidence (Patton, 2015). Additionally, while the study engaged a diverse sample of SDM stakeholders, it did not include classroom teachers and school support staff, who may also play a role in data management practices. This limitation was mitigated by eliciting headteachers' perspectives on how SDM policies affected teachers and staff, ensuring that their experiences were indirectly represented.

Another methodological constraint was the challenge of establishing causality, given that qualitative research does not rely on statistical inference (Creswell & Creswell, 2018). Since this study focused on meaning-making rather than causation, it was not designed to determine direct cause-and-effect relationships between SDM policies and outcomes. Instead, it employed thematic pattern identification, allowing for conceptual insights into the factors that enable or constrain SDM effectiveness. Future research could complement these findings with quantitative or mixed-methods studies, which may help to establish statistical correlations between policy interventions and school-level data outcomes.

Despite these limitations, the qualitative sequential methodology provided a structured yet flexible framework for investigating SDM governance in Malaysia. The iterative nature of the research design ensured that findings were continuously refined and validated, leading to the development of a well-substantiated theoretical model of techno-enablement. By adopting a rigorous and critically engaged methodological approach, the study contributed to both empirical insights and theoretical advancements, ensuring that its findings were methodologically credible, theoretically robust, and practically relevant.

3.3 Population and Sampling Strategy

This study undertook a comprehensive examination of SDM within the Malaysian education system, requiring a strategic selection of participants to capture diverse perspectives on policy implementation, leadership agency, and data-driven decision-making. Given the centralised-decentralised nature of Malaysia's education governance, it was imperative to ensure that participants represented multiple hierarchical levels, spanning from central policymakers to school-level practitioners. The selected sampling strategies aligned with theoretical and methodological considerations, ensuring that the study included key stakeholders capable of offering informed perspectives on SDM operations and governance.

The population selection process was guided by the principles outlined in Creswell and Creswell (2018), which emphasise that qualitative research should involve participants with deep, context-specific knowledge to enhance the richness and validity of findings. Additionally, Cohen, Manion, and Morrison (2018) argue that educational research should reflect the structural complexity of the system being studied, necessitating multi-stakeholder engagement. Thus, the study adopted a purposive and snowball sampling strategy to identify educational leaders, policymakers, and administrators with direct involvement in data management practices, policy enactment, and digital governance initiatives.

3.3.1 Population Sampling in a Centralised-Decentralised Educational System

The centralised-decentralised structure of Malaysia's education system necessitated a multi-tiered sampling approach to capture the policy-practice divide in SDM implementation. While the Ministry of Education (MOE) formulates policies at the national level, District Education Offices (DEOs) and schools are responsible for translating these policies into operational realities. Thus, participants were selected from both central and decentralised governance levels, ensuring that the study provided a comprehensive view of how SDM is managed, interpreted, and enacted at different administrative tiers.

The research engaged four key participant groups:

- a. **Headteachers** - School leaders responsible for SDM execution at the institutional level. Their perspectives were critical in understanding how policies were implemented, adapted, or challenged in practice.
- b. **District Education Officers (DEOs)** - Administrative personnel overseeing SDM compliance, policy enforcement, and data utilisation at the district level. They provided insights into regional disparities, resource constraints, and administrative challenges in SDM operations.
- c. **Ministry of Education (MOE) Officers** - Central policymakers involved in SDM policy formulation, digital education strategies, and national-level monitoring. Their input was essential for understanding the institutional vision of SDM and the extent to which it aligns with on-the-ground realities.
- d. **Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) Officers** - Representatives from the government agency overseeing digital transformation and public sector data governance. Their perspectives were crucial in examining the role of digital infrastructures, inter-agency collaboration, and technological challenges in SDM governance.

The selection of these participant groups ensured that the study incorporated a multi-level analysis, bridging the gap between policy intent and practical implementation. By engaging stakeholders across multiple layers of the education system, this research provided a nuanced exploration of the enablers and constraints affecting SDM effectiveness in Malaysia.

3.3.2 Sampling Techniques and Participant Selection

To ensure methodological rigor, the study employed a combination of purposive and snowball sampling. Purposive sampling was used to target key educational stakeholders with relevant expertise, while snowball sampling allowed for the identification of additional informants through participant referrals.

The following table summarises the sampling distribution and data collection methods:

Data Collection Technique	Participants	Sample Size (N)
a. Online Questionnaire	Headteachers	40
b. Consultation Session	Headteachers	33
c. Interview Sessions	MOE Officers	2
d. Focus Group Discussions	MAMPU Officers	6
	DEO Officers	5

3.3.3 Convenience and Purposive Sampling for Headteachers

The study engaged 40 experienced headteachers as key informants, as they are directly responsible for implementing SDM policies within schools. Given their leadership roles and involvement in administrative decision-making, they were well-positioned to provide insights into the operational challenges, resource limitations, and institutional constraints affecting SDM.

The selection process employed a combination of convenience and purposive sampling. Convenience sampling ensured that participants were accessible and available for engagement, while purposive sampling guaranteed that they met stringent experience and expertise criteria (Creswell, 2014). The criteria for selection included:

- A minimum of five years of experience as a headteacher.
- Direct involvement in school data management processes.
- Representation from multiple regions of Malaysia to ensure geographic diversity.

To recruit participants, the study leveraged social media platforms, specifically Facebook, which hosts active communities of Malaysian educators. An advertisement campaign was launched within a Facebook group comprising 187,000 members, inviting headteachers to participate in an SDM-focused conference. The campaign attracted 2,818 applications, of which the first 40 applicants meeting the eligibility criteria were selected. While venue capacity

limitations restricted participation, the randomised selection of eligible candidates ensured that the final sample was diverse and representative of various school settings.

Participants attended a nationwide SDM conference, where they engaged in discussions on data-driven decision-making, digital integration, and administrative challenges. The conference facilitated both in-person and virtual participation, allowing for broad inclusivity. This hybrid model aligns with Flick's (2018) argument that multi-mode engagement enhances research inclusivity, particularly in geographically dispersed contexts.

Additionally, the headteachers participated in a follow-up consultation session, where they provided real-time feedback on research tools and emerging themes. This iterative engagement strengthened the validity and credibility of the study by ensuring that practitioner perspectives were systematically integrated into the research process.

3.3.4 Purposive and Snowball Sampling for DEO, MOE, and MAMPU Officers

To capture the institutional and policy dimensions of SDM, the study engaged Ministry of Education (MOE) officers, District Education Officers (DEOs), and MAMPU representatives. Since these stakeholders occupy strategic policymaking and implementation roles, their insights were essential for understanding governance challenges, data utilisation, and inter-agency coordination.

Purposive sampling was initially employed to identify participants with direct SDM responsibilities, ensuring that only individuals with expertise in data governance, digital integration, and educational administration were included (Sharma, 2017). The selection criteria for policymakers included:

- Active involvement in SDM policy formulation or implementation.
- Institutional affiliation with MOE, DEO, or MAMPU.
- At least three years of experience in an SDM-related role.

Since policymakers and high-ranking officials are not always easily accessible, snowball sampling was employed to identify additional participants through peer referrals. This approach was particularly effective in securing MAMPU officers, whose expertise in government data management and ICT policy was central to understanding the digital transformation of SDM. Snowball sampling enabled the study to tap into insider networks, ensuring that highly knowledgeable informants were recruited despite accessibility constraints (Patton, 2002).

By integrating purposive and snowball sampling, the study ensured that its sample was both representative and theoretically relevant, capturing multi-level perspectives on SDM governance, policy execution, and leadership agency. The dual sampling strategy aligns with Creswell and Creswell's (2018) recommendation that qualitative research should balance methodological rigor with inclusivity, ensuring that diverse voices are incorporated into the analysis.

3.4 Research Timeline and Ethical Approval

This section outlines the structured timeline of the research and the ethical considerations that guided the study. A clear and well-defined timeline was essential in ensuring that each research phase was systematically executed, allowing for a sequential qualitative approach that built upon findings from earlier phases. Ethical approval played a central role in maintaining research integrity, ensuring that all data collection activities adhered to international research standards and institutional guidelines.

3.4.1 Research Timeline

The research began on January 3, 2022, with an extensive policy document analysis, which was instrumental in examining the alignment of SDM practices with the MEB. This phase was crucial as it provided the foundational institutional framework for understanding how SDM governance was conceptualised at the national level. By systematically reviewing policy documents, the study identified structural issues, institutional constraints, and policy narratives that shaped SDM implementation.

Building on this foundation, a systematic review was conducted on February 22, 2022, to further explore the governance structures, technological constraints, and leadership dynamics of SDM. This review played a critical role in identifying research gaps and refining research questions, ensuring that the empirical phases of the study were informed by a strong theoretical and policy-oriented grounding. The systematic review also guided the selection of key stakeholders, ensuring that the study engaged participants with decision-making authority and direct involvement in SDM execution.

The next phase involved securing research access and ethical clearance, which was a critical prerequisite for conducting fieldwork. Given that SDM governance involves multiple administrative layers, formal approvals were required from various government agencies. On May 24, 2022, research consent was granted by the Education Sponsorship Division of the Ministry of Education Malaysia, allowing access to MOE-affiliated institutions. This was followed by an additional research permit from the Economic Planning Unit (EPU) of the Prime Minister's Department on December 12, 2022, which authorised access to public educational institutions, including the public institute for educational leadership and management training in Malaysia, State Education Departments (SEDs), District Education Offices (DEOs), and schools. These approvals ensured that the study adhered to national research governance protocols, reflecting institutional transparency and compliance with public sector research policies (Patton, 2015).

Ethical approval from the College of Social Science Research Ethics Committee at the University of Glasgow was secured on February 24, 2023, ensuring that the research complied with ethical guidelines for data confidentiality and informed consent. Ethical approval was essential in maintaining participant anonymity and data protection, particularly given the sensitive nature of educational policy discussions and leadership decision-making.

Following ethical clearance, an online meeting was held on February 25, 2023, with the public institute for educational leadership and management training in Malaysia representatives to coordinate research logistics and plan the Leadership in the Digital Era for School Action (LENSA) conference. This conference, held on March 15-16, 2023, served as a key platform for engaging headteachers and school leaders in discussions on SDM implementation, digital transformation, and

leadership challenges. The LENSEA conference was a collaborative initiative between me, a representative from the public institute for educational leadership and management training in Malaysia, and School A, ensuring that practitioner voices were central to research discussions.

From March 1-5, 2023, an online questionnaire was distributed to 40 headteachers, capturing insights into their experiences, challenges, and leadership roles in SDM governance. The findings from the questionnaire were instrumental in developing tailored interview questions for MOE officers, ensuring that subsequent phases of data collection were grounded in school-level realities.

The period of intense fieldwork concluded with individual interviews with MOE officers on May 10 and May 19, 2023, followed by a focus group session with MAMPU officers on May 23, 2023. These interviews provided institutional insights into SDM policymaking, digital transformation challenges, and governance constraints, forming a crucial component of the policy-practice analysis.

After completing the data collection phase, I returned to Glasgow on June 1, 2023, to commence data analysis and thesis writing. This phase involved thematic coding, triangulation of findings, and refinement of theoretical insights, ensuring that techno-enablement emerged as an empirically substantiated conceptual framework.

The structured timeline of the research highlights the methodical approach taken to collect, analyse, and validate data, ensuring that each phase built upon previous findings, thereby strengthening the theoretical and practical contributions of the study.

3.4.2 Ethical Approval and Considerations

Ensuring ethical integrity and research compliance was a fundamental priority throughout this study. Given the multi-stakeholder engagement in SDM governance, ethical considerations were particularly important in protecting participant anonymity, maintaining data confidentiality, and mitigating risks associated with power dynamics in institutional research.

The study received ethical clearance from the College of Social Science Research Ethics Committee at the University of Glasgow on February 24, 2023. This approval ensured that the research conformed to international ethical standards for educational and policy research, addressing key areas such as informed consent, voluntary participation, and data security.

A comprehensive informed consent process was implemented for all participants, ensuring that they were fully aware of the purpose, scope, and confidentiality measures of the study. Prior to participation, each respondent was provided with a detailed participant information sheet, outlining their rights to withdraw at any stage, refuse to answer specific questions, and request clarification on data usage. These measures were particularly critical in focus groups and interviews, where power imbalances between policymakers and school-level practitioners could have influenced responses (Cohen, Manion, & Morrison, 2018).

Confidentiality and data security were rigorously upheld, with anonymisation protocols applied to all qualitative responses. Data storage followed institutional data protection policies, ensuring that all research materials were securely encrypted and accessible only to me. Given the policy-sensitive nature of SDM governance, additional measures were taken to ensure that no participant's identity could be inferred from their responses, safeguarding against potential institutional repercussions.

A further ethical consideration was the mitigation of bias in researcher-participant interactions, particularly in focus groups and interviews, where social desirability bias and hierarchical power relations could influence findings. To address this, structured facilitation techniques were employed, ensuring that all participants had equal opportunities to contribute without external pressure or influence. Strategies such as anonymous polling, neutral questioning, and systematic follow-up probing were implemented to minimise researcher bias and participant conformity to dominant opinions.

The integration of member-checking procedures further strengthened ethical integrity by allowing participants to review and verify their responses, ensuring that their perspectives were accurately represented. This approach aligns with

best practices in qualitative research, ensuring credibility and confirmability of findings.

3.4.3 Justification for Not Using Coded Identifiers for MOE, MAMPU, and DEO Officers

In this study, I have chosen not to use coded identifiers (e.g., "MOE Officer 1, MOE Officer 2," or "MAMPU Officer 1-6") for participants from the Ministry of Education (MOE), Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), and District Education Offices (DEO). This decision is based on several methodological and ethical considerations supported by literature on qualitative research and data anonymity.

First, coding participants numerically within highly structured organisations risks creating an artificial distinction that does not necessarily reflect the relational and hierarchical nature of governance interactions (Creswell & Poth, 2018). Public sector governance, particularly in centralised systems like Malaysia's, operates within a dynamic network of authority, policy translation, and decision-making structures (Bush & Glover, 2014). Assigning individual numerical identifiers may misrepresent the collective and institutional nature of their engagement with.

Second, the use of generic role descriptors (e.g., "MOE Officer," "MAMPU Officer," "DEO Officer ") better aligns with the interpretivist approach of this study, which seeks to analyse SDM governance as an institutional process rather than focusing on individual-level accounts. Actor-network theory (Latour, 2005) and policy translation perspectives (Callon, 1986) suggest that governance processes are shaped by institutional interactions rather than isolated individuals, making it more appropriate to discuss insights at the organisational level rather than attributing statements to specific numbered officials.

Third, de-identification in qualitative research is not merely about removing names but about preventing indirect traceability (Saunders, Kitzinger, & Kitzinger, 2015). Given that senior officers in MOE, MAMPU, and DEOs operate in relatively small, identifiable policy circles, even coded references may make individuals recognisable based on their rank, specialisation, or policy role. To

ensure anonymity and prevent any unintended identification through cross-referencing with policy documents or public reports, I have opted for broad role-based descriptions rather than coded identifiers.

Finally, ethical considerations regarding participant anonymity must be balanced with the need for clarity in reporting findings (Wiles et al., 2008). By referring to participants based on institutional role rather than assigned numbers, this study maintains transparency in how data was interpreted while ensuring that individual identities are protected in accordance with research ethics guidelines.

3.5 Data Collection Methods

This section presents a detailed account of the data collection methods employed in this study, offering a critical evaluation of the rationale behind their selection, the processes undertaken, and the measures implemented to ensure data validity and integrity. Given the sequential qualitative methodology, multiple data collection techniques were strategically chosen to allow for progressive refinement of findings. Each method was assessed in terms of its strengths and limitations, ensuring that the research design remained methodologically rigorous while acknowledging potential constraints.

A key consideration in this section is the justification for why specific instruments were chosen over others. In qualitative research, the selection of data collection methods significantly influences the depth of insights and the extent to which participant perspectives are authentically represented (Creswell & Poth, 2018). This study critically evaluates the trade-offs between alternative methods, particularly regarding the use of open-ended questionnaires instead of structured surveys and consultation sessions instead of purely individual interviews. Furthermore, the researcher's positionality and role in managing focus groups and self-reported data are critically examined to demonstrate awareness of potential biases and steps taken to mitigate them.

3.5.1 Policy Document Analysis: Establishing Institutional Narratives

Policy document analysis was selected as the foundational phase of data collection to provide an institutional and structural understanding of SDM governance in Malaysia. Given that SDM is a policy-driven initiative, analysing government-issued documents, strategic plans, and institutional reports was essential to understanding how data-driven decision-making is framed within national education policies. This phase was critical in identifying governance structures, institutional priorities, and policy expectations, which were later tested against practitioner and policymaker experiences in subsequent research phases.

Policy documents are primary sources of institutional discourse, serving as official records of government strategies, policy directives, and regulatory frameworks (Bowen, 2009). They shape how SDM is implemented, evaluated, and integrated within educational administration, making them crucial for examining the structural mechanisms that define data governance in schools. Unlike practitioner narratives, which offer on-the-ground perspectives, policy documents provide macro-level insights into the intended goals and institutional constraints of SDM governance.

The use of policy document analysis was justified based on three key considerations. First, educational policies in Malaysia are highly centralised, meaning that the MOE and other government bodies play a dominant role in shaping SDM implementation. Understanding policy discourse was therefore essential to contextualising how data-driven decision-making was positioned within Malaysia's centralised-decentralised education system. Second, policy documents allowed for a longitudinal perspective, showing how SDM governance evolved over time, particularly in response to technological advancements, institutional reforms, and international education benchmarks. Third, policy analysis served as a baseline for comparative validation, allowing subsequent interviews, focus groups, and consultation sessions to test whether policy expectations aligned with the realities of school-level SDM implementation.

Despite these advantages, policy document analysis has inherent limitations, primarily because policy texts often present idealised narratives that emphasise strategic success rather than operational challenges (Ball, Maguire, & Braun, 2012). Policies are frequently framed in bureaucratic and aspirational language, which can obscure the practical difficulties of implementation. Additionally, policy documents do not capture the lived experiences of educators, administrators, and data users, making it necessary to triangulate policy narratives with empirical data. To address these concerns, this study cross-referenced policy findings with stakeholder interviews, headteacher questionnaires, and focus group discussions, ensuring that the research did not rely solely on formal institutional discourse but critically examined how SDM policies were enacted in practice.

The study analysed four key policy documents that outline the governance, objectives, and institutional mechanisms of SDM in Malaysia:

- **Malaysia Education Blueprint (MEB) 2013-2025:** The MEB 2013-2025 serves as Malaysia's national strategic plan for education, providing the overarching framework for education policy development and institutional reforms. Within the blueprint, data-driven decision-making is emphasised as a key pillar of educational transformation, particularly in relation to school leadership, digital governance, and student performance tracking. This document was critical in understanding how SDM was positioned within Malaysia's broader education reform agenda.
- **Annual MEB Reports (2015-2020):** The annual MEB reports provide progress updates on education reforms, policy implementation challenges, and institutional adjustments. By examining these reports, the study was able to track how SDM policies evolved over time, identifying shifts in institutional priorities, budget allocations, and administrative expectations regarding school-level data governance.
- **Public Sector Open Data Blueprint (2015):** This document outlines Malaysia's national strategy for open data governance, including guidelines for data-sharing, interoperability, and digital transformation in public sector institutions. Given that SDM is part of the broader government digitalisation

initiative, this blueprint was instrumental in examining how education data policies were integrated into national ICT strategies.

- **UNICEF’s 2020 Report on Malaysia’s Education Management Information System (EMIS):** The UNICEF report provided an external evaluation of SDM implementation, assessing how effectively the Education Management Information System (EMIS) supports data-driven decision-making in Malaysian schools. Unlike government-issued reports, the UNICEF evaluation offered a critical, independent assessment of SDM challenges, including data accuracy issues, infrastructure limitations, and capacity-building gaps.

The selection of these documents was based on their institutional authority, temporal relevance, and direct impact on SDM policies. By analysing both national strategic plans and external evaluations, the study ensured that its findings were not only based on government narratives but also incorporated third-party assessments of policy effectiveness.

To analyse these documents, the study employed critical discourse analysis (Fairclough, 2013) and network analysis (Borgatti et al., 2013). Discourse analysis was used to examine how SDM is framed within policy texts, focusing on language, assumptions, and ideological underpinnings. This method was essential in identifying the policy narratives that shaped SDM implementation, particularly in relation to school leadership responsibilities, data accountability structures, and institutional expectations regarding digital transformation. Discourse analysis also helped uncover gaps between policy rhetoric and practical realities, providing insights into whether policy language emphasised technological optimism without fully addressing on-the-ground constraints.

Network analysis was employed to map the relationships between different government agencies and institutional actors involved in SDM governance. Given that SDM implementation is a multi-agency effort, network analysis allowed for a visual representation of inter-agency dependencies, reporting hierarchies, and institutional bottlenecks. By analysing how different governmental bodies (MOE, MAMPU, DEO) interacted in SDM implementation, this study identified structural constraints that influenced data governance efficiency, bureaucratic coordination, and policy enforcement mechanisms.

Together, these two analytical approaches ensured that policy analysis was not merely descriptive but critically engaged with governance structures, power dynamics, and institutional constraints. The findings from this phase were later triangulated with practitioner perspectives, ensuring that policy discourse was tested against the lived realities of headteachers, administrators, and policymakers.

3.5.2 Systematic Review for Themes Identification

Following the completion of an initial policy-related document analysis, which provided a comprehensive understanding of the legislative and policy frameworks surrounding SDM in Malaysia, the study transitioned into a systematic review phase for informing the design of the online questionnaire. This phase adhered to the methodology proposed by Tranfield, Denyer, and Smart (2003), who advocate for a systematic and transparent process in literature reviews. This approach involved three stages: an exhaustive search for relevant studies, a rigorous appraisal of the evidence, and the synthesis of key themes.

The systematic review focused on academic literature, including empirical research, theoretical frameworks, and case studies pertinent to SDM. The primary goal was to identify recurring patterns, gaps, and critical themes that could inform the subsequent development of an online questionnaire targeted at headteachers. Key databases such as EBSCO, ScienceDirect, Emerald, Semantic Scholar, and Google Scholar were searched using targeted keywords, including “School Leadership,” “School Data Management,” and “Teacher Workload.” From an initial pool of 547 studies, after screening for duplicates and applying inclusion/exclusion criteria, 28 articles were ultimately included in the analysis. This literature review phase was critical in ensuring that the questionnaire was grounded in current SDM research and aligned with the study’s objectives.

The 28 selected articles were subjected to a thematic analysis, following the systematic approach outlined by Braun and Clarke (2006). This method involves a rigorous process of identifying, analysing, and reporting patterns (themes) within qualitative data, allowing for the extraction of meaningful insights that align with the study’s objectives. The application of thematic analysis in this research

provided a structured framework to explore the prevailing themes and patterns related to SDM.

Initially, the articles underwent a familiarisation phase, during which each article was carefully read and re-read to gain a comprehensive understanding of its content. Braun and Clarke (2006) emphasise the importance of immersion in the data during this stage to ensure that the researcher becomes well-acquainted with the depth and breadth of the material. Following this, initial coding was conducted to identify relevant segments of data, focusing on recurring concepts and ideas related to SDM, technological integration, and educational leadership.

Once the initial coding was completed, the research proceeded to the theme generation phase, wherein codes were organised into potential themes that encapsulated the broader meanings behind the data. At this stage, the analysis focused on key areas such as the role of data in decision-making processes, challenges in SDM implementation, the influence of leadership structures, and the interplay between human agency and technological systems in educational settings.

The themes were then reviewed and refined to ensure they accurately represented the underlying data. This refinement process involved revisiting the coded data and checking for coherence and distinctiveness within each theme, as well as ensuring that the themes collectively provided a comprehensive picture of the literature on SDM. The final themes were then defined and named, with each theme given a clear and concise label that reflected its core meaning.

The following table provides a concise summary of the key findings obtained from the literature review, divided into four specific domains: understanding roles, policy practice, school practice, and prospective implications. Each of these findings is supported by relevant studies and research outcomes, highlighting their importance in the field of school data management and educational practices.

Table 3.1 Systematic Review related to SDM¹

Categories	Key Findings	Justifications
Understanding Roles	Roles of agencies in SDM	Data management refers to the collective ability of individuals or teams (Hubers, 2016; Mandinach et al., 2015), technological systems (Selwyn, 2021), and organisational structures (Kallemeyn, 2014; Farley-Ripple & Buttram, 2015; Marsh & Farrell, 2015)
	Decision-making capacity and burnout: Teachers with limited decision-making autonomy experience a higher risk of burnout.	Multiple studies consistently demonstrate the link between limited autonomy and teacher burnout (Johari et al., 2018; Nordin et al., 2019; Othman et al., 2013; Rathakrishnan et al., 2020; Roslan et al., 2015).
Policy Practice	Autonomy's impact on data use practices: Greater school autonomy is correlated with enhanced data-informed decision-making.	European studies, such as those in the UK, Germany, and the Netherlands, show this correlation (Schildkamp et al., 2014).
	Limited school autonomy in data-driven practices affects the development of a genuine data-driven school culture.	Schools' authority to manage data is constrained by predefined responses from local education authorities (Bush et al., 2018).
	Standardised data decisions: Rigid, state-imposed data decisions hinder school performance improvement efforts.	Malaysian schools face challenges in adapting to standardised data-driven decisions, limiting their flexibility and ownership (Gill & Berezina, 2021; Bush et al., 2021).
School Practice	School leaders' ICT competencies: Principals play a crucial role in fostering technology-centric school improvement practices.	Research shows that principals' technology leadership positively influences school practices (Fong et al., 2013; Hamzah et al., 2016; Thannimalai & Raman, 2018; Wei et al., 2017).
	ICT infrastructure support and system synchronisation: Inadequate infrastructure and lack of system synchronisation contribute to teacher workload.	Poor internet access, inefficient systems, and manual data entry increase teacher workload (Wong & Daud, 2017; Kenayathulla & Ibrahim, 2016; Hamid et al., 2019).

- a. ¹ The systematic review was peer-reviewed, presented, and published in the "Imagining Better Education" conference proceedings on October 20, 2022. The publication, titled "Data-Driven Practices in Malaysian Education Blueprint (2012-2025): What Can Malaysia Learn from Europe?" by Nur Aiman bin Zainudin, can be found in Bennion, H., Broadfoot, H., Fan, K., Meng, T., Zhang, Y., & Zhou, Q. (Eds.), *Imagining Better Education* (pp. 130 - 149). University of Durham: Conference Proceedings 2022.

Prospective Implications	Inter-operability challenges: Limited inter-operability among government agencies affects the efficiency of the education system.	Separate divisions and systems within the Ministry of Education lead to data duplication and misalignment (UNICEF, 2020).
	Data policies and ethics: The absence of comprehensive national data ethics guidelines poses ethical concerns in data use.	Many countries lack regulations governing data ethics, raising concerns about privacy and informed decision-making (Schildkamp et al., 2019; Nouri et al., 2019; Leitner et al., 2019; Slade et al., 2019; Fracassi & Magnuson, 2021).

Critical Reflection: An Overlooked Dimension of Administrators' Perspective in the Literature

A significant gap in the current literature on SDM is the underrepresentation of administrators' perspectives, particularly those of District Education Officers (DEO), Ministry of Education (MOE) officers, and Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) officers. Existing studies tend to focus heavily on educators and school-level data management practices, while the roles and insights of these key administrative figures are often overlooked. Understanding their viewpoints and experiences is essential to developing a comprehensive understanding of SDM, as these officers play critical roles in shaping data policies, implementing technologies, and ensuring compliance with national frameworks.

The importance of these administrative roles is stated in the UNICEF Report (2020), which explicitly highlights the influence of education and public sector officers on the efficacy of data management in Malaysia. The report stresses the need for coordinated efforts between various governmental bodies to achieve seamless data integration and management across educational institutions. However, despite their pivotal role in overseeing and facilitating data management initiatives, the perspectives of these administrators have been largely neglected in scholarly discussions on SDM.

In response to this identified gap, I made the decision to include MAMPU officers alongside DEO and MOE officers as participants in this research. MAMPU officers, in particular, are responsible for public sector digitalisation and ICT policies,

which directly influence the implementation and operation of SDM systems in schools. Their expertise and involvement in both policy implementation and the technical aspects of data management make their contributions significant to this study.

3.5.3 Online Questionnaire: Capturing Headteachers' Perspectives

The next phase of data collection involved the distribution of an open-ended online questionnaire to 40 headteachers to explore their experiences with SDM implementation, data literacy, and leadership roles. Given that headteachers occupy a pivotal position in school data governance, their insights were essential in understanding how national SDM policies are operationalised at the school level and the extent to which digital tools, leadership agency, and institutional constraints shape decision-making.

The decision to use an open-ended qualitative questionnaire instead of structured surveys or direct interviews was guided by several methodological considerations.

First, an open-ended format allowed for detailed, reflective responses, enabling headteachers to articulate their experiences in their own words rather than being constrained by pre-coded response categories (Patton, 2015). Given that SDM implementation is context-dependent, structured surveys with limited response options would have oversimplified the complexities of school-level decision-making, leadership agency, and technological constraints. The open-ended design ensured that emerging themes were practitioner-driven rather than imposed by the researcher, aligning with the interpretivist epistemology of the study (Creswell & Poth, 2018).

Second, an online format was selected to maximise accessibility and participant engagement. Headteachers, as senior school administrators, face high workloads and competing professional responsibilities, making real-time interviews difficult to schedule. The asynchronous nature of the questionnaire allowed participants to respond at their convenience, increasing the likelihood of thoughtful, in-depth contributions. Additionally, an online approach enabled the study to reach a geographically diverse sample of headteachers across multiple regions of

Malaysia, mitigating location-based biases that could arise from in-person data collection (Flick, 2018).

Despite these advantages, the limitations of an online qualitative questionnaire were acknowledged. A key drawback was the inability to probe responses in real-time, unlike interviews where the researcher can seek clarification, request elaboration, and explore emerging themes in greater depth (Bryman, 2016). Additionally, digital literacy disparities among participants may have influenced the clarity and expressiveness of responses, with some headteachers providing minimal reflections while others offered detailed, narrative-rich answers. These challenges were partially addressed by integrating consultation sessions as a follow-up, where participants could elaborate on and clarify their questionnaire responses in structured discussions.

Another methodological concern was self-reported bias, where participants might frame their experiences to align with perceived institutional expectations rather than offering fully candid reflections (Cohen, Manion, & Morrison, 2018). To mitigate this, the questionnaire was administered anonymously, allowing headteachers to express their perspectives without fear of institutional scrutiny. Additionally, questions were intentionally framed to elicit critical reflections, encouraging headteachers to identify challenges and constraints rather than just successes in SDM implementation.

Development of the Questionnaire

The questionnaire was developed through an iterative process, ensuring that questions were aligned with research objectives while allowing for open-ended participant responses. The design process involved:

- a. Synthesising themes from the systematic review and policy analysis - ensuring that the questionnaire addressed key institutional priorities and governance expectations identified in national SDM policies.
- b. Incorporating insights from existing literature - particularly studies on educational leadership, digital governance, and data-driven decision-making, to align the questionnaire with international research frameworks.

Drawing from the findings of the systematic review summarised in **Table 3.1**, a total of 18 open-ended questions were formulated, categorised into four thematic sections:

- a. **Understanding Roles** - Examining the role of headteachers in SDM governance, their data literacy levels, and how they perceive their responsibilities in implementing SDM policies.
- b. **Policy Practice** - Exploring how SDM policies are enacted at the school level, including challenges related to compliance, data reporting, and policy alignment with school needs.
- c. **School Practice** - Investigating how headteachers use data in decision-making, the effectiveness of SDM tools, and institutional barriers to effective data management.
- d. **Prospective Implications** - Assessing headteachers' views on the future of SDM in Malaysia, potential areas for improvement, and anticipated policy shifts.

The inclusion of open-ended questions was critical for gaining deeper insights into headteachers' roles in SDM, their engagement with policy practices, and their views on future SDM directions in Malaysian schools. This thematic alignment ensured coherence across research phases, allowing for a structured yet flexible exploration of SDM implementation challenges. The questionnaire's detailed structure is included in Appendix (see: Questionnaire) for further reference.

Questionnaire Administration and Data Collection

The questionnaire was administered to a targeted sample of 40 experienced headteachers across Malaysia, each with a minimum of five years of service, ensuring that participants had substantial expertise in SDM implementation. To enhance research efficiency and maximise participation, the questionnaire distribution was integrated with the registration process for the LENSEA conference, an event focused on SDM practices. This dual-purpose approach

facilitated data collection while also engaging participants in a professional setting closely aligned with the research focus.

The questionnaire was disseminated via Google Forms between March 1st and 5th, 2023. Participants were fully informed of their role in the research, with the consent process embedded directly into the questionnaire. Before completing the questionnaire, headteachers were presented with a detailed participant information sheet, outlining the study's objectives, their rights as participants, and the confidentiality measures in place. By responding to the questionnaire, participants explicitly acknowledged their informed consent, ensuring adherence to ethical research standards (Creswell & Creswell, 2018). The inclusion of a consent statement at the beginning of the questionnaire reinforced the voluntary nature of participation, ensuring transparency and ethical integrity in data collection.

Thematic Analysis of Headteachers' Responses

After collecting the questionnaire responses, the data were analysed using thematic analysis, following Braun and Clarke's (2006) six-step framework. This process involved:

- a. Familiarisation with the data - Immersing in the responses to identify emerging patterns and key narratives.
- b. Generating initial codes - Systematically coding data to capture recurring themes and variations in responses.
- c. Searching for themes - Identifying broader thematic categories that linked individual responses to structural patterns in SDM implementation.
- d. Reviewing themes - Refining thematic classifications to ensure that they accurately represented participant experiences.
- e. Defining and naming themes - Articulating the core findings from the data, ensuring coherence between participant perspectives and research objectives.

- f. Producing the final analysis - Synthesising findings into a structured discussion, aligning them with policy insights, consultation sessions, and interviews.

The analysis was first conducted in Malay, as responses were provided in this language, and then translated into English to maintain the integrity of participants' original meanings and contextual nuances (Temple & Young, 2004). This bilingual analytical approach ensured that findings were not distorted through translation bias, preserving the depth and authenticity of headteachers' narratives.

The questionnaire findings played a pivotal role in shaping subsequent research phases, particularly in refining interview questions for policymakers. Key themes that emerged from headteacher responses—such as the lack of alignment between policy expectations and technological infrastructure in schools, the bureaucratic burden of SDM reporting, and the challenges of data literacy among educators—were later explored in consultation sessions and policymaker discussions. This iterative design ensured that insights from the questionnaire were not analysed in isolation but were systematically integrated into the broader research framework.

Critical Reflection on the Integration of Thematic Analysis and Interview Design

The integration of thematic analysis and interview question development was not merely a procedural step but a deliberate methodological strategy to ensure coherence, validity, and alignment between different phases of data collection. By using headteacher perspectives as the foundation for designing policymaker interviews, the study sought to bridge the gap between policy formulation and on-the-ground implementation, an issue that is often overlooked in educational governance research (Spillane, 2006). This approach ensured that policy discussions were not detached from practitioner realities but were instead shaped by firsthand experiences of those directly responsible for implementing SDM in schools.

One of the key methodological strengths of this approach was that it transformed the study from a top-down policy analysis to a multi-layered exploration of SDM governance. Rather than relying solely on predefined theoretical constructs, the study ensured that themes emerging from headteacher narratives drove the research trajectory, reinforcing data authenticity and ecological validity (Creswell & Poth, 2018). This process aligned with interpretivist research principles, which emphasise the need to capture lived experiences and construct meaning through iterative engagement with participants (Guba & Lincoln, 1994).

However, despite these methodological strengths, several challenges and limitations must be acknowledged.

First, thematic analysis, by its very nature, is inherently interpretive, meaning that the researcher's own analytical lens influenced the identification and categorisation of themes (Braun & Clarke, 2006). While rigorous coding frameworks and peer review processes were implemented to minimise researcher bias, it is important to recognise that theme construction is not an objective exercise but an iterative process of meaning-making. To address this, the study employed a multi-step validation process, where emergent themes were triangulated with policy documents, consultation sessions, and expert feedback, ensuring that findings were not solely dependent on subjective interpretations.

Second, the reliance on self-reported data from headteachers introduced potential biases, particularly in the framing of challenges and successes in SDM implementation. Participants may have either understated or exaggerated constraints depending on their personal leadership experiences, regional education priorities, or perceived expectations from policymakers (Cohen, Manion, & Morrison, 2018). This risk was mitigated by incorporating critical questioning techniques in the questionnaire design, where participants were encouraged to identify specific examples and contextual factors rather than providing generic responses. Additionally, contradictions and inconsistencies in responses were critically examined, ensuring that policy-practice gaps were analysed in a nuanced manner rather than being accepted at face value.

Third, the transition from thematic analysis to interview question construction required careful methodological balancing. While it was essential to ensure that headteacher concerns shaped policymaker discussions, it was equally important to avoid an overly deterministic approach, where interview questions merely reinforced existing assumptions rather than allowing new insights to emerge. This issue was addressed by designing a mix of exploratory and confirmatory interview questions, ensuring that policymakers had the flexibility to introduce perspectives beyond those identified in the headteacher data. This approach prevented the research from becoming overly constrained by a single participant group's experiences, allowing for a more holistic exploration of SDM governance.

A further challenge in integrating headteacher-derived themes into policymaker interviews was the potential for institutional defensiveness, where policymakers might feel compelled to justify existing SDM policies rather than critically engage with identified challenges. Given the political sensitivities surrounding educational governance, there was a risk that interviews with MOE, DEO, and MAMPU officers could become a policy defense exercise rather than an open dialogue on implementation gaps. This concern was mitigated through the careful structuring of interview questions, where inquiries were framed as explorations rather than critiques, allowing policymakers to reflect on policy efficacy while still acknowledging areas for improvement. Additionally, neutral facilitation techniques were employed to encourage candid discussions rather than institutionalised responses (Rubin & Rubin, 2012).

Another critical consideration was the potential limitations of aligning interview questions too closely with headteacher narratives, which might have led to an overemphasis on practitioner concerns while underexploring systemic and bureaucratic dimensions of SDM policy. Policymakers, unlike headteachers, operate within larger institutional frameworks influenced by political directives, budgetary constraints, and inter-agency coordination challenges. If interview questions had been exclusively derived from school-level concerns, they might have overlooked macro-level policy challenges such as data standardisation, national benchmarking, and cross-sectoral data integration (Wayman et al., 2012). To counteract this, the interview questions incorporated both bottom-up and top-down perspectives, ensuring that the study provided a multi-dimensional

understanding of SDM governance rather than a one-sided critique from school leaders.

Lastly, the iterative process of refining interview questions through expert validation played a crucial role in ensuring methodological rigor. The involvement of Professor James Charles Conroy in reviewing the draft interview questions added an additional layer of academic scrutiny, helping to ensure that questions were logically structured, theoretically sound, and methodologically coherent. This validation process was particularly important in avoiding redundancy in questioning, ensuring that each interview topic contributed uniquely to the study's research objectives (Creswell & Creswell, 2018). The structured refinement of questions—from an initial list of 16 to a final set of 13—demonstrates the depth of critical engagement in designing the research instruments, ensuring that they were not only reflective of participant concerns but also strategically targeted to elicit rich, policy-relevant insights.

3.5.4 Consultation Session: Collaborative Validation of Emerging Findings

The next phase of data collection involved a consultation session aimed at gathering in-depth insights from headteachers and refining the interview questions for officers. This consultation session was conducted as part of the Leadership in the Digital Era & Navigation for School Action (LENSA) conference.

In designing this conference, I aimed to create a discourse platform that acts as a mobilising token, as discussed in the literature review. The conference functions to frame both human and non-human actors—such as headteachers and sharing sessions/workshops related to data systems—within a shared network. By enabling these actors to engage in dialogue and critique SDM practices, the conference mobilises diverse perspectives and aligns them toward a common understanding.

A second mobilising token is the feedback gathered from the consultation session. This feedback serves as a mechanism for realigning the officers' practices and perspectives with the lived experiences of headteachers. By incorporating these insights into the subsequent phases of the study, the

research facilitates continuous engagement and coordination among the key actors in SDM.

The entire process, from the planning to the conclusion of the conference, represents a careful orchestration of actors within a network, aligning them to ensure effective collaboration and understanding of SDM. As detailed in Chapter 5, this relational approach to SDM highlights how mobilising tokens function within complex educational systems.

This conference was a collaboration between me as the researcher, the public institute for educational leadership and management training in Malaysia, District Education Office A, and School A. The conference, conducted on March 15 and 16, 2023, was a carefully orchestrated event planned to optimise engagement and facilitate an environment conducive to open dialogue and feedback.

The conference as one of data collection method² and its findings were presented by me in 2024 at the Sustainable Visions Postgrad Research Poster Challenge. The presentation, titled ‘Data-Driven Sustainability: Enhancing Data Literacy Among Headteachers’, was part of the event hosted by the College of Social Science at the University of Glasgow.

Sessions in the conference were designed not just as venues for data gathering, but as platforms for dialogue, reflection, and critical examination of the research themes and instruments. This interactive setting encourages stakeholders to discuss and reflect upon the pertinent issues, challenges, and potential improvements, fostering a collaborative environment where all voices are heard and valued (Greenwood, Whyte, & Harkavy, 1993). The active engagement of participants not only deepens their understanding of the issues at hand but also promotes a sense of ownership and commitment to the outcomes of the research.

² Nur Aiman bin Zainudin. (2024, May 5). Data-Driven Sustainability: Enhancing data literacy among headteachers [Poster presentation]. Sustainable Visions Postgrad Research Poster Challenge. College of Social Science. University of Glasgow

Each session was structured to accommodate the preferences and limitations of the participants. This hybrid format allowed for both physical attendance and virtual participation, ensuring inclusivity and expanding engagement. This approach was advantageous in overcoming geographical and logistical barriers, resulting in a diverse and representative group of participants. The decision to use Malay language as the communication language was strategic as it is the participants' mother tongue and to promote clear and comfort exchanges of ideas.

The LENSEA conference, a collaborative effort involving me, the public institute for educational leadership and management training in Malaysia, and the District Education Office A, comprised three key activities designed to enhance understanding and practices of SDM. Each activity was carefully curated to address different aspects of SDM and facilitate a comprehensive exploration of the topic from various stakeholder perspectives.

- a. **Keynote Speech: Human and Technology in SDM Practices** The conference began with an insightful keynote speech focused on the interplay between human elements and technological advancements in SDM practices. This speech provided attendees with a conceptual framework for understanding how technology can be effectively integrated into educational data management processes while emphasising the critical role of human agency.
- b. **Series of Workshops on Using Data Technology** Following the keynote, a series of practical workshops were conducted to equip participants with hands-on experience in using data technology for SDM. These workshops covered various topics, including data collection methods, data analysis techniques, and the application of data management tools in educational settings. The interactive nature of the workshops allowed participants to engage directly with the technology, fostering a deeper understanding of its capabilities and potential applications.
- c. **Consultation Session with Headteachers (Refining Interview Questions)** A critical element of this research involved the use of a consultation session designed to refine and validate the interview questions developed for subsequent stages of the study.

- d. During the consultation session, I engaged 33 headteachers, the same group who had previously completed the online questionnaire (though 7 were absent), in a reflective process centred around 13 pre-constructed interview questions. These questions were initially developed based on the responses from the online questionnaire distributed to the headteachers. The primary aim of this session was to refine the interview questions further, ensuring that they would elicit in-depth responses from DEO, MOE, and MAMPU officers, while also gathering real-time feedback from the headteachers.
- e. In my role as facilitator, I led the discussion by displaying each question on Mentimeter slides, which were projected onto the screen one at a time. For each question, I invited headteachers to critique and relate the content to their personal experiences with SDM. This open, participatory format encouraged active engagement, allowing each headteacher to voice their thoughts and suggestions. After every round of discussion, I sought a consensus from the group, ensuring that the refined questions resonated with their collective insights and practical experiences.

The term "consultation session" was deliberately chosen to reflect the active, collaborative nature of the engagement process. Unlike traditional focus groups, which primarily gather participant opinions, a consultation session emphasises expert validation and iterative refinement of research findings. The decision to frame these discussions as consultations rather than focus groups or workshops was based on three key principles:

- a. Active Expert Engagement - Headteachers were not passive participants but expert contributors whose validation and critique of thematic findings directly influenced research refinement. The consultation sessions ensured that participants did not merely respond to predefined questions but actively shaped the discussion, offering critical reflections on how SDM is implemented at the school level.
- b. Stakeholder-Driven Research Validation - Rather than treating headteacher insights as data to be extracted, the consultation sessions were structured to validate and refine the research trajectory, ensuring that subsequent policymaker interviews reflected school-level realities. This distinction is

critical in interpretivist research, where co-construction of knowledge between researchers and participants is fundamental to methodological rigor (Creswell & Poth, 2018).

- c. **Iterative Refinement of Research Instruments** - The consultation sessions were not just discussions but structured validation exercises, where participants critically reviewed thematic findings from the questionnaire phase and refined interview protocols for policymakers. Unlike traditional data collection methods, consultation sessions positioned participants as co-researchers, actively contributing to the refinement of research design.

The consultation framework thus functioned as a bridge between the questionnaire phase and policymaker interviews, ensuring that research findings were not merely validated but critically examined and refined in a practitioner-driven manner.

Combining Delphi and NGT for The Consultation Session

The consultation session was designed using a combination of Delphi and Nominal Group Technique (NGT), both of which are well-established participatory research methodologies that facilitate expert consensus-building and structured group decision-making (Delbecq et al., 1975; Okoli & Pawlowski, 2004). By incorporating these approaches, the study ensured that headteacher perspectives actively influenced subsequent data collection phases, particularly in shaping the interview questions for DEO, MOE, and MAMPU officers.

Justification for Delphi and Nominal Group Technique (NGT)

The integration of Delphi and NGT methodologies was a strategic decision aimed at ensuring rigorous, iterative validation of research findings while allowing for collaborative refinement of research instruments.

The Delphi method is commonly used in educational research to facilitate expert consensus on complex issues through structured rounds of feedback and iterative refinement (Linstone & Turoff, 1975). In this study, Delphi principles were applied to ensure that headteacher perspectives were systematically reviewed,

critiqued, and refined over the course of multiple sessions. Given the varying levels of digital literacy and administrative experience among headteachers, the Delphi process enabled participants to engage in structured reflection before responding, reducing the risk of impulsive or surface-level feedback (Hasson et al., 2000).

NGT, on the other hand, provided a structured format for group discussions, ensuring that headteacher input was not dominated by a few vocal participants but was instead collectively deliberated and prioritised (Varga-Atkins et al., 2017). One of the key advantages of NGT over unstructured focus groups is that it equalises participant contributions, ensuring that all voices are heard and systematically incorporated into the research process. Given that headteachers come from diverse institutional backgrounds, the structured nature of NGT minimised hierarchical influences, allowing for a more balanced discussion of SDM challenges and leadership experiences (Delbecq et al., 1975).

By integrating both Delphi and NGT approaches, the study was able to combine structured expert consensus-building with participatory, practitioner-led dialogue, ensuring that research instruments were refined based on real-world insights rather than purely theoretical assumptions.

Role of Headteachers in Refining Interview Questions

A key objective of the consultation session was to ensure that headteachers played an active role in shaping the research trajectory, particularly in validating the emerging findings from the questionnaire phase and refining the interview questions for policymakers.

The consultation sessions involved a structured three-step process:

- a. **Presentation of Emerging Themes** - The researcher presented thematic findings from the questionnaire responses, summarising key challenges, institutional constraints, and leadership insights related to SDM implementation.

- b. Critical Review and Prioritisation of Issues - Participants were invited to critically assess the thematic findings, offering reflections on whether they accurately represented their lived experiences. Using NGT ranking techniques, headteachers identified which themes they considered most pressing or underexplored, ensuring that subsequent interview questions were aligned with practitioner concerns (Varga-Atkins et al., 2017).
- c. Refinement of Research Instruments - The final phase involved a structured review of the proposed interview questions for policymakers. Headteachers provided feedback on clarity, relevance, and areas requiring further exploration, ensuring that the interview questions captured both macro-level policy concerns and micro-level implementation realities.

Through this process, headteachers contributed to enhancing the validity of the research instruments, ensuring that the interviews with DEO, MOE, and MAMPU officers addressed not just policy objectives but also school-level operational challenges.

One of the key methodological strengths of this approach was that it prevented the study from being overly top-down, where research instruments are developed purely based on policy documents and theoretical frameworks. Instead, the consultation session ensured that the study was deeply rooted in practitioner realities, strengthening the ecological validity and practical relevance of the findings (Creswell & Poth, 2018).

However, one challenge of engaging headteachers in research refinement was the risk of self-reported bias, where participants may have emphasised their own institutional constraints while underplaying systemic or structural factors influencing SDM implementation. To counteract this, I facilitated comparative discussions, where headteachers were encouraged to reflect on both their personal experiences and broader policy-level challenges. This approach helped to contextualise individual narratives within the larger governance framework of SDM, ensuring that research instruments captured both micro- and macro-level insights.

How Feedback Influenced Subsequent Research Stages?

The insights generated from the consultation sessions had a direct impact on the refinement of research instruments and the overall structuring of later data collection phases. The most significant refinements included:

- a. **Strengthening Questions on Policy-Practice Gaps** - Headteachers emphasised that many SDM policies were formulated without adequate consideration of school-level infrastructure and human resource constraints. This led to a refinement of policymaker interview questions, ensuring that more probing questions on implementation feasibility were included.
- b. **Expanding the Scope of Leadership Challenges** - Initial interview questions for policymakers primarily focused on technical SDM challenges (e.g., data accuracy, interoperability). However, headteachers highlighted the psychological and leadership challenges associated with SDM adoption, such as resistance from teachers, lack of training, and data fatigue. As a result, new interview questions were developed to explore leadership and change management in SDM implementation.
- c. **Contextualising Digital Readiness Disparities** - Some headteachers from rural schools pointed out that SDM discussions often assume uniform access to digital infrastructure, whereas rural schools face significant limitations in internet connectivity, hardware availability, and staff training. This led to the incorporation of specific questions for policymakers on how SDM policies address regional disparities in digital readiness.

By ensuring that consultation session feedback was systematically integrated into later research stages, the study maintained a dynamic, iterative research process that was responsive to stakeholder concerns. This not only strengthened the validity of the study but also ensured that research findings would be practically relevant for SDM policy refinement.

Critical Reflection on the Consultation Process

While the Delphi and NGT methodologies provided a structured, participatory mechanism for engaging headteachers, several methodological challenges were encountered.

First, the risk of dominant voices shaping group discussions was a key concern. While NGT helped balance participation, some highly experienced headteachers tended to exert greater influence over discussions, potentially overshadowing the perspectives of less senior participants. To address this, I employed anonymous digital polling (using tools like Mentimeter), allowing all participants to contribute their perspectives independently before group discussions.

Second, there was a challenge in balancing broad thematic validation with in-depth discussion. Given that the consultation session aimed to validate questionnaire findings, refine research instruments, and discuss policy implications, there was a risk of spreading discussions too thin. To mitigate this, I prioritised high-impact themes, ensuring that the most pressing SDM challenges were explored in detail rather than covering all findings superficially.

Third, the consultation session required careful facilitation to prevent predetermined biases. Given that thematic findings were presented before discussions, there was a risk that participants might align their views with the pre-identified themes rather than critically engaging with them. To address this, the session structured to actively invite alternative perspectives, dissenting views, and critiques of the emerging findings.

Finally, logistical constraints related to time and participant availability limited the extent to which multiple rounds of Delphi refinement could be conducted. While traditional Delphi studies involve multiple rounds of iterative feedback, this study employed a modified Delphi approach, where consensus-building occurred within a single structured session rather than across multiple engagements. This adjustment ensured practical feasibility without compromising methodological integrity.

3.5.5 Focus Groups and Interviews: Institutional and Policy-Level Perspectives

The next stage of data collection involved gathering responses from officers, informed by the interview questions and the feedback provided by headteachers during the consultation session. This stage utilised a combination of focus group

sessions and individual interviews to gain a comprehensive understanding of the officers' perspectives on SDM.

The decision to employ both interviews and focus group sessions was driven by an understanding of the complementary strengths each method offers. Individual interviews allowed for a deep exploration of personal views, providing rich, detailed contextual information, and offering participants the freedom to express their thoughts in a candid manner (Rubin & Rubin, 2012). In contrast, focus group sessions facilitated dynamic interactions between participants, uncovering shared experiences, fostering collaborative discussions, and generating consensus on key issues (Krueger & Casey, 2014). By incorporating both methods, the research was able to triangulate findings from diverse sources, thereby enhancing the robustness, depth, and validity of the study outcomes (Patton, 2015).

A semi-structured format was employed for both the focus group sessions and individual interviews. This format, based on the principles articulated by Morgan (1997), facilitated an interactive and dynamic environment where participants felt comfortable sharing detailed perspectives. This flexibility was critical for encouraging participants to share more detailed insights and nuanced reflections on SDM practices. The interviews were conducted in Malay language, the participants' native language, to ensure clarity of communication and comfort in expressing complex ideas and concerns. This choice of language also helped in capturing the cultural and contextual specificities that might otherwise have been lost in translation.

The interviews and focus group sessions were recorded using audio devices, with notetaking to capture any additional observations and reflections, following the guidelines outlined by Rubin and Rubin (2012). This dual approach ensured that the subtleties and nuances of the conversations were preserved, safeguarding the integrity of the data. Additionally, strict ethical protocols were followed, adhering to the guidelines established by the Ethics Committee of the College of Social Science at the University of Glasgow and the Ministry of Education, Malaysia. These ethical considerations, as emphasised by Creswell and Creswell (2018), were central to ensuring the confidentiality and respectful treatment of all participants.

DEO and MAMPU Focus Group Session

Five District Education Office (DEO) officers and six Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) officers participated in focus group sessions as part of this research. The session with the DEO officers was conducted during the LENSEA conference, the day following the consultation session with headteachers. The session with MAMPU officers, on the other hand, took place at the MAMPU state headquarters in Melaka.

The focus group sessions were guided by pre-constructed interview questions, which had been refined through the feedback provided by headteachers during the consultation session. This approach ensured that the discussion was both structured and aligned with the broader themes and challenges identified by educational practitioners at the school level. The integration of headteachers' feedback into the interview questions added an important layer of real-world relevance to the discussions, fostering a collaborative environment where participants could reflect on both the practical and policy dimensions of SDM. This process facilitated a comprehensive exploration of the challenges, opportunities, and future directions for improving data management systems within the Malaysian educational context.

As the facilitator, I played a key role in guiding the discussion, ensuring that all participants had the opportunity to contribute, and maintaining the focus of the conversation. Facilitating the session required balancing open dialogue with the need to cover all relevant topics within the allotted time. Effective facilitation, as highlighted by Morgan (1997), is essential in focus group research to foster an environment where participants feel comfortable sharing their thoughts, while also ensuring the session remains productive and focused. This approach ensured that the focus group discussions remained constructive and yielded insights that contributed significantly to the overall study.

Focus group discussions are a critical component of qualitative research, as highlighted by Krueger and Casey (2014). These sessions provided a platform for collective discourse, allowing participants to collaboratively engage in discussions and offer feedback on the research instrument. The interactive nature of the focus groups fostered rich conversations that not only helped

validate the research instrument but also ensured that it captured the complexities and nuances of SDM. This process was essential in enhancing the instrument's comprehensiveness and ensuring its validity across diverse contexts.

The focus group design was intentionally structured to promote open discussion. Participants were encouraged to share their views and experiences candidly, offering critical feedback and suggestions that were crucial in refining the research instrument. The collective reflections from the group provided an additional layer of validation, contributing a depth of understanding that individual interviews alone might not have achieved. This method of collective critique ensured that the research tool was attuned to the practical realities of SDM as experienced by these key stakeholders.

The decision to use focus groups as a primary method for qualitative data collection was informed by the unique advantages they offer. As Krueger and Casey (2015) note, focus groups excel at capturing group dynamics, shared experiences, and collective insights. The interactive discussions that emerge in a group setting often lead participants to build upon each other's contributions, resulting in more comprehensive and nuanced data. This method is particularly effective for understanding group norms, values, and the common challenges faced by participants within their professional contexts.

Additionally, focus groups provide the opportunity to capture both verbal and nonverbal cues, which further enrich the data. As Beyea and Nicoll (2000) emphasise, observing body language, tone of voice, and the flow of interactions within the group can provide important insights into participants' attitudes and experiences that may not be fully expressed in words. These nonverbal cues complement the spoken content, offering a more holistic understanding of the participants' perspectives.

Critical Reflection on the Researcher's Role in Enhancing Focus Group Integrity

The final phase of data collection involved focus groups and individual interviews with policymakers, providing essential insights into the institutional,

administrative, and strategic dimensions of SDM. Given that policymakers operate at the macro level, their perspectives were crucial in understanding how SDM governance is framed, enacted, and evaluated within Malaysia's centralised-decentralised education system. However, eliciting authentic and critical perspectives from policymakers posed several methodological challenges, requiring careful research design considerations.

One of the primary challenges of conducting focus groups with policymakers was the risk of social desirability bias, wherein participants may align their responses with institutional priorities rather than providing candid reflections (Cohen, Manion, & Morrison, 2018). Given that policymakers are often the architects of SDM frameworks, there was a risk that their responses might emphasise policy intent rather than actual implementation realities. To counter this, I explicitly framed focus group discussions around challenges and unintended consequences, asking participants to critically reflect on barriers to SDM effectiveness rather than solely describing its benefits.

Another methodological concern was hierarchical power dynamics within focus groups, particularly when involving officials from different agencies such as MOE, DEO, and MAMPU. In multi-agency discussions, higher-ranking officials may dominate conversations, while lower-ranking participants may defer to senior policymakers rather than expressing independent viewpoints (Krueger & Casey, 2015). To mitigate this, I implemented equalisation techniques, ensuring that each participant was given the opportunity to contribute. This included structuring turn-taking so that all participants were encouraged to provide input before dominant voices could steer the discussion.

Individual interviews with MOE officers allowed for deeper engagement with policy development processes, providing insights into the rationale behind SDM policies and the challenges of inter-agency collaboration. Unlike focus groups, interviews allowed policymakers to reflect on institutional priorities without the influence of peers (Rubin & Rubin, 2012), leading to more candid discussions about political and bureaucratic constraints in SDM implementation.

A critical limitation of the focus group and interview approach was that, despite efforts to facilitate candid discussions, policymakers are ultimately

institutionally embedded actors, meaning that their perspectives are shaped by organisational constraints and political considerations. Even with neutral facilitation techniques, participants may have been reluctant to voice criticisms of SDM policies, particularly in discussions involving multiple agencies. To address this, I triangulated focus group and interview findings with questionnaire responses from headteachers, ensuring that practitioner perspectives were used to verify and contextualise policy-level narratives.

Another methodological challenge was ensuring that thematic saturation was achieved, given that the number of policymakers interviewed was smaller than the number of headteachers engaged in earlier phases. The risk in qualitative research is that findings from a smaller interview sample may be over-interpreted, particularly if responses are highly institutionalised (Morrow, 2005). To counter this, I conducted data validation exercises, cross-checking key themes from policymaker interviews against official policy documents and practitioner experiences, ensuring that conclusions were well-substantiated and not drawn from isolated narratives.

The strength of incorporating both focus groups and individual interviews was that it allowed for a dual-layered exploration of SDM governance. While focus groups facilitated debate and knowledge exchange, individual interviews provided depth and reflexivity, allowing for a more nuanced understanding of institutional decision-making and policy evolution. This mixed-methods approach strengthened the analytical validity of the study, ensuring that policy insights were critically interrogated rather than taken at face value.

The researcher's role in focus group discussions extended beyond passive facilitation to active methodological oversight, ensuring that the data collected were authentic, credible, and not skewed by self-reported biases or institutional narratives. While focus groups serve as effective platforms for uncovering shared experiences and policy-practice gaps, they also introduce methodological complexities related to power dynamics, response biases, and researcher influence (Krueger & Casey, 2015). The following critical reflections examine the challenges, limitations, and strategic interventions employed to uphold the integrity of focus group discussions with DEO and MAMPU officers.

Addressing the Risk of Institutional Alignment and Policy Endorsement Bias

One of the major methodological risks in conducting focus groups with government officers is the tendency for participants to align their responses with official policy positions rather than critically engaging with implementation challenges (Cohen, Manion, & Morrison, 2018). Given that DEO and MAMPU officers operate within hierarchical bureaucratic structures, their participation in a research discussion on SDM governance posed inherent risks of self-censorship, institutional defensiveness, and overemphasis on policy compliance rather than critical reflection.

To mitigate this risk, I implemented strategic reframing techniques to encourage constructive critique without directly challenging policy legitimacy. This involved:

- a. **Neutral Question Framing:** Instead of directly asking, *“What are the failures of SDM implementation?”*, questions were framed as, *“What aspects of SDM policy require further refinement for more effective implementation?”* This reframing reduced institutional defensiveness while still inviting critical insights into policy-practice misalignments.
- b. **Encouraging Experience-Based Reflection:** Participants were prompted to provide specific examples from their administrative experiences, shifting the focus from policy rhetoric to practical realities. This strategy depersonalised critiques, making it easier for officers to engage in honest discussions without fear of policy non-compliance repercussions.

Despite these measures, some degree of institutional alignment remained, as expected in government-related research. This highlights an inherent challenge in qualitative policy research: the difficulty of separating policy critique from policy endorsement in hierarchical institutions. Future research could explore alternative methods such as anonymous policy reviews or embedded ethnographic studies to further mitigate this risk.

Overcoming Hierarchical Power Imbalances in Group Dynamics

A second critical issue in focus group methodology—particularly in bureaucratic settings—is the presence of power asymmetries between participants. In the context of this study, senior officers held decision-making authority over junior officers, which created potential hesitancy in expressing dissenting views (Morgan, 1997). This power imbalance could have led to response conformity, where lower-ranking officers reinforced the views of their superiors rather than presenting independent perspectives.

To counteract this challenge, I employed structured participation techniques designed to reduce the influence of hierarchical positioning. Each participant was required to contribute to the discussion before open debates began, ensuring that junior officers had the opportunity to express their perspectives before senior officers could dominate the conversation.

Despite these interventions, hierarchical influence was still present, albeit minimised. This reflects a larger challenge in research involving government personnel, where organisational culture and reporting structures inherently shape participant engagement.

Validating Self-Reported Data Through Multi-Level Triangulation

Another methodological limitation of focus groups is that self-reported data are inherently subjective and may reflect personal perceptions rather than institutional realities (Creswell & Creswell, 2018). This was a particularly relevant concern in this study, as government officers may have underreported implementation challenges to maintain institutional credibility.

To address this limitation, I implemented multi-level data triangulation:

- a. **Cross-Verification with Policy Documents:** Participants' claims about SDM effectiveness were cross-checked with official policy documents to identify discrepancies between stated policy goals and on-the-ground realities.
- b. **Comparative Analysis with Headteacher Consultation Findings:** Focus group discussions were analysed alongside headteacher consultation session data, ensuring that administrative narratives were evaluated against practitioner

experiences. This bottom-up validation approach allowed the study to identify gaps between how SDM is administered and how it is experienced in schools.

- c. **Incorporating Contradictory Evidence in Thematic Coding:** Rather than filtering out contradictory statements, the I intentionally coded conflicting perspectives as separate themes, allowing for a more nuanced analysis of policy-practice misalignment.

This multi-layered triangulation approach enhanced the reliability of focus group findings, ensuring that institutional perspectives were not accepted at face value but rigorously examined within the broader SDM governance framework.

3.5.6 Researcher Reflexivity and Positionality

As the facilitator of the focus groups, I was acutely aware that complete objectivity is neither attainable nor always desirable in qualitative research. Bias, when acknowledged and critically examined, can become a valuable lens through which deeper insights emerge. My dual role—as both an insider with professional experience in school data management and an outsider conducting academic inquiry—was not a limitation but a strength that brought layered understanding to the fieldwork. As an insider, my background as an education officer and ICT specialist allowed me to engage meaningfully with participants, interpret technical discussions with fluency, and pose contextually relevant questions. At the same time, I adopted an outsider’s stance by positioning myself as a learner and listener, intentionally bracketing my assumptions to let participants’ voices lead the conversation.

To reduce the influence of my positionality, I designed the focus group sessions around structured prompts grounded in official policy documents, rather than my own interpretations. Discussions were open-ended and participant-driven, avoiding leading questions and allowing authentic narratives to emerge. I also practised member checking during the sessions, summarising participants’ responses in real time and inviting clarification or correction—ensuring that their meanings were represented accurately.

Managing the duality of my role required a deliberate commitment to reflexivity. I maintained a research diary throughout the data collection process, using it to interrogate how my own beliefs and experiences may have shaped the data and its interpretation. I also engaged in peer debriefing with academic colleagues, who provided critical feedback to challenge my analytical framing and anchor my interpretations in the data rather than personal bias. These strategies ensured that while my professional background informed the research, it did not dominate it—allowing the findings to reflect the lived realities of the participants.

MOE Officer Interviews: A Critical Examination of Policy-Level Perspectives on SDM

A key component of my research involved individual interviews with two MOE officers, providing an insider's perspective on power dynamics, decision-making structures, and operational intricacies within the Malaysian education system. These interviews were essential for understanding how SDM policies are conceptualised, implemented, and negotiated within the bureaucratic landscape of education governance. While the focus group discussions with DEO and MAMPU officers examined SDM at the district and technological levels, my interviews with MOE officers allowed me to critically assess how national policies were designed, prioritised, and aligned with broader education reforms. This top-down perspective provided a necessary counterpoint to the practitioner narratives of headteachers and district administrators, ensuring that my research incorporated a multi-layered examination of SDM governance.

Conducting these interviews allowed me to explore the tensions between policy formulation and practical implementation, a crucial area of inquiry in understanding why SDM policies succeed or fail at different levels of the education system. While government reports and policy documents present a structured, goal-oriented vision of SDM, these interviews revealed the complexities, internal negotiations, and bureaucratic constraints that shape policy execution. Merriam and Tisdell (2015) emphasise that qualitative research benefits from incorporating multiple institutional perspectives, particularly in complex, hierarchical systems like education governance. By engaging directly with MOE officers, I was able to uncover the internal struggles, competing

priorities, and hidden challenges that influence SDM adoption at the national level.

Justification for Semi-Structured Interviews and Their Methodological Strengths

I conducted these interviews using a semi-structured format, following Patton's (2015) approach to qualitative interviewing. This method provided a flexible yet structured framework, allowing the officers to discuss key topics while also offering insights that extended beyond the predefined research questions. The semi-structured approach allowed me to maintain focus on the central themes of SDM governance while also adapting to emergent topics raised by the participants. This flexibility was particularly important when engaging with government officers, as it enabled me to capture policy discussions in their full complexity rather than being restricted to scripted responses.

Using semi-structured interviews instead of structured or unstructured formats was a deliberate methodological decision. A structured interview would have constrained responses, potentially reinforcing official policy narratives rather than uncovering critical perspectives on SDM challenges. Conversely, an unstructured interview would have lacked direction, making it difficult to extract focused insights on SDM governance and leadership decision-making. The semi-structured format struck a balance between allowing depth of response while maintaining coherence with the study's objectives. It also provided the officers with the flexibility to engage critically with SDM issues, offering institutional reflections that I could later cross-validate with headteacher and DEO perspectives.

Critical Reflection on the Interview Methodology and Its Limitations

Despite the value of these interviews, I encountered several methodological challenges that highlight the complexities of engaging with policymakers in qualitative research. One of the main limitations was the small sample size, as I interviewed only two MOE officers. While their insights were rich and detailed, they do not fully capture the diversity of perspectives within the ministry, particularly across different policy divisions. Future research could address this

limitation by interviewing officers from multiple MOE departments, including those involved in curriculum planning, teacher training, and ICT policy development, to provide a more holistic view of SDM governance.

However, while the sample size was limited, the strategic selection of participants ensured that the interviews captured perspectives from two of the most critical positions related to SDM implementation. The first interviewee was responsible for managing school data at the MOE level, overseeing how data flows from schools to central databases, ensuring compliance with reporting standards, and shaping policy adjustments based on data trends. The second interviewee was in charge of ICT and data systems, focusing on the technical aspects of SDM, including system interoperability, infrastructure challenges, and digital transformation initiatives within the education sector. These two officers were uniquely positioned at the intersection of policy, technology, and data governance, making their insights highly valuable in understanding both the administrative and technological dimensions of SDM implementation.

Another key challenge in conducting these interviews was the inherent power imbalance between myself as an external researcher and the MOE officers as high-ranking government officials. Engaging with senior policymakers required careful navigation to ensure that the interviews did not reinforce official policy narratives or become platforms for institutional justifications rather than reflective critique. Given their positions of authority, the officers might have felt inclined to present SDM as a success story, downplaying implementation challenges or internal conflicts. To counter this, I employed strategic questioning techniques that encouraged officers to provide concrete examples rather than generalised policy statements. By asking, "Can you describe a specific instance where SDM data influenced a policy decision at the national level?", rather than, "How effective is SDM in policymaking?", I was able to elicit more grounded, experience-based responses that moved beyond abstract policy discourse.

Other concern in conducting these interviews was mitigating response bias, particularly given that MOE officers work within a politically sensitive environment where discussing policy weaknesses might be perceived as undermining institutional credibility. To encourage candid discussions, I

emphasised confidentiality and anonymity, ensuring that responses would not be linked to specific individuals or departments. I also framed my questions carefully to reduce defensiveness, focusing on exploring policy refinements rather than directly critiquing policy failures. For example, instead of asking, “What are the main failures of SDM policy?”, I posed questions such as, “What aspects of SDM implementation require further development to meet the needs of school leaders?” This shift in framing helped to facilitate reflective discussions while still inviting critiques of existing SDM challenges.

Another crucial methodological consideration was the risk of institutional alignment, where officers might feel compelled to present a unified, politically safe version of SDM effectiveness rather than discussing internal tensions and policy contradictions. To address this, I used probing follow-up questions to challenge surface-level responses, encouraging participants to provide specific examples and personal experiences rather than repeating policy rhetoric. This approach enabled me to move beyond idealised accounts of SDM success and uncover the everyday challenges of policy execution, inter-agency conflicts, and resistance to change within the ministry.

Critical Insights Gained from MOE Interviews

The interviews provided critical insights into how SDM policies are both constructed and constrained by bureaucratic processes. One of the most striking themes that emerged was the persistence of bureaucratic inertia, where policy initiatives often lag behind technological advancements and school-level needs. The officers acknowledged that while SDM policies emphasise efficiency and data-driven decision-making, actual implementation remains slow due to entrenched administrative cultures. Many schools still rely on manual reporting systems, despite the government’s push for fully digital SDM platforms. This insight reinforced the findings from headteacher consultations, where participants highlighted the excessive reporting burden and the lack of integration between different data systems.

Another key theme was inter-agency coordination bottlenecks, particularly between MOE and MAMPU. While MAMPU focuses on technical aspects of digital transformation, MOE officers expressed frustration that SDM policies were often

shaped by IT infrastructure goals rather than educational priorities. This misalignment has led to delays in implementing integrated SDM platforms, with schools and district offices caught between competing administrative mandates. The officers also revealed that district-level capacity to implement SDM varies significantly, with some DEOs being more proactive in adopting digital reporting systems than others. This variation further complicates the standardisation of SDM practices, as some districts struggle with technological infrastructure gaps and training limitations.

Perhaps the most revealing insight from the interviews was the resistance to data-driven decision-making at the leadership level. Despite MOE's emphasis on data governance, some senior policymakers remain skeptical of its role in school leadership. One officer remarked that education should focus on pedagogy and human relationships, not just performance metrics and data dashboards. This sentiment aligns with broader critiques in education research, where data-driven governance is often perceived as a bureaucratic mechanism rather than a transformative leadership tool (Wayman et al., 2012). The resistance from school leaders, district administrators, and even policymakers themselves indicates that SDM adoption is not merely a technical challenge but a cultural shift that requires greater buy-in from education stakeholders.

3.6 Data Analysis Approach

Data analysis is a crucial phase in qualitative research, serving as the bridge between raw data and meaningful interpretations that answer the research questions. In this study, the data analysis approach was designed to capture the complexities of SDM governance in Malaysia, ensuring that insights were systematically developed, critically examined, and validated across multiple data sources. Given the multi-stakeholder nature of SDM implementation, where policy directives from the MOE must align with district-level execution and school-based practices, data analysis had to be methodologically rigorous, iterative, and reflexive.

To achieve this, I employed thematic analysis as the primary analytical approach, following Braun and Clarke's (2006) six-step framework, which allowed for a structured yet flexible interpretation of qualitative data. Thematic

analysis was chosen because it enables researchers to identify, analyse, and report patterns (themes) within qualitative datasets, making it particularly suited to exploring the subjective experiences, institutional challenges, and policy-practice gaps inherent in SDM implementation. Unlike quantitative methods, which often reduce responses to numerical patterns, thematic analysis preserves the depth and richness of participant narratives, allowing for a more nuanced understanding of SDM governance at different institutional levels.

Data analysis in this study was conducted iteratively, meaning that insights were continuously refined as new data were collected and examined. Rather than treating analysis as a linear process, I adopted a recursive approach, moving back and forth between data coding, theme development, and theoretical interpretation. This ensured that emergent findings were not imposed by pre-existing assumptions but were grounded in participant narratives and policy realities.

Given that the study incorporated multiple qualitative data sources—including policy document analysis, online questionnaires, consultation sessions with headteachers, focus group discussions with DEO and MAMPU officers, and individual interviews with MOE officers—data synthesis was a critical aspect of the analytical process. Each data source contributed a unique perspective on SDM governance, requiring a careful cross-comparative approach to identify consistencies, contradictions, and gaps in institutional narratives. To manage and organise the extensive dataset, I utilised NVivo software, which facilitated systematic coding, thematic clustering, and visualisation of interconnections between different data points.

An essential aspect of the data analysis process was ensuring trustworthiness and credibility, particularly given that much of the data were self-reported by government officials, school administrators, and policymakers. To mitigate response bias and institutional alignment tendencies, I employed data triangulation techniques, cross-referencing findings across different respondent groups to validate claims and expose discrepancies. Furthermore, I engaged in reflexive journaling throughout the analysis process, documenting potential biases, unexpected findings, and shifts in analytical interpretation to enhance transparency and critical awareness in data interpretation.

3.6.1 Thematic Analysis Framework

Thematic analysis served as the primary method of qualitative data analysis in this study, following Braun and Clarke's (2006) six-step framework. This approach was chosen because of its flexibility and depth, allowing me to systematically identify, analyse, and report patterns within qualitative datasets. Thematic analysis is particularly suited to studies examining institutional decision-making, policy-practice gaps, and multi-stakeholder governance, as it enables researchers to preserve the complexity of participant narratives while uncovering broader structural patterns. Given that my study incorporated data from policy documents, online questionnaires, consultation sessions, focus groups, and interviews, thematic analysis provided a structured yet adaptable analytical method that allowed for both inductive and deductive coding approaches.

The process of analysing qualitative data began with a combination of audio recordings and detailed notetaking during interviews and focus groups to ensure a comprehensive and accurate capture of participant narratives. I employed Sonix.ai, an advanced AI-powered transcription tool, to convert Malay audio recordings into English text efficiently. AI-assisted transcription was selected for its precision and ability to expedite the transcription process, an increasingly common practice in qualitative research where large volumes of data must be processed in a short time (McMullin, 2023). However, recognising that automated transcription tools can struggle with nuanced conversations, specialised terminology, and variations in speaker accents, I implemented a rigorous manual review process to validate the accuracy of transcriptions. By balancing AI efficiency with human verification, I ensured that the transcriptions retained contextual accuracy and participant intent, aligning with Creswell and Poth's (2018) guidelines for ensuring the integrity of qualitative data.

Following transcription, I conducted thematic analysis iteratively, engaging deeply with the data to develop a nuanced, empirically grounded understanding of SDM governance challenges and institutional power dynamics. The analysis process unfolded in six distinct but overlapping stages, ensuring that findings were continuously refined rather than imposed from pre-existing assumptions.

The first stage, familiarisation with the data, involved an immersive engagement with transcripts and audio recordings to develop a holistic understanding of the data corpus. By repeatedly listening to the recordings and reading through transcripts, I identified emerging patterns, unexpected insights, and potential contradictions within participant narratives. This step was critical in ensuring that preliminary interpretations were not shaped solely by preconceived theoretical constructs but were genuinely reflective of participant perspectives.

The second stage involved systematic coding, where I applied both inductive and deductive coding approaches to categorise significant data segments. Inductive coding allowed me to capture themes emerging organically from the data, particularly regarding unforeseen implementation challenges, administrative constraints, and resistance to SDM adoption at leadership levels. At the same time, deductive coding ensured that the analysis remained aligned with key research objectives, particularly regarding the Techno-Enablement Framework and power dynamics in SDM governance. I utilised NVivo software to manage, organise, and cross-reference codes systematically, ensuring that the thematic structure was methodologically robust and internally coherent.

Once initial coding was completed, I moved to theme generation, where related codes were grouped into broader thematic categories. This phase was highly iterative, as I sought to ensure that themes were not arbitrarily imposed but emerged from recurring patterns across participant responses. Given the multi-stakeholder nature of SDM governance, one of the key challenges in this phase was accounting for contradictions and tensions between different institutional perspectives. For instance, while MOE officers highlighted the strategic importance of SDM for evidence-based decision-making, headteachers emphasised the practical difficulties of data collection, reporting burdens, and a lack of interoperability between different SDM platforms. Rather than treating these inconsistencies as analytical limitations, I recognised them as essential findings, demonstrating the structural and political tensions that shape SDM implementation.

The reviewing themes stage involved critically evaluating the coherence, relevance, and distinctiveness of identified themes. I examined whether each theme was well-supported by empirical data and whether any overlapping

categories needed refinement or further differentiation. I also engaged in cross-data validation, comparing findings from different data sources to ensure that themes were not solely driven by one participant group but reflected broader patterns across policy narratives, administrator perspectives, and practitioner experiences. This phase was essential in preventing superficial thematic reporting, ensuring that each theme was grounded in multiple data points and rigorously substantiated.

Once themes were finalised, I moved to defining and naming them, a process that required conceptual clarity and analytical precision. Each theme was carefully defined, ensuring that it captured not only the content of participant discussions but also the underlying institutional structures, power relations, and technological constraints influencing SDM adoption. I avoided overgeneralised theme labels, opting instead for descriptive, analytically rich categorisations that reflected both participant narratives and theoretical insights.

Finally, in the writing phase, I synthesised my findings into a structured, cohesive discussion, integrating thematic insights with theoretical reflections, policy critiques, and comparative perspectives across data sources. I supported my themes with direct participant quotes, ensuring that findings were not merely researcher interpretations but were deeply embedded in participant voices. This phase required careful balancing between descriptive reporting and analytical depth, ensuring that the study not only documented institutional challenges but also critically examined the socio-political and technological forces shaping SDM governance.

Given that much of the data were originally in Malay, I conducted the initial thematic analysis in the original language before translating themes into English. This decision was made to preserve the depth, accuracy, and contextual nuances of participant narratives, ensuring that findings were not distorted by linguistic translation (Temple & Young, 2004). To further validate translation accuracy, I employed bilingual cross-checking techniques, where translated findings were compared with original transcripts to ensure consistency in meaning. This was particularly important in understanding headteacher and administrator perspectives, as certain Malay expressions related to policy implementation challenges and bureaucratic inefficiencies do not always have direct English

equivalents. By maintaining linguistic fidelity in the thematic analysis, I ensured that participant narratives were accurately represented in their original context.

Throughout the data analysis process, I employed multiple strategies to ensure trustworthiness, credibility, and analytical rigor. I systematically triangulated findings across data sources, validating thematic insights through comparative analysis between policy documents, focus groups, and individual interviews. Additionally, I engaged in member-checking, where I presented preliminary findings to select participants to confirm whether the identified themes resonated with their experiences. This practice, recommended by Creswell and Creswell (2018), enhances the credibility of qualitative research by involving participants in the verification of analytical interpretations.

Reflexivity was also a critical component of my thematic analysis. Throughout the process, I maintained a reflexive journal, documenting potential biases, interpretive decisions, and evolving analytical insights. This allowed me to critically examine how my own positionality as a researcher influenced theme development and to remain transparent about subjective interpretations. By continuously reflecting on how power structures and institutional discourses shape both participant narratives and researcher analysis, I ensured that my findings were not only methodologically rigorous but also critically engaged with the socio-political realities of SDM governance.

Despite the strengths of thematic analysis, I encountered challenges, particularly in managing contradictory perspectives, synthesising large datasets, and ensuring depth while maintaining coherence. However, by employing structured analytical techniques, data triangulation, and participant validation, I ensured that my analysis was not only comprehensive but also critically robust, providing a multi-layered understanding of SDM governance in Malaysia. The following section will examine how I ensured trustworthiness, validity, and credibility throughout the data analysis process, reinforcing the methodological rigor of my study.

3.6.2 Coding Process and Data Management

The coding and data management process was a methodologically rigorous and reflexive exercise, ensuring that themes were not merely descriptive but critically interrogated for their underlying structural, political, and institutional dimensions. Given the multi-source nature of the dataset—comprising policy documents, headteacher questionnaires, consultation sessions, focus groups, and interviews with MOE and MAMPU officers—systematic coding was essential for synthesising diverse perspectives while maintaining analytical depth and coherence. A key concern throughout this process was the necessity of interrogating institutional narratives, identifying contradictions, and distinguishing between policy rhetoric and implementation realities. By integrating inductive and deductive coding approaches, I ensured that my analysis was empirically grounded while remaining theoretically engaged, particularly within the broader framework of techno-enablement and SDM governance.

A fundamental challenge in coding a large, multi-perspective dataset was ensuring that findings were not merely reflective of dominant institutional narratives but critically engaged with the complexities, contradictions, and unintended consequences of SDM policies. I had to account for structural tensions between different governance levels, ideological divergences in data-driven decision-making, and practical constraints affecting SDM adoption in schools. Thematic triangulation was central to addressing these challenges, ensuring that themes were not derived in isolation but were systematically cross validated against multiple data points to expose both consistencies and discrepancies.

Data Preparation and Transcription

The preparation of data for analysis required multiple layers of verification, validation, and critical engagement. The first challenge arose in transcribing qualitative data from interviews and focus groups, given that discussions were conducted in Malay and contained significant bureaucratic terminology, technical jargon, and conversational nuances. While Sonix.ai was used for AI-assisted transcription, I quickly identified limitations in its ability to capture

specialised SDM terms, inter-agency acronyms, and conversational overlaps in group discussions.

For example, in a focus group discussion, MAMPU officer 3 referenced "*dasar terbuka SDM*" (open data policy in SDM), but the AI transcription system incorrectly recorded it as "*data sekolah terbuka*" (open school data), creating an entirely different policy implication. Such errors were not merely linguistic misinterpretations but epistemological distortions, which, if left uncorrected, could have skewed thematic development and policy interpretation. Recognising these challenges, I manually reviewed and corrected all transcripts, ensuring that terminology remained consistent with institutional discourse while accurately reflecting participant intent.

Another layer of complexity in data preparation was managing inconsistencies between institutional discourse in policy documents and practitioner realities in field data. The MEB annual reports and the Public Sector Open Data (PSOD) Document presented a vision of SDM as a harmonized, data-driven governance framework, yet interview data from MOE and MAMPU officers contradicted this claim, particularly in relation to policy-system misalignment, poor data interoperability, and administrative inefficiencies. To systematically document these contradictions, I created a discrepancy log, where policy claims were systematically cross-referenced with empirical findings, ensuring that the coding process captured not only dominant narratives but also the gaps and inconsistencies within them.

Additionally, I anonymised all participant data while preserving institutional identifiers, as fully decontextualising responses would have removed critical distinctions between policymaker, administrator, and practitioner perspectives. For example, if a statement from an MOE officer described "seamless data integration across educational clusters", I needed to ensure that this was not attributed to a school-level actor, as headteacher responses frequently contradicted this narrative. Thus, responses were systematically categorised by policy level (MOE), administrative execution (DEO), and on-the-ground experience (headteachers), maintaining both confidentiality and analytical clarity.

Initial Coding and Categorisation

The initial coding phase required both openness to emergent insights and analytical precision to ensure thematic coherence. Using NVivo software, I performed a line-by-line coding of transcripts, assigning preliminary open codes to meaningful data segments. A major challenge in this stage was identifying how institutional power structures shaped participant narratives, particularly in focus groups where junior officers were reluctant to openly contradict senior policymakers.

For instance, in a focus group discussion, a senior DEO officer emphasised that "district education offices are fully prepared to support schools in implementing SDM", yet a junior officer later hesitantly remarked that "some schools are struggling to align their internal data with district requirements". Rather than treating these statements as isolated contradictions, I coded them as part of a broader theme of "Institutional Confidence vs. Implementation Struggles", recognising that these discrepancies were not incidental but reflected deeper structural tensions between policy formulation and execution.

One of the most analytically demanding aspects of coding was dealing with institutionalised language. MOE officers often used phrases such as "strategic capacity-building initiatives" or "optimised data governance structures", which, on the surface, appeared to validate the effectiveness of SDM policies. However, when I cross-referenced these statements with headteacher responses from the questionnaire and consultation sessions, it became evident that many school leaders found SDM systems cumbersome, inefficient, and misaligned with pedagogical needs. To capture this divergence, I coded these responses separately under "Policy Narrative on Capacity-Building" and "Headteacher Perspectives on Administrative Burden", ensuring that analysis was not subsumed under institutional rhetoric but remained attuned to practitioner realities.

Theme Development and Refinement

Moving from coded data to thematic categorisation required multiple rounds of refinement, ensuring that themes were empirically substantiated, analytically coherent, and meaningfully distinct from one another. At this stage, I focused on

distinguishing between overlapping themes and refining subcategories to capture the nuances within participant narratives.

For example, in the Infosystemic Challenges category, I initially coded technological limitations and policy misalignment within a single theme. However, as analysis progressed, I realised that these issues needed to be conceptually disentangled. I refined the theme into "Policy-System Misalignment" and "Human-Tech Interaction Challenges," recognising that while some challenges were structural (e.g., policy divergence in MEB reports vs. school data realities), others were operational (e.g., poor internet connectivity impeding SDM adoption at rural schools). This refinement allowed for greater analytical clarity, ensuring that challenges were not homogenised but understood within their specific institutional and technological contexts.

A particularly contentious thematic category was Divergent Perspectives, where participants provided contradictory views on data technology and school data flow processes. Rather than dismissing these contradictions as anomalies, I actively analysed them as self-contradicting statements (where the same participant expressed contradictory views) and inter-contradicting statements (where different stakeholder groups provided conflicting accounts). This distinction proved critical in understanding the complexities of SDM implementation, as it revealed how actors at different governance levels interpreted the same system in fundamentally different ways.

3.6.3 Ensuring Trustworthiness and Analytical Rigour

Ensuring trustworthiness and analytical rigor was a critical component of the data analysis process in this study. Given the multi-stakeholder nature of SDM governance, where policy narratives, administrative perspectives, and practitioner experiences often diverged, it was essential to implement systematic validation strategies to safeguard the credibility, dependability, and authenticity of the findings. I employed a multi-pronged approach to establish trustworthiness in thematic analysis, drawing upon established qualitative research criteria, including credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985; Morrow, 2005). These methodological safeguards ensured that findings were not solely shaped by dominant

institutional discourses but accurately reflected the diverse realities of SDM implementation across different governance levels.

One of the primary challenges in ensuring trustworthiness was navigating the tension between institutional rhetoric and ground-level realities, particularly when analysing policy documents and government official statements. Given that MOE and MAMPU officers framed SDM as a well-integrated, technologically advanced system, while headteachers and district education officers highlighted structural inefficiencies, resource gaps, and bureaucratic burdens, I had to ensure that my analysis captured the complexity of these contradictions without privileging one perspective over another. To address this, I systematically employed data triangulation, member-checking, reflexive engagement, and inter-coder reliability techniques, ensuring that thematic interpretations were rigorously tested against multiple sources and critical perspectives.

Credibility and Triangulation Across Data Sources

Credibility in qualitative research is achieved by ensuring that findings are robustly grounded in multiple, corroborating data sources (Lincoln & Guba, 1985). In this study, credibility was strengthened through data triangulation, which involved cross-referencing insights from different data sources, including policy documents, questionnaire responses, consultation sessions, focus groups, and individual interviews. By systematically comparing these sources, I was able to identify consistencies, contradictions, and gaps in SDM narratives, ensuring that themes were not solely driven by individual perspectives but reflected broader governance trends.

For instance, in analysing Inter-Agency Data Flows under Infostructural Challenges, I observed that MAMPU officers frequently cited collaboration struggles and conflicting directives, suggesting that inter-agency coordination was fragmented. This claim was validated by policy reports that indicated overlapping responsibilities between MOE and MAMPU in SDM governance. However, these perspectives were contradicted by MOE officers, who emphasised that inter-agency collaboration was effective and fully integrated. By cross-referencing these claims with headteacher and DEO responses, which pointed to persistent data synchronization issues and bureaucratic bottlenecks

at the school level, I was able to confirm that despite policy claims of integration, practical execution remained uneven and inconsistent.

Similarly, in the theme of Infosystemic Challenges, particularly Policy-System Alignment, I analysed MEB annual reports, the Public Sector Open Data (PSOD) Document, and the UNICEF Report 2020 alongside interview transcripts from MOE and MAMPU officers. While policy documents projected a seamless transition toward interconnected data systems, interview and focus group findings revealed a stark divergence between policy intent and institutional capacity. MAMPU officers noted a deficiency in interconnectedness in the political dimension, suggesting that SDM digitalisation efforts were constrained by bureaucratic inertia rather than technological limitations. By integrating these sources into a comparative analytical framework, I was able to strengthen the credibility of findings by ensuring that thematic conclusions were not isolated claims but were substantiated by empirical evidence from multiple perspectives.

Dependability and Reflexive Engagement

Dependability in qualitative research requires that findings are not only credible but also consistent and repeatable, given the same research conditions (Shenton, 2004). To enhance dependability, I engaged in ongoing reflexive engagement throughout the data analysis process, systematically documenting thematic decisions, coding rationales, and evolving interpretations.

A key challenge in maintaining dependability was managing the evolving complexity of themes as new data emerged. For instance, during the initial coding phase, I grouped data mismanagement, poor internet connectivity, and technology adoption issues under a broad category of "Technical Barriers to SDM". However, as analysis progressed, it became evident that technology-related issues were not merely technical challenges but were deeply entangled with governance structures and policy failures. This led to thematic refinement, where technology adoption challenges were placed under "Human-Tech Interaction," while system inefficiencies were categorised under "Divergence in Policy Narrative." By maintaining a systematic audit trail of coding decisions and theme evolution, I ensured that the analytical process remained transparent and could be independently assessed for methodological consistency.

Another key reflexive strategy was documenting researcher positionality and bias management strategies. Given my direct engagement with government officials and education practitioners, I recognised the risk of being inadvertently influenced by institutional perspectives. To counteract this, I maintained a reflexive journal, where I critically examined my interpretive decisions, moments of analytical uncertainty, and potential biases introduced during the coding process. This ongoing reflexive practice ensured that my thematic conclusions remained analytically rigorous and not unduly shaped by personal assumptions or pre-existing policy narratives.

Confirmability and Inter-Coder Reliability

Confirmability refers to the extent to which research findings are shaped by the data rather than researcher bias or personal interpretation (Guba & Lincoln, 1989). To enhance confirmability, I employed inter-coder reliability techniques, where selected transcripts were coded independently by a research colleague to assess consistency in theme identification and coding rationale. This collaborative approach allowed me to identify potential coding discrepancies, refine thematic definitions, and ensure that coding decisions were not arbitrary but grounded in empirical evidence.

For example, in coding 'Enablement for Advocated Approaches', I initially categorised inter-agency leadership and communication channels under a general theme of "Institutional Support Mechanisms". However, my colleague's independent coding revealed that these subthemes had distinct implications for SDM governance—inter-agency leadership was more aligned with structural decision-making, while communication channels reflected procedural and logistical coordination. Recognising this distinction, I restructured the theme into two separate categories, ensuring that findings retained conceptual clarity and analytical precision.

Additionally, I systematically checked for thematic saturation by iteratively reviewing coded data against existing themes. For instance, in the Divergent Perspectives category, I initially coded contradictions in data technology statements from different stakeholder groups without distinguishing between institutional vs. individual-level contradictions. As analysis progressed, I refined

this distinction into "Inter-Contradicting Statements" (conflicts between agencies) and "Self-Contradicting Statements" (conflicts within the same institution, such as MOE officers contradicting their earlier assertions). This refinement allowed for a more sophisticated analysis of institutional discourse and policy ambivalence.

Transferability and Generalisability of Findings

While qualitative research does not aim for statistical generalisability, it is still essential to ensure transferability, meaning that findings can be meaningfully applied to similar contexts beyond the immediate research setting (Shenton, 2004). To enhance transferability, I provided rich, thick descriptions of SDM governance issues, ensuring that thematic insights were detailed enough to be relevant to other education systems experiencing similar digital transformation challenges. By incorporating a multi-stakeholder perspective, policy analysis, and real-world implementation challenges, the study provides insights that are applicable not only within the Malaysian education system but also in other centralised-decentralised governance models facing similar SDM implementation difficulties.

3.6.4 Data Triangulation: Cross-Validating Findings from Multiple Sources to Enhance Trustworthiness

Ensuring trustworthiness in qualitative research requires rigorous cross-validation techniques that systematically integrate multiple sources of data, thereby strengthening the credibility, dependability, and confirmability of findings (Lincoln & Guba, 1985; Morrow, 2005). In this study, I employed data triangulation as a critical strategy for validating thematic interpretations and reducing biases that could arise from institutional narratives, participant subjectivities, or researcher preconceptions. Given the multi-level nature of SDM governance, where policy directives from the MOE intersect with district administration, inter-agency collaborations, and school-level operations, triangulation was essential for identifying the gaps, contradictions, and alignments between official policies and on-the-ground realities.

A significant challenge in SDM research is navigating the discrepancies between policy rhetoric and operational realities, particularly when official documents frame SDM as a streamlined, data-driven governance model while practitioner feedback reveals barriers such as technological inefficiencies, bureaucratic complexity, and misalignment between policy and school needs. Data triangulation allowed me to systematically interrogate these contradictions by cross-referencing policy texts, consultation feedback, interviews, and focus group discussions, ensuring that findings were not shaped by any single stakeholder perspective but reflected a multi-layered understanding of SDM governance.

By integrating document analysis, headteacher feedback, interviews with MOE and MAMPU officers, and focus group discussions with DEO officers, I employed two key triangulation techniques to enhance trustworthiness; comparing policy narratives with practitioner realities, and cross-validating institutional perspectives across stakeholder groups.

Comparing Policy Narratives with Practitioner Realities

The first level of triangulation involved comparing how SDM policies were framed in official documents with how they were perceived and experienced by school administrators and district officers. Policy documents, including the Malaysian Education Blueprint (MEB) and the Public Sector Open Data (PSOD) Document, presented SDM as an integrated, interoperable system designed to enhance decision-making, transparency, and administrative efficiency. However, data from headteacher consultation sessions and focus groups with DEO officers exposed the practical difficulties of implementing these policies, revealing that SDM adoption was often hindered by technological barriers, policy incoherence, and excessive reporting burdens imposed on schools.

For instance, policy documents frequently emphasised the empowerment of school leaders through data-driven decision-making, yet consultation feedback from headteachers painted a different picture, where SDM was perceived as a top-down compliance mechanism rather than a tool for educational improvement. One headteacher remarked:

“We are expected to use SDM for decision-making, but in reality, we spend most of our time inputting data that do not reflect the actual learning process in our schools.”

This discrepancy between policy expectations and school-level realities was systematically documented through theme mapping, allowing for the identification of structural gaps between how SDM was conceptualised at the ministry level and how it was operationalised at the school level. The ability to triangulate these contradictions ensured that the analysis did not reinforce policy rhetoric but instead critically examined its implementation challenges.

Furthermore, MOE documents described SDM as a tool for promoting school autonomy, yet headteacher feedback revealed that data requirements often constrained rather than enhanced their leadership agency. By triangulating these competing perspectives, I ensured that my analysis remained critical, balanced, and reflexive, preventing the reproduction of institutionally constructed success narratives that were disconnected from actual school experiences.

Cross-Validating Institutional Perspectives Across Stakeholder Groups

The second level of data triangulation focused on cross-validating institutional perspectives across different governance actors, particularly between MOE officers, DEO officers, and MAMPU representatives. While MOE officials framed SDM as an example of successful digital governance, findings from focus groups with DEO officers and interviews with MAMPU officers revealed persistent inter-agency conflicts, bureaucratic inefficiencies, and resource allocation problems that hindered SDM integration.

For example, MOE officers emphasised that inter-agency coordination with MAMPU was well-established, citing the Public Sector Open Data (PSOD) framework as evidence of a unified data strategy. However, interviews with MAMPU officers contradicted this claim, as they described ongoing struggles with conflicting directives, lack of shared protocols, and resistance from some MOE divisions in fully integrating SDM within broader digital transformation agendas. One MAMPU officer openly challenged the narrative of seamless inter-agency collaboration, stating:

“We have designed interoperability standards, but the problem is that some departments within MOE operate in silos. They are not fully aligned with the digital transformation objectives we are working towards.”

This contradiction was further triangulated with feedback from DEO officers, who reported inconsistent instructions regarding SDM compliance, with some districts receiving conflicting directives from MOE and MAMPU on reporting standards. The triangulation process allowed me to disentangle how governance fragmentation contributed to SDM inefficiencies, rather than merely attributing implementation failures to technical limitations.

By cross-referencing stakeholder perspectives, I was able to develop a nuanced analytical framework that accounted for both structural constraints and power asymmetries within SDM governance. This approach reinforced confirmability, as findings were not shaped by any single institutional narrative but rather emerged from comparative analysis across multiple governance levels.

3.7 Analytical Generalisation: Extending Findings Beyond the Research Context

Analytical generalisation plays a pivotal role in qualitative research by ensuring that findings contribute to broader theoretical and policy discussions rather than being confined to the specific study context (Yin, 2018). Unlike statistical generalisation, which aims to extrapolate results to a larger population, analytical generalisation focuses on developing conceptual insights that are applicable across different but comparable settings (Guba & Lincoln, 1985). Given the context-dependent nature of governance research, especially in the domain of educational data systems like SDM, analytical generalisation allows for a critical interrogation of governance mechanisms, institutional constraints, and policy-practice dynamics that extend beyond Malaysia’s centralised education system.

The nature of digital governance reforms, particularly in education, is shaped by competing institutional logics, power asymmetries, and structural tensions between policy directives and implementation realities. While this study is anchored in Malaysia’s SDM governance model, the findings are not intended to

be confined to this specific case but instead serve as a lens to examine broader global challenges in data-driven education reforms. The governance contradictions, policy misalignments, and stakeholder conflicts that emerged from this study are symptomatic of larger trends in digital transformation initiatives across different national education systems, reinforcing the applicability of the findings beyond the immediate research setting.

By systematically integrating thematic analysis, institutional discourse critique, and policy-practice triangulation, this study provides conceptual tools that can be used to examine digital education governance in other centralised or semi-centralised education systems. Rather than offering prescriptive policy recommendations applicable only to Malaysia, the study advances theoretical insights into how data governance is framed, negotiated, and contested within bureaucratic structures. This makes the findings transferable, not in terms of direct policy replication, but as an analytical framework for understanding how education reforms interact with institutional realities in different contexts.

3.7.1 Theoretical Contribution: Developing an Analytical Framework for Digital Governance in Education

One of the central objectives of analytical generalisation is to ensure that findings contribute to theoretical advancements, extending the exploratory power of research beyond its immediate empirical setting. In this study, the framework for analysing SDM governance was developed through a synthesis of techno-enablement, inter-agency collaboration dynamics, and institutional contradictions in digital transformation policies. While the findings are drawn from Malaysia's SDM experience, the analytical framework provides insights that are broadly relevant to education systems undergoing similar digital governance transitions.

At its core, the study offers a critical interrogation of how data-driven governance in education is structured around competing institutional logics. Three key theoretical insights emerge from this:

- a. The paradox of centralised digital governance: While SDM is framed as a tool for decentralisation and school empowerment, the study reveals that digital

governance structures often reinforce top-down administrative control rather than autonomy. This contradiction is not unique to Malaysia but is evident in other national contexts where data reforms claim to promote decentralised decision-making yet function primarily as instruments of bureaucratic oversight (Williamson, 2017).

- b. The illusion of seamless inter-agency collaboration: Official narratives about the interoperability of SDM systems often obscure the bureaucratic frictions, misaligned incentives, and regulatory inconsistencies that undermine inter-agency cooperation. These governance challenges are observed in other centralised education systems where digital initiatives are hindered by fragmented policymaking and jurisdictional conflicts between ministries, local governments, and ICT agencies (Selwyn, 2021).
- c. The burden of digital compliance on frontline practitioners: While data-driven education policies emphasise evidence-based decision-making, practitioners often experience digital reforms as an additional layer of bureaucratic labor rather than as a genuine decision-support tool. This tension is present in multiple education systems, such as the UK's EdTech Strategy and India's Unified District Information System for Education (UDISE), where digital platforms have increased teacher workload rather than reducing administrative burdens (Jantjies, 2019; Govinda & Bandyopadhyay, 2011).

These insights extend beyond Malaysia, providing a conceptual framework for analysing similar digital governance initiatives across different education systems. The study's theoretical contribution is therefore not in prescribing solutions but in highlighting the structural tensions that shape data-driven policy implementation in centralised education bureaucracies.

3.7.2 Transferability: Applying Key Findings to Other Digital Education Reforms

While qualitative research does not aim for statistical generalisation, ensuring the transferability of findings is essential for extending their relevance to similar policy environments (Shenton, 2004). Transferability in this study is achieved

through rich, thick descriptions of SDM governance, allowing for meaningful comparisons with other national education systems experiencing digital transformation challenges.

For example, three core themes identified in this study—Infosystemic Challenges, Inter-Agency Data Flows, and Divergent Perspectives on Data Technology—offer transferable insights that apply to other centralised education systems undergoing digital reforms:

a. Infosystemic Challenges: Policy Intent vs. Digital Capacity

This theme captures the persistent misalignment between policy ambitions and technological realities, a problem evident not only in Malaysia but also in South Africa’s digital education policies, where data-driven governance is constrained by unequal access to ICT resources across urban and rural schools (Jantjies, 2019).

b. Inter-Agency Data Flows: Fragmented Governance and Bureaucratic Silos

Governance fragmentation has emerged as a critical barrier to SDM effectiveness, where conflicting mandates between MOE and MAMPU undermine coordinated data governance efforts. Similar challenges are observed in India’s UDISE system, where federal-state coordination issues have led to duplication of reporting efforts and inconsistencies in data standardisation (Govinda & Bandyopadhyay, 2011).

c. Divergent Perspectives on Data Technology: The Bureaucratic Surveillance Model

This study reveals that while MOE policymakers view SDM as a technological enabler, frontline educators experience it as a bureaucratic surveillance mechanism. This contradiction mirrors global debates in learning analytics and education technology policies, where data-driven accountability often comes at the expense of teacher agency and pedagogical flexibility (Eynon, 2015; Williamson, 2017).

By framing these themes within a broader discussion of digital education governance, the study ensures that its findings are not only relevant within Malaysia but also provide insights into other national education systems undergoing similar data-driven transformations.

3.7.3 Limitations and Reflexivity in Analytical Generalisation

While analytical generalisation strengthens the theoretical and practical relevance of qualitative research, it is essential to acknowledge its limitations and the role of researcher reflexivity in shaping analytical interpretations.

One of the primary limitations of analytical generalisation is that findings are deeply embedded within specific socio-political and institutional contexts. The governance tensions, policy contradictions, and stakeholder conflicts identified in Malaysia's SDM system cannot be assumed to be identical to other education systems, particularly those with different political structures, regulatory frameworks, and levels of ICT infrastructure development.

However, the objective of this study is not to claim direct applicability but to provide a transferable analytical framework that can be adapted to different policy environments. By focusing on the governance logics, institutional constraints, and power asymmetries inherent in SDM implementation, rather than context-specific policy details, the study offers insights that are conceptually relevant beyond Malaysia.

Moreover, throughout the research process, I maintained a reflexive journal to critically examine my own positionality, assumptions, and interpretive choices. Recognising that qualitative analysis is inherently shaped by researcher perspective, I engaged in iterative coding reviews, thematic refinement, and peer debriefing to ensure that findings were rigorously interrogated and not unduly influenced by preconceived policy critiques.

Analytical generalisation in this study was achieved by developing a conceptual framework that extends beyond Malaysia's SDM governance to inform broader discussions on digital education policies, data governance, and inter-agency coordination. By systematically linking thematic findings to global education

reform challenges, this study demonstrates that policy-practice misalignments, governance conflicts, and digital compliance burdens are not unique to Malaysia but reflect larger trends in digital education reform worldwide.

3.8 Limitations of the Study: Critical Engagement and Mitigation Strategies

While this study provides a comprehensive analysis of SDM governance in Malaysia, it is essential to acknowledge its methodological, institutional, and epistemological constraints. No research is without limitations, and in qualitative inquiry, the scope, access, and interpretive choices of the researcher inevitably shape the findings (Guba & Lincoln, 1985). However, rather than treating these limitations as mere constraints, this section critically engages with them as epistemic challenges that inform the boundaries of the study while also proposing mitigation strategies to strengthen future research in this domain.

Given the politically embedded nature of education governance, the structural hierarchies within centralised bureaucracies, and the contested nature of digital transformation narratives, this study encountered challenges related to (1) methodological constraints, (2) access and power asymmetries, (3) data reliability and self-reporting biases, and (4) scope and transferability. Each of these issues was actively managed through mitigation strategies, though some limitations remain inherent to the nature of qualitative governance research.

Methodological Constraints: Challenges of Multi-Source Data Synthesis and Thematic Complexity

One of the most significant methodological challenges in this study was the integration of multiple data sources—including policy documents, consultation sessions, focus groups, interviews, and observational field notes. While methodological triangulation enriched the depth of analysis, synthesising institutional narratives, stakeholder critiques, and documentary discourses required careful negotiation to avoid privileging any single perspective (Patton, 2015).

A core issue was the reconciliation of competing narratives, particularly between policy-level claims of SDM effectiveness and the practical implementation difficulties reported by school leaders and district administrators. For example, while MOE documents described SDM as a data-driven solution for educational transformation, consultation sessions with headteachers exposed persistent gaps in digital infrastructure, usability, and compliance pressures. These contradictions were not merely differences in perception but reflections of governance asymmetries, requiring iterative thematic refinement and validation through cross-data triangulation.

To mitigate the risk of oversimplification or selective representation, I employed constant comparative analysis, systematically cross-referencing conflicting accounts and validating findings across data sources (Glaser & Strauss, 1967). Additionally, NVivo software was used to manage large volumes of qualitative data, ensuring that thematic coding remained transparent, replicable, and grounded in evidence rather than interpretive bias.

However, despite these efforts, the interpretive nature of qualitative thematic analysis remains a limitation, as it is shaped by researcher positionality and epistemological choices. Future research could mitigate this by incorporating longitudinal data collection, allowing for an analysis of how SDM policies evolve over time rather than being assessed as a static phenomenon.

Participant Access and Power Asymmetries: Institutional Gatekeeping and Cautious Responses

Access to government officials, district education officers, and school leaders was crucial for understanding SDM governance from multiple perspectives. However, institutional hierarchies, bureaucratic sensitivities, and the presence of power asymmetries influenced participant openness, self-censorship, and response framing.

For example, in focus group discussions with DEO officers, junior participants often deferred to senior officers when discussing SDM implementation challenges, resulting in moderated critiques that aligned with official policy narratives. Similarly, MOE officers framed SDM as a success story, emphasising

policy intent rather than acknowledging operational difficulties. While headteachers were more candid in voicing implementation struggles, some hesitated to directly critique MOE directives, indicating an implicit institutional pressure to conform to bureaucratic expectations.

To navigate institutional gatekeeping and response moderation, I employed reflexive interview techniques, such as probing questions, scenario-based discussions, and indirect questioning, to encourage deeper reflections rather than surface-level institutional responses (Brinkmann & Kvale, 2015). Additionally, triangulation across governance levels helped reveal implicit tensions, as contradictions between MOE, DEO, and headteacher responses highlighted discrepancies that individual participants may not have been comfortable explicitly stating.

Despite these efforts, access restrictions meant that certain high-level policy actors, such as top-tier MOE strategists or SDM technology developers, were not directly interviewed, limiting insights into the political and economic drivers behind SDM policymaking. Future research could address this by conducting anonymous digital surveys with policymakers or leveraging Freedom of Information (FOI) requests to obtain internal SDM reports, allowing for deeper analysis of decision-making rationales.

Data Reliability and Self-Reporting Biases: The Politics of Institutional Narratives

As with any qualitative research that relies on interviews and focus groups, self-reporting bias was an inherent limitation, particularly in how different institutional actors framed their engagement with SDM. Government officials tended to emphasise SDM's policy benefits, while school-level actors highlighted operational burdens, resource constraints, and bureaucratic inefficiencies.

Moreover, some participants strategically framed their responses to align with institutional expectations, particularly in discussions about data accuracy, reporting compliance, and school autonomy in using SDM systems. While MOE officers claimed that schools were fully trained and equipped for SDM

implementation, headteachers reported feeling unprepared, constrained, and burdened by the system's compliance-driven nature.

To counteract self-reporting biases, I systematically cross-validated verbal statements with observational data and documentary evidence, ensuring that institutional claims were interrogated against ground-level realities. Additionally, non-verbal cues and indirect contradictions in participant responses were critically analysed to identify hidden tensions, policy ambiguities, and unspoken bureaucratic constraints.

However, one methodological limitation that remained unresolved was the inability to access raw SDM usage data, such as log-in frequencies, error reports, or school-level analytics that could have provided empirical validation of SDM adoption trends. Future research could integrate mixed-method approaches, combining qualitative governance analysis with quantitative assessments of SDM functionality and school engagement metrics.

Scope and Transferability: Context-Specific Constraints and Analytical Boundaries

While this study offers theoretical and conceptual insights into digital governance in education, its findings are situated within the socio-political context of Malaysia's centralised education system. Although analytical generalisation enables broader applicability, direct transferability to decentralised education systems or countries with different governance models may be limited.

For example, the inter-agency conflicts, bureaucratic hierarchies, and digital compliance burdens identified in SDM governance are highly relevant to other centralised education systems, such as those in India, South Africa, and Singapore. However, these challenges may manifest differently in federal or decentralised systems, where digital education reforms are driven by regional rather than national agencies (Govinda & Bandyopadhyay, 2011).

To enhance transferability, this study provides rich, thick descriptions of SDM governance dynamics, ensuring that findings can be contextually adapted to

other policy environments. Additionally, the study does not claim direct applicability but instead offers a conceptual framework for analysing governance contradictions, institutional power struggles, and digital transformation paradoxes across different education systems. Future research could strengthen this by conducting comparative case studies in multiple national contexts, examining how different governance models influence digital education policies.

The limitations of this study reflect the complexities of researching digital governance, policy-practice tensions, and institutional power structures in centralised education systems. While methodological triangulation, reflexive engagement, and critical discourse analysis helped mitigate key constraints, access limitations, self-reporting biases, and the absence of quantitative system-level data posed ongoing challenges. However, by acknowledging and critically engaging with these limitations, this study remains transparent in its epistemological boundaries, reinforcing the need for further interdisciplinary, longitudinal, and mixed-method research on digital education governance.

Rather than viewing these limitations as weaknesses, this study positions them as sites for further inquiry, ensuring that future research continues to deepen, expand, and refine the understanding of digital governance in education systems worldwide.

Chapter 4 Structural Findings — The Compliance Cycle Trap in SDM Governance

4.1 Introduction

This chapter presents the structural findings of the study, based on document analysis, semi-structured interviews, consultation, and focus group sessions. The analysis critically examines the extent to which School Data Management (SDM) in Malaysia functions as an enabler of educational improvement or is trapped in a cycle of compliance and performance reporting that reinforces systemic inefficiencies.

The findings reveal that SDM, while conceptually linked to data-driven decision-making as outlined in the Malaysia Education Blueprint (MEB) 2013-2025, has been operationalised primarily as a top-down mechanism for monitoring compliance. Instead of empowering school-level decision-making, SDM is embedded in a *compliance cycle trap*—a repetitive loop of data collection, reporting, and evaluation that prioritises administrative outputs over educational outcomes. Despite policy narratives advocating for decentralised school autonomy, structural contradictions persist: central authorities retain control over data metrics, evaluation criteria, and platform design, leaving schools with limited agency in how data is interpreted or used.

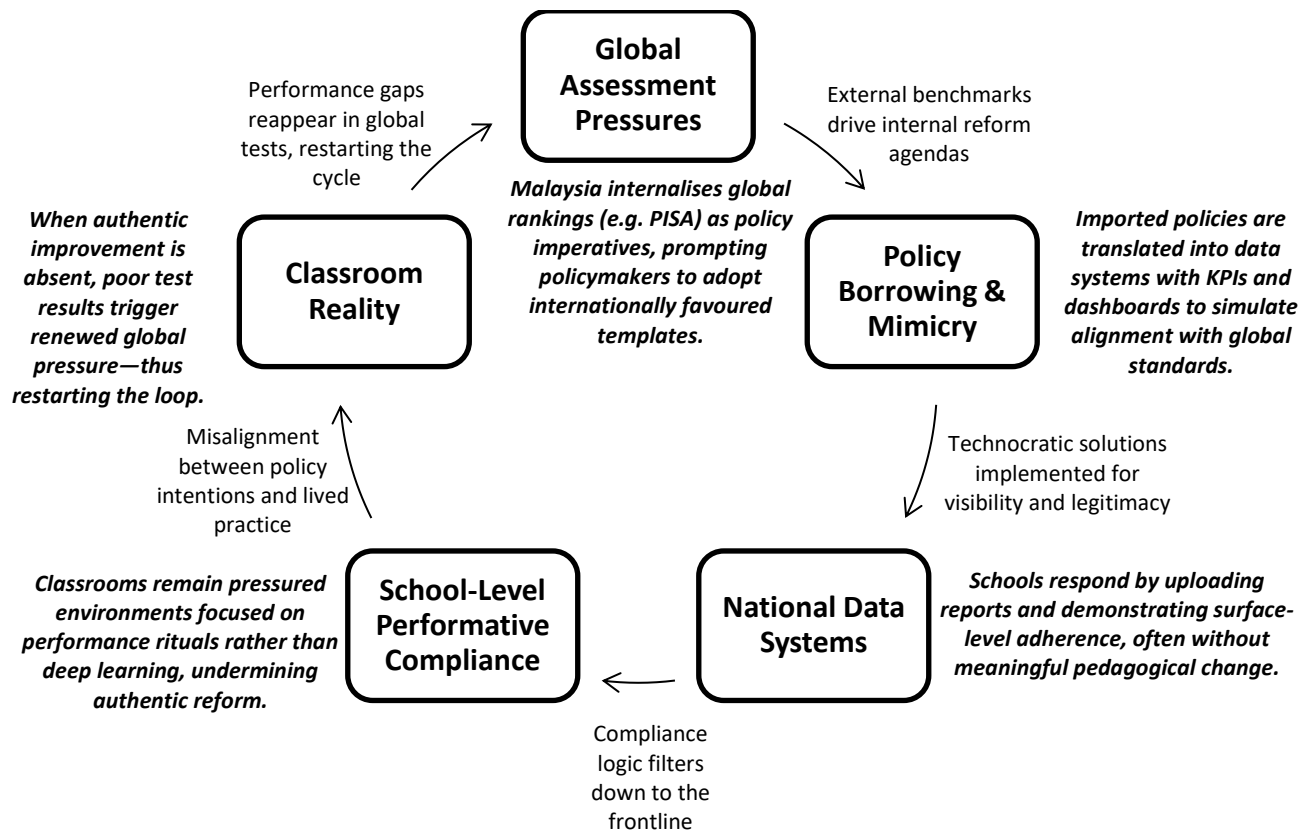


Figure 4-1 The Compliance Trap Cycle

The diagram above illustrates how Malaysia's education system becomes locked in a loop of performative compliance rather than genuine school improvement. The cycle begins with external pressures from global benchmarks like PISA and TIMSS, which drive policy mimicry through borrowed frameworks and national blueprints. These translate into the development of centralised data systems that emphasise visibility and surveillance over substance. As this filters down to schools, leaders and teachers feel compelled to perform through superficial documentation and token initiatives, prioritising alignment with central expectations. Consequently, real classroom practices remain stagnant, and student learning needs are neglected. Though the system appears to function well on dashboards, the underlying issues of disengagement and inequity persist — hidden behind the illusion of progress.

This trap is exacerbated by fragmented inter-agency governance. The exclusion of MAMPU—despite its role in national data governance—from SDM policymaking reflects a deeper political resistance to collaborative oversight. As a result, overlapping mandates between MOE, DEOs, and MAMPU generate policy

incoherence and hinder the creation of an integrated data ecosystem. Instead of fostering synergy, the SDM network operates in silos, with each agency guarding its own domain.

Technological systems such as IDME and MOEIS have been introduced as solutions to these governance challenges, yet they are often underfunded, poorly integrated, and misaligned with school-level realities. The emphasis on digital compliance—rather than digital enablement—signals a broader pattern where technology is deployed to reinforce bureaucratic control rather than support adaptive governance.

Ultimately, the findings suggest that SDM in Malaysia is caught in a cycle where compliance overshadows purpose. Rather than functioning as a transformative governance tool, SDM reproduces existing hierarchies and operational inefficiencies. This chapter unpacks these systemic tensions by exposing the *infostructural* (governance, policy, agency) and *infosystemic* (technological and institutional) misalignments that constrain SDM's potential as an enabler of meaningful, school-centred decision-making.

4.2 Infostructural Challenges: Inter-Agency Data Flows

The findings revealed that inter-agency data flows within Malaysia's SDM landscape are highly fragmented, leading to inefficiencies and conflicts between key agencies. While policy documents emphasise the importance of integrated data management, the study finds that bureaucratic competition, unclear authority lines, and conflicting mandates hinder effective data sharing and coordination.

The term *infostructure*, synthesised from Zurkowski (1984) and Mutch (2010), refers to the structural and organisational elements that support the movement and utilisation of information across an educational system. In Malaysia, SDM's infostructural challenges are deeply rooted in historical governance structures that prioritise top-down control over collaborative decision-making. As a result, the findings indicate that instead of facilitating efficient data-driven decision-making, SDM has inadvertently become an additional layer of administrative burden.

A critical examination of agency interactions reveals that MOE, DEOs, and MAMPU often operate in silos, leading to redundant data collection processes, misaligned priorities, and conflicting reporting requirements. The study uncovered that power asymmetries between agencies further exacerbate inefficiencies, as decision-making authority remains concentrated within MOE, leaving regional and district education offices with little autonomy to customise SDM implementation based on local needs.

Additionally, findings suggest that the technical infrastructure supporting SDM is unevenly distributed. While some agencies possess state-of-the-art data management systems, others rely on outdated, disconnected platforms. This digital divide reinforces disparities in data accessibility and usability, creating an unequal playing field for stakeholders responsible for educational governance.

Furthermore, the study questions the political motivations behind SDM implementation, arguing that data management has become a tool for performance surveillance rather than a mechanism for educational improvement. Interviewees highlighted cases where data was manipulated to align with policy targets rather than reflect actual school performance, raising concerns about the integrity and reliability of SDM-generated insights.

In this context, this section critically analyses three major infostructural challenges: (1) collaboration struggles, (2) conflicting directives, and (3) resource allocation disparities. These challenges not only hinder effective data utilisation but also perpetuate bureaucratic inefficiencies, ultimately undermining SDM's potential as an enabler of evidence-based educational policymaking.

4.2.1 Struggles in Collaboration

A major barrier to effective SDM implementation is the lack of collaboration between agencies, particularly between MAMPU and MOE. The findings indicate that, rather than fostering cooperative partnerships, inter-agency relations are characterised by territorial disputes, bureaucratic inertia, and power struggles. The resistance to collaboration is not simply a matter of logistical inefficiencies

but reflects deep-seated institutional rigidities that prioritise administrative hierarchy over functional cooperation.

An officer from MAMPU shared experiences that highlight significant collaboration difficulties between MAMPU and MOE concerning the flow of information crucial for effective inter-agency operation, particularly in handling school data and subsequent intervention strategies. The officer detailed an instance where meeting minutes were supposed to be communicated to the director, who was then responsible for briefing the officers involved in disseminating the information. However, resistance from the officers and passive leadership from the director led to the failure of this communication process.

This incident exemplifies the toxic work culture within inter-agency collaboration, where delegation is confused with delegation of responsibility—tasks are shifted downward, but accountability remains ambiguous. The findings further suggest that MOE officers only recognise external agencies like MAMPU when they need assistance but resist taking instructions from them, reinforcing the perception of collaboration as a one-way process rather than a reciprocal partnership.

“Most MOE officers only give us authority to help them resolve their problems or reduce their workload, but they struggle to accept instructions from us. I have been asked to attend management meetings. Upon my return, I sent out meeting minutes to the director, who then asked us to provide a briefing to officers for disseminating the information. However, during the meeting, they resisted our instructions. Despite it being a collaborative task, the director remained silent. In the end, we ended up doing all the work. We already had our own tasks, and we also helped complete the work of officers. When it came to working together, they resisted. This toxic work mentality is what we experience.”

(MAMPU Officer 4, Focus Group Transcription, 23 May 2023, Melaka)

This perspective raises fundamental questions about authority, power dynamics, and accountability in inter-agency collaboration. If collaboration is merely used as a mechanism for offloading responsibility without meaningful shared ownership, SDM’s structural inefficiencies will persist. Furthermore, passive leadership within agencies exacerbates the problem, as officers lack the

necessary guidance or intervention from senior officials to facilitate smoother cooperation.

The findings suggest that without a shift towards a more participatory and transparent collaboration model, SDM will continue to face bureaucratic bottlenecks and internal resistance. A restructuring of inter-agency relations—one that establishes clear mandates, mutual accountability, and shared incentives—is necessary to transform SDM from a fragmented bureaucratic exercise into a genuinely data-driven governance tool.

4.2.2 Conflicting Directives

The lack of coordination between agencies has not only hindered collaboration but has also led to conflicting directives that disrupt SDM processes at multiple levels. These conflicts stem from power struggles between MOE, DEOs, and SEDs, creating a policy environment where schools are burdened with contradictory requirements. Instead of fostering a streamlined data governance model, the system reinforces confusion, redundancy, and frustration among educators and administrators.

The study found that teachers and school administrators are often caught in the crossfire of these conflicting directives. MAMPU officers, despite their involvement in data governance, are frequently excluded from critical decision-making discussions, leading to misaligned expectations regarding responsibilities. This results in a cycle of inefficiency, where teachers receive training on ICT systems but still rely on MAMPU for implementation, as highlighted by MAMPU Officer 3:

"It's strange that most teachers or officers who attended ICT and data management courses end up seeking our help when they returned. Even though they attended the courses, we should be the ones learning from them, but it often turned out the opposite way."

(MAMPU Officer 3, Focus Group Transcription, 23 May 2023, Melaka)

This situation highlights the fundamental gap between policy design and execution. While training and capacity-building efforts exist on paper, the lack

of cross-agency collaboration renders them ineffective in practice. The study also found that school-level data responsibilities are frequently shifted onto MAMPU officers, despite their role being primarily advisory rather than operational. This discrepancy reflects a broader structural failure to define inter-agency roles clearly.

Further complicating matters is the decentralised power structure at the state and district levels, which often results in competing data management systems. As MAMPU Officer 5 recounted:

"Any changes depend on the leaders at the top because our system is centralised. What the top leaders want, the subordinates will follow. What is worrisome is when a SED wants A, but a DOE wants B, and in the end, the schools are confused."

(Focus Group Transcription, 23 May 2023, Melaka)

The study also found clear instances where conflicting directives directly burdened teachers, leading to unnecessary duplication of tasks. MOE Officer 1 observed:

"While the MOE establishes a directive to use the existing web application system to collect data from schools, there are also directives at the SEDs and DEOs levels for teachers to manually submit student achievement data using Microsoft Excel. This (situation) has affected the workload of teachers as the MOE aims to reduce it, but DEOs and SEDs seem to add to their workload. It's like teachers have to do the same task twice."

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

These findings suggest that until clear lines of authority, accountability, and inter-agency cooperation are established, SDM will continue to function in a state of disarray, where administrative burdens override its intended benefits as an enabler of data-driven decision-making.

4.2.3 Poor Resource Allocation

The discussion of resource allocation highlights deeper inefficiencies within Malaysia's SDM framework, particularly the political nature of funding distribution and the lack of transparency in budgetary decision-making. While MOE retains ultimate control over SDM-related resources, its centralised power structure often leads to inefficient allocation, duplication of investments, and an over-reliance on external vendors rather than internal expertise.

Findings indicate that rather than prioritising sustainable capacity-building, both MOE and MAMPU favor procurement-driven solutions. This reliance on contract-based systems, rather than optimising in-house talent, raises concerns about long-term cost efficiency and the actual effectiveness of SDM investments. As MAMPU Officer 3 expressed:

"I believe this issue applies not just to the MOE but also to MAMPU's planning division. Both agencies tend to prefer purchasing systems from external contractors or vendors rather than utilising the expertise of their own officers. I know many friends who can develop better systems than the current ones, but since it's not their official job and the planning division doesn't make an effort to identify talent internally, their skills go to waste. However, I understand that purchasing is a business aspect. I don't want to delve deeper into this."

(MAMPU Officer 3, Focus Group Transcription, 23 May 2023, Melaka)

This preference for outsourcing over internal development suggests a structural inefficiency in policy implementation, where SDM reforms are treated as short-term projects rather than long-term capacity-building efforts. The study also found that budget allocations for SDM projects lack consistency and follow-through, resulting in disjointed funding cycles that hinder the continuity of data-driven initiatives.

As MAMPU Officer 6 noted:

"We have raised this issue in meetings and included it in reports, but there has been no action taken (sighed and took a long breath). Even if we receive feedback, it's always the same response that there is no

additional allocation. However, suddenly we hear about plans to purchase new systems, and then funding becomes available."

(MAMPU Officer 6, Focus Group Transcription, 23 May 2023, Melaka)

These inconsistencies in funding allocation suggest that decision-making on SDM investments is often reactive rather than strategic. The lack of a coherent national funding model for SDM raises serious concerns about the sustainability and effectiveness of data governance strategies. Unless budgetary planning prioritises long-term investment in human capital, infrastructure, and operational efficiency, Malaysia's SDM landscape will remain dependent on short-term technological fixes that fail to address systemic governance issues.

4.3 Infosystemic Challenges: Interconnected Data Systems

The findings also revealed the complexities of infosystemic issues within SDM, highlighting the misalignment between technological systems, policy frameworks, and human interaction. Infosystemic challenges emerge from structural inefficiencies in data collection, management, and analysis, often leading to disjointed decision-making, system redundancies, and inconsistent implementation.

Drawing insights from MEB annual reports, policy documents, and agency feedback, this section critically examines whether Malaysia's SDM systems genuinely serve as enablers of data-driven decision-making or merely add another layer of bureaucratic complexity. The study found that while digital platforms exist to centralised school data, their actual implementation is fraught with usability issues, poor integration, and resistance from key stakeholders.

The term infosystemic, as synthesised from Camarinha-Matos and Afsarmanesh (2003) and Orlikowski and Robey (1991), refers to the technological and procedural systems used to collect, manage, and analyse data within the educational sector. While these systems are intended to streamline decision-making, their effectiveness is often undermined by misalignment with policy objectives and inadequate human-technology interaction.

Key issues identified within infosystemic challenges include:

- a. **Policy-system alignment:** The degree to which technological systems and data management practices align with broader educational policies and objectives. The findings suggest that policy directives are often detached from the realities of technological capabilities, leading to systems that fail to meet actual user needs.
- b. **Human-tech interaction:** The relationship between teachers, administrators, and policymakers with SDM systems. Findings indicate that poor training, lack of incentives, and resistance to new technologies significantly limit the practical usability of SDM platforms.

This section critically evaluates whether current SDM systems contribute to improved data governance or act as another bureaucratic tool that increases administrative burdens. The findings indicate that without meaningful reform in both policy alignment and human engagement with SDM technologies, infosystemic inefficiencies will continue to persist. The next sections will further analyse how these disconnects manifest in the practical implementation of SDM and their impact on decision-making processes.

4.3.1 Policy-System Alignment

Analysis highlights critical flaws in policy-system alignment, particularly within the MEB. While the MEB provides analytical, operational, and political frameworks for SDM (Wu et al., 2015), the study reveals significant disconnects between its stated objectives and the realities of implementation.

One of the most glaring issues is the exclusion of key public agencies from SDM policy narratives. Notably, MAMPU is absent from annual MEB reports, despite its central role in public data governance through the Public Sector Open Data (PSOD) policies. This omission raises concerns about the coherence and inclusivity of SDM governance, as it suggests a lack of cross-agency integration in policy formulation.

Furthermore, the study found that policy directives often overestimate the technological readiness of SDM stakeholders, assuming seamless system adoption despite clear infrastructure and capacity gaps. While the MEB positions SDM as a strategic enabler of data-driven decision-making, its failure to align with on-the-ground realities results in a policy-practice gap that exacerbates inefficiencies.

This section critically evaluates whether MEB's policy-framework is designed for genuine systemic reform or primarily serves as a performative bureaucratic document. Findings suggest that unless SDM policy integrates all relevant stakeholders—including agencies like MAMPU—systemic misalignment will persist, leading to fragmented governance and ineffective data utilisation.

Network Analysis of the MEB as Capacity Enabler

The MEB is positioned as a key enabler of data-driven decision-making, yet its implementation highlights critical challenges in network connectivity, authority distribution, and bureaucratic bottlenecks. While the MEB aims to enhance data accessibility and operational efficiency, its centralised nature limits grassroots flexibility, leading to a disconnect between top-down policymaking and on-the-ground realities.

At the core of MEB's strategy is the development of a unified database that consolidates educational data across various levels of the system. This database is intended to provide real-time updates on key performance indicators (KPIs) for schools, districts, and states. However, findings suggest that instead of democratising access to data, the system reinforces central control, limiting how schools and districts engage with data for localised decision-making.

Furthermore, while the Blueprint claims to reduce administrative burdens on educators, the study finds contradictory evidence where teachers report increased workloads due to redundant data entry requirements. Rather than streamlining data collection, the system has created layers of bureaucracy, adding to the very inefficiencies it was meant to eliminate.

“The plan claims to reduce paperwork for teachers, but in reality, it adds another layer of responsibility. Instead of focusing on teaching,

we are spending more time inputting data into multiple platforms that don't communicate with one another.”

(Headteacher, Consultation Session, 15 March 2023, Terengganu)

A major component of the MEB's infosystem is 1BestariNet, the principal platform for integrating educational data. While initially designed to facilitate a seamless digital transformation in schools, its implementation has faced persistent connectivity issues, limited user adoption, and misalignment with existing school practices. The MOE's documentation (2013, pp. 6-8) outlines a vision for universal access to digital tools, but in reality, resource disparities across schools hinder equitable usage.

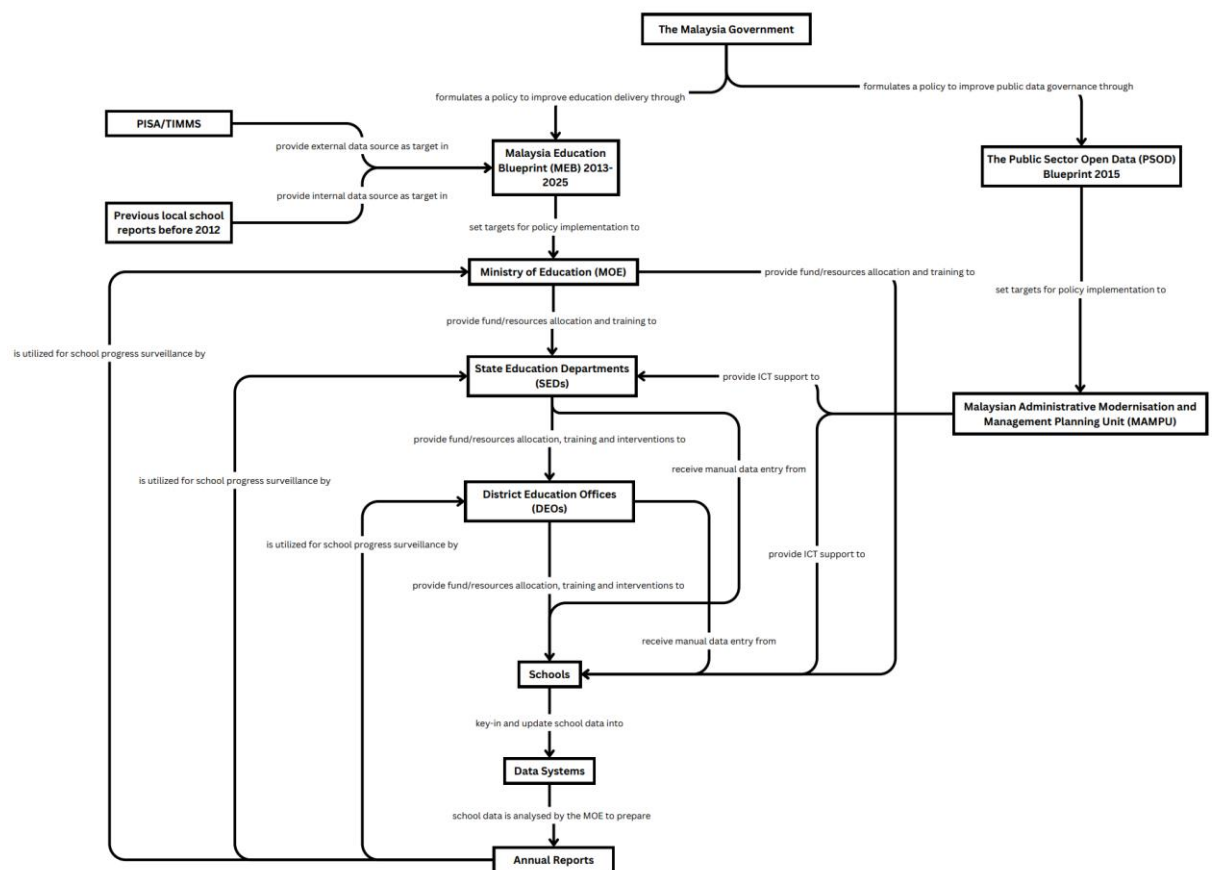


Figure 4-2 Network Analysis Findings of SDM in Malaysia

The network analysis findings (see Figure 4.1) of the Malaysian education data governance framework reveals a hierarchical yet fragmented system, where policy directives flow downward from central government entities, while data flows upward from schools with little room for modification at intermediate levels. At the top of the network, the Malaysian Government formulates key policies such as the MEB 2013-2025 and the Public Sector Open Data (PSOD) Blueprint 2015. These policies establish the groundwork for educational reforms and public data governance, setting broad targets that must be implemented by state and district education offices (SEDs and DEOs).

At the MOE level, resources, funding, and training initiatives are disseminated downward to SEDs and DEOs, which are tasked with ensuring school compliance with data reporting mandates. While this centralised approach allows for standardised monitoring, it fails to account for localised challenges, leaving schools burdened with uniform policies that may not fit their specific needs.

A critical component of this network is MAMPU, which is mandated with overseeing public data governance through the PSOD Blueprint 2015. Despite its role, MAMPU's involvement in SDM remains marginal, highlighting a misalignment in inter-agency cooperation. While MAMPU ensures that data governance practices align with national objectives for transparency and efficiency, its exclusion from key education frameworks like MEB suggests a disconnect between educational data management and broader national data policies.

Additionally, external data sources such as PISA/TIMSS reports and historical local school data are incorporated into national policy targets. However, these integrations are often perceived as tokenistic, with insufficient adaptation to contextual needs. The findings suggest that instead of fostering genuine data-driven governance, the system prioritises compliance over strategic usage of insights.

The MEB frame SDM as Data Surveillance Over Goal Achievement

The MEB presents SDM as a mechanism for performance oversight rather than a transformative tool for educational improvement. Through its annual reports from 2013 to 2020, the MEB consistently emphasises data visualisation and

analytics as means to enhance transparency and accountability. While this approach positions data as a driver of evidence-based decision-making, findings indicate that the practical application of SDM has leaned heavily toward performance monitoring rather than fostering meaningful educational progress.

A key narrative in the MEB reports is the highlighting of success stories and targeted interventions that have yielded positive results. These narratives showcase improved student outcomes and school performance metrics, reinforcing the perception of SDM as a functional enabler of educational excellence. However, a critical review of these reports reveals an underlying issue—the lack of robust analysis of areas where targets were not met. While the reports regularly highlight achievements, they seldom offer in-depth analysis of systemic failures. The absence of detailed explanations for missed targets raises concerns about whether SDM is being leveraged for genuine problem-solving or merely as a compliance tool.

One recurring issue is the absence of comprehensive discussions on the root causes of educational challenges. While the reports acknowledge gaps in policy implementation, they fail to provide an evaluative framework to dissect these shortcomings. This lack of critical analysis restricts stakeholders from understanding systemic inefficiencies, ultimately limiting their ability to develop targeted solutions. Without a deeper examination of policy failures, SDM risks becoming an instrument for justifying existing educational strategies rather than a tool for continuous improvement.

A particularly concerning discovery is the disappearance of MEB reports for 2021 and 2022 from the MOE's website (see Table 4.1). Given that these reports serve as key performance indicators for educational progress, their absence raises serious questions about data continuity and institutional transparency. The lack of publicly available reports disrupts the ability of policymakers, educators, and researchers to assess the trajectory of education reforms, further complicating decision-making at multiple levels of governance. The absence of up-to-date reports also suggests a breakdown in systematic data collection and reporting mechanisms within the MOE, signaling deeper governance inefficiencies that must be addressed.

Table 4.1 Progress Status of Goals in the MEB

Period	Goals	Current Trajectory	Commentary
2013 - 2016	<ul style="list-style-type: none"> - Achieve 100% literacy in Bahasa Malaysia (BM) and numeracy after 3 years of schooling. - Position Malaysia's performance at par with the international average in the next Trends in TIMSS and PISA cycles. 	<ul style="list-style-type: none"> - SPM Examination (BM): 68.9% (2016) - SPM Examination (English): 76.4% (2016) - PISA Scores (2012 and 2015): Below average OECD scores in numeracy, literacy, and scientific literacy. - TIMSS (2011): Mathematics (440), Science (426) 	<ul style="list-style-type: none"> - Lack of data transparency for the percentage of students passing the SPM examination in Bahasa Malaysia and English for the years 2013 to 2015. - PISA scores below average OECD scores indicate a performance gap. - The absence of data regarding the urban-rural gap, socio-economic gap, and gender gap limits the evaluation of equity and inclusiveness in education.
2016 - 2020	<ul style="list-style-type: none"> - Ensure 100% preschool to lower secondary enrolment. - Achieve a 50% reduction in the urban-rural gap and a 25% reduction in socio-economic and gender gaps. 	<ul style="list-style-type: none"> - SPM Examination (BM): 72.2% (2017), 76% (2018), 77.7% (2019), 76.9% (2020) - SPM Examination (English): 79.1% (2017), 79.4% (2018), 80.5% (2019), 80.1% (2020) - TIMSS (2019): Mathematics (461), Science (460) - Enrolment rates showed steady improvement. - Urban-Rural Gap: 2017 (0.47%), 2018 (0.43%), 2019 (0.44%), 2020 (0.38%) - Socio-Economy Gap: 2017 (4.5%), 2018 (3.4%), 2019 (4.1%), 2020 (4.49%) - Gender Gap: 2017 (12.6%), 2018 (11.5%), 2019 (12.1%), 2020 (9.7%) 	<ul style="list-style-type: none"> - The reduction targets for the urban-rural gap, socio-economic gap, and gender gap were not fully achieved, indicating the challenges of substantial reductions. - While enrolment rates improved, there was a decrease in preschool enrolment in 2020, which requires further investigation. - The gender gap reduction is noteworthy, but the socio-economic gap remains significant.
2021 - 2025	<ul style="list-style-type: none"> - Maintain or improve enrolment rates. - Achieve a 50% reduction in socio-economic and gender gaps. 	Data for MEB Annual reports for 2021 and 2022 not available.	<ul style="list-style-type: none"> - Lack of data for 2021 and 2022 limits the assessment and evaluation of current trajectory and progress. - The ambitious targets for socio-economic and gender gap reductions require significant policy adjustments and interventions. - Ensuring equitable access and outcomes for all students, especially in rural and socio-economically disadvantaged areas, remains a complex challenge that requires sustained attention and strategies.

The missing reports highlight several concerns. First, there is a disruption in data governance, as the failure to publish updated reports indicates a lack of consistency in educational monitoring. Second, without access to these reports, policymakers, educators, and the public remain uninformed about the system's current state, hindering informed decision-making. Lastly, the absence of these reports raises speculation about whether unfavorable educational performance metrics are being withheld to maintain a positive policy narrative. Without transparency, the integrity of SDM as a tool for data-driven governance is called into question, potentially undermining trust in the education system's ability to self-regulate and improve.

The study further suggests that SDM is often used to reinforce pre-existing policy narratives rather than critically evaluate policy effectiveness. This performance-driven approach positions SDM as a tool for justifying strategic plans rather than a means of identifying and addressing systemic educational issues. Rather than functioning as an objective analytical mechanism, SDM appears to serve a confirmatory role in policy-making, where the emphasis is placed on meeting targets rather than questioning the efficacy of those targets. If data collection

and reporting processes are structured to validate government narratives rather than identify meaningful areas for intervention, the true potential of SDM to drive educational improvement will remain unfulfilled.

To address these concerns, a more transparent and analytically rigorous approach to educational data management is required. Rather than using SDM as a tool for performance surveillance, stakeholders must advocate for a more inclusive and diagnostic use of data—one that focuses not just on accountability, but also on genuine educational transformation. If SDM is to function as an effective tool for decision-making, it must shift from a compliance-oriented approach to one that prioritises meaningful insights and actionable policy adjustments. Without this shift, SDM will continue to operate as an administrative formality rather than a driver of substantive change in Malaysia's education system.

Deficiency of Interconnectedness in Political Dimension

The examination of political dimensions within the context of policy capacity in SDM in Malaysia reveals a complex and nuanced landscape. Despite the critical role of political considerations in shaping policy success, the intricate interplay between politics and capacity—particularly in data governance—remains poorly understood. This gap is especially evident in public policy documents, which often fail to directly address how political factors impact data-sharing mechanisms and governance structures.

The analysis indicates that political capacity—or the lack thereof—significantly affects the coordination and integration of various agencies responsible for data governance. While Wu et al. (2015) argue that all dimensions of policy capacity, including political, are interconnected, the absence of strong political capacity leads to fragmented data-sharing ecosystems. The study finds that power struggles, bureaucratic inertia, and inter-agency competition hinder effective collaboration, reducing the potential of SDM to function as a tool for improving education governance. Mukherjee et al. (2021) further emphasise that the political component is often the most crucial dimension of policy capacity, as it dictates the allocation of resources, strategic priorities, and inter-agency power dynamics.

Findings from focus group discussions with MOE and MAMPU officers reveal a fundamental disconnect in political coordination between national and regional education offices. An MOE officer shared that many policy decisions made at the federal level do not reflect the realities at the district and school levels, leading to misalignment in data implementation. Similarly, a MAMPU officer expressed frustration over the lack of engagement in decision-making, stating:

“We are tasked with overseeing data governance, yet when key decisions are made, we are often the last to be consulted. The MOE creates policies that assume we will facilitate their execution, but there is little coordination on how to implement them effectively.”

(MAMPU Officer 6, Focus Group Transcription, 23 May 2023, Melaka)

The study further found evidence of conflicting directives across different levels of governance, resulting in duplication of efforts and inconsistent data reporting mechanisms. A District Education Office (DEO) officer highlighted how political priorities often dictate how SDM is implemented, rather than a structured policy framework, stating:

“We receive different instructions depending on which administration is in power. Some leaders push for digital transformation, while others revert to manual data reporting because they don’t trust the system. This inconsistency makes it difficult to create a long-term data management culture.”

(DEO Officer 2, Focus Group Transcription, 15 June 2023, Terengganu)

In the context of public service delivery, policy capacity is essential for navigating institutional limitations and bureaucratic complexities. However, the findings suggest that Malaysia’s SDM landscape suffers from fragmented governance, low mutual trust, and insufficient political support, which in turn stifles effective data integration across agencies. These constraints appear to be deeply embedded in Malaysia’s broader cultural and administrative structures, which prioritise hierarchical control over collaborative governance. As a result, agencies involved in SDM often operate in isolation, reinforcing siloed decision-making and redundant data collection processes.

Findings from document analysis indicate that the MEB's policy structure lacks an explicit political strategy for inter-agency collaboration, leaving individual departments to interpret policies differently, thereby exacerbating fragmentation. The absence of MAMPU from key educational policy discussions, despite its mandate over public sector data governance, is a critical gap that contributes to these inefficiencies.

Despite the importance of political considerations in shaping SDM policy, the intricacies of how political factors interact with capacity-building efforts remain underexplored. This gap in understanding is particularly pronounced in developing countries like Malaysia, where the interconnections between politics, bureaucracy, and education policy are seldom reflected in the existing literature on data governance. The lack of scholarly and policy attention to these issues results in repetitive policy failures, weak enforcement of data governance regulations, and inconsistent implementation of SDM frameworks.

The findings indicate an urgent need for more in-depth research and critical analysis of the political dimensions of SDM policy capacity. Without a clearer articulation of how political dynamics influence data governance, Malaysia's SDM framework risks remaining a fragmented and underutilised tool, rather than a mechanism for meaningful educational reform. By addressing political barriers to effective data sharing and governance, policymakers can create a more interconnected and functional SDM system, ensuring that data-driven decision-making becomes an enabler of educational improvements rather than a bureaucratic exercise in compliance.

Divergence in Policy Narratives

The political dimension of policy capacity in SDM in Malaysia reveals a significant disparity in how SDM is portrayed in internal and external reports. The MEB annual reports provide an optimistic perspective, often emphasising success stories and advancements in SDM while glossing over systemic challenges. This approach, while promoting a positive outlook on education reforms, tends to omit critical discussions on inefficiencies and unresolved issues, limiting the scope for comprehensive policy evaluation and reform.

In contrast, external reports, such as the UNICEF 2020 report, present a more critical and detailed assessment of SDM. These external evaluations highlight persistent gaps in data governance, inter-agency coordination failures, and the practical challenges faced by educators in utilising SDM systems. The divergence in these narratives underscores a fundamental disconnect between internal policy reporting and ground-level realities, suggesting that MEB's documentation serves more as a promotional tool rather than an objective assessment of SDM effectiveness.

Findings from focus group discussions with education officers, school administrators, and policy analysts further validate this discrepancy in narratives. One MOE officer noted:

“Our internal reports focus on meeting KPIs and showcasing progress, but they don't always reflect the challenges we face on the ground. There's a reluctance to highlight systemic problems because it may be perceived as policy failure.”

(MOE Officer 2, Individual Interview, 10 May 2023, Putrajaya)

This sentiment was echoed by school administrators who argued that the MEB's portrayal of SDM implementation is often detached from actual school experiences. An education officer at the district level provided further insight:

“We receive top-down mandates on data reporting, but little guidance on addressing real challenges. Teachers struggle with outdated infrastructure, redundant reporting tasks, and a lack of integration between SDM platforms. These realities rarely make it into official reports.”

(DEO Officer 3, Daily Fieldwork Reflection, 15 June 2023, Terengganu)

The analysis also highlights a critical disconnection between major national data policies. The MEB, despite its ambitious educational reform goals, does not effectively integrate or acknowledge the Public Sector Open Data (PSOD) policy, which is designed to facilitate centralised data sharing across government agencies. The absence of cross-references between MEB annual reports and PSOD documentation suggests that data governance in education is being

developed in silos rather than through an interconnected, multi-agency strategy (see Figure 4.2).

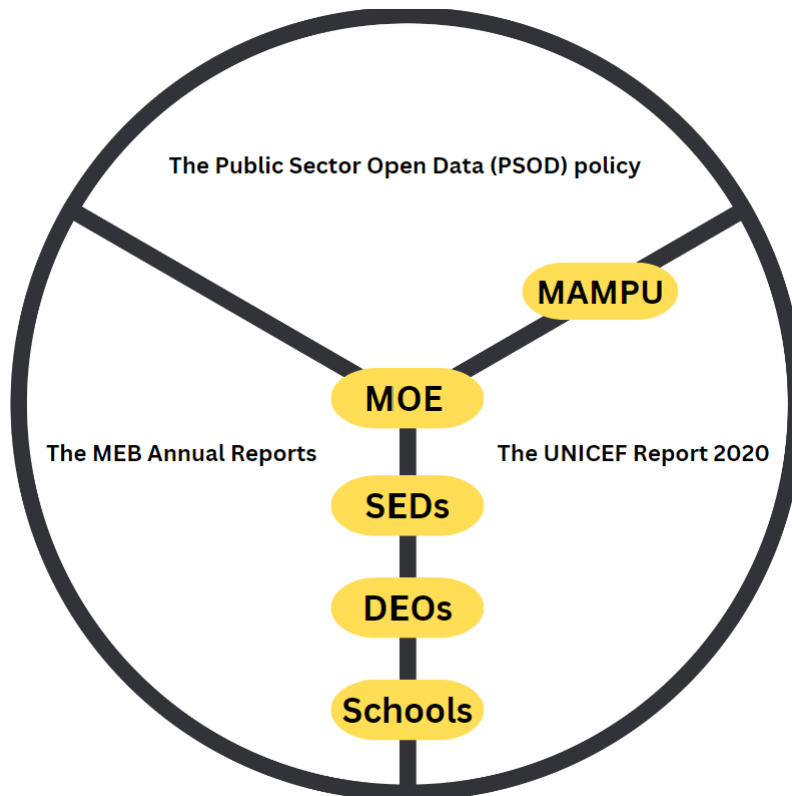


Figure 4-3 Prominent Agencies Identified in Policy Network Analysis

Further reinforcing this fragmentation is the lack of recognition for MAMPU's role in educational data governance. Despite being the primary architect behind PSOD and overseeing public sector data exchange, MAMPU is largely absent from MEB's SDM discussions and reports. The UNICEF 2020 report explicitly acknowledges MAMPU's contributions to education data governance, yet the MEB and its annual reports fail to reference these efforts, creating a significant gap in policy execution.

The exclusion of MAMPU and other key stakeholders from MEB's SDM policy formulation reflects a broader systemic weakness in Malaysia's education policy-making process. The failure to align operational capabilities with institutional roles has led to inefficiencies in SDM execution, redundant reporting structures, and missed opportunities to leverage MAMPU's expertise in improving data governance.

A policy network analysis of MEB annual reports, PSOD documentation, and UNICEF evaluations provides further evidence of these inefficiencies. While MOE-led reports prioritise performance metrics and compliance indicators, external assessments highlight practical implementation failures, such as schools struggling with data entry workloads, incompatible reporting systems, and insufficient training for SDM adoption. These findings suggest that without a unified data governance strategy that includes all relevant agencies, Malaysia's SDM will continue to operate in an inefficient, disjointed manner.

The MEB's 12-year education plan aspires to transform Malaysia's education system, yet its failure to explicitly integrate essential data governance agencies like MAMPU undermines its effectiveness. The siloed approach to SDM policy development prevents meaningful inter-agency collaboration and obstructs a holistic, transparent implementation of education reforms.

This lack of policy cohesion and cross-sectoral engagement significantly limits the potential of SDM as a driver of data-driven decision-making in education. Unless MEB reports begin to provide a more balanced and critical view—one that acknowledges systemic failures alongside achievements—the policy development process will remain reactionary rather than proactive, resulting in continuous cycles of fragmented data management and policy misalignment.

4.3.2 Human-Tech Interaction

The infosystemic challenges in SDM in Malaysia extend beyond policy-system alignment to encompass the critical dynamic between human actors and technological systems. The interaction between educators, administrators, and policymakers with SDM technologies presents both challenges and opportunities, as the effectiveness of digital data governance depends not only on technological infrastructure but also on human adaptability, trust, and technical proficiency.

Technology Adoption

The findings revealed significant challenges in technology adoption, driven by individual factors, generational disparities, and institutional resistance.

Teachers and school administrators exhibit varying levels of engagement with digital tools, with some fully integrating technology into their daily routines, while others struggle to adapt. These challenges contribute to inefficiencies in SDM implementation and limit the effectiveness of digital education governance.

A MAMPU officer highlighted the underutilisation of specific SDM tools, such as the Student Merit System (SSDM), designed to track student contributions and reward positive behaviour. Despite its intended function as an incentive mechanism, many teachers either rarely log in or completely ignore the system, indicating low levels of adoption and engagement:

“I would like to share my opinion about the SSDM application, which is the student character system. This system rewards students with merits in the form of points when they assist teachers. However, in the schools I’ve observed, even the teachers rarely use this system. Some teachers never log in, and only a few specific teachers use it.”

(MAMPU Officer 2, Focus Group Transcription, 23 May 2023, Melaka)

Beyond system-specific underutilisation, the findings suggest that technology adoption is also shaped by generational disparities in digital literacy. While younger teachers are more adaptable to emerging technologies, older school administrators and senior educators tend to exhibit slower learning curves. This discrepancy creates a digital divide within school leadership, where younger educators become the default technology facilitators, while senior officers rely on outdated methods or delegate digital tasks to younger staff:

“I don’t think that the teachers in schools are ready for the emergence of AI in data management. Most likely, teachers, especially those aged 45 and above, have never used AI technology like ChatGPT. This age group is not the TikTok generation. TikTok has many AI effects. So, younger teachers may be more exposed to AI. Younger teachers may learn faster and be able to master AI in their work. But the problem lies in the fact that most top-level management officers and school administrators are aged 45 and above. Age is not the issue, but they tend to be slow in adapting and learning new technologies.”

(MAMPU Officer 2, Focus Group Transcription, 23 May 2023, Melaka)

This generational gap in technology adoption extends beyond artificial intelligence (AI) tools to core SDM functions, such as data analytics and visualisation platforms. A Ministry of Education (MOE) officer emphasised that school administrators often depend on teachers who possess stronger digital skills, creating an over-reliance on tech-savvy educators for routine data management tasks:

“Based on my experience, most school administrators rely on teachers who are proficient in data management. School administrators themselves may have limited skills in managing data, particularly when it comes to using advanced applications. Younger teachers or those who keep up with the latest developments are usually more skilled in utilising tools like Data Studio and Power BI for data management. As for DOEs, SEDs, and the MOE officers, some of them possess data management skills, albeit to varying degrees. Many are able to use Microsoft Excel, but they may be less familiar with newer or current applications. Their exposure to these tools is often limited.”

(MOE Officer 2, Individual Interview Transcription, 19 May 2023, Putrajaya)

The findings suggest that without structured digital training initiatives and continuous professional development programs, the adoption of SDM technologies will remain uneven and inconsistent. The digital competency gap among education personnel not only slows down technology integration but also reinforces dependency on a small group of tech-savvy educators, limiting the widespread impact of SDM tools. Addressing these issues will require targeted policies that encourage technology training at all levels of the education hierarchy, ensuring that adoption efforts are inclusive, scalable, and sustainable.

Poor Internet Connectivity

Despite ongoing efforts to enhance technology adoption, poor internet connectivity continues to be a significant obstacle in school data management. The findings indicate that limited broadband access and unstable network infrastructure hinder efficient data input, retrieval, and real-time decision-making. This issue is particularly prevalent in rural and underserved areas,

where schools struggle to maintain consistent access to SDM platforms, creating disparities in data availability and accuracy.

A District Education Officer (DEO) highlighted how internet connectivity issues disrupt both administrative and instructional processes, emphasising that even routine data entry becomes a challenge due to frequent system downtimes and slow network speeds:

“The schools in our district face significant difficulties accessing online SDM platforms. Teachers struggle to update student records because the system takes too long to load, and sometimes, they can’t even log in. We are expected to make data-driven decisions, but how can we when the data is either delayed or incomplete?”

(DEO Officer 2, Daily Fieldwork Reflection, 15 June 2023, Terengganu)

This connectivity issue not only hampers real-time data input but also impedes collaboration between schools, district education offices, and the Ministry of Education (MOE). Many educators and officers resort to offline documentation methods, which lead to duplication of work and inconsistencies in data reporting. Another DEO officer described the frustration of teachers who must frequently redo tasks due to system failures:

“When the internet is slow or unavailable, teachers save records manually and try to upload them later. But sometimes, data gets lost in the process, and they have to start over. This affects not just workload but also the accuracy of the records.”

(DEO Officer 3, Daily Fieldwork Reflection, 15 June 2023, Melaka)

The impact of poor internet infrastructure extends beyond administrative inefficiencies. The findings suggest that delayed data entry affects policy decisions, as officials rely on outdated or incomplete information to assess school performance and resource needs. An MOE officer noted that disparities in internet access result in unequal participation in data-driven policymaking:

“Urban schools have no issue updating SDM records in real time, but rural schools lag behind. By the time we consolidate data, some of it is already outdated. This creates an imbalance in decision-making, as we’re working with incomplete information.”

(MOE Officer 2, Individual Interview, 10 May 2023, Putrajaya)

These findings highlight the urgent need for infrastructure investments to improve internet reliability and accessibility in all schools, particularly in rural and underprivileged areas. Without equitable access to stable connectivity, the full potential of SDM platforms remains unrealised, perpetuating inefficiencies in educational governance and decision-making. Addressing this challenge requires a multi-stakeholder approach, involving government agencies, telecommunications providers, and local education offices to develop long-term solutions for improving digital infrastructure across Malaysia's education system.

Data Mismanagement

The findings uncovered significant instances of data mismanagement stemming from human interactions with SDM systems, revealing biases, errors, and deliberate manipulation of educational data. These issues undermine the reliability and integrity of SDM records, ultimately affecting policy decisions and resource allocations.

A Ministry of Education (MOE) officer highlighted that data handling at the district and state levels is sometimes compromised by selective reporting, as District Education Offices (DEOs) and State Education Departments (SEDs) may manipulate data to reflect favorable regional performance. This raises concerns about data accuracy and transparency, particularly during critical periods such as the COVID-19 pandemic:

“There are instances where school data should go directly to the MOE without going through DEOs and SEDs. DEOs and SEDs should only monitor whether the data entry is taking place and if the submission is happening correctly. The focus should be on ensuring that teachers enter the data, and DEOs and SEDs should supervise this process. However, there are cases where the data sent by schools through DEOs or SEDs doesn't reach the ministry. This (situation) leads to the MOE making decisions based on inaccurate data. A recent example is during the online learning period in the pandemic, where DEOs and SEDs reported that online learning was implemented well. However, feedback from parents on social media indicated otherwise. I can only speculate that some DEO and SED officers filtered the data to portray

their regions as better in managing education during the pandemic.”

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

This example illustrates how selective reporting can distort national education assessments, creating misleading representations of policy effectiveness. The misalignment between official reports and actual experiences on the ground highlights the fragility of data accuracy when subjective human intervention is involved.

Beyond intentional data filtering, data mismanagement also occurs due to misclassification errors and inadequate oversight in eligibility determinations. A MAMPU officer provided an example of how flawed data classification affected educational assistance programs, where parents without salary statements were incorrectly categorised as impoverished:

“Allow me to elaborate further. While assisting a DOE officer in managing student affairs data in district A, I observed inefficiencies in data management for providing educational assistance to students. The problem arises when parents do not have salary statements. Typically, officers categorise parents without salary statements as eligible for assistance. This is a mistake. The absence of salary statements does not necessarily indicate that the parents are poor. Self-employed parents, for example, do not have salary statements despite potentially earning tens of thousands of ringgit. This is unfair. The issue lies not with the data itself but with how we manage it.”

(MAMPU Officer 4, Focus Group Transcription, 23 May 2023, Melaka)

This finding highlights systemic weaknesses in how eligibility data is interpreted and applied, demonstrating how administrative assumptions lead to misallocation of resources. Such errors in classification compromise the effectiveness of aid distribution, reinforcing inequities rather than addressing them.

The study suggests that data mismanagement in SDM is not solely a technological issue but is deeply rooted in human decision-making processes. Errors arise not

only from deliberate manipulation but also from poor understanding of data categorisation principles, lack of validation mechanisms, and bureaucratic inefficiencies. Without standardised protocols for data verification and enhanced accountability measures, the integrity of SDM as a reliable decision-making tool remains compromised.

Addressing these challenges requires greater transparency in data governance, stricter enforcement of verification processes, and independent auditing mechanisms to ensure that educational policies are informed by accurate, untampered data rather than politically motivated adjustments. Strengthening data literacy among officers responsible for SDM implementation is also crucial in mitigating human-induced errors and improving the overall reliability of the education data ecosystem.

4.3.3 Enablement of Advocated Approaches

Despite the persistent infostructural and infosystemic challenges in SDM, the findings reveal that officers across various agencies have identified key strategies to enable more effective implementation of SDM. These advocated approaches represent proposed solutions based on their expertise, experience, and direct engagement with SDM challenges. The strategies emphasise external regulatory mechanisms, capacity-building initiatives, effective communication channels, leadership strategies, and robust policy governance frameworks as critical enablers for overcoming systemic obstacles.

The study aligns these proposed strategies with the concept of enablementism, which suggests that human behaviour and social dynamics are not merely determined by external constraints but also shaped by the possibilities created within structural conditions (Valsiner, 2014). In this context, the advocated approaches leverage the interplay between technology and human agency, demonstrating how organisational and technological structures can be optimised to empower stakeholders rather than limit them.

External Regulatory Oversight

The proposal for an auditing body at the parliamentary level reflects a critical shift toward greater transparency, accountability, and systemic enablement in SDM. Findings from interviews with MOE officers highlight that current oversight mechanisms are fragmented, with limited authority and enforcement power at different administrative levels. This lack of centralised regulatory oversight creates disparities in data compliance, inconsistencies in reporting, and opportunities for mismanagement.

The study suggests that the establishment of an independent parliamentary auditing body would strengthen SDM governance by introducing rigorous evaluation standards, ensuring that data integrity is maintained from the school level to national decision-making processes. The MOE officer advocating for this measure explained:

“By having an auditing body at the parliamentary level, agencies involved in school data management would be subject to rigorous scrutiny and evaluation, thereby promoting accountability and enhancing trust in the integrity of data management processes.”

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

This proposal aligns with enablement principles, where systemic conditions must be established to facilitate the effective use of SDM for decision-making rather than merely enforcing compliance. The study finds that existing internal auditing bodies, such as the Education Performance and Delivery Unit (PADU) and Jemaah Nazir, lack jurisdiction over inter-agency coordination, which limits their ability to address discrepancies between MOE, State Education Departments (SEDs), and District Education Offices (DEOs).

The absence of centralised regulatory oversight has led to inconsistencies in data handling, with some agencies prioritising bureaucratic performance metrics over meaningful data-driven improvements. A DEO officer commented on this issue:

“We follow whatever directive is given to us, but without a uniform auditing body, data standards are applied differently across districts. Some offices emphasise data accuracy, while others focus on meeting

reporting deadlines, even if it means submitting incomplete or estimated data.”

(DEO Officer 1, Daily Fieldwork Reflection, 15 June 2023, Terengganu)

These inconsistencies compromise the reliability of SDM as a tool for evidence-based policymaking, reinforcing the need for external regulatory oversight to ensure standardisation, uniform enforcement, and equitable resource allocation.

Moreover, findings indicate that introducing an auditing body at the parliamentary level would require significant legal and administrative reforms, particularly amendments to the Education Act. While the MOE officer acknowledged the challenges of legislative approval, the potential long-term benefits of institutionalizing SDM oversight at the highest level far outweigh the procedural barriers:

“We need an auditing body that can oversee implementation at the SEDs and DEOs levels, transcending the MOE, SEDs, DEOs, and schools. The audit report should be presented to Parliament. While MOE already has the Education Performance and Delivery Unit (PADU) and Jemaah Nazir, their authority is limited due to the division of work boundaries between the MOE, SEDs, and DEOs. Establishing such a body would require approval at the highest level and amendments to the Education Act in Parliament.”

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

The study further highlights that a robust external oversight mechanism would not only enhance compliance but also create an enabling environment where SDM serves its intended purpose of improving educational governance. Without external checks and balances, SDM risks becoming a performative tool rather than a substantive driver of data-driven reforms.

Thus, the proposed auditing body at the parliamentary level represents a transformative step toward enabling a transparent, accountable, and standardised SDM framework. Ensuring multi-agency participation and aligning oversight mechanisms across all levels of governance would mitigate

inconsistencies, enforce best practices, and restore confidence in the credibility of SDM data.

Cross-Agency Capacity Building

The findings highlight that cross-agency capacity building is a critical enabler of effective SDM, particularly in fostering collaborative knowledge sharing and skills enhancement. The MAMPU officers emphasised the pressing need for structured, inclusive training programs that reach beyond top-level management to frontline officers and practitioners who are responsible for the daily execution of SDM initiatives.

A fundamental gap in capacity-building initiatives is the hierarchical approach to training, where only senior officers attend courses on new technologies such as artificial intelligence (AI), ICT systems, and data analytics, leaving implementation officers with limited exposure to these advancements. As a MAMPU officer pointed out, this top-heavy knowledge distribution model results in an inefficient trickle-down effect, where only a fraction of the acquired knowledge is transferred to those directly engaging with SDM systems:

“Typically, if there are new courses or training on AI, only top-level management officers will attend. Then it is the lower-level officers who have to implement it. Usually, only 50% of the knowledge and skills are shared by the planning officers with the implementation officers. It would be more appropriate to provide training to the officers involved in the implementation phase so that we can be prepared. This is important because for any issues at the state level, teachers and officers will refer to us. They won’t refer to officers in Putrajaya.”

(MAMPU Officer 3, Focus Group Transcription, 23 May 2023, Melaka)

This disconnect between planning and execution limits the effectiveness of SDM adoption and adaptation, as those who are directly engaging with SDM tools lack adequate training and hands-on experience. Moreover, excluding key agencies such as MAMPU from MOE-led training programs further exacerbates the siloed nature of data management practices, reducing opportunities for integrated problem-solving and cross-agency collaboration.

“MOE does provide training or short courses for us, but they are usually general courses like language, integrity, and communication. Moreover, these courses are conducted online. I haven’t attended any courses specifically related to ICT and data management so far. I’ve been searching, but they haven’t been offered yet. Maybe they assume that we are already knowledgeable and proficient in ICT, systems, and data. However, we also need to enhance our knowledge and skills because technology is advancing, and if we fall behind, we will be at a disadvantage.”

(MAMPU Officer 6, Focus Group Transcription, 23 May 2023, Melaka)

This statement underscores the critical need for targeted, role-specific capacity-building programs that ensure continuous skill enhancement and technological adaptation. The study suggests that effective enablement requires training models that empower all levels of stakeholders, not just high-ranking officials. Without inclusive training, the full potential of SDM technologies remains unrealised, and the system continues to operate with inefficiencies.

Moreover, the lack of structured capacity-building programs creates disparities in SDM implementation across different regions, leading to variations in data accuracy, system usability, and reporting consistency. The findings indicate that MOE’s assumption that certain agencies, such as MAMPU, possess innate ICT proficiency overlooks the evolving complexities of SDM systems, which require constant upskilling to keep pace with technological advancements.

By integrating cross-agency training initiatives, enabling multi-level participation in digital competency programs, and ensuring structured knowledge dissemination, SDM can transition from a bureaucratic reporting tool to a functional, data-driven decision-making mechanism. The study emphasises that capacity building should not be seen as an isolated function but as a continuous, adaptive process that evolves with technological changes and operational demands.

Therefore, cross-agency capacity-building programs must be restructured to include all relevant stakeholders, ensuring equitable access to training, fostering inter-agency coordination, and equipping officers with the necessary expertise to effectively manage and utilise SDM systems. Without these measures, the gap

between technology availability and actual implementation will persist, hindering SDM's potential as an enabler of educational improvement and policy efficiency.

Inter-Agency Communication Channels

The findings suggest that ineffective inter-agency communication is a major barrier to enabling SDM as a functional governance tool. Despite repeated discussions and documentation of issues, stakeholders often encounter delays, misinterpretations, and a lack of concrete follow-up actions, which impede the resolution of systemic challenges.

A MAMPU officer expressed frustration over how inter-agency communication fails to translate into meaningful policy adjustments or resource allocations. The officer highlighted the disconnect between discussions in official meetings and the actual implementation of solutions, pointing out that despite formal documentation of challenges, little action is taken:

“We have raised this issue in meetings and included it in reports, but there has been no action taken. Even if we receive feedback, it's always the same response that there is no additional allocation. However, suddenly we hear about plans to purchase new systems, and then funding becomes available.”

(MAMPU Officer 6, Focus Group Transcription, 23 May 2023, Melaka)

This statement reflects a deeper structural issue in SDM governance, where decision-making processes lack transparency and coordination, resulting in inefficiencies in resource distribution and Prioritisation. The inconsistent flow of information between agencies not only delays problem resolution but also fosters frustration among officers who are responsible for SDM implementation.

Findings suggest that current communication channels are largely hierarchical and reactive rather than proactive and collaborative. Many officers feel excluded from decision-making processes, particularly in instances where funding priorities suddenly shift without prior consultation or justification. A DEO officer also noted that important directives often arrive too late or conflict

with earlier instructions, leading to duplication of efforts and misalignment in SDM execution:

“We sometimes receive last-minute instructions that contradict earlier guidelines. This creates confusion at the school level, as teachers and administrators are forced to adjust data reporting processes multiple times based on conflicting directives.”

(DEO Officer 2, Daily Fieldwork Reflection, 15 June 2023, Terengganu)

The study finds that effective inter-agency communication is not just about information dissemination but about creating structured feedback loops that facilitate follow-up actions. A robust two-way communication system would enable agencies to track policy implementations, monitor bottlenecks, and ensure accountability in SDM execution. Without these mechanisms, meetings and reports serve as documentation exercises rather than problem-solving initiatives.

Moreover, the lack of integrated communication platforms across agencies exacerbates data silos and fragmentation, which hinders cross-agency collaboration. A MAMPU officer emphasised the need for a centralised digital platform where agencies can track discussions, follow up on key decisions, and ensure that commitments made in meetings are executed effectively:

“Right now, agencies operate in silos. If we had an integrated system that documented discussions and tracked follow-up actions in real time, we could ensure that problems raised in meetings are not just recorded but actively addressed.”

(MAMPU Officer 2, Focus Group Transcription, 23 May 2023, Melaka)

The study concludes that inter-agency communication channels must be restructured to foster proactive problem-solving, real-time information sharing, and greater transparency in decision-making. The adoption of a centralised SDM governance platform, real-time reporting mechanisms, and structured follow-up frameworks would enhance policy coordination, reduce redundancies, and ensure that communication translates into meaningful actions. Without these enablers, inter-agency collaboration will remain a bureaucratic formality rather than a strategic driver of SDM effectiveness

Inter-Agency Leadership

The findings highlight the critical role of leadership in enabling effective SDM by bridging the gap between policy formulation and ground-level implementation. A fundamental challenge in SDM leadership is the disconnect between high-level decision-makers and the realities of implementation at district and school levels. Findings suggest that without engaged and informed leadership, SDM risks becoming a bureaucratic compliance exercise rather than an enabler of educational transformation.

A MAMPU officer expressed concerns about the lack of direct engagement from top-level leadership in Putrajaya, noting that policy planners often rely on reports rather than first-hand field observations. This detachment from on-the-ground realities leads to misalignment in policy expectations and operational capacities, causing implementation bottlenecks at State Education Departments (SEDs), District Education Offices (DEOs), and schools:

“The readiness level actually depends on the top-level management. At the implementation level, we simply follow their lead. The problem arises when the MOE declares readiness, but DOEs, SEDs, and schools are still not prepared in terms of infrastructure and expertise. The planners in Putrajaya sometimes do not know what is happening at the implementation level. They only wait for reports. They rarely visit the field or schools to see the problems firsthand. They only want good reports. This kind of situation has happened many times before, and in the end, we at the implementation level face the difficulties.”

(MAMPU Officer 1, Focus Group Transcription, 23 May 2023, Melaka)

This top-down leadership approach weakens the ability of SDM to function as a tool for informed decision-making. Without active engagement from leadership, resource gaps, infrastructure limitations, and digital literacy barriers remain unaddressed, further exacerbating inefficiencies in data management. Findings suggest that leaders must shift from a directive-based approach to a participatory leadership model, ensuring that policies are designed with direct input from the stakeholders responsible for their implementation.

Conversely, strong leadership at the school level has been identified as an enabler of effective SDM implementation. A MOE officer emphasised that principals serve as key intermediaries between schools and external agencies, ensuring that directives are communicated effectively and that teachers are not overburdened by conflicting data requirements:

“For example, while the MOE establishes a directive to use the existing web application system to collect data from schools, there are also directives at the SEDs and DEOs levels for teachers to manually submit student achievement data using Microsoft Excel. This (situation) has affected the workload of teachers as the MOE aims to reduce it, but DEOs and SEDs seem to add to their workload. It’s like teachers have to do the same task twice. To overcome this, we need principals who can effectively manage these directives. They should prioritise and provide considerations for each directive, ensuring the smooth functioning of our education system. Principals can balance the workload of teachers so that data collection directives don’t overlap, eliminating the need for repetitive tasks and saving time and energy.”

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

This finding highlights that principals play a pivotal role in ensuring that SDM is implemented efficiently and in alignment with school operational capacities. When principals are proactive and skilled in inter-agency coordination, they mitigate the risk of redundant administrative tasks, enhance collaboration, and streamline reporting processes, allowing teachers to focus on their core instructional duties.

Both responses from MAMPU and MOE officers underscore that effective leadership in SDM must facilitate collaboration, communication, and strategic decision-making. Findings suggest that weak leadership leads to fragmented SDM execution, whereas empowered and engaged leaders create an enabling environment for successful implementation.

Empowering school leaders to manage data efficiently, ensuring that teachers are not overwhelmed by redundant reporting requirements. Without a leadership transformation that prioritises engagement, adaptability, and collaboration, SDM

will remain a compliance-driven exercise rather than a strategic tool for data-driven decision-making. Therefore, developing leadership training programs, incentivizing participatory leadership models, and ensuring greater transparency in decision-making processes will be key enablers of SDM's success in Malaysia's education system.

Interconnected Policy Governance

The findings highlight that fragmented policy governance continues to hinder the effective implementation of SDM. Without a cohesive and interconnected approach, policies risk becoming disjointed directives rather than integrated frameworks for systemic improvement. The study suggests that post-MEB 2013-2025 initiatives must shift toward an interconnected policy governance model, ensuring collaboration among key agencies, cross-sectoral coordination, and policy continuity to enhance data-driven decision-making.

A MAMPU officer emphasised that current SDM policies are developed in silos, with limited alignment between MOE, MAMPU, and other governmental agencies. This disconnected approach results in inconsistencies in data management, leading to duplication of efforts, gaps in policy enforcement, and limited adoption of technological innovations:

“Instead of rushing to release new policies for AI, I believe it would be better for the MOE and the MAMPU to review existing policies. In the MEB 2013-2025, it is mentioned about improving access to education, using ICT and data to facilitate student learning, and gaining insights into student achievements to enable improvements. Therefore, the MOE needs to ensure high and stable internet access in all schools. This (policy) is mentioned in the MEB 2013-2025. I think the MOE needs to take more aggressive actions to solve this problem. The MEB will end in two years. Do we want to see the MEB 2013-2025 report stating that the level of internet access in schools is still low? Unless there are officers who want to hide data related to this.”

(MAMPU Officer 2, Focus Group Transcription, 23 May 2023, Melaka)

This officer's observation suggests the critical need for policy governance mechanisms that are both integrated and proactive rather than reactive. The tendency to introduce new policies without first addressing implementation

challenges in existing frameworks exacerbates inefficiencies and prevents sustainable improvements in SDM. The study finds that while the MEB 2013-2025 includes objectives related to digital transformation, its execution remains inconsistent due to weak inter-agency collaboration and inadequate infrastructure investments.

Moreover, findings suggest that policy governance should move beyond compliance-driven enforcement toward a model that enables adaptive decision-making and continuous monitoring. A MOE officer pointed out that without a structured feedback mechanism, policies often fail to reflect operational challenges:

“Policies look good on paper, but their success depends on how they are implemented. We need governance structures that allow policies to evolve based on ground realities rather than just setting targets without follow-through.”

(MOE Officer 2, Individual Interview, 10 May 2023, Putrajaya)

This highlights a major gap in policy governance—lack of dynamic adjustments based on real-time data insights. Current governance structures rely heavily on periodic reporting rather than continuous assessment, which delays interventions and creates blind spots in SDM implementation. The study suggests that establishing a real-time data monitoring framework, integrated across agencies, would enable adaptive governance and ensure timely interventions.

Another crucial barrier to interconnected policy governance is the lack of accountability mechanisms to ensure policies align with national education priorities. The study finds that many policy objectives remain aspirational rather than actionable due to limited enforcement mechanisms. A DEO officer noted:

“We are given new directives, but there is little accountability for ensuring they are implemented effectively. If inter-agency coordination is weak, policies remain disconnected from the realities on the ground.”

(DEO Officer 3, Daily Fieldwork Reflection, 15 June 2023, Terengganu)

To enable effective SDM governance, policies must be designed with built-in accountability frameworks, real-time monitoring tools, and multi-agency cooperation mechanisms. The study recommends shifting from static policy formulations toward dynamic, data-driven policymaking, where decisions are continuously informed by real-world data rather than predetermined timelines.

Ultimately, interconnected policy governance is essential for unlocking the full potential of SDM as an enabler of data-driven educational improvements. By fostering cross-agency collaboration, embedding real-time data monitoring, and ensuring structured policy adaptation mechanisms, Malaysia's education sector can move beyond policy rhetoric toward tangible, sustainable improvements in SDM implementation.

4.4 Comparative Analysis: Divergence in Perspectives

The findings revealed divergent perspectives among key stakeholders—headteachers, District Education Office (DEO) officers, Ministry of Education (MOE) officers, and MAMPU officers—regarding the implementation of the Integrated Data Management System (IDME) as a centralised data system. These differing viewpoints highlighted fundamental disagreements on the system's efficacy, usability, and overall impact on school data governance.

The comparative analysis exposed varying levels of confidence in IDME's effectiveness, with some stakeholders viewing it as a solution for data integration, while others perceived it as a burdensome administrative requirement that complicated rather than streamlined data management. Additionally, the findings revealed inconsistencies in how IDME was implemented and interpreted across different administrative levels, suggesting that policy execution varied depending on institutional structures, leadership priorities, and technological capabilities.

Moreover, the study identified contradictions in statements from MOE officers regarding the flow of school data across agencies, pointing to potential inefficiencies in data communication, gaps in policy coordination, and a lack of uniformity in data-sharing protocols. These inconsistencies raised critical questions about whether IDME, in its current state, had fulfilled its intended

purpose or reinforced existing bureaucratic challenges. By analysing these contrasting perspectives, this section aimed to uncover the root causes of these discrepancies and explore potential pathways for achieving a more cohesive and functional data management ecosystem in the education sector.

4.4.1 Divergent Perspectives of Data Technology

A comparative analysis of the findings between headteachers, DEO, MOE, and MAMPU officers revealed divergent perspectives regarding the implementation of the Integrated Data Management System (IDME) as a centralised data technology. While some stakeholders viewed it as an essential tool for data-driven decision-making, others saw it as a redundant and burdensome administrative system that complicated rather than streamlined data management.

During a consultation session, headteachers expressed dissatisfaction with the IDME implementation, with visible agreement among other school leaders. Their concerns centred around the excessive data entry requirements imposed by IDME, which doubled their workload rather than simplifying administrative processes:

“School data management seems to boil down to endless data entry for the MOE, and it’s becoming an overwhelming burden for all of us. Since the introduction of the Integrated Digital Management System (IDME), we find ourselves having to double our data entry efforts.”

(Consultation Session with Headteachers, Daily Fieldwork Reflection, 15 March 2023, Terengganu)

A DEO officer shared a similar concern, pointing out that IDME’s direct data flow to MOE bypassed district offices, forcing SEDs and DEOs to create their own parallel databases to capture additional required data. This redundancy in data collection resulted in inefficiencies, frustration, and inconsistencies in reporting:

“Due to the direct flow of data from schools to the MOE bypassing the DEO, the SED and DEO offices have had to create their own database systems to gather specific data, such as students’ scores and activity reports. This redundancy in data collection is a result of the difficulty in obtaining certain data directly from the MOE... Teachers may find it

burdensome and time-consuming to input data into multiple systems. Nevertheless, this redundancy is deemed necessary to ensure access to crucial information, despite the challenges in obtaining it directly from the MOE.”

(DEO Officer 4, Daily Fieldwork Reflection, 16 June 2023, Terengganu)

Concerns regarding IDME’s infrastructure limitations were also echoed by MAMPU officers, who noted that the system’s server capacity was inadequate to handle increasing data demands. This limitation raised doubts about the feasibility of introducing the Ministry of Education Integrated System (MOEIS), a proposed expansion of IDME:

“If we want a centralised data application system, the MOE needs to upgrade its server system. The current data flow is too high and congested. I am concerned about the introduction of MOEIS, which is a proposal for an integrated system at the MOE level. However, the existing issues have not been resolved. The servers are still slow, which will result in similar problems for teachers.”

(MAMPU Officer 6, Focus Group Transcription, 23 May 2023, Melaka)

A MAMPU officer also highlighted the financial inefficiencies of MOE’s multi-system approach, arguing that consolidating data management systems under one robust framework could save significant costs:

“In my opinion, every purchase should be done in an economical manner. When MOE uses multiple application systems, they end up spending a lot of money on numerous contractors or vendors. Based on my experience, if MOE had a single integrated system, they would save a significant amount of money. I can only voice my opinion here as I am not the decision-maker. However, this is the reality. I hope that when MOEIS is introduced, the MOE can allocate more funds for high-capacity servers and maintenance.”

(MAMPU Officer 2, Focus Group Transcription, 23 May 2023, Melaka)

In contrast, MOE officers defended IDME, arguing that its long-term benefits would outweigh its initial implementation difficulties. One MOE officer insisted that previous system shutdowns had resulted in schools requesting

reinstatement, which indicated that educators ultimately recognised the necessity of IDME for effective data governance:

“Past experiences have shown that requests for system shutdowns were often followed by requests for its reinstatement, as teachers realised their need for the system to input data. Dealing with system-related issues requires a high level of trust between teachers and the MOE, and I believe efforts are being made to address and improve the system based on feedback and user experiences.”

(MOE Officer 2, Individual Interview Transcription, 19 May 2023, Putrajaya)

MOE officers also emphasised that the long-term return on investment (ROI) of IDME could not yet be fully measured, as its implementation was still in progress. They pointed to the development of new modules within MOEIS, arguing that these enhancements would ultimately reduce teacher workloads:

“The development cost of the system is indeed substantial, as it involves various vendors assigned to develop different modules. However, it is important to note that the return on investment (ROI) of the system cannot be measured at present. We will have to wait for reports after 2025 to assess the system’s impact. The MOEIS system is still in its early stages, with only two or three modules currently implemented. Nonetheless, I am confident that the MOE’s plans are aimed at ensuring the MOEIS system operates more effectively than its predecessors.”

(MOE Officer 2, Individual Interview Transcription, 19 May 2023, Putrajaya)

Critical Analysis of Divergent Perspectives

The findings reveal a fundamental divide in how different stakeholders perceive the role and effectiveness of IDME. While MOE officers argue that IDME is a necessary step toward digital transformation, headteachers, DEO officers, and MAMPU officers highlight its operational inefficiencies, redundancy, and lack of infrastructure readiness.

This divergence suggests that MOE’s top-down approach to IDME implementation has overlooked practical implementation challenges, particularly at the school

and district levels. The study indicates that without addressing infrastructure limitations, reducing administrative burdens, and aligning stakeholder expectations, IDME may continue to face resistance rather than being fully integrated into Malaysia's education system.

Moving forward, resolving these divergent perspectives will require MOE to actively engage with educators, district officers, and technical agencies like MAMPU to co-design improvements that ensure IDME truly enhances data management rather than exacerbating administrative burdens.

4.4.2 Contradicting Statement of School Data Flow

In addition to the divergent perspectives identified, the findings revealed contradictions in statements from MOE officers regarding the flow of school data. While MOE emphasised decentralised decision-making by granting autonomy to State Education Departments (SEDs) and District Education Offices (DEOs), it simultaneously maintained a centralised accountability mechanism that held officers responsible for meeting key performance indicators (KPIs). This contradiction created confusion about authority distribution within the education system and generated conflicts regarding data flow responsibilities.

A MOE officer articulated this duality in data governance, acknowledging both the decentralisation of decision-making and the continued central oversight by MOE:

“I agree that the MOE holds the highest authority in the education system. However, the MOE has granted more decision-making autonomy to SEDs and DEOs, as stated in the Malaysia Education Development Plan 2013-2025. This means that although the ministry remains the highest authority, officers in SEDs and DEOs need to comply with their directors' decisions. These officers report their tasks to directors who evaluate their work, provide recommendations for promotions, and make decisions aligned with the overall education system.... However, if the KPIs are not met, officers are required to provide explanations to the MOE.”

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

This contradiction exposed a critical governance issue in SDM, where MOE mandated decentralisation but still retained ultimate control over performance accountability. This tension resulted in inefficiencies, as agencies operated under conflicting directives that blurred the chain of command.

Comparative Analysis of Data System Implementation

The study also conducted a comparative analysis of stakeholder perceptions regarding the implementation of data systems like IDME. Findings revealed that MOE officers, DEO officers, headteachers, and MAMPU officers held conflicting views on the effectiveness of SDM platforms.

Implementation of Data Systems

Headteachers criticized MOE officers for the poor execution of IDME, citing issues such as time-consuming processes, multiple redundant data entry requirements, and system inefficiencies. DEO officers echoed these concerns, stating that MOE's failure to design an integrated system forced them to create their own database frameworks to supplement missing data. In contrast, MOE officers acknowledged these shortcomings but maintained that MOEIS—an upcoming centralised platform—would address these challenges. Meanwhile, MAMPU officers expressed scepticism about MOE's technological capabilities, questioning whether MOEIS would genuinely resolve existing problems or further exacerbate inefficiencies.

A MAMPU officer voiced concerns about MOE's financial and technical management of digital infrastructure:

“If we want a centralised data application system, the MOE needs to upgrade its server system. The current data flow is too high and congested. I am concerned about the introduction of MOEIS, which is a proposal for an integrated system at the MOE level. However, the existing issues have not been resolved. The servers are still slow, which will result in similar problems for teachers.”

(MAMPU Officer 6, Focus Group Transcription, 23 May 2023, Melaka)

This concern reflects a broader issue of MOE's system procurement and capacity planning, where technological limitations and uncoordinated system rollouts hindered the effectiveness of SDM implementation.

Flow of Data Among Agencies

The comparative analysis also examined how data flow inefficiencies affected different agencies. Headteachers complained about redundant data requests from DEOs, while DEO officers criticized MOE for bypassing district offices and sending directives directly to schools. This top-down approach disrupted data workflows, leading to duplication of efforts and fragmentation of information-sharing mechanisms.

A DEO officer described the practical challenges resulting from MOE's unilateral approach:

“We are expected to submit data directly to MOE, but at the same time, we need to compile separate reports for DEOs and SEDs. Because MOE's system does not integrate data effectively, we have to manually input the same data multiple times, creating unnecessary administrative burdens.”

(DEO Officer 2, Daily Fieldwork Reflection, 16 June 2023)

This fragmented data governance structure not only increased the workload for educators but also resulted in inconsistent data reporting across agencies. MOE officers, while acknowledging these inefficiencies, asserted that these challenges fell beyond their jurisdiction, implying that MOE's role was to issue policies, while DEOs and SEDs bore responsibility for execution.

Meanwhile, MAMPU officers critiqued the competency of DEO officers in managing databases, highlighting inconsistencies in data handling and misinterpretation of reporting criteria. They argued for a standardised framework that would streamline data flow and improve data integrity.

Key Takeaways from Comparative Analyses

The findings underscore a fundamental structural weakness in the SDM framework, where contradictory policy directives, misalignment in data responsibilities, and fragmented technology adoption hinder effective governance. While MOE promoted decentralisation, its simultaneous emphasis on centralised accountability contradicted the principles of distributed leadership in data management. Improving inter-agency collaboration, streamlining data collection workflows, and ensuring clearer communication between MOE, SEDs, and DEOs will be critical to overcoming these challenges.

Unless these contradictions are resolved, SDM risks remaining a bureaucratic tool rather than an enabler of data-driven education governance. Moving forward, a more coherent and transparent data governance framework, supported by technological enhancements that prioritise user needs, will be essential for improving SDM efficiency and trust in data-driven decision-making.

Table 4.2 Comparative Analysis of SDM Perceptions Among Agencies

Aspects	Headteachers	DEO Officers	MOE Officers	MAMPU Officers ⁶
Data Technology	Headteachers criticised MOE officers for the poor implementation of data systems like IDME, citing issues such as time-consuming processes due to system limitations on multiple users inputting data simultaneously.	DEO officers critiqued MOE officers for the inadequate implementation of data systems like IDME, which creates additional burdens for them and headteachers.	MOE officers acknowledged the shortcomings in the implementation of IDME and express plans for improvement. They anticipated the launch of a new centralised platform, MOEIS, to address these issues.	MAMPU officers criticised the implementation of IDME and the forthcoming MOEIS by MOE, citing concerns about the competence of top-level officers and questioning their ability to effectively manage such systems.
Data Flow	Headteachers criticised DEO officers for repeatedly requesting the same database due to the implementation of IDME.	DEO officers critiqued MOE officers for the direct flow of data from schools to MOE, bypassing the DEO. Consequently, DEO and SED offices developed their own database	MOE officers criticised DEO officers for their approach to schools, alleging repetitive data requests. However, they assert that such matters are	MAMPU officers critiqued the competence of DEO officers in managing school databases and analysing data, particularly in deciding students' eligibility for aid

⁶ While MAMPU and MOE share similar roles in policy planning, the implementation of policies within the education sector confers a higher authority to the MOE.

		systems to collect specific data, leading to redundancy in data collection.	beyond their responsibility.	based on database information.
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4.4.3 Perceptual Disparities between Policy Planning and Policy Implementation

The perceptual disparities between policy planning and policy implementation, particularly regarding the Integrated Data Management System (IDME) as a centralised data system, offer a thought-provoking lens through which to examine the intricacies of Malaysia's educational governance. These disparities are clearly evidenced in the contradictions between strategic planning at the Ministry of Education (MOE) level and operational realities at the district and school levels. As Table 4.2 illustrates, MOE officers maintained confidence in the planned benefits of IDME, while headteachers, DEO officers, and MAMPU officers expressed frustration over its inefficient execution and practical shortcomings.

Roles and Perspectives

The distinct institutional roles of MOE officers and MAMPU officers within the government hierarchy shape their contrasting perceptions of SDM effectiveness. MOE officers, occupying higher management positions, are deeply involved in strategic planning and policy formulation, focusing on macro-level decision-making that shapes national education policy. Their approach is inherently top-down, informed by policy objectives rather than real-time implementation feedback.

In contrast, MAMPU officers, operating under the Prime Minister's Department, are responsible for implementing ICT policies at the school level. Their role involves practical execution and system integration, often requiring mediation between MOE's overarching directives and on-the-ground realities. As evidenced in Table 4.2, MOE officers viewed IDME as a progressive step toward digital transformation, while MAMPU officers questioned the system's feasibility due to existing infrastructure limitations and server congestion issues.

Divergent Perceptions and Policy Gaps

The divergence in perspectives is not merely theoretical but reflects concrete challenges in policy implementation. As Table 4.2 outlines, MOE officers defended IDME as a means to improve data standardisation and reduce teacher workload, while headteachers and DEO officers criticized the system's inefficiencies, arguing that IDME increased administrative burdens rather than reducing them.

This contradiction is further exacerbated by MOE's contradictory stance on decentralisation and centralised accountability. While MOE grants more decision-making autonomy to SEDs and DEOs, it simultaneously holds them accountable for KPI achievement, reinforcing centralised oversight. As a MOE officer explained:

“I agree that the MOE holds the highest authority in the education system. However, the MOE has granted more decision-making autonomy to SEDs and DEOs, as stated in the Malaysia Education Development Plan 2013-2025. This means that although the ministry remains the highest authority, officers in SEDs and DEOs need to comply with their directors' decisions. These officers report their tasks to directors who evaluate their work, provide recommendations for promotions, and make decisions aligned with the overall education system.... However, if the KPIs are not met, officers are required to provide explanations to the MOE.”

(MOE Officer 1, Individual Interview Transcription, 10 May 2023, Putrajaya)

This inherent contradiction in policy execution reinforces inefficiencies. While MOE officers focus on meeting strategic objectives, DEO officers and headteachers struggle with redundant reporting obligations and unclear directives, further hindering IDME's effectiveness as an integrated data system.

The disparities highlighted in Table 4.2 expose the underlying power dynamics within inter-agency interactions and reveal a significant gap between policy intent and implementation realities. The rigid rollout of IDME, without sufficient consultation or adaptability, has created conflicting expectations: while MOE

officers remain focused on the system's projected long-term benefits, frontline implementers—DEO officers and headteachers—grapple with its immediate operational challenges.

These findings point to the urgent need for a more adaptive policy framework that prioritises continuous feedback from those directly engaged in implementation. For IDME to function as an effective governance tool rather than a compliance mechanism, MOE must incorporate the perspectives of DEO officers, school leaders, and technical agencies like MAMPU into ongoing system evaluation and reform.

Crucially, this reflects a broader governance dilemma—balancing centralised policy control with the flexibility required for localised implementation. Without clear accountability structures, stronger communication channels, and a genuine commitment to inter-agency collaboration, IDME risks reinforcing bureaucratic compliance rather than enabling meaningful, data-driven decision-making at the school and district levels.

Chapter 5 Relational Findings – The Ghost Network of SDM Leadership

5.1 Introduction

This chapter presents findings from a relational analysis of Malaysia's School Data Management (SDM) governance, based on immersive observation during the LENSEA SDM conference. The event served not only as a live case study but also as a dynamic setting where the SDM system could be observed in action—not merely as a digital infrastructure, but as a living, relational network shaped by people, technologies, documents, routines, and institutional expectations. By taking on a participatory moderator-observer role, I captured critical translation moments of negotiation, sensemaking, and leadership behaviour that revealed the deeper, often invisible, contours of governance practice within SDM.

Two key interactions emerged during the conference, each illuminating different layers of SDM's socio-technical ecosystem:

a. Shared Anecdotes of the SDM Network (Asynchronous Interaction):

Headteachers shared stories that underscored systemic challenges in SDM governance—strained communication with MOE officers, overwhelming reporting workloads, and inconsistent digital infrastructure. Their reflections highlighted how data systems often demand compliance without enabling insight, and how technical issues such as poor connectivity or dysfunctional platforms compound the problem. Yet, beneath these surface-level complaints lay something more profound: a shared sense that their actions were being guided not by formal policy alone, but by a set of unspoken expectations embedded in everyday tools and routines.

b. Assemblage of SDM Networks (Synchronous Interaction):

In the interactive consultation and focus group sessions, a more complex network unfolded. Human and non-human actors—headteachers, DEO officers, dashboards, reporting templates—formed dynamic alliances that shaped decision-making behaviour. These were not just policy implementers responding

to rules, but actants within a network governed by silent instructions, technical cues, and institutional fears. Observations revealed that leadership was often exercised not through formal authority but through responsiveness to implied expectations—what would look good in a dashboard, what the district officer might expect, or how a report should be shaped to align with performance norms.

These findings reveal the presence of what I term the Ghost Network of SDM leadership: an unofficial, often unconscious web of actors—poor work relations between teachers, headteachers and officers, heavy database workload, poor internet access, and poor data systems—that silently orchestrate school leadership behaviour. This ghost network is not written into any policy, yet it shapes what is done, how it is done, and what is left unsaid. It governs by implication rather than instruction, creating a system where school leaders anticipate and perform to meet invisible demands, often at the expense of authentic, localised decision-making.

This chapter responds to two central research questions:

- a. What constitutes the SDM network?
- b. What are the network issues within SDM practices?

By addressing these questions, the findings demonstrate that SDM governance challenges are not merely about technology or training. They are rooted in deeper relational patterns of control, delegation, and compliance—where the visible tools of governance (dashboards, reports, platforms) are underpinned by an invisible logic of performance. These insights are foundational to the techno-enablement critique developed later in the thesis, which argues for a shift away from compliance-centred data governance towards systems that support meaningful agency, collaboration, and institutional learning.

5.2 Shared Anecdotes of SDM Networks

The findings revealed the exploration of relational dynamics within SDM networks through shared anecdotes, illustrating how stakeholders navigate and

negotiate their roles within the network. This process involved asynchronous translation, which unfolded in distinct phases of Actor-Network Theory (ANT): problematisation, interessement, enrolment, and mobilisation.

These phases provided a structured analytical framework for understanding how SDM participants identified challenges, engaged with proposed solutions, formed alliances, and mobilised resources. The relational interactions captured in these shared anecdotes demonstrated how actors—whether institutional entities, technological tools, or human agents—contributed to shaping the SDM network's functionality.

By examining the asynchronous translation of these shared experiences, this section highlights the complexities, negotiations, and contestations that emerged within the decentralised and often fragmented SDM ecosystem. The insights from these narratives offer a deeper understanding of the barriers and enabling factors that influenced the effectiveness of data-driven decision-making in schools.

5.2.1 Problematisation (Issues)

The first process focused on identifying and framing issues that resonated with stakeholders, including myself as the researcher and relevant education officers. This process facilitated unfolding problematisation, allowing for an in-depth examination of shared issues pertinent to all involved.

After receiving ethics approval from the College of Social Science Ethics Committee on 24th February 2023, I sought counsel from a colleague on 26th February 2023. Engaging in an online conversation, my colleague expressed a keen interest in exploring the challenges surrounding SDM implementation. Drawing from extensive experience as an educator and trainer, they shared anecdotes from interactions with headteachers enrolled in the National Professional Qualification for Educational Leaders (NPQEL) certificate program.

Common complaints among these headteachers revolved around the centralisation of data systems and database management by the MOE. A significant disparity was noted between the extensive efforts dedicated to data

management and the lack of tangible progress in Malaysia's educational performance. Particularly striking were observations regarding the nation's persistent underperformance in international assessments such as the OECD PISA and TIMSS rankings. These insights reinforced the findings from the literature review, further validating the relevance of these issues.

To examine these challenges, we decided to collaborate on organising an SDM conference aimed at fostering dialogue and collaboration among headteachers. A division of responsibilities was established: I would coordinate conference logistics and develop the agenda, while my colleague would leverage their network and expertise to secure a suitable venue and handle administrative arrangements.

During our discussion, we emphasised the conference's overarching aim of cultivating a sense of collective purpose among participants. This aim involved fostering a shared understanding and appreciation of SDM's intricacies. Headteachers were expected to acquire practical skills in data management, particularly in utilising technology, while also developing critical thinking capabilities essential for effective decision-making in SDM. Both technological proficiency and analytical thinking were seen as integral elements within SDM practices.

A suggestion was made to involve the DEOs, describing this collaboration as instrumental in aligning with our goal of creating a space where headteachers could share their experiences, insights, and concerns about SDM. This approach aimed to promote a sense of shared purpose and solidarity among all participants.

On 27th February 2023, we held a second online meeting with colleagues and representatives from the DEOs of Kuala Terengganu. I proposed a detailed plan for the SDM conference. Through these discussions, we reached a consensus to organise an impactful SDM conference focused on capacity building for headteachers. The conference, titled 'Leadership in the Digital Era & Navigation for School Action (LENSA)', was designed to include diverse sessions addressing the evolving needs and challenges in school data management.

The conference was scheduled on 15th and 16th March 2023 at School A in Kuala Terengganu, Malaysia. LENSEA aimed to empower headteachers with insights, strategies, and tools essential for navigating the complexities of education in the digital age.

The itinerary for Day 1 included a keynote speech by Professor James Conroy from the University of Glasgow on ‘The Intersection of Leadership and Artificial Intelligence: Navigating the New Landscape of Education’, followed by a policy speech on ‘Education Data Management in The Malaysia Education Blueprint (2013-2025)’ by a lecturer from the public institute for educational leadership and management training in Malaysia. The day also featured a Google Data Studio Workshop and a consultation session for headteachers, moderated by myself, involving 40 participants.

Day 2 began with a focus group for DOE officers, followed by an advanced Google Data Studio Workshop. The event concluded with a closing session, providing opportunities for real-time feedback and addressing participant questions and concerns.

One of the officers shared insights on the systemic challenges that often impede effective feedback transmission from grassroots levels to MOE decision-makers. Despite teachers expressing grievances on social media platforms like Facebook, there was a disconnect between these expressions and tangible policy interventions. It became evident that a more direct and structured approach was needed to ensure headteachers’ voices were not only heard but acted upon by relevant authorities.

On 1st March 2023, I received an email from the director of the public institute for educational leadership and management training in Malaysia approving the conference to be held at School A. This approval allowed us to proceed with organising the conference as a collaborative effort.

5.2.2 Interessement (Interest)

The second process involved gathering individuals with the same interest, known as interessement. The LENSEA conference brought together stakeholders,

particularly headteachers, who shared a common interest in SDM. These shared concerns and experiences naturally drew participants into the network to foster a sense of shared interest.

The conference was designed to be inclusive, welcoming all headteachers across Malaysia. To reach a broad audience, I posted advertisements on Facebook, targeting a group with 187,000 members. The advertisement ran from 1st to 5th March 2023, giving ample time for interested individuals to prepare and register.

To manage the number of applications and ensure a meaningful interaction, specific criteria were set. Only headteachers with at least 5 years of experience could apply, and participation was restricted to Malaysian nationals. Although we received 2,818 applications, logistical constraints allowed us to accommodate only the first 40 headteachers who registered due to venue capacity limitations.

The registration process included responding to 18 open-ended questions. These questions covered topics such as understanding roles, policy practices, school operations, and the implications of SDM. The diverse responses highlighted the deep engagement and willingness of participants to discuss critical issues and contribute to the collective discourse.

In addition to headteachers, the conference was attended by lecturers from the public institute for educational leadership and management training in Malaysia and officers from the DEOs. Although these individuals were collaborators for the event, they participated voluntarily in the workshop and focus group sessions.

5.2.3 Enrolment (Engagement)

The third process involved the enrolment of headteachers and lecturers in the consultation session. This interactive session aimed to gather detailed feedback about SDM practices at the school level from the headteachers and also to refine interview questions. The session was designed to foster engagement among participant to encourage them to share their experiences and insights.

Out of the 33 participants who attended the conference, 20 were present in person, while 13 participated remotely. This hybrid format allowed for broader participation, ensuring that geographical constraints did not limit engagement. Despite the physical distance, online participants actively contributed to discussions, using technology to share their perspectives and participate in the dialogue. Including the five lecturers, the total number of attendees for the consultation session was 38.

As the mediator for the consultation session, I facilitated the dialogue, encouraging constructive exchanges and keeping discussions focused and productive. We sought consensus on each question, with participants collectively deliberating on the wording and structure to ensure clarity and relevance. Any divergent viewpoints were respectfully addressed, and efforts were made to reconcile differing perspectives and reach agreement.

The consultation session proved to be particularly intense and emotionally charged, surpassing the level of engagement observed in other parts of the conference. The atmosphere was electric as participants eagerly voiced their perspectives and shared personal experiences. Many participants were deeply invested in the discussions, reflecting a high level of emotional involvement and a strong desire to contribute meaningfully to the dialogue.

Several participants expressed their frustrations, resonating with the shared experiences of their peers:

An intriguing scenario unfolded where headteachers expressed their frustrations and concerns. The room was filled with restrained energy, as voices competed for attention. As they reviewed and revised the interview questions, the conversation turned towards the technical aspects of their roles, specifically the collection and analysis of school data. They voiced their dissatisfaction with the existing web-based systems, their faces clouded with frustration and hands animated as they elaborated on the challenges they face. Their body language—furrowed brows, animated hand gestures, and impassioned tones—all echoed the same sentiment: dissatisfaction with the systems implemented for data management by the Ministry. A significant majority expressed shared feelings, hinting at the profound impact of the technology on their working lives.

(Daily Fieldwork Reflection, 16 March 2023, Terengganu)

Throughout the session, there was a notable influx of comments and contributions from all attendees, indicative of their eagerness to engage with the topic. Emotions ran high as participants openly reflected on their individual experiences, with some expressing frustration and dissatisfaction with the new implementation of IDME.

One headteacher candidly expressed feeling unheard and overlooked when attempting to voice concerns regarding the IDME implementation. For him, the consultation session provided a much-needed outlet to express his frustrations and grievances at the same time offering a sense of relief and catharsis.

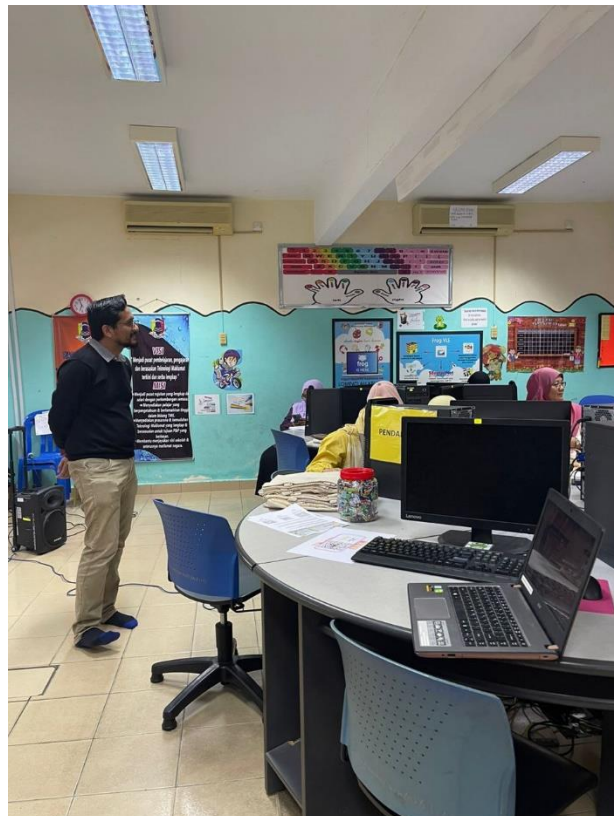


Figure 5-1 I moderated the Consultation Session



Figure 5-2 A Headteacher voiced out his concerns relating to SDM practices

5.2.4 Mobilisation (Action)

The final process involved gathering and acting on the collective voice of concern, embodying the shared narratives and perspectives of headteachers within the SDM network. This process, known as gathering feedback, is not merely an endpoint but the starting point for mobilisation and collective action.

Mobilisation began during the consultation session. Headteachers together with lecturers refined and verified the interview questions and achieved consensus on them. This was a critical step to ensure that the questions accurately represented their concerns and issues. By working together, they were able to clarify and focus their inquiries, making them more effective tools for dialogue.

The analysis of the feedback from participants revealed the need to restructure and narrow down the original 13 questions. Some redundant and unnecessary questions were eliminated to streamline the process. As a result, the questions were refined through consensus from 13 to 7, considering the one-hour limit for individual interviews. The feedback addressed not only the functionality but also

the appropriateness and relevance of the questions to ensure they were clear and impactful.

During the consultation session, two headteachers expressed their hopes that these refined questions would address their issues with SDM. They believed that having clear and relevant questions would help highlight their concerns and lead to better solutions. This sentiment was shared by other participants, who felt that the consultation provided a crucial platform for their voices to be heard.

The refined questions served as a mobilising token. These questions would be presented to MOE and MAMPU officers to seek their responses and actions. This step ensured that the concerns of the headteachers were heard and addressed at higher levels.

5.2.5 Addressing the Research Questions

These findings directly address the research questions guiding this study. In response to “What constitutes the network of SDM?”, the findings reveal that SDM is not a singular, cohesive entity but a fragmented system of actors, digital infrastructures, and policy directives. MOE officers maintained policy control, but the system’s functionality relied on the cooperation of implementers at the school and district levels. The findings expose a governance misalignment, where policy objectives frequently clashed with operational realities, leading to disengagement among school administrators.

Regarding “What are the network issues within SDM practices?”, the study identifies several critical barriers: hierarchical decision-making, lack of participatory governance, technological limitations, and weak inter-agency communication. The problematisation phase highlighted how headteachers and DEO officers were responsible for executing SDM policies but were excluded from decision-making, causing a disconnect between design and execution. The interessement and enrolment phases exposed the rigidity of SDM frameworks, which failed to accommodate localised needs and operational constraints. Finally, the mobilisation phase demonstrated that while stakeholders could articulate concerns, existing institutional mechanisms for feedback integration remained weak, limiting SDM’s impact as a data-driven decision-making tool.

5.2.6 Network Issue: The Fragmented Will in Human Agency

Despite moving through the four phases—problematization, interestment, enrolment, and mobilisation—a significant structural issue persisted within SDM networks: the fragmented will in human agency. The findings revealed a lack of cohesion among key agencies, with varying degrees of engagement and willingness to address SDM's challenges.

During interviews with MOE and MAMPU officers, differing levels of engagement were observed. MOE officers participated in interviews but displayed caution when discussing sensitive topics related to data technology implementation in schools. While no explicit reluctance was expressed, their responses were shaped by institutional pressures, performance expectations, and the centralised nature of SDM governance. Conversations were guarded, reflecting concerns about accountability and institutional constraints (MOE Officer Interviews, 10 May 2023, Putrajaya).

Conversely, MAMPU officers exhibited a more open stance, actively discussing the challenges of inter-agency collaboration and the technical limitations within SDM systems. They demonstrated a proactive approach to problem-solving, contrasting with the cautious stance of MOE officers. While both perspectives were treated with respect, the variance in engagement levels signified a broader governance issue: SDM reform lacked unified agency across institutions (MAMPU Officer Interviews, 23 May 2023, Melaka).

This divergence reflects a fundamental barrier to effective SDM governance: fragmented will in human agency. Some agencies, such as MAMPU, were willing to acknowledge and address SDM's flaws, while MOE remained more restrained, potentially due to bureaucratic and political pressures. The reluctance of certain participants to engage fully is not a failure on their part but rather an indication of the institutional constraints they operate under. Without a coordinated inter-agency approach that fosters open dialogue and trust, SDM will continue to function as a fragmented and inconsistent system rather than a collaborative, data-driven governance tool.

5.3 Assemblage of SDM Networks

The findings also revealed the relational dynamics within the assemblage of SDM networks. The translation moments of problematisation and interessement within the SDM network share similarities with the translation moment of shared anecdotes. Each of these moments involves identifying, framing, and disseminating issues and concerns within the network. However, the key difference lies in how the moments of assemblage of SDM networks bring actors together synchronously, leading to network issues.

The significance of these findings lies in their demonstration of how agency is distributed across human and non-human actors within the SDM ecosystem. The interactions that took place in the preparation meeting and consultation session illustrate how power, influence, and resistance emerge dynamically in SDM governance. These moments highlight the entanglement of human actors (headteachers, DEO officers, lecturers) and technological actants (laptops, databases, internet systems) in shaping policy discussions and implementation experiences. By critically examining these interactions, the study uncovers the systemic barriers that contribute to inefficiencies in SDM and reinforces the importance of adaptive governance models that integrate real-time stakeholder feedback.

Two significant moments of enrolment within the SDM network, as observed from an ANT perspective.

5.3.1 Moment: Preparation Meeting

The first moment of assemblage occurred two days before the SDM conference, during the preparation day. Present at this meeting were two lecturers, the headteacher of School A, three DEO officers, and myself, serving as the chairperson.

The meeting commenced with a comprehensive review of the agenda, allowing us to clarify the objectives and expected outcomes of the event. Together, we defined key themes and specific topics that would be addressed during the conference, ensuring alignment with the overarching goals and objectives.

A significant portion of the meeting was dedicated to planning logistical arrangements to ensure a seamless and well-organised event. This included confirming the venue and assessing its suitability and accessibility for all participants. Initially, we chose the school hall as the venue, considering its spaciousness and convenience for attendees.

Given the initial plan of my workshop, which aimed to foster critical thinking skills in SDM, I opted for a low-tech approach. Rather than relying on laptops or digital tools, I planned to facilitate activities using traditional pen-and-paper methods. This decision was intended to promote more interactive group work and encourage deeper engagement with the subject matter.

As we were transitioning to the next agenda item, a DEO officer unexpectedly proposed shifting the venue from the school hall to the computer room. The officer argued that conducting the event in a computer lab would offer a more immersive learning experience, especially in the context of school data management. He emphasised this point by gesturing towards his nearby laptop.

This DEO officer's argument was quickly echoed by his colleagues, who supported the proposal with additional reasons. He stressed the importance of providing attendees with hands-on experience and practical tutorials on tools like Google Sheets, Google Data Studio, and Chat GPT. Their collective enthusiasm led to a unanimous decision to relocate the event to the computer room.

With this agreement, the venue change necessitated adjustments to the planned workshops and presentations, including my own workshop. In response to the new setting, I adapted the focus and content of my workshop to align with the theme of '3D (Data-Design-Decision): From Data Analytics to Artificial Intelligence'. This revised session explored the intersection of data analytics and artificial intelligence, providing participants with insights into cutting-edge technologies and their applications in school data management.

I updated my slides and approaches to utilise laptops and digital tools, allowing for a more dynamic and interactive learning experience. This adjustment

leveraged technology to engage participants and facilitate a deeper exploration of complex concepts.

The venue shift from the school hall to the computer room and the subsequent adjustment of workshop content were tangible network effects resulting from the assemblage of SDM networks during the preparation meeting. Initially, I attributed the venue shift suggestion by the DEO officer to his individual agency power. However, closer observation revealed that his laptop played a role in influencing his decision-making process.

The DEO officer's laptop became an actant, exerting influence during the meeting. This realisation underscored the interconnectedness and mutual shaping of human and non-human actors within the SDM network. The laptop facilitated communication and access to information, significantly shaping the discussion and decision-making process.

5.3.2 Moment: Consultation Session

The second moment occurred during the consultation session, where a diverse array of actors converged to participate in discussions and activities. This included 33 participants—comprising headteachers, lecturers, and three DEO officers—alongside myself as the facilitator. The assemblage also encompassed essential technological components, such as a laptop, internet source, computer room, and database work tools.

During the consultation session, the second moment of enrolment in the translation process, the assemblage of the SDM network was vividly evident. Headteachers actively shared their experiences and provided feedback on SDM implementation in their schools.

A poignant moment occurred when a headteacher expressed frustration, stating, "School data management seems to boil down to endless data entry for the MOE, and it's becoming an overwhelming burden for all of us." Her words resonated with many in the room, highlighting the shared challenges faced by educators under the Integrated Digital Management System (IDME) mandated by the MOE.

As she spoke, the headteacher gestured towards her laptop, symbolising the relentless data entry tasks. She explained that she had brought her laptop to the session in hopes of entering and verifying databases using the IDME system. However, she encountered the same accessibility issues that had plagued her attempts to work from home, with the system remaining inaccessible due to the overwhelming number of users.

This sentiment resonated deeply with at least three other headteachers, who also brought their laptops and database work to the session. Their shared experiences emphasised the widespread challenges faced by educators in managing the demands of IDME implementation.

One headteacher shared her experience of having to input and verify student and teacher performance records for her school, comprising 1,000 students across nine subjects and 80 teachers. The sheer volume of data was daunting, reflecting the substantial administrative burden placed on educators. She also highlighted the challenge of ensuring that data entered into the IDME system was accurately reflected in physical record files, essential for auditing purposes, further adding to the workload.

The persistent issues with the IDME system, characterised by slow performance and frequent loading delays, compounded the challenges faced by educators. Despite their dedication, the system's limitations significantly hindered their productivity and efficiency.

This collective testimony highlighted the urgent need for systemic improvements and support mechanisms to alleviate the administrative burden on educators. It emphasised addressing technological shortcomings and providing the necessary resources and support to effectively navigate the complexities of data management in the digital age.

The presence of the laptop with database work wielded by a headteacher exemplified the network effects within the SDM network. Various actors converged to shape the situation's dynamics, including the headteacher, laptop, database, and internet. Each played a distinct role in influencing the course of action.

From an ANT perspective, the laptop with database work assumed the role of an actant, exerting agency and influencing the headteacher's actions. By bringing her laptop to the conference, the headteacher demonstrated the intertwining of human and non-human actors in shaping her routine. Her emotional portrayal underscored the power dynamics at play.

The headteacher's decision to bring her laptop was not merely a personal choice but influenced by the network of relations and constraints within which she operated. This example highlights the intricate interplay between human actors, technological artifacts, and institutional structures within the SDM network. It elucidates how the configuration of actors and their interactions shape the practices and routines of individuals within the network, underscoring the complex nature of technological mediation and power relations in educational contexts.

5.3.3 Network Issue: Technological Overemphasis

The analysis revealed a significant network issue: the overemphasis on technology within the SDM network. This overreliance on technological solutions, as exemplified by the decision to move the conference to a computer room and the frustrations voiced by headteachers, highlighted several critical challenges that directly address the research questions.

The research question "What constitutes the network of SDM?" is answered through the realization that technology has become a dominant actor within the SDM ecosystem, influencing decision-making processes, workload distribution, and governance structures. The assemblage of SDM networks illustrated how digital tools, such as laptops and the IDME system, were not merely passive objects but active participants in shaping interactions. The venue shift during the preparation meeting demonstrated how the mere presence of a laptop influenced decisions, reinforcing the technological bias embedded within SDM governance. This overemphasis on digitalisation often overlooks the nuanced human interactions essential for effective data management.

The research question "What are the network issues within SDM practices?" is addressed through the findings that technological dependency has created

systemic inefficiencies, reinforced administrative burdens, and disconnected data management from its human elements.

Technological Dependency: The shift to a technology-rich environment showed the network's dependence on digital tools for managing school data. While these tools have the potential to enhance efficiency, they also pose challenges when infrastructure is inadequate or inaccessible. Headteachers reported persistent difficulties with IDME, noting that the system was often slow or entirely inaccessible due to high traffic, reducing the effectiveness of digital solutions rather than improving them (Consultation Session, LENSEA, 15 March 2023).

Administrative Burden: The increased reliance on technology for data management tasks has paradoxically expanded, rather than reduced, the administrative burden on educators. The necessity to input and verify large volumes of student and teacher performance data has detracted from their primary teaching responsibilities, causing frustration and stress. A headteacher expressed, "We spend more time on data entry than on classroom teaching—this is not why we became educators" (Daily Fieldwork Reflection, 16 March 2023, Terengganu). This demonstrates that SDM policies fail to account for the realities of educators' workloads, reinforcing inefficiencies rather than streamlining processes.

Systemic Inefficiencies: Persistent technical issues within the IDME system have hampered productivity, illustrating the inadequacy of current technological infrastructure to support school data management. The consultation session revealed that headteachers often had to duplicate data entry across multiple platforms, wasting valuable time. A participant highlighted that "if IDME was truly effective, we would not need to maintain physical record files for audits", pointing to MOE's failure to establish trust in its own digital system (Daily Fieldwork Reflection, 16 June 2023, Terengganu).

Disconnection from Human Elements: The strong emphasis on technological solutions has overshadowed the lived realities of educators. The assemblage of SDM networks revealed that policy decisions prioritised digitalisation without considering its actual usability and impact on school administrators. The MOE's push for automation and artificial intelligence in data management often

ignored the emotional and cognitive burdens placed on educators, reinforcing the disconnect between policy design and implementation.

Power Dynamics: The findings also revealed the complex power dynamics embedded within technological decision-making. The influence of technological artifacts, such as laptops and digital reporting systems, in shaping governance decisions raises concerns about who ultimately holds power in SDM policymaking. The venue shift from a low-tech environment to a digital-based training was not solely a human decision but was influenced by the DEO officer's use of his laptop as a justification tool. From an ANT perspective, the laptop itself acted as a persuasive agent, guiding the conversation and shaping network interactions (Preparation Meeting, LENSEA, 13 March 2023). This highlights how non-human actors exert influence within SDM networks, reinforcing the need to critically assess how technology is positioned within decision-making frameworks.

These findings are highly significant because they challenge the prevailing assumption that digitalisation automatically enhances data governance. The assemblage of SDM networks revealed that while technology is positioned as an enabler, its actual implementation has introduced new layers of complexity, inefficiency, and burden. By revealing these contradictions, the findings underscore the necessity of rethinking SDM from a socio-technical perspective—one that balances technological solutions with the realities of human engagement, capacity, and agency.

The fragmented will in human agency observed in the previous section is further compounded by the overemphasis on technology, as some actors (MOE) view digitalisation as a solution, while others (headteachers) experience it as an obstacle. This discrepancy highlights the need for participatory governance that includes implementers in decision-making, ensuring that technological tools truly support rather than hinder educational administration.

Addressing the issue of technological overemphasis requires a shift toward human-centred data governance models, where technology is integrated as a complement rather than a replacement for administrative processes. This means prioritising user-friendly interfaces, reducing redundant data entry, and ensuring that digital tools are accessible and functional before full-scale implementation.

Without this shift, SDM will continue to be dominated by a policy mindset that assumes technological advancements equate to progress, without critically assessing their impact on stakeholders. The findings call for a more nuanced, participatory approach to SDM governance that acknowledges both the affordances and limitations of digitalisation, ensuring that human agency is not diminished in the process.

Chapter 6 Discussion: Techno-Enablement

6.1 Introduction: From Findings to Solutions

While the Malaysia Education Blueprint (MEB) envisions School Data Management (SDM) as a tool for data-driven governance, this study reveals a deeper structural and relational entrapment. SDM, in practice, is caught in what this thesis conceptualises as the Compliance Trap Cycle—a system where global benchmarks like PISA are translated into domestic performance rituals. These rituals reward surface-level compliance through KPIs, uploads, and templated reports, rather than fostering authentic school improvement. The illusion of progress is maintained, but deep engagement with data for localised decision-making remains rare.

Layered beneath this cycle is what Actor-Network Theory (ANT) helps to uncover: the Ghost Network of School Leadership. This network comprises invisible, non-human and human actors—dashboards, data systems, laptops—that silently shape how leaders behave. These ghostly instructions do not operate through formal authority but through implied expectations, habits, and shared survival tactics among educators. As a result, decision-making becomes a choreography of anticipation, shaped more by systems than by agency.

This discussion chapter builds on these findings by introducing the theoretical contribution of techno-enablement—a framework developed through critical engagement with institutional theory, policy capacity, policy translation, and socio-material networks. Rather than blaming technological inefficiencies or individual actors, this framework shifts the focus to the enabling conditions necessary for SDM to function as a participatory governance tool.

The chapter is structured around the techno-enabler framework, which identifies five interrelated conditions—techno-governance, techno-competency, techno-networking, techno-decisioning, and techno-integration—as the foundation for meaningful SDM reform. By synthesising the structural findings (Chapter 4) and

relational insights (Chapter 5), this discussion repositions SDM not as a failed system, but as a system yet to be properly enabled.

6.2 Addressing the Research Questions Through the Findings

The findings presented in Chapter 4 and 5 provide critical insights into the structural and relational dimensions of SDM in Malaysia, answering the research questions guiding this study. The analysis highlights the impact of the MEB on SDM implementation, the role of prominent agencies in SDM governance, the challenges faced by these agencies, and the enabling and hindering factors shaping SDM effectiveness. These insights are significant in understanding how policy, institutional frameworks, and technological infrastructures shape SDM outcomes, providing a foundation for rethinking governance models, digital integration, and inter-agency collaboration.

RQ1: How does the Malaysia Education Blueprint (MEB) impact the implementation of School Data Management (SDM)?

The findings reveal that the MEB has played a pivotal role in shaping SDM implementation, but its influence has been fragmented and inconsistent. The policy-system alignment examined in Section 4.3.1 highlights that while MEB articulates a vision for data-driven decision-making, its execution has been hindered by gaps in digital infrastructure, policy misalignment, and bureaucratic constraints.

The network analysis of the MEB (Section 4.3.1.1) demonstrates that the policy envisions SDM as a tool for performance monitoring and accountability, yet fails to integrate key actors such as MAMPU into its reporting structures. The omission of crucial agencies limits the blueprint's effectiveness in ensuring that SDM is coherent, efficient, and adaptable to school-level realities.

Moreover, the MEB frames SDM as a mechanism of data surveillance rather than an enabler of school improvement (Section 4.3.1.2). The findings show that MEB

annual reports primarily focus on success stories and numerical progress indicators rather than examining challenges and systemic inefficiencies. The lack of critical reflection on unmet targets (as seen in the absence of reports for 2021 and 2022) suggests that SDM is primarily used for top-down monitoring rather than bottom-up decision-making. This creates a paradox in which SDM is perceived as a bureaucratic obligation rather than a tool for meaningful school-level change.

The significance of these findings lies in exposing the gap between policy intent and execution, illustrating that MEB's emphasis on SDM as a strategic mechanism is undermined by its failure to address structural inefficiencies in its implementation. This has implications for policy reform, requiring a shift from rigid compliance-driven models to adaptable, school-centred frameworks that empower local actors.

RQ2: What are the prominent agencies identified in Malaysian public policies related to SDM?

The findings identify multiple agencies that play significant roles in SDM governance, but also reveal fragmentation and disjointed coordination between them. Section 4.3.1.4 (Divergence in Policy Narratives) highlights that the Ministry of Education (MOE) dominates SDM governance but does not fully integrate other key agencies such as MAMPU, the State Education Departments (SEDs), and the District Education Offices (DEOs) into decision-making structures.

Figure 4.2 (Prominent Agencies Identified in Policy Network Analysis) demonstrates that MAMPU plays a key role in public data governance through the Public Sector Open Data (PSOD) policy yet is largely absent from the MEB's SDM framework. This oversight limits the effectiveness of SDM as an integrated governance tool, as technological and infrastructural expertise from MAMPU is not leveraged effectively.

The findings also reveal tensions between MOE, DEOs, and SEDs, where MOE exerts centralised control over SDM policies, but implementation responsibilities fall on state and district education officers who face challenges in aligning local needs

with national directives (Section 4.4.2). This mismatch between policy authority and implementation responsibility results in inefficiencies, as schools are often caught between competing expectations from national and local education agencies.

These findings are significant as they expose the fragmented governance of SDM, highlighting the need for clearer role delineation and improved inter-agency communication. Addressing these coordination issues is crucial for ensuring more streamlined, data-driven decision-making processes.

RQ3: What constitutes the network of SDM?

The findings indicate that SDM is a multi-layered, interconnected network involving various actors, technological infrastructures, and institutional policies. Sections 4.2 and 4.3 illustrate that SDM governance involves the interaction between national policymakers (MOE), state-level decision-makers (SEDs), district-level officers (DEOs), and school administrators (headteachers). However, the network is highly fragmented, with limited communication and coordination between these levels.

Figure 4.1 (Network Analysis Findings of SDM in Malaysia) demonstrates that while MOE serves as the central hub, the flow of information between agencies is inconsistent, resulting in bottlenecks in data processing and policy execution.

RQ5: What are the network issues within SDM practices?

The findings reveal that SDM is hampered by fragmented communication channels, inefficiencies in data flow, and technological overemphasis. Section 4.4.3 (Perceptual Disparities between Policy Planning and Policy Implementation) illustrates that while MOE sees SDM as a policy instrument for accountability, educators experience it as an administrative burden.

Furthermore, technological constraints (Section 4.3.3.5) have created significant challenges in SDM implementation, with slow system speeds and redundant

reporting requirements increasing frustration among stakeholders. The absence of a unified SDM governance model has resulted in data silos, where different agencies maintain separate, often conflicting, datasets.

The significance of these findings lies in revealing that SDM's effectiveness is contingent upon resolving its fragmented structure, necessitating stronger integration across policy, technological, and administrative networks.

RQ6: What are the enabling factors and hindering causes of SDM?

The findings provide insights into both the conditions that enable SDM effectiveness and the barriers that hinder its success. Regulatory oversight (Section 4.3.3.1), capacity-building initiatives (Section 4.3.3.2), and improved communication structures (Section 4.3.3.3) are key enablers that could improve SDM governance. However, the fragmented will in human agency (Section 4.4.3.4), technological overemphasis (Section 4.3.3.5), and power centralisation (Section 4.2.1) are significant obstacles to SDM reform.

6.3 Rethinking SDM Through Techno-Enablement

The governance of SDM in Malaysia has been shaped by policy centralisation, institutional fragmentation, and a compliance-driven reporting structure that prioritises top-down oversight over participatory decision-making. While the MEB 2013-2025 envisions SDM as a mechanism for data-driven governance, its implementation has largely failed to empower school leaders, teachers, and administrators to engage with SDM data for localised decision-making. Instead, MOE's centralised control over SDM governance has created a system where schools primarily act as passive data providers, responsible for submitting performance metrics without the ability to leverage data for school improvement. This paradox—where SDM is positioned as an instrument for education accountability yet remains inaccessible to institutional actors—demands a fundamental rethinking of how SDM governance should function.

While these challenges have been identified in SDM governance, existing policy frameworks do not sufficiently account for the relational and structural factors that constrain its effectiveness. Most SDM research either focuses on the technical efficiency of data systems or critiques the administrative burden of compliance, but these perspectives fail to explain how governance conditions shape institutional engagement with SDM. A new conceptual approach is needed to explain how governance structures interact with institutional agency and technology to shape SDM outcomes. This study develops techno-enablement to address these gaps.

6.4 Systematic Development of Techno-Enablement as a Synthesis of the Techno-Agential Condition

Techno-enablement is not developed in isolation; rather, it emerges as a synthesis of the techno-agential condition, which is extensively discussed in Section 2.11 of the literature review. This condition conceptualises SDM governance as the interaction between technological affordances (potentiality) and institutional agency (power), structured through enabling conditions. Techno-enablement extends this discussion by systematically integrating and expanding multiple theoretical perspectives to explain how SDM governance can transition from a compliance-driven system to an adaptive, institutionally responsive governance tool.

Rather than assuming that technology alone enhances governance outcomes, techno-enablement posits that SDM's effectiveness is contingent upon governance structures, institutional agency, and policy adaptability that shape its use. This aligns with the techno-agential condition, which asserts that technology does not inherently empower decision-making unless institutional actors are enabled to interpret, apply, and modify SDM insights within a supportive policy framework. Therefore, techno-enablement conceptualises SDM not merely as a digital infrastructure but as an interactive governance mechanism embedded within broader structural and relational conditions.

By synthesising power (human agency), potentiality (technological affordances), and enablementism (structural conditions), techno-enablement operationalises the techno-agential condition into a structured framework for SDM governance reform. It moves beyond technological determinism, which assumes that digitisation alone improves decision-making, and instead positions SDM as an embedded system where institutional capacity, leadership structures, and inter-agency collaboration must align to ensure effective educational governance. This synthesis ensures that SDM transitions from a passive data repository into a participatory decision-making tool, fostering institutional autonomy within a structured governance model.

The foundation of techno-enablement begins with Institutional Theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983), which explains how education policies often become ceremonial rather than transformative, with institutions conforming to policy mandates for legitimacy rather than for substantive improvements. This is evident in Malaysia's SDM governance, where schools report data to meet bureaucratic requirements, but the data is not necessarily used for localised decision-making. Institutional Isomorphism (DiMaggio & Powell, 1983) further explains how SDM adoption in Malaysia follows external global pressures, particularly from international benchmarks like PISA and TIMSS, rather than being driven by internal national education goals.

To move beyond a purely institutional perspective, Policy Capacity Theory (Wu, Ramesh & Howlett, 2015) is integrated into techno-enablement to examine the technical, operational, and political capacities necessary for SDM governance to function effectively. Policy capacity theory highlights that education data alone does not drive decision-making—actors must have the analytical, operational, and political competencies to engage with and act upon data insights. Without institutional structures that support the meaningful use of SDM, schools and district education offices (DEOs) become passive data providers rather than active decision-makers.

Beyond institutional and policy structures, Policy Translation Theory (Callon, 1986) contributes to techno-enablement by explaining how education policies are not merely implemented but continuously reinterpreted and reshaped by institutional

actors. SDM governance in Malaysia reflects this translation process, where data policies formulated at the national level are interpreted differently across state, district, and school levels, leading to fragmented implementation. This theoretical insight underscores that SDM effectiveness is contingent upon governance adaptability and inter-agency collaboration rather than rigid policy enforcement.

Socio-Material Network Theory (Fenwick & Edwards, 2010) provides another layer to techno-enablement by framing SDM as a governance system rather than just a technological tool. Socio-materiality emphasises that technology does not function in isolation but is shaped by its interactions with institutional actors, policy structures, and organisational routines. In SDM governance, digital infrastructures such as KPI dashboards and AI-driven analytics do not inherently enhance governance effectiveness unless enabling conditions—such as institutional agency, professional capacity, and collaborative policymaking—are present. This theoretical grounding helps position techno-enablement as an approach that moves beyond technological determinism to consider how SDM is embedded in broader governance dynamics.

To further refine the interplay between agency, structure, and power in SDM governance, techno-enablement builds upon the techno-agential condition, incorporating Heidegger's concept of potentiality, Foucault's notion of power, and Valsiner's enablementism. These theoretical foundations highlight why SDM does not inherently function as an enabler of decision-making but remains constrained by governance structures that regulate institutional engagement with data.

Heidegger's (1927) concept of potentiality informs techno-enablement by challenging the assumption that technology alone drives governance transformation. Heidegger argues that technology's impact is not intrinsic but contingent upon the conditions that allow its potential to be realised. In the context of Malaysia's SDM governance, while digital infrastructures exist, they do not automatically improve decision-making unless institutional conditions actively facilitate their meaningful use. The existence of data repositories, AI-driven analytics, and centralised reporting systems does not equate to participatory governance—without policy flexibility, institutional agency, and professional

capacity, these systems remain passive bureaucratic instruments rather than decision-making enablers.

Foucault's (1977) concept of power further shapes techno-enablement by revealing that SDM governance structures are not neutral but operate as mechanisms that regulate authority and constrain agency. SDM governance is not just a technical system for education data management but a political tool that reinforces existing hierarchies of control. Under Malaysia's centralised-decentralised education system, schools and district offices act as data providers rather than active decision-makers, as SDM policies prioritise top-down accountability over institutional autonomy. Thus, SDM serves as an instrument of surveillance and performance measurement rather than a participatory governance mechanism, limiting the capacity of school leaders and educators to interpret, negotiate, or challenge data-driven mandates.

Valsiner's (2014) enablementism contributes to techno-enablement by bridging the gap between technological infrastructures, governance structures, and institutional agency. While Heidegger critiques the assumption that technology inherently drives transformation, and Foucault exposes how power structures limit agency, Valsiner shifts the focus toward the conditions necessary for agency to be exercised effectively. Techno-enablement extends this perspective by asserting that SDM governance must not only provide access to data but also establish the enabling conditions that allow institutional actors to utilise data meaningfully. Without these conditions—such as training in data literacy, decentralised decision-making authority, and policy adaptability—technology remains a bureaucratic tool rather than an enabler of governance transformation.

Thus, Techno-enablement moves beyond simply describing SDM's limitations and instead provides a structured framework for analysing how governance, technology, and institutional agency must be aligned to enable participatory decision-making. It critiques Heidegger's notion of technology as mere potential by emphasising the need for governance mechanisms that allow its realization and expands Foucault's analysis of power by offering a pathway for institutions to move beyond control-based governance toward more adaptive and participatory

models. In doing so, Techno-enablement provides a critical, yet actionable, framework for rethinking SDM governance in Malaysia and beyond.

6.5 Theoretical Discourses on SDM Governance

6.5.1 Institutional Theory and Policy Standardisation in SDM

The governance of SDM in Malaysia aligns with broader theoretical discussions on institutional legitimacy, policy standardisation, and organisational conformity, particularly as conceptualised by Meyer & Rowan (1977) in Institutional Theory. According to their framework, institutional policies often serve symbolic purposes, adopted to demonstrate alignment with global governance expectations rather than to drive substantive structural improvements. This perspective is crucial in assessing whether Malaysia's SDM policies function primarily as a symbolic compliance mechanism—reinforcing legitimacy for digital transformation efforts—or whether they have led to meaningful governance reforms.

The findings from Sections 4.3.1.4 and 4.4.3.3 suggest that SDM policies are largely designed to reinforce national education legitimacy rather than to empower schools with data-driven decision-making. This is particularly evident in the way SDM implementation in Malaysia mirrors global education policy trends but does not necessarily translate into institutional autonomy or improved governance outcomes at the school level. The MEB presents SDM as an instrument for digital transformation, school accountability, and performance benchmarking, aligning with international education policy trends influenced by UNESCO and OECD frameworks. However, evidence suggests that schools engage with SDM as an obligatory administrative task rather than as a governance tool, reinforcing the idea that SDM adoption is more about policy compliance than actual systemic change.

Meyer & Rowan's (1977) argument that institutional policies are often designed to create external legitimacy rather than internal effectiveness is particularly relevant in this context. The MOE's emphasis on SDM as a national digital governance tool aligns with global trends in data-driven educational reform, but

the study findings indicate that the practical implementation of SDM remains disconnected from actual school governance needs. The absence of a participatory decision-making structure that integrates SDM insights into school-level decision-making suggests that SDM functions as a symbolic policy rather than as a transformative governance mechanism.

SDM as a Policy Standardisation Mechanism

The concept of policy standardisation in education governance further reinforces the argument that Malaysia's SDM implementation aligns more with global policy trends than with localised institutional needs. Findings from Sections 4.3.1.1 and 4.3.1.2 indicate that Malaysia's SDM policies are heavily shaped by global data governance frameworks rather than by direct input from educational practitioners. This reflects a broader trend in education policy, where national governments adopt standardised policy frameworks to align with international governance expectations rather than tailoring solutions to contextual institutional challenges.

One of the critical shortcomings of standardised SDM governance models is their one-size-fits-all approach, which often fails to account for institutional diversity and localised governance needs. In Malaysia's case, the uniformity of SDM reporting requirements across different types of schools (e.g., urban, rural, public, private) does not account for the unique administrative and infrastructural challenges faced by different institutions. This rigidity reflects Meyer & Rowan's (1977) argument that standardised policy structures can become decoupled from real institutional practices, where compliance takes precedence over functional efficiency or governance improvement.

Is SDM an Instrument of Policy Control Rather than School Empowerment?

The findings from Section 4.4.3.4 also align with critical institutional theory perspectives that emphasise how policy standardisation can reinforce centralised control rather than institutional empowerment. While SDM is presented as a governance tool designed to enhance decision-making, its practical implementation suggests that it serves as a mechanism for hierarchical

accountability rather than school autonomy. Meyer & Rowan (1977) argue that institutions often adopt structured governance models to create the appearance of rational decision-making, even when such models do not necessarily result in increased institutional efficiency.

This theoretical critique is particularly relevant when considering how SDM has been positioned within Malaysia's education governance framework. The MOE's control over SDM data collection, reporting, and access suggests that SDM is primarily used as a surveillance mechanism rather than as a decision-making enabler. Findings from Chapter 5 indicate that teachers and school administrators rarely have meaningful access to SDM insights, reinforcing the argument that SDM primarily serves the interests of policymakers rather than educators.

Furthermore, the top-down design of SDM policy frameworks means that schools have little flexibility in how they engage with data-driven decision-making. Institutional theory predicts that standardised governance models often limit institutional agency, a trend that is evident in Malaysia's SDM implementation. The findings show that school leaders are often required to submit data for national performance evaluations but are given little guidance on how to interpret or use the data to inform localised school governance strategies.

Policy Legitimacy vs. Institutional Effectiveness: A Theoretical Tension

One of the central tensions in institutional theory applications to SDM governance is the conflict between policy legitimacy and institutional effectiveness. The adoption of SDM as part of Malaysia's national education policy agenda has strengthened the country's position as a proponent of digital governance in education, aligning with international expectations on evidence-based policy reform. However, findings from Section 4.3.3.1 indicate that the actual impact of SDM policies on school governance remains limited, raising critical questions about whether SDM is a legitimization tool or a substantive governance reform initiative.

This theoretical critique aligns with the work of Ball (2012) on policy performativity, which argues that education governance models often prioritise

the symbolic value of policy adoption over its practical impact on institutional actors. The study findings suggest that Malaysia's SDM model exhibits similar performative tendencies, where the national policy discourse on SDM modernization does not necessarily translate into school-level governance improvements.

Moreover, the absence of structured feedback mechanisms within SDM governance structures means that schools are positioned as passive data providers rather than active participants in data-driven governance. This reinforces the institutional theory argument that standardised governance frameworks often fail to account for localised institutional agency, resulting in policy adoption without substantive governance change.

Critical Reflections on the Institutional Constraints of SDM Governance

Given the institutional constraints embedded within SDM governance in Malaysia, a key question arises: Is SDM truly enabling school-level decision-making, or does it primarily function as an accountability tool for policymakers? The findings suggest that Malaysia's SDM implementation aligns with global education governance trends but remains structurally rigid, limiting its potential as a localised governance tool. This reflects a broader challenge in institutional governance models, where policy structures prioritise compliance over agency, leading to a disconnect between policy intent and institutional practice.

While Meyer & Rowan's (1977) institutional theory provides a useful lens for analysing the symbolic nature of SDM governance, it also presents an opportunity to rethink how SDM policies can be redesigned to support substantive governance improvements. Future policy iterations should focus on creating enabling conditions for schools to use SDM data meaningfully, ensuring that data-driven decision-making is an embedded institutional practice rather than an imposed compliance task.

6.5.2 Isomorphism in SDM Adoption

The governance of SDM in Malaysia can also be analysed through the lens of DiMaggio & Powell's (1983) concept of isomorphism, which explains how institutions tend to adopt similar structures and practices due to coercive, mimetic, or normative pressures. This framework is particularly relevant in assessing whether Malaysia's SDM policies are internally driven by national education goals or externally influenced by global education governance trends. The findings from Chapters 4 and 5 suggest that SDM adoption in Malaysia is not merely a product of domestic education policy priorities but is also shaped by international benchmarking pressures, digital governance trends, and policy diffusion from global organisations such as UNESCO and OECD.

Coercive Isomorphism: SDM as a Response to Global Policy Pressures

Coercive isomorphism occurs when governments or institutions implement policies due to pressures from regulatory bodies, funding organisations, or international mandates. In the context of Malaysia's SDM governance, findings from Section 4.3.1.4 indicate that MOE's digital education policies align closely with global education reform narratives that emphasise evidence-based policymaking, digital transformation, and data-driven accountability. This suggests that Malaysia's SDM framework is influenced not only by internal governance needs but also by external expectations for digital governance modernization.

One example of coercive isomorphism in SDM adoption is the alignment of Malaysia's education data policies with UNESCO's Sustainable Development Goal (SDG) 4, which calls for the integration of digital governance in education to enhance learning outcomes and system accountability. The use of SDM data for national performance evaluations also aligns with OECD's PISA rankings, which influence education policymaking in many countries by setting global benchmarks for system effectiveness. Findings from Section 4.3.3.1 suggest that Malaysia's emphasis on SDM as a monitoring tool reflects broader global trends in using education data for international comparisons rather than localised school improvement. This aligns with the argument by Rizvi & Lingard (2009) that global

education policy agendas shape national governance priorities, often leading to compliance with international standards rather than policy adaptation based on local needs.

A critical implication of coercive isomorphism in Malaysia's SDM adoption is that while the government promotes SDM as a tool for national education reform, its underlying structure is designed to meet international expectations rather than to empower schools with meaningful data-driven decision-making. The findings suggest that schools are required to report data in standardised formats that align with global performance indicators but are given limited opportunities to use the data for local governance. This reinforces the critique that policy standardisation under external influence often leads to institutional conformity rather than innovation, limiting the potential for adaptive, school-centred data governance frameworks.

Mimetic Isomorphism: SDM as a Policy Borrowing Practice

Mimetic isomorphism occurs when governments or institutions copy policies from other systems perceived as successful, particularly in times of uncertainty. Findings from Section 4.3.1.1 suggest that Malaysia's SDM adoption was partially influenced by best practices from high-performing education systems, particularly Singapore, Finland, and the United Kingdom, where data-driven decision-making is integrated into school governance. However, while these countries have successfully embedded SDM within decentralised governance models that empower local education authorities, Malaysia's approach remains highly centralised, limiting institutional autonomy in data interpretation and usage.

This discrepancy between policy adoption and actual implementation is a common challenge in policy borrowing and lending, as highlighted by Phillips & Ochs (2003), who argue that policy transfer between countries often overlooks contextual differences in governance structures, stakeholder capacity, and institutional culture. While Malaysia has borrowed elements of SDM reporting structures from global best practices, the findings suggest that the centralised nature of its education system prevents meaningful adaptation. Schools are expected to comply

with national reporting standards rather than develop localised data-driven governance strategies, making SDM more of a compliance tool than an enabler of institutional agency.

A key concern with mimetic isomorphism in SDM adoption is the over-reliance on international models that may not align with local educational contexts. While Singapore and Finland have successfully integrated SDM into decentralised governance systems, Malaysia's highly bureaucratic policy structure limits the ability of schools to independently engage with data-driven decision-making. Findings from Section 4.4.3.4 indicate that school leaders often experience SDM as an administrative burden rather than as a governance resource, further reinforcing the disconnect between policy borrowing and institutional realities.

Normative Isomorphism: SDM as a Professional Expectation

Normative isomorphism refers to policy adoption driven by professionalization trends, where institutions implement reforms based on widely accepted norms and expectations within a field. In the case of SDM adoption in Malaysia, findings suggest that the push for digital governance in education has been reinforced by professional discourses on data-driven decision-making, accountability, and school performance evaluation. This aligns with Sellar & Lingard's (2013) argument that the professionalization of education governance has led to an increasing reliance on quantitative data for policymaking, school evaluations, and institutional benchmarking.

Findings from Section 4.3.3.3 suggest that MOE has actively promoted SDM as an essential governance tool, aligning with international discourses on evidence-based policymaking. However, despite this normative push, many educators remain skeptical about the practical benefits of SDM, particularly given the lack of professional training and school-level data autonomy. This reflects the broader critique that professionalization trends often emphasise compliance with dominant governance models without necessarily providing the structural conditions needed for meaningful engagement.

A critical implication of normative isomorphism in SDM adoption is that Malaysia's education sector is expected to engage with SDM, but without adequate professional capacity-building initiatives, its implementation remains uneven. Findings from Chapter 5 indicate that while school administrators recognise the theoretical benefits of SDM, they lack institutional support to effectively integrate it into decision-making processes. This reinforces the argument by Ball (2012) that the performativity of governance often leads to policy adoption without substantive institutional transformation.

6.5.3 Public Policy Capacity in SDM Implementation

The effectiveness of SDM in Malaysia depends not only on technological infrastructure and policy standardisation but also on the capacity of institutions, policymakers, and educators to effectively implement and utilise SDM systems. Wu, Ramesh, & Howlett (2015) identify three key dimensions of policy capacity that determine the success of public policy implementation:

- a. Analytical Capacity - The ability to collect, process, and interpret data for decision-making.
- b. Operational Capacity - The infrastructure, human resources, and technical systems needed to implement SDM effectively.
- c. Political Capacity - The ability of institutions to align stakeholder interests, manage resistance, and ensure long-term policy sustainability.

Findings from Chapters 4 and 5 suggest that Malaysia's SDM governance faces critical challenges in all three dimensions of policy capacity, leading to fragmented implementation, low stakeholder engagement, and limited policy impact at the school level. This section critically examines each dimension of public policy capacity in relation to Malaysia's SDM implementation, assessing whether the current governance structure has the necessary analytical, operational, and political capacity to sustain effective education data management.

Analytical Capacity: The Limits of Data Literacy and Evidence-Based Policymaking

Analytical capacity in SDM refers to the ability of institutions to collect, analyse, and apply data for informed decision-making. In principle, SDM is designed to enable evidence-based policymaking, where data insights drive school governance, policy adjustments, and performance evaluations. However, the findings from Section 4.3.3.1 suggest that Malaysia's SDM governance suffers from low analytical capacity, as data collection processes are primarily designed for compliance rather than for meaningful decision-making.

A key issue is the lack of data literacy among educators, school administrators, and policymakers. While schools are required to submit SDM reports, many teachers and school leaders do not receive training on how to interpret SDM data or use it for institutional planning. This reflects a broader issue identified in global education governance studies: the presence of data does not automatically lead to improved decision-making if institutional actors lack the analytical capacity to engage with it effectively (Coburn & Turner, 2011).

Findings from Section 4.4.3.4 indicate that educators often perceive SDM data as an external requirement rather than as a resource for improving teaching and school management. This suggests that Malaysia's SDM system is not fully integrated into school-level governance processes, reinforcing the argument by Wu et al. (2015) that public policy implementation fails when institutions lack the capacity to translate data into actionable governance improvements.

Moreover, the absence of structured feedback loops between policymakers and school administrators further limits analytical capacity. While MOE and central education agencies collect extensive SDM data, findings from Section 4.3.3.3 suggest that this data is rarely used to generate insights that inform localised decision-making at the school or district level. This disconnect aligns with Fullan's (2019) critique of education policy implementation, which emphasises that successful policy adoption requires iterative feedback mechanisms rather than static compliance structures.

Thus, strengthening Malaysia's analytical capacity in SDM governance requires a fundamental shift toward data literacy training, participatory policymaking, and decentralised decision-making. Without these reforms, SDM will continue to function primarily as a bureaucratic reporting tool rather than as an enabler of institutional effectiveness.

Operational Capacity: Infrastructure, Technical Gaps, and Institutional Readiness

Operational capacity in SDM refers to the technological infrastructure, human resources, and administrative systems needed to implement SDM effectively. Findings from Section 4.3.3.5 indicate that Malaysia's SDM implementation suffers from significant operational challenges, particularly in infrastructure limitations, inconsistent digital integration, and insufficient technical support.

One of the key challenges is the digital divide between urban and rural schools. Findings from Chapter 5 suggest that schools in urban centers have better access to SDM infrastructure, whereas rural schools struggle with unreliable internet connectivity, outdated hardware, and insufficient IT support. This discrepancy reflects broader challenges in public policy implementation in developing education systems, where unequal distribution of resources creates disparities in policy effectiveness (Ben Williamson, 2018).

Another issue is the lack of interoperability between different SDM platforms used by MOE, state education departments, and district education offices. Findings from Figure 4.2 indicate that schools often have to submit data across multiple reporting systems that do not communicate effectively with one another, resulting in redundant reporting and inefficiencies in data consolidation. This aligns with critiques in public sector digital governance (Dunleavy et al., 2006), which argue that fragmented digital systems reduce operational efficiency by increasing administrative burdens rather than streamlining governance processes.

Furthermore, Section 4.3.3.2 reveals that Malaysia's SDM framework lacks a structured capacity-building program to train teachers, school leaders, and district

officers in SDM best practices. Without adequate professional development initiatives, operational inefficiencies persist, as many institutional actors lack the technical skills to fully engage with SDM data.

To improve operational capacity, policymakers must focus on infrastructure standardisation, interoperability improvements, and sustained professional training initiatives. Without these changes, SDM will continue to function as a fragmented and underutilised governance tool, rather than as an integrated system for educational improvement.

Political Capacity: Stakeholder Alignment and the Challenge of Bureaucratic Control

Political capacity in SDM governance refers to the ability of institutions to manage stakeholder interests, navigate power dynamics, and ensure long-term policy sustainability. Findings from Section 4.3.1.4 indicate that Malaysia's SDM framework suffers from low political capacity, as decision-making authority is highly centralised within MOE, limiting the ability of schools and local education agencies to influence policy direction.

A key issue is the bureaucratic dominance of MOE in SDM governance, which creates a rigid, top-down implementation structure that limits school autonomy. Findings from Section 4.4.3.4 indicate that school leaders and district education officers have little say in how SDM policies are implemented, leading to resistance and disengagement. This reflects Fullan's (2011) critique of education reform models that rely on hierarchical control rather than participatory governance—when stakeholders are not actively involved in shaping policy, they are less likely to engage meaningfully with its implementation.

Another challenge is the absence of cross-agency collaboration in SDM decision-making. Findings from Section 4.3.1.1 reveal that MAMPU plays a minimal role in SDM policymaking, despite being responsible for national IT modernization efforts. This lack of inter-agency coordination mirrors governance challenges in other

centralised education systems, where policy silos limit the ability of government departments to work together effectively (Margetts & Dunleavy, 2013).

Improving political capacity in SDM implementation requires a shift toward more inclusive policymaking models that engage school administrators, district education officers, and digital governance agencies in collaborative decision-making. Without these changes, SDM will continue to function as a bureaucratic data-collection mechanism rather than as a participatory governance tool that aligns stakeholder interests and institutional priorities.

6.5.4 Resource Dependence Theory (RDT) in SDM Implementation

The effectiveness of SDM in Malaysia is not solely determined by policy intent or institutional capacity, but also by external resource dependencies that shape how SDM policies are adopted, implemented, and sustained. Pfeffer & Salancik's (1978) Resource Dependence Theory (RDT) argues that organisations do not operate in isolation but are embedded within networks of resource dependencies, where their ability to function effectively depends on their access to external funding, technology, expertise, and policy support.

Applying RDT to SDM governance, this section critically examines whether Malaysia's SDM challenges stem primarily from financial constraints, technological limitations, or political reluctance to decentralised data governance. The findings from Chapters 4 and 5 indicate that while financial investments in SDM infrastructure have been substantial, inefficiencies in inter-agency collaboration, digital expertise, and institutional autonomy have prevented schools from fully utilising SDM as a decision-making tool. This suggests that Malaysia's SDM governance is shaped by complex resource dependencies that influence policy sustainability, technological adoption, and institutional engagement.

Financial Dependencies and the Challenge of Sustainable SDM Funding

One of the primary considerations in SDM implementation is whether financial constraints limit its effectiveness. Findings from Section 4.3.3.5 suggest that

Malaysia has invested heavily in SDM infrastructure, particularly in centralising data management systems under MOE, yet schools continue to face operational challenges due to unequal funding distributions, outdated hardware, and inconsistent access to digital tools. This reflects a common challenge in public sector digitalisation, where large-scale technology investments at the national level do not always translate into functional improvements at the institutional level (Williamson, 2018).

A key issue is that SDM funding in Malaysia is primarily centralised within MOE, creating a dependency on top-down resource allocation. Findings from Section 4.4.3.4 suggest that district education offices (DEOs) and schools have limited budgetary control over SDM implementation, making them dependent on national funding cycles and policy directives. This centralised funding model mirrors governance challenges identified in other resource-dependent public sector systems, where local institutions struggle to adapt digital policies due to rigid budgetary constraints imposed by central authorities (Margetts & Dunleavy, 2013).

Furthermore, while international funding bodies such as UNESCO and the World Bank have supported digital education initiatives in Malaysia, findings suggest that these investments are often directed toward large-scale infrastructure projects rather than localised capacity-building efforts. This raises concerns about the sustainability of SDM funding, particularly as digital infrastructure requires ongoing maintenance, updates, and staff training to remain effective. Without a more flexible and decentralised funding model, SDM risks becoming a technological initiative that lacks long-term institutional integration.

Technological Dependence and the Risk of Vendor Lock-In

Another critical dimension of resource dependence in SDM governance is the reliance on external technology providers for software development, data management, and IT support. Findings from Section 4.3.1.1 indicate that Malaysia's SDM platforms are developed and maintained by private-sector technology vendors, creating a dependency on proprietary digital systems that may not always align with public sector needs. This raises concerns about vendor lock-

in, where education institutions become reliant on specific technology providers for SDM functionality, limiting flexibility in system adaptation and integration.

The challenge of vendor dependence in public sector digitalisation is widely recognised in governance research (Dunleavy et al., 2006). When government agencies outsource digital infrastructure to private companies, they often lose direct control over system development, data governance, and long-term adaptability. Findings from Section 4.3.3.3 suggest that Malaysia's SDM implementation reflects these challenges, as schools and district offices must operate within predefined digital platforms that offer little customisation for localised needs.

Furthermore, the reliance on external software providers for SDM system upgrades and maintenance means that technical expertise remains concentrated within private-sector entities rather than being developed within the public education system. This aligns with critiques by Williamson (2017), who argues that education data governance is increasingly being shaped by corporate technology providers rather than by educational institutions themselves. The risk here is that SDM governance becomes a function of private-sector innovation rather than public-sector policymaking, potentially limiting the ability of schools to influence system development and data usage policies.

Political Dependencies and the Centralisation of SDM Governance

While financial and technological dependencies shape SDM implementation, findings from Section 4.3.1.4 suggest that the most significant resource dependency in Malaysia's SDM governance is political rather than economic or technological. MOE maintains centralised control over SDM policies, data access, and implementation directives, limiting institutional autonomy at the school and district levels. This suggests that the primary challenge in SDM reform is not necessarily a lack of resources but rather the political will to decentralised decision-making authority.

From an RDT perspective, organisations that lack control over critical resources must comply with the directives of those who do. In the case of Malaysia's SDM governance, schools and district offices rely on MOE for policy approval, data access, and system funding, making them institutionally dependent on centralised governance structures. Findings from Section 4.4.3.4 indicate that school administrators and educators feel disempowered in SDM decision-making, as they must comply with national reporting requirements but have little influence over how SDM policies are shaped.

This aligns with the argument by Ball (2012) on education policy centralisation, which states that governments often maintain control over digital education policies to reinforce bureaucratic authority rather than to enable institutional autonomy. Findings from Chapter 5 suggest that Malaysia's SDM governance follows this pattern, where MOE's control over data governance reinforces hierarchical reporting structures rather than participatory decision-making models.

Another consequence of political dependency in SDM implementation is that policy reforms must align with the broader political agenda of the government in power. Findings from Section 4.3.1.2 indicate that Malaysia's SDM policies are often tied to national education policy cycles, making them susceptible to shifts in political leadership and policy priorities. This raises concerns about the sustainability of SDM governance, as changes in government may result in disruptions to SDM funding, reporting requirements, and data governance structures.

Occam's Razor in SDM Policy Efficiency

One of the critical questions in evaluating SDM in Malaysia is whether its governance structure is unnecessarily complex, leading to inefficiencies, or whether its intricacies are justified to ensure data integrity, accountability, and effective oversight. The principle of Occam's Razor, which suggests that the simplest solution that effectively addresses a problem is often the best one, provides a useful framework for analysing whether Malaysia's SDM system is overengineered or if a simpler, more adaptive model could enhance its usability and impact.

Findings from Chapters 4 and 5 indicate that Malaysia's SDM governance suffers from excessive bureaucratic layers, redundant reporting mechanisms, and fragmented data management structures. Schools are required to submit the same data multiple times across different agencies, leading to inefficiencies and administrative fatigue. Moreover, school leaders and educators often find themselves burdened with repetitive data entry tasks that do not contribute directly to school improvement. These inefficiencies raise concerns about whether SDM has been designed primarily as a compliance mechanism rather than as an enabler of institutional decision-making.

The need to critically assess SDM complexity is particularly important given the broader challenges of education governance reform. Studies in public administration and digital governance (Dunleavy et al., 2006; Margetts & Dunleavy, 2013) suggest that overly complex bureaucratic systems can create inertia, where compliance becomes an institutional goal rather than a means for policy effectiveness. The application of Occam's Razor to SDM policy efficiency therefore requires an evaluation of whether the system's complexity enhances decision-making or whether it creates unnecessary administrative burdens that reduce its practical impact.

The Complexity of SDM Governance: Bureaucratic Layers and Redundant Reporting

A defining characteristic of Malaysia's SDM framework is its highly centralised structure, which involves multiple layers of bureaucratic oversight. Findings from Section 4.3.1.4 reveal that schools must submit SDM reports to the Ministry of Education (MOE), state education departments (SEDs), and district education offices (DEOs), each of which operates under distinct reporting requirements. This fragmented structure results in inconsistent data management practices, increased workload for educators, and inefficiencies in data consolidation and utilisation.

The multi-tiered nature of SDM governance slows down data processing and decision-making. Schools, which are expected to comply with multiple reporting directives, experience delays in accessing their own data for school-level decision-

making. The findings suggest that by the time data moves through different bureaucratic layers, its relevance for immediate institutional planning may be diminished. The slow data feedback loops further reinforce a compliance-driven culture, where schools focus on fulfilling reporting obligations rather than engaging with data for meaningful governance improvements.

From an Occam's Razor perspective, these inefficiencies suggest that Malaysia's SDM system may be unnecessarily complex, with excessive bureaucratic layers reducing its overall effectiveness. While governance oversight is necessary, the question arises as to whether a more streamlined reporting structure could achieve the same accountability goals without burdening educators with redundant administrative tasks. Simplifying SDM governance through integrated reporting mechanisms, automated data collection, and decentralised decision-making structures could significantly enhance policy responsiveness and institutional engagement.

Unnecessary Complexity in Data Collection: A Compliance-Driven Burden?

Beyond governance inefficiencies, the data collection process itself in Malaysia's SDM system appears to be overly complicated, requiring schools to submit granular details that are often not directly relevant to their immediate governance needs. Findings from Section 4.3.3.3 indicate that educators frequently report data for the sake of compliance rather than because it directly informs school decision-making. This raises concerns about whether Malaysia's SDM policy prioritises exhaustive data collection over practical usability.

The volume of data collected is disproportionate to its actual use. Schools are expected to report detailed performance metrics, financial records, student demographic data, and operational statistics—yet, findings suggest that much of this information is not actively analysed at the school level. Instead, the data is aggregated at higher administrative levels, where it is used primarily for policy evaluation rather than institutional improvement. This reflects a broader issue identified in education data governance studies (Williamson, 2018; Selwyn, 2016),

which critique the tendency of education policymakers to prioritise data accumulation over meaningful data engagement.

A significant drawback of overly complex data collection is the phenomenon of data fatigue, where institutional actors, overwhelmed by reporting obligations, begin to view data submission as an administrative chore rather than as an opportunity for evidence-based governance. Findings from Section 4.4.3.4 indicate that many educators perceive SDM as a top-down reporting tool rather than a resource for school-level decision-making. This lack of engagement with SDM insights further diminishes the potential of data-driven decision-making in Malaysia's education system.

The application of Occam's Razor to this issue suggests that data collection should be as streamlined as possible without compromising accuracy and policy oversight. Policymakers should focus on collecting only the most essential data, ensuring that reporting requirements align with institutional decision-making needs rather than just national performance evaluation metrics. If schools are required to report data that does not directly impact their governance, the efficiency and relevance of SDM will continue to decline.

The Inefficiency of Multi-Tiered Decision-Making in SDM Governance

Another area where Occam's Razor can be applied to Malaysia's SDM system is in the decision-making process itself. Findings from Section 4.3.1.2 indicate that school administrators often face significant delays in receiving SDM insights due to the hierarchical reporting structure. Since data must be reviewed and processed at multiple governance levels before being distributed back to schools, the time lag reduces its usefulness for real-time decision-making.

A common critique of highly centralised decision-making models in education governance (Fullan, 2019; Margetts & Dunleavy, 2013) is that excessive administrative control reduces institutional agility. In the case of Malaysia's SDM, the multi-tiered approval process slows down school responsiveness, preventing administrators from using real-time data to address immediate challenges. From

an Occam's Razor perspective, this raises the question of whether such a complex governance structure is necessary for effective SDM implementation or whether a more decentralised approach would improve institutional responsiveness.

Simplifying SDM decision-making by reducing the number of bureaucratic approval layers and granting schools greater autonomy over data usage could significantly improve its functionality. The findings suggest that school leaders should have more direct access to SDM data without waiting for central approval, ensuring that data-driven governance is truly embedded at the institutional level.

Balancing Simplicity and Oversight: Towards a Lean SDM Governance Model

While Occam's Razor suggests that simplification is beneficial, it is essential to acknowledge that some level of governance complexity is necessary to ensure regulatory oversight, accountability, and data security. The challenge lies in striking a balance between simplicity and functionality. Findings from Section 4.3.1.1 indicate that MOE policymakers believe SDM complexity is necessary to maintain national education reporting standards and ensure data integrity. However, research in public administration and digital governance (Dunleavy et al., 2006; Margetts & Dunleavy, 2013) suggests that overly complex governance models can lead to bureaucratic inertia, where compliance overshadows actual policy effectiveness.

A lean SDM governance model would focus on:

- Eliminating redundant reporting requirements while maintaining essential oversight mechanisms.
- Improving system interoperability to reduce the administrative burden on educators.
- Decentralising SDM decision-making to enhance institutional responsiveness.

By applying Occam's Razor, policymakers can create a simplified yet robust SDM framework that enhances data management efficiency while ensuring policy accountability.

6.5.5 Data Autocracy vs. Data Democracy in SDM Governance

The governance of SDM in Malaysia is deeply intertwined with broader debates on data power hierarchies and institutional agency, particularly in assessing whether SDM operates as a data democracy—where educational institutions actively engage with and utilise data for localised decision-making—or a data autocracy, where data is strictly controlled by central authorities with limited access and influence at the institutional level. Kelly et al. (2010) conceptualise this distinction between data autocracy and data democracy, arguing that the extent to which organisations are allowed to interpret and act on data directly impacts their ability to function as autonomous, decision-making entities.

Findings from Chapters 4 and 5 indicate that Malaysia's SDM governance leans toward a data autocracy model, where MOE retains strict control over SDM data flow, accessibility, and utilisation, leaving school administrators, district officers, and teachers with minimal agency to engage with the data in meaningful ways. This centralised data governance structure raises critical concerns about whether SDM is truly empowering institutional actors or whether it serves as a mechanism of top-down surveillance and compliance.

The following sections critically examine the characteristics of data autocracy in Malaysia's SDM framework, the limitations it imposes on school governance, and the potential for a shift towards a more participatory, data-democratic system.

Data Autocracy in Malaysia's SDM Governance: Centralised Control and Institutional Disempowerment

A defining characteristic of data autocracy is the concentration of data ownership and decision-making authority in the hands of central agencies, limiting institutional actors' ability to interpret or act upon the data they generate.

Findings from Section 4.3.1.4 reveal that MOE acts as the sole custodian of SDM data, overseeing its collection, storage, and dissemination, while schools and district education offices (DEOs) serve primarily as data providers rather than active participants in data-driven decision-making.

This centralised model creates a number of governance inefficiencies. First, schools are required to submit detailed performance, operational, and financial data, but they receive limited access to the aggregated insights generated from this data. This means that while MOE uses SDM to evaluate and monitor school performance at a national level, individual schools lack the autonomy to analyse and act on their own data. The findings suggest that educators often feel disconnected from the decision-making processes that SDM is supposed to support, reinforcing the perception that data is collected for compliance rather than for institutional improvement.

Second, the hierarchical structure of SDM data access slows down institutional responsiveness. Findings from Section 4.4.3.4 indicate that school leaders and district education officers often experience delays in receiving actionable insights from SDM reports, as data must first be processed at multiple administrative levels before it is disseminated back to schools. This time lag reduces the relevance of the data, making it difficult for schools to respond proactively to emerging challenges such as student performance trends, attendance patterns, and resource allocation needs.

The absence of a participatory data governance framework further reinforces the autocratic nature of SDM. Findings from Figure 4.2 indicate that teachers and school administrators have little to no input in determining what data is collected, how it is interpreted, or how it should be used for decision-making at the institutional level. This reinforces the argument by Williamson (2018) that education data governance often prioritises national accountability measures over localised school improvement, creating a disconnect between policy-level data utilisation and institutional-level data engagement.

The Impact of Data Autocracy on Institutional Agency and Decision-Making

The centralisation of SDM data control within MOE has significant implications for institutional agency, governance effectiveness, and the role of data in school-level decision-making. One of the primary challenges highlighted in Section 4.3.3.1 is that school leaders and district officers are often unable to modify or interpret SDM data independently, as MOE determines the metrics, reporting structures, and analysis methods used in national education data governance.

This limitation aligns with Foucault's (1977) concept of data surveillance, where data collection primarily serves as a tool for hierarchical oversight rather than as an enabler of institutional agency. By restricting schools' ability to independently engage with their own data, MOE maintains control over the education system but simultaneously reduces the capacity of local institutions to leverage data for school improvement. This governance model contradicts global best practices in education data-driven decision-making, where institutions are encouraged to use data insights to shape localised policies, allocate resources efficiently, and improve student outcomes (Fullan, 2019).

Another major issue with data autocracy in Malaysia's SDM governance is that it reinforces passive compliance rather than active problem-solving among educators. Findings from Section 4.3.3.5 suggest that teachers often view SDM reporting requirements as bureaucratic tasks rather than as meaningful tools for improving teaching and learning outcomes. This is largely due to the fact that educators have little control over how the data they submit is utilised, leading to disengagement and a lack of motivation to integrate SDM into their professional practices.

The lack of data transparency in SDM governance further exacerbates the problem. Findings indicate that aggregated SDM insights, particularly those related to school performance, student learning trends, and resource allocation, are often not made fully available to schools. This lack of transparency reduces accountability at the institutional level, as schools are unable to cross-check their reported data with broader national education trends. Kelly et al. (2010) argue that true data democracy requires open access to information at all levels of an institution,

ensuring that all stakeholders can engage with, interpret, and act on data insights collaboratively.

Shifting from Data Autocracy to Data Democracy in SDM Governance

Given the challenges posed by Malaysia's data autocracy model, there is a need to transition towards a more participatory, decentralised approach to SDM governance. A data democracy model would ensure that:

- Schools and district offices have greater autonomy over how they collect, analyse, and utilise data for governance improvements.
- Educators and school leaders are provided with training and resources to engage meaningfully with SDM insights.
- Data accessibility is improved through open-data initiatives, where institutional actors have full access to relevant SDM insights in real-time.

Findings from Section 4.3.3.2 suggest that many school leaders support the idea of greater institutional autonomy in SDM governance but feel constrained by the current hierarchical structure of data access and decision-making. A data democracy model would address this issue by embedding SDM insights into professional development programs, ensuring that teachers and school leaders are equipped with the analytical skills needed to make data-driven decisions.

Furthermore, moving towards an open-access SDM system—where schools have real-time access to performance data, predictive analytics, and comparative benchmarking insights—would help shift the role of SDM from a surveillance mechanism to an enabling tool for institutional self-governance. This aligns with Valsiner's (2014) enablementism, which emphasises that organisations must be given the necessary conditions to utilise available resources effectively. By creating a more transparent, participatory, and decentralised SDM governance model, schools would be able to use data as an instrument for self-improvement rather than merely as a compliance mechanism.

6.5.6 Policy Translation Theory in SDM Implementation

The governance of SDM in Malaysia does not function as a straightforward, top-down implementation of national education policies. Instead, SDM policies are continuously interpreted, negotiated, and recontextualised at different levels of the education system, creating discrepancies between policy intent and on-the-ground implementation. Callon's (1986) Policy Translation Theory provides a useful lens for analysing how SDM policies are transformed as they move from national policymakers to district education offices (DEOs) and individual schools.

Findings from Chapters 4 and 5 indicate that Malaysia's SDM implementation does not follow a linear, uniform adoption process. Instead, policy directives issued by the Ministry of Education (MOE) are subject to reinterpretation by state education departments (SEDs), district education officers, and school administrators, leading to varied levels of compliance, adaptation, and resistance. This section critically examines how SDM policies are translated across different governance levels, the factors that shape policy reinterpretation, and the implications of policy translation for education governance efficiency.

Policy Translation and the Complexity of SDM Implementation

Traditional policy implementation models assume that government directives are adopted uniformly across institutions, following a rational, step-by-step execution process. However, findings from Section 4.3.1.4 suggest that this assumption does not hold in Malaysia's SDM governance, as different education agencies and schools interpret policy requirements differently based on their local contexts, institutional constraints, and available resources.

Callon (1986) argues that policies are not merely implemented but continuously translated as they move through different institutional actors. This process involves three key dimensions:

- a. **Reinterpretation** - Policies are understood and adapted based on the priorities, constraints, and experiences of those responsible for implementing them.

- b. **Negotiation** - Institutional actors modify or adjust policy requirements to fit their operational realities.
- c. **Contestation** - Some policy directives are resisted or selectively ignored if they are perceived as impractical, redundant, or misaligned with local needs.

Findings from Section 4.4.3.3 indicate that district education offices (DEOs) often modify SDM reporting requirements before they reach schools, resulting in inconsistent data collection practices across different regions. This aligns with Callon's argument that institutional actors do not passively adopt policies but actively reshape them to align with their existing governance structures and operational priorities.

Reinterpretation of SDM Policies Across Governance Levels

One of the most significant findings from Chapter 5 is that Malaysia's SDM implementation varies widely between different state and district offices. While MOE establishes standardised SDM reporting guidelines, the findings suggest that local education offices exercise discretion in how these policies are communicated and enforced at the school level.

For instance, findings from Section 4.3.3.5 indicate that some district education officers impose additional reporting requirements beyond national SDM mandates, creating inconsistencies in data reporting structures between different states and regions. This discretionary adaptation of policy aligns with Callon's (1986) argument that policy translation is shaped by institutional actors who must navigate the tensions between national policy objectives and localised governance constraints.

A key challenge in SDM policy translation is that schools are often caught between conflicting interpretations of SDM requirements from MOE, state education departments, and district education offices. Findings from Section 4.3.1.1 suggest that some schools receive contradictory instructions regarding SDM reporting formats, deadlines, and performance evaluation metrics, leading to administrative

confusion and inefficiencies. This further reinforces the idea that policy implementation is not a straightforward transmission of directives but a continuous negotiation between central authorities and local institutions.

Negotiation and Selective Adoption of SDM Directives

Policy translation also involves negotiation between different levels of governance, where institutional actors modify or selectively adopt certain aspects of SDM policies while disregarding others. Findings from Section 4.4.3.4 indicate that some school administrators actively push back against excessive SDM reporting requirements, arguing that they detract from more pressing institutional responsibilities such as teaching and student engagement.

This negotiation process highlights a broader debate in education governance research (Ball, 2012; Sellar & Lingard, 2013), where schools must balance compliance with national policy mandates against their own institutional priorities. Findings from Section 4.3.3.2 suggest that some schools negotiate reduced reporting obligations with district education offices, particularly in cases where SDM requirements are perceived as redundant or overly burdensome.

This process of negotiation and policy reinterpretation aligns with Callon's (1986) argument that institutional actors are not passive recipients of policy but active participants in shaping its implementation. The challenge, however, is that these negotiations create disparities in how SDM policies are applied across different schools and regions, leading to inconsistent implementation outcomes.

Contestation and Resistance to SDM Compliance

While policy translation often involves reinterpretation and negotiation, findings from Section 4.3.3.1 suggest that some institutional actors actively resist SDM compliance, particularly when reporting requirements are seen as misaligned with school priorities or operational constraints.

One form of resistance is data manipulation, where schools adjust reported data to meet performance benchmarks rather than reflecting actual conditions. Findings from Section 4.4.3.5 suggest that some school administrators modify SDM reports to align with MOE expectations, fearing negative evaluations if their performance metrics appear unfavorable. This behaviour reflects a broader challenge in data-driven governance models (Williamson, 2018), where institutions prioritise meeting compliance targets over engaging with data for meaningful governance improvements.

Another form of resistance is non-compliance, where schools selectively ignore certain SDM reporting requirements. Findings from Section 4.3.1.2 indicate that some educators openly contest the value of SDM data collection, arguing that it serves bureaucratic interests rather than institutional development. This resistance aligns with Ball's (2012) critique of performativity in education governance, where institutions push back against data-driven evaluation systems that prioritise policy accountability over actual educational quality.

The challenge with contestation in SDM implementation is that it creates disparities in compliance and accountability. While some schools fully adhere to SDM requirements, others actively modify or ignore certain directives, leading to inconsistencies in data reporting accuracy and reliability. This suggests that MOE's assumption of uniform SDM adoption does not reflect the reality of policy implementation, where institutional actors exercise discretion in determining how they engage with policy directives.

Implications of Policy Translation for SDM Governance

- a. The findings suggest that Malaysia's SDM governance model is shaped not just by national policy directives but also by the ways in which these directives are translated, negotiated, and contested across different governance levels. This has several critical implications for SDM reform:
- b. **Recognising Policy Flexibility** - Instead of assuming uniform policy adoption, MOE must acknowledge that policy directives will be interpreted differently at

the state, district, and school levels. This requires greater flexibility in SDM implementation, allowing for localised adaptations that align with institutional needs.

- c. Reducing Bureaucratic Complexity - Findings suggest that reducing redundant SDM reporting requirements could improve compliance and engagement, as institutional actors are more likely to participate in policy implementation when it aligns with their priorities.
- d. Improving Communication Across Governance Levels - Addressing contradictory SDM instructions from different agencies would reduce institutional confusion and improve policy consistency.

6.5.7 Socio-Material Networks in SDM Governance

The governance of SDM in Malaysia is not solely shaped by policy mandates or technological infrastructure but by the interplay between digital systems, institutional actors, and governance structures. Fenwick & Edwards (2010) conceptualise SDM as a socio-material network, where policy implementation, data collection, and decision-making are mediated by both human and technological agents. This perspective challenges the traditional technocratic assumption that digital systems function as neutral governance tools, instead emphasising that SDM effectiveness depends on how policies, technologies, and institutional practices interact within complex, multi-layered governance ecosystems.

Findings from Chapters 4 and 5 indicate that Malaysia's SDM system is not a standalone technological solution but an entangled network of human and non-human actors, including policymakers, school administrators, educators, digital platforms, and regulatory agencies. These interactions shape how data is collected, processed, interpreted, and ultimately used for decision-making. This section critically examines the socio-material nature of SDM governance, the limitations of its current configuration, and the implications for education data management efficiency.

SDM as a Socio-Material Network: The Interdependence of Policy, Technology, and Human Agency

Traditional SDM governance models often assume a linear relationship between policy mandates, technology adoption, and institutional compliance. However, findings from Section 4.3.1.4 suggest that SDM does not operate as a straightforward, top-down system but is mediated by a range of institutional interactions, policy adaptations, and digital infrastructures that shape its practical implementation. This aligns with Fenwick & Edwards' (2010) argument that SDM is not just a policy framework but a living network that evolves based on how different actors engage with it.

One of the key findings from Section 4.3.3.3 is that the effectiveness of SDM in Malaysia depends on how institutional actors engage with the digital platforms designed for data management. While MOE oversees centralised SDM reporting structures, teachers and school administrators remain the primary users responsible for inputting and managing data. However, the usability and accessibility of these digital platforms significantly influence institutional engagement. Findings suggest that teachers who find SDM platforms cumbersome or redundant are less likely to engage with data meaningfully, reducing the system's overall effectiveness.

This interdependence between digital infrastructure and human agency highlights a critical limitation in SDM governance: while digital platforms provide the technical means for data collection, their usability, accessibility, and adaptability determine whether they are actually utilised as governance tools. The findings suggest that Malaysia's SDM implementation does not fully account for this socio-material complexity, leading to inefficiencies in how data is collected, processed, and applied at the institutional level.

Technology as a Governing Actor: SDM Platforms and Algorithmic Decision-Making

One of the defining features of SDM as a socio-material network is that digital systems do not simply function as passive tools but actively shape governance practices. Fenwick & Edwards (2010) argue that education data platforms operate as governing actors that structure how policies are implemented, which decisions are prioritised, and how institutional actors interact with governance frameworks.

Findings from Section 4.3.3.5 indicate that Malaysia's SDM system relies on algorithmic decision-making tools that categorise schools based on performance indicators, student demographics, and compliance levels. However, the study suggests that many educators feel that these algorithmic assessments oversimplify complex institutional realities, reducing school governance to data-driven categorisations rather than nuanced, context-specific evaluations.

This aligns with critiques of algorithmic governance in education (Williamson, 2017; Selwyn, 2016), which argue that while digital platforms enhance data processing efficiency, they also introduce biases in policy evaluation, particularly when algorithms prioritise quantitative performance indicators over qualitative institutional dynamics. The reliance on predefined data metrics means that schools are often assessed based on rigid categories that do not always reflect their actual governance challenges or contextual needs.

A major issue identified in Section 4.4.3.4 is that school leaders often have limited control over how SDM data is interpreted and used in policymaking, reinforcing concerns about technocratic governance, where decision-making is increasingly driven by automated processes rather than institutional agency. This suggests that while SDM platforms enhance data collection, they also introduce new governance challenges related to transparency, accountability, and the potential dehumanization of education policymaking.

Institutional Resistance and the Adaptation of SDM Technologies

While MOE envisions SDM as a standardised, universal governance tool, findings from Section 4.3.1.1 indicate that schools and district offices actively modify, reinterpret, and, in some cases, resist SDM technologies based on their

institutional realities. This reinforces Fenwick & Edwards' (2010) argument that socio-material networks are not static but evolve based on how actors interact with governance frameworks.

Findings suggest that some schools develop informal data management practices that operate parallel to official SDM reporting structures, reflecting a form of institutional adaptation. In cases where MOE-mandated SDM platforms are seen as inefficient, school administrators and teachers create their own localised databases to track student performance, attendance, and financial records. While these adaptations improve efficiency at the institutional level, they also create discrepancies between officially reported SDM data and the data schools actually rely on for governance.

This divergence between formal SDM reporting structures and informal institutional practices aligns with broader debates in education data governance. Ball (2012) and Williamson (2018) argue that when centralised data systems do not align with local institutional needs, schools and educators develop their own workaround solutions, reducing compliance with official governance frameworks. Findings from Section 4.3.3.2 suggest that Malaysia's SDM implementation reflects this challenge, as educators often find official SDM platforms too rigid to accommodate the complexity of school operations.

This resistance also manifests in data manipulation practices, where some school administrators modify or adjust SDM reports to align with MOE expectations. Findings suggest that schools facing performance evaluation pressures sometimes alter attendance records or student achievement metrics to avoid negative assessments, further reinforcing concerns about the misalignment between SDM data governance and actual institutional realities.

Mobilising Tokens in SDM Governance

The governance of SDM in Malaysia is not merely a matter of policy mandates or technological integration but also of data control, access, and mobilisation. Murdoch (1998) introduces the concept of mobilising tokens, which refers to the

mechanisms through which data is moved, controlled, and interpreted within governance structures. In SDM governance, data does not flow neutrally or freely; instead, it is controlled by specific actors who determine how it is collected, stored, analysed, and used for decision-making.

Findings from Chapters 4 and 5 indicate that Malaysia's SDM system reflects a centralised model of data mobilisation, where the Ministry of Education (MOE) serves as the primary authority in determining how school data is processed and interpreted. However, this centralised control over data flow and access creates significant power asymmetries between policymakers, district education offices (DEOs), school administrators, and educators. The mobilisation of SDM data is highly restricted at lower governance levels, meaning that schools generate data but have little influence over how it is ultimately used.

This section critically examines how SDM data is mobilised within Malaysia's education governance system, the role of power dynamics in determining data control, and the implications for institutional autonomy and data-driven decision-making.

Data as a Contested Resource: Who Controls SDM Data in Malaysia?

A fundamental issue in Malaysia's SDM governance is that while schools and educators are responsible for generating data, they are not the primary users or decision-makers regarding its application. Findings from Section 4.3.1.4 reveal that SDM data is primarily collected for national-level education policymaking, rather than for institutional decision-making at the school level. This creates a top-down data governance structure, where data moves from schools to district offices to MOE but rarely circulates back in a form that is usable for school leaders and educators.

This pattern aligns with Murdoch's (1998) concept of mobilising tokens, which argues that data in governance systems is often controlled by dominant institutions that determine how it is interpreted and acted upon. In Malaysia's case, MOE acts

as the primary gatekeeper of SDM data, deciding which insights are disseminated, who has access, and how data-driven policies are formulated.

The findings suggest that this centralised data control creates several governance inefficiencies:

- a. **Limited Institutional Autonomy** - Schools do not have the authority to analyse and act upon their own SDM data without MOE approval, reducing their ability to engage in localised data-driven decision-making.
- b. **Bottlenecks in Data Access** - Findings from Section 4.3.3.5 indicate that school leaders and district officers often experience delays in receiving relevant SDM reports, as data must first be processed at multiple administrative levels before being shared with lower-tier institutions.
- c. **Restricted Data Transparency** - The lack of open access to SDM insights prevents educators from using real-time data to inform teaching strategies, student interventions, or resource planning, reinforcing the perception that SDM is primarily an external compliance tool rather than an internal governance mechanism.

The Politics of Data Interpretation: Who Gets to Define SDM Success?

Another critical dimension of mobilising tokens in SDM governance is that data does not merely exist; it is interpreted and given meaning by those who control it. Findings from Section 4.3.1.1 suggest that MOE's interpretation of SDM data is often focused on national performance indicators, efficiency metrics, and compliance rates rather than on school-level development needs.

This aligns with Murdoch's (1998) argument that data mobilisation is not just about movement but about meaning-making—the way data is framed and categorised determines how it is used in governance decisions. In Malaysia's case, SDM success is largely defined by MOE's priorities, which emphasise school performance rankings, student attendance rates, and policy compliance levels. However,

findings suggest that many educators and school administrators believe that these metrics do not fully capture the complexities of school governance, leading to tensions between national policy goals and localised institutional needs.

A major concern in SDM data interpretation is the use of standardised performance indicators to assess school effectiveness, which does not always reflect the unique challenges and contextual realities of different institutions. Findings from Section 4.4.3.4 indicate that many school leaders feel that SDM performance evaluations rely too heavily on quantitative metrics, ignoring qualitative factors such as community engagement, teacher-student relationships, and localised learning environments.

The result is a governance model where:

- a. MOE determines what “good” school performance looks like based on aggregated national data, rather than localised needs assessments.
- b. Schools are pressured to align with predefined benchmarks, even when they do not accurately reflect institutional realities.
- c. Educators have little say in how SDM insights should be interpreted or applied to their own school governance processes.

This reinforces the argument by Kelly et al. (2010) on data power hierarchies, where central authorities retain control over both data access and interpretation, limiting institutional agency at the local level.

Data Mobility vs. Data Lock-In: The Challenge of Restricted Information Flow

One of the significant limitations of Malaysia’s SDM system is that data is primarily mobilised in a one-directional flow from schools to MOE, with little movement back to the institutions that generate it. Findings from Section 4.3.3.2 indicate that school administrators often feel disconnected from SDM insights, as they do

not have direct access to national or regional data trends that could inform their own governance strategies.

This issue reflects what Murdoch (1998) describes as data lock-in, where information is collected but not circulated effectively among relevant institutional actors. Instead of functioning as a dynamic governance tool, SDM in Malaysia primarily serves as a data aggregation mechanism that consolidates information at the national level while restricting its mobility at lower institutional tiers.

This restricted data mobility creates several challenges:

- a. Schools cannot benchmark their performance against other institutions, as they do not have access to comparative SDM reports.
- b. District offices lack real-time data insights, reducing their ability to provide timely interventions for schools that require additional support.
- c. Teachers and school leaders do not have access to predictive analytics that could help them anticipate student performance trends, resource needs, or attendance issues.

From a mobilising tokens perspective, the key problem is that MOE functions as both the primary collector and regulator of SDM data, limiting its ability to function as an open-access governance tool. This contradicts global best practices in education data transparency (Williamson, 2018; Selwyn, 2016), which advocate for greater institutional access to performance insights, allowing for decentralised, data-driven governance models.

6.5.8 Data Power Hierarchies in SDM Governance

The governance of School Data Management (SDM) in Malaysia is deeply shaped by hierarchical structures of data access, control, and decision-making authority. Kelly et al. (2010) argue that data governance models can either promote open-access data democracy—where institutions and stakeholders have equitable access

to information for decision-making—or reinforce data autocracy, where data is controlled by centralised entities, limiting institutional agency. In Malaysia’s SDM system, power over data does not reside equally across all levels of the education system. Instead, data access, interpretation, and usage are determined by governance hierarchies that privilege national-level policymakers while restricting lower-tier institutions from engaging meaningfully with SDM insights.

Findings from Chapters 4 and 5 indicated that Malaysia’s SDM implementation reflects a rigid data power hierarchy, where the Ministry of Education (MOE) functions as the primary authority in collecting, storing, and interpreting education data. This hierarchical structure influences how SDM data is mobilised, who gets to define its meaning, and what institutional actors are allowed to do with the insights generated from it. This section critically examines how power hierarchies in Malaysia’s SDM governance impact institutional autonomy, data transparency, and decision-making efficiency.

The Centralisation of Data Power: Who Owns SDM Data?

A defining characteristic of Malaysia’s SDM system is that while schools and educators generate the bulk of the data, they do not control how it is stored, analysed, or utilised. Findings from Section 4.3.1.4 reveal that MOE retains exclusive authority over SDM databases, determining who has access to what information and under what conditions. This reflects a centralised data power model, where data ownership is concentrated within national education agencies rather than being distributed across the education system.

The implications of this centralisation are significant. First, school administrators, district education officers (DEOs), and teachers lack direct access to national or regional SDM datasets, meaning they cannot benchmark their institutional performance against other schools or districts. Findings from Section 4.3.3.5 indicate that many school leaders express frustration over their inability to access comparative SDM reports, as this restricts their ability to identify best practices or assess their schools’ relative performance.

Second, the absence of school-level data ownership means that educators cannot modify, update, or verify data independently. Findings suggest that once SDM data is submitted to MOE, schools have little ability to correct errors, provide contextual explorations, or ensure that the reported metrics accurately reflect their realities. This lack of institutional control aligns with critiques of centralised data governance models (Williamson, 2018; Selwyn, 2016), which argue that data systems designed for national-level policymaking often fail to account for local institutional needs, limiting their effectiveness as governance tools.

Third, MOE's exclusive control over SDM databases restricts transparency in decision-making. Findings from Section 4.4.3.4 indicate that schools are often unaware of how their data is used in policy evaluations, funding allocations, or school ranking systems, reinforcing a disconnect between data collection and its practical application in institutional governance.

Hierarchies of Data Interpretation: Who Defines SDM Success?

Another critical dimension of data power hierarchies in SDM governance is that MOE does not just control access to data but also determines how data is interpreted and used in policy decision-making. Findings from Section 4.3.1.1 suggest that MOE's interpretation of SDM data is primarily focused on national education performance indicators, compliance metrics, and statistical benchmarks, rather than on qualitative insights into school governance challenges.

This top-down approach to data interpretation means that:

- a. National policymakers define what counts as a "successful" school based on standardised SDM metrics, rather than local institutional needs.
- b. Educators and school leaders have little influence in shaping how SDM data is analysed, reducing their ability to advocate for policy adjustments that reflect their realities.

- c. Data-driven decision-making is skewed toward national-level priorities, often overlooking the contextual complexities of individual schools and districts.

Findings from Section 4.3.3.2 indicate that many school administrators feel that SDM reporting structures prioritise bureaucratic efficiency over meaningful institutional insights. This reflects broader concerns in education data governance literature (Ball, 2012; Sellar & Lingard, 2013), where the emphasis on standardised performance metrics often leads to the oversimplification of complex governance issues, limiting the utility of data for school-level decision-making.

Moreover, the rigid hierarchy of data interpretation prevents schools from contesting or reContextualising SDM findings based on their institutional experiences. Findings suggest that even when schools identify discrepancies between official SDM reports and their on-the-ground realities, they have limited avenues for correcting misrepresentations, as MOE maintains exclusive authority over data finalisation. This reinforces the power imbalance in SDM governance, where data flows upward but decision-making authority does not flow downward.

One of the most significant consequences of data power hierarchies in Malaysia's SDM governance is that schools and educators are positioned as passive participants in the data ecosystem rather than as active decision-makers. Findings from Section 4.3.3.3 indicate that teachers and school administrators frequently express dissatisfaction with the limited access they have to SDM insights, particularly regarding student learning trends, funding allocations, and policy evaluations.

This restricted data access creates several governance challenges. First, schools cannot engage in real-time data-driven decision-making, as they must wait for national SDM reports to be processed, approved, and disseminated by MOE. Findings suggest that by the time schools receive relevant SDM insights, much of the data is already outdated, reducing its practical value for immediate governance improvements.

Second, district education offices (DEOs) lack the authority to independently analyse SDM data for localised policy interventions. Findings from Section 4.3.1.2 indicate that DEOs must rely on MOE-approved SDM reports, even when they have access to raw data that could be used to address district-specific challenges. This top-down control reinforces bureaucratic inefficiencies, where local education offices have the technical capacity to engage with SDM insights but lack the institutional authority to act on them.

Third, educators remain disconnected from the potential benefits of SDM data, as they are primarily positioned as data contributors rather than as data users. Findings suggest that while teachers provide extensive student performance and attendance data, they are rarely given access to longitudinal insights that could inform their instructional strategies or classroom management approaches. This marginalization of educators in data-driven decision-making contradicts best practices in education data governance (Fullan, 2019), which emphasise the need for school-level actors to engage directly with data insights to foster evidence-based educational improvements.

6.5.9 Technological Determinism in SDM Governance

The implementation of SDM in Malaysia raises an important theoretical question: Does the success of SDM depend primarily on technological advancements, or is it shaped by governance structures and institutional capacity? The concept of technological determinism, as explored by Winner (1977) and Postman (1992), suggests that technological development inherently drives social, political, and institutional change. However, critics argue that technology does not operate in isolation but is deeply embedded in human decision-making structures, policy frameworks, and institutional cultures.

Findings from Chapters 4 and 5 suggest that Malaysia's SDM governance does not reflect a simple cause-and-effect relationship between technology and policy success. While MOE has invested in digital reporting platforms, data analytics tools, and centralised databases, the study reveals that technological advancements alone have not led to improved governance efficiency, greater

institutional agency, or better data-driven decision-making. Instead, SDM effectiveness is constrained by governance challenges, bureaucratic inefficiencies, and a lack of stakeholder engagement in data usage.

This section critically examines whether SDM success is primarily determined by technological capabilities or by governance structures, institutional readiness, and human agency.

The Myth of Technology as an Independent Driver of SDM Success

Proponents of technological determinism argue that digital transformation in education governance leads to greater efficiency, transparency, and evidence-based decision-making. This perspective has influenced Malaysia's SDM policy framework, where MOE has emphasised digitalisation as a solution to administrative inefficiencies in data reporting, school evaluation, and policy implementation. Findings from Section 4.3.1.1 indicate that MOE's SDM modernization initiatives have focused on expanding digital reporting systems, streamlining data collection processes, and integrating AI-based analytics for school performance monitoring.

However, the assumption that technology alone can improve SDM governance is challenged by several key findings. First, many educators and school administrators struggle with SDM platforms due to usability issues, lack of training, and insufficient integration with institutional decision-making processes. Findings from Section 4.3.3.3 suggest that teachers often perceive SDM as an additional bureaucratic burden rather than as a tool for school improvement. This reinforces Postman's (1992) critique of technological determinism, which argues that technological innovations often introduce new challenges, including increased complexity, administrative overload, and resistance from institutional actors.

Second, technological investments in SDM have not resolved fundamental governance inefficiencies. Findings from Section 4.4.3.4 indicate that despite advancements in digital data management, schools still experience delays in receiving relevant SDM insights, as data processing and reporting structures remain

centralised within MOE. This aligns with Winner's (1977) argument that technological systems are not inherently progressive but reflect existing power structures and governance hierarchies. In Malaysia's case, SDM digitalisation has reinforced bureaucratic control rather than enabling decentralised, data-driven decision-making.

Third, schools with access to the same SDM technology demonstrate varying levels of effectiveness in utilising data for governance, suggesting that institutional capacity and leadership play a larger role than technological infrastructure alone. Findings from Section 4.3.3.5 reveal that schools with proactive leadership and trained educators are more likely to engage with SDM insights, while others struggle to integrate data into daily governance practices. This reinforces the argument that technology is only as effective as the institutional frameworks and human capacities that support it.

SDM as a Socio-Technical System: Beyond Technological Determinism

An alternative perspective to technological determinism is the socio-technical systems theory, which argues that technology does not function independently but must be embedded within organisational cultures, human expertise, and governance structures (Bijker, Hughes, & Pinch, 1987). This perspective is particularly relevant to SDM, as findings from Section 4.3.3.2 indicate that digital reporting systems alone do not improve governance unless institutional actors have the capacity, motivation, and authority to use the data effectively.

One of the key challenges in Malaysia's SDM implementation is the lack of alignment between digital tools and institutional decision-making needs. Findings from Section 4.3.1.4 suggest that MOE-designed SDM systems prioritise compliance reporting over real-time, school-level data usage. This results in a situation where schools generate large volumes of data but have limited opportunities to apply these insights in their own governance processes.

The socio-technical perspective suggests that for SDM to be effective, it must be supported by:

- a. **Human-Centred Design** - SDM platforms must be designed with user experience in mind, ensuring that teachers, school leaders, and district officers can easily access and interpret data. Findings from Section 4.3.3.3 indicate that many educators struggle with complex SDM interfaces, limiting their engagement with data insights.
- b. **Professional Development and Training** - Institutional actors must be equipped with data literacy skills, allowing them to analyse and apply SDM insights to school governance. Findings suggest that schools that receive targeted SDM training demonstrate higher engagement with data-driven decision-making.
- c. **Decentralised Data Access** - Rather than maintaining centralised control over SDM insights, MOE should enable district offices and schools to access real-time data, empowering localised decision-making. Findings from Section 4.4.3.4 indicate that schools often experience delays in receiving SDM reports, reducing the relevance of data for immediate governance decisions.

This socio-technical approach challenges the technocratic assumption that SDM effectiveness depends primarily on digitalisation. Instead, findings suggest that institutional readiness, policy flexibility, and human agency are just as important—if not more so—than technological infrastructure alone.

Algorithmic Governance and the Risks of Technocratic Decision-Making

Another dimension of technological determinism in SDM governance is the assumption that automated data analytics and algorithmic decision-making will enhance education system efficiency. Findings from Section 4.3.3.5 indicate that MOE has increasingly relied on AI-driven analytics to assess school performance, attendance rates, and student achievement metrics. While these systems improve data processing speed and standardisation, they also introduce new governance risks related to algorithmic bias, loss of human oversight, and the decontextualization of school performance assessments.

Critics of technocratic governance models (Williamson, 2017; Selwyn, 2016) argue that algorithmic decision-making in education often prioritises quantitative performance indicators while overlooking qualitative factors such as community engagement, teacher effectiveness, and student well-being. Findings from Section 4.3.1.1 suggest that some schools feel misrepresented by SDM performance metrics, as standardised assessments do not always account for contextual differences in school environments.

This raises critical concerns about whether Malaysia's SDM governance is shifting toward a technocratic model, where AI-driven insights dictate school rankings and funding decisions with limited human oversight. Findings indicate that some educators fear that SDM evaluations rely too heavily on quantitative data, potentially reinforcing inequities in education policy implementation.

To mitigate these risks, SDM reform must:

- a. Ensure human oversight in algorithmic decision-making, allowing educators and policymakers to contextualise AI-generated insights.
- b. Incorporate qualitative data into SDM governance, ensuring that performance evaluations are not based solely on numerical indicators.
- c. Develop ethical AI governance frameworks, ensuring transparency and accountability in how SDM analytics influence education policy.

6.5.10 Enablementism and the Techno-Agential Condition in SDM Governance

The effectiveness of SDM in Malaysia is not solely dependent on technological infrastructure but on the governance conditions that determine how institutional actors engage with data for decision-making. Valsiner's (2014) enablementism challenges the assumption that providing access to digital tools inherently leads to better governance outcomes, emphasising instead that institutions require the right structural, cultural, and policy conditions to translate technology into

effective practice. However, while enablementism highlights the importance of enabling conditions, it does not fully explain how human agency interacts with technological systems within governance structures. This study extends these insights by introducing the Techno-Agential Condition, which examines the mediation of power, decision-making, and institutional agency within digital governance frameworks.

Findings from Chapters 4 and 5 reveal that Malaysia's SDM implementation has prioritised technological infrastructure but has failed to establish sufficient enabling conditions for institutional actors to engage with data-driven decision-making. Despite investments in centralised SDM platforms, AI-driven analytics, and digital reporting tools, many educators, school leaders, and district officers lack the training, autonomy, and policy flexibility needed to translate SDM insights into meaningful governance actions. The study finds that SDM remains compliance-driven, with data being collected for administrative oversight rather than for localised decision-making. This failure to align technological advancement with institutional agency reflects a disconnect between policy design and governance reality, reinforcing the need for a techno-agential condition that explains why SDM governance must evolve beyond rigid compliance structures.

This section critically examines the barriers that limit techno-agential engagement with data governance, demonstrating how Malaysia's SDM system does not yet fulfill the conditions of enablementism. It then explores the structural changes necessary to establish an enabling environment, ensuring that SDM functions not just as a data repository but as a governance tool that enhances institutional decision-making rather than reinforcing top-down control.

The Limits of Technological Access Without Enablement

One of the key assumptions in Malaysia's SDM policy framework is that providing schools with access to digital reporting tools will inherently improve data-driven governance. Findings from Section 4.3.3.1, however, suggest that access alone is insufficient if institutional actors do not have the knowledge, authority, or motivation to utilise SDM data effectively.

This aligns with Valsiner's (2014) argument that enabling conditions must be actively cultivated through institutional support structures, professional development, and governance reforms. In Malaysia's case, findings from Section 4.3.3.3 reveal that many educators and school leaders feel disconnected from SDM insights, as data is primarily collected for national-level reporting rather than for local institutional decision-making. The lack of structured capacity-building programs, clear policy incentives, and participatory governance mechanisms has resulted in SDM functioning more as a compliance tool than as an enabler of school improvement.

The implications of this disconnect are significant. Without enabling conditions:

- a. Teachers remain passive data contributors rather than active data users, limiting SDM's impact on classroom decision-making.
- b. School administrators lack autonomy in interpreting SDM insights, as data is primarily processed and analysed at the national level.

These findings reinforce the enablementism principle that institutional transformation does not occur simply by introducing new technologies but by fostering the right conditions for technology to be effectively utilised.

The Role of Human Agency in SDM Engagement

A central aspect of enablementism and the techno-agential condition is that institutions must empower individuals to actively shape how digital systems function within governance structures. Findings from Section 4.3.1.4 suggest that Malaysia's SDM implementation has not fully embraced this principle, as most decision-making authority over SDM data remains centralised within MOE. This creates a top-down governance model, where school leaders, district officers, and teachers have little influence over how data is collected, analysed, or applied to policy decisions.

This issue is particularly evident in the restricted ability of schools to modify or recontextualise SDM insights. Findings from Section 4.4.3.4 indicate that school administrators often experience delays in receiving SDM reports, and when they do, the data is pre-interpreted according to national performance metrics rather than localised governance needs. This contradicts Valsiner's argument that agency must be an active component of technological engagement, as institutional actors should have the ability to interpret and adapt digital insights to their specific contexts.

Furthermore, findings from Section 4.3.3.5 suggest that some schools develop their own parallel data tracking systems to compensate for SDM's lack of real-time accessibility, reflecting a misalignment between national SDM governance models and the on-the-ground realities of school management. This supports the argument that institutions must not only be given access to technology but must also be empowered to shape how it functions in their operational ecosystems.

Policy Constraints and the Lack of Institutional Flexibility

A significant barrier to techno-agential enablement in SDM governance is the rigidity of policy structures that dictate how schools and district offices engage with data. Findings from Section 4.3.1.2 reveal that MOE's SDM policies emphasise standardisation, compliance, and national benchmarking, leaving little room for local adaptations. This top-down governance model limits the ability of schools to integrate SDM insights into institutional decision-making processes.

From an enablementism perspective, this lack of institutional flexibility prevents schools from transitioning from data compliance to data empowerment. Findings suggest that while some school leaders attempt to use SDM data for localised decision-making, policy constraints limit their ability to modify reporting formats, adjust performance metrics, or interpret data beyond MOE-defined frameworks. This contradicts Valsiner's argument that institutions must be given control over the conditions that enable their technological engagement.

A key implication of these findings is that SDM policies must shift from rigid compliance structures to more adaptive governance models that allow for institutional agency in data engagement. This requires:

- a. Decentralising SDM data access, allowing schools to engage with real-time data rather than waiting for MOE-approved reports.
- b. Granting schools and district offices greater interpretative authority over SDM insights, ensuring that national performance metrics do not override localised governance needs.
- c. Reforming SDM policy frameworks to encourage adaptive, institution-driven data utilisation rather than rigid compliance mandates.

These reforms align with the techno-agential principle that technology should be an enabler rather than a constraint on human decision-making.

The Need for a Multi-Level Enablement Framework

Findings from Chapters 4 and 5 suggest that Malaysia's SDM governance requires a more structured enablement framework that integrates technological access with policy flexibility, capacity-building, and institutional autonomy. Drawing on Valsiner's (2014) Enablementism, an effective SDM framework must operate at three levels:

- a. Institutional Enablement - Schools and district offices must be provided with the policy flexibility and decision-making authority to engage with SDM data on their own terms.
- b. Professional Enablement - Teachers, administrators, and education officers must receive targeted training in data literacy and SDM utilisation, ensuring that they have the skills to integrate digital insights into governance practices.

- c. **Structural Enablement** - SDM governance must transition from a compliance-driven model to an adaptive governance framework, allowing for contextualised data engagement rather than rigid, top-down control.

By implementing a multi-level enablement strategy, Malaysia's SDM system can transition from a bureaucratic reporting tool to a participatory data governance model that empowers institutional actors to use data for meaningful decision-making.

The Techno-Agential Condition: Where Technology and Human Agency Intersect

The techno-agential condition refers to the extent to which institutions and individuals are enabled to meaningfully interact with technology within governance systems. Williamson (2017) argue that data-driven governance models should not function as rigid, automated systems but should allow human actors to dynamically engage with digital tools to enhance decision-making.

Findings from Section 4.3.3.1 indicate that Malaysia's SDM implementation has focused heavily on data collection efficiency while neglecting the human dimensions of governance, such as educator agency, school leadership autonomy, and localised policy adaptation. While schools are expected to submit extensive SDM reports, they are rarely given the opportunity to shape how data is used for their own institutional planning. This creates a disconnect between technology-driven data generation and the human capacity to utilise that data for school improvement.

The absence of a strong techno-agential condition in Malaysia's SDM system can be observed in three key areas:

- a. **Rigid Data Structures** - SDM platforms are designed primarily for compliance and national benchmarking, limiting schools' ability to customise data insights for localised decision-making.

- b. **Limited Institutional Control Over Data Interpretation** - Schools are required to submit data that is interpreted through MOE's standardised metrics, reducing their ability to contextualise findings based on their specific governance needs.
- c. **Minimal Educator Engagement in Data Utilisation** - Despite being the primary generators of SDM data, educators are not given adequate training, incentives, or authority to actively use data for classroom and institutional improvements.

From a techno-agential perspective, these constraints illustrate that SDM effectiveness is not simply about technological access but about creating governance structures that allow human actors to meaningfully interact with data.

Barriers to Techno-Agential Engagement in SDM Governance

One of the key challenges in Malaysia's SDM governance is that technological investments have not been accompanied by corresponding efforts to decentralised decision-making authority or build institutional capacity for data engagement. Findings from Section 4.3.3.2 suggest that many school administrators and district officers lack the autonomy to modify SDM reporting requirements based on their localised needs. This reinforces Williamson's (2018) argument that centralised education data systems often function as surveillance mechanisms rather than as tools for institutional empowerment.

Three major barriers to techno-agential engagement in Malaysia's SDM system include:

- a. **Centralised Data Interpretation** - While SDM platforms collect large amounts of school performance data, MOE retains control over how this data is analysed, categorised, and applied in policy decisions. Schools have little input in defining success metrics or in adapting data analysis methods based on their specific needs.
- b. **Bureaucratic Constraints on Data Usage** - Even when schools receive SDM insights, they are often required to seek approval from district or national

education offices before implementing data-driven changes. This top-down approval process slows down institutional responsiveness, reducing the agility of schools in adapting to emerging challenges.

- c. Lack of Professional Development in Data Literacy - Findings from Section 4.4.3.4 indicate that educators and school leaders are not systematically trained in how to interpret and apply SDM insights, limiting their ability to use data for governance improvements. Without structured training, technology remains an underutilised resource rather than an enabler of decision-making.

These barriers highlight that SDM effectiveness is not limited by technological capacity but by governance structures that restrict techno-agential engagement. Without policy reforms that allow institutions to engage with data more freely and meaningfully, digitalisation efforts will remain limited in their impacts.

Reforming SDM Governance Through a Techno-Agential Condition

To transition Malaysia's SDM system from a compliance-driven model to a participatory governance tool, reforms must move beyond technocratic data collection models that prioritise reporting over institutional empowerment. A techno-agential approach repositions SDM as an interactive governance mechanism, where technology, human agency, and policy structures co-evolve to create enabling conditions for data-driven decision-making. This shift requires reforms in three key areas:

a. Decentralising Data Access and Interpretation

Schools and district offices should have greater control over SDM data, allowing them to contextualise performance metrics and modify reporting structures based on localised governance needs. Regional data advisory panels should be established by MOE, enabling educators and administrators to participate in shaping SDM success indicators and school evaluation frameworks, ensuring a balance between national policy goals and institutional autonomy.

b. Developing Professional Training Programs in Data Literacy

Institutional actors—including teachers, school leaders, and education officers—must receive structured training on how to analyse, interpret, and apply SDM insights to institutional decision-making. Digital platforms should be redesigned with user-friendly data visualisation tools, ensuring that non-technical stakeholders can effectively engage with SDM insights, rather than being passive recipients of top-down data directives.

c. Shifting from Compliance-Driven to Participatory Data Governance

Rather than using SDM primarily for oversight and performance monitoring, the system should be restructured to support schools in making evidence-based decisions on curriculum planning, resource allocation, and student interventions.

SDM policy frameworks should incorporate bottom-up data feedback loops, where schools can provide qualitative insights alongside quantitative metrics, ensuring a more holistic approach to school performance assessment.

These reforms align with Valsiner's (2014) enablementism and the techno-agential condition, emphasising that technology should not be viewed as an independent solution but as a governance tool that institutional actors must be enabled to engage with meaningfully. While MOE has invested in digital SDM platforms, findings from Chapters 4 and 5 indicate that SDM governance remains constrained by centralised control, bureaucratic rigidity, and limited institutional autonomy in data utilisation.

A techno-agential approach to SDM reform would prioritise institutional engagement, decentralised data access, and participatory decision-making, ensuring that schools, district offices, and educators function as active agents in shaping education data governance rather than as passive data providers. By integrating human agency, structural enablement, and technological mediation, these reforms create the conditions necessary for SDM to function as an enabler of participatory governance rather than a compliance tool.

6.6 The Novelty of Techno-Enablement and the Techno-Enabler Framework: A 4Cs Analysis

The novelty of this study lies in the development of techno-enablement, a conceptual framework that synthesises the techno-agential condition with enablementism to explain how SDM governance can transition from a compliance-driven system to a participatory, decision-support tool. While previous research on SDM has examined its role in data governance and institutional accountability, existing studies have not sufficiently explored the enabling conditions necessary for SDM to function as an interactive governance mechanism rather than a rigid administrative tool. This study extends the conversation on SDM effectiveness by moving beyond structural and relational perspectives, integrating insights from policy enforcement, institutional agency, and technological mediation to develop a framework that accounts for both the role of digital infrastructures and the conditions required for human actors to meaningfully engage with them.

At the core of techno-enablement is the techno-agential condition, which explains how technology, governance, and institutional agency co-evolve within SDM governance structures. However, the mere presence of digital tools and decentralised decision-making structures does not guarantee participatory governance—these mechanisms must be enabled through institutional flexibility, policy adaptability, and capacity-building. This is where Valsiner's (2014) enablementism becomes critical: it highlights that agency alone is insufficient; institutional conditions must actively support and sustain decision-making autonomy for SDM to function effectively. Techno-enablement emerges from this synthesis, asserting that technology does not independently drive governance improvements, nor does institutional agency function in isolation—both require structured enabling conditions to facilitate participatory decision-making.

From this perspective, the techno-enabler framework is developed as an operational model that translates techno-enablement into governance conditions necessary for SDM to function as an enabler rather than merely a compliance mechanism. This framework redefines how SDM governance can be structured to support participatory, school-centred decision-making rather than reinforcing

centralised data control. By integrating insights from the techno-agential condition and enablementism, techno-enablement provides a theoretical lens to understand how governance structures must evolve to ensure that technology serves as a tool for empowerment rather than bureaucratic oversight.

To systematically analyse the novelty of this research, the 4Cs Novelty Framework is applied. This framework assesses the study's Contribution, Challenge, Change, and Context, highlighting how techno-enablement advances knowledge, critiques existing models, redefines SDM governance, and applies its findings in a relevant policy environment.

Below is a structured summary of how the study's novelty is articulated using the 4Cs Framework:

Table 6.1 4Cs Analysis for Techno-Enablement and the Techno-Enabler Framework

Aspect	Description
Contribution	Introduced techno-enablement, a conceptual framework integrating policy structures, institutional agency, and technology to redefine SDM governance. Developed the Techno-Enabler Framework as a governance model for shifting SDM from a compliance mechanism to a participatory decision-making tool.
Challenge	Questioned the assumption that centralised SDM inherently leads to better decision-making, demonstrating that effectiveness depends on institutional engagement and governance flexibility. Critiqued technological determinism, arguing that digital transformation alone does not guarantee SDM success.
Change	Shifted SDM governance from a compliance-driven, bureaucratic tool to a techno-enabled governance system that fosters participatory decision-making at school and district levels. Proposed data mobility between national and institutional levels as a key component of SDM effectiveness.
Context	Applied techno-enablement in the Malaysian education system, analysing how SDM policies impact data mobility, decision-making autonomy, and institutional engagement. Provided insights that can be adapted to other centralised education systems facing similar SDM governance challenges.

Through this framework, this research paves the way for a more dynamic, institutionally engaged, and technologically adaptive approach to SDM governance, ensuring that future SDM policies can be designed not just for compliance, but for participatory education governance and meaningful institutional decision-making.

6.7 Constructing the Techno-Enabler Framework for SDM

The governance of SDM in Malaysia has revealed significant challenges that extend beyond technological implementation. Findings from Chapters 4 and 5, supported by extensive theoretical discussions, demonstrate that SDM is not merely a digital tool for data collection but a socio-technical system that is deeply embedded within policy frameworks, institutional power structures, and human agency dynamics. The research questions guiding this study identified key barriers to SDM effectiveness, particularly governance fragmentation, centralised data control, and limited institutional autonomy. Furthermore, the theoretical discussions surrounding institutional theory, isomorphism, policy translation, and socio-material networks provide a critical foundation for understanding why SDM struggles to function as an enabling governance mechanism rather than as a bureaucratic compliance tool.

Through this theoretical research, it became clear that the problem is not simply the presence or absence of technology but the lack of enabling conditions that allow institutional actors to meaningfully engage with SDM systems. This study builds on Valsiner's (2014) enablementism, which argues that institutions and individuals must be provided with the necessary conditions to utilise technology effectively. While technological determinism suggests that digitalisation alone leads to better governance, this study challenges that assumption, arguing that technology must be integrated with structural, relational, and institutional enablers for meaningful impact. Thus, this research conceptualises techno-enablement as the process of creating these enabling conditions within SDM governance.

The transition from techno-enablement to techno-enabler for SDM is rooted in the distinction between the conceptual process and the practical implementation of governance mechanisms. Techno-enablement refers to the theoretical principle that SDM effectiveness depends on structural, institutional, and policy enablers rather than on digital tools alone. However, theoretical insights must be operationalised into actionable governance mechanisms. Therefore, the concept of the Techno-Enabler Framework emerged as a structured framework that translates

techno-enablement theory into a governance system that can be practically implemented in Malaysia's education sector. The Techno-Enabler Framework for SDM is designed to shift SDM from a compliance-driven data reporting mechanism into an adaptive, participatory, and school-centred governance tool.

The theoretical foundation of this framework integrates insights from institutional theory (Meyer & Rowan, 1977), isomorphism (DiMaggio & Powell, 1983), policy translation theory (Callon, 1986), and socio-material networks (Fenwick & Edwards, 2010). By synthesising these perspectives, the Techno-Enabler Framework provides a governance framework that moves beyond top-down policy enforcement and data surveillance toward a system where SDM actively enables schools, district offices, and policymakers to make informed, localised, and context-sensitive decisions.

The techno-enabler framework posits that SDM effectiveness is contingent upon five interrelated governance enablers that allow institutions to move from passive data providers to active decision-makers. These enablers—techno-governance, techno-competency, techno-networking, techno-decisioning, and techno-integration—form the core of this theoretical framework, each addressing a specific governance failure identified in the research findings. By reframing SDM as an interactive and participatory governance mechanism rather than a bureaucratic data collection tool, this framework provides an alternative pathway for SDM reform in Malaysia, one that aligns with emerging global trends in education data democratisation and decentralised decision-making.

Techno-Governance: Enabling Institutional Autonomy and Regulatory Oversight

At the heart of the techno-enabler framework is the need to establish a balanced governance structure that ensures both regulatory oversight and institutional autonomy. The findings indicate that MOE's centralised control over SDM data limits the ability of schools to engage in independent decision-making, reinforcing a hierarchical governance structure that prioritises policy compliance over institutional empowerment. This governance framework aligns with Meyer & Rowan's (1977) institutional theory, which suggests that policy standardisation is

often implemented to enhance external legitimacy rather than to improve internal efficiency. While the rationale for maintaining national education performance standards through SDM is valid, the findings reveal that excessive bureaucratic control over SDM reporting mechanisms discourages schools from actively utilising data for localised governance improvements.

To address this issue, techno-governance proposes a restructured SDM framework where schools and district education offices are granted greater control over data access, analysis, and reporting modifications. The findings indicate that the current SDM system does not provide schools with real-time access to performance analytics or allow them to contextualise data based on localised governance needs. Drawing from Valsiner's (2014) enablementism, this enabler asserts that educational institutions must be given structured autonomy over SDM data interpretation, ensuring that governance reforms prioritise data utilisation rather than merely data compliance. Additionally, the framework calls for the creation of independent SDM regulatory bodies, responsible for providing policy oversight, audit mechanisms, and compliance evaluations without restricting institutional flexibility.

By establishing a more adaptive governance structure, techno-governance ensures that sdm data is not just a tool for national-level performance evaluation but also a resource for schools to engage in self-directed improvement and evidence-based policymaking. This aligns with the argument made by Ball (2012) on performativity in education governance, which suggests that institutional actors are more likely to engage with data meaningfully when they perceive it as an enabler of decision-making rather than as a compliance mandate.

Techno-Competency: Strengthening Data Literacy and Professional Development

While SDM digitalisation has improved data collection efficiency, findings from Section 4.3.3.2 indicate that many educators and school administrators lack the training and expertise to utilise data effectively in governance processes. This supports the argument made by Wu, Ramesh & Howlett (2015) that policy

implementation requires not only technological infrastructure but also analytical, operational, and political capacity-building to ensure success. Without structured training programs, SDM remains an underutilised governance resource, reinforcing the need for systematic professional development initiatives that enhance data literacy among institutional actors.

The techno-competency enabler proposes that SDM engagement should be integrated into teacher training programs, leadership development courses, and continuous professional learning frameworks. Drawing on the concept of policy capacity-building (Wu et al., 2015), this enabler suggests that institutional actors must not only have access to digital tools but also the skills to engage with them effectively. Findings from Section 4.4.3.4 indicate that educators who receive structured SDM training are more likely to engage with data for instructional planning and school governance, supporting the argument that professional development is a prerequisite for institutional agency in data-driven decision-making.

By prioritising data literacy, analytics training, and participatory decision-making conditions, techno-competency ensures that SDM is not a passive reporting tool but an active governance resource that enhances institutional capacity for data-informed decision-making.

Techno-Networking: Strengthening Inter-Agency Collaboration and Policy Adaptation

One of the major governance failures identified in the research is the fragmentation of SDM policies across different administrative levels, leading to inconsistencies in data reporting requirements and policy enforcement. The findings from Section 4.3.1.1 indicate that MOE's SDM policies are not always aligned with the operational needs of district offices and schools, reinforcing DiMaggio & Powell's (1983) argument that isomorphic policy adoption often leads to governance inefficiencies rather than functional improvements.

Techno-networking proposes a multi-agency collaboration condition, where SDM policies are not dictated exclusively by MOE but are co-developed with state education departments (SEDs), district education offices (DEOs), and school leadership teams. Drawing on Callon's (1986) Policy Translation Theory, this enabler asserts that SDM implementation must be viewed as a negotiated process rather than as a rigid directive imposed from above. Findings from Section 4.3.3.3 suggest that schools and district offices often reinterpret SDM requirements based on operational constraints, reinforcing the need for greater flexibility in policy adaptation. By integrating cross-agency collaboration mechanisms, techno-networking ensures that SDM policies remain responsive to institutional realities rather than functioning as static compliance mandates.

Techno-Decisioning: Shifting from Passive Data Providers to Active Decision-Makers

One of the most significant challenges identified in Malaysia's SDM governance is the role of schools as passive data providers rather than active decision-makers. Findings from Section 4.3.3.1 indicate that schools are primarily tasked with submitting SDM reports to higher administrative levels, but they have minimal authority to interpret, contextualise, or act upon the data they generate. This aligns with Kelly et al.'s (2010) critique of data power hierarchies, which suggests that data centralisation reinforces institutional disempowerment, limiting the agency of local education actors in governance processes.

The techno-decisioning enabler addresses this governance failure by advocating for a shift from top-down data control to school-led decision-making, ensuring that institutional actors are empowered to engage with SDM insights for localised governance improvements. This requires a fundamental reconfiguration of SDM decision-making structures, allowing schools and district education offices to interpret and apply SDM data based on their specific operational needs rather than merely complying with national reporting requirements.

The findings from Section 4.4.3.4 indicate that schools that have some autonomy in utilising SDM data for internal governance demonstrate higher levels of

institutional engagement and problem-solving capacity. However, in most cases, SDM remains a tool for national oversight rather than for school improvement, reinforcing the argument by Fenwick & Edwards (2010) that education governance must function as a socio-material network, where digital tools and human agency interact dynamically rather than being dictated by rigid policy structures.

To operationalise techno-decisioning, SDM governance must:

- a. Decentralised SDM data interpretation, allowing schools and district offices to customise data usage based on local governance priorities.
- b. Reconfigure SDM platforms to provide user-friendly data visualisation tools, enabling educators and school leaders to engage with real-time analytics for institutional decision-making.
- c. Develop school-led SDM governance frameworks, where educators and administrators have structured decision-making roles in determining how SDM insights are applied to policy adjustments, resource allocation, and instructional improvements.

By embedding techno-decisioning into SDM governance, this enabler ensures that data is not just collected but actively utilised as a tool for institutional self-governance. This aligns with the techno-agential perspective, which emphasises that technology must function as an enabler of institutional decision-making rather than as a mechanism of top-down policy enforcement.

Techno-Integration: Aligning National SDM Policies with Institutional-Level Needs

While SDM was introduced as a tool to enhance evidence-based decision-making in Malaysia's education system, findings from Section 4.3.1.2 indicate that SDM policies remain largely compliance-driven, with rigid reporting structures that limit institutional flexibility. Schools are required to submit data in standardised formats dictated by MOE, even when these reporting requirements do not align

with their actual governance needs. This reflects Valsiner's (2014) argument in enablementism, which suggests that technological access is not enough—institutions must also have the structural flexibility to engage with technology in ways that enhance their autonomy and problem-solving capacity.

The techno-integration enabler proposes that SDM policies must be restructured to align with both national performance indicators and localised institutional governance needs. Currently, schools are burdened with excessive data reporting requirements, many of which do not directly contribute to school-level decision-making. Findings from Section 4.3.3.3 suggest that teachers and administrators often experience SDM as an additional bureaucratic task rather than as a tool for improving education outcomes. This reinforces Occam's Razor, which argues that governance models should be as simple and adaptable as possible to maximise efficiency and usability.

To achieve techno-integration, SDM governance must:

- a. Ensure that reporting structures are adaptable, allowing schools to prioritise relevant data collection without excessive administrative burden.
- b. Design SDM policies to be outcome-driven rather than compliance-driven, ensuring that data reporting enhances institutional decision-making rather than functioning solely for national performance monitoring.
- c. Reduce redundant reporting requirements by creating integrated data management systems, minimising the need for educators to input the same data multiple times across different SDM platforms.

By embedding techno-integration into SDM governance, this enabler ensures that SDM policies are not just aligned with global education benchmarking standards but are also responsive to the practical governance needs of schools and district education offices. This transition is crucial for ensuring that SDM functions as an adaptive governance tool rather than as a rigid bureaucratic system.

6.7.1 Summary of the Techno-Enabler Framework for SDM

The following table synthesises the five core enablers, their theoretical basis, and their application in SDM governance reform:

Techno-Enabler	Theoretical Foundation	Governance Issue Addressed	Proposed Reform in SDM Governance
a. Techno-Governance	Institutional Theory (Meyer & Rowan, 1977)	Over-centralisation of SDM governance, limiting institutional autonomy	Establish independent SDM oversight bodies to ensure transparent regulatory oversight while granting schools and district offices greater decision-making authority.
b. Techno-Competency	Policy Capacity Theory (Wu, Ramesh & Howlett, 2015)	Limited data literacy and lack of professional training in SDM utilisation	Develop structured data literacy programs for educators and school leaders, ensuring that SDM insights are integrated into professional development and continuous learning frameworks.
c. Techno-Networking	Policy Translation Theory (Callon, 1986) & Isomorphism (DiMaggio & Powell, 1983)	Fragmentation in SDM implementation, inconsistent data policies across education agencies	Establish multi-agency collaboration frameworks, ensuring coordinated SDM policy adaptation across MOE, state education departments, and district offices.
d. Techno-Decisioning	Socio-Material Networks (Fenwick & Edwards, 2010)	Schools serve as passive data providers rather than active decision-makers	Shift SDM decision-making from top-down control to school-led governance, allowing schools and district offices to contextualise data for localised decision-making.
e. Techno-Integration	Enablementism (Valsiner, 2014) & Occam's Razor	Rigid compliance-driven SDM policies prevent data flexibility	Align national SDM policies with institutional-level needs, ensuring that reporting structures are adaptable, efficient, and designed to enhance institutional agency.

The Techno-Enabler Framework for SDM ensures that technology does not function in isolation but is embedded within a governance structure that supports

institutional empowerment. By addressing the structural, relational, and policy barriers identified in the study, this framework provides a blueprint for SDM reform that enhances education governance at multiple levels.

6.7.2 S.P.I.R.E. Canvas as a Practical Leadership and Decision-Making Tool

To strengthen the practical application of the Techno-Enabler Framework, this study introduces the S.P.I.R.E. Canvas (Sense, Probe, Initiate, Reframe & Respond, Envision). Designed as a leadership and policy instrument, the canvas guides education leaders, district officers, and policymakers through a structured, action-oriented process that moves beyond traditional problem identification. It systematically connects governance challenges with data technology potential, human agency, and inter-agency collaboration—ensuring that SDM functions as a participatory governance tool rather than a compliance mechanism.

The canvas integrates critical improvements based on reflections from the framework’s testing and analysis. Notably, it incorporates power mapping, risk assessment, equity checks, and sustainability planning—ensuring that leaders consider the broader system dynamics influencing data-driven decision-making. These enhancements respond directly to common gaps in leadership tools, where power imbalances, hidden risks, and short-term project thinking often undermine reform efforts.

Stage	S.P.I.R.E. Component	Critical Focus	Guided Questions
S	Sense the Challenge (<i>Techno-Governance & Power Mapping</i>)	Clarify the governance problem and who holds power.	<ul style="list-style-type: none"> - What is the problem and its governance root? - Who is most affected? - Who controls the data and decision?
P	Probe the Data Landscape (<i>Techno-Competency, Networking & External Engagement</i>)	Identify available data, required actors, and collaboration potential.	<ul style="list-style-type: none"> - What data and systems exist? - Who must collaborate (inside and outside)? - Who holds influence or may resist change?
I	Initiate Enabling Strategies (<i>Enablementism & Equity Lens</i>)	Design actions, build capacity, and	<ul style="list-style-type: none"> - What enables local use of data? - How do we empower schools or

		ensure inclusive participation.	agencies? - Are marginalised groups included?
R	Reframe & Respond (<i>Techno-Decisioning & Risk Assessment</i>)	Move from problem recognition to feasible action while assessing risks.	- What is the biggest blocker? - What action or pilot is possible now? - What are the risks if we act or don't act? - Who gains or loses power?
E	Envision (<i>Techno-Integration & Scaling</i>)	Anticipate change, plan sustainability, and explore scalability.	- What positive change is expected? - How will success be measured? - What is needed to sustain impact? - Can this scale to influence policy?

To demonstrate its practical application, the S.P.I.R.E. Canvas is applied to a widely relevant education governance challenge: improving Science and Technology (STEM) stream enrolment using integrated student data. The issue reflects common global tensions—data-rich environments with centralised decision-making and limited school-level agency.

Stage	Refined Example Notes
S - Sense	Schools observe low STEM enrolment. Data is collected but not utilised. Power sits with central STEM units, excluding schools from decisions. Students are affected by late or inaccurate placements.
P - Probe	Data sources: academic records, co-curricular, interest surveys. Actors: schools, districts, STEM agencies, career counsellors, industry partners. Gaps: fragmented data, weak analytics skills, no common dashboard. Potential resistance from STEM placement authorities.
I - Initiate	Action: Develop a STEM Potential Profile dashboard. Build school capacity for data analysis. Ensure equity: identify girls or under-represented groups for STEM pathways.
R - Reframe & Respond	Blocker: STEM placement is fully centralised. Risk: Continuing the status quo means talent loss. Response: Pilot a district-level STEM Committee allowing school recommendations. Engage data policy units for long-term reform.
E - Envision	Impact: Increased, more accurate STEM enrolment. Measure through STEM enrolment data, performance tracking. Sustainability plan: Annual dashboard update, policy proposal for shared decision-making. Potential for scaling nationwide.

The S.P.I.R.E. Canvas advances the Techno-Enabler Framework by providing a highly adaptable, action-oriented tool that integrates the complexities of power

dynamics, risk, equity, and sustainability into SDM decision-making. Its structured design ensures that leadership teams critically interrogate both the technical and relational aspects of data use, moving beyond mere compliance toward system-level change.

This tool offers value not only within Malaysia's education context but also for global education systems facing similar governance challenges. It is intentionally designed to scale across sectors, educational levels, and policy environments, offering a replicable model for integrating data-driven decision-making with distributed leadership principles. By embedding this tool into leadership workshops or SDM strategy planning, education systems can strengthen their capacity to leverage technology for meaningful, sustained, and participatory governance reform.

6.8 The Implications of Techno-Enablers for SDM Reform

The Techno-Enabler Framework for SDM represents a paradigm shift in how SDM governance is conceptualised and implemented. Unlike traditional SDM frameworks that prioritise compliance, centralisation, and standardised data reporting, the Techno-Enabler Framework proposes that SDM should function as an adaptive, institution-driven governance tool that empowers schools, district offices, and educators to actively engage with data for decision-making. The framework moves beyond the technocratic assumption that digitalisation alone improves governance by emphasising that technology must be embedded within enabling conditions that foster institutional agency, leadership capacity, and collaborative decision-making.

The empirical findings from Chapters 4 and 5, combined with the theoretical insights from institutional theory, policy translation, and socio-material networks reveal that Malaysia's SDM system currently operates as a centralised, compliance-driven mechanism rather than as an enabler of school-led governance. This governance structure limits the transformative potential of education data systems, preventing schools from leveraging SDM insights for contextualised decision-making, school improvement planning, and localised resource allocation. The Techno-Enabler Framework, therefore, serves as a corrective framework that

addresses these limitations by integrating regulatory oversight, professional capacity-building, inter-agency collaboration, decentralised decision-making, and flexible policy adaptation into a holistic governance framework.

6.8.1 Theoretical Implications: Repositioning SDM as an Enabler of Institutional Autonomy

The Techno-Enabler Framework reconfigures School Data Management (SDM) by shifting its role from a bureaucratic compliance tool to an enabler of institutional autonomy. At present, Malaysia's SDM governance model remains centralised, where schools function primarily as data providers rather than active decision-makers. Findings from Section 4.3.1.4 indicate that national-level policy evaluations prioritise bureaucratic oversight over school-specific governance needs, reinforcing a top-down control structure. This hierarchical model aligns with Meyer & Rowan's (1977) institutional theory, which posits that bureaucratic systems often prioritise structural legitimacy over functional effectiveness, leading to policies that focus on compliance rather than practical governance.

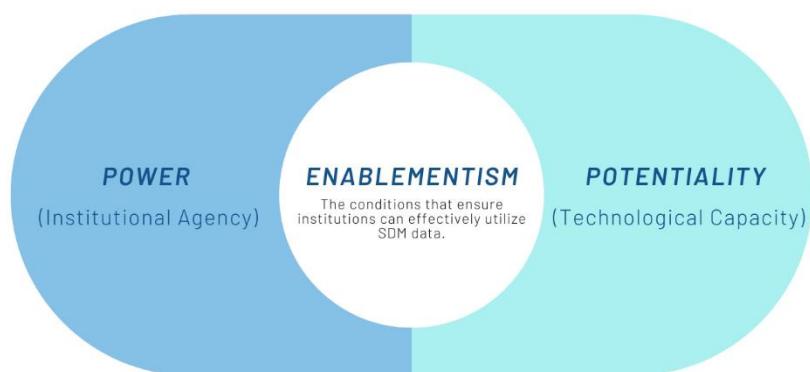
Drawing from Foucault's (1980) concept of power, which sees power as relational rather than possessed, SDM governance in its current form reflects a disciplinary mechanism where data collection serves as a means of policy surveillance rather than an instrument of empowerment. Schools and district offices, despite being at the core of data generation and usage, remain subordinate in the data hierarchy, with decision-making authority retained by central agencies. This creates a paradox—while SDM is framed as a tool for data-driven decision-making, its implementation reinforces dependency on centralised control rather than fostering localised agency in governance.

From a Heideggerian (1927) perspective on potentiality, SDM embodies technological potential that remains unactualised due to structural constraints. Heidegger's distinction between "Sein" (being) and "Seinkönnen" (being-able-to-be) is particularly relevant here—while SDM holds the capacity to enhance educational governance, it is limited by rigid hierarchical reporting structures that prevent school leaders and district officers from utilising data autonomously. The

Techno-Enabler Framework addresses this by positioning SDM within a techno-agential model, where power (human agency) and potentiality (technological affordances) intersect through enablementism (Valsiner, 2014).

This intersection can be understood through a Venn diagram model, where power represents institutional agency (schools, district offices, leadership), potentiality represents technological capacity (data analytics, digital platforms, SDM tools), and enablementism represents the structured conditions that allow these elements to function optimally. The absence of one component—either agency, technology, or enabling conditions—renders SDM ineffective. If schools lack agency, they become passive data collectors. If SDM lacks technological capacity, decision-making is delayed and inefficient. If enablement conditions are absent, the interaction between agency and technology remains unstructured, reinforcing policy-driven data submission rather than institutional engagement.

**TECHNO-ENABLEMENT IN SDM:
INTERSECTION OF POWER, POTENTIALITY, AND ENABLEMENTISM**



When power and potentiality are harmonized through enablementism, SDM transitions from a compliance tool to a governance enabler.

Figure 6-1 Techno-Enablement: Intersection of Power, Potentiality, and Enablementism

The implication of this theoretical positioning is that SDM reform must establish structural-relational conditions that foster institutional autonomy while maintaining alignment with national education priorities. To achieve this, the Techno-Enabler Framework proposes three critical shifts in SDM governance. First,

decentralising SDM data access ensures that schools and district offices are not solely dependent on national reports but have real-time access to data for localised decision-making. Second, enabling flexible reporting structures allows institutions to engage with SDM insights based on their governance priorities, rather than adhering to one-size-fits-all compliance metrics. Third, developing institutional mechanisms for SDM integration ensures that data is embedded within school governance processes, influencing resource allocation, curriculum planning, and teacher professional development rather than serving as a detached policy function.

By repositioning SDM as an enabler of institutional autonomy, the Techno-Enabler Framework redefines how power and potentiality interact within SDM governance. Rather than viewing SDM as a hierarchical reporting tool, it must be recognised as a dynamic governance instrument that enables schools and district offices to actively interpret, adapt, and implement data-driven strategies. This shift not only ensures functional decentralisation but also transforms middle-tier leadership into a distributed governance model, where decision-making authority is embedded within localised educational institutions rather than concentrated at the ministerial level.

6.8.2 Policy and Governance Implications: The Role of Middle-Tier Leadership in Distributed Leadership through Techno-Enablement

The middle-tier leadership—comprising State Education Departments (SEDs) and District Education Offices (DEOs)—plays a crucial role in the distributed leadership structure of SDM. While SDM policies emphasise data-driven autonomy, implementation remains highly centralised, with MOE retaining control over data interpretation and decision-making. This has created a contradiction where schools are expected to make data-driven decisions, yet their ability to contextualise and act on data is restricted. The Techno-Enabler Framework reconfigures this dynamic by embedding middle-tier leadership within a distributed leadership model, ensuring that SEDs and DEOs act as enablers rather than enforcers of SDM governance.

The current SDM governance structure often positions middle-tier leadership as policy enforcers, responsible for ensuring compliance with centralised directives rather than facilitating institutional autonomy. Findings from Section 4.3.3.2 indicate that school leaders lack the authority to independently interpret or modify SDM insights, reflecting Kelly et al.'s (2010) concept of data power hierarchies, where data control is retained at the central level, limiting institutional engagement. The Techno-Enabler Framework shifts this paradigm by positioning middle-tier leadership as an active intermediary that can bridge national education policies with localised SDM applications. By fostering a more decentralised and responsive SDM system, middle-tier leaders move beyond their role as compliance monitors and instead function as strategic facilitators of data-driven decision-making.

In a distributed leadership structure, middle-tier leaders must have the authority to support schools in adapting SDM insights to local educational contexts rather than simply enforcing top-down mandates. However, bureaucratic rigidity, misaligned policy directives, and inconsistent resource distribution often limit their ability to do so. In some districts, DEOs have proactively piloted localised SDM dashboards, allowing schools to track real-time student performance trends and adjust interventions accordingly. In contrast, other districts, constrained by hierarchical reporting structures, continue to restrict school-level data interpretation, resulting in delayed responses to emerging educational challenges. The Techno-Enabler Framework addresses these disparities by emphasising the need for decentralised data interpretation while ensuring that middle-tier leaders act as capacity builders rather than data enforcers.

To strengthen distributed leadership in SDM, middle-tier leadership must transition from passive policy enforcement to active data governance engagement. The Techno-Enabler Framework achieves this by integrating three key enablers of middle-tier leadership in SDM: (1) Leadership Training Programs, ensuring SEDs and DEOs are equipped with data literacy skills to support schools in SDM decision-making; (2) Decentralised Data Interpretation, allowing school leaders to contextualise SDM insights based on institutional needs rather than relying solely on MOE's national-level assessments; and (3) Expanded Decision-Making Autonomy

for DEOs, enabling them to develop localised SDM engagement strategies tailored to their districts, rather than applying standardised, compliance-driven policies. These enablers reinforce the role of middle-tier leadership within a distributed leadership framework, ensuring that SDM becomes a tool for school improvement rather than a bureaucratic obligation.

While expanding the role of middle-tier leadership in SDM governance is essential, certain risks must be mitigated. Decentralised SDM interpretation could lead to inconsistencies in reporting standards across districts, weakening national education policy coherence. Similarly, an overreliance on localised discretion without accountability mechanisms could reduce policy alignment. To address these risks, the Techno-Enabler Framework proposes the establishment of cross-district collaborative networks, ensuring that best practices in SDM interpretation are shared across regions. Additionally, the implementation of regular review mechanisms would ensure that localised SDM strategies remain aligned with national education objectives, preventing policy fragmentation while maintaining institutional autonomy.

The role of middle-tier leadership in distributed SDM governance cannot be understated. When empowered with decision-making authority, professional training, and adaptive tools, SEDs and DEOs can transform from compliance-driven enforcers into strategic enablers of data-driven education. The Techno-Enabler Framework repositions middle-tier leadership as a critical node in the distributed SDM network, ensuring that schools are supported in utilising SDM for localised improvements rather than merely complying with reporting requirements. By embedding SEDs and DEOs within a decentralised decision-making structure, Malaysia can shift from a hierarchical, compliance-driven SDM model toward an adaptive, participatory governance system that enhances institutional autonomy and evidence-based decision-making.

6.9 Conclusion: The Future of SDM Reform Through Techno-Enablers

This chapter has argued that Malaysia's SDM system requires a shift from a compliance-driven, top-down model to a participatory, decentralised, and institution-centred governance framework. The Techno-Enabler Framework, developed from empirical findings and theoretical insights, offers a structured pathway for this transformation by embedding regulatory balance, leadership capacity, policy adaptability, and institutional agency at the heart of SDM reform.

Findings reveal that despite significant investments in SDM digitalisation, Malaysia's system remains constrained by centralised control, limited institutional autonomy, and weak capacity-building. Schools and district offices function primarily as data providers rather than empowered decision-makers, resulting in a system focused more on compliance than on leveraging data for meaningful governance improvements.

The Techno-Enabler Framework addresses these challenges through five interrelated enablers:

- **Techno-Governance:** Balancing regulatory oversight with autonomy, allowing schools and districts greater control over data use.
- **Techno-Competency:** Enhancing professional capacity through data literacy and evidence-based governance training.
- **Techno-Networking:** Fostering inter-agency collaboration and participatory policy engagement.
- **Techno-Decisioning:** Decentralising data interpretation, enabling localised decision-making beyond national benchmarks.
- **Techno-Integration:** Aligning SDM reporting with institutional needs rather than rigid compliance structures.

Together, these enablers promote a new vision of SDM governance—one that empowers institutions, decentralises decision-making, and fosters participatory engagement in education policy. Technology is repositioned not as a tool for control but as a catalyst for institutional empowerment, leadership development, and adaptive governance.

The study concludes that sustainable SDM reform in Malaysia requires moving beyond technological determinism. The true driver of governance transformation lies in creating enabling conditions that allow institutional actors to engage meaningfully with digital systems. The Techno-Enabler Framework aligns with global trends towards data transparency, decentralised policy engagement, and participatory decision-making, offering both a theoretical and practical roadmap for reform.

Future implementation of this framework will depend on policy commitment, leadership readiness, and institutional adaptability. While challenges remain, embracing this shift from passive data reporting to active, data-driven governance offers the potential to reshape education policymaking in Malaysia—and serve as a model for other systems navigating the complexities of digital governance.

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Appendices

Online Questionnaire

a. Questionnaire

7/17/23, 10:20 AM

Title/Tajuk: Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies / Pemahaman...

Title/Tajuk: Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies / Pemahaman Makna & Kesalinghubungan Polisi untuk Strategi Pengurusan Data Pendidikan Bermakna

This research survey is conducted in two languages; English and Bahasa Melayu / Soal selidik kajian ini disediakan dalam dwibahasa; Bahasa Inggeris dan Bahasa Melayu

* Indicates required question.

1. Email *

About The Research / Tentang Kajian

Greetings,

I am Nur Aiman, the lead researcher for a study of Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies. You are being invited to take part in this research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve.

Please read the information below carefully.

1. The research aims to gain a better understanding of the relationship between functional capacity and policy capacity in the context of educational data management strategies for policy improvement.
2. There are 18 survey open-ended questions. You are encouraged to answer them all. However, you are free to withdraw at any time without prejudice, without giving any reason.
3. Through these questions, you are given the opportunity to reflect about your roles and share your opinions on the implementation of education data management strategies at your schools.
4. There will be no effect or risk to your employment as a result of your participation or non-participation in this research.

Your data will be ethically treated as below:

1. All names and other material likely to identify individuals will be anonymised.
2. All participants will be referred to by pseudonym.
3. The material will be treated as confidential.
4. The material will be kept in secure storage at all times.
5. The material will be retained in secure storage for use in future academic research.
6. The material may be used in future publications, both print and online.
7. Please note that confidentiality will be respected subject to legal constraints and professional guidelines.
8. This research has been considered and approved by the College Research Ethics Committee, University of Glasgow.
9. To pursue any complaint about the conduct of the research: contact the College of Social Sciences Lead for Ethical Review, Dr Susan Batchelor: email socsci-ethics-lead@glasgow.ac.uk

Thank you in advance for participating in this research.

Translation/Terjemahan:

Salam sejahtera.

Saya Nur Aiman, penyelidik utama untuk kajian Pemahaman Makna & Kesalinghubungan Polisi untuk Strategi Pengurusan Data Pendidikan Bermakna. Anda dijemput untuk mengambil bahagian dalam kajian penyelidikan ini. Sebelum anda membuat keputusan untuk mengambil bahagian, adalah penting untuk anda memahami sebab penyelidikan ini dilakukan dan perkara yang akan melibatkannya.

Sila baca maklumat di bawah dengan teliti.

1. Kajian ini bertujuan untuk mendapatkan pemahaman yang lebih baik mengenai hubungan antara keupayaan fungsi individu dan keupayaan dasar dalam konteks strategi pengurusan data pendidikan.
2. Terdapat 18 soalan tinjauan terbuka. Anda digalakkan untuk menjawab kesemuanya. Walaupun bagaimanapun, anda bebas untuk menarik diri pada bila-bila masa tanpa prejudis, tanpa memberi sebab.
3. Melalui soalan-soalan ini, anda diberi peluang untuk merenung tentang peranan anda dan berkongsi pendapat anda tentang pelaksanaan strategi pengurusan data pendidikan di sekolah anda.
4. Penyertaan anda dalam kajian ini dijamin tidak mendatangkan sebarang risiko kepada diri dan pekerjaan anda.

Data anda akan diproses secara beretika seperti di bawah:

1. Semua nama dan bahan lain yang mungkin mengenal pasti individu akan dirahsiakan.
2. Semua peserta akan dirujuk dengan nama samaran.
3. Semua bahan kajian akan diklasifikasikan sebagai sulit.
4. Semua bahan kajian akan disimpan dalam simpanan selamat sepanjang masa.
5. Semua bahan kajian akan disimpan dalam simpanan selamat untuk digunakan dalam penyelidikan akademik masa hadapan.
6. Semua bahan kajian boleh digunakan dalam penerbitan akan datang, baik bercetak mahupun dalam talian.
7. Sila ambil perhatian bahawa kerahsiaan akan dihormati tertakluk kepada kekosongan undang-undang dan garis panduan profesional.
8. Penyelidikan ini telah dipertimbangkan dan diluluskan oleh Jawatankuasa Etika Penyelidikan Kolej, University of Glasgow. *
9. Sebarang aduan tentang pengendalian penyelidikan bolehlah menghubungi Ketua Kolej Sains Sosial untuk Kajian Etika, Dr Susan Batchelor: e-mel socsci-ethics-lead@glasgow.ac.uk

Terima kasih terlebih dahulu kerana mengambil bahagian dalam penyelidikan ini.

2. I have read, comprehended the statement above and willingly to participate in this research survey. *

Saya telah membaca, memahami kenyataan di atas dan sukarela untuk mengambil bahagian dalam tinjauan penyelidikan ini.

Tick all that apply.

☐ I agree and willingly to participate in this research survey / Saya setuju dan sukarela untuk mengambil bahagian dalam tinjauan penyelidikan ini.

https://docs.google.com/forms/d/1Z10w8NYM6cqbtkZHNI15IM2V_k8azWPLwld80ELuRZ4/edit

1/5

As part of their responses, the participants' consent was recorded in Google Sheets. This allowed for the documentation of their agreement and willingness to participate in the research survey, alongside other data collected during the study.

[illegible]

7/17/23, 10:20 AM

Title/Tajuk: Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies / Pemaham...

Demographic Details

Maklumat Demografi

3. Gender / Jantina **Mark only one oval.*☐ Male / Lelaki☐ Female / Perempuan**4. Roles / Peranan ****Mark only one oval.*☐ Data teacher / Guru data☐ Head teacher / Pengetua / Guru besar**5. Age / Umur ****Mark only one oval.*☐ 26 - 30 years old☐ 31 - 35 years old☐ 36 - 40 years old☐ 41 - 45 years old☐ 46 - 50 years old☐ 51 - 55 years old☐ 56 - 60 years old**6. Working Experience / Pengalaman Kerja ****Mark only one oval.*☐ 6 - 10 years☐ 11 - 15 years☐ 16 - 20 years☐ 21 - 25 years☐ 26 - 30 years☐ 31 - 35 years☐ 36 - 40 years**Section 1: Understanding Roles**

Seksyen 1: Memahami Peranan

7. What do you understand about the purpose of data management at your school? *

Apakah yang anda faham tentang tujuan pengurusan data di sekolah anda?

8. What do you understand by the role data manager in schools? *

Apakah yang anda faham tentang peranan pengurus data di sekolah?

7/17/23, 10:20 AM

Title/Tajuk: Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies / Pemaham...

9. Can you describe about your roles in relation to data management? *

Bolehkah anda menerangkan tentang peranan anda berhubung dengan pengurusan data?

10. How do you perceive the process of collecting and analyzing data to improve school management? *

Bagaimanakah anda melihat proses mengumpul dan menganalisis data untuk menambah baik pengurusan sekolah?

11. How do you perceive the process of collecting and analyzing data to improve students' ability or performance? *

Bagaimanakah anda melihat proses mengumpul dan menganalisis data untuk meningkatkan keupayaan atau prestasi pelajar?

12. What are some of the challenges you face as a school data manager? *

Apakah cabaran yang anda hadapi sebagai pengurus data sekolah?

Section 2: Policy Practice

Seksyen 2: Amalan Polisi

13. What do you understand about the purpose of data management strategies in the Malaysia Education Blueprint 2013-2025? *

Apakah yang anda faham tentang tujuan strategi pengurusan data dalam Pelan Pembangunan Pendidikan Malaysia 2013-2025?

14. How helpful are data management strategies as suggested in the Malaysia Education Blueprint 2013-2025 for collecting data systematically, regularly and safely? *

Sejauh manakah strategi pengurusan data membantu seperti yang dicadangkan dalam Pelan Pembangunan Pendidikan Malaysia 2013-2025 untuk mengumpul data dengan sistematik, kerap dan selamat?

15. How do you think the data management strategies as suggested in the Malaysia Education Blueprint 2013-2025 could be improved to fix the problems you encountered? *

Pada pendapat anda, bagaimanakah strategi pengurusan data seperti yang dicadangkan dalam Pelan Pembangunan Pendidikan Malaysia 2013-2025 boleh diperbaiki untuk menyelesaikan masalah yang anda hadapi?

7/17/23, 10:20 AM

Title/Tajuk: Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies / Pemahaman...

Section 3: School Practice

Seksyen 3: Amalan Sekolah

16. What do you understand about the purposes of having web-based systems and apps for collecting and analyzing school data? *

Apakah yang anda faham tentang tujuan mempunyai sistem dan aplikasi berasaskan web untuk mengumpul dan menganalisis data sekolah?

17. From your experience, how can these systems and apps help schools collect data systematically, regularly and safely? *

Berdasarkan pengalaman anda, bagaimanakah sistem dan aplikasi ini boleh membantu sekolah mengumpul data dengan sistematik, kerap dan selamat?

18. In what ways do you think that school data management could be improved/enhanced through technology? *

Pada pendapat anda, bagaimanakah pengurusan data sekolah boleh dipertingkatkan melalui sokongan teknologi?

19. In what ways do you think that school data management could be improved/enhanced through trainings? *

Pada pendapat anda, bagaimanakah pengurusan data sekolah boleh dipertingkatkan melalui sokongan latihan?

20. In what ways, do you think that school data management could be improved/enhanced through leadership or teamwork? *

Pada pendapat anda, bagaimanakah pengurusan data sekolah boleh dipertingkatkan melalui sokongan kepimpinan dan kerja sepasukan?

Section 4: Prospective Implication

Seksyen 4: Implikasi Masa Depan

21. How do you think of future roles of head teachers/teachers in relation to data manager? *

Bagaimana pendapat anda tentang peranan guru besar/guru masa depan berhubung dengan pengurus data?

7/17/23, 10:20 AM

Title/Tajuk: Sense-Making & Policy Interconnectedness for Meaningful Education Data Management Strategies / Pemaham...

22. What future qualities that you think are needed to collect, process, and analyse student data? *

Apakah kualiti yang anda fikir diperlukan untuk mengumpul, memproses dan menganalisis data pelajar pada masa depan?

23. How do you see school data management evolving in the future with the presence of artificial intelligence? *

Bagaimanakah anda melihat pengurusan data berkembang pada masa hadapan dengan kehadiran kecerdasan buatan?

24. How can student data be used in the future to help students get help and make progress? *

Bagaimanakah data pelajar boleh digunakan pada masa hadapan untuk membantu perkembangan pelajar?

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b. Thematic Analysis for Online Questionnaire

Themes	Sub-themes
1. Purpose of data management	<ul style="list-style-type: none"> a. Multifaceted nature of data management b. Objectives and goals of data management
2. Challenges of data management	<ul style="list-style-type: none"> a. Lack of resources b. Data privacy and security concerns c. Teacher resistance d. Standardisation of data collection and analysis e. Technical difficulties f. Capacity building g. System improvement h. Involving stakeholders in data collaboration i. Effectiveness of data management strategies
3. Benefits of data management	<ul style="list-style-type: none"> a. Evidence-based decision-making b. Continuous improvement c. Improved student performance and achievement d. Tailoring teaching to meet student needs e. Implementation of data management strategies
4. Role of data manager	<ul style="list-style-type: none"> a. Crucial in ensuring accuracy, compliance, security, and confidentiality of school data b. Collecting and analysing data to support evidence-based decision-making and improvement efforts
5. Current Data Management (Using Web-based systems and apps)	<ul style="list-style-type: none"> a. Potential to support student learning and success b. Technical, administrative, and ethical challenges c. Automation, security measures, and data analysis can enhance school data management. d. Collaborative and comprehensive approach involving leadership and teamwork can improve student outcomes
6. Future of data management	<ul style="list-style-type: none"> a. Technical proficiency, communication skills, knowledge and expertise, attitude and motivation, and ethics and confidentiality b. Artificial intelligence and its potential to automate data-related tasks, improve data accuracy and consistency, and support decision-making and research efforts c. Use of student data to personalise instruction, track progress, and inform decision-making for student success d. Potential risks and challenges associated with using student data and AI in education, such as privacy concerns and biases in data analysis.

c. Generated Questions for Consultation Session

Themes	Further Questions	Simplified Version	Rationales
a. Purpose of data management	<ul style="list-style-type: none"> How does our district/state/ministry define success when it comes to data management? What steps are being taken to ensure that data management practices in Malaysian schools are equitable and student-centred, and how are these principles being incorporated into policy and practice? How can data management practices in Malaysian schools be improved to better meet the needs and perspectives of different stakeholders, such as teachers or education officers? What steps are being taken to gather and incorporate these perspectives into policy and practice? 	<ul style="list-style-type: none"> What is data management, and why is it important for schools in Malaysia? How is data management helping to ensure that schools are fair and focused on students? How can data management be improved to meet the needs of different people in the education system? 	These questions are important to understand the reasons behind data management practices and how they fit into larger education goals.
b. Benefits of data management	<ul style="list-style-type: none"> How is the Malaysia Education Blueprint 2013-2025 being used to guide the implementation of data management strategies in Malaysian schools, and what evidence is available to support its effectiveness? 	<ul style="list-style-type: none"> How is the Malaysia Education Blueprint 2013-2025 guiding the use of data in schools, and is it working well? 	These questions are important to understand the benefits of data management practices and their impact on student outcomes.
c. Challenges of data management/Role of Data Managers	<ul style="list-style-type: none"> How can the government address the challenges related to lack of resources, data privacy and security concerns, teacher resistance, and technical difficulties in schools in relation to data management? Can 	<ul style="list-style-type: none"> What are the problems that schools face in managing data, and how can they be addressed? How can teachers and education officers be involved 	These questions are important to understand the challenges faced in data management and how they are being addressed. These questions are also important to understand the

	<p>AI be utilised to overcome some of these challenges?</p> <ul style="list-style-type: none"> • What steps are being taken to improve the capacity building and system improvement efforts in Malaysian schools to support effective data management? • How are stakeholders at different levels of the education system hierarchy, such as teachers or education officers, being involved in the development and implementation of data management strategies? • How can education officials and policymakers be better engaged to ensure that policies and practices related to data management are effective and sustainable in a larger system? 	<p>in making data management better?</p> <ul style="list-style-type: none"> • How can policymakers help make sure data management is effective and stays that way? 	<p>role of a data manager and how they contribute to effective data management practices.</p>
d. Current Data Management (Using Web-based systems and apps)	<ul style="list-style-type: none"> • What potential benefits do web-based systems and apps offer for supporting student learning and success? • What technical, administrative, and ethical challenges have been faced when implementing web-based systems and apps? • How are these strategies being evaluated and improved over time? • Despite the MEB, what policies and guidelines are in place to shape data management practices in education, and how are these policies being 	<ul style="list-style-type: none"> • What are the advantages and disadvantages of using web-based systems and apps to manage data in schools? • How are these systems being monitored and improved? • What policies are in place to guide data management practices in schools? 	<p>These questions are important to understand the current use of web-based systems and apps in data management and how they can be optimised for student success.</p>

	implemented in Malaysian schools?		
e. Future of data management	<ul style="list-style-type: none"> • What are the potential benefits and risks of using AI in data management practices in Malaysian schools? • How can AI be used to improve data management practices in Malaysian schools, and what are the potential benefits and risks of using AI in this context? • What factors should be considered in present policies if the government intends to apply AI in school data management? 	<ul style="list-style-type: none"> • What are the potential benefits and risks of using AI to manage data in schools? • How can AI be used to make data management better, and what do we need to be careful about? • What factors should be considered in present policies if the government intends to apply AI in school data management? 	These questions are important to understand how data management practices may evolve in the future and what considerations need to be taken into account to ensure ethical and effective practices.

Consultation Session

a. Participants' Attendance Record

Participants (Code name)	Gender	State	Professional background	Participants' status.
1	Male	Terengganu	Headteacher	Face to face
2	Male	Kedah	Headteacher	Face to face
3	Female	Kedah	Headteacher	Face to face
4	Female	Selangor	Headteacher	Face to face
5	Male	Kedah	Headteacher	Face to face
6	Female	Selangor	Headteacher	Face to face
7	Male	Terengganu	Headteacher	Face to face
8	Female	Johor	Headteacher	Face to face
9	Female	Selangor	Headteacher	Face to face
10	Male	Selangor	Headteacher	Face to face
11	Female	Kedah	Headteacher	Face to face
12	Female	Johor	Headteacher	Face to face
13	Male	Johor	Headteacher	Face to face
14	Male	Terengganu	Headteacher	Face to face
15	Male	Johor	Headteacher	Face to face
16	Female	Kedah	Headteacher	Face to face
17	Male	Johor	Headteacher	Face to face
18	Male	Selangor	Headteacher	Face to face
19	Male	Terengganu	Headteacher	Face to face
20	Male	Terengganu	Headteacher	Face to face
21	Male	Terengganu	Headteacher	Online
22	Female	Kedah	Headteacher	Online
23	Female	Terengganu	Headteacher	Online
24	Female	Selangor	Headteacher	Online
25	Male	Terengganu	Headteacher	Online
26	Female	Kuala Lumpur	Headteacher	Online
27	Male	Kedah	Headteacher	Online
28	Female	Kuala Lumpur	Headteacher	Online
29	Male	Selangor	Headteacher	Online
30	Female	Kuala Lumpur	Headteacher	Online
31	Female	Terengganu	Headteacher	Online
32	Male	Kuala Lumpur	Headteacher	Online
33	Female	Selangor	Headteacher	Online

Interviewees' Profile

Interviewee Profile: MOE Officer 1

Location: Putrajaya, Malaysia

Years of Experience: 25 years

Background

MOE Officer 1 is a highly experienced education administrator currently serving as Deputy Chief Secretary in the Management and Development Division at the MOE. With 25 years of experience in education policy, administration, and governance, he has played a significant role in shaping national education strategies and overseeing the management of key educational initiatives.

Previous Experience

Prior to their current role, MOE Officer 1 spent 10 years working at the State Education Department (SED), where he gained direct experience in regional education administration and policy implementation.

Role and Responsibilities

His duties include overseeing resource allocation, improving policy execution frameworks, and coordinating cross-departmental initiatives to enhance the efficiency of Malaysia's education system. He also contributes to high-level decision-making on education development programs, working closely with various stakeholders to ensure policy coherence and effectiveness.

Expertise and Knowledge

MOE Officer 1 possesses deep expertise in education management, policy formulation, and institutional development. His specialisation includes education system governance, strategic planning, inter-agency collaboration, and policy evaluation. With extensive experience in managing large-scale education programs, performance tracking, and institutional development, his insights

contribute significantly to the study of School Data Management (SDM) governance and its role in education reform.

Interviewee Profile: MOE Officer 2

Location: Putrajaya, Malaysia

Years of Experience: 13 years

Background

With 13 years of experience in digital learning and education data management, he has been actively involved in the development and implementation of digital tools and data-driven policies for education administration. Their expertise lies in leveraging data systems to support education governance and enhance digital learning environments.

Previous Experience

Before assuming their current position, MOE Officer 2 spent five years working at a District Education Office (DEO), where he developed hands-on experience in managing school-level data, supporting digital infrastructure projects, and assisting in education technology implementation. His work at the district level allowed them to gain an in-depth understanding of the challenges faced by schools in adopting digital learning and data-driven decision-making processes.

Role and Responsibilities

In their role as Assistant Director, MOE Officer 2 is responsible for overseeing digital learning initiatives, managing education data platforms, and supporting policy implementation related to school data management. His responsibilities include ensuring the accuracy, integrity, and security of school-related data while assisting in the design and deployment of education technology solutions. He works closely with education stakeholders to enhance data collection methodologies and improve analytics for decision-making.

Expertise and Knowledge

MOE Officer 2 has extensive expertise in education data management, digital learning systems, and data-driven decision-making in education governance. His work involves analysing education trends using data analytics, developing strategies for digital integration in schools, and ensuring compliance with data privacy regulations.

Refined Interview Questions

Themes	Questions	Commentary	Refined Questions (Consensus)
1. Purpose of data management	1. What is data management, and why is it important for schools in Malaysia? 2. How is data management helping to ensure that schools are fair and focused on students? 3. How can data management be improved to meet the needs of different people in the education system?	1. Avoid including two questions within a single question. 2. The 1 st question helps to set the foundation for understanding the importance of data management in schools. 3. Eliminate the 2 nd question because the prospective respondents may have answered it in the 1 st question. 4. Eliminate the 3 rd question because it could have been asked under the third theme (Challenges of data management/Role of Data Managers).	1. Why is data management important in schools?
2. Benefits of data management	4. How is the Malaysia Education Blueprint 2013-2025 guiding the use of data in schools, and is it working well?	5. Avoid including two questions within a single question. 6. Rephrase the question to check the respondents' understanding about data management strategies in Malaysia Education Blueprint 2013-2025.	2. What do you know about data management strategies in Malaysia Education Blueprint 2013-2025?
3. Challenges of data management/ Role of Data Managers	5. What are the problems that schools face in managing data, and how can they be addressed? 6. How can teachers and education officers be involved for a better data management practice? 7. How can policymakers	7. Avoid including two questions within a single question. 8. Rephrase the 6 th question by including relevant stakeholders to explore their roles of in implementing effective data management practices in schools. 9. Eliminate the 7 th question because the prospective respondents may have answered it in the 7 th question.	3. How can stakeholders in education (e.g., teachers, education officers and policy makers) be involved for a better data management practice?

	help make sure data management is effective and stays that way?		
4. Current Data Management (Using Web-based systems and apps)	<p>8. What are the advantages and disadvantages of using web-based systems and apps to manage data in schools?</p> <p>9. How are these systems being monitored and improved?</p> <p>10. What policies are in place to guide data management practices in schools?</p>	<p>10. Avoid including two questions within a single question.</p> <p>11. Provide the specific examples of web-based systems.</p> <p>12. Rephrase the 8th question to give direction on how these apps might assist teachers' and school leaders' in making decision regarding students' learning.</p> <p>13. Eliminate the 9th question because the prospective respondents may have answered it in the 8th question.</p> <p>14. Readdress the 10th question by posing specific to ask about impact based on analysis.</p>	<p>4. Ministry of Education has provided six primary web-based systems (namely: Student Database Application (APDM), Assessment of Physical, Sports & Co-curricular Activities (PAJSK), Student Character System (SSDM), School Management System (SPS), E-Operation System, and School Examination Analysis System (SAPS) for data management practice, how do you think these apps will help teachers and school leaders to make decision about students' learning?</p> <p>5. What is return of investment or cost impact analysis of these systems?</p>
5. Future of data management	<p>11. What are the potential benefits and risks of using AI to manage data in schools?</p> <p>12. How can AI be used to make data management better, and what do we need to be careful about?</p>	<p>13. Avoid including two questions within a single question.</p> <p>14. Rephrase the 11th and 12th questions to explore the prospective respondents' perspective about the potential use of artificial intelligence in school data management practice based on his job responsibilities and</p>	<p>6. We are talking about the current trend and future technologies, any possible plan to integrate ai in data management practice in schools. What are your thoughts about the potential use of artificial intelligence in</p>

	<p>13. What factors should be considered in present policies if the government intends to apply AI in school data management?</p>	<p>working experience at the district/state/ministry level.</p> <p>15. Rephrase the 13th question to explore the prospective respondents' perspective about prospective teachers and school leaders' capacity with the emergence of the artificial intelligence.</p>	<p>data management in schools?</p> <p>7. The use of artificial intelligence is expected to provide data analysis automation with predictive analytics, how do you think that teachers could still optimise their own capability in making sense of the data to support students' learning?</p>
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Triangulation of Thematic Analysis

a. Infostructural challenges

Themes	Subthemes	References
Inter-Agency Data Flows	collaboration struggles	MAMPU officer 4
	conflicting directives	MAMPU officer 3/5/6, MOE officer 1
	poor resource allocation	MAMPU officer 3/6

b. Infosystemic challenges

Themes	Subthemes	Sub-sub themes	References
Interconnected Data systems	Policy-system alignment	deficiency of interconnectedness in political dimension	The MEB annual reports, The Public Sector Open Data (PSOD) Document, The UNICEF Report 2020
		divergence in policy narrative	
	Human-tech interaction	technology adoption	MAMPU officer 2. MOE officer 2
		poor internet connectivity	DEO officer 2
		data mismanagement	MOE officer 1, MAMPU officer 4

c. Enablement for Advocated Approaches

Themes	Subthemes	References
Enablement for Advocated Approaches	external regulatory oversight	MOE officer 1
	inter-agency capacity building	MAMPU officer 3/6
	inter-agency communication channels	MAMPU officer 6
	inter-agency leadership	MAMPU officer 1, MOE officer 1
	interconnected policy governance	MAMPU officer 2

d. Divergent in Perspectives

Themes	References
data technology (inter-contradicting statement)	Headteacher, DEO officer 4, MAMPU officer 2/4/6, MOE officer 2
school data flow (self-contradicting statement)	MOE officer 1

