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From desired futures to market realities: examining policy imaginaries and strategies in the globalization of Ayurveda

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This paper uses the framework of socio-technical imaginaries to examine how Indian state policy envisions the global future of Ayurveda. The paper is structured in two parts. The first part juxtaposes policy narratives with export market data, revealing several ironies arising from a deep misalignment: while science-based innovation is framed as the key path to global legitimacy, the most profitable segments of the global herbal market demand minimal scientific input and lie largely outside this framing. To understand this disconnect, I trace the evolution of dominant imaginaries shaping ISM policy since the colonial period, alongside contesting imaginaries that drive market formation. This analysis shows that a persistent tension between top-down state imaginaries—shaped by the norms of the biomedical global health order—and grassroots market dynamics animated by consumer imaginaries lies at the heart of the observed misalignments. The second part of the paper critically examines the Ayurveda-Biology initiative, which was framed by a broader technoscientific imaginary that positioned Ayurveda not merely as a tradition to be validated, but as a source of conceptual insights to global science. Although the initiative briefly opened space for scientific research sensitive to Ayurvedic epistemology and forged a high-profile network linking scientific institutions, clinicians, and industry actors, it was never institutionally prioritized. Promising findings were met with indifference, exposing the disconnect between rhetorical commitments to innovation and the structural realities of research governance. In practice, regulatory priorities aligned with market demands were given precedence over foundational inquiry and clinical application. At the same time, these governance dynamics reveal the limits of the technoscientific imaginary, which—though dominant in state policy and global governance regimes of traditional medicine—does not fully determine how the field evolves. Ayurveda's trajectories—both local and global—are also shaped from below, as practitioners, patients, and consumers exercise implicit forms of agency. Their choices—reflected in everyday clinical practice and market demand—continue to influence how Ayurveda evolves along paths that elude formal institutional control, shaped by alternative imaginaries that operate at the margins of, and sometimes beyond, regulatory frameworks.

KEYWORDS

Ayurveda, Ayurveda-Biology, AYUSH policy, traditional medicine, India, sociotechnical imaginaries, medical anthropology, global herbal market

Introduction

Around the turn of the millennium, national policies on traditional medicine across Asian countries began to adopt a distinctly global orientation (Banerjee, 2004; Kim, 2006a; Hsu, 2008). Pioneering studies by medical anthropologists, notably Janes (1999, 2002) and Adams (2002), raised concerns about potential adverse effects of bioscience-dominant regulatory regimes. In the years since, a growing body of work has borne out these concerns, underscoring the expanding influence of bioscientific paradigms on traditional medicine (Bode, 2008; Banerjee, 2009; Pordié, 2010; Schrempf, 2015; Kloos, 2017, 2022). At the same time, several accounts have documented adaptation and resistance within traditional medicine practices (Pordié and Gaudilliere, 2014; Scheid, 2002; Blaikie, 2022). Researchers have further examined the impact of global markets on national medicine policies (Banerjee, 2009; Hsu, 2008), the manufacturing sector (Craig, 2011; Campinas, 2022; Chee, 2022), and trajectories of pharmaceutical circulation (Coderey and Pordié, 2022; Pordié and Hardon, 2015).

While the impact of global market aspirations on stakeholders of traditional medicine has been extensively analyzed, the dynamics of these markets remain underexamined. The market is largely treated as an independent variable, and consequently, economic interest or market logic is taken for granted as externally produced forces exerting influence on stakeholders. This gap persists partly because scholarship on Asian medicines is shaped by medical anthropologists, whose focus rarely extends to market analysis, and partly because the marginal status of these markets in the formal economy has limited their appeal to economists and business analysts.[1]

Kudlu and Nichter (2019) challenge the widely held perception in Indian policy circles that Chinese medicine's global success stems primarily from state-led scientization, showing instead that it draws heavily on historical-cultural linkages, diasporic networks, and grassroots practitioner pathways. Their review underscores how overestimating China's scientific accomplishments has sustained imaginaries that frame scientization as the primary pathway to global pharmaceutical markets. Building on this insight, the current paper probes the imaginaries underlying policy discourses of Indian medicine, particularly Ayurveda, to examine their alignment—or misalignment—with global market realities. The analysis is guided by the following questions: How are desirable global futures imagined within the policy discourse on Ayurveda's globalization? To what extent do these visions align with observed global market trends and realities? What implications might these alignments (or misalignments) hold for the long-term prospects of Ayurveda?

The analysis is framed by the concept of "sociotechnical imaginaries", which Jasanoff and Kim (2015, p. 4) define as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology." In their seminal analysis of socio-technical imaginaries of nuclear power, Jasanoff and Kim (2009, p. 124) demonstrated how national political cultures are intertwined with "the development and reception of science and technology". Since then, this approach has been widely used to uncover how collective visions shape science, technology, and society in a variety of policy contexts, ranging from artificial intelligence to farming policy, climate change to epigenetics (Jasanoff and Kim, 2015; Verschraegen et al., 2020).

A growing body of research has explored the application of sociotechnical imaginaries in healthcare systems, particularly in relation to emerging technologies such as artificial intelligence and regenerative medicine (Gardner et al., 2017), and digital health technologies (Lang et al., 2024). The relevance of this framework to the analysis of Indian systems of medicine (ISM)[2] lies in their recent incorporation into the sociotechnical imaginaries of the state, and the state's expanding regulatory role in the global health order. However, only one notable study—Urquiza-Haas and Cloatre (2022)—has applied this framework to traditional medicine, focusing on herbal medicine in Europe. Nevertheless, valuable insights can be drawn from medical anthropological and sociological scholarship on Asian medicines, particularly those employing science and technology studies (STS) frameworks.

Jasanoff (2015) argues that, as analytic concepts, sociotechnical imaginaries bridge structure and agency and are best studied through interpretive methods that attend to meaning-making—how imaginaries link pasts and futures, shape action, and naturalize certain worldviews. Within this framework, she emphasizes comparison as an indispensable strategy: comparative work across national contexts, policy sectors, or time can help uncover situated, normative commitments embedded in political cultures, and unsettle assumptions treated as universal. This study adopts a two-part structure: the first employs a comparative frame to examine policy narratives and assess Ayurveda's actual performance in international markets against its projected potential. It further traces the evolution of state imaginaries over time, identifying key shifts in orientation and emphasis. The second part offers a critical examination of the outcomes of the Ayurveda–Biology initiative, a flagship project of the Indian government aimed at integrating traditional knowledge with modern scientific research. This initiative offers a key site for examining the institutional embedding of sociotechnical imaginaries. The analysis draws on media reports, conference proceedings, policy documents, government press releases, editorials, scientific publications in Ayurvedic journals, herbal export data, and interviews with key stakeholders.[3]

The first part of the study began with identifying dominant themes in policy discourse and evaluating the alignment between stated objectives and actual export performance. The quest for global legitimacy emerged as one of four dominant themes influencing

1 For discussion regarding paucity of data on Asian medicine industries, see Kloos (2022, pp. 5–6) and Campinas (2022, pp. 52–53).

2 This includes six state-recognized medical systems: Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Sowa Rigpa. The acronym AYUSH—which also includes Homeopathy—is the term most commonly used by the Indian government in policy and market contexts, but is used here only when referencing official sources. While this paper focuses primarily on Ayurveda, I use the term Indian systems of medicine (ISM) in contexts where policies or market structures apply more broadly.

3 Conducted across Varanasi, Delhi, Bangalore, Udupi, Trivandrum, and Thrissur between June and December 2023.

contemporary Ayurveda, the others being public health, healthcare integration, and wellness. The current discussion is restricted to the first theme and two salient subthemes: the perception of scientific evidence as key to global legitimacy, and science-based innovation as key to transforming traditional knowledge into globally marketable commodities. Indian performance in the global herbal market, when assessed against these objectives, reveals striking misalignments. In Euro-American markets, which are the key policy target, herbal supplements are the most accessible and profitable segment, but require minimal scientific input. Conversely, segments demanding scientific innovation, such as herbal extracts, reduce Ayurvedic formulations to generic compounds. Policy, however, emphasizes evidence-based products—arguably the least viable commercially—while overlooking medicinal formulations that form the core of Ayurveda's identity. The most promising market for Ayurvedic medicines lies in the Middle East, a region peripheral to dominant 'global' imaginaries.

These misalignments are not merely technical or strategic; they are deeply ironic—the markets most emphasized by policymakers are the least viable, while those neglected in policy discourse hold the greatest promise. While state policy seeks to globalize Ayurveda through the idioms of science, development, and economic growth, market forces are animated by alternative imaginaries grounded in consumer desires for wellness, holism, and non-biomedical therapeutics. To understand this disconnect, I trace the evolution of dominant sociotechnical imaginaries shaping Indian ISM policy since the colonial period, alongside contesting imaginaries, drawing comparative insights from East Asian trajectories of medical modernization. This analysis shows that a persistent tension between top-down state visions—shaped by the norms of the biomedical global health order—and grassroots market dynamics animated by patient/consumer orientations lies at the heart of the observed misalignments.

The second part of the paper critically examines the Ayurveda–Biology initiative, framed by a broader 'technoscientific imaginary' (Marcus, 1995) that positioned Ayurveda not merely as a tradition to be validated, but as a source of conceptual insights to global science. Although the initiative briefly opened space for epistemology-sensitive research and forged a high-profile network linking scientific institutions, clinicians, and industry actors, it was never institutionally prioritized. Promising findings were met with indifference, exposing a disconnect between rhetorical commitments to innovation and the structural realities of research governance. This marginalization of foundational inquiry reflects how state-backed innovation has been driven primarily by product-development and regulatory priorities aligned with global market demands.

At the same time, these institutional dynamics reveal the limits of the technoscientific imaginary, which—though dominant in state policy narratives and entrenched within global governance regimes of traditional medicine—does not fully determine how the field evolves. The trajectories of Ayurveda in both local and global contexts are shaped not only from above but also from below, as practitioners, patients, and consumers exercise implicit forms of agency. Their choices—reflected in clinical practice and market demand—continue to influence how Ayurveda evolves, along paths that elude formal institutional control and are shaped by alternative imaginaries not entirely circumscribed by regulatory frameworks.

Part 1: Desired futures versus market realities

Desired futures: salient themes in the policy discourse

"The world" as a source of legitimacy

> "India is presiding over and hosting the G-20 group. We have also set the theme for the G-20 committee. One Earth, One Family, One Future… You will deliberate for the health of the entire world. I am happy that more than thirty countries of the world have recognized Ayurveda as a system of traditional medicine. We have to work together to spread this to as many countries as possible."

So began Prime Minister Narendra Modi's speech at the Ninth World Ayurveda Congress in Goa on December 11, 2022 (Modi, 2022). Highlighting the accomplishments of his government, he observed, "the world's first and only Global Centre for Traditional Medicine," set up by the WHO (World Health Organization) in Gujarat had brought "enthusiasm and confidence" to Ayurveda, "India's efforts have been praised (by the world) in a recent summit on innovation." The International Yoga Day instituted by his government, he claimed, is celebrated by "the entire world" as a "global festival of health and wellness," and that hitherto "neglected" practices like Yoga and Ayurveda, have emerged as "a new hope for all humanity." In his tweet wishing the public on the occasion of Ayurveda day (29.10.24), he noted that "the importance of Ayurveda is being acknowledged by the whole world today", and emphasized its utility for the health of "the entire humanity" (Naseer, 2024).

Invocations of 'the world' loom large in political and policy rhetoric surrounding Ayurveda, where the global market serves not only as a source of profit but also as a crucial site for securing recognition and legitimacy for once-marginalized medical traditions. Economic motives are is inseparable from the need for validation and the political aim of instrumentalizing these traditions as soft power. However, India is presented not as a needy taker but a generous giver—offering services to the world, advancing planetary health, and providing hope for humanity.

Recognition of the global significance of Ayurveda began to crystallize around the turn of the millennium. The World Ayurveda Congress (WAC) was established in 2001 as a voluntary advocacy forum to bring together stakeholders to protect and promote Ayurveda's global interests (Pharmexcil, 2019). Since then, there has been a proliferation of forums, conferences, and festivals on Ayurveda, most of them carrying the prefix "world" or "global." These events dedicate a significant portion of their proceedings to discussing the global status, achievements, and potential of Ayurveda. Many feature separate international delegate summits, attended by practitioners of CAM (complementary and alternative medicine) from the Global North. Their presence offers symbolic affirmation to an Ayurveda establishment beleaguered by low institutional confidence, while providing delegates with networking opportunities and alignment with a global CAM community. For CAM practitioners from the Global North—where traditional medicine remains marginalized within biomedicine-dominated regulatory systems—India's leadership offers a source of inspiration and legitimacy. This reciprocal dynamic

reinforces the narrative of India as a beacon of cultural authority and epistemic legitimacy in both domestic and global arenas (Kudlu, 2022).

International recognition of Ayurveda is invoked not only at high-profile global conferences but also at routine domestic events. For example, a report on the inauguration of a small health facility was titled "AYUSH Poised to Become a World Leader in Holistic Health and Wellness," quoting the Health Minister's statement that "global acceptance" has "placed much responsibility" on the sector, calling for improvements in education and health delivery to meet growing global demand (Economic Times, 2024a). Similarly, a report on a regional review meeting titled "AYUSH Bringing Health and Wellness to the World," quoted the AYUSH Minister saying, "the world is looking forward to holistic healthcare, and today yoga and AYUSH are hoisting their glory across the globe" (Rajput, 2024).

Need for science-based innovation

During his address at the Fourth Global Ayurveda Festival in Calicut, Kerala, in 2016, the Prime Minister attributed Ayurveda's limited global market performance to the Ayurvedic community's shortcomings, emphasizing the urgency of transforming traditional medicines into innovative, globally palatable products (Kudlu, 2022). The call for 'innovation' recurs in discourses surrounding Ayurveda, particularly in relation to its global potential. Reflecting this narrative, the annual "Ayurveda Day" celebrations on October 23 2024 adopted the theme "Ayurveda Innovation for Global Health." At a curtain-raiser press conference, the Union Minister of State for AYUSH reiterated Ayurveda's potential to advance global health through "innovative practices" (Economic Times, 2024b).

In public and policy discourse, innovation is typically paired with science and technology, which are seen as essential tools for transforming traditional knowledge into global commodities. Emphasis is placed on engineering applications—digital platforms, Ayurveda apps, telemedicine, e-commerce, and advanced production technologies. An editorial in the AIIA journal highlights the potential of innovations such as AI-driven diagnostics, biosensors, and health trackers to "unlock new opportunities in the digital health market and advance the vision of health for all" by empowering AYUSH professionals and industries (Nesari, 2024a).

In a media interview, Tanuja Nesari, then Director of AIIA, characterized AYUSH as a key driver of economic growth and cultural diplomacy—"soft power," a unique unreplicable USP," a "sunrise sector with untapped potential" that could serve as "a backbone" for the economy by boosting employment. She highlighted emerging sectors like health foods and biomedical engineering, where point-of-care innovations are gaining ground. Nesari also mentioned the government's ambitious goal of fostering innovation by supporting the development of 100 unicorns in the health sector over the next 3 years, aimed at bolstering entrepreneurship and driving growth (Yadav, 2024).

While the discourse on innovation has gained prominence in recent years, its institutionalization began much earlier, with the establishment of the AYUSH Sector Innovation Council in 2011. This was part of a broader push initiated by the National Knowledge Commission (NKC), set up in 2005 under Sam Pitroda as a high-level advisory body to the Prime Minister. Sectoral Innovation Councils were created around 2010 to foster an "innovation ecosystem" addressing economic and social challenges (Singh, 2011), and 2010–2020 was designated the "Decade of Innovation." The 2013 Science, Technology, and Innovation Policy under the Manmohan Singh-led government positioned innovation as a "cornerstone of national development" (Krishna, 2014).

Continuing this policy trajectory, in mid-2018, the Modi-led government established the Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC). The council has spearheaded several flagship initiatives, such as Digital India, Make in India, and Start-up India. AYUSH is considered a priority sector. In October 2021, an Incubation Centre was launched at AIIA "to foster innovation and entrepreneurship by leveraging a network of cutting-edge businesses in AYUSH." The center supports entrepreneurs through capacity building, mentoring, and outreach. Designated start-up categories include: Food Innovations and Cosmetics; Ayur-bioinstrumentation; and IT-Innovations (Nesari, 2023).

In early 2022, linking with the Start-up India mission, the AIIA launched an annual 'Start-up Challenge' to identify and nurture early-stage start-ups and individual entrepreneurs focused on AYUSH innovations in the above-mentioned categories. Selected start-ups were incubated at AIIA with mentoring and development support. In its inaugural year, the winning innovations included a brand of therapeutic ayurvedic nutraceuticals, a thermoregulator designed for sudation chambers, and a pulse-diagnosis device (BioSpectrum, 2022).

In May 2023, the government announced a center for excellence at IIT-Jodhpur, named AyurTech, described as "the first-of-its-kind initiative in the precision health and medicine space that would combine electronics, digital health, artificial intelligence, and multi-omics technologies for realising 'Evidence-based Ayurveda' solutions in a transdisciplinary framework" (Express Healthcare, 2023). Announcing the 2024 Start-up Challenge, AYUSH Secretary Rajesh Kotecha cited innovations like a constitution analysis app, digital yoga platform, and medicinal plant marketplace. He also mentioned a company that became a unicorn in 7 years, exporting Ashwagandha to 52 countries. "From 900 start-ups now, we aim to reach 9,000 in 5 years," he added (Mathew, 2024).

In early 2024, the "Pharma Research in Ayur-Gyan and Techno Innovation" (PRAGATI, 2024) initiative was launched to foster collaboration between CCRAS and the Ayurvedic industry, with the goal of maximizing Ayurveda's potential in drug and device development. In his address, Kotecha described it as a "significant step forward in Ayurveda's development," providing "a platform for fostering partnerships for research and innovation to drive growth in the sector." (PRAGATI, 2024).

Scientific validation as key to global legitimacy

> "It has taken so long for Ayurveda to gain global consensus, ease, and acceptance because modern science is based on evidence and proof. We had the outcomes of Ayurveda, but in terms of evidence, we were lagging behind. Therefore, today it is essential for us to document this evidence. For this, we need to work continuously for a long time. Our medical data needs to be consolidated and each claim must be verified against modern scientific parameters."

This is another excerpt from Prime Minister Modi's, 2022 speech at the World Ayurveda Congress in Goa (Modi, 2022). Six years earlier, at the Global Ayurveda Festival in Kerala, he had criticized Ayurvedic professionals for their inadequate performance, urging

them to publish in prestigious scientific journals. He had remarked with disappointment that "the fault was not of Ayurveda," but of the Ayurvedic community, which had failed to "translate their science into modern language" (Kudlu, 2022, p. 151). In contrast, the 2022 speech strikes a celebratory note, recognizing past advancements, but highlighting his government's contributions. The optimism is tempered by a sobering recognition of the challenges ahead. The global recognition Ayurveda has achieved is attributed to efforts to bolster its evidence base—a claim that justifies past investments on scientific validation, and serves as a rationale for increasing future investment to widen global acceptance.

The refrain of 'scientific validation as essential to securing the future of AYUSH' is a central theme in speeches by political leaders and AYUSH officials, highlighting its critical role in shaping policy and public discourse on Indian medical traditions. This emphasis aligns with prevailing global discourses, as evident in the first WHO global summit on traditional medicine held in Gujarat in August 2023 (WHO, 2024a). In the inaugural session, the master of ceremonies declared: "This two-day conference intends to catalyse action towards the integration of traditional medicine based on the latest scientific evidence." She later emphasized, "Science, evidence and the way forward in scaling up the rigorous research on traditional medicine will loom large at this Summit. It is the science that will realize the full potential of traditional medicine for health and well-being to turn ancient knowledge into game-changing interventions."

The video message by Harold Varmus, Chair of the WHO Science Council and Nobel laureate in physiology or medicine, emphasized the critical role of science in evaluating the safety and efficacy of traditional medicine. "It is important to understand what ingredients are actually in traditional medicines, why they work in some cases, and how we can improve their use… understand and identify which traditional medicines do not work or occasion detrimental drug interactions," he said, while expressing profound appreciation for those dedicated to bringing "fundamental science to bear on" them "to protect the public from misuse or unwarranted expenses." The summit's report, titled 'Global partners commit to advance evidence-based traditional, complementary, and integrative medicine' (WHO, 2023), is indicative of WHO's priority. The increasingly pervasive pairing of 'evidence-based' with traditional medicine is telling, tacitly implying that its credibility requires defense without this label, unlike biomedicine, which is presumed to be evidence-based by default, although the concept originally emerged as a corrective within biomedicine itself (Lambert, 2006).

Courting WHO recognition has brought the global emphasis on evidence-based methods home, paving the way for more centralized technologies. A recent editorial in a CCRAS-run Journal (Nesari, 2024b) advocates adopting evidence mapping, "an interactive data visualization technique" useful for synthesizing evidence to assist medical professionals, stakeholders, and policy makers in setting priorities for research to fill in the existing knowledge gaps. Three WHO-linked developments are highlighted: the focus on "evidence, data analytics, sustainability, equity, and innovation" at the WHO GTMC; the identification of the "lack of research data" as "the primary challenge" in the 2019 WHO Global Report; and the commitment to promote EBM at the global summit on traditional medicine, with emphasis on "identification of practices with potential for scientific evaluation."

While current policies aim to strengthen ISM and integrate them into public health systems, the central focus of research agenda is on producing scientific evidence, as reflected in the mission statements of the apex research bodies. For instance, the CCRAS outlines its vision as:

> To develop scientific evidence in Ayurvedic Principles, drug therapies by way of integrating ancient wisdom with modern technology and to bring Ayurveda to the people through scientific innovations related to diagnostics, preventive, promotive as well as treatment methods and also introduce scientific research for sustained availability of quality natural resources, to translate them into products and processes and in synergy with concerned organizations to introduce these innovations into public health systems (CCRAS, 2024).

Three of the four objectives in the CCRAS's mission statement emphasize scientific validation and global positioning. They include promoting national healthcare "through evidence-based Ayurvedic principles and practices," advancing "modern scientific knowledge and technology" to explore Ayurveda's "scientific treasure" using established "scientific methods," and achieving "global leadership in research for treatment and prevention of emerging lifestyle-related diseases" (CCRAS, 2024). The CCRAS policy underscores this need, stating that one of the key challenges faced by AYUSH systems is "generating scientific evidence on quality-based data, safety and efficacy of formulations/therapies and other interventions including basic principles" (CCRAS, 2018).

In January 2024, the CCRAS proposed an "innovative idea" to foster collaborative research with Ayurveda institutions and hospitals, aiming to generate "tangible evidence" of efficacy and safety through interdisciplinary methods and translate it into public health care—framed as "the need of the hour." The program was named SMART (Scope for Mainstreaming Ayurveda Research in Teaching Professionals), yet another entry to the government's ever-expanding repertoire of catchy acronyms (PIB, 2024).

Market realities: export trends, targets, and ironies

India's aspiration to expand its footprint in the global herbal market makes export performance a revealing lens to evaluate policy effectiveness. This analysis draws on two reports: the Task Force for Medicinal Plants Report (Planning Commission, 2000) and the Report on AYUSH Exports (Pathak and Agarwal, 2023), referred to as the PC and RIS[4] Reports.[5] Key points for comparison include: performance relative to targets; share in target markets (Europe and the United States); proportion of AYUSH products (medicines and herbal/food supplements) as compared to raw material (medicinal plants and extracts); and proportion of AYUSH medicines/drugs/pharmaceuticals.

4 Research and Information System for Developing Countries.

5 Although the total is inconsistent with annual export data, it offers a verifiable methodology and a comprehensive breakdown for 2021, and is frequently cited in official briefings.

The PC report noted a rise in AYUSH exports from INR 3.94 billion in 1996–97 to INR 4.47 billion in 1998–99. It set ambitious targets of INR 30 billion by 2005 and INR 100 billion by 2010, hoping to capture 10% of the then USD 60 billion global herbal market. Two decades on, exports have reached only half the target—INR 53.3 billion (USD 628.25 million, 2022–23)—with India's share at around 0.1% of the global market (estimated at USD 657.5 billion in 2020, RIS, 2021). Europe and the US were key focus regions in the PC report, with Germany identified as Europe's key market. India's growth trajectory aligns with these goals: in 2021, the US and EU accounted for 34.95 and 18.66% of AYUSH exports respectively, totalling 53.6%. Within the EU, Germany led with 40% of imports, followed by Italy (16.8%), France (10.9%), and the Netherlands (7.7%).

However, AYUSH products account for just 4.8% of US exports (USD 21 million) and 13.9% of EU exports (USD 32.7 million). Exports to the US are dominated by herbal extracts (57.3%) and medicinal and aromatic plants (MAPs) (37.9%), with only two plants—psyllium (74.6%) and turmeric (13%)—together comprising nearly the entire total. MAPs and extracts account for 58.8 and 27.3% of exports to the EU, respectively. France leads in AYUSH products (33.8%), followed by the Netherlands (13.5%), Poland (12.4%), Italy (5.01%), and Spain (5.53%). Between 2017–21, extracts and finished products grew faster than MAPs—a trend cited as evidence of "increasing acceptance of AYUSH drugs."

In reality, however, the absence of registered medicines in these markets means such products are marketed primarily as food supplements, leaving open the question of what, exactly, is being accepted. Moreover, absolute export volumes remain low. Poland, described as "an important AYUSH pharmaceuticals market," saw a 54.6% rise in exports to a mere USD 3 million. In Puranik's (2021) assessment, AYUSH export growth has been stagnant across all segments over the past decade. Nearly 80% of India's medicinal plant exports consist of just two species—psyllium and senna—driven by global demand for their dietary and phytochemical properties, not their Ayurvedic uses. While some interest has emerged in standardized herbal extracts, he notes that no meaningful export drive grounded in Ayurveda has yet borne fruit.

Taken together, these export patterns unsettle the assumed correlation between scientific advancement and global market success, laying bare a set of striking ironies. The most accessible market segments in the Global North—herbal supplements and functional foods—do not require advanced scientific inputs, as these products are not required to meet safety and efficacy standards. The primary innovation lies in reformulation and repackaging, a practice well-established in the domestic Ayurvedic pharmaceutical industry (Pordié and Gaudilliere, 2014), albeit subject to stricter quality standards. In contrast, the science-based innovation segment—herbal extracts and purified ingredients—does little to enhance the brand value of ISM, as it reduces them to generic ingredients in biomedical, cosmetic, and food industries. The framing of growth in this segment as "hopeful development" and a revenue opportunity (Pathak and Agarwal, 2023, p. xx), belies the reality that it strips AYUSH medicines of their identity, reducing them to raw materials for biomedical, cosmetic, and food industries.

These disjunctures reveal a mismatch between the state's vision for Ayurveda and its actual global performance. India's global ambitions continue to rest on the assumption that scientific legitimacy will unlock market success, yet commercial realities suggest otherwise. While India's growth trajectory in target markets aligns with policy goals—and has even surpassed China in exports to the US and EU—the broader outcomes reveal significant gaps. Not only do finished products form a negligible share of exports, but they are also largely sold as herbal supplements rather than as medicines. Moreover, in the dominant extract and raw herb categories, exports are heavily concentrated around a small number of plant ingredients. Thus, in practice, two decades of policy emphasis on scientific validation and innovation have not translated to proportional market gains.

The RIS report notes the finished product segment's underperformance as "worrying" (Pathak and Agarwal, 2023, p. 29). It nonetheless maintains hope, proposing that India could emulate China by establishing a Working Party to navigate the EU's simplified registration pathway. But with only seven products approved over a decade (Qu et al., 2022), the framing of China's export strategy as 'successful' becomes questionable. Moreover, finished products constitute only a small proportion of China's herbal exports (Chen et al., 2025). These figures sit uneasily with the perception, common in Indian policy discourse, that Chinese medicine's global success is driven primarily by a science-based strategy, and that a similar pathway holds promise for India (Kudlu and Nichter, 2019). This perception also obscures critical differences between the two, both in their trajectories of modernization and in the transnational circuits through which they have gained global presence (Kudlu and Blaikie, unpublished manuscript).

The report tacitly acknowledges the limitations of a product-centric export strategy. It notes that laws permitting CAM practice in 11 U.S. states are paving the way for broader acceptance of AYUSH systems, which could, in turn, boost exports of Ayurvedic pharmaceuticals. In other words, AYUSH's long-term export potential appears to lie in leveraging clinical pathways rather than product innovation. Thus, the most viable route to global markets requires neither scientific innovation nor validation. This adds to the growing list of ironies. Compounding this irony is the fact that the most promising region for AYUSH exports lies outside the dominant imagination of the 'global market', oriented to Euro-American geographies. The UAE, with just 9.5 million people, is India's third-largest AYUSH export destination, accounting for 5.5% of total exports. Of these, 30% are AYUSH medicines—98% Ayurvedic. The RIS report highlights the broader Middle East—including Saudi Arabia, Kuwait, and Egypt—as a major growth region, with the market valued at USD 4.52 billion in 2019 and expected to grow at a CAGR of 22.75% through 2027.

Middle Eastern markets demand a distinct approach. Ayurvedic manufacturers would not only have to distance themselves from orientalist symbolism but also adapt to region- and religion-specific regulations, such as restrictions on pork and alcohol (Pathak and Agarwal, 2023, p. 26). Though unremarkable in global trade, such accommodations have become politically charged in India, where Hindutva-led campaigns against halal practices led the State of Uttar Pradesh to ban halal-certified products (Hindustan Times, 2023). This dissonance came into sharp public focus when Patanjali Yogpeeth—a multi-billion-dollar enterprise built on Hindu symbolism and owned by yoga guru Baba Ramdev (see Khalikova, 2017)—was forced to issue a clarification. A news headline stated: "Halal certification is for our products sent to Gulf, not for meat export as some MNCs are alleging: Patanjali" (Jaiswal, 2020), inadvertently capturing the tension between domestic ideological positioning and export pragmatism.

The Middle East's emergence as a key growth hub suggests the Global South offers more accessible, if smaller, avenues for expansion, particularly for medicinal products. China's global market trajectory illustrates this: Asia, particularly East Asia, has historically accounted for the bulk of its herbal exports, supported by longstanding historical-cultural linkages (Kudlu and Nichter, 2019). These ties, including longstanding regional affinities and global Chinese communities, are further leveraged through the Belt and Road Initiative, which promotes Chinese medicine as shared heritage and a source of 'cultural power' (Kuah, 2021). The significance of cultural mediation by diaspora is visible in Ayurveda's uptake in Africa. Although Africa accounted for just 3% of AYUSH exports in 2023, countries such as Kenya (Meier zu Biesen, 2025) and South Africa have become important markets, with the latter alone making up 18.7% of AYUSH pharmaceutical exports (Pathak and Chavan, 2025).

While India seeks to emulate China's path to success in the global herbal market, AYUSH export patterns suggest that little has been done to leverage its own regional-cultural affinities. In 2023–24, South Asia and Southeast Asia accounted for just 5.5% and 4.8% of total AYUSH exports, respectively (AYUSH, 2025). Nepal is the only Asian country identified as a high-growth market in the RIS report; others—such as Thailand, Bangladesh, Vietnam, and Pakistan—are mentioned only in passing, categorized as "difficult to access" due to high tariff barriers (Pathak and Agarwal, 2023, p. 6). While historical, geopolitical and economic factors expectedly shape India's global ISM strategies, whether a racialized idea of the international—such as that noted by Zhan (2009) in the case of Chinese medicine[6]—has also played a constitutive role remains to be examined.

Governance and circulation: the evolution of competing imaginaries

The misalignment between state ambitions and global market behavior invites a deeper inquiry into the forces shaping this divergence. At first glance, it reflects tensions between top-down state imaginaries—formulated in response to a global health order centered on biomedicine—and market dynamics animated by alternative imaginaries grounded in consumer desires for wellness, holism, and non-biomedical therapeutics. A closer examination reveals three overlapping sociotechnical imaginaries that have shaped Indian state policy on traditional medicine since the colonial era: the first, emerging in the late nineteenth and early twentieth centuries, was anchored in the modernist state's self-conception as the locus of scientific rationality. In this paradigm, medicine became a domain of state governance, and traditions that failed to align with bioscience were excluded or marginalized. A second imaginary crystallized in the mid-twentieth century, as traditional medicine was incorporated into the emerging global health architecture institutionalized by the World Health Organization—even as it was being reconfigured as a biogenetic reservoir to be conserved, managed, and extracted under the sign of global biodiversity. A third imaginary, taking shape from the 1980s onward, reflects a neoliberal inflection: an articulation of technoscientific and economic logics through which traditional medicine is reconstituted as a governable, tradable commodity, subject to regulatory and scientific rationalization for integration into global markets.

Medicine as state science

The incorporation of medicine into state governance was not an inevitable outcome of scientific progress but a development shaped by the confluence of colonial political imperatives and the exigencies of epidemic crises. Until the late 19th century, European medicine in India had remained largely confined to colonial enclaves, except for smallpox vaccination, and the institutional segregation of leprosy and mental illness. This changed rapidly post-1860s, when the combined force of an interventionist public health model from Victorian Britain and advances in bacteriology worked to consolidate biomedicine as an arm of the colonial state (Arnold, 1991). Fearing marginalization, indigenous medical practitioners began mobilizing in the 1890s, aligning with the nascent nationalist movement, formalizing education, and industrializing medicine production (Leslie, 1976).

The project of revitalizing Ayurveda as part of recovering "Hindu science," rooted in orientalist legacies and animated by nationalist fervor, drew support from across the political-intellectual spectrum, including non-ISM actors like doctor-cum-Sanskritist Srinivas Murti and scientist-entrepreneur P. C. Ray (Prakash, 1999; Habib and Raina, 2005). This movement intensified from the 1910s, when colonial regulations privileging biomedicine increasingly threatened to delegitimize indigenous systems (Hardiman, 2009). The diarchic phase (1919–1939) opened space for state recognition, embedding ISM within provincial bureaucracies (Berger, 2013). In 1920, the Indian National Congress passed resolutions supporting Ayurveda and Unani. However, leading nationalists, including Nehru and Gandhi, were ambivalent—their support conditional on alignment with modern science (Hardiman, 2009, p. 278).

By the 1930s-1940s, biomedicine was firmly positioned at the center of national health planning—a stance that persisted post-independence, relegating indigenous systems to the margins (Hardiman, 2009). The consolidation of biomedicine must be understood within the broader transformation in which science became foundational to the very identity and authority of the modern state (Prakash, 1999). While modern science had its roots in early modern Europe (Gaukroger, 2008), the technoscientific vision of the state was shaped through colonial entanglements rather than imposed unilaterally (Raj, 2007). In colonial India, science became not only a tool of governance but a symbol of order and rationality. Post-independence, it was further mobilized to construct a national identity rooted in modernity, legitimacy, and developmental progress (Prakash, 1999). As Arnold (2004, p. 15) rightly observes: "science, technology and medicine were more than a colonial force. They were, and surely remain, aspects of a global hegemony; it is prodigiously difficult for states, even those as large and powerful as India, even under Jawaharlal Nehru to attain their own scientific salvation."

By the late 19th century, medicine had become closely linked to state power and imperial legitimacy—nowhere more so than in East Asia. Japan's Meiji state, fearing civilizational decline, adopted Western science wholesale, making biomedicine the sole official system by the 1870s (Arai et al., 2022). Korea followed, initially granting Korean

6 Zhan (2009, pp. 42–44) argues that "the global" is not a neutral category but a "racialized idea." As China's allegiance shifted from Sino-African solidarities to middle-class consumers in Europe and North America, "being international" became conflated with whiteness, while Africanness came to signify "undesirable kinds of internationalism" and Asian Americans came to be viewed as "not international enough."

medicine equal status until it was subordinated under Japanese rule (Park, 2006). In China, the 1911 Manchurian plague catalyzed biomedical reform. Although the late Qing state had previously shown little interest in regulating medicine, the crisis—along with mounting geopolitical pressures—prompted a shift. By 1929, China had established a Ministry of Health and banned Chinese medicine (Lei, 2014). Globally, this era cemented the perception of traditional medicine as inferior and cast biomedicine as essential to epidemic control and imperial ambition—what Lei (2014, p. 8) calls "the unprecedented alliance between sovereignty and the microscope."

Developments from the early to mid-twentieth century are key to understanding the disconnect between contemporary state narratives and global market dynamics in the ISM context. The patterns of dominance and resistance and stakeholder configurations established in this period laid the groundwork for the institutional hierarchies, regulatory structures, and epistemic tensions that unfolded over the next century (see Khan, 2006; Banerjee, 2009). In Euro-American contexts, biomedicine established its dominance through professionalization, scientific authority, and state support, relegating other medical traditions to the margins under the label of "complementary and alternative medicine" (CAM) (Saks, 2002). In Asia, the biomedicine–state nexus shaped divergent institutional futures: modernist sociotechnical imaginaries positioned traditional medicine either as a resource for modernization or as an obstacle, resulting in varied outcomes—from institutionalization to marginalization or selective scientization (Blaikie, 2022).

Contesting imaginaries

While the state shaped industrial structures, production norms, and market access, industries also exercised agency, resisting or reinterpreting official agendas (Blaikie, 2022). In Japan, the Kampo patent medicine industry survived on the margins until its post-1960s revival (Arai et al., 2022). In post-independence Korea, attempts to exclude Korean medicine were reversed by public pressure: it was reinstated in 1951 with secondary status, restored to parity in 1961, and revived in the 1970s–80s (Park, 2006; Kim, 2009). In China, the Nationalist government banned Chinese medicine in 1929, but granted legal recognition on practitioners' acceptance of an integrationist framework—albeit without state funding (Lei, 2014; Crozier, 1970). The resulting Institute of National Medicine, founded in 1931, laid the groundwork for the scientization and revival of Chinese medicine during the Mao era(Lei, 2014).

In India, a minority but influential faction of purist/traditionalist Ayurvedic practitioners successfully resisted integration, mobilizing against legislative moves that threatened their epistemic autonomy.[7] A spate of government committees formed in the 1950s and 1960s failed to build consensus (Hardiman, 2009). Eventually, student unrest in the 1950s–60s led to the adoption of a concurrent curriculum combining Ayurvedic and biomedical subjects, standardized in 1977 under the Central Council for Indian Medicine (Langford, 2002). While traditional medicine in China thrived within the state's sociotechnical imaginary, its relative exclusion in India weakened its institutional base. Traditional systems received only 2–3% of the health budget and remained marginal. Poor state support eroded Ayurveda's public standing, reducing it to a backdoor for biomedical practice (Leslie, 1989). Crozier (1970, p. 286) observes the paradox that post-1949 China, "the most militantly scientific regime in Asia, granted traditional medicine nearly everything Indian medical conservatives had long demanded: institutional backing, curricular inclusion, and legal recognition." Deprived of state support, ISM development in India shifted to the private sector, funded largely by pharmaceutical revenues.[8]

As the symbolic value of cultural nationalism declined, many stakeholder groups involved in revitalizing Ayurveda during the anticolonial movement disengaged (Kudlu, 2022). Its exclusion from the state's science and technology priorities reduced its appeal to scientists pursuing modernizing agendas. Resistance, however, emerged elsewhere. By the late 1970s, numerous voluntary (non-state) initiatives formed at the intersections of science and society, coalesced under the People's Science Movement (PSM). These spanned health, agriculture, ecology, and education, mobilizing alternative imaginaries of modernity that challenged dominant technocratic paradigms. Rejecting state-led, Euro-American science, they advocated a socially situated, dialogic science receptive to alternative knowledge forms (Prasad and Quet, 2022). These movements gained momentum in the 1980s–90s, as critiques of developmentalism by dissenting scientists and rights-based groups converged around cognitive justice in feminist, anti-development, human rights, and environmental spaces (Visvanathan, 2007). Banerjee (2009) identifies four types of community health groups engaging with traditional medicine: those combining healthcare with folk medical knowledge, those revitalizing and systematizing local traditions, and movements resisting state neglect and advocating institutional recognition. Among these, Patriotic and People-oriented Science and Technology (PPST), Lok Swasthya Parampara Samvardhan Samiti (LSPSS), and the Foundation for the Revitalisation of Local Health Traditions (FRLHT) grew to have national stature, the last two particularly important in influencing ISM policy.

Traditional medicine as global resource

Between the 1950s and 1980s, traditional medicine was shaped by two strands of the sociotechnical imaginary of "globalism," traced by Miller (2015) to the post-war emergence of UN Specialized Agencies like WHO, IMF, and the World Bank. These agencies evolved from platforms for international cooperation into expert-led institutions focused on supranational monitoring and response. The globalist imaginary redefined security—not as protection from geopolitical conflict but as management of systemic vulnerabilities within

7 For a detailed account, see Langford (2002, pp. 108–116), who traces the emergence of a sharp divide between *śuddha* (purist/traditionalist) and *miśra* (mixed/integrationist) Ayurvedic practitioners to the 1938 Bombay Medical Practitioners Act, which, by granting legal recognition only to those trained in mixed curricula, effectively marginalized practitioners educated through apprenticeship or lineage-based systems.

8 This national picture obscures significant state-level variation, with greater support for ISM and higher budgetary allocations observed in Kerala, Rajasthan, UP, Punjab, and Gujarat (Hardiman, 2009). In Kerala, most colleges were state-funded until 2000, a public pharmaceutical company was established, and a separate Directorate of Ayurveda Education was created in 2000 (Abraham 2018).

complex, interconnected systems. Science played a central role in this shift —rendering earth systems visible, measurable, and governable, reconfiguring the planet as a scientifically objectified whole. Health and environment were among the first domains restructured by this imaginary (Miller, 2015, 279). While postwar globalism imposed Eurocentric technoscience across domains, traditional medicine became a rare site where alternative imaginaries from the Global South came to mount epistemic challenges.

The first strand of the globalist imaginary emerged in the 1960s through postcolonial internationalism—particularly Pan-African efforts to broaden WHO's biomedically oriented "right to health" framework to include ancestral and intergenerational knowledge, within a broader primary health care movement (Tilley, 2021). Pordié (2010) identifies two other sources of influence operating in parallel: a 1950s WHO-UNICEF project in the Philippines that trained traditional birth attendants in biomedical protocols, and the emergence of evidence-based medicine as a global standard for evaluating therapeutic efficacy. China's integrated healthcare model was a key influence—both on early WHO approaches to traditional medicine (Pordié, 2010) and on postcolonial African health systems through Sino-African medical aid and exchange programs (Langwick, 2010). Although grounded in a Soviet-influenced model of state-led national self-reliance (Lei, 2014), and officially framed as egalitarian and revolutionary (Kadetz, 2022), Maoist healthcare policy was also shaped by the "international health episteme of biomedical expertise," institutionalized through policymakers trained in Rockefeller-Foundation-funded medical programs at Peking Union Medical College (Kadetz, 2015, p. 125-137), as well as by a Japanese-inspired approach to pharmaceutical innovation carried over from the Nationalist era (Lei, 2014).

The integrated healthcare model formalized by the World Health Assembly's 1977 resolution and the Alma-Ata Declaration of 1978—endorsed by 134 governments—called for restructuring healthcare around community networks, upholding China's barefoot doctor model as exemplar. While healers were nominally included (with rudimentary biomedical training), medicinal plants and products were brought under a bioscientific regime of governance (Pordié, 2010). Dissenting voices were sidelined, as several African countries had already adopted this approach (Ashworth and Cloatre, 2022). Political support from Russian delegates and senior Chinese officials within the WHO was also instrumental. However, by the time China's model was codified in the Alma-Ata Declaration, Mao's own barefoot doctor model and rural cooperative medical system had already begun to be dismantled (Kadetz, 2022). Across the world, the neoliberal turn of the 1980s—driven by Structural Adjustment Programs—dismantled much of the public health infrastructure prioritizing cost efficiency (Langwick, 2010).

During the 1980s, in keeping with this neoliberal logic, the WHO's focus began shifting from traditional healers to medicinal plants and herbal pharmaceuticals (Kadetz, 2015). This shift was guided by another globalist imaginary developing in parallel—that of "biodiversity," which framed the planet's biological wealth as facing "a worldwide crisis of endangerment," legitimizing global intervention in developing-world "hotspots" (Hayden, 2003, p. 52). The field of ethnopharmacology, which emerged from North American ethnobotanical engagement in the Amazon in the late 1970s, played a key role in aligning traditional medicine with this imaginary (Pordié, 2010). Although grounded in the ethos of epistemological advocacy, the framing was extractive—biogenetic resources were cast as reservoirs for conservation and bioprospecting, embedded within new market-based logics of value. Northern NGOs such as the International Union for Conservation of Nature (IUCN) and the World Resources Institute (WRI), alongside UN bodies, institutionalized this imaginary through initiatives that culminated in the 1992 Convention on Biological Diversity (CBD) (Hayden, 2003).

Contesting imaginaries

The key driver of global interest in traditional medicine was not pharmaceutical companies (see Brown, 2003, 110), but the Western counter-culture movement of the late 1960s and 1970s, which challenged science, technocratic authority, and materialism.[9] Embracing alternative lifestyles—including drug use, meditation, mysticism, and New Age spiritualities—the movement gave rise to a health imaginary that questioned the limitations of biomedicine, its standardization, and its depersonalized modes of care (Saks, 2009). Demand grew for holistic, personalized solutions lacking in conventional medicine (Cant, 2020). While grounded in the holistic heritage of native European traditions, the movement drew both material and philosophical support from Asian medical systems (Saks, 2009).

While Chinese medicine gained visibility through acupuncture, Ayurveda entered Western markets through colonial-era orientalist symbolism associated with Hinduism, gaining traction in the 1980s via the Transcendental Meditation movement as a spiritually inflected healing system (Wujastyk and Smith, 2008). "Transplanted" into Western wellness circuits, Ayurveda was rebranded as a uniquely Indian ethnomedicine, framed within a mind–body cosmology and marketed as a mass-market, spa-oriented practice centered on diet, lifestyle, *panchakarma*, and yoga (Reddy, 2002).

While the CAM resurgence facilitated the entry of Asian medicines, structural dominance of biomedicine in medical regulatory regimes created a bifurcated market of spiritual therapies and herbal products (Janes, 2002), described by Hsu (2008, p. 481) as a 'Cartesian mind–body dichotomy' separating 'spiritualized' and 'physiologized' markets. Since Asian medical systems could not enter Euro-American markets in their integral form, acupuncture served as a key conduit for Chinese herbal medicine (Kudlu and Nichter, 2019), while yoga and *panchakarma* functioned as gateways for the entry of Ayurvedic products as cosmetics and supplements (Humes, 2008).

Traditional medicine as governable commodity

In 1991, the International Cooperative Biodiversity Groups (ICBG) program was launched, funded by the US government's National Institutes of Health (NIH), National Science Foundation (NSF), and Agency for International Development (USAID) (Hayden, 2003). Coordinated pressure from the Global South during the CBD laid the formal foundation for Access and Benefit Sharing (ABS), a framework originally proposed by one of the scientists involved in crafting the biodiversity imaginary (Hayden, 2003, p. 50). Framed as

9 The conservationist ethos described earlier was shaped by this ferment, catalyzed by the activist ethnobotany of Richard Schultes and his students (Hayden, 2003).

a model for implementing ABS, the ICBG program had, by 1994, initiated several bioprospecting projects across South America and Africa. Initially hailed for forging ethical alliances between indigenous communities and pharmaceutical corporations, the projects soon became mired in allegations of biopiracy (Brown, 2003). These tensions escalated into a North–South conflict over intellectual property rights (IPR), when the World Trade Organization sought to enforce global patent standards through TRIPS (Trade-Related Aspects of Intellectual Property Rights), undermining the spirit of the CBD (Hayden, 2003).

The threat of IPR appropriation emerged just as governments across the Global South began to recognize the economic value of traditional medicine. This attention was fueled, on the one hand, by the 'green rush' for bioprospecting (Brown, 2003), and on the other, by the rapidly growing global herbal product market—then valued at $60 billion—further amplified by the 1994 U.S. Dietary Supplement Health and Education Act (DSHEA), which allowed over-the-counter sale of non-prescription herbal products without pre-market FDA approval (Wallace and Koturbash, 2024). Attracted by the booming herbal market and alarmed by the threat of IPR appropriation, countries across the Global South began to revise their regulatory frameworks to align with global market standards.

Spurred by patent disputes over turmeric, neem, and basmati rice, the Indian government sought to protect and promote ISM internationally (Kudlu, 2022). In 1995, a dedicated ISM Department was carved within the Health Ministry (later renamed AYUSH). In 1999, the Planning Commission established a Task Force to devise strategies to promote trade and conservation of medicinal plants. The first national ISM policy was formulated in 2000, and the first step towards regulating the ISM industry came with the Good Manufacturing Practices (GMP) guidelines that same year (Banerjee, 2004). In 2004, Ayurveda and Yoga were rebranded as key soft-power assets, part of the broader project of marketing Brand India to the world (Pharmexcil, 2019), reviving the colonial-era fusion of cultural and economic nationalism forged during the anticolonial movement, within a contemporary neoliberal rhetorical framework (Kudlu, 2022; Khalikova, 2017).[10]

Global regulation of herbal medicine too was gaining momentum. In 2002, the WHO launched Traditional Medicine strategy (2002–2008), promoting regulatory harmonization based on bioscientific standards (Ashworth and Cloatre, 2022). In early 2004, the EU introduced the Traditional Herbal Medicinal Products Directive (THMPD), with a seven-year transition period. Two months later, the USFDA created a separate regulatory pathway for botanical drugs. But with the promise of expanded market access came heightened regulatory scrutiny. That same year, Ayurveda appeared on the UK's list of "unscientific traditional medicines," prompting the launch of the World Ayurveda Congress (WAC) as an advocacy forum to "unite all concerned parties … to offer robust scientific support" in anticipation of "impending European legislation to bar Ayurveda" (Pharmexcil, 2019). Reports of heavy metals in exports (Saper et al., 2004) further damaged Ayurveda's reputation, triggering unease among ISM stakeholders (Kudlu, 2022).

After the EU herbal regulations took effect in April 2011, Chinese herbal medicine exports dropped by 50%. The proprietary medicine category was hit hardest, with 99% of the 10,000 previously available products banned. Urquiza-Haas and Cloatre (2022) show how the EU regulation, shaped by imaginaries of 'tradition,' redefined the scope of herbal medicine in ways that exclude industrialized Asian medical systems. The global expansion of bioscientific regulation accelerated as the WHO renewed efforts to harmonize traditional medicine (TM) through a bioscientific governance regime in its 2014–2023 TM Strategy (Ashworth and Cloatre, 2022). With expanding "regulatory globalization" (Kuo, 2015), informal distribution channels—like diaspora-based Ayurvedic markets in East Africa—face increasing restrictions from tightening national regulatory regimes (Meier zu Biesen, 2018).

By 2018, 98 WHO member states had national TM policies, 109 had regulatory laws, and 124 had implemented herbal medicine regulations (WHO, 2019). A report by Indian policy thinktank RIS portrays the WHO as a key platform through which China advanced the global legitimacy of Chinese medicine (James et al., 2020, pp. 73–74). India's USD 250 million investment in the WHO Global Traditional Medicine Centre (GTMC) reflects a strategic effort to shape international norms. Described by the WHO Director-General as a 'game changer,' the Centre aims to catalyze global research and evidence generation (Sharma, 2022). This emphasis was reinforced at the first WHO global summit on traditional medicine in 2023, and in ongoing consultations for the WHO Traditional Medicine Strategy 2025–2034 (WHO, 2024b). The inclusion of Ayurveda, Unani, and Siddha in the International Classification of Diseases (ICD-11) is another key milestone in institutional recognition. While this promises to enhance their global standing, it also evokes epistemic anxieties about imposed biomedical standardization (Shaw et al., 2022)—as seen in efforts to translate Chinese medicine diagnostics into globally legible codes (Pritzker, 2014).

Contesting imaginaries

The political-economic impact of the global health order on the ISM landscape has been well examined, with scholars noting how an already evident trend of pharmaceuticalization (Nichter, 1996; Banerjee, 2009) further intensified under its influence (Sujatha, 2011a; Pordié, 2010; Blaikie, 2019, 2025). At the same time, it prompted creative accommodations across manufacturing (Pordié and Gaudilliere, 2014; Madhavan, 2014; Kudlu, 2016), academic and clinical spaces (Bode and Payyapallimana, 2013), wellness-focused medical tourism (Warrier, 2011; Islam, 2012), subaltern medical markets (Hardiman and Mukherjee, 2012), and civil society initiatives (Banerjee, 2009; Sujatha, 2011b). A stakeholder that has re-emerged with growing influence since the 1980s is the scientist. As the project of scientization deepened, scientist-modernizers gradually came to assume a pivotal role in translation and validation. The short-lived physician-scientist program and the creation of AYUSH Distinguished Scientist Chairs illustrate efforts to institutionalize this role.

Ayurveda–Biology has emerged as one of the key platform where scientists, civil society initiatives, and Ayurvedic practitioners converge. A central actor in its institutional embedding is the Bangalore-based Transdisciplinary University (TDU), which grew out of the previously mentioned FRLHT. Founded by Darshan Shankar in 1993 with a focus

10 This development has bolstered Ayurveda at the expense of other ISM such as Siddha, Unani, and Sowa Rigpa (Weiss, 2009; Khalikova, 2018; Blaikie, 2019), as well as furthering the marginalization of non-textual traditions (Sujatha, 2011b; Girija, 2022).

on community health and biodiversity conservation, FRLHT aligned with integrationist and technoscientific imaginaries (Ganguly, 2012, 2014). It now includes an integrative medicine hospital, a laboratory hosting Ayurveda–Biology research, and an M.Sc. program (Bode, 2025). The evolution of this organization demonstrates how civil society initiatives both contest and accommodate dominant imaginaries, creating space for new ideas while also being shaped by them.

Closing reflections

What emerges from this historical trajectory is not a linear arc, but a shifting constellation of sociotechnical imaginaries that have variously positioned traditional medicine as a threat, a resource, and eventually a governable global commodity. As technoscientific and economic imaginaries converged in the decades following economic liberalization, traditional medicine was finally brought into the fold of state science—not through epistemic integration, but as a regulatory object and export asset. In choosing to prioritize access to lucrative Global North markets within ISM policy, the state has aligned itself with international regulatory regimes. Compelled to assume the role of arbiter of ISM's global legitimacy, it can only do so through the language and apparatus of science, given the constraints of the modernist ideology within which it is embedded.

However, scientization is only one among several strategies the Indian state uses to promote Ayurveda globally. In the past five years, ISM policy has entered a dynamic phase, marked by rising budgets, curriculum reforms, and the launch of the AIIA and AYUSH units in major national hospitals. Its global profile is being raised through ventures such as the WHO GTMC, overseas AYUSH chairs and information cells, and collaborations with foreign institutions (AYUSH, 2024). New trade and policy platforms—including the AYUSH Export Promotion Council and the Forum on Indian Traditional Medicine—aim to close information gaps and coordinate strategy (See AYUSH-EXCIL, 2024; James et al., 2020). The state has also begun investing in wellness infrastructure (Economic Times, 2022), positioning it as a channel for Ayurveda's global outreach (Payyapallimana and Puranik, 2021), as seen in initiatives like the AYUSH visa (PIB, 2023b). Operating in the diffuse domain of health and lifestyle, the wellness sector enables the state to engage alternative imaginaries beyond science. Understanding India's global strategy requires attention to the diverse, evolving modalities through which Ayurveda is institutionalized, promoted, and governed in an increasingly internationalized policy landscape.

Part 2: Return of the scientist-stakeholder

If China's bid to globalize traditional medicine was driven by the anxiety of "catching up with the world," India's interest in promoting the global expansion of Ayurveda was shaped by the anxiety of catching up with China, which was perceived as successful because of its "science-based model" (Kudlu and Nichter, 2019). This, along with the growing influence of ethnopharmacology (Pordié, 2010) and the emergence of new scientist-stakeholders engaging with Ayurveda (Banerjee, 2014; Ganguly, 2012), was key to the rise of technoscientific imaginaries in state policy and public discourse.

One major institutional outcome of this shift was the launch of the Golden Triangle Partnership (GTP), a flagship initiative aimed at demonstrating and advancing the scientific potential of Ayurveda. GTP's orientation, as Banerjee (2014) notes, was shaped by earlier translational efforts by scientists such as Ashoka Vaidya, though it was formally articulated and championed by Dr. R. A. Mashelkar, then Director of the Council of Scientific and Industrial Research (CSIR), India's apex scientific body. Mashelkar proposed the idea during a meeting in Chitrakoot in 2003, where he put forward the idea of a golden triangle comprising three vertices: traditional medicine, modern medicine, and modern science. The "Chitrakoot declaration" urged the government to create a "Golden Triangle Fund" (Ganguly, 2012). The initiative, developed in partnership with the Indian Council of Medical Research (ICMR) and the Ministry of AYUSH, aimed to foster convergence between Ayurveda, biomedicine, and allied sciences. Beginning in 2003–2004, over 25 projects were initiated under GTP's aegis, including identifying target therapeutic areas, molecular description of active fractions, toxicological studies, and clinical trials.

The keynote speech delivered by Mashelkar (2008) at the Second World Ayurveda Congress, themed "Ayurveda for the Future," captured the euphoric public mood of the time as well as the anxiety evoked by emerging regulatory challenges, setting the stage for ethnopharmacology's rise as the governing paradigm for Ayurveda's global future. He claimed that Ayurveda's national profile had experienced a "sea change" over the past five years, with its value as "a source of national wealth and medical expertise" finally gaining official recognition. He attributed this shift to advocacy from leading scientists and doctors persuaded of Ayurveda's potential, as well as recognition from international organizations such as the WHO. He expressed collective regret on behalf of the scientific community for neglecting traditional knowledge, a mindset he traced to the colonial period. "It is a great, great pity," he exclaimed, citing a Nobel laureate's research on the molecular basis of acupuncture: "while Western scientists probe Eastern practices, Indian research remains focused on the West's leftover problems." He called on the Indian scientific community to engage in the 'fundamental physical investigation' of Ayurveda.

Two key sources of legitimacy emerge here: 'science' and 'the world,' both crucial in securing support from a previously indifferent government. One key driver of ISM regulation was the heavy metal controversy (mentioned earlier), which had triggered alarm among global regulators and dismay within India's Ayurveda community. Mashelkar urged introspection rather than anger, emphasizing the need to enhance the scientific credibility of Ayurveda. "What we should do is put our own house in order," he said, going on to outline a path forward: encouraging clinical research, creating a comprehensive Ayurvedic pharmacopoeia, developing an effective surveillance system, conducting multi-centric trials, and establishing a strong presence in international scientific journals. "There is no point in shouting… we must have a strong presence in the world's scientific journals," he asserted.

Mashelkar's speech focused on the urgent need for scientific evidence to prove Ayurveda's efficacy "to the outside world," with the ethnopharmacological mandate at its core. However, his aspiration extended beyond validation, to elevate Ayurveda to the status of "universal medicine," a dream comparable to China's Maoist goals for

Chinese medicine (see Hsu, 2008). He envisioned India making "original contributions to the world of science" by building on Ayurveda's foundations, specifically through two frameworks: Ayurvedic Biology and Ayurgenomics.

The framework of Ayurveda–Biology emerged concretely in 2006 through a dedicated Task Force created within "A Science Initiative in Ayurveda" (ASIIA), chaired by Dr. M. Sankaran Valiathan. This initiative aimed to explore the mechanistic basis of Ayurveda's therapeutic effects using molecular tools. In his 2008 speech, Mashelkar credited Valiathan as a key visionary who inspired the initiative. Valiathan, former President of the Indian National Science Academy, is a renowned cardiac surgeon, inventor, and academic. He gained international acclaim not only for his contributions to medical education but also for inventing cost-effective surgical tools such as artificial heart valves and vascular grafts. At 65, after retiring as Vice-Chancellor of Manipal Academy of Higher Education (MAHE), he set out to study the classics of Ayurveda from a renowned senior scholar-practitioner from Kerala. This culminated in the publication of four books on Ayurveda, including a trilogy on key classics.

Now, close to two decades since the inception of Golden Triangle initiative, how far had the Ayurveda–Biology initiative progressed in advancing its vision of building scientific legitimacy for Ayurveda and generating original scientific insights from its foundations? What was its status, and how far had it fulfilled its objectives? Some answers emerged from Valiathan's own reflections on the project's accomplishments (Valiathan, 2016) and from other publications, including an interview (Joshi et al., 2023). Seeking clarity on the remaining questions, I turned to Kishor Patwardhan, a professor of Ayurveda at Banaras Hindu University. Patwardhan—an authority on Ayurvedic education and well acquainted with both Valiathan and other key researchers—helped unpack the technical stakes of the Ayurveda–Biology initiative. To pursue the questions that followed, I met Valiathan at his office in the Center for Ayurveda–Biology, MAHE.

The curious case of ayurvedic biology

"Ayurveda–Biology" was conceived as a program to use molecular and biomedical tools to investigate Ayurvedic concepts and practices, with the aim of synthesizing Ayurveda's systemic knowledge with the molecular insights of biology to extend the frontiers of health science. The idea was first articulated in a talk Valiathan delivered at the Indian National Science Academy. At the request of its President, he prepared a decadal vision document which was published by the Academy in 2006 (Valiathan, 2006). Skeptical of the reception the idea might receive, he decided to test it. He delivered talks at half a dozen leading institutions of science, technology, and medicine, and was pleasantly surprised to find the halls packed. The enthusiastic encouragement he received from distinguished figures such as cardiologist K. K. Talwar and space scientist Satish Dhawan made him hopeful about the initiative's future. To his disappointment, however, there was little interest from the Departments of Health and Science. The proposal would not have seen the light of day, he said, but for the special interest taken by R. Chidambaram, Principal Scientific Advisor to the Government of India, which led to the establishment of ASIIA. with seed funding from the Department of Science and Technology.

ASIIA initiated four projects investigating the genomic basis of *prakriti* (constitution), the effects of a classical rejuvenative, *Amalaki Rasayana*, on biomarkers in *Drosophila* and rat brains, the impact of traditional processing on the mercury-based *Rasa Sindura*, and a clinical trial of a *Panchakarma* procedure, *basti* (medicated enema), for the treatment of obesity. The studies, conducted by leading scientific institutions, resulted in publications in international journals such as *Nature Reports, Journal of Translational Medicine* and *Journal of Biosciences*. Despite these promising outcomes, the research groups discontinued their projects, leaving Valiathan disillusioned. Frustrated with the slow progress of the Task Force, Valiathan resigned from the chairmanship in 2016.

For the purpose of this analysis, the most instructive of the Ayurveda-Biology projects is an exploratory, proof-of-concept clinical trial on a *Panchakarma* procedure, published in the *Indian Journal of Medical Research*. Conducted at Poddar Hospital in Mumbai, the trial examined the physiological effects of *basti* (medicated enema), a classical Ayurvedic intervention prescribed for obesity. It was carried out by an interdisciplinary team comprising Ayurvedic clinicians, a clinical pharmacologist and an immunologist of repute.

When Valiathan first proposed the project to pharmacologist Urmila Thatte, she was highly skeptical. "Do you really think a course of enemas can produce changes in immunity?" she asked. "I cannot answer that question, but I can tell you why I believe it will," he said, explaining that he had witnessed the effects of *Panchakarma* in clinical settings—particularly in cases of polyarthritis—where he had seen dramatic reductions in inflammation within 3–4 days. With great reluctance, Thatte agreed to come on board.

The outcome was striking. Following the first enema, pro-inflammatory cytokines dropped within 48 h and remained low at 72 h. Thatte called to share the results, expressing her surprise. The treatment had produced significant changes in immunological markers—not signs of acute infection, but of chronic, low-grade inflammation associated with obesity and metabolic disorders. The findings, she conceded, suggested that Panchakarma exerted systemic immunomodulatory effects. If such changes could occur within 72 hours, its immunological basis could no longer be dismissed.

The significance of this finding, Valiathan explained, lay not in validating an Ayurvedic procedure but in posing "a challenge to conventional immunological paradigms, with implications for understanding disease pathways in a variety of metabolic disorders such as insulin resistance and hypertension, and several other non-communicable diseases." But, he added, "the sad point" was that his proposal to initiate a larger project to investigate its mechanisms found no takers. Despite the promising results, neither the Ayurvedic community nor the biomedical or scientific establishment pursued the study further.

"I have now withdrawn from all this," he said, visibly disillusioned. Hope returned about seven years ago, when the Kerala government sought his help to establish an international Ayurvedic research institute in Kannur. He was impressed that the initiative came directly from Chief Minister Pinarayi Vijayan and that it prioritized research over treatment or wellness. Taking it seriously, he proposed two centres—one for foundational research using advanced technologies, the other for clinical studies involving Ayurvedic practitioners and students. It should not become an ivory tower, he emphasized. His tone grew animated as he described the project. But this hope, too, eventually faded when the initiative failed to take off.

Despite the ASIIA's success in fostering collaborations between medical, scientific, and Ayurvedic institutions, Ayurveda–Biology remains at the margins of health science research in India (Shankar, 2021). That an initiative explicitly designed to explore the scientific basis of Ayurveda—backed by senior figures, promising results, and institutional support—failed to draw sustained attention is curious. When I asked Valiathan why, he replied, "I do not understand. This is a question you have to follow," in a quiet voice edged with frustration and lingering puzzlement.

Formulating the question: Why did Ayurveda–biology lose steam?

Although Valiathan was uncertain why the project saw limited follow-up, his reflections point to several contributing factors. The first issue was lack of quality proposals. Not a single proposal came from Ayurvedic or medical colleges, despite his efforts to publicize the initiative. Most proposals, he said, came from pharmacy colleges—95% of which were focused on phytopharmacology—and were unimaginative, lacking scientific depth. Publication and funding trends reflect this skew. A review of publications in Ayurveda journals from 2012 to 2017 found that 81% focused on plant extracts, compounds, or method development, with little shared purpose or conceptual engagement with traditional medicine (Thatte and Gogtay, 2018). A review of recent CCRAS-funded intramural projects (CCRAS, 2023) shows that, of the 57 completed projects, 10 focused on medicinal plants, 16 on pharmacology, and 22 on clinical trials using biomedical categories. Of the 161 ongoing projects, 37 center on plants, 74 on pharmaceuticals, and 31 on clinical studies focused on drug validation.

A second difficulty was retaining trained researchers: doctoral students he mentored found few opportunities to continue aligned research careers and moved to industry. This attrition undermined not just individual projects but the broader goal of institutionalizing Ayurveda–Biology. A third issue was the lack of sustained institutional support. He described the research climate as negative—lacking initiative, vision, and coordination. One particularly illustrative episode was a turf war: the Ministry of AYUSH insisted that ideas should originate from them and that they alone would conduct the research, while the Department of Science and Technology argued that ideas were worthless without scientific execution, which was their domain. Each demanded the other fund the work.

Some of these problems have also been observed by Bode (2025, pp. 17–19), who notes that structural impediments and chronic underfunding created a vicious cycle: without a research community, credible projects falter; without projects, funding and recognition remain out of reach. Although AYUSH allocations have modestly increased—from a decades-long average of 3% to around 5–6%—research funding remains critically inadequate. Shankar (2023a, p. 5) points out that the small pool of government funds is monopolized by bureaucratic bodies with weak research cultures, while extramural research remains "disgracefully" underfunded at ₹1–10 crore (USD 120,000–1.2 million) annually, calling into question the credibility of the policy narrative of promoting "science-based" Ayurveda.

Kishor Patwardhan offered a grounded assessment. Although some projects initially generated excitement, they ultimately failed to yield usable protocols, which he attributed partly to weak scientific credibility and partly to limited clinical applicability. For instance, findings of the much-hyped Ayurgenomics project, while initially promising, lacked generalizability and failed to convince mainstream scientists. Bode (2025, pp. 6–9) attributes its poor performance to epistemological incompatibility: the research reduced a qualitative Ayurvedic concept to a rating-scale model, relying on ideal constitutional types rarely found in classical texts. Although shaped by different concerns—clinical utility versus conceptual fidelity—both critiques raise questions of viability: project findings were too generalized for Ayurveda, too variable for biomedicine.

The concept of 'boundary objects' offers a useful interpretive lens for understanding why the Ayurveda–Biology projects struggled to sustain momentum. Boundary objects, in STS terms, are entities that enable collaboration across epistemic communities by being sufficiently flexible to be locally meaningful while retaining enough stability to serve as common reference points (Star and Griesemer, 1989). The availability of such objects—both conceptual and material—has been linked to the relative success of Chinese medicine in international collaborations (Brosnan et al., 2024). The Ayurveda–Biology projects appear not to have generated boundary objects effective enough to anchor and sustain collaborative work. Herbs, by contrast, have long functioned as effective boundary objects, easily assimilated into biomedical research pipelines—as Lei's (1999) seminal study of the anti-malarial Changshan demonstrates. This helps explain the dominance of pharmacological research in the Ayurvedic scientific landscape.

Not all impediments were technical. Respondents alluded to deeper social and institutional frictions: ego clashes, resentment of scientific condescension, institutional turf wars, and bureaucratic hurdles. While Valiathan did not speak directly to these, the absence of a shared vision or enabling institutional climate was implicit in his reflections. Recalling the development of the Chitra valve and blood bag, he noted, "It did not take genius—just a few Indian-trained engineers." He attributed their success to specific circumstances, shaped by institutional visions and cultures that supported focused innovation.[11]

While questions of academic freedom affect Indian science more broadly, they acquire a different resonance in the context of traditional medicine. Noting similar dynamics in the Korean context, Kim (2009) contrasts the affective frictions in a hierarchic, epistemically uneven field with the rational, dispassionate scientific collaboration idealized in STS studies. Rather than autonomous agents forging seamless networks, he finds Korean medicine professionals navigating exclusion, insecurity, and professional rivalries—encounters often marked by a pettiness reflective of their constrained positionality.

The conflicts and failures of Ayurveda–Biology collaborations also reflect deeper structural frictions—between research cultures, validation norms, and professional hierarchies—common across interdisciplinary

11 In 1974, Kerala's Chief Minister Achutha Menon invited Valiathan to establish a specialty hospital in Thiruvananthapuram, giving him the freedom and authority to shape its direction. Within four years the team had developed the Chitra-TTK mechanical heart valve. Soon after, the institute was declared an Institute of National Importance by an Act of Parliament and placed under DST. By 2012, more than 75,000 valves had been implanted, with about 1,200 produced monthly and exported. The team also developed blood bags, vascular grafts, and other devices (for details, see Joshi, 2012).

initiatives. Pickering (2011) observes that interdisciplinarity often fails: "The jigsaw pieces do not join up." He cites a British bench-to-bedside stem cell project that collapsed because of mismatched incentives, publishing norms, and diverging career logics. In the context of traditional medicine, additional challenges stem from asymmetries in scientific exchange. In Korean medicine, Kim (2009) shows that promising scientific-industrial assemblages faltered in two distinct ways during market translation: first, when complex therapeutic protocols had to be simplified into products, and second, when polyherbal formulations that did reach the product stage failed to meet biomedically defined efficacy and safety standards favoring single-compound drugs.

Among the less visible but influential currents shaping Ayurveda's aspirational scientization project are global healthcare imaginaries, which operate through national research agendas and global circuits of science, technology, and medicine. Two of them in particular have displayed remarkable persistence. One is the ethnopharmacological approach to pharmaceutical innovation, traced in Part 1 in connection with the emergence of the biodiversity imaginary. The sustenance of this imaginary—despite the waning promise of bioprospecting and entrenched disciplinary interests (Pordié, 2010)—explains the dominance of pharmacology-oriented research in ISM. The second is the imaginary of 'personalized medicine,' which has underpinned Ayurgenomics, and several of the TDU projects (Bode, 2025, p. 14). Also termed 'precision' or 'individualized medicine,' this imaginary has become a prominent driver of research agendas in global healthcare (Vegter, 2018), even as the genomic medicine it drew upon—propelled by the Human Genome Project—has delivered limited clinical benefit despite massive investment (Aarden et al., 2021).

A third imaginary, increasingly ascendant in global biomedicine, is that of "integrative medicine." Unlike the other two, this imaginary appears more concrete in its institutionalization and policy traction. It shows momentum reinforced both by India's aspiration to emulate China's model and by its growing global salience. One of the key sites of its institutionalization is the TDU, where integration extends across hospital, research, and education (Bode, 2025, pp. 10–19). TDU founder-chairman Darshan Shankar positions Ayurveda–Biology as a long-term conceptual platform for extending health science by synthesizing Ayurveda's systemic knowledge with biology's molecular perspectives. Integration, he emphasizes, must occur on equal epistemic terms, avoiding "mixopathy." Valiathan voices the same caution, as does Patwardhan, who links this apprehension to the government's historic approach of co-location and superficial mixing[12]. Patwardhan supports integration, but only if grounded in philosophical clarity within Ayurveda to avoid asymmetrical and incoherent integration. He finds AYUSH policy incongruent in simultaneously emphasizing incompatibility and promoting integration.

Does this incongruence represent yet another instance of policy misalignment, or does it raise a more fundamental question about the very relevance of the commensurability debate in the era of evidence-based medicine? Willis and White (2004) suggest that EBM, despite its limitations, offers greater flexibility to traditional systems by shifting emphasis from causal explanation—why treatments work—to outcomes—whether they work. This move lowers the demand for epistemic equivalence and enables more pragmatic engagement across medical systems. Is the translational pathway too constrained by inherited assumptions—or outdated imaginaries—about how legitimacy must be established?

The broader aim envisioned in the Golden Triangle initiative remains relevant, but without pathways that support either epistemically balanced clinical integration, as Shankar advocates, or foundational research, as Valiathan envisaged, translational efforts risk becoming scientific cul-de-sacs, reinforced by path-dependent trajectories. While the Indian government's integrationist agenda remains well-aligned with global health policy trends, its much-touted "one-nation one-health" policy remains largely on paper. Government efforts to implement have stalled amid resistance from both Ayurveda and biomedical professionals—as seen in the recent controversy over the proposed integrated degree program (Mudur, 2025). This calls for deeper investigation, but at the outset it points to a different kind of misalignment—not one arising from a lack of vision or political will, but from structural barriers posed by entrenched professional boundaries.

Scientists as epistemological advocates: resistance or reification?

In her case studies of scholars engaged in translational research, Banerjee (2014, pp. 140–141) traces a shift from passive accommodation of biomedical norms to active redefinition of clinical trials aligned with Ayurvedic principles, from validating drugs to examining processes and parameters, "possibly heading toward" Ayurveda's conceptual foundations. She attributes this to growing epistemic confidence and recognition that Ayurveda's contribution could extend beyond system boundaries—a trajectory expressed in the Ayurveda–Biology initiative. At first glance, Ayurveda–Biology projects resemble routine scientific validation, but two crucial differences stand out. First, Valiathan's investigation of the bioscientific basis of Ayurvedic theories and protocols was not aimed at validation, but at mobilizing them to advance medical science. Second, he integrated a rigorous bioscientific framework with Ayurveda's conceptual foundations in diagnosis, treatment, and drug preparation.

While larger in scope and ambition, Valiathan's project is comparable in institutional impact to that of pharmacologist Sharadini Dahanukar (Banerjee, 2014). Ayurveda–Biology forged a high-profile network connecting Ayurvedic institutions with leading biomedical research centres, bringing Ayurvedic materials and frameworks into engagement with biomedical logics through frontier technologies and research. Ayurveda–Biology has been institutionalized through degree programs at JNU (5-year integrated B.Sc.–M.Sc.) and TDU (M.Sc.). A recent thought-leadership piece identifies seven areas where Ayurveda Biology could "break the silos." (Vijay et al., 2022). In September 2024, amid heightened attention following Valiathan's passing, Ayurveda–Biology was officially recognized as a subject category in the national teaching and research fellowship entrance examination.

Bode and Shankar (2017, p. 10) view the Golden Triangle initiative as a promising step toward enhancing Ayurveda's scientific credibility, but

12 Co-location refers to the policy of posting AYUSH doctors alongside biomedical doctors in the same public health facilities. Evaluations have shown this arrangement to be largely ineffective: instead of fostering collaboration or strengthening their own systems, AYUSH doctors are often drawn into providing allopathic services, particularly in rural PHCs where biomedical doctors are absent. This undermines the credibility of AYUSH and leaves its distinct potential underutilized (see Chandra and Patwardhan 2018).

rue its failure to critically engage with the relationship between knowledge and power. The Ayurgenomics project, they argue, pursues "ever deeper layers of materiality"—from organ to cell to gene—while bypassing Ayurveda's holistic foundations. This aligns with Scheid's (2016) argument that integrating Chinese medicine with systems biology reflects the aims of reductionist biomedicine (also see Glatz, 2019). The Korean medicine experience is illustrative: neuroscientific studies validating acupuncture won international acclaim, but the omission of meridian theory to meet biomedical publication norms meant that legitimacy arrived alongside the risk of appropriation and delegitimization, dampening practitioners' initial enthusiasm (Kim, 2006b).

This paradoxical coupling of legitimization and delegitimization is embedded in the extractive logics in which traditional medicine has become enmeshed since its post-1980s emergence as a global resource. Hayden's (2003) analysis of ethnopharmacological networks shows how this unfolded in practice: 'scientist allies' who entered collaborations in the spirit of 'epistemological advocacy' became entangled in the very extractive structures they sought to resist. The terms of engagement were rarely reversed; few questioned how science itself might be transformed or unsettled by indigenous epistemologies. While scientist-stakeholders in Ayurveda have emerged from and are shaped by the same ferment, they also build on local legacies of contestation over epistemic justice, including various strands of nationalist thought, Gandhian visions of alternative science, and orientalist tropes (Visvanathan, 2007).

The element most visible in Valiathan's narrative is a combination of a nationalist impulse and a passionate belief in the promise of science, the zeitgeist of the early decades of independence. Valiathan completed his MBBS at Trivandrum in the 1950s, pursued postgraduate surgical training in the UK, and undertook advanced specialization in cardiac surgery in the United States during the 1960s (for details, see Joshi, 2012). He recalled being deeply unsettled by a Western physicist's remark at the time that "only white people were capable of doing original research in science." For a time, he admitted, he believed it himself, finding it difficult to explain India's lack of original contributions after two centuries of exposure to European medicine. This question troubled him, "became an obsession," and drove his pursuit of low-cost biomedical innovations, eventually leading to his turn toward Ayurveda (for details, see Joshi, 2012).

Valiathan's early writings lament India's limited contribution to global medical research (Valiathan, 1990, 1992, 1994, 1995). Similar sentiments surfaced in the personal narrative of Darshan Shankar, whose quest for knowledge moved beyond the elite corridors of the university. Shankar began his unconventional intellectual journey experimenting with experiential learning at Bombay University in the 1970s, following which he spent a decade in the Adivasi regions of Maharashtra. Encounters with local healers during this period set him on a lifelong engagement with local health traditions, culminating in the founding of FRLHT in 1993 (For details, see Shankar, 2023b). In Ayurveda–Biology, the distinct trajectories of Valiathan and Shankar converge, bringing together bioscientific regimes and contesting visions of epistemic justice.

Equally important in shaping Valiathan's orientation was his personal familiarity with Ayurveda: a native of Kerala, he recalled that he had "grown up in a household where Ayurveda was part of the environment," where Ayurvedic treatments, especially *panchakarma*, were part of everyday life. It was this lived experience that gave him the conviction to subject *panchakarma* to a clinical trial against scientific commonsense, much as Kim's curative experience with acupuncture led him to persist with validation experiments despite initial setbacks (Kim, 2006b). While it is important to examine scientists' work for the epistemic hierarchies they inhabit and reproduce, it is equally important to attend to individual motivations—a balance Banerjee (2014) handles with particular nuance in her case studies of scholars engaged in translational research on Ayurveda. Particularly interesting is the case of P. Rammanohar, an Ayurvedic practitioner-academic, who led the NIH-funded clinical trial on Ayurvedic treatment for rheumatoid arthritis. In discussing this trial, Banerjee (2014) engages the central question of whether such engagements reinforce or resist dominant epistemologies, noting that it balanced strategic accommodation with subversion and concluding that "the interpretation one chooses would depend on which side of the power divide one's subjectivity lies."

A key factor to be examined in unpacking this subjectivity is actors' positionality. Bioscience and Ayurvedic experts alike face epistemic stress—the strain of navigating competing knowledge systems (Brosnan and Cribb, 2019)—but the pressures differ. For scientists, engagement with traditional medicine invites skepticism from their own communities, creating pressure to "act scientific" (Polich et al., 2010). For practitioner-scholars, the challenge is balancing their grounding in Ayurveda with the demands of scientific validation, as evident in Rammanohar's return to clinical practice: "without clinical experience, I could not be a researcher true to Ayurvedic principles" (Banerjee, 2014, p. 140). Brosnan (2016) shows how Chinese medicine in Australia managed this tension through compartmentalization: academic research aligned with bioscientific norms, while pedagogical spaces preserved traditional philosophies. Chiropractic, by contrast, struggled to maintain this balance. For Ayurveda, coexistence is more fraught, owing to the entrenched institutional boundaries separating it from biomedicine.

Bioscientific and traditional pathways to legitimation coexist to address different constituencies (Cloatre and Ramas, 2019), but the former's dominance in governance tends to exclude the latter in knowledge production. Lei's (1999) seminal study shows how Chinese medicine practitioners central to developing anti-malarial *Changshan,* were excluded from the scientization process. Several such instances have been noted in Korean medicine, where pursuit of scientific legitimacy allowed pro-scientization groups to monopolize resources, marginalizing contesting groups (Kim, 2006a, 2007, 2009). As Ganguly (2014) notes, scientization has reshaped not only Ayurveda's public face but also its internal hierarchies, concentrating visibility and funding in a pro-science elite while relegating practice-based epistemologies to the margins.

Valiathan was acutely aware of this hierarchy; the enthusiastic reception his proposal received at premier scientific institutions, he said, would have been unlikely had he not been a cardiac surgeon. He was also well aware of the limitations of translational research, as were other scientists engaged with Ayurveda Biology (Bode, 2025). However, the very expertise that enables them to carve new paths also imposes significant constraints. The problems they select are shaped by their field of specialization, research designs by the biomedically-oriented publication ecosystem, and product forms acceptable to the mainstream drug regulatory regimes. These rarely align with the operational realities of the ISM context.

The multi-centred clinical trial plan Valiathan described (part of his proposal to the Kerala government), though ingeniously

integrating Ayurvedic epistemology, still operated within global scientific hierarchies. While the plan is well conceived, its resource demands, alongside institutional logistics, make its feasibility uncertain. Even a relatively simple trial under the Ayurveda–Biology mission (Thatte et al., 2015) required technology sourced internationally: radioimmunoassay kits (South Korea), biochemical kits (Austria), an automated biochemical analyzer (Italy), a Nycocard Reader (Norway), an HPLC kit (Germany), ELISA kits (California), and a hematology analyzer (Japan).

As Bode (2025) notes, despite positioning itself as distinct from twentieth-century state research, Ayurveda Biology continues to center laboratory testing as the primary site of innovation, risking a return to epistemic compromises it seeks to distance itself from. Thus, while "multiple epistemic cultures" (Brosnan, 2016) characterize the ISM ecosystem, institutional processes tend to privilege formalized, codified approaches, sidelining what Madhavan (2017) calls "below the radar" innovations—practitioner-led explorations that remain largely invisible.

While the ideological prominence of pro-science elites and state-led programs in shaping research agendas is growing, their material influence on the Ayurveda sector remains limited. As Shankar (2023a p. 4) observes, "The government annual budget can hardly impact an enterprise more than 30 times its size unless deployed strategically," pointing to the largely self-funded nature of the sector, whose turnover in 2022 was estimated at USD 12 billion. The political economy of Ayurvedic practice and production must therefore be understood not only through institutional agendas but also through less visible forms of epistemic agency, including practice-based innovations, informal clinical experimentation, and market-driven adaptations that shape the field.

The agency of invisible evidence

"We have loads of records of successful cases in the hospital!" said the Vice President of R&D at one of South India's largest Ayurvedic establishments, her brow furrowed as she puzzled over my reference to the widespread perception that evidence was lacking. "Maybe the problem is, it is not all systematized," she added, after a pause. Questions about the inadequate status of evidence are often met with ambivalent responses, reflecting uncertainty about what counts as evidence—and who is expected to furnish it. Similar responses came from D. Ramanathan, Secretary of the Kerala-based Ayurvedic Medicine Manufacturers Organization of India (AMMOI), and Vijayan Nangelil, President of Kerala's Hospital Management Association (KHMA). While all acknowledged the critical need to build an evidence base, the overflowing wards of their hospitals suggested it was not an immediate priority.

Ramanathan referred me to Bhagavathy Ammal, a senior Ayurvedic physician at Sitaram Ayurveda Speciality Hospital, who, he said, had successfully treated around 70 patients with polycystic ovary syndrome. Willing to share the records, Ammal instructed her assistants to locate the box where "the evidence" was stored. After some discussion, they realized it had been stowed in the attic during hospital renovations. Apologetically, she offered to show me the current case sheets instead. Pointing to a nearby noticeboard, covered with photos of newborns, she smiled and said, "They are my evidence!" I spent some time poring over the case sheets: they contained excruciating detail—comprehensive case histories, biomedical report summaries, Ayurvedic diagnoses, and treatment protocols, all recorded in a standardized template. Yet the wide variation across cases meant considerable effort was required to synthesize the material into a coherent evidentiary archive.

"Why do you want to answer those making noise? In my 30 years of clinical experience, no patient has asked for evidence!" remarked the principal of a Bangalore-based Ayurvedic college. This stance, however, is uncommon. In over a decade of ethnographic engagement with Ayurvedic stakeholders in Kerala, I have encountered few who dismissed the need for evidence outright. Many practitioners said they did not need evidence for themselves, but to reassure patients or counter skepticism. Overall, it seemed less a rejection of the demand for evidence than a lack of clarity around how it might be operationalized. Even those who maintained detailed case sheets lack the time, training, or resources to convert them into quantifiable or publishable forms. These responses, however, were largely incidental—emerging in the course of other conversations rather than through focused inquiry. The positions Ayurvedic stakeholders hold are varied and complex—marked by uncertainty, strategic ambiguity, and a large dose of "double-think" (Nichter, 1996)—positions that can only be parsed through deep ethnographic engagement.[13]

Kishor Patwardhan, a vocal advocate for strengthening Ayurveda's evidence base, argues that some practitioners and educators—himself included—need evidence to bolster their professional confidence. He proposes to generate real-world evidence through cost-effective observational studies (See Patwardhan, 2020). Darshan Shankar proposes an ambitious proposal—to collect ten years of retrospective data from a hundred reputed clinical establishments in both biomedicine and Ayurveda, for an impartial review of each system's clinical contributions (see Shankar, 2023a).

Former Secretary of the ISM Department, Shailaja Chandra, offers an administrator's perspective—troubled by the limited reach of effective treatments, but equally wary of "wild claims." She recalled that the ISM secretary post had been an unwelcome imposition she had tried, unsuccessfully, to dodge. Although unfamiliar and skeptical of the sector, she chose to approach it with openness—undertaking extensive field visits, engaging with practitioners, and reviewing patient records. This culminated in a voluminous report, which is by far the most comprehensive assessment of ISM to date (Chandra, 2011). Having witnessed several cases of improvement and cure, Chandra is deeply puzzled by the biomedical establishment's disinterest and unwillingness to engage. She asks, "Must beneficial treatments remain confined to word-of-mouth transmission? Can evidence be systematized without undermining the individualized protocols central to their efficacy?" To address these dilemmas, she recommends rigorous before–after observational studies that she argues could generate evidence of therapeutic efficacy without undermining practitioner logic (see Chandra, 2016, 2019).

The real obstacle, as Fan and Uretsky (2017) argue, lies less in epistemic incommensurability than in entrenched evidentiary hierarchies that privilege statistical over experiential knowledge. Conversations with Patwardhan and Chandra, among others, suggest

13 For aunt of diverse views on evidence among Ayurvedic physicians, see Mohammed (2025).

that while many uncertainties persist, the EBM framework is not considered an impediment, since it is seen as flexible enough to be applied to Ayurvedic therapeutic protocols. However, even real-world evidence requires substantial institutional resources, sustained commitment, and political will. Although not a comprehensive solution, the Ayurveda Gyan Naipunya Initiative (AGNI)—launched by CCRAS in 2023 to support practitioner-led documentation of innovative practices and foster researcher–clinician collaboration—represents a step forward (PIB, 2023a).

The structure-agency conundrum: some closing observations

Bode (2025, p. 22) suggests that the "microbiologization" of Ayurveda serves less as an epistemic translation than as a performative tactic: rendering Ayurvedic concepts into laboratory protocols and bioassays, researchers seek to make them legible to biomedical scientists, secure funding, and resist marginalization. But how exactly does this resistance operate if it remains peripheral to mainstream health policy? How should we understand the limited institutional support for the Ayurvedic Biology project, and its limited uptake within Ayurvedic institutions, given the policy emphasis on scientific validation?

In interpreting Ayurvedic practitioners' divergent responses to the 2005 WTO-mandated Patents Act, Halliburton (2011), drawing on Pickering's (1995) "mangle of practice," argues that agency in such opaque terrains—shaped by shifting legal, scientific, and institutional forces—is emergent and co-constituted by human and nonhuman actors. What appears to be inaction or apathy may instead reflect a strategic response to uncertainty and epistemic fragmentation, where conventional models of agency—premised on a clear link between action and outcome—no longer apply. While this analysis lacks comparable ethnographic depth, I use Halliburton's insights heuristically to reflect on dilemmas that arise in interpreting the disjunctures surrounding the institutionalization of Ayurveda–Biology.

Though not precisely analogous, the global market context presents a similarly indeterminate terrain: distant cultural geographies, opaque regulations, and uncertain returns. These factors make stakes difficult to assess and outcomes hard to foresee. Choosing not to invest in the science-based regulatory pathways risks incurring an opportunity cost, while prioritizing them may reinforce their dominance. The dilemmas faced by actors are rarely articulated directly but emerge through patterns of engagement, selective participation, and discursive positioning. These dynamics suggest two lines of inquiry that merit consideration: whether the muted response of Ayurvedic stakeholders reflects a strategic calculus shaped by risk, constraint, and uncertain epistemic payoff—rather than limited capacity or a principled stance against scientization; and how scientists and Ayurvedic practitioner-scholars engaged in translational research navigate competing demands of disciplinary credibility, and how personal and professional stakes shape cross-system engagement.

Revisiting the site of Halliburton's analysis reveals that, even two decades later, many of the divergent positions voiced by the respondents in his study remain relevant. At the time, the government's creation of a defensive database—the Traditional Knowledge Digital Library (TKDL)—had drawn criticism for decontextualizing knowledge (Reddy, 2006). Recent scholarship suggests the TKDL has, to some extent, challenged global power asymmetries (Fredriksson, 2021), although in retrospect, the biopiracy threat that prompted its creation now seems overstated. The IPR question continues to be unresolved (Dutfield, 2017), and the terms of database access remain contested. Shailaja Chandra describes the TKDL as a "shining star," a milestone in the history of ISM. She recalls how, with support from CSIR under R. A. Mashelkar, her ministry recruited Ayurveda scholars to extract, translate, and digitize textual material for patent examiners. However, she is critical of the decision to restrict access to patent examiners alone, arguing that without public access it risks remaining a "dead asset." The current director of TKDL, Viswajanani Sattigeri, advocates commercialization through paid access, but notes that her efforts to secure legislative change have stalled due to bureaucratic bottlenecks.

The uncertainty surrounding questions of bioscientific legitimation is further complex, as experiences of scientization projects in Chinese and Korean medicine demonstrate (Hsu, 2009; Kim, 2009; Chee, 2022). Hence, it is tempting to end with Halliburton's cautionary insight: "While we feel compelled to expose ideologies or dispel misrecognitions of social reality, the real is also recognized by acknowledging the limitations in our and our informants' abilities to read power" (2011, 98). However, unlike the IPR question, scientization of Asian medicines has a long history that has been extensively studied. Treating these processes as inscrutable risks depoliticizing them and obscuring the power struggles they embody. Moving forward, we must ask: How are visions of global market success constructed, and whom do they serve; to what extent do they reflect practitioners' realities or aspirations? Who sets the terms of translational research, and how are priorities negotiated? Which knowledge forms are privileged—and which sidelined—in aligning with bioscientific norms? How do clinicians navigate tensions between demands for standardization and everyday practice?

Grasping these layered power dynamics requires closer attention to the agents and sites through which Ayurveda's future is being imagined and enacted. This discussion offers only preliminary pointers. Pursuing the question, as Valiathan suggested, would require a wide-ranging inquiry combining policy analysis and ethnographic engagement. This would entail, first, following the money—to track institutional funding flows, project priorities, and decision-making processes—and second, sustained ethnographic attention to diverse stakeholders, ideological positions, and, most crucially, to practice. Unlike policy visions that are publicly articulated and performed, resistance tends to take routine or embodied forms that must be inferred. Although bioscientific governance shapes the global herbal market, its recalcitrant circulation paths embed the agency of diverse actors—including herbs, medicaments, processes, and illness conditions—manifested in shifting production, prescription, and usage practices.

Scheid's (2016, pp. 120–133) analysis of Chinese medicine demonstrates the limits of top-down standardization, even in an authoritarian state that systematically sought to institutionalize traditional medicine. He draws on Pickering's 'mangle of practice' to propose a model of 'emergent synthesis' for navigating the structure–agency dilemma at the heart of classical social theory. In this model, institutional structures are transformed not through overt contestation, but through incremental pressures from below—routine demands for milder drugs, faster diagnostics, or more palatable formulations. Individual acts of selection, resistance, and adaptation in clinical practice exert "tactical and

performative" agency, cumulatively generating shifts within the system. These insights hold relevance for Ayurveda, where state-led initiatives coexist with—and lag behind—the dispersed yet impactful agency of private actors. Even as policy initiatives foreground scientific validation, the cumulative weight of micro-level decisions—what is prescribed, demanded, and consumed—continues to shape Ayurveda's evolving configuration across local, national, and global scales.

Conclusion

This analysis highlights a central tension in India's global Ayurveda strategy, between the prioritization of technoscientific innovation as a pathway to global legitimacy and the divergent logics animating actual global markets. While policy narratives emphasize science-based innovation to unlock international opportunity, the most active and lucrative markets for Ayurvedic products operate largely outside those frames. This disconnect is further underscored by the stalled progress of initiatives such as the Ayurveda–Biology Mission, calling into question the assumed centrality of bioscientific credibility to Ayurveda's global expansion.

As noted earlier, the past five years have seen a range of policy efforts both in institution-building and in promoting global expansion. The impact of these initiatives will take time to become visible. But as of today, significant gaps exist between policy rhetoric and implementation. While ISM was emphasized in the 2017 National Health Policy, it was absent from the NITI Aayog Action Agenda (Shankar and Patwardhan, 2017; Vasudevan, 2021). The AYUSH budget has increased, but key budget lines and institutional priorities have remained largely unchanged since 1995, indicating an absence of transformative shifts in strategic vision or investment priorities—despite the expanding ambitions around globalization and innovation in recent policy discourse (Shankar, 2023a).

Such gaps in ISM policy implementation are also visible in the regulatory and institutional landscape governing medicinal plant cultivation and export, which remains fragmented and underdeveloped. A recent policy appraisal highlights systemic gaps across the medicinal plant value chain—from regulatory ambiguity and licensing overlaps to weak inter-ministerial coordination and export facilitation. Despite rhetorical commitments, the absence of demand–supply analysis, cultivation planning, and harmonized export codes continues to constrain India's capacity to scale its exports (Chandra and Narayana, 2023).

The emphasis on science-based innovation largely remains symbolic, with initiatives launched under high-profile banners failing to translate into sustained institutional commitment, as seen in the case of Ayurveda–Biology. A recent Task Force report on Evidence-Based Traditional Medicine notes that, despite a marked increase in allocations following the formation of a separate Ministry, funding for traditional systems remains marginal relative to the broader health sector, underscoring the need for greater institutional integration and strategic coherence (NAMS, 2023). Such disconnects between promise and delivery are not unique to ISM but reflect broader patterns across sectors, where aspirational initiatives frequently outpace structural capacity and institutional follow-through (Echeverri-Gent et al., 2021; Jeffery, 2022; Rao, 2022).

In the case of ISM, however, the difficulty of distinguishing speculative imaginaries from emergent realities is further compounded by the nature of therapeutic markets themselves, which—as Pordié (2010) argues—are shaped not only by economic demand but also by cultural values, political dynamics, and social meanings. This challenge is reinforced by the structural uncertainties of global therapeutic markets which are distant, unevenly regulated, and continually shifting. Fragmented regulation, information asymmetries, and dispersed consumer imaginaries weaken feedback loops between action and outcome. Apparent misalignment with current trends may instead reflect speculative investment in a future yet to be shaped—one in which scientific validation reconfigures global demand. China's continued emphasis on scientific advancement as a pathway to legitimacy for traditional medicine—despite limited returns—illustrates this logic of futuristic hope.

A further layer of complexity stems from the constitutive power of policy discourse itself. Aspirational narratives do not merely describe the future—they actively shape it. As Appadurai (1996) argues, imagination is a social practice through which futures are anticipated, desired, and brought into being; such narratives can precede and even create markets. Even in mainstream domains, science and technology function not only as tools of problem-solving but also as potent symbols—mobilized to envision futures, assert authority, and secure public legitimacy (Jasanoff, 2015). Associating Ayurveda with scientific standards helps counter stigma, enhance credibility, and appeal to national pride—especially for a tradition long subject to systemic marginalization (Banerjee, 2009). Scientific validation is widely regarded as essential for global legitimacy, even in countries where traditional medicine enjoys formal state support, such as China (Hsu, 2008) and South Korea (Kim, 2009).

In practice, performances of progress, however speculative, can produce real effects: drawing interest, sustaining funding, and generating momentum even in the absence of tangible results (Tsing, 2000). Though symbolically productive, the persistence of technoscientific imaginaries—despite limited alignment with market realities—raises concerns over continued investment in translational research that delivers neither commercial outcomes nor scientific innovation. This calls for a reassessment of how resources are allocated—not only in terms of market potential but also in relation to their ability to support therapeutic goals rooted in the medical traditions themselves, as scholars of Asian medicines have long argued (e.g., Nichter, 1996; Janes, 1999; Sujatha, 2011a; Pordié, 2010; Meier zu Biesen, 2025). It is therefore crucial to interrogate the structures that sustain such imaginaries: to ask whom these performances serve, and which stakeholders and epistemic frameworks they exclude or render invisible. It is equally important to understand why policy actors buy into and invest in such imaginaries. As Jasanoff and Simmet (2021) show in their study of solar transitions in India and Senegal, public performances by powerful institutions can obscure this constructedness, enabling leaders to invoke global promises while deflecting local resistance and marginalizing alternative visions.

The analytical lens of sociotechnical imaginaries helps uncover visions of desirable futures grounded in tacit assumptions about the relations between science, technology, the state, and society—assumptions that stabilize political order and animate public reasoning (Jasanoff, 2015). It also exposes the constructed nature of the global market, challenging the view of 'market forces' as objective, showing how political choices and structural imbalances among stakeholders constitute market power. Situating traditional medicine within the framework of sociotechnical imaginaries facilitates comparison with

other state-regulated domains—such as agriculture (Stone, 2022), urban governance (Coelho and Sood, 2021), energy (Jasanoff and Simmet, 2021), and climate change (Blok, 2016)—where science and economic rationality are mobilized to justify technocratic development.

Traditional medicine, however, occupies a distinct, historically embedded, and culturally coded space. Its tensions arise not from public resistance to innovation, but from the encounter between longstanding practices and emerging regulatory and knowledge frameworks—making it broadly comparable to agriculture, where technocratic state visions have clashed with traditional farming practices, as in the case of GMOs in China and India (Chen, 2015; Stone and Flachs, 2017). Codified systems like Ayurveda add another layer of complexity through the presence of organized expert groups and professional infrastructures—ranging from institutionalized pedagogies and canonical texts to manufacturing networks. Such institutional features produce distinctive stakeholder configurations and stabilize alternative knowledge claims that are not easily displaced. Moreover, the cultural power of traditional medicine—its symbolic centrality in imagining the nation—aligns with the performative functions of science and technology within the state's sociotechnical imaginaries, even as the terms of inclusion remain uneven and contested.

Data availability statement

The datasets presented in this article are not readily available because the data presented in this article are not readily available because interview and ethnographic data contain potentially sensitive personal identifiers that cannot be anonymised. As a rule in social anthropology, such data is never shared except in analysed, published form. Requests to access the datasets should be directed to ckudlu@go.wustl.edu.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/participants OR patients/participants legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

CK: Writing – original draft.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Publisher's note

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