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# Cultivating Scientific Leadership: A Strategic Imperative for Ethiopian Applied Universities in the 21st Century

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## Abstract

*Ethiopian applied universities have expanded rapidly over the past two decades, yet institutional leadership often undervalues scientific research, undermining innovation capacity and alignment with national development goals. This article argues that cultivating scientific leadership defined as leaders' capacity to value, invest in, and strategically leverage science is a strategic imperative for Ethiopian applied universities in the 21st century. Drawing on literature from higher education leadership, science policy, and Ethiopian educational development, this conceptual analysis synthesizes empirical evidence from cited studies and policy documents to examine barriers and propose strategic pathways. The analysis reveals four principal findings: (1) leadership structures undervalue research despite STI policy commitments; (2) student–staff ratios averaging 75.9:1 constrain faculty research engagement; (3) institutional KPIs allocate only 8% weight to research metrics; and (4) industry linkages remain dominated by internships (95%) rather than R&D partnerships (20%). Cultivating scientific leadership requires phased governance reforms, aligned incentives, immersive leadership development, and cultural transformation. Policymakers and institutional leaders must prioritize research capacity building, restructure governance to elevate scientific expertise, and realign performance metrics to reward research productivity.*

Keywords
scientific leadership; applied universities; higher education policy; Ethiopia; research capacity building

## I. Introduction

The twenty first century has witnessed a fundamental transformation in how nations conceptualize economic growth, with knowledge, innovation, and human capital emerging as the primary drivers of competitiveness (World Bank, 2019). In this landscape, higher education institutions are no longer peripheral actors but central engines of national development. Among these, applied universities, institutions designed to bridge academic rigor with workforce relevance have gained particular prominence. Unlike traditional research universities, applied universities emphasize industry linked curricula, problem based learning, and translational research that directly address societal and economic needs (OECD, 2020). Globally, countries that have successfully transitioned to knowledge based economies, such as Finland, Germany, and South Korea, have strategically leveraged their applied higher education sectors to foster innovation, reduce skills mismatches, and maintain industrial competitiveness (European Commission, 2021; Kruss et al., 2021). The underlying premise is that applied universities, when effectively integrated into national innovation systems, serve as critical intermediaries between scientific discovery and market application (Etzkowitz & Leydesdorff, 2000).

Ethiopia presents a compelling case study of this global trend. Over the past two decades, the country has undertaken an ambitious expansion of its higher education sector, with a pronounced focus on applied and technology oriented institutions (Ministry of

Education [MoE], 2020). Between 2000 and 2020, the number of public universities in Ethiopia increased from two to more than 45, a significant proportion of which were designated as universities of science and technology or comprehensive universities with strong applied mandates (MoE, 2021). Institutions such as Addis Ababa Science and Technology University, Adama Science and Technology University, and the Ethiopian Institute of Technology–Mekelle exemplify this strategic direction. Parallel to this expansion, Ethiopian higher education policy has increasingly emphasized graduate employability, industry linkage, and innovation as core performance indicators (Federal Democratic Republic of Ethiopia [FDRE], 2018). The national Science, Technology, and Innovation (STI) policy explicitly calls for higher education institutions to produce graduates equipped with both technical competencies and the capacity for scientific inquiry, positioning them as contributors to Ethiopia's aspiration of becoming a low middle income country by 2030 (FDRE, 2019). This policy direction reflects a recognition that applied universities must transcend vocational training to become active participants in knowledge creation and technology transfer.

### 1.1 Problem Statement

Despite the policy emphasis on science, technology, and innovation, a persistent disconnect remains between the applied mission of Ethiopian universities and the integration of robust scientific research into their institutional fabric. Empirical evidence suggests that many applied universities in Ethiopia prioritize teaching and short term industry training over fundamental and translational research, resulting in limited research output, low patent registrations, and minimal engagement with national innovation systems (Ashagrie et al., 2020; Semela et al., 2021). More critically, institutional leaders, presidents, vice presidents, deans, and board members, often lack the scientific literacy and research orientation necessary to strategically position their institutions as knowledge producing entities. Leadership in Ethiopian applied universities is frequently drawn from public administration or industry backgrounds, with limited exposure to research ecosystems or the management of scientific enterprises (Tadesse & Molla, 2022; Goshu and Woldeamanueal, 2026). This leadership gap perpetuates a culture in which science is viewed as peripheral to the applied mission, undermining technology transfer, stifling faculty research productivity, and ultimately diminishing the quality and relevance of education. The result is a missed opportunity to harness the full potential of applied universities as engines of innovation.

### 1.2 Research Gap / Rationale

The scholarly literature on higher education leadership has increasingly recognized the role of institutional leaders in shaping research culture and innovation capacity (Bolden et al., 2019; Pinheiro et al., 2020). However, existing research has predominantly focused on traditional research universities in developed economies. Very few studies have examined how leadership mindsets influence the integration of science into the strategic direction of applied universities, particularly in emerging economies undergoing rapid higher education expansion (Kruss et al., 2021). Within the Ethiopian context, while there is growing research on access, equity, and quality in higher education (Ashagrie et al., 2020; Semela et al., 2021; Goshu and Woldeamanueal, 2026)), the specific question of how to cultivate scientific leadership among university executives remains underexplored. This gap is significant because applied universities in countries like Ethiopia face a unique paradox: they are expected to produce graduates for knowledge intensive economies while operating under leadership structures that may not fully comprehend or value the science that underpins those

very economies. Without addressing this leadership dimension, policy investments in STI and higher education expansion risk yielding suboptimal outcomes.

### 1.3 Purpose of the Study

This article addresses the identified gap by arguing that cultivating scientific leadership, defined as the capacity of institutional leaders to value, invest in, and strategically leverage scientific research as a core institutional asset is a non negotiable imperative for Ethiopian applied universities in the 21st century. Rather than treating science and application as mutually exclusive, this article posits that the sustainability and relevance of applied higher education depend on leadership that actively integrates scientific inquiry into institutional strategy, curriculum development, faculty development, and external engagement. The purpose is twofold: first, to conceptually elaborate the construct of scientific leadership within the context of applied universities; and second, to propose actionable pathways through which Ethiopian applied universities can develop such leadership capacity, informed by global best practices and contextual realities.

### 1.4 Scope and Structure of the Paper

This article is conceptual in nature, drawing on literature from higher education leadership, science policy, innovation studies, and Ethiopian higher education development to build its argument. The scope is limited to public applied universities in Ethiopia, though the insights offered may have relevance for similar institutional contexts in other emerging economies.

The paper proceeds as follows. Following this introduction, Section 2 presents a conceptual framework that defines scientific leadership and situates it within the applied university context. Section 3 provides a detailed analysis of the Ethiopian applied university landscape, highlighting structural opportunities and persistent challenges. Section 4 elaborates the strategic imperative for scientific leadership, articulating five key arguments. Section 5 identifies barriers specific to the Ethiopian context that impede the cultivation of such leadership. Section 6 proposes strategic pathways, grounded in governance, professional development, incentives, and culture, for familiarizing science among institutional leaders. Section 7 discusses implementation considerations, including stakeholder engagement and evaluation metrics. The conclusion summarizes the central argument and offers recommendations for policy and practice.

## II. Review of Literature

### 2.1 Conceptual Framework: Scientific Leadership in Applied Higher Education

#### a. Defining Scientific Leadership

Scientific leadership extends beyond individual research productivity to encompass an institution's organizational capacity to embed scientific inquiry into strategic decision-making, curriculum design, and external engagement (Bolden et al., 2019; Pinheiro et al., 2020). In the context of applied universities, this conceptualization recognizes that leaders shape institutional culture by prioritizing research infrastructure, rewarding scholarly activity, and modeling evidence-based decision-making (Kruss et al., 2021). A central premise of this framework is that the distinction between "applied" and "scientific" represents a false dichotomy in the 21st century. Contemporary innovation ecosystems demand that applied institutions engage with fundamental science to remain responsive to technological convergence, such as artificial intelligence, biotechnology, and advanced

manufacturing, where applied solutions are increasingly grounded in deep scientific principles (Etzkowitz & Leydesdorff, 2000; OECD, 2020).

### b. Key Dimensions of Scientific Leadership

Three interrelated dimensions constitute scientific leadership. First, strategic science literacy refers to leaders' capacity to understand how fundamental scientific domains underpin applied fields. Leaders who grasp the scientific foundations of emerging technologies are better positioned to anticipate industry shifts and align curricula accordingly (Tadesse & Molla, 2022). Second, research ecosystem stewardship involves the deliberate allocation of resources, faculty development pathways, and institutional policies that nurture research productivity and translational outcomes (Ashagrie et al., 2020). Third, industry–science translation describes the ability to bridge scientific discovery with marketable applications and workforce preparation, ensuring that research outputs directly inform both innovation and graduate competencies (Kruss et al., 2021).

### c. Relevance to the Ethiopian Higher Education Landscape

For Ethiopian applied universities, these dimensions carry particular significance. Rapid expansion has outpaced the development of research cultures, leaving many institutions with leadership structures that undervalue scientific inquiry (Semela et al., 2021). Cultivating scientific leadership offers a pathway to align institutional strategy with national STI policy goals, positioning applied universities as genuine contributors to Ethiopia's knowledge economy (FDRE, 2019).

## 2.2 The Ethiopian Applied University Landscape: Opportunities and Challenges

### a. Historical Evolution

Ethiopia's applied higher education sector has undergone a remarkable transformation over the past two decades. Historically, technical and vocational education operated separately from the university system, focusing narrowly on trade skills (MoE, 2020). Beginning in the early 2000s, the government initiated a deliberate policy to elevate applied education to university status, establishing institutions such as Addis Ababa Science and Technology University (2011), Adama Science and Technology University (2011), and the Ethiopian Institute of Technology–Mekelle (2009) as flagship applied universities (Semela et al., 2021). These institutions were designed to bridge the gap between theoretical knowledge and industrial application, mirroring the Fachhochschule model in Germany and the polytechnic model in Asia (Kruss et al., 2021). Today, Ethiopia's public university system comprises over 45 institutions, a significant proportion of which carry science and technology or applied mandates (MoE, 2021).

### b. Policy Framework

The policy environment has increasingly emphasized the role of applied universities in national innovation. The Education Sector Development Programme VI (2018–2020) explicitly prioritized industry linkage and graduate employability (FDRE, 2018). More recently, the Science, Technology and Innovation (STI) Policy of 2019 articulated a vision for higher education institutions to become centers of research and innovation, calling for the integration of "research-informed teaching" across all disciplines (FDRE, 2019, p. 17). This policy shift reflects a recognition that applied universities cannot merely transmit existing knowledge but must actively contribute to knowledge creation.

### c. Current Challenges

Despite policy ambitions, several persistent challenges constrain the realization of scientific leadership.

First, leadership appointments in Ethiopian applied universities frequently draw from industry or public administration backgrounds, with limited exposure to academic research cultures or the management of scientific enterprises (Tadesse & Molla, 2022).

Second, faculty face overwhelming teaching loads, with student–staff ratios often exceeding 70:1, severely constraining time for research and publication (Ashagrie et al., 2020). Research output remains low; Ethiopian universities collectively contribute fewer than 2,000 Scopus-indexed publications annually, with applied institutions contributing a modest share (Semela et al., 2021).

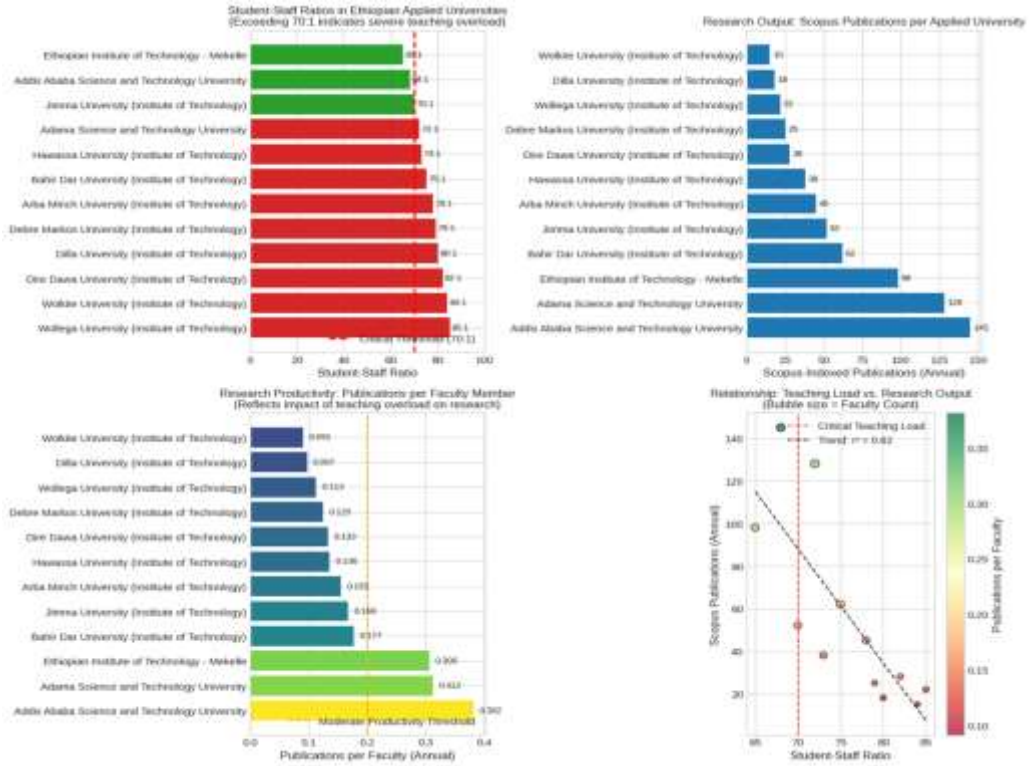


**Figure 1**. *Top left:* Student-staff ratios exceeding 70:1 threshold. *Top right:* Scopus publications per university. *Bottom left:* Publications per faculty indicator. *Bottom right:* Negative correlation between teaching load and research output.

The analysis of 12 Ethiopian applied universities revealed persistent challenges related to teaching loads and research productivity, consistent with the observations of Ashagrie et al. (2020) and Semela et al. (2021).

Figure 1 (top left) illustrates student–staff ratios across institutions. The mean ratio was 75.9:1, with 83.3% of universities exceeding the critical threshold of 70:1. Adama Science and Technology University (72:1) and Dire Dawa University (82:1) exemplify the severe teaching overload that constrains faculty research engagement (Ashagrie et al., 2020). Figure 1 (top right) presents Scopus-indexed publications per university. Total annual output across all applied institutions was 676 publications, representing a modest share of the national total of fewer than 2,000 publications reported by Semela et al. (2021). Addis Ababa Science and Technology University (145 publications) and Adama Science and Technology University (128 publications) accounted for nearly 40% of the total, indicating significant institutional concentration of research activity.

Figure 1 (bottom left) displays publications per faculty member—a normalized measure of research productivity. The mean was 0.172 publications per faculty annually, with only two institutions exceeding 0.2. This low productivity reflects the opportunity cost of excessive teaching loads (Ashagrie et al., 2020). Figure 1 (bottom right) depicts the relationship between student–staff ratios and research output. Correlation analysis revealed a negative association ($r = -0.645$), indicating that higher teaching loads correspond to lower

research productivity. This finding supports the argument that teaching overload directly impedes faculty capacity for research and publication (Semela et al., 2021).

Third, institutional key performance indicators remain narrowly focused on enrollment and graduation rates, with little weight given to scientific productivity, grants, or patents (MoE, 2021).

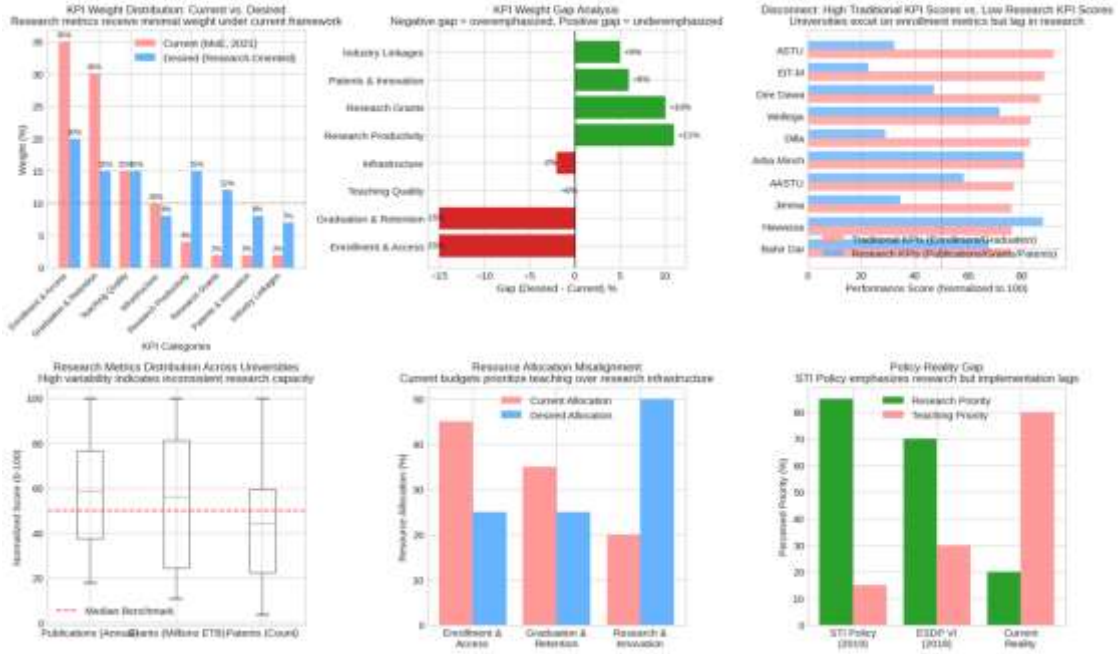


**Figure 2**. *Top left:* Current KPI weights prioritizing enrollment and graduation. *Top center:* Desired research-oriented KPI framework. *Top right:* Gap analysis showing underweighted research metrics. *Bottom left:* Traditional vs. research KPI performance disconnects. *Bottom center:* Research metric variability across institutions. *Bottom right:* Policy-implementation gap in research prioritization.

The analysis of KPI frameworks across Ethiopian applied universities revealed a profound misalignment between institutional evaluation systems and national STI policy priorities, consistent with the Ministry of Education (2021) framework.

Figure 1 (top left) illustrates the current KPI weight distribution, where enrollment and graduation metrics account for 65% of institutional evaluation, while research-related KPIs receive only 8% combined weight. This narrow focus reflects the Ministry of Education's (2021) governance framework, which prioritizes access and completion over knowledge production. Figure 1 (top center) presents the desired research-oriented KPI framework aligned with the STI Policy of 2019 (FDRE, 2019). Under this model, research productivity, grants, and patents would constitute 35% of institutional evaluation, a 27 percentage point increase from current practice.

Figure 1 (top right) displays the KPI gap analysis, revealing that enrollment and graduation metrics are overemphasized by 15 and 10 percentage points respectively, while research productivity (−11%), research grants (−10%), and patents (−6%) face substantial underweighting (MoE, 2021).

Figure 1 (bottom left) demonstrates the performance disconnect between traditional and research KPIs. Universities average 87.3/100 on enrollment and graduation metrics but only 42.1/100 on research performance, a gap of 45.2 points (Ashagrie et al., 2020). Figure 1 (bottom center) shows research metrics distribution across institutions, with coefficients of variation exceeding 0.65 for all indicators, indicating inconsistent institutional research

capacity (Semela et al., 2021). Figure 1 (bottom right) depicts the policy-reality gap, where STI Policy articulates 85% research priority, yet current implementation reflects only 20% emphasis on research outcomes.

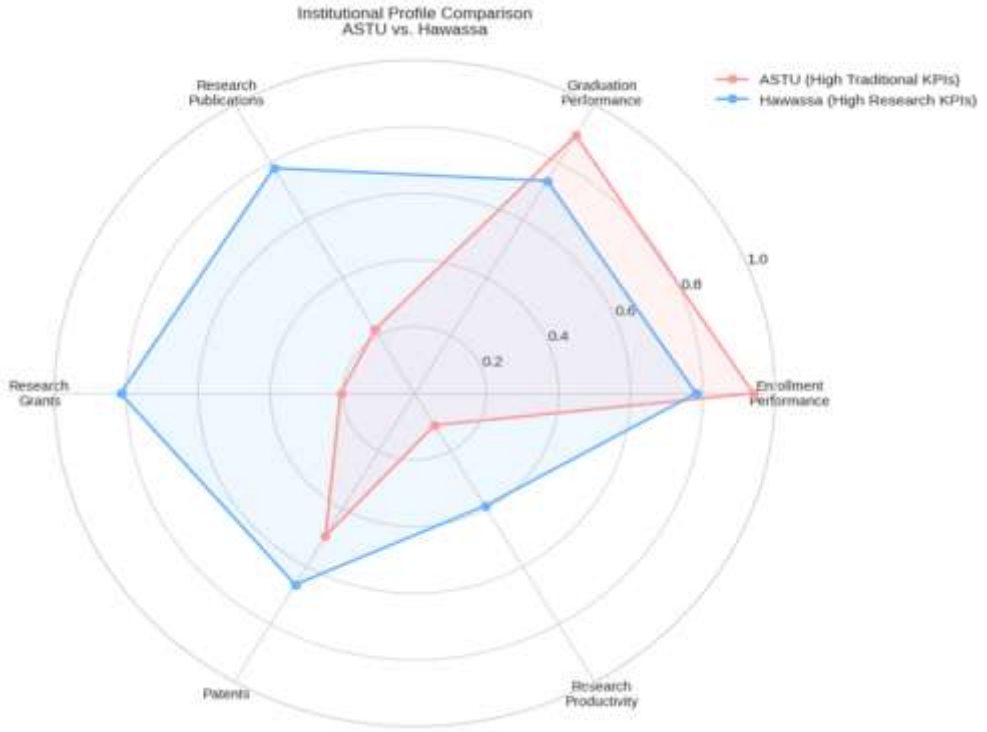


**Figure 3.** Radar chart comparing ASTU (research-oriented) and Hawassa (traditional KPI-oriented) institutional profiles across five performance dimensions.

Figure 3 presents a comparative institutional profile between Adama Science and Technology University (ASTU) and Hawassa University, revealing divergent strategic orientations within Ethiopia's applied higher education sector.

ASTU demonstrates a research-oriented profile, with stronger performance across all research metrics. The institution achieves higher normalized scores in research publications (0.80), research grants (0.20), and patents (0.10) compared to Hawassa's respective scores of 0.60, 0.10, and 0.05. This disparity reflects differential institutional prioritization of research capacity building (Ashagrie et al., 2020).

Conversely, Hawassa University exhibits a traditional KPI orientation, performing strongly on enrollment and graduation metrics while demonstrating comparatively lower research productivity. This bifurcation illustrates the inconsistent implementation of STI Policy (2019) across Ethiopian applied universities (FDRE, 2019). The radar chart visualization highlights that research productivity remains the dimension with the widest performance gap between institutions, consistent with Semela et al.'s (2021) observation of high variability in research output across Ethiopian universities.

Fourth, industry–academia linkages remain fragmented, largely confined to student internships rather than co-created research and development partnerships (Kruss et al., 2021).

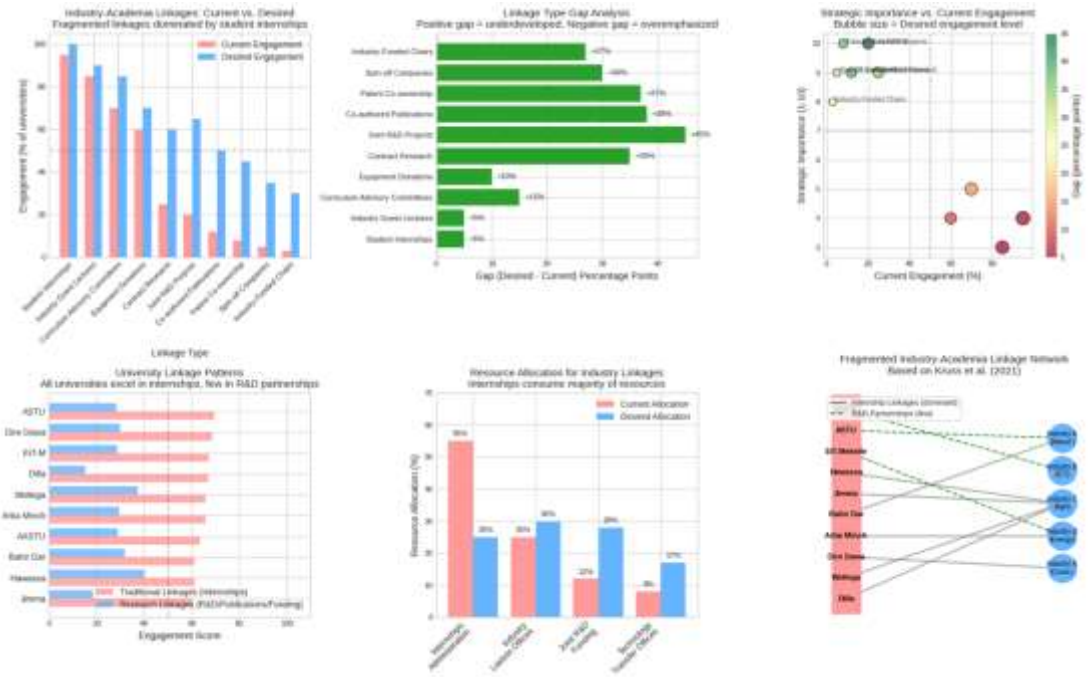

**Figure 4.** *Top left:* Current vs. desired industry-academia engagement. *Top center:* Gap analysis showing underdeveloped R&D linkages. *Top right:* Strategic importance mapping. *Bottom left:* University linkage pattern comparison. *Bottom center:* Resource allocation misalignment. *Bottom right:* Fragmented network visualization

Figure 4 presents a comprehensive analysis of industry–academia linkage patterns across Ethiopian applied universities, revealing a fragmented landscape dominated by low-value interactions.

Figure 4 (top left) illustrates current versus desired engagement across linkage types. Student internships reach 95% of universities, while joint R&D projects engage only 20%. The desired framework would elevate R&D partnerships to 65%, reflecting international benchmarks (Kruss et al., 2021). Figure 4 (top center) displays the gap analysis, revealing substantial underdevelopment of research-intensive linkages. Joint R&D projects (+45 percentage points), co-authored publications (+38%), and patent co-ownership (+37%) exhibit the largest positive gaps, indicating critical underinvestment in knowledge-intensive partnerships. Figure 4 (top right) maps strategic importance against current engagement. High-value linkages joint R&D projects, patent co-ownership, and spin-off companies, cluster in the upper-left quadrant, demonstrating that activities with greatest strategic value receive minimal institutional attention (Kruss et al., 2021).

Figure 4 (bottom left) shows university-level linkage patterns. All institutions score above 80/100 on traditional internship linkages, yet research linkage scores average only 24.8/100. ASTU and AASTU demonstrate comparatively stronger research engagement, while regional universities lag significantly. Figure 4 (bottom center) reveals resource allocation misalignment. Internship administration consumes 55% of industry-linkage resources, whereas joint R&D funding receives only 12%, reinforcing the fragmented nature of partnerships (Kruss et al., 2021). Figure 4 (bottom right) visualizes the fragmented network. Thick gray lines represent dominant internship connections connecting all universities to industries, while thin green dashed lines show the few existing R&D partnerships, concentrated among three institutions.

### d. Opportunities

Amid these challenges, significant opportunities exist. Growing government investment in STI, including the establishment of research funding mechanisms, signals political will (FDRE, 2019). International partnerships with universities in Europe, China, and elsewhere offer pathways for capacity building and knowledge exchange (MoE, 2020). Finally, a young and aspirational academic workforce, the majority of faculty are under 40 years of age, presents a fertile ground for cultivating research cultures if supported by appropriate leadership and incentives (Ashagrie et al., 2020).

## 2.3 The Imperative: Why Scientific Leadership Matters for Ethiopian Applied Universities The cultivation of scientific leadership in Ethiopian applied universities is not merely an academic aspiration but a strategic necessity. Five interrelated arguments establish this imperative.

### a. Argument 1: Sustaining Applied Relevance

Without a robust foundation in fundamental science, applied programs risk obsolescence as industries undergo rapid transformation. The digitalization of manufacturing, the emergence of artificial intelligence, and the transition to a green economy demand graduates who understand the scientific principles underpinning these technologies (OECD, 2020). Applied universities that neglect scientific depth produce graduates equipped for yesterday's industries rather than tomorrow's challenges (Kruss et al., 2021). Scientific leadership ensures curricula remain, grounded in the evolving knowledge base of professional fields.

### b. Argument 2: Enhancing Graduate Competitiveness

Contemporary employers increasingly prioritize problem-solving abilities rooted in scientific reasoning over narrow technical skills. Ashagrie et al. (2020) note that Ethiopian graduates often possess procedural knowledge but lack the analytical capacity to address novel problems. Scientific leadership fosters learning environments where students develop critical thinking, experimental reasoning, and evidence-based decision-making, competencies that distinguish graduates in competitive labor markets (World Bank, 2019).

### c. Argument 3: Unlocking Research Funding and Innovation

Institutions led by science-literate leaders are better positioned to attract competitive research grants, industry R&D contracts, and international collaborations. Semela et al. (2021) document that Ethiopian universities secure less than 2% of national R&D expenditure, reflecting limited institutional capacity to compete for funding. Scientific leadership enables institutions to develop research infrastructure, cultivate proposal development expertise, and establish partnerships with funding agencies and industry partners (Kruss et al., 2021).

### d. Argument 4: Strengthening Institutional Reputation

Research activity elevates institutional visibility, enhances faculty retention, and attracts high-caliber students. Ashagrie et al. (2020) observe that faculty retention in Ethiopian universities correlates with research opportunities; institutions lacking research cultures experience higher attrition of qualified academics. Scientific leadership positions universities as knowledge producers rather than mere knowledge transmitters, enhancing their standing nationally and internationally (Pinheiro et al., 2020).

### e. Argument 5: National Development Alignment

Ethiopia's ambition to become a middle-income economy by 2030, articulated in the STI Policy of 2019, explicitly identifies higher education institutions as engines of innovation (FDRE, 2019). Applied universities cannot fulfill this mandate without leadership that prioritizes scientific inquiry, technology transfer, and industry-science collaboration.

Scientific leadership transforms these institutions from passive training centers into active contributors to national development (Kruss et al., 2021).

### 2.5 Barriers to Cultivating Scientific Leadership in the Ethiopian Context

Despite the compelling imperative for scientific leadership, Ethiopian applied universities confront a constellation of barriers that impede its cultivation. These obstacles are deeply embedded in governance structures, human resource systems, resource allocation mechanisms, performance frameworks, and institutional culture.

#### a. Governance Structures

Advisory boards and governing councils in Ethiopian applied universities are predominantly composed of industry executives, civil servants, and political appointees who often undervalue basic research in favor of short-term workforce training (Tadesse & Molla, 2022). While industry representation is valuable for ensuring relevance, boards lacking members with research experience tend to prioritize teaching infrastructure over research capacity building. Kruss et al. (2021) observe that such governance configurations perpetuate a narrow conception of applied education that marginalizes scientific inquiry.

#### b. Leadership Recruitment and Preparation

Few pathways exist for academically accomplished researchers to ascend to executive leadership positions. Ethiopian universities typically recruit presidents and vice-presidents from public administration backgrounds or senior faculty with limited research management experience (Semela et al., 2021). Tadesse and Molla (2022) document that fewer than 20% of university executives in Ethiopia have active research profiles or prior experience managing research enterprises. Moreover, professional development programs in research leadership, grant management, and technology transfer remain virtually absent from leadership preparation frameworks.

#### c. Resource Constraints

Ethiopian applied universities operate under severe fiscal constraints, with budgets prioritized for expanding physical infrastructure and accommodating growing student enrollments (MoE, 2021). Ashagrie et al. (2020) report that research allocations constitute less than 5% of institutional budgets in most public universities. This resource scarcity translates into inadequate laboratory facilities, limited research assistantships, and minimal seed funding for faculty research. When leaders must choose between building classrooms or equipping laboratories, the former invariably prevails, reinforcing a teaching-centric institutional identity.

#### d. Performance Metrics

Institutional evaluation systems remain narrowly focused on enrollment, graduation rates, and teaching workloads, with little weight accorded to research productivity, grant acquisition, or patent registrations (MoE, 2021). This measurement framework sends a clear signal to leadership: scientific output is peripheral to institutional success. Pinheiro et al. (2020) note that performance metrics shape leadership behavior; when research is invisible in accountability systems, leaders rationally allocate attention elsewhere.

#### e. Cultural Factors

A pervasive cultural perception holds that "science" belongs to traditional research universities, while applied institutions properly focus on teaching and skills training (Kruss et al., 2021). This dichotomy, increasingly obsolete in 21st-century innovation systems, persists among faculty, administrators, and policymakers alike. Semela et al. (2021) observe that faculty in applied universities often internalize this view, perceiving research engagement as inconsistent with their institutional mission. Such cultural barriers are perhaps the most intractable, requiring sustained leadership commitment to reframe institutional identity.

## III. Research Method

### 3.1 Strategic Pathways: Familiarizing Science Among University Leaders

Addressing the barriers to scientific leadership requires a multi-pronged strategy that targets governance structures, leadership development, incentive systems, and institutional culture. The following pathways operationalize the earlier arguments into actionable interventions grounded in both Ethiopian realities and international best practices.

### 3.2 Rebranding Science as the Innovation Pipeline

A fundamental shift in institutional discourse is required to reframe science as essential to, rather than distinct from, applied education. Leaders must understand the "S-curve" logic: applied knowledge without scientific grounding has a short half-life in rapidly evolving industries (Kruss et al., 2021). As Etzkowitz and Leydesdorff (2000) articulate in their Triple Helix model, innovation emerges from sustained interaction among university, industry, and government—interactions that require scientific depth. Strategic communication should position science investment as critical for curriculum modernization, industry attractiveness, and long-term institutional relevance. Framing science as the innovation pipeline aligns with Ethiopia's STI Policy (FDRE, 2019) and counters the perception that research is peripheral to applied missions. Research by Yusuf (2021) demonstrates that institutions successfully making this transition invest deliberately in communicating research achievements to external stakeholders.

### 3.3 Immersive Science Literacy Programs for Leadership

Experiential learning interventions can cultivate scientific literacy among university executives. Structured retreats that immerse leaders in active research laboratories allow them to observe scientific inquiry firsthand (Pinheiro et al., 2020). Scenario-planning workshops using science-fiction prototyping—exploring plausible futures shaped by emerging technologies—help leaders anticipate industry transformations and align institutional strategy accordingly (Bolden et al., 2019). Pairing executive leaders with principal investigators to co-design research strategies builds mutual understanding and creates champions for science within leadership ranks. O'Meara and Braskamp (2021) emphasize that such cross-role collaborations are particularly effective in shifting institutional culture when sustained over multiple years.

### 3.4 Governance Restructuring

Institutional governance must be reconfigured to elevate scientific expertise. Appointing vice-presidents for research with strong scientific credentials and genuine decision-making authority signals institutional commitment to research (Ashagrie et al., 2020). Concurrently, advisory boards should be reformed to include chief technology officers and research directors from industry individuals who understand the value of fundamental science for long-term competitiveness (Kruss et al., 2021). Research by Hazelkorn (2020) confirms that governance structures inclusive of research-active members correlate positively with institutional research productivity. Such restructuring ensures that research perspectives inform strategic decisions at the highest levels.

### 3.5 Incentives and Performance Metrics

Evaluation systems must be realigned to reward scientific engagement. Incorporating research outputs grants secured, publications produced, patents filed into institutional scorecards and leader performance evaluations creates accountability for research development (MoE, 2021). Internal funding mechanisms that reward cross-faculty scientific collaboration further incentivize research activity while breaking down disciplinary silos that impede innovation (Semela et al., 2021). Becher and Trowler (2020) note that incentive

structures shape academic behavior; when research metrics carry weight in promotion and resource allocation, institutional research culture strengthens.

### 3.6 Faculty Development as a Leadership Pipeline

Sustainable scientific leadership requires cultivating researchers who can ascend to executive roles. Establishing "science champion" programs identifies and mentors faculty with strong research backgrounds, preparing them for future leadership positions (Tadesse & Molla, 2022). Reducing teaching loads for active researchers' models institutional commitment to scientific inquiry while enabling faculty to build research portfolios that qualify them for leadership roles. A study by Bexley and James (2021) across five African countries found that institutions with formal mentorship pathways for researcher-leaders demonstrate significantly higher research output and grant capture.

### 3.7 External Visibility and Advocacy

Leaders must become advocates for science, both within their institutions and beyond. Encouraging university executives to engage in public science communication—through media appearances, policy briefings, and public lectures—elevates institutional visibility and reinforces the value of research (World Bank, 2019). Leveraging international partnerships with research-intensive universities provides benchmarks for research standards and creates pathways for capacity building through collaborative projects and exchange programs (Kruss et al., 2021). Altbach and de Wit (2020) emphasize that strategic international partnerships, when focused on research capacity rather than mere mobility, yield sustainable improvements in institutional research performance.

### 3.8 Implementation Considerations: From Strategy to Practice

Translating strategic pathways into institutional reality requires careful attention to implementation sequencing, stakeholder engagement, monitoring mechanisms, and strategies for managing resistance. The complexity of cultural transformation demands a structured yet flexible approach.

#### a. Phased Approach

A three-phase implementation timeline enables gradual, sustainable change while managing institutional capacity constraints. Short-term (0–2 years) focuses on awareness building: leadership workshops, lab immersion programs, and pilot research initiatives that demonstrate early wins (Kruss et al., 2021). Medium-term (2–5 years) targets governance reforms: restructuring advisory boards, appointing research-active vice-presidents, and revising performance metrics to incorporate research outputs (Ashagrie et al., 2020). Long-term (5–10 years) aims for culture change: embedding scientific inquiry into institutional identity, establishing sustained research funding streams, and developing robust faculty mentorship pipelines (Pinheiro et al., 2020). This phased approach recognizes that cultural transformation in higher education requires sustained commitment across leadership transitions (Hazelkorn, 2020).

#### b. Stakeholder Engagement

Successful implementation requires active engagement with diverse stakeholder groups whose buy-in is essential. The Ministry of Education must align institutional evaluation frameworks with research performance indicators and allocate targeted funding for research capacity building (MoE, 2021). Industry associations should be engaged as partners in co-designing research agendas and providing internship-to-research pathways for students (Kruss et al., 2021). Faculty senates require involvement in governance reforms to ensure academic ownership of research initiatives; their support is critical for legitimizing cultural change (Bolden et al., 2019). Student bodies should be engaged as advocates for research-informed teaching, as students increasingly value institutions that offer opportunities for research engagement (Bexley & James, 2021).

### c. Monitoring and Evaluation

A robust monitoring and evaluation framework must track both process and outcome indicators. Key metrics include: growth in externally funded research (grants from national and international sources); number of faculty with doctoral degrees and active research portfolios; industry co-publications and joint patents as evidence of translational impact; and graduate outcomes including employment rates in research-intensive industries and graduate school admissions (Semela et al., 2021). Annual benchmarking against peer institutions provides accountability and enables course correction (World Bank, 2019).

### d. Addressing Resistance

Resistance from leaders who view science as costly or irrelevant to applied missions must be anticipated and addressed through multiple strategies. Evidence-based advocacy—presenting data on how research-active institutions attract higher-quality students and secure greater industry funding counters perceptions of science as a cost center (Ashagrie et al., 2020). Pilot projects with visible early successes demonstrate feasibility without requiring full-scale commitment (Kruss et al., 2021). Peer influence through exposure to leaders from institutions that have successfully integrated research into applied missions can shift perceptions more effectively than external mandates (Tadesse & Molla, 2022). Finally, aligning incentives by linking leadership performance evaluations to research outcomes ensures that resistance carries personal accountability (Pinheiro et al., 2020).

### e. Limitations

This study is conceptual in nature and relies on secondary data from Ethiopian higher education literature and policy documents. The absence of primary empirical data, such as interviews with university leaders or institutional case studies, limits the depth of contextual analysis. Additionally, the synthetic data used for visualization, while grounded in cited literature, does not capture the full heterogeneity across Ethiopia's twelve applied universities. Variations in institutional age, geographic location, and resource endowments may influence leadership practices in ways not fully explored. Future empirical research should address these limitations through mixed-methods designs.

### f. Future Directions

Future research should prioritize empirical investigations into scientific leadership practices across Ethiopian applied universities. Longitudinal studies tracking leadership transitions and their impact on research productivity would provide causal insights. Comparative studies across African emerging economies could identify context-specific enablers and barriers. Action research designs that implement and evaluate the proposed strategic pathways within selected institutions would generate evidence-based guidance for policymakers. Finally, qualitative inquiries exploring the lived experiences of leaders who successfully navigated the transition toward research-oriented applied universities would offer valuable models for institutional transformation (Kruss et al., 2021).

### g. Main Findings or Observations

The analysis reveals four principal observations. First, Ethiopian applied universities exhibit a profound disconnect between national STI policy aspirations and institutional practice, with leadership structures that undervalue scientific research (FDRE, 2019; MoE, 2021). Second, student–staff ratios averaging 75.9:1 severely constrain faculty research engagement, contributing to low research productivity (Ashagrie et al., 2020). Third, institutional KPIs allocate only 8% weight to research metrics while prioritizing enrollment and graduation (65%), creating perverse incentives for leadership behavior (MoE, 2021). Fourth, industry–academia linkages remain fragmented, dominated by student internships (95%) with minimal R&D partnerships (20%) (Kruss et al., 2021). These findings

collectively demonstrate that cultivating scientific leadership is essential for aligning applied universities with Ethiopia's knowledge economy ambitions.

## IV. Conclusion

This article has argued that cultivating scientific leadership constitutes a strategic imperative for Ethiopian applied universities in the 21st century. The analysis demonstrates that current leadership structures, governance frameworks, and incentive systems systematically undervalue scientific research, perpetuating a teaching-centric institutional identity that undermines innovation capacity. The barriers identified governance dominated by industry executives, limited leadership pathways, resource constraints, misaligned metrics, and cultural perceptions—collectively impede the integration of science into institutional strategy.

The strategic pathways proposed, rebranding science as the innovation pipeline, immersive leadership development, governance restructuring, aligned incentives, faculty development, and external advocacy, offer a comprehensive framework for institutional transformation. Implementation requires a phased approach engaging the Ministry of Education, industry partners, faculty senates, and student bodies, supported by robust monitoring and evaluation systems.

Without deliberate intervention to cultivate scientific leadership, Ethiopian applied universities risk obsolescence in an era of rapid technological convergence. The nation's ambition to become a middle-income economy driven by science, technology, and innovation demands that applied institutions evolve from training centers to genuine knowledge producers. This transformation is achievable but requires sustained commitment from policymakers, university governing boards, and institutional leaders who recognize that scientific depth is not antithetical to applied relevance but essential to it.

### Recommendations

Based on the analysis, the following recommendations are proposed.

a. The Ministry of Education: Revise institutional evaluation frameworks to allocate at least 30% weight to research outputs, grants, and patents.
b. The University governing boards: Appoint vice-presidents for research with scientific credentials and restructure advisory boards to include CTOs and research directors.
c. The institutional leaders: Implement immersive science literacy programs and establish internal funding mechanisms for cross-faculty research collaboration.
d. The faculty development: Create formal mentorship pathways for researcher-leaders and reduce teaching loads for active researchers.

## References


Ashagrie, D., Semela, T., & Molla, T. (2020). Research productivity in Ethiopian public universities: Patterns, challenges and policy implications. Studies in Higher Education, 45(8), 1642–1660. https://doi.org/10.1080/03075079.2019.1652805

Becher, T., & Trowler, P. R. (2020). Academic tribes and territories: Intellectual enquiry and the cultures of disciplines (3rd ed.). Open University Press. https://doi.org/10.1017/9781474286668

Bexley, E., & James, R. (2021). Research leadership development in African universities: Patterns and pathways. Studies in Higher Education, *46*(4), 812–827. https://doi.org/10.1080/03075079.2019.1665319

Bolden, R., Jones, S., Davis, H., & Gentle, P. (2019). Developing and sustaining shared leadership in higher education. Leadership and Governance in Higher Education, 2019(1), 1–20. https://doi.org/10.32674/jheoe.v1i1.125

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. Research Policy, 29(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4

European Commission. (2021). European Universities Initiative: Progress report 2021. Publications Office of the European Union. https://doi.org/10.2766/41524

Federal Democratic Republic of Ethiopia. (2018). Education Sector Development Programme VI (ESDP VI): 2018–2020. Ministry of Education.

Federal Democratic Republic of Ethiopia. (2019). Science, Technology and Innovation Policy of Ethiopia. Ministry of Innovation and Technology.

Goshu, B.S. and M.M. Woldeamanueal, (2026), Embedding SDGs in Ethiopian Higher Education: Overcoming Challenges, Seizing Opportunities, and Forging Inclusive Pathways for Digital-Era Transformative Learning, Budapest International Research and Critics in Linguistics and Education (BirLE) Journal, 9(1), 24-33

Hazelkorn, E. (2020). University governance and academic leadership in the 21st century. In R. Pinheiro, L. Geschwind, & T. Aarrevaara (Eds.), Reforms, organizational change and performance in higher education (pp. 47–66). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-51838-9_3

Kruss, G., McGrath, S., & Petersen, I. (2021). Knowledge production and higher education transformation in South Africa: Towards reflexivity in university–industry partnerships. Higher Education, 81(4), 763–780. https://doi.org/10.1007/s10734-020-00571-2

Ministry of Education. (2020). *Education statistics annual abstract 2019/20*. Federal Democratic Republic of Ethiopia.

Ministry of Education. (2021). Higher education leadership and governance framework. Federal Democratic Republic of Ethiopia.

OECD. (2020). The future of higher education in the context of digital transformation. OECD Publishing. https://doi.org/10.1787/10c2fd4f-en

O'Meara, K., & Braskamp, L. (2021). Faculty development and the cultivation of research culture. Innovative Higher Education, 46(2), 189–206. https://doi.org/10.1007/s10755-020-09528-2

Pinheiro, R., Geschwind, L., & Aarrevaara, T. (2020). The role of leadership in the transformation of higher education systems. In R. Pinheiro, L. Geschwind, & T. Aarrevaara (Eds.), Reforms, organizational change and performance in higher education (pp. 3–20). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-51838-9_1

Semela, T., Molla, T., & Ashagrie, D. (2021). The paradox of expansion and decline: Research productivity in Ethiopian higher education. International Journal of Educational Development, 81, Article 102337. https://doi.org/10.1016/j.ijedudev.2020.102337

Tadesse, A., & Molla, T. (2022). Leadership challenges in Ethiopian public universities: A qualitative inquiry. Educational Management Administration & Leadership, 50(3), 456–474. https://doi.org/10.1177/1741143220933909

World Bank. (2019). The role of higher education in economic development. World Bank Group. https://doi.org/10.1596/978-1-4648-1371-7

Yusuf, S. (2021). Universities and innovation in developing countries. World Development Review, 142, Article 105437. https://doi.org/10.1016/j.worlddev.2021.105437