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ASSESSING TECHNOLOGY COMMERCIALIZATION PRACTICES OF SCIENCE GRANTING COUNCILS

Cases of Science Granting Councils

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1. Introduction

Technology transfer and commercialization span multiple dimensions of society, shaped by diverse policy frameworks, and exert influence on the behaviour of academia, industry, and markets. Their practices vary across countries, reflecting distinct traditions, beliefs, cultures, and norms, yet they also converge among some features. For example, while inventions may emerge from individuals or teams, most systems incorporate mechanisms to reward inventors, protect intellectual property, and ensure delivery of innovations to end users.

This became especially evident during the COVID-19 pandemic, when governments worldwide, regardless of ideology, invested heavily in vaccine research. Candidate vaccines were tested, approved or rejected, protected through intellectual property rights, and supported for manufacture, purchase, and distribution. At the same time, accusations of cybertheft of research data underscored the importance of safeguarding scientific outputs. Technology transfer and commercialization must therefore be viewed as a continuum spanning research, development, production, and delivery to end-users.

National approaches to technology transfer are deeply influenced by social norms and governance systems. In countries where property rights are weak, intellectual property rights are also often underdeveloped and poorly enforced. Similarly, the balance between knowledge treated as a public good and knowledge treated as private property affects opportunities for commercialization.

Every society establishes boundaries between technology that may be commercialized for profit and those that must remain in the public interest. For instance, medical knowledge, such as procedures to remove a tumour, repair a spine, or extract a tooth, typically diffuses globally at little or no cost, reflecting ethical expectations of professional duty. By contrast, the medical devices, pharmaceuticals, and production methods that make such practices possible are protected and commercialized.

To assess the state of technology transfer and commercialization in Africa, this study combined a critical review of literature with two surveys of science granting councils and their partners in target countries. The desk review examined support mechanisms and experiences at global, regional, and national levels, identifying key patterns, challenges, and gaps relevant to designing effective frameworks for technology transfer and commercialization. These insights guided the development of semi-structured questionnaires used to collect primary data from members of the Science Granting Councils Initiative (SGCI).

2. A Synthesis of Desktop Review of Existing Practices and Literature

Investment in research and development (R&D) is essential for advancing technological and industrial development, economic growth, and international competitiveness. However, R&D generates value only when outputs are successfully transferred, exploited, and commercialized. This reality has driven policy reforms worldwide, particularly in publicly funded universities and research institutions, to strengthen technology transfer and enhance the return on investment in R&D. Such reforms aim to generate measurable social and economic impact.

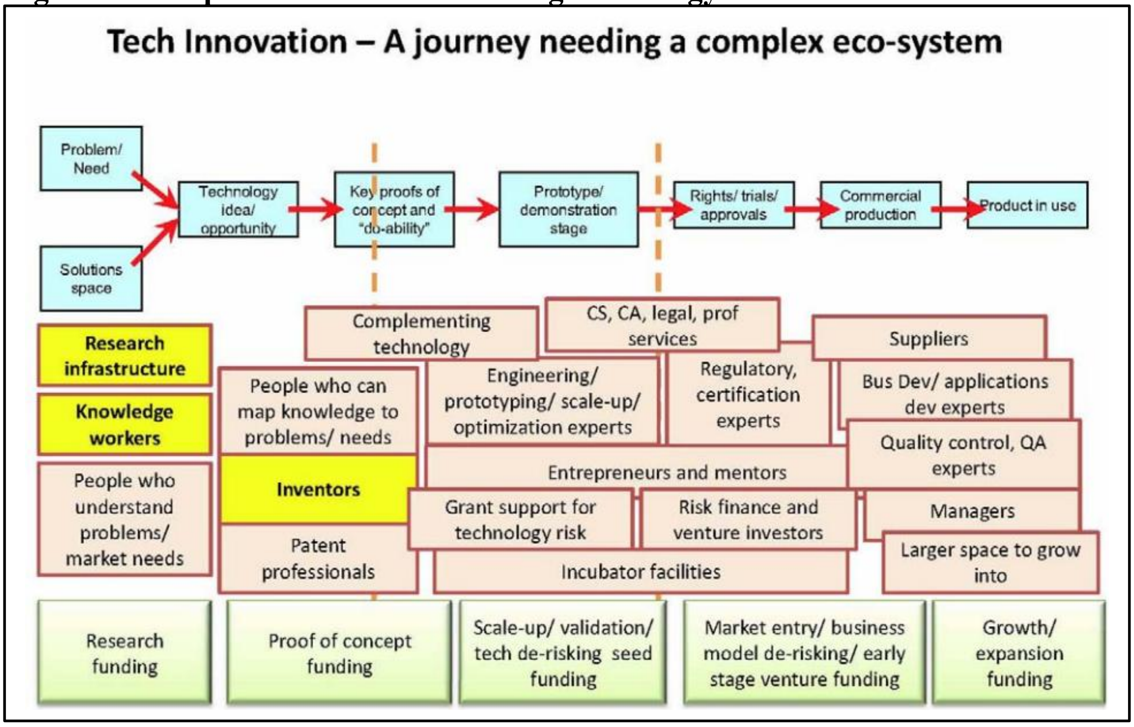
2.1 The Conception of Commercialization and Technology Transfer

Commercialization should be understood as the cumulative outcome of a spectrum of activities across different stages of the innovation process: from ideation through product development, market launch, and adoption. It builds on knowledge outputs from all three main types of R&D: basic research, applied research, and experimental development.

Because these activities are often carried out by different entities within a country, technology and knowledge transfer become critical pathways that make commercialization possible. They are, therefore, inseparable from any discussion of strategies to promote commercialization.

Designing effective commercialization frameworks requires systemic thinking. Such frameworks must account for the functions and mechanisms operating at each stage of the process, the roles of participating entities (direct actors, intermediaries, and other stakeholders), the influential factors at play (see Figures 1 and 2, also Marule, 2022[1]), as well as the diverse commercialization routes, options, and their intermediate and final impacts (see Figure 3).

Figure 1: Components involved in taking technology from lab to market



Source: Nandagopal, M., Gala, K. and Premnath V. (2011). Improving technology commercialization at research institutes: Practical insights from NCL Innovations. Innovation Educators' Conference (IEC), Indian School of Business, Hyderabad, 30 April 2011. https://www.venturecenter.co.in/pdfs/ISB-Conf-Paper-ver04.pdf

[1] Marule, N.P. (2022). The Role of Technology Commercialisation in the Operationalisation of Innovation and Industrial Policies in South Africa. *Triple Helix*, https://brill.com/view/journals/thj/9/2/article-p119_2.xml?language=en&srsltid=AfmBOoo-Tmk1jS4izUM8b7yr5-sqW5Ke8WNKFuwfUtWDfgX_96OiGaD2

Technology transfer does not have a universally agreed definition (Bozeman, 2000)[2]. Broadly, it can be described as *"the movement of know-how, technical knowledge, or technology from one organizational setting to another"* (Roessner, 2000)[3]. Within the context of commercialization, technology and knowledge transfer encompasses the movement of data, information, techniques, tools, skills, and artefacts into productive use and practical application. The ultimate goal is to develop new products or processes, or improve existing ones - an approach often captured by the phrase *"from Lab to Market"* (Kassicieh & Radosevich, 1994) [4].

Typically, the transferor is the producer or owner of knowledge, such as firms, universities and other public or private research institutions, while the transferee is the user of knowledge, most often firms within industry. However, technology transfer extends beyond this dyadic transferer-transferee relationship, involving a broader set of actors, including individuals and organizations with diverse needs and interests (Table 1). It also occurs through multiple modes and channels (see Figure 3 and Table 2; also Aridi & Cowey, 2018[5]; Kirchberger & Pohl, 2016[6]) and encompasses varied forms of knowledge.

This diversity makes it difficult to establish universal measures or indicators of effective technology transfer and its outcomes. Evaluation must therefore draw on a range of success measures tailored to the distinct needs and objectives of the participating entities, rather than relying on a single, standardized benchmark.

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[2] Bozeman, B. (2000). Technology Transfer and Public Policy: A Review of Research and Theory. *Research Policy*, 29(4-5), 627-655. https://doi.org/10.1016/S0048-7333(99)00093-1

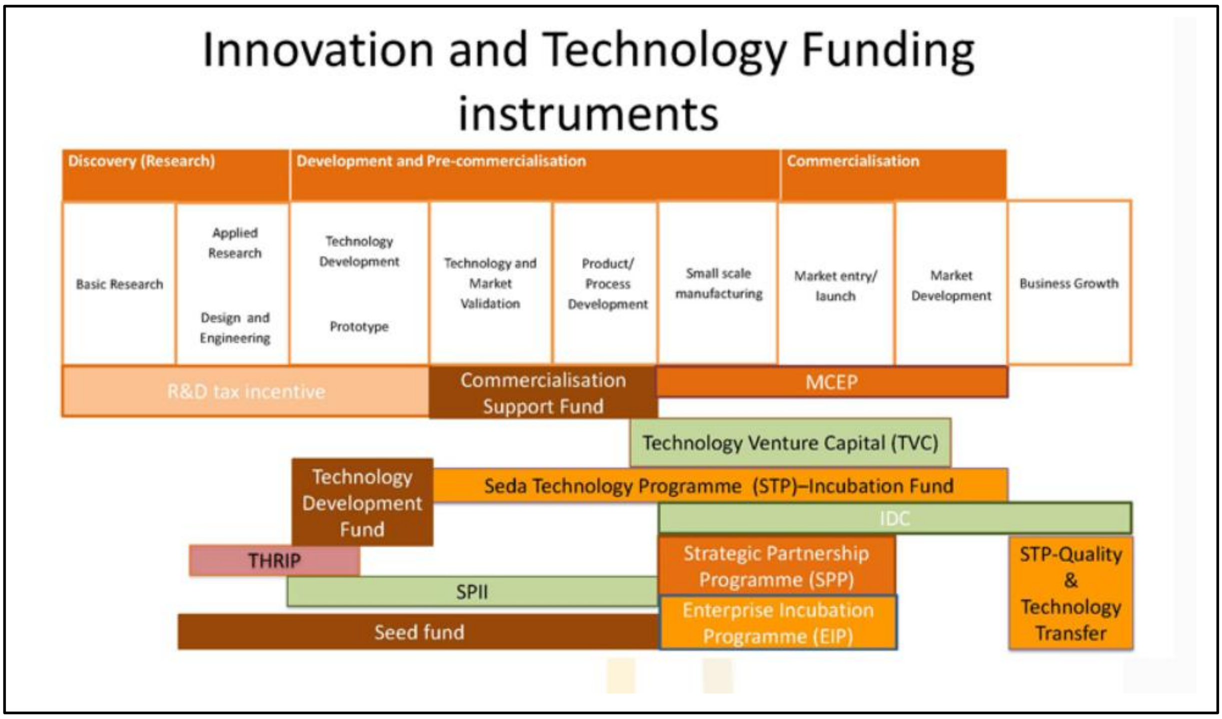
[3]Roessner, D. (2000). Quantitative and qualitative methods and measures in the evaluation of research. *Research Evaluation*, 9(2), 125-132. https://doi.org/10.3152/147154400781777296

[4] Suleiman K. Kassicieh & H. Raymond Radosevich (eds). *From Lab to Market: Commercialization of Public Sector Technology*. Springer.

[5] Aridi, A., & Cowey, L. *Technology transfer from public research organizations: a framework for analysis (English).* Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/384851539285043693

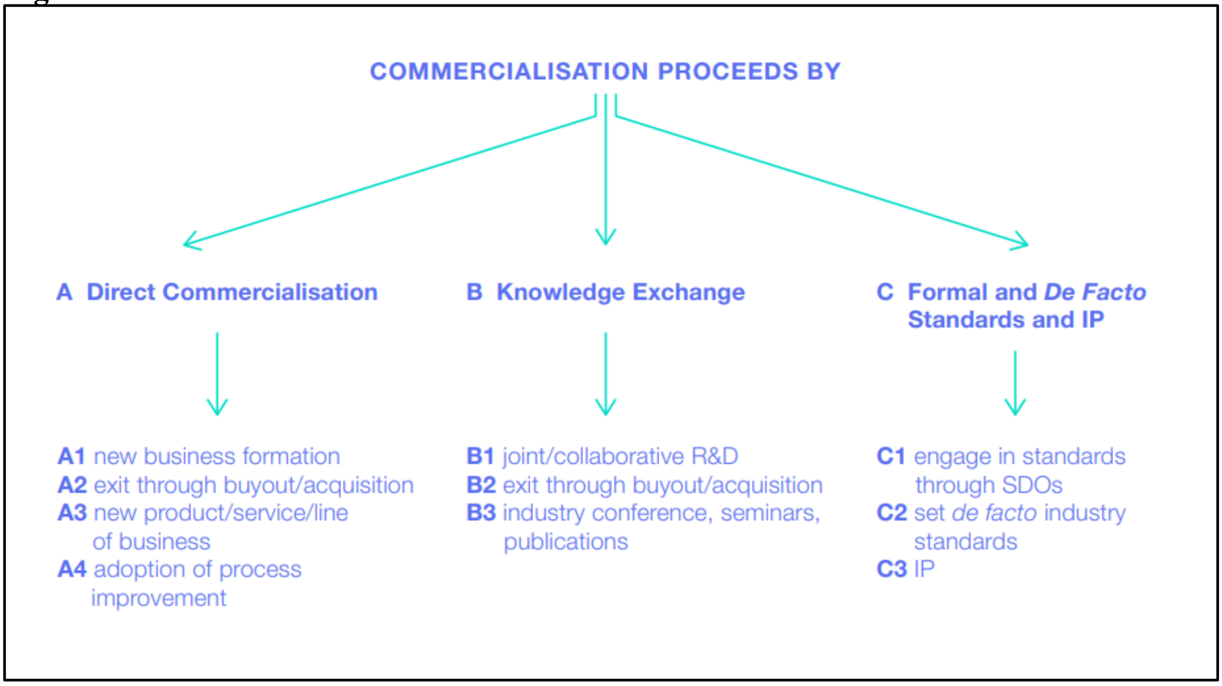
[6] Kirchberger, M.A., & Pohl, L. Technology commercialization: a literature review of success factors and antecedents across different contexts. *The Journal of Technology Transfer,* **41**, 1077–1112. https://doi.org/10.1007/s10961-016-9486-3

Figure 2: The Innovation and Technology Funding Instruments in South Africa



Source: Department of Trade, Industry and Competition, Republic of South Africa. https://www.thedtic.gov.za/financial-and-non-financial-support/incentives/innovation-and-technology-funding-instruments/

Figure 3. Different Commercialization Routes



Source: Westgarth, Chen, Hay and Heath (2022). Understanding UK Artificial Intelligence R&D commercialisation and the role of standards.
https://www.gov.uk/government/publications/understanding-uk-ai-rd-commercialisation-and-the-role-of-standards

Table 1. A generic list of success measures of technology transfer by the needs of involved

R&D Performers
- **Inventors**: usefulness of technology
- **Institutions**: patents; licences; revenues

(Government) Legislation: Benefits to nation's economic well-being and competitiveness
Industry in general: Profit, market share, access to knowledge and expertise, sharing risks, leveraging and complementing R&D portfolios
- *Large firms*: generic technologies and early-stage expertise
- *Small firms*: products and processes closer to commercialization
- *Entrepreneurs/Venture Capitalists*: growth of companies, wealth creation

Consumers: New or improved products

Source: Wang et al. (2003). Technology Transfer of Federally Funded R&D Perspectives from a Forum[7].

Table 2: Major Modes and Channels of Technology Transfers

	Mode of Transfer		
Mechanisms	Market	Network (Intermediary)	[Firm] Hierarchy
Direct investment in an entity (domestic or foreign)			X
Joint ventures			X
Co-operative alliances*		X	
Licensing	X		
Subcontracting		X	
Imports of [capital] goods	X		
Exports	X		
Transfer by people		X	
Development assistance	X	X	

Source: Radosevic (1999)[8]
**Co-operative alliances include production sharing agreements; management and marketing contracts; service agreements; R&D consortia and other co-operative contracts and pacts; franchising; and other technical services agreement*

2.2 Major Barriers and Challenges to Technology Transfer and Commercialization

Technology transfer and commercialization are inherently dynamic, multifaceted processes that unfold across multiple actors, mechanisms, and stages. A large body of research underscores the barriers and challenges that limit their effectiveness, drawing evidence from

[7] Wang et al. (2003). Technology Transfer of Federally Funded R&D: Perspectives from a Forum. Conference Proceeding No.187, RAND. https://www.rand.org/pubs/conf_proceedings/CF187.html
[8] Radosevic, S. (1999). Transformation of science and technology systems into systems of innovation in central and eastern Europe: the emerging patterns and determinants. *Structural Change and Economic Dynamics,* 10(3-4), 277-320. https://doi.org/10.1016/S0954-349X(99)00016-8

diverse contexts and perspectives (Cunningham & O'Reilly, 2018[9]; Greiner & Franza, 2003[10]; Jasinsk, 2009[11]; Kirchberger & Pohl, 2016[12]; Mazurkiewicz & Poteralska, 2017[13]).

Broadly, these barriers exist at three levels:

- **Macro level** – the broader environment (e.g. policy, regulatory) withing which entities operate.
- **Meso level** – the industry and market environment.
- **Micro level** – the organizational and individual actors

They can also be categorized by the ***what*** (the technology or knowledge being transferred), the ***who*** (the organizations and individuals involved), the ***when*** (the timing of transfer), and the ***how*** (the mechanisms, processes, and channels through which transfer occurs).

Studies highlight barriers related to the availability, suitability, quality, and readiness of critical factors that enable effective transfer and commercialization (Bozeman et al., 2015[14]; Jiagwe et al., 2024[15]). These include:

- **Formal institutional conditions,** including national development priorities, policies and regulatory frameworks, capabilities, infrastructure, codes, and standards.
- **Cultural norms and practices,** such as prevailing values, levels of trust, power distance, and orientation toward individualism or collectivism.
- **Industrial and market needs and demand,** such as needs for productivity, efficiency, cost saving, and environmental sustainable solutions.
- **Technology-related factors,** covering both the focal technologies and supporting/auxiliary technologies that enable their application.
- **Resources,** including financial, human, and informational resources necessary for enabling effective transfer and commercialization.

Table 4 provides a summary of key influential factors.

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[9] Cunningham, J.A., O'Reilly, P. Macro (2018). Meso and micro perspectives of technology transfer. *The Journal of Technology Transfer,* **43**, 545–557. https://doi.org/10.1007/s10961-018-9658-4

[10] Greiner, M.A., & Franza, R.M. (2003). Barriers and Bridges for Successful Environmental Technology Transfer. *The Journal of Technology Transfer* **28**, 167–177. https://doi.org/10.1023/A:1022998617118

[11] Jasinski, A.H. (2009). Barriers for technology transfer: the case of a country in transition. *Journal of Technology Management in China* 4 (2): 119–131. https://doi.org/10.1108/17468770910964984

[12] See footnote 6.

[13] MazurKiewicz, A., & Poteralska, B. (2017). Technology Transfer Barriers and Challenges Faced by R&D Organisations. *Procedia Engineering*, 182, 457-465. https://doi.org/10.1016/j.proeng.2017.03.134

[14] Bozeman, B., Rimes, H., & Youtie, J. (2015). The evolving state-of-the-art in technology transfer research: Revisiting the contingent effectiveness model. *Research Policy*, 44, 34-49. https://doi.org/10.1016/j.respol.2014.06.008

[15] Jiagwe, R. et al. (2024). The drivers and barriers influencing the commercialization of innovations at research and innovation institutions in Uganda: a systemic, infrastructural, and financial approach. *Journal of Innovation and Entrepreneurship,* **13**, 78. https://doi.org/10.1186/s13731-024-00435-y

2.3 Promoting technology transfer and commercialization of public-funded research: Policy instruments

In both developed and developing countries, governments play a direct and critical role in promoting technology transfer and commercialization. Research documents a wide range of policy instruments employed worldwide, including:

- **Legislation and regulation** – for example, the Bayh–Dole Act, the Federal Technology Transfer Act (FTTA) of 1986, and the America COMPETES Act of 2022 in the United States
- **Direct financial incentives** – such as R&D funding, low-interest loans, subsidies, and vouchers
- **Indirect financial incentives** – including tax relief and credits, as well as public contracts and procurement mechanisms
- **Infrastructure investments** – in research, technology transfer, and commercialization systems
- **Institutional support** – through specialized agencies for research, technology transfer, and commercialization
- **Soft instruments** – such as advocacy, persuasion, and consultation (Cunningham & O'Reilly, 2018[16]; Guimón & Paunov, 2019[17]).

Governments often adopt a mix of **"carrot, stick, and sermon"**—coercive, incentive-based, and voluntary instruments (Bemelmans-Videc, Rist, & Vedung, 1998[18]; Kern, Rogge, & Howlett, 2019[19]). Table 3 presents key policy instruments identified by the OECD and summarized by Guerrero & Urbano (2019)[20].

The selection of instruments should be guided by the following criteria (Borras & Edquist, 2013) [21]:

- **Appropriateness and effectiveness** – suitability of instruments given their characteristics and potential synergies

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[16] See footnote 9

[17] Guimón, J., & Paunov, C. (2019). Science-Industry Knowledge Exchange: A Mapping of Policy Instruments and Their Interactions. OECD Science, Technology and Industry Policy Paper No. 66. https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/04/science-industry-knowledge-exchange_de2b8676/66a3bd38-en.pdf

[18] Bemelmans-Videc, M-L. et al. (2003). *Carrots, Sticks and Sermons: Policy Instruments and Their Evaluation*. New York: Routedge. 1st Edition

[19] Kern, F., Rogge, K.S., Howlett, M. (2019). Policy mixes for sustainability transitions: New approaches and insights through bridging innovation and policy studies. *Research Policy*, 48(10), 103832. https://doi.org/10.1016/j.respol.2019.103832

[20] Guerrero, M., & Urbano, D. Effectiveness of technology transfer policies and legislation in fostering entrepreneurial innovations across continents: an overview. *The Journal of Technology Transfer*, **44**, 1347–1366 (2019). https://doi.org/10.1007/s10961-019-09736-x

[21] Borras, S., & Edquist, C. (2013). The choice of innovation policy instruments. *Technological Forecasting and Social Change*, 80(8), 1513-1522. https://doi.org/10.1016/j.techfore.2013.03.002

- **Efficiency** – in terms of cost and timeliness
- **Flexibility** – capacity to adapt to specific contexts and conditions
- **Workability** – ease, simplicity, and robustness of implementation
- **Equity** – fairness in the distribution of benefits and outcomes

2.4 Structure and Administration of Technology Transfer and Commercialization Programs: Selected Country Examples

The design and administration of purposive policy instruments for technology transfer and commercialization often mirror the political and administrative framework of a country. Responsibilities typically rest with key national or federal agencies, each with specialized mandates to develop and implement targeted support programs. These governance structures may also include additional administrative layers, ranging from supra-national entities (e.g., the EU, ASEAN) to sub-national authorities such as municipalities. The following outlines technology transfer and commercialization support structures in six countries (also see Upstill and Symington, 2002[22]), spanning both developed and developing contexts.

- **United States of America (USA):** Over 30 federal agencies fund or perform R&D aligned with their missions, with five agencies concentrating over 90% of federal R&D funding in 2021: Department of Defense (DoD), Department of Health and Human Services (HHS, including NIH), NASA, Department of Energy (DOE), and National Science Foundation (NSF). Research is conducted across federal laboratories (performing approximately 30% of funded R&D), universities, and businesses. The Federal Laboratory Consortium for Technology Transfer (FLC) is a network of more than 300 federal labs, agencies, and research centers established by the Federal Technology Transfer Act to drives technology transfer activities, promotes collaboration with non-federal entities, and accelerates commercialization.
- **Canada:** The "Tri-agency" model consists of the Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council (NSERC), and Social Sciences and Humanities Research Council (SSHRC). These agencies collaborate in selected initiatives while independently managing others (e.g., NSERC's Idea to Innovation program). Oversight is provided by the Canada Research Coordinating Committee (CRCC), with administrative functions centralized in the Tri-agency Institutional Programs Secretariat (TIPS) housed within SSHRC[23].
- **United Kingdom (UK):** UK Research and Innovation (UKRI), established in 2018 and sponsored by the Department for Science, Innovation and Technology (DSIT), serves as the central funding agency. UKRI integrates seven disciplinary research councils, Research England (supporting higher education research and knowledge exchange in England), and Innovate UK (the national innovation agency supporting

[22] Upstill, G., & Symington, D. (2002). Technology transfer and the creation of companies: the CSIRO experience. *R&D Management*, 32 (3), 233-239. https://doi.org/10.1111/1467-9310.00256
[23] Government of Canada (2021). Tri-Agency Framework: Responsible Conduct of Research. https://rcr.ethics.gc.ca/eng/documents/framework-cadre-2021-en.pdf

business-led innovation). Additionally, devolved administrations in Wales, Scotland, and Northern Ireland have separate higher education funding councils administering regional research and innovation funding[24].

- **Singapore:** The Research, Innovation and Enterprise Council (RIEC), chaired by the Prime Minister, sets strategic directions for national research and innovation. The National Research Foundation (NRF) acts as RIEC's secretariat and executes the R&D strategy, coordinating cross-government innovation challenges. The Agency for Science, Technology and Research (A*STAR) bridges academia and industry, managing research institutes and fostering partnerships between universities and industry[25] [26].
- **India:** The Council of Scientific and Industrial Research (CSIR) oversees large public research institutions. The Science and Engineering Research Board (SERB), established in 2019, funds basic research in emerging science and engineering fields[27]. A forthcoming National Research Foundation (NRF), modelled on the US NSF, will centralize strategic research funding by consolidating existing funding bodies. Key agencies supporting technology transfer include the National Research Development Corporation (NRDC), Technology Information, Forecasting and Assessment Council (TIFAC), the Kalam Institute of Health, and the Office of Technology Transfer at C-CAMP[28].
- **China:** The structure is characterized by a dual party-government system and multi-level administration involving national, provincial, and municipal authorities. Research priorities and funding are set by inter-ministerial committees led by the Ministry of Science and Technology (MoST) working closely with the Central Committee of the Communist Party. National-level science and innovation funding is grouped into five pillars: National Natural Science Fund (basic and applied research), National S&T Innovations 2030 Major Projects (strategic megaprojects), National Key R&D Programs (social welfare and livelihood), Technology Innovation Guidance Funds (venture capital and commercialization), and Bases and Talents Program (scientific infrastructure and human capital development). Provincial funding structures align with national priorities but may vary to reflect regional focus areas[29] [30].

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[24] UKRI, UK. https://www.ukri.org/

[25] UK Science & Innovation Network Country Summary – Singapore.

[26] NRF, Singapore. https://www.nrf.gov.sg/about/about-nrf-singapore/nrf-singapore/

[27] About SERB. https://serb.gov.in/page/english/about

[28] Venugopalan, P. & Purushotham, H. (2023). The Origins of Organized Technology Transfer in India: The NRDC. *Journal of the Licensing Executives Society*, Volume LVIII No. 1. https://ssrn.com/abstract=4335728

[29] Naughton et al. (2023). Reorganization of China's Science and Technology System. UC Institute on Global Conflict and Cooperation. Working Paper No. 10. https://ucigcc.org/wp-content/uploads/2023/08/2023_wp10_naughton_v2-FINAL.pdf

[30] STINT (2020). Public Research and Innovation Funding Actors in China. https://www.stint.se/wp-content/uploads/2020/09/23087_STINT_rapport_Public_Research_and_Innovation_Funding_Actors_in_China_webb.pdf

Insights from the national cases

A clear and concrete national-level Science, Technology, and Innovation (STI) strategy is essential. This strategy should explicitly define strategic technology priority areas, key development challenges, and national capabilities to be enhanced. Furthermore, it must be effectively communicated and aligned across government ministries and agencies to ensure a unified direction (see Table 3 and Table 4).

Strong coordination and alignment across multiple levels of government and diverse agencies are critical. Dedicated institutional arrangements and mechanisms are required to enhance cross-agency communication, stakeholder engagement, and collaborative involvement. Such coordination minimizes duplication, prevents conflicts in policy direction, and promotes synergy in technology transfer and commercialization efforts.

Continuous monitoring, evaluation, and periodic revision of policy instruments, administrative structures, and organizational arrangements are necessary. These adaptive mechanisms allow responsive adjustments to evolving environmental conditions, technological advancements, and institutional dynamics, thereby maintaining relevance and effectiveness of technology transfer programs.

Table 3 Selected OECD policy instruments to promote innovation, technology transfer and commercialization

Focus	Policy instrument	Objective (expectation)	Evidence (reality)	Source
Connectivity	Clusters	To facilitate collaboration on complementary economic activities (e.g., smart specialisation)	Most OECD countries have implemented the development of platforms, international and specialised clusters. Scarce evidence	OECD (2009, 2012c)
Regulatory frameworks	Intellectual property rights	Allow innovative entrepreneurs to protect their inventions	An effective IPR system allows entrepreneurs to have more time to grow their businesses before their ideas are imitated	OECD (2011a, b), WIPO (2004)
Regulatory frameworks	Product market	To promote or inhibit competition	The economic effects of PMR are heterogeneous	Wölfl et al. (2010)
Regulatory frameworks	Administrative	Seek to enter markets and also to grow	Evidence is the annual Doing Business report	OECD (2012d)
Complementary frameworks	Market for technology	Domestic, Foreign, competition	Few evidence how to get access to technologies	OECD (2010)
Complementary frameworks	Labour and capabilities	Business support, attitudes, skilled capital	Firms suffer from a shortage of skilled labour	Toner (2011)
Complementary frameworks	Access to finance	Access to debit, venture capital and other	Few evidence about how innovative businesses are financing their innovations	OECD (2008)
Complementary frameworks	Access to knowledge	ICT, cooperation, public/private investment	Evidence about networks of knowledge flows	Winters and Stam (2007)

Source: Adapted from Guerrero and Urbano (2019)[31].

[31] Guerrero, M., & Urbano, D. Effectiveness of technology transfer policies and legislation in fostering entrepreneurial innovations across continents: an overview. *The Journal of Technology Transfer*, **44**, 1347–1366 (2019). https://doi.org/10.1007/s10961-019-09736-x

Table 4. Factors influencing technology transfer and commercialization

Dimension	Factors	Researcher
Technology	Compatibility Complexity Innovativeness (radical/incremental) Maturity Nature of technology (process/product) Simplicity (ease of introduction and implementation) Type of technology (equipment machines/production, methods/ production know-how/design) Uncertainty	Ettlie (1982) Lasserre (1982) Reddy and Zhao (1990) Brown et al. (1991) Spann et al.(1993) Kimura (2010) Chen et al. (2011)
Organization	Competitive position Economic capability (financial resources) Experience Marketing and finding the right customers Organization (function) Research facility and equipment (physical resources) Strategy Technical capability (user understanding) Willingness of owner and managerial skills	Lasserre (1982) Reddy and Zhao (1990) Spann et al. (1993) Kumar and Jain (2003) Nahar et al. (2006) Kimura (2010)
Market	Investment climate Market conditions Nature of Industry (concentrated/competitive) Possible application (unified/diverse) Pricing of technology	McEachron (1978) Lasserre (1982) Reddy and Zhao (1990) Brown et al. (1991)
Environment	Desired time-line (long payback time) Government support (policy, funding) Relationships (trust, behaviour, communications, network, cooperation, etc.) Training	McEachron (1978) Lasserre (1982) Reddy and Zhao (1990) Brown et al. (1991) Spann et al. (1993) Kimura (2010) Kumar and Jain (2003)

Source: Jung, Lee, & Lee (2015) Classifying and prioritizing the success and failure factors of technology commercialization of public R&D in South Korea: using classification tree analysis[32].

[32] Jung,M., Lee, Y-B., & Lee, H. (2015). Classifying and prioritizing the success and failure factors of technology commercialization of public R&D in South Korea: using classification tree analysis. *The Journal of Technology Transfer,* **40**, 877–898. https://doi.org/10.1007/s10961-014-9376-5

3. Survey of Science Granting Councils in Africa

3.1 Survey Design

Building on insights from the preceding literature review, a structured questionnaire survey was developed to collect primary data from research funding councils across the targeted countries. The survey was designed to explore six key dimensions of practice and experience among these councils:

1. Perceptions of the importance of commercialization for research institutions and national development.
2. The council's perceived roles in supporting technology transfer and commercialization.
3. Research funding practices, including funding sources, types of research and recipient entities, application assessment criteria, and funding stages.
4. Effectiveness of funding, measured by the range and extent of outputs and outcomes achieved.
5. Influential factors that limit or facilitate technology transfer and commercialization.
6. Institutional arrangements, encompassing the existence of policies, guidelines, and organizational mechanisms that support or govern technology transfer and commercialization activities.

The draft questionnaire was initially reviewed by three subject-matter experts and subsequently pilot-tested in Zambia. Following two rounds of refinement, the final survey was converted into an online form via Google Forms to enhance accessibility and maximize response rates.

3.2 Data Collection

The survey was initially designed to target six countries. However, all members of the Science Granting Councils Initiative (SGCI) were subsequently invited to participate in order to capture a broader dataset and identify of common challenges, strengths, and cross-country variations.

To encourage participation and promote shared ownership, a virtual briefing was held with SGCI members via Zoom on August 28, 2023. The session outlined the survey’s objectives, highlighted potential policy relevance of findings, provided guidance on suitable respondents as well as recommended questionnaire return targets for each council and country.

Participants were requested to:

- Complete the questionnaire themselves and encourage at least one additional key informant within their institution to do the same, in order to enrich and validate data quality.

- Provide contact details of other relevant national stakeholders actively engaged in technology transfer and commercialization and invite their participation, ensuring inclusion of country-specific contexts.
- Share pertinent institutional policies, guidelines, or frameworks that support technology transfer initiatives.

As of January 2024, 27 responses had been received from 14 countries - Botswana, Burkina Faso, Ethiopia, Ghana, Ivory Coast, Kenya, Malawi, Mozambique, Senegal, Sierra Leone, Tanzania, Uganda, and Zambia. Of these, 23 were complete and usable, while four contained several missing data points.

4. Key Findings and Discussions

4.1 Roles of councils and funding practices

The source of funding significantly influences institutional practices, including allocations across R&D segments and technology transfer and commercialization activities. Different funders may emphasize different priorities: for example, the business sector often focuses on market performance, innovation potential, and corporate responsibility, whereas not-for-profit entities may prioritize social and environmental outcomes over economic returns.

Survey results indicate that government is the dominant source of funding: 13 of 23 surveyed institutions receive over 75% of their budgets from government, while 10 receive between 50–74% from government (see Table 5). Only four institutions received more than 35% of their funding from not-for-profit entities, and all received less than 20% from private industry. While unsurprising given the predominance of public institutions, it was expected that some institutions would engage more actively with industry and not-for-profit partners to facilitate knowledge exchange.

Table 5: Proportion of Total Institutional Budget by Source

Percentage	Own resources	Government	Industry	Not-for-profit	Abroad
>75%	**2**	**13**	0	0	0
50–75%	0	**6**	0	0	3
25–49%	0	1	0	4	2
1–24%	**11**	3	4	**10**	**12**
0%	**10**	0	**19**	**9**	**6**
Total	**23**	**23**	**23**	**23**	**23**

Source: AEH analysis based on survey of funding entities

The source of funding strongly shapes institutional decision-making and strategic orientation. Institutions drawing primarily on internal resources (over 59%) often enjoy greater autonomy, enabling them to set independent priorities and pursue agendas aligned with institutional strengths. In contrast, those reliant on external funders often need to calibrate their activities to donor interests, whether delivering public goods for government, addressing market demands for industry, or advancing social objectives for civil society. Such dependencies influence not only institutional agendas but also the degree of flexibility and risk-taking in technology transfer and commercialization strategies.

Patterns of funding by research type further underscore systemic orientations. The concentration of resources in applied research, on which 13 institutions dedicating more than half of their R&D budgets, reflects an instrumental focus on immediate problem-solving and practical utility (see Table 6). By comparison, only two institutions prioritized (>50%) basic research and three experimental development. Conversely, eight institutions did not fund basic research, and six provided no funding for experimental development. This imbalance has significant implications. It limited investment in foundational research and consequently, constrains the pipeline of new knowledge. Underfunding of experimental development hampers the transition from laboratory prototypes to market-ready technologies. Taking together, these gaps highlight a structural weakness in the innovation ecosystem, where short-term applied outcomes are emphasized at the expense of the long-term capabilities required to sustain breakthrough innovations.

Table 6. Funding by type of research and development

Percentage	Basic research	Applied research	Experimental development
Over 75%	**1**	**7**	**2**
50-75%	**1**	**6**	**1**
25-49%	3	4	5
1-24%	10	4	9
0%	**8**	**2**	**6**
Total	**23**	**23**	**23**

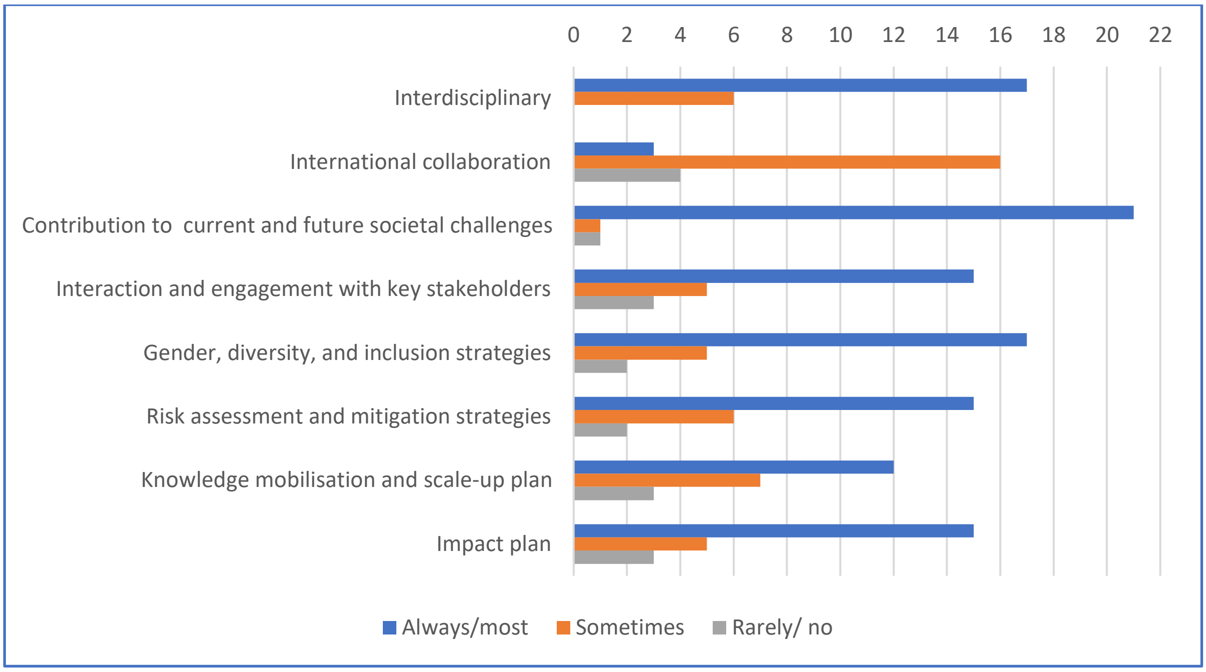
Source: AEH analysis based on survey of funding entities

From a technology transfer perspective, funders and policymakers aiming to accelerate commercialization should embed this priority explicitly within research and innovation calls. Calls that highlight knowledge mobilization, stakeholder engagement, and risk assessment can build early awareness of market dynamics among researchers and encourage alignment with commercialization pathways. Survey results, however, suggest that such elements are often rated lower than research-focused criteria, such as contributions to development challenges, inclusivity, and interdisciplinarity by responding institutions (see Figure 4). While these broader research priorities remain valuable, a recalibration toward commercialization-oriented criteria is necessary to ensure that research outputs progress beyond academic contribution and translate into marketable solutions with tangible benefits for society, researchers, and funders alike.

Survey findings should be interpreted with caution, as notable variations emerge across criteria. For instance, while 21% of surveyed entities reported that they “always/mostly” include international collaboration in calls, 16% reported “rarely/not including” it. Similarly, knowledge mobilization and scale-up plans were prioritized by 53%, but they were overlooked by 21%. Lower ratings in the “always/mostly” category consistently align with higher scores in the “rarely/not included” category, underscoring gaps that require targeted attention (see Figure 4).

Tracking and monitoring of funded research outcomes reveals that publications dominate as the primary output (34.8%), followed by awards (14%) and products (12%). Patent applications are comparatively low, potentially reflecting that commercialization is pursued only after market validation or the prevalent of funding focuses on generic products not eligible for IP protection. Consequently, income from licensed IP averages just 1.2%. Moreover, delays in securing IP protection relative to publication timelines, combined with short-term funding cycles, may further constrain follow-through on commercialization outcomes.

Figure 4. Key conditions in research proposals calls (Number of entities)



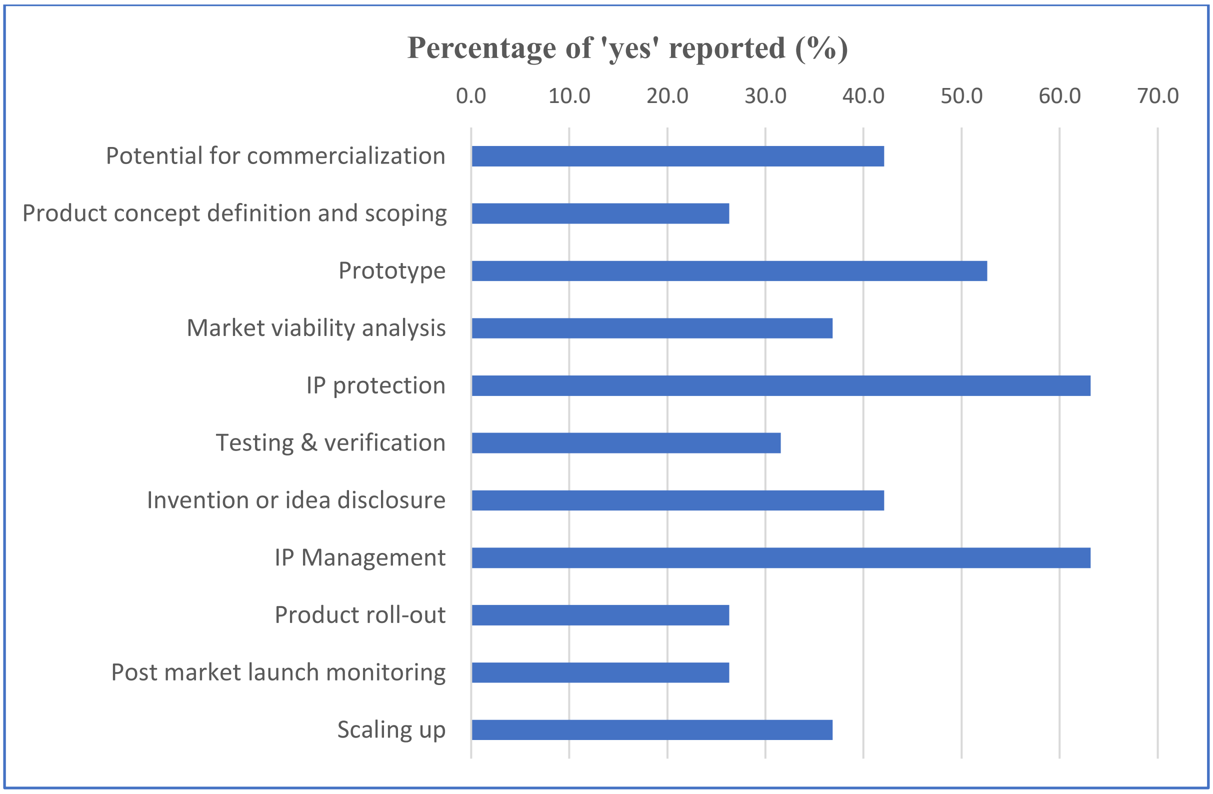
Source: AEH based on survey of funding entities

4.2 Institutional arrangements and policies

Institutional readiness for technology transfer and commercialization is uneven. While at least two-thirds of entities surveyed include IP management and protection mechanisms in their technology transfer and commercialization policies, only 42% incorporate processes for idea and invention disclosure or for assessing commercialization potential (see Figure 5).

Given that product and firm formation were the more likely research outcomes than IP related aspects, one would expect frameworks for technology transfer and commercialization to emphasize components directly deal with product commercialization and firm formation. Yet, fewer than 30% of entities reported components such as product roll-out, concept definition, or post-market launch monitoring, well below the expected benchmark of 50% for core R&D performance functions. This gap suggests that even where innovation outputs exist, the institutional structures needed to translate them into sustainable market impact remain inadequate.

Figure 5. Does your institution or national technology transfer and commercialization framework include mechanisms for (supporting/assessing)?

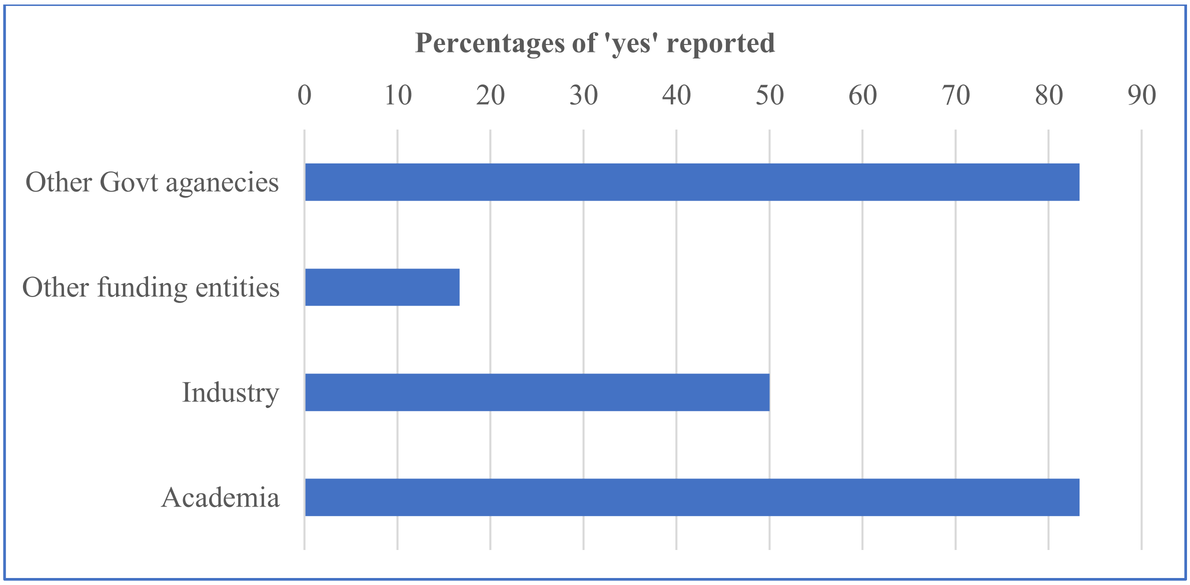


Source: AEH analysis based on survey of funding entities

4.3 Existence of advisory bodies

Technology transfer and commercialization require diverse expertise across multiple disciplines. Advisory or technical committees play a crucial role in ensuring fairness, inclusivity, and effective impact of outcomes. However, only 52% of surveyed entities reported having such committees. Of those that had committees, membership was dominated by academic (83%) and government (83%) representatives, while fewer included industry (50%) or funding experts (17%) (see Figure 6). Notably, most of the private sector representatives lacked startup experience, leaving gaps in assessing the commercial potential of research and innovations. Committees are expected to include individuals with technology or entrepreneurial backgrounds, but without this expertise they overlook critical market perspectives. Even more surprising, participation from funding agencies was rare, limiting opportunities to build relationships, pursue joint investments and joint funding of large-scale initiatives.

Figure 6: Composition of advisory committee members by affiliation



Source: AEH analysis based on survey of funding entities

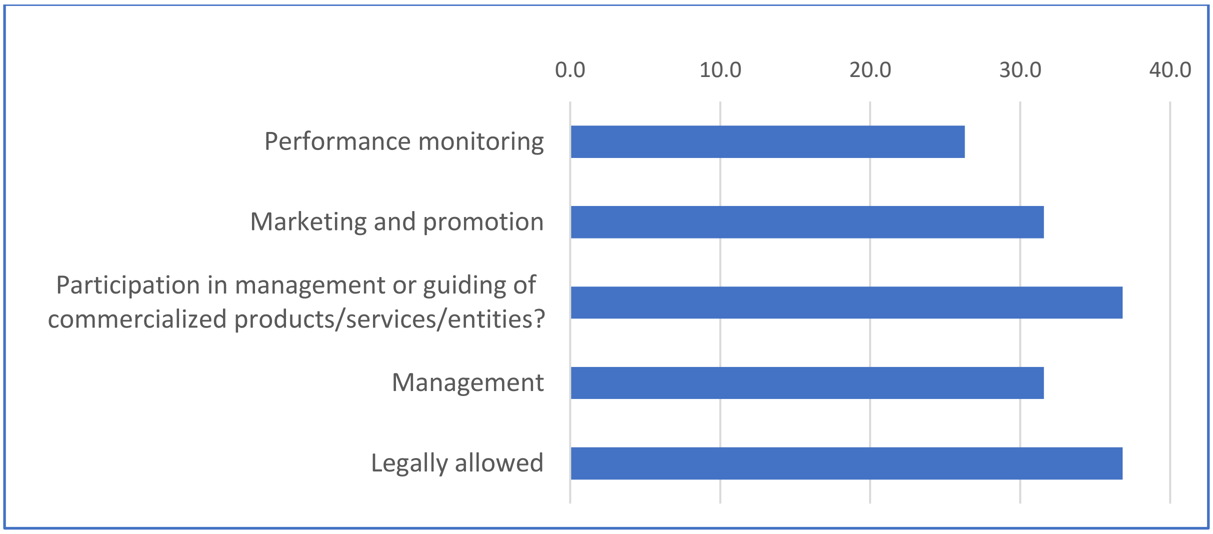
In terms of in-house personnel, about 53% of entities reported having dedicated in-house staff for technology transfer and commercialization, leaving nearly half without staff regularly focused on these activities.

4.4 Support measures offered

We also examined the support services provided by surveyed entities and whether they are legally permitted to provide critical services that help startups to stay on track and perform well. As discussed earlier, technology commercialization can include taking equity participation in a startup, sale or licensing of IP or technology, or even the full ownership of a firm. These pathways often require funders to extend support services beyond financing, including advisory, managerial, and promotion roles.

However, the availability of such support services critical for startup success, such as equity participation, IP licensing, or management involvement, are limited. Only 26% of surveyed entities reported monitoring of performance of funded entities, and just 32% were legally allowed to take up management position (see Figure 7). Overall, only 37% indicated that they are legally allowed to undertake these services, such as participation in management guidance only and/or undertaking marketing and promotion of firms that commercialized funded technologies. This gap warrants attention, particularly since these functions are rated poorly in terms of research outcomes. At the same time, greater involvement by public sector employees in such activities risks being perceived as a conflict of interest or "double dipping," which may constrain their engagement.

Figure 7. Institution commercialization support offered (% of entities reported 'yes')

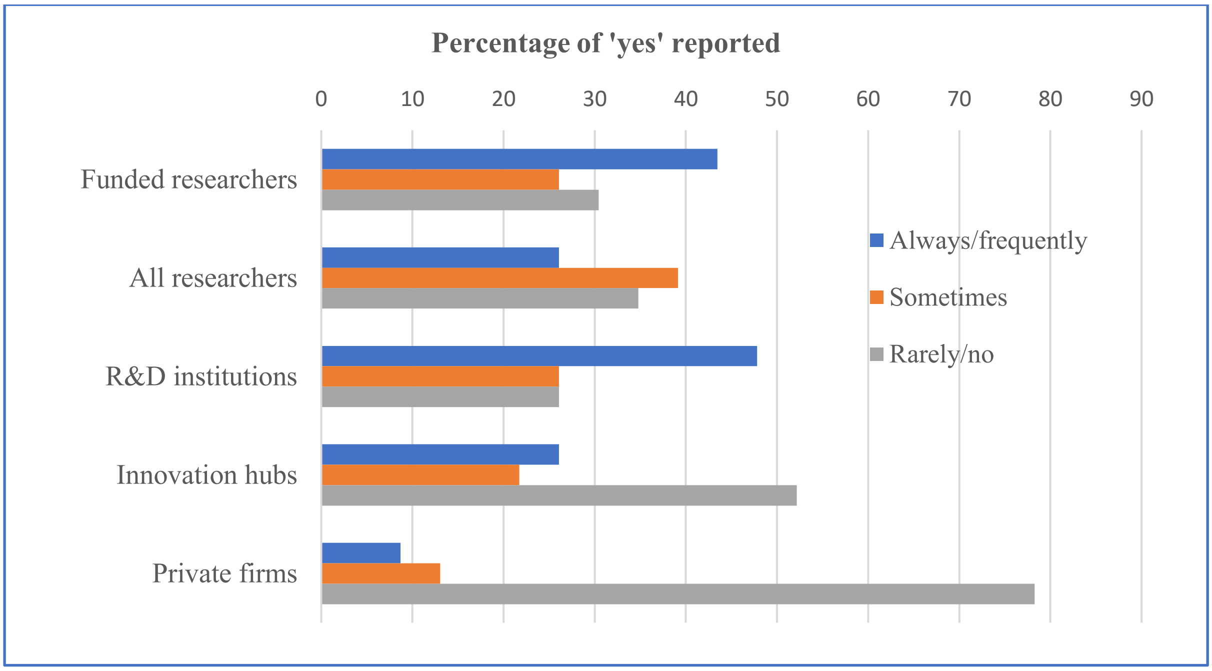


Source: AEH analysis based on survey of funding entities

Policies that enable public sector funders and researchers to safeguard their institutions' interests in technology commercialization appear to be underdeveloped. In practice, the incentives for individuals to support commercialization seem low, while the perceived risks remain high. As a manager from one of Zambia's largest R&D institutions explained: *"I was almost fired for commercializing a product we developed because it was seen as the sale of public property. Commercialization here is viewed as disposal of public assets, and neither I nor my institution have the rights to do so"* (AEH paraphrasing).

Data of the beneficiaries of the above support services provided by surveyed entities show that R&D centres (48%) and funded researchers (43%) are the primary beneficiaries of commercialization support provided by science granting councils, while only 26% of support targets innovation hubs, 26% targets all researchers, and just 9% reaches firms directly (see Figure 8). To strengthen the pathway from research to market, councils should broaden their support to include incubation and innovation hubs, as well as the firms that emerge from funded projects. Expanding support beyond researchers and R&D institutions would help ensure that research outputs are effectively translated into market-ready innovations. At the same time, councils may need to address resource and staffing constraints that currently limit their ability to engage with external commercial entities.

Figure 8. Provision of technology transfer support (% that reported yes)

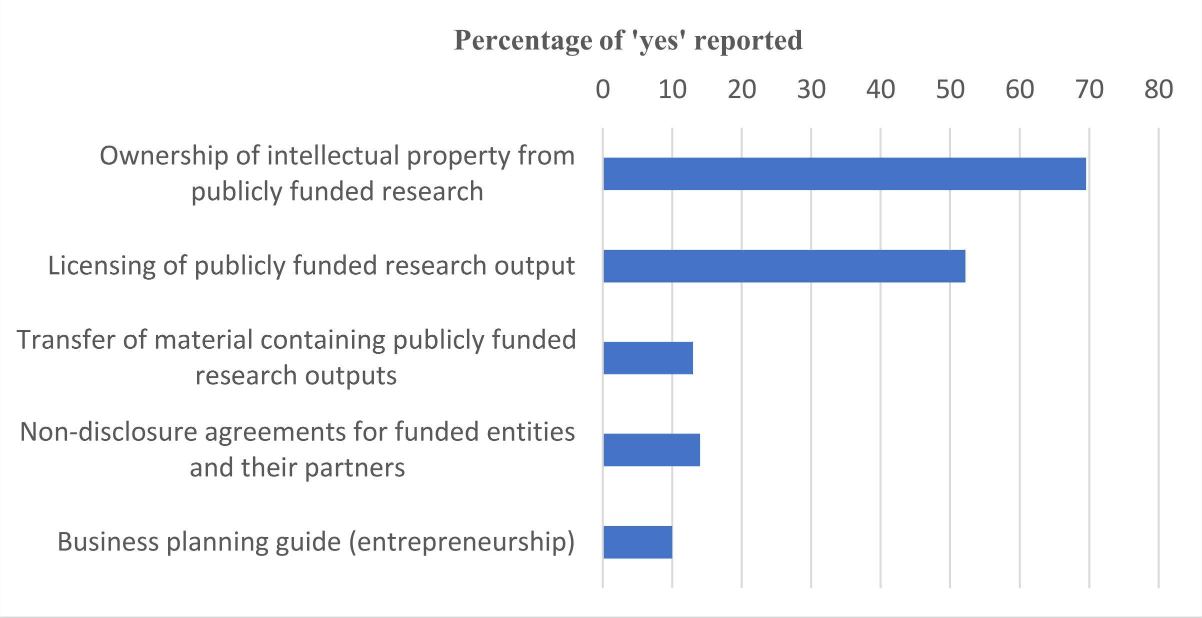


Source: AEH analysis based on survey of funding entities

We examined the existence of basic mechanisms that support technology transfer and commercialization, such as guidelines, procedures, and standardized forms. Respondents were asked whether their country or institutions had generic policies or frameworks (either as stand-alone documents or embedded within broader policies) that researchers are expected to reference. They could answer "yes", "no", or "I don't know".

About 70% reported that frameworks for the ownership of intellectual property from publicly funded research exist, and 52% confirmed the existence of frameworks for licensing publicly funded research outcomes (see Figure 9). However, significantly fewer institutions reported having mechanisms for non-disclosure agreements (14%), material transfer agreements (13%), or business planning guides (10%). This is surprising, as comprehensive IP frameworks would normally be expected to address the handling of biological materials and documents, as well as require parties to sign non-disclosure agreements to safeguard proprietary knowledge.

Figure 9: Existence of generic guidelines and measures for technology commercialization



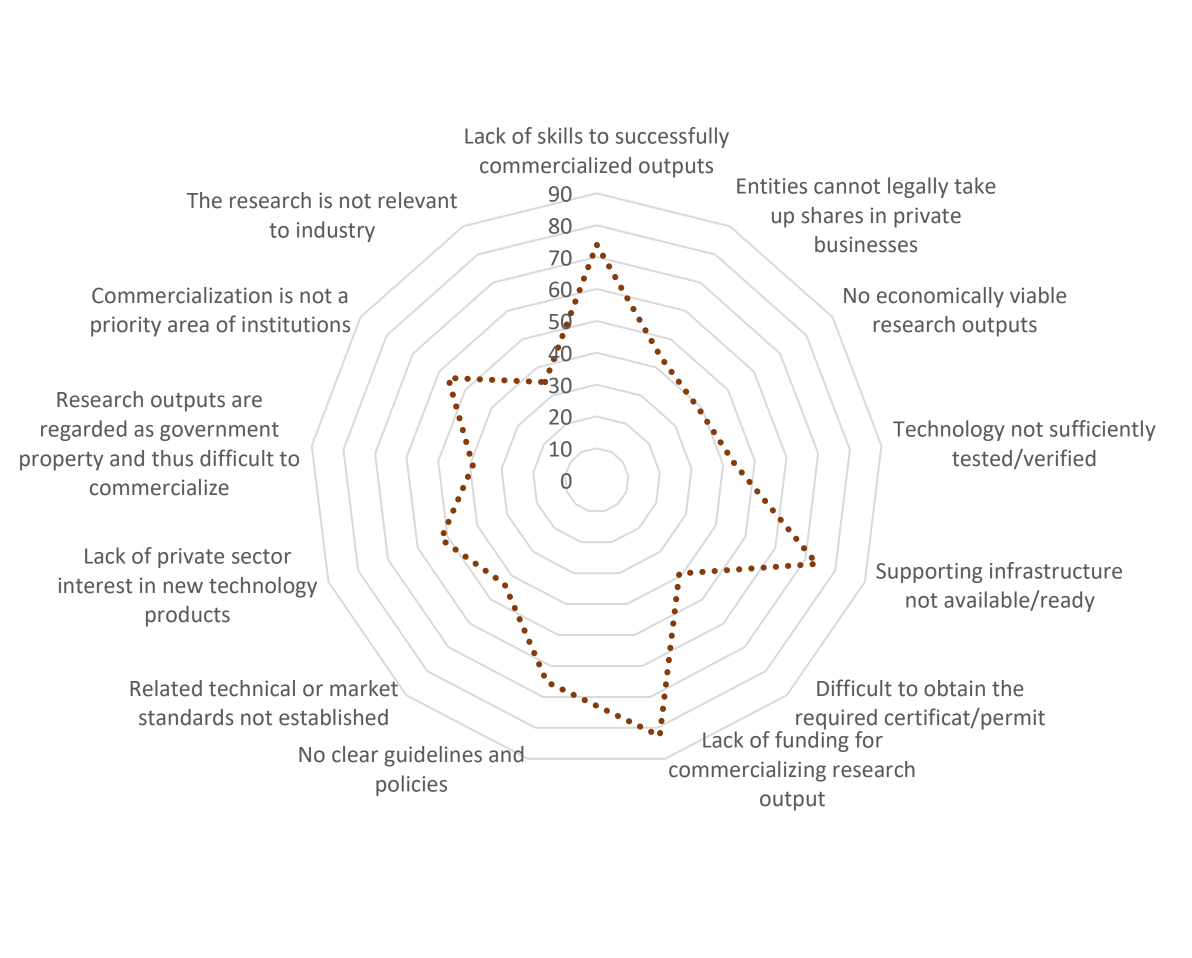
Source: AEH Analysis

4.5 Main hurdles to technology commercialization

Finally, entities were asked to rank key hurdles to technology transfer and commercialization. The top challenges identified were lack of funding (83%), lack of skills (74%), and insufficient infrastructure to support commercialization initiatives (74%) (see Figure 10). These barriers are likely interrelated, particularly since many SGCs lack dedicated staff for technology commercialization and advisory bodies to guide such processes. As mentioned earlier, approximately half of the surveyed entities reported not having specialized commercialization personnel. The fourth major challenge cited was the absence of appropriate policies to guide commercialization efforts (64%), followed by a lack of prioritization of commercialization within their institutions (57%). In many cases, gaps in funding, skills, and policy frameworks appear linked to the broader perception that technology commercialization is not a core function of SGCs.

On a more positive note, most entities reported that their research outputs are relevant to industry and that they are experienced in handling permits, certificates, and contractual requirements. This capacity is valuable, as successful commercialization often depends on navigating complex legal and regulatory steps, including securing trial permits, meeting safety standards, registering business names, and managing contractual arrangements, all of which, if poorly managed, can otherwise slow progress, increase costs, and elevate risks of failure.

Figure 10. Major hurdles to technology commercialization



Source: AEH analysis based on survey of funding entities

5. Concluding Remarks

This report represents the first Africa-centric assessment of technology commercialization practices examined from both a continental and global perspectives. The findings confirm that the mere existence of policies and regulations is only a starting point. Equally critical are factors such as the way funding is administered, the types of support provided, and the degree of freedom public entities and their staff have to engage with funded organizations. Most importantly, technology commercialization should be elevated as a priority for all research and innovation funding bodies, supported by dedicated units, skilled personnel, appropriate advisory committees, and robust frameworks.