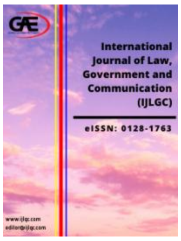
International Journal of Law, Government and Communication
IJLGC
EISSN : 0128-1763
Volume: 11 Issue: 44 (June 2026) PP. 01-24



INTERNATIONAL JOURNAL OF LAW, GOVERNMENT AND COMMUNICATION (IJLGC)
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ALTERNATIVE FUNDING MODELS FOR RESEARCH AND DEVELOPMENT: A COMPREHENSIVE SYSTEMATIC REVIEW

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Article Info:

Article history:
Received date: 29.03.2026
Revised date: 15.04.2026
Accepted date: 17.05.2026
Published date: 07.06.2026

To cite this document:

Mazlan, E. M., & Abdul Rahim, Z. (2026). Alternative Funding Models for Research and Development: A Comprehensive Systematic Review. *International Journal of Law, Government and Communication, 11*(44), 01-24.

Abstract:

The growing complexity of societal challenges and the increasing costs and risks associated with research and development (R&D) have intensified scrutiny of traditional, project-based public funding models, which are criticised for rigidity, short-termism, and uneven distribution of resources. In response, a diverse set of alternative funding models has emerged, yet the existing evidence remains fragmented across disciplines, policy contexts, and methodological approaches. This study presents a systematic literature review that synthesises and critically evaluates scholarly work on alternative funding models for R&D, with a system-level focus on how funding is designed, allocated, governed, and experienced by research actors. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, a structured search was conducted using the Scopus as well as Web of Science databases, employing advanced keyword combinations associated with R&D and public funding. Following screening, eligibility assessment, and quality appraisal, 57 primary studies were retained for in-depth analysis. The findings are organised into four thematic areas: (1) funding mechanisms, allocation design, and performance effects; (2) equity, disparities, and the question of who gets funded; (3) governance, accountability, integrity, and regulatory constraints; and (4) institutions, innovation ecosystems, participation, and researcher-facing realities. Across these themes, the literature reveals persistent tensions between efficiency and inclusivity, accountability and flexibility, and strategic steering and academic autonomy. The review shows that alternative funding models—including hybrid public–private schemes, mission-oriented instruments, and participatory mechanisms—can generate benefits

International Journal of Law, Government and Communication
IJLGC
EISSN : 0128-1763
Volume: 11 Issue: 44 (June 2026) PP. 01-24

but also introduce governance and equity challenges depending on their design and institutional context. By reframing alternative funding models as interacting allocation logics and governance arrangements, this review advances a more integrated understanding of R&D funding systems and highlights priorities for future research on comparative effectiveness, long-term innovation outcomes, and system-level funding design.

DOI: 10.35631/IJLGC.1144001

Keyword:

Public Funding, Research and Development Funding, R&D Funding

Introduction

The organisation and financing of research and development (R&D) have become increasingly contested as governments and funding agencies confront rising research costs, growing societal expectations, and heightened uncertainty surrounding innovation outcomes (Gigerenzer et al., 2025; Osimo et al., 2016). Traditional public funding models—most commonly competitive, project-based grants—have long been central to national research systems, yet they are increasingly criticised for their rigidity, short funding horizons, and uneven distribution of resources across institutions, disciplines, and regions (Moreno-Delgado et al., 2025). At the same time, policymakers are under pressure to ensure that public investment in R&D delivers measurable economic and societal returns, intensifying debates over accountability, performance measurement, and strategic steering (Banal-Estañol et al., 2023; Bell et al., 2022). These pressures have exposed persistent tensions between efficiency and inclusivity, flexibility and control, and curiosity-driven research and mission-oriented agendas, raising questions about whether existing funding arrangements remain fit for purpose (Gigerenzer et al., 2025; Graddy-Reed & Lanahan, 2023).

In response, a diverse set of funding arrangements has emerged across national and international research systems. These arrangements are often described as "alternative funding models" and include performance-based and block funding, hybrid public–private schemes, mission-oriented and challenge-driven programmes, participatory and community-based allocation mechanisms, and new financial instruments enabled by digital platforms and financial innovation (Calyx, 2022; Fanea-Ivanovici & Baber, 2024). While such models are frequently presented as solutions to the limitations of traditional grant funding, their effects are far from uniform (Barnett et al., 2024a; Dong et al., 2025). Empirical studies report mixed outcomes with respect to research performance, risk-taking behaviour, collaboration patterns, and long-term capability building (Babina et al., 2023; Banal-Estañol et al., 2023). Moreover, many of these models are not fully external to mainstream public funding systems but are embedded within them, operating alongside conventional instruments and subject to existing institutional and regulatory constraints (Blume-Kohout, 2023; Coca et al., 2024). This raises an unresolved conceptual question: whether these models represent genuine alternatives, or whether they reflect alternative allocation logics and governance arrangements within evolving R&D funding architectures.

A growing body of literature has examined specific funding instruments and programmes, often focusing on discrete outcomes such as publication productivity, patenting activity, or collaboration intensity (Song et al., 2025; Wang et al., 2024). Parallel strands of research address equity and access to funding, highlighting persistent concentration of resources in established institutions and regions, as well as disparities linked to gender, discipline, and geographic location (Mancuso et al., 2023; Mohammadi et al., 2023; Moreno-Delgado et al., 2025). Additional studies explore governance and accountability challenges, including regulatory rigidity, integrity risks, compliance burdens, and the increasing use of data-driven monitoring systems (Coca et al., 2024; Conix et al., 2023; Perianes-Rodríguez et al., 2024). While these investigations generate valuable insights, the evidence remains fragmented across disciplines, policy contexts, and analytical levels. As a result, existing research tends to evaluate funding models in isolation, limiting understanding of how funding instruments interact with one another, with institutional capacity, and with broader innovation system dynamics (Barbosa & Gomes, 2026; Majava & Rinkinen, 2026).

Against this background, there is a need for a systematic synthesis that moves beyond instrument-level assessments to examine how different funding arrangements collectively shape research behaviour, distributional outcomes, and innovation ecosystems (Kitchenham, B., & Charters, 2007). Rather than asking whether individual funding models "work" in isolation, a system-level perspective is required to understand how combinations of instruments, allocation rules, and governance practices generate structural trade-offs and path dependencies within R&D funding systems (Banal-Estañol et al., 2023). This research seeks to fill this gap by undertaking a systematic literature review of recent scholarly work on alternative funding models for R&D. By synthesising evidence on performance effects, equity and access, governance and integrity, and institutional and researcher-facing realities, the review aims to clarify how alternative allocation logics operate in practice and what their implications are for the design of adaptive, equitable, and learning-oriented R&D funding architectures.

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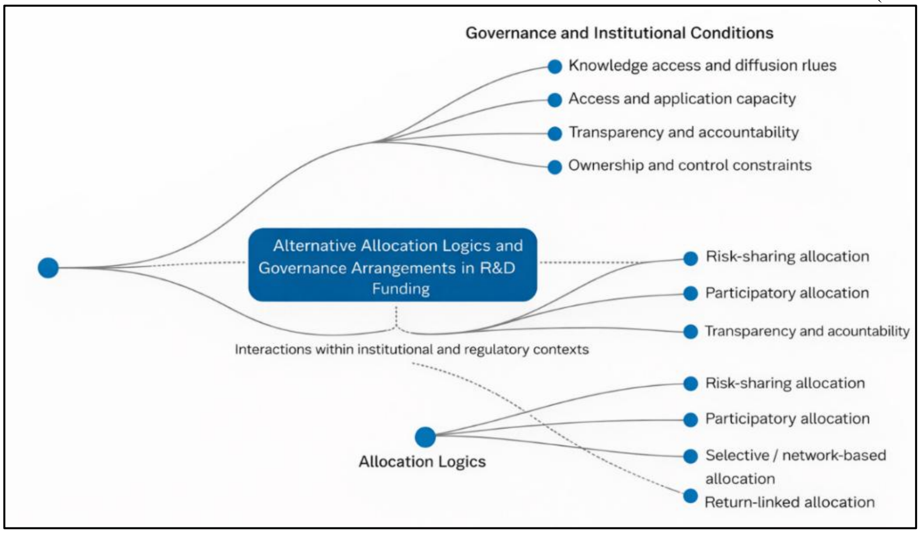

Figure 1. System-Level Conceptual Map Illustrating Alternative Allocation Logics and Governance Arrangements in Research and Development (R&D) Funding, And Their Interaction Within Institutional and Regulatory Contexts.

Figure 1 presents a system-level conceptual map that guides the synthesis undertaken in this review by reframing alternative funding models for research and development (R&D) as configurations of allocation logics and governance arrangements operating within institutional and regulatory contexts. Rather than depicting individual funding instruments as discrete alternatives, the figure emphasises how different allocation logics—such as risk-sharing, return-linked, participatory, and selective or network-based approaches—shape the resources distribution, incentives, as well as decision-making authority within R&D funding systems. These logics capture the underlying principles through which funding is allocated, regardless of the specific financial instruments employed.

Research Questions

This structured approach guarantees that the research questions are clearly focused, methodologically defensible, and well consistent with the systematic literature review objectives. RQs constructed as below:

RQ1 In R&D-performing organisations and research projects (Population), how do alternative funding models and their allocation designs (Interest) influence research performance, innovation outcomes, and project sustainability within research and development funding systems (Context)?
RQ2: Among researchers, institutions, and research communities (Population), how do alternative research and development funding models (Interest) shape equity, access, and funding disparities across research and development funding schemes (Context)?
RQ3: For funding agencies, policymakers, and R&D governance actors (Population), what governance, accountability, integrity, and regulatory challenges (Interest) arise from the implementation of alternative funding arrangements for research and development (Context)?
RQ4: Within researchers and research institutions (Population), how do alternative funding models (Interest) influence institutional roles, ecosystem participation, and researcher experiences in research and innovation ecosystems (Context)

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Material And Methods

This study adopts the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to guide the conduct of the systematic literature review. PRISMA provides a structured approach for the transparent identification, screening, and inclusion of studies, supporting methodological clarity and reproducibility across the review process (Grimshaw et al., 2021). In line with this framework, a systematic and auditable procedure was applied to study selection and synthesis. Web of Science and Scopus was selected as the primary databases due to their broad coverage of peer-reviewed literature, citation reliability, and relevance to interdisciplinary research on innovation, policy, and R&D funding.

The PRISMA process was operationalised through four sequential stages: identification, screening, eligibility, and data abstraction.

Identification

In accordance with the PRISMA framework, the identification stage defined the scope of the literature prior to screening and eligibility assessment. Two multidisciplinary bibliographic databases, Scopus and Web of Science, were used for study identification due to their broad coverage of peer-reviewed research across innovation, policy, and R&D-related fields. A systematic keyword search was conducted using terms related to research and development funding, R&D financing, and public funding. This search yielded 555 records from Scopus and 427 records from Web of Science, resulting in a total of 982 records identified before duplicate removal.

Table 1: The Search String

Scopus	**TITLE-ABS-KEY (("research and development funding" OR "R&D funding" OR "R&D financing" OR "research funding" OR "development funding") AND ("public funding" OR "government funding" OR "state funding" OR "federal funding" OR "grant funding")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2024) OR LIMIT-TO (PUBYEAR , 2025) OR LIMIT-TO (PUBYEAR , 2026)) AND (LIMIT-TO (LANGUAGE , "English"))** **Date of Access: January 2025**
WoS	(("research and development funding" OR "R&D funding" OR "R&D financing" OR "research funding" OR "development funding") AND ("public funding" OR "government funding" OR "state funding" OR "federal funding" OR "grant funding")) (Topic) and 2026 or 2025 or 2024 or 2023 or 2022 (Publication Years) and Article (Document Types) and English (Languages) Date of Access: January 2025

Screening

During the screening stage of the PRISMA process, records identified in the previous step were assessed at the title and abstract level to determine their alignment with the research objectives. Following duplicate removal, a total of 231 records were screened, comprising 115 records from Scopus and 116 from Web of Science, as reflected in the PRISMA flow diagram. At this stage, studies that did not meet the predefined inclusion criteria were excluded.

In total, 751 records were excluded because they were non-English publications, published outside the defined time window (2022–2026), classified as conference papers, books, review articles, or “in press” publications. In addition, five duplicate records that were not identified during the initial de-duplication process were removed at this stage. Following screening, 71 studies were retained for full-text eligibility assessment.

Table 2: The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	2022 – 2026	< 2022
Literature type	Journal (Article)	Conference, Book, Review
Publication Stage	Final	In Press
Subject	Social Science Business, Management and Accounting Economics, Econometrics and Finance Multidisciplinary	Besides Social Science Business, Management and Accounting Economics, Econometrics and Finance Multidisciplinary

Eligibility

The eligibility phase is a critical step in the PRISMA-guided review process, as it ensures that only studies with substantive relevance and sufficient quality are included for final analysis. As shown in the diagram, 231 articles were subjected to full-text assessment during this stage. Each article was carefully examined to determine whether its core content aligned with the research objectives and met the predefined inclusion criteria. This assessment went beyond titles and abstracts and focused on the actual scope, methodology, and contribution of each study, thereby strengthening the rigour and credibility of the review.

Following this detailed evaluation, 174 articles were excluded for clearly justified reasons. These included studies that were outside the research field, titles that lacked sufficient relevance, abstracts that did not address the objectives of the study, and the absence of accessible full-text versions. Excluding articles without full-text access was necessary to ensure transparency and enable proper assessment of methods and findings. As a result of this eligibility assessment, 57 articles were retained for the final review. This refined set of studies represents a focused and reliable evidence base, suitable for in-depth synthesis and analysis, and ensures that the conclusions drawn from the review are grounded in relevant, high-quality, and accessible research.

Data Abstraction and Analysis

An integrative analysis was adopted as the primary analytical strategy to synthesise evidence drawn from diverse qualitative research designs, enabling a comprehensive examination of research and development (R&D) funding across heterogeneous studies. This approach is particularly suited to complex policy and funding domains, where insights are dispersed across varying methodologies and disciplinary perspectives. Theme development began with a systematic data collection phase, during which 57 selected publications were examined in depth, as illustrated in Figure 2. Each study was scrutinised for relevant arguments, empirical observations, and conceptual discussions aligned with the objectives of the current study. In parallel, the methodologies employed, and the reported findings were analysed to ensure that thematic patterns were derived from both substantive content and methodological consistency. This dual focus strengthened the analytical foundation of the review and reduced the risk of superficial theme construction.

Subsequently, the authors engaged in collaborative analysis to iteratively develop and refine themes grounded in the contextual evidence of R&D funding. Maintaining a detailed analytical log throughout this process enhanced reflexivity by documenting interpretive decisions, emerging viewpoints, uncertainties, and analytical insights. This practice supports transparency and methodological rigour, particularly in qualitative synthesis where interpretation plays a central role. The resulting themes were then systematically compared to identify inconsistencies, overlaps, or conceptual gaps in the thematic structure. Where differences in interpretation emerged, these were resolved through structured discussion among the authors, ensuring analytical coherence and consensus. This iterative and collaborative process strengthens the credibility of the findings by demonstrating that the themes were not only evidence-based but also critically examined and collectively validated.

Quality of Appraisal

In accordance with the guidelines proposed by Kitchenham and Charters (Kitchenham, 2007), once the primary studies were identified, a quality assessment was conducted to evaluate the rigour and relevance of the selected research and to enable systematic comparison across studies. Primary studies refer to the original research articles included in the systematic review following the screening and eligibility processes; these studies constitute the core evidence base used to address the review's research questions. This study adopts the quality assessment framework proposed by Anas Abouzahra (Abouzahra et al., 2020), which comprises six quality assessment (QA) criteria. Each criterion was evaluated using a three-level scoring scheme: "Yes" (Y), assigned a score of 1 when the criterion was fully satisfied; "Partly" (P), assigned a score of 0.5 when the criterion was partially met; and "No" (N), assigned a score of 0 when the criterion was not met.

- QA1. Is the purpose of the study clearly stated?
- QA2. Is the interest and the usefulness of the work clearly presented?
- QA3. Is the study methodology clearly established?

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• QA4. Are the concepts of the approach clearly defined?
• QA5. Is the work compared and measured with other similar work?
• QA6. Are the limitations of the work clearly mentioned?

The table outlines a quality assessment (QA) process used to evaluate a study based on specific criteria.

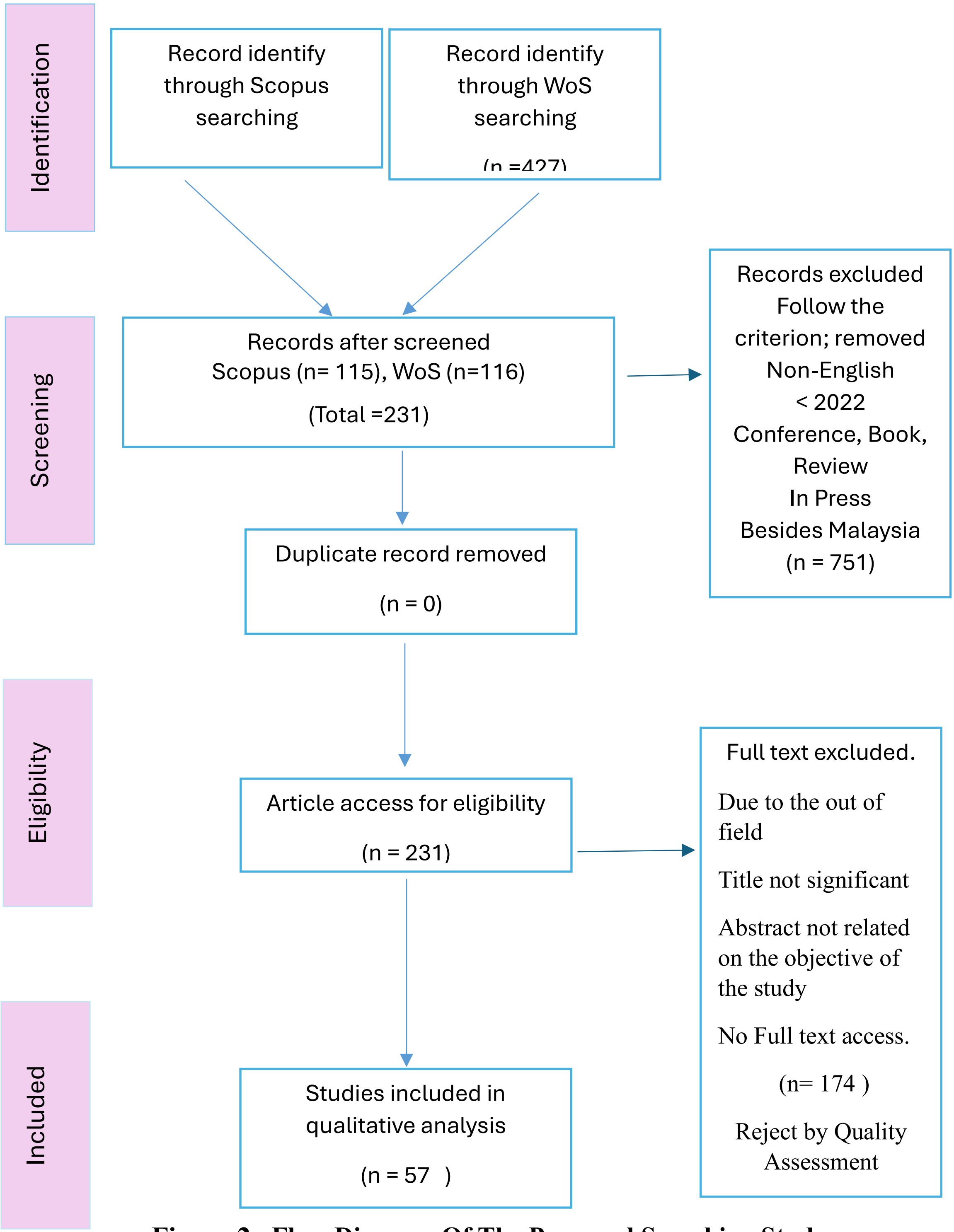

Figure 2. Flow Diagram Of The Proposed Searching Study
(Moher D, Liberati A, Tetzlaff J, 2009)

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Result and Discussion

The quality assessment results for PS1–PS22 show that the selected studies generally demonstrate satisfactory to high methodological quality based on the six evaluation criteria. The total quality scores range from 50% to 92%, with the majority of articles scoring 75% or above, indicating that their research objectives (QA1), relevance and usefulness (QA2), and methodological approaches (QA3) are clearly articulated. High-performing studies, such as PS9, PS16, and PS17, achieved scores above 90%, reflecting strong conceptual clarity (QA4) and, in some cases, comparative analysis with related work (QA5), although explicit discussion of limitations (QA6) remains relatively limited across the dataset. A small number of studies, notably PS7, attained the minimum acceptable threshold of 50%, mainly due to partial or absent descriptions of methodology, conceptual framing, or comparative evaluation. Importantly, no study within PS1–PS22 scored below 50%; therefore, in accordance with the predefined exclusion criterion, all studies in this subset were retained for inclusion in the systematic literature review, as none failed to meet the minimum quality requirement.

The following table presents the quality assessment for the included papers.

Summary:

- **Highest Score**: The paper by Keane et al. received the highest score of 100%, owing to its clear articulation of purpose, practical relevance, robust methodology, well-defined concepts, comparison with existing work, and acknowledgment of limitations.
- **Lowest Score**: The paper by Nahrawi et al. received the lowest score (66.67%), as it only partially satisfied the criteria for the concepts of approach and comparison with other work, and did not mention the limitations.

Table 2: Outcomes for the Included Primary Study

PS	QA1	QA2	QA3	QA4	QA5	QA6	Total	%
PS1 (Gu & Ni, 2026)	Y	Y	Y	Y	P	N	4.5	75
PS2 (De Souza Barbosa et al., 2023)	Y	Y	Y	Y	Y	N	5.0	83
PS3 (Majava & Rinkinen, 2026b)	Y	Y	Y	Y	P	N	4.5	75
PS4 (Dong et al., 2025)	Y	Y	Y	P	P	N	4.0	67
PS5 (Taylor et al., 2026)	Y	Y	Y	Y	P	N	4.5	75
PS6 (Moreno-Delgado et al., 2025)	Y	Y	Y	Y	P	P	5.0	83
PS7 (Lampe & Zackowski, 2025)	Y	Y	P	P	N	N	3.0	50
PS8 (Jin & Li, 2023)	Y	Y	Y	Y	P	N	4.5	75

PS	QA1	QA2	QA3	QA4	QA5	QA6	Total	%
PS9 (Bosma et al., 2025)	Y	Y	Y	Y	Y	P	5.5	92
PS10 (Balla et al., 2025)	Y	Y	Y	P	Y	N	4.5	75
PS11 (Lami & Paçukaj, 2025)	Y	Y	Y	Y	P	N	4.5	75
PS12 (Henriques et al., 2025)	Y	Y	Y	Y	P	N	4.5	75
PS13 (Dong et al., 2025)	Y	Y	Y	Y	P	N	4.5	75
PS14 (Song et al., 2025)	Y	Y	Y	Y	P	N	4.5	75
PS15 (Ribeiro et al., 2025)	Y	Y	Y	Y	P	P	5.0	83
PS16 (Behfar et al., 2024)	Y	Y	Y	Y	Y	P	5.5	92
PS17 (Barnett et al., 2024)	Y	Y	Y	Y	Y	P	5.5	92
PS18 (Adigwe et al., 2024)	Y	Y	Y	P	N	P	4.0	67
PS19 (Coca et al., 2024)	Y	Y	Y	Y	P	P	5.0	83
PS20 (Latos et al., 2024)	Y	Y	Y	Y	P	P	5.0	83
PS21 (Perianes-Rodríguez et al., 2024)	Y	Y	Y	Y	P	P	5.0	83
PS22 (Sultan et al., 2024)	Y	Y	Y	Y	N	P	4.5	75
PS23 (Janošec et al., 2024)	Y	Y	Y	Y	P	N	4.5	75
PS24 (Wendelborn et al., 2024)	Y	Y	P	Y	N	P	4.0	67
PS25 (Wang et al., 2024)	Y	Y	Y	Y	P	N	4.5	75
PS26 (Skipper et al., 2024)	Y	Y	Y	Y	P	P	5.0	83
PS27 (Piro et al., 2024)	Y	Y	Y	Y	P	N	4.5	75
PS28	Y	Y	Y	Y	P	N	4.5	75

PS	QA1	QA2	QA3	QA4	QA5	QA6	Total	%
(Abdul Rahman et al., 2024)								
PS29 (Henshaw et al., 2024)	Y	Y	Y	Y	N	N	4.0	67
PS30 (Tang et al., 2023)	Y	Y	Y	Y	N	P	4.5	75
PS31 (Conix et al., 2023)	Y	Y	Y	Y	N	P	4.5	75
PS32 (Haworth et al., 2023)	Y	Y	Y	Y	P	N	4.5	75
PS33 (Meadmore et al., 2023)	Y	Y	Y	Y	N	P	4.5	75
PS34 (Yang & Cho, 2023)	Y	Y	Y	Y	P	Y	5.5	92
PS35 (Blume-Kohout, 2023)	Y	Y	Y	Y	P	N	4.5	75
PS36 (Banal-Estañol et al., 2023)	Y	Y	Y	Y	Y	P	5.5	92
PS37 (Mancuso et al., 2023)	Y	Y	Y	Y	P	N	4.5	75
PS38 (Mohammadi et al., 2023)	Y	Y	Y	Y	Y	P	5.5	92
PS39 (H. Cheng et al., 2023)	Y	Y	Y	Y	P	N	4.5	75
PS40 (Babina et al., 2023)	Y	Y	Y	Y	Y	P	5.5	92
PS41 (Graddy-Reed & Lanahan, 2023)	Y	Y	Y	Y	P	N	4.5	75
PS42 (AbdulRafiu, 2023)	Y	Y	Y	Y	P	N	4.5	75
PS43 (Ardern et al., 2023)	Y	Y	Y	P	N	N	3.5	58
PS44 (Wernick et al., 2023)	Y	Y	Y	Y	P	N	4.5	75
PS45 (Bohn et al., 2023)	Y	Y	Y	Y	P	P	5.0	83
PS46 (Kindsiko et al., 2022)	Y	Y	Y	Y	P	P	5.0	83
PS47 (Ocampo et al., 2022)	Y	Y	Y	Y	P	N	4.5	75

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PS	QA1	QA2	QA3	QA4	QA5	QA6	Total	%
PS48 (O'Kane et al., 2022)	Y	Y	Y	Y	P	N	4.5	75
PS49 (Zhang et al., 2022)	Y	Y	Y	Y	Y	N	5.0	83
PS50 (Xia et al., 2022)	Y	Y	Y	Y	P	N	4.5	75
PS51 (Coupet & Ba, 2022)	Y	Y	Y	Y	Y	N	5.0	83
PS52 (Bell et al., 2022)	Y	Y	P	Y	N	P	4.0	67
PS53 (Sikimić, 2022)	N	P	N	N	N	N	0.5	80
PS54 (Calyx, 2022)	Y	Y	P	Y	N	P	4.0	67
PS55 (Nugent et al., 2022)	Y	Y	Y	Y	Y	N	5.0	83
PS56 (Yousoubova & McAlpine, 2022)	Y	Y	Y	Y	N	P	4.5	75
PS57 (Yousoubova & McAlpine, 2022)	Y	Y	Y	Y	N	P	4.5	75

The identified themes were iteratively refined to ensure analytical consistency and coherence. An expert in Technology Management conducted an independent review to validate the relevance and domain appropriateness of the themes. This expert validation process enhanced the clarity, significance, and suitability of each subtheme. The authors subsequently cross-checked the findings to reconcile differences in interpretation, with any discrepancies resolved through collaborative discussion. The final thematic structure was thus consolidated to ensure consistency and conceptual alignment.

This systematic literature review synthesises evidence on alternative funding models for research and development (R&D) across four key dimensions: performance, equity, governance, and institutional dynamics. The findings indicate that funding arrangements influence research performance, innovation outcomes, and project sustainability primarily through their underlying allocation logics rather than through individual instruments alone. At the same time, alternative funding models can both mitigate and reproduce structural inequalities, depending on their design and implementation context. Recurring challenges related to governance, accountability, integrity, and regulatory constraints highlight the complex interaction between funding arrangements and existing institutional frameworks. In addition, funding models shape institutional roles, ecosystem participation, and researcher experiences, underscoring the importance of system-level dynamics in understanding researcher-facing realities. Taken together, these insights support a system-level perspective on R&D funding, contributing to a more integrated understanding of how funding design, governance, and participation interact within contemporary research and innovation systems.

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Funding Mechanisms, Allocation Design, And Performance Effects

Funding mechanisms show consistent links with how R&D actors choose risk, collaboration, and technology acquisition pathways. In firm settings, financing composition appears to "steer" strategy: bank lending and public subsidies align more often with lower-risk or collaborative acquisition routes, while internal cash flow aligns more often with independent or higher-risk R&D choices, suggesting that funding origin influences both governance and appetite for novelty (D. Cheng, 2026; Jin et al., 2025; Yang & Cho, 2023). Evidence from universities also indicates that changes in federal support can reshape the portfolio of outputs and partners: reductions in public funding may trigger partial substitution toward private money, accompanied by shifts in output type and accessibility (Babina et al., 2023; Blume-Kohout, 2023; (Babina et al., 2023; Blume-Kohout, 2023; Coupet & Ba, 2022), 2022). Across these studies, "who pays" is not only a resource question; it is also a design lever that correlates with risk posture, partner selection, and the balance between internal creation and external acquisition (Babina et al., 2023; D. Cheng, 2026; Jin & Li, 2023)(Cheng, 2026; Babina et al., 2023; Jin et al., 2025).

Allocation design matters because different public funding modes seem to generate asymmetric performance responses and distributional effects. In higher education, competitive grant funding can display non-linear effects on research quality, whereas block funding tends to show more uniformly positive associations, with benefits varying by institutional rank (Banal-Estañol et al., 2023a; Dong et al., 2025a; Song et al., 2025a). Performance-based systems can raise aggregate quantity and quality at the system level yet still concentrate excellence in elite institutions, implying that incentive strength may increase measured outputs while reinforcing stratification (Banal-Estañol et al., 2023a; Dong et al., 2025a; Wang et al., 2024a). Region-level eco-innovation results add a parallel signal: disparities can persist across groups of countries, where stronger public support and innovation investment correlate with better environmental productivity, while weaker funding efficiency aligns with persistent performance gaps, pointing toward the importance of "outcome-driven" allocation rather than only volume-based support (Henriques et al., 2025; Jin et al., 2025; Yang & Cho, 2023).

Performance effects in the abstracts split into two recurring patterns: (i) funding raises output counts more reliably than it raises output quality, and (ii) targeted rules can redirect output mix rather than simply increase productivity. Personnel-level evidence indicates that receiving national research funding can enhance publication quality and quantity, but increasing the funding amount tends to raise quantity without a statistically clear improvement in quality, consistent with goal-setting incentives tied to deliverable counts (Banal-Estañol et al., 2023a; Barnett et al., 2024a; Song et al., 2025a). Experimental-style evidence from a modified lottery shows no clear causal improvement in publications or citations over follow-up, reinforcing concerns that selection and measurement may overstate returns in observational settings, and suggesting that marginal funding effects can be weak or context-sensitive (Barnett et al., 2024; Dong et al., 2025; Song et al., 2025). At the same time, reductions in funding can lead to declines in high-tech entrepreneurship and higher-quality basic publications while increasing patenting of lower quality and more private assignments. This implies that funding volatility and substitution toward private contracts may tilt outputs toward appropriable or less open forms of innovation (Babina et al., 2023; Blume-Kohout, 2023; Nugent et al., 2022).

Taken together, the theme "funding mechanisms, allocation design, and performance effects" points to a practical policy implication: evaluation and allocation need to treat funding as a

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EISSN : 0128-1763
Volume: 11 Issue: 44 (June 2026) PP. 01-24

portfolio architecture, not a single instrument. Landscape-level patent evidence suggests that large public agencies can shape the innovation map through changing priorities and institutional rules around ownership, with measurable shifts in patenting activity and recipient participation over time (Babina et al., 2023; Blume-Kohout, 2023; Chen et al., 2022). Program-level analyses show that strategic funding can expand international collaboration networks and publication growth, but these gains sit alongside risks of concentration and metric gaming when rewards focus on competitive performance measures (Banal-Estañol et al., 2023; Song et al., 2025; Wang et al., 2024). Evidence on targeted university–industry schemes suggest short-lived boosts in patent activity, while mixed funding (targeted plus traditional) associates with the greatest number of new patent applications, supporting a view that complementary instruments can outperform isolated schemes (Coupet & Ba, 2022; Nugent et al., 2022; Yang & Cho, 2023). Across contexts, efficiency and fairness concerns recur stronger designs appear to link funding to outcomes and learning, while also managing heterogeneity across institution types, regions, and technology fields (Dong et al., 2025a; Henriques et al., 2025; Jin et al., 2025).

Equity, Disparities, and "Who Gets Funded"

Across national and supranational programmes, the abstracts describe a persistent concentration of competitive research funding in already-advantaged institutions and territories, with equity concerns framed as "structural stickiness" rather than short-term noise. In Spain, large differences in success rates and funding amounts across institution types, disciplines, and regions, with stronger positions held by well-established public research actors and leading regions (Moreno-Delgado et al., 2025).

A comparable skew appears in European Union Framework Programmes, where Piro, Seeber, and Wang (2024) find uneven ability to attract funding across regions and sectors. This disparity is primarily influenced by variations in regional capacity and application behaviour. Regions with greater research and development capacity, as well as more proactive and intense application practices, tend to secure higher levels of funding. Conversely, regions with less established research infrastructure or lower proposal intensity often face challenges in attracting comparable support. These findings highlight the persistent imbalances in funding distribution within the EU, emphasizing that both the inherent capacity of a region and the strategies employed in the application process play critical roles in determining funding outcomes (Piro et al., 2024). (Piro et al., Regional Disparities in European Union Framework Programmes2024).

In the United States context long-standing geographic inequality in federal funding, while also showing that lower-funded regions can exhibit strong productivity relative to dollars received, suggesting that unequal allocation is not fully justified by performance differences alone (Mohammadi et al., 2023). Together, these findings portray "who gets funded" as a distribution problem with institutional, disciplinary, and geographic layers that reinforce each other.

The abstracts also point to mechanisms behind skewed outcomes that sit inside the allocation process, especially differences in proposal intensity, local R&D capacity, and the ability to request larger amounts. It was also reported that in the private sector, certain Southern European regions achieve high attraction rates through strong proposal intensity (large amounts requested), while higher education success in the "blue banana" aligns with higher R&D investment, research intensity, and higher requested funding (Piro et al., 2024). Similar report of discipline-level and region-level disparities in Spain's Knowledge Generation Projects, consistent with a system where established centres and fields receive higher approval rates and larger amounts per project (Moreno-Delgado et al., 2025a). It was also found that funding concentration correlates with concentration of faculty capacity, yet per-dollar output efficiency can be higher in historically underfunded regions, implying that allocation may be driven as much by accumulated capacity and application dynamics as by marginal returns to investment. In this view, disparities are produced by feedback loops—capacity supports more applications and larger requests, which supports more awards, which further grows capacity (Mohammadi et al., 2023; Alicia Moreno-Delgado et al., 2025; Piro et al., 2024).

Equity questions also appear at the individual level, particularly in mission-oriented funding where topic definition can indirectly screen participation. Female scholars are less likely to apply even after controlling for multiple characteristics, and that the under-application pattern is explained by greater distance between women's research interests and call topics rather than by masculine wording in call texts (Mancuso et al., 2023). This showed that disparities can occur before peer review, at the stage of deciding to apply, especially when funding calls narrow eligible topics. Disparities in how early-pipeline federal support is allocated across institutions and individuals, while noting comparable research impact rates after controlling for disciplinary practices, indicates that allocation differences can exist even when downstream productivity patterns look similar (Graddy-Reed & Lanahan, 2023). At a geographic scale, unequal starting positions in funding can coexist with high relative efficiency among less funded groups, suggesting that participation barriers and structural location influence access independently of capability (Mohammadi et al., 2023). The abstracts suggest equity policy must address more than review-stage fairness, since call design, topic selection, and early allocation affect the applicant pool and award distribution.

Finally, the theme extends beyond domestic science systems into international finance, where instrument choice appears to influence whether resources reach high-need settings. Grant-based funding is more likely to flow toward Global South countries facing higher climate vulnerability and biodiversity threat, while return-based instruments show opposite or non-significant relationships with need (Bosma et al., 2025). This implies weaker alignment between allocation and vulnerability when financial-return logic dominates. This result complements the domestic-level evidence of trade-offs between national priorities and broadening participation (Graddy-Reed & Lanahan, 2023a). Allocation disparities prompt debate over whether systems prioritise strategic concentration or inclusion (Graddy-Reed & Lanahan, 2023). Changing divergence patterns across sectors and programmes indicates that policy goals such as cohesion can alter distribution, but not remove skewness (Piro et al., 2024). Across these abstracts, equity emerges as an outcomes-and-instruments problem: the same "alternative" funding forms that promise efficiency or leverage may also reduce need-based allocation unless additional design constraints are introduced.

Governance, Accountability, Integrity, and Regulatory Constraints

Regulatory and governance rules shape how publicly funded R&D is executed, and several abstracts describe a recurring tension between legal compliance and operational flexibility. In the Spanish context, rigid legislative requirements restrict common change-management actions in projects, especially adjustments to scope, budgets, and timelines, which are often necessary under uncertainty (Coca et al., 2024). In EU smart city R&D compliance duties and localisation costs linked to data protection requirements can influence developer choices and market direction, creating pressure to pursue jurisdictions with weaker safeguards (Wernick et

International Journal of
Law, Government and Communication
EISSN : 0128-1763
IJLGC
Volume: 11 Issue: 44 (June 2026) PP. 01-24
al., 2023) . In the UK public finance setting, rule design and the consistency of principles behind funding arrangements matter during shocks and reforms, since limited flexibility can amplify governance disputes and constrain subnational responsiveness (Bell et al., 2022). Thus, regulatory constraints appear not only as “controls” but also as design parameters that can either enable adaptive delivery or produce administrative friction that reduces execution quality.

Accountability in funding is treated as both a data infrastructure problem and a performance-assurance problem. Perianes-Rodríguez, Olmeda-Gomez, Delbianco, and Grácio (2024) proposed a linked open data approach using funding acknowledgements and metadata integration to measure productivity as well as the impact of funded projects, emphasising robustness and reproducibility, and introducing co-funding networks as a new analytic unit. In Canada, summarise quality assurance monitoring of peer review contributions, reporting that most reviews meet expected standards while a minority show inadequate quality or engagement, supporting continued attention to review process governance (Ardern et al., 2023). In China’s funding system, accountability also includes detection and sanctioning capacity, with misconduct identification occurring through multiple pathways (for example retractions, whistleblowing, and software), and sanctions such as debarment and grant reclamation (Tang et al., 2023b). Findings indicate that accountability is increasingly operationalised through traceable data, structured monitoring, and enforcement tools, but outcomes depend on coverage, standardisation, and the incentives embedded in review and reporting systems.

Integrity risks appear in the abstracts as both individual wrongdoing and system-level pressures created by competitive allocation. Survey findings indicate that questionable research practices linked to grant competition are common among applicants and reviewers, alongside frequent doubts about peer review reliability, suggesting that preventive measures may be required (Conix et al., 2023). Tang, Wang, and Hu (2023) provide complementary evidence from disclosed misconduct investigations, where triggers include plagiarism detection and whistleblowing, and prevalent misconduct types include fraudulent papers and proposal falsification, indicating vulnerability at the proposal and reporting stages. Ardern et al. (2023) add an institutional governance response via reviewer quality feedback and monitoring, implying that strengthening peer review processes is one route to reduce allocation errors and integrity concerns. The literature shows that governance logic where integrity cannot rely only on post-publication corrections; detection mechanisms, reviewer oversight, and grant-process design interact with competitive pressure and can influence the prevalence of problematic practices.

A further governance dimension concerns normative duties and priority-setting under public funding, where accountability extends to ethics, social benefit, and policy alignment. Public funders have ethical obligations to promote data sharing, while also recognising competing obligations that can justify limits or careful conditions on mandatory sharing instruments (Wendelborn et al., 2024). In federally funded clinical trials, a gap was identified between health needs and trial design choices, reporting limited attention to controlling comorbidities relevant to outcomes in specific populations, framed as a priority-setting issue for public funding (Sultan et al., 2024). Governance tensions in interdisciplinary decarbonisation research, describing how funding priorities and institutional resistance can shape which topics and institutions gain visibility, including concerns about limited promotion of Global South institutions and themes (Abdulrafiu, 2023). Across these abstracts, governance is presented as multi-layered: ethical requirements (such as data sharing), integrity protection (misconduct control), and regulatory compliance (legal constraints, GDPR-related duties) jointly influence accountability for both process quality and societal relevance.

Institutions, Ecosystems, Participation, and Researcher-Facing Realities

Despite being the "connective tissue" of policy and innovation ecosystems, universities and research institutions have uneven influence. Most policy-cited research comes from universities. However, policy visibility concentrates in a limited number of research-intensive institutions and in states with stronger research ecosystems, with federal funding as well as institutional prestige correlating with policy impact (Gu & Ni, 2026). In an innovation ecosystem synthesis, research institutions, institutes, venture capital, leading enterprises, and intermediaries were identified as significant stakeholders (Majava & Rinkinen, 2026). Public financing and legislative incentives foster proximity, collaboration, and critical mass. Gaps between publicly funded research topics and environmental policy topics in an emergent economy, suggest that institutional research and policy agendas can drift even when both are publicly oriented. These abstracts place institutions at the center of "policy-facing science," but concentrated capacity and agenda misalignment determine which institutions gain influence and which research themes become policy visibility (Barbosa & Gomes, 2026).

At the researcher-facing level, the funding environment is described as a practical system of time, support, and social embeddedness rather than only proposal quality. In the UK health and social care, high application and reporting time and effort burdens, inefficiencies, unclear expectations, and perceived underfunding contribute to research waste and a negative research culture (Meadmore et al., 2023). A gap between individual funding success and institutional funding environment effectiveness, including pre-grant support, implementation assistance, as well as post-grant recognition and motivation, in New Zealand universities (O'Kane et al., 2022). In Canada, grant success depends on "fundability" built through collaborative research networking and feedback practices over time, rather than proposal text alone (Yousoubova & McAlpine, 2022). Variable funding supply in Estonia makes early-career researchers vulnerable due to short eligibility periods (Kindsiko et al., 2022). Taken together, these abstracts position participation as shaped by administrative load, institutional scaffolding, and the social systems surrounding grant success, with volatility amplifying strain on early career.

Many abstracts describe "multi-voice" funding architectures that include community perspectives and overlooked professional roles. The National Multiple Sclerosis Society employs a community review committee to integrate patient-centred relevance feedback alongside scientific review, reporting benefits for applicants and the community and creating a repeatable process for incorporating lived expertise (Lampe & Zackowski, 2025). Participatory budgeting in research funding decisions strengthens legitimacy and supports translation into evidence-based policymaking,variety of participants is a design prerequisite for legitimacy (Calyx, 2022). Henshaw, Bradshaw, and Geyer (2024) find that librarian inclusion is rarely required or explicitly stated in eligibility criteria for Canadian knowledge synthesis grants, despite evidence that librarian involvement improves quality. This suggests a mismatch between funding design and the real division of labor in producing reliable evidence. These abstracts suggest that researcher-facing realities include role recognition and structured inclusion, with funding rules affecting whether lived and information-specialist expertise are routinely integrated or optional.

Institutional ecosystems also appear in regionally and sectorally specific development settings, where participation depends on capacity building, policy fit, and infrastructure. In Nigeria, stakeholder perceptions of limited legislative support for government funding, weak infrastructure, inadequate R&D funding, and insufficient workforce capacity, linking these ecosystem constraints to weak local vaccine manufacturing readiness (Adigwe et al., 2024). In structurally affected Czech regions, public R&D funding improves regional innovation environments, with stronger average responsiveness in affected regions than in mature regions, implying that ecosystem context changes the marginal value of public support (Janošec et al., 2024). Regional development funding reinforces existing pathways in Arctic tourism regions, with limited transformative effect during shocks due to program rigidity, while public projects can improve networking and knowledge creation (Bohn et al., 2023). In Chinese cities, government funding support combines with organisational and environmental factors to support high-quality digital economy development. Absence of government funding is associated with absence of high-quality outcomes in the blockchain domain (Xia et al., 2022). Studies indicate that ecosystem readiness, regional innovation system maturity, and funding flexibility affect participation in pathway change.

Finally, several papers discussed institutional strategies and funding architectures to stabilize participation and improve outcomes, despite coordination and measurement issues. RISE-UC, a department-level internal program that combines shared governance, internal funding, mentorship, research services infrastructure, and incentives to increase external funding and internal award returns (Haworth et al., 2023). In cross-country funding programmes supporting academic-industry collaboration, Innosuisse was found to exhibit “rich-get-richer” dynamics, benefiting both academic and industry partners (Behfar et al., 2024). In state-level cannabis research funding, less than half of legalised states specify research funding mechanisms, and only a subset allocate funds, with distribution sometimes routed through agencies and sometimes directly to universities. This implies uneven institutional opportunity to build sustained research programmes (Balla et al., 2025b). In educational research, an evidence pipeline from grants to clearing house-reviewed outputs, arguing that funding must sustain both the supply of rigorous studies and the institutional capacity of evidence vetting and dissemination systems (Taylor et al., 2026). In ROI measurement work, ROI for fundamental educational research is difficult to calculate and often defaults to impact indicators rather than intrinsic value, proposing more robust approaches and distinguishing tangible outputs, intangible outputs, and outcomes (Abdul Rahman et al., 2024). These abstracts jointly frame “alternative funding models” as arrangements that must support institutional capacity, reduce fragility in participation, coordinate fragmented funding landscapes, and measure value in ways that reflect real research work rather than only countable outputs.

Conclusion

This systematic literature review provides a system-level understanding of alternative funding models for research and development (R&D) by integrating evidence across performance, equity, governance, and institutional dimensions. The findings demonstrate that the effects of funding arrangements are shaped less by individual instruments and more by the interaction between allocation logics, governance structures, and institutional contexts.

Across the literature, several consistent patterns emerge. First, funding design influences not only research outputs but also risk-taking behaviour, collaboration dynamics, and the balance between exploratory and applied research. Second, alternative funding models do not inherently resolve inequities; rather, they often reproduce or reconfigure existing disparities depending on allocation rules and institutional capacity. Third, governance and accountability remain central challenges, as increasing demands for transparency and control may constrain flexibility and adaptive research practices. Finally, institutional ecosystems and researcher-facing conditions play a critical role in shaping participation, particularly for early-career researchers and actors outside established centres.

By reframing alternative funding models as configurations of allocation logics and governance arrangements, this review advances a more integrated perspective on R&D funding systems. The findings highlight the need for portfolio-based approaches that balance efficiency, inclusivity, accountability, and flexibility, rather than relying on isolated funding instruments. From a policy perspective, the results suggest that effective R&D funding requires coordinated and adaptive architectures that align incentives with long-term capability development and societal priorities. Future research should extend this work through comparative and longitudinal analyses, with particular attention to how funding models interact with national innovation systems over time.

Acknowledgements:	The authors would like to express their sincere gratitude to [Universiti Teknologi Malaysia] for providing the necessary resources and support throughout the course of this research. Special appreciation is extended to colleagues and peers who contributed valuable insights and constructive feedback, which greatly enhanced the quality of this paper. No funding
Conflict of Interest Statement:	The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed to this work and approved the final version of the manuscript for submission to the International Journal of Law, Government and Communication (IJLGC).
Ethics Statement:	This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.
Author Contribution Statement:	All authors contributed significantly to the development of this manuscript. Zulhasni Abdul Rahim was responsible for the conceptualization, critical revision of the manuscript and overall supervision of the study. Elena Mazlinda Mazlan contributed to the literature review, drafting, methodology, handled data collection, analysis, and interpretation of results. All authors read and approved the final version of the manuscript prior to submission.

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