The Epistemology of Metrics: How Quantification Shapes What Organisations Believe Is "Real" — A Cross-Cultural Analysis of Engineering and Academia

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ABSTRACT

Metrics increasingly define competence and legitimacy in engineering and academia, from chartership and licensure to rankings and citation indices. Although treated as objective, these measures vary across national, disciplinary, and institutional contexts, shaping what organisations recognise as credible knowledge and success. This paper develops a conceptual framework that positions metrics as epistemic infrastructure—systems that structure attention, identity, and organisational behaviour. Through a comparative analysis of engineering credentialing systems across the UK, Australia, the United States, and Malaysia, it identifies three distortions of quantification—compression, incentive, and legitimacy—that explain how metrics tend to reshape perceptions and actions. The Global Metric–Identity Feedback Loop is introduced to show how these distortions become self-reinforcing over time. The analysis argues that metrics act as epistemic filters, privileging certain forms of expertise while obscuring others, often favouring Western credentialing traditions. By treating metrics as situated practices rather than universal standards, the framework provides diagnostic and comparative tools for analysing evaluation systems and identifying more inclusive approaches to professional and academic assessment.

Keywords: Professional credentials; Epistemic injustice; Chartership; Quantification; Global mobility; Engineering education; Academic metrics

1. INTRODUCTION

An engineer chartered in the United Kingdom faces credential recognition barriers when seeking work in Australia. A Malaysian engineering graduate holds both local and Western credentials because neither travels well on its own. A civil engineer licensed in one US state cannot practice in another. These mobility challenges are not bureaucratic accidents — they reflect a deeper structural asymmetry in which the rules of professional recognition were written by some systems for some engineers, and the burden of adaptation falls disproportionately on those outside dominant credentialing traditions.

Quantification regimes shape professional judgment in ways rarely examined from within practice itself. Porter (1995) demonstrated how quantification serves as a technology of distance, enabling decision-making without requiring trust in persons. MacKenzie (2006) demonstrated how theoretical models actively construct the market realities they purport merely to describe — a performative dynamic that extends to the measurement systems examined in this paper. Espeland and Stevens (2008) showed how commensuration—the transformation of qualitative differences into quantitative metrics—fundamentally reshapes what organisations can see and value. Yet these insights remain largely disconnected from the daily experience of technical professionals who navigate, resist, and improvise within quantification regimes.

Across engineering and academia, metrics have become the dominant language for defining competence, success, and legitimacy (Espeland and Stevens, 2008). Professional bodies use credentials, chartership, and licensure to certify expertise (Abbott, 1988); universities depend on rankings, citation indices, and grant income to demonstrate global competitiveness (Hazelkorn, 2015). These systems appear neutral, objective, and universally applicable (Merry, 2016), yet the meaning and authority of these metrics vary dramatically across countries, disciplines, and institutional traditions — and that variation is not random. It tends to follow the contours of historical power.

This paper argues that metrics do not simply measure reality — they construct it (Espeland and Sauder, 2007). In engineering, chartership, licensure, and degree expectations differ widely across national contexts, shaping who is recognised as a "competent engineer" and what forms of expertise are valued. A parallel dynamic operates in academia, where global rankings privilege particular publication cultures and Western epistemic traditions (Hazelkorn, 2015; Shin and Toutkoushian, 2011) — a pattern extensively documented elsewhere and drawn on here for comparative purposes.

Existing research typically treats metrics as instruments of evaluation: tools designed to measure performance, competence, or quality with varying degrees of accuracy and bias (Dahler-Larsen, 2011). This paper takes a different approach. Rather than treating metrics as evaluative tools that occasionally misrepresent reality, it conceptualises them as epistemic infrastructure—systems that actively shape what organisations notice, value, and treat as legitimate (Bowker and Star, 2008). Distortion is not a failure of measurement but a predictable outcome of how quantification operates within professional and institutional systems. Crucially, these distortions tend to advantage credentialing traditions with the longest institutional histories and the greatest global reach.

This paper develops a conceptual framework for understanding metrics as epistemic infrastructure: systems that structure attention, shape identity, and guide organisational behaviour. Drawing on comparative analysis of engineering credentialing systems across the UK, Australian, US, and Malaysian contexts, and informed by practitioner experience navigating these systems across multiple jurisdictions, the framework identifies three characteristic distortions of quantification — compression, incentive, and legitimacy — and introduces the Global Metric–Identity Feedback Loop to explain how these distortions become self-reinforcing through use.

2. THEORETICAL BACKGROUND

The analysis builds on three intersecting literatures: the sociology of quantification, the sociology of professions, and the politics of the knowledge system (Desrosières, 2011) — all of which reveal how metrics actively construct what organisations recognise as "real" expertise rather than simply measuring it.

2.1 Quantification as an Organisational Practice

Numbers carry authority (Porter, 1995). As Porter demonstrates, quantification offers organisations a technology for making decisions that appear objective, even when the underlying judgments are deeply situated. Metrics promise comparability across contexts, standardisation across differences, and accountability without the messiness of local knowledge (Merry, 2016). In technical fields like engineering and academia, this promise is particularly seductive because both domains value precision, demonstrable evidence, and universal standards.

In engineering credentialing, Porter's (1995) technology of distance operates with particular clarity. When a global engineering firm accepts CEng status as proof of competence without directly assessing the individual, it is doing precisely what Porter describes: substituting quantified credentials for personal trust. The chartered engineer becomes legible at a distance — their decades of contextual experience, tacit judgment, and discipline-specific expertise compressed into a single recognised indicator. This compression enables decisions to be made quickly and consistently across organisational boundaries, but it does so by privileging credentials over practitioners. The same dynamic operates in reverse for engineers whose credentials are not recognised: they become illegible not because their competence is absent, but because it has not been encoded in a form the system can read. Distance, in Porter's terms, is not neutral — it tends to advantage those whose expertise has already been rendered quantifiable within dominant credentialing traditions.

2.2 Epistemic Authority and Professional Legitimacy

Professional credentials function as "jurisdictional claims" — public assertions of exclusive competence within a domain of work (Abbott, 1988). Chartership in engineering, licensure in regulated industries, and advanced degrees in academia all serve similar purposes: they signal that someone possesses legitimate expertise and should be trusted with consequential decisions.

But these credentials do more than signal existing competence — they actively construct what counts as competence in the first place. Credentialing systems function as "market closure" strategies, creating artificial scarcity by defining some forms of knowledge as legitimate while excluding others (Larson, 2020). This is not necessarily malicious; professional bodies argue they are protecting public safety and maintaining standards. But the effect is the same: systematic filtering that advantages some forms of expertise while marginalising others.

What Larson's market closure argument does not fully capture is the political process through which the boundaries of legitimate competence are drawn in the first place. This is where Desrosières (2011) becomes essential. For Desrosières, statistical categories and classificatory systems do not describe pre-existing realities — they help constitute them through processes of negotiation, struggle, and institutional settlement. The criteria that define a chartered engineer, the competency frameworks that underpin licensure, the accreditation standards that determine which degrees count — none of these emerged from neutral technical deliberation. They were fought over by professional bodies, universities, industry representatives, and regulatory authorities, each with interests in how the boundaries were drawn. Once settled, these categories acquire the appearance of objectivity and inevitability, obscuring the political choices embedded within them. Understanding credentialing systems as outcomes of historical struggle rather than technical solutions helps explain their resistance to reform: challenging a metric means challenging the settlement that produced it.

2.3 Global Diversity in Professional and Academic Systems

Professional and academic credentialing systems vary dramatically across national contexts, yet global metrics increasingly claim universal authority. UK chartership emphasises peer-reviewed professional competence; Australian registration prioritises legal accountability; US licensure combines examination-based assessment with jurisdictional restriction; Malaysian credentials blend post-colonial professional structures with local adaptation (Engineering Council UK, 2020; Engineers Australia, 2019; NCEES, 2023; REA, 1967). These differences reflect what Faulconbridge and Muzio (2012) call the "situated" nature of professional work — the ways expertise is always embedded in institutional, legal, and cultural contexts. Global mobility demands that these situated forms of expertise be made comparable and legible across borders, producing what this paper terms "credential translation friction" — the labour required to make one jurisdiction's proof of competence intelligible to another's gatekeepers. Table 2 maps these variations across seven representative systems.

2.4 Metrics as Cultural Artefacts

Metrics are often presented as culturally neutral, but they are profoundly cultural. Every classification system embeds values, assumptions, and power relations (Bowker and Star, 2008). The prominence of chartership in UK engineering, the emphasis on licensure in the US, and the growing importance of PhD credentials in global engineering each reflect specific institutional histories rather than natural categories — each is a historical artefact of professional politics.

The danger is not that metrics exist but that they are naturalised — treated as reflecting reality rather than constructing it. When metrics gain “mechanical objectivity,” they become resistant to challenge (Porter, 1995). But naturalisation is not simply a cognitive phenomenon — it is also a political accomplishment. Metrics are actively defended by the actors and institutions whose authority depends on them. Professional bodies invest in the legitimacy of their credentialing frameworks because those frameworks define their jurisdiction. Engineering firms that have built hiring pipelines around recognised credentials have organisational incentives to maintain the current system rather than question it. Once a metric becomes institutionally embedded, the cost of challenging it falls on those least able to bear it — typically those outside the dominant credentialing tradition whose expertise the metric was never designed to capture. Resistance is possible, but it is structurally expensive.

2.5 The Need for a Cross-Cultural, Cross-Disciplinary Lens

Existing research tends to examine engineering credentials or academic metrics in isolation. This paper addresses that gap by developing a framework that identifies three systematic distortions produced by metric-based evaluation — compression, incentive, and legitimacy — that reflect fundamental tensions in how organisations standardise judgment about expertise (Dahler-Larsen, 2011).

A reasonable alternative framing would draw on the sociology of standards (Busch, 2011; Lampland and Star, 2009; Timmermans and Epstein, 2010), which examines how organisations and professions are shaped by conformity to formal models. Standards and metrics overlap substantially — credentialing frameworks operate simultaneously as standardising and quantifying instruments — but they are not identical. A competence framework can standardise without quantifying, and a citation index can quantify without imposing a single behavioural standard. This paper foregrounds quantification because the three distortions identified here — compression, incentive, and legitimacy — operate through the specifically numerical and categorising properties of metric systems. Compression requires reduction to an indicator; legitimacy distortion depends on the mechanical objectivity that numbers carry. The standards lens illuminates adjacent dynamics, but quantification is the analytic that captures the mechanisms central to this paper’s argument.

Documenting non-equivalence across credentialing systems is descriptive; the framework developed here explains why non-equivalence persists. Legitimacy distortion operating through institutional accretion across procurement, insurance, and liability frameworks makes the dominant credentialing tradition self-reinforcing in ways that diversity-of-systems framings, however thorough, cannot capture.

2.6 A Note on Methodology

This paper develops a conceptual framework rather than reporting empirical findings, and its methodology reflects that purpose. The comparative analysis of engineering credentialing systems draws on published professional body frameworks, accreditation documentation, and policy instruments across four primary jurisdictions — the United Kingdom, Australia, the United States, and Malaysia — including the Engineering Council UK's UK-SPEC (2020), Engineers Australia's Chartered Status framework (2019), the NCEES Licensure Guide (2023), alongside Washington Accord and EUR ING framework documentation. This documentary analysis is informed throughout by the author's 25 years of professional engineering practice across UK, Australian, and Malaysian contexts, and by sustained engagement with engineering education across international university environments, including contexts in the Asia-Pacific region where global metric pressures operate with particular intensity. Following established practice in conceptual framework development (Jaakkola, 2020; Recker, 2013), the framework is offered as a generative analytical tool rather than an exhaustive account, and its propositions are intended to guide future empirical investigation. The author's practitioner positionality is treated here not as a source of bias to be neutralised but as a form of situated knowledge — the kind of insider perspective Haraway (1988) argues provides epistemic access to dynamics invisible from more distanced analytical positions.

3. METRICS AS EPISTEMIC FILTERS

An epistemic filter refers to the mechanism through which metrics selectively highlight certain forms of expertise, achievement, or institutional performance while rendering others less visible or entirely illegible. Unlike commensuration (which focuses on converting qualities into quantities) or audit culture (which emphasises surveillance and accountability), epistemic filtering captures the cognitive and organisational consequences of quantification: what becomes thinkable, comparable, and actionable once a metric is adopted (Espeland and Stevens, 2008; Power, 2013).

3.1 Engineering: How Metrics Define Competence Across Contexts

Engineering competence is assessed through quantifiable indicators — chartership, licensure, postgraduate qualifications, years of experience — but these indicators carry fundamentally different meanings across national and disciplinary contexts. In the United Kingdom, chartership is widely regarded as a hallmark of professional maturity, reflecting a tradition of peer-reviewed recognition in which competence is assessed through narrative evidence and professional interview (Engineering Council UK, 2020). In the United States, licensure is tied to legal accountability and varies by state and discipline: civil engineering is tightly regulated while software engineering remains largely unregulated, producing different credentialing logics within a single national system (NCEES, 2023). In Australia, chartership exists but is not universally required, and industry experience often carries greater epistemic weight than formal credentials (Engineers Australia, 2019).

Postgraduate qualifications operate as a further layer of credentialing whose meaning is equally context-dependent. In some engineering cultures, a master's degree or PhD is considered essential for senior technical roles; in others, practical experience is valued more highly (Beagon and Bowe, 2023; Downey and Lucena, 2004). A postgraduate qualification is not a universal indicator of capability but a signal whose meaning depends on context — one that can compound credential asymmetries when engineers from non-Western contexts are expected to hold both local and Western postgraduate credentials for equivalent recognition.

The same credential can signal technical competence in one context, regulatory compliance in another, and optional professional development in a third. This filtering effect tends to fall unevenly across national contexts. Engineers from credential-intensive Western systems tend to find their qualifications recognised more readily in global labour markets than those from experience-based or post-colonial systems, not because their competence is greater but because their credentials are encoded in forms that dominant metric systems can read. Credential expectations also vary along an implicit hierarchy between operationally-focused and intellectually-oriented work (Freidson, 2001) — postgraduate qualifications are expected in a growing number of emerging technology disciplines while extensive experience may carry greater weight in hands-on operational roles.

3.2 Academia: A Parallel Dynamic

A structurally similar filtering effect operates in academic evaluation. Global university rankings — particularly the QS World University Rankings, Times Higher Education, and the Shanghai Academic Ranking of World Universities — rely on citation indices, publication volume in indexed journals, international faculty and student ratios, and research income, privileging disciplines, publication cultures, and institutional traditions aligned with Western research-intensive universities (Hazelkorn, 2015). Teaching quality, community engagement, and locally grounded scholarship remain largely unmeasurable within these frameworks, producing a systematic disadvantage for institutions whose missions are defined by those contributions rather than research output. At the individual level, h-index scores, journal impact factors, and grant income have become proxies for scholarly worth regardless of whether they capture the forms of contribution most valued in specific disciplines or contexts (Hicks et al., 2015). National research assessment frameworks — the UK's Research Excellence Framework, Australia's Excellence in Research for Australia, and equivalent systems elsewhere — compound this further by concentrating resources and reputational capital in ways that reshape institutional priorities regardless of whether those priorities align with educational mission. The reactivity dynamic identified by Espeland and Sauder (2016) — whereby metrics change the behaviours they purport to measure — is extensively documented in this literature and is referenced at relevant points in the analysis that follows. This paper draws on these dynamics for comparative purposes; the primary analysis concerns engineering credentialing, where the practitioner perspective developed here provides analytical purchase unavailable from within the higher education literature alone.

3.3 The Filtering Effect of Global Metrics

When metrics travel globally — whether chartership frameworks, licensure standards, or university rankings — they encounter diverse institutional logics. Organisations interpret the same metric through their own cultural and regulatory lenses, which helps explain why harmonisation efforts often encounter friction and why engineers can experience markedly different expectations when moving across borders. The three distortions identified below provide the analytical vocabulary for understanding how epistemic filtering operates in practice.

Table 1. The Three Distortions of Quantification: Mechanisms, Manifestations, and Consequences

Distortion	Mechanism	Engineering Credentials Manifestation	Academic Evaluation Manifestation	Consequence for Mobility and Recognition
Compression	Complex, multidimensional competence reduced to a single numerical or categorical indicator	Chartership and licensure condense decades of professional development into a binary credential status	Citation counts and rankings condense diverse scholarly contribution into single numerical indicators	Tacit knowledge, contextual expertise, and experiential skill become organisationally invisible; engineers and scholars optimise for the metric rather than the practice
Incentive	Metrics reshape the behaviours and priorities they are designed to measure	Engineers pursue chartership or licensure primarily because credentials are required for promotion or global mobility, regardless of whether the credential reflects the most relevant expertise	Academics prioritise publication volume and grant income over mentoring, teaching, and applied research	Behaviour aligns to system visibility rather than substantive practice quality; non-measurable but essential work is systematically undervalued
Legitimacy	Metrics acquire authority through apparent objectivity, enabling them to substitute for professional judgement	Credential checklists replace contextual assessment of capability; engineers from non-recognised systems must re-prove competence regardless of actual expertise	Ranking position and citation metrics justify strategic institutional decisions including hiring, restructuring, and resource allocation	Trust shifts from people and contextual knowledge to systems and indicators; metric authority becomes self-reinforcing and resistant to challenge

Table 2. Cross-National Variation in Engineering Credential Systems

Region/Country	Dominant Credential Signals	Regulatory Force	Underlying Institutional Logic	International Credential Mobility	Post-Colonial Legacy	Dual Credential Burden	Reform and Harmonisation Frameworks	Key Citations
UK	CEng, accredited degrees (UK-SPEC)	Professional self-regulation via Engineering Council	Peer review of competence and professional maturity; narrative evidence and interview	High within Commonwealth; moderate elsewhere; high symbolic weight in former colonial contexts	UK frameworks exported during colonial period; retain disproportionate prestige in post-colonial contexts	Low — CEng broadly recognised; minimal re-credentialing required within Commonwealth-aligned systems	Washington Accord signatory (founding 1989); EUR ING available; bilateral recognition with Australia, New Zealand, Canada, Ireland	Engineering Council UK (2020); Faulconbridge & Muzio (2012)
US	PE (state-level), ABET-accredited degrees	State-level statutory regulation; variable by discipline	Legal accountability and public safety; examination-based assessment	Very low — state-by-state fragmentation; PE in one state does not confer practice rights in another; engineers entering US must re-sit examinations	Minimal direct colonial credential export; US frameworks influence global engineering education through ABET international accreditation programmes	Moderate to high — PE not recognised outside US	Washington Accord signatory (1989); NCEES reciprocity agreements between some states; limited international bilateral recognition	NCEES (2023)
Australia	Degrees + optional CPEng; Stage 1 competency assessment	Light statutory regulation; Engineers Australia as professional body; state-by-state variation in mandatory registration	Capability demonstration and professional visibility; hybrid between UK peer-review and less regulated systems	Moderate — CPEng recognised in New Zealand and partially in UK; Washington Accord facilitates academic recognition; state fragmentation creates internal mobility barriers	Derived from UK model; retains Commonwealth alignment; less post-colonial credential export than UK	Low to moderate — CPEng holders have reasonable Commonwealth mobility; engineers from non-aligned systems face re-assessment including practical testing for electrical engineers	Washington Accord signatory (1989); Trans-Tasman Mutual Recognition with New Zealand; partial alignment with UK	Engineers Australia (2019); Energy Safe Victoria (n.d.)
New Zealand	Degrees + optional CPEng; Chartered Professional Engineer	Professional body recognition via Engineering New Zealand	Peer trust and competence assessment; aligned with Australian model	Low friction with Australia and UK; moderate internationally	Similar derivation to Australian system from UK model; minimal independent post-colonial credential export	Low — strong Trans-Tasman alignment reduces burden	Washington Accord signatory; Trans-Tasman Mutual Recognition Act; partial UK alignment	Washington Accord (2024)

Region/Country	Dominant Credential Signals	Regulatory Force	Underlying Institutional Logic	International Credential Mobility	Post-Colonial Legacy	Dual Credential Burden	Reform and Harmonisation Frameworks	Key Citations
EU/Continental Europe	National degrees + EUR ING (optional); Bologna Process harmonised degrees	Variable national regulation; mix of statutory and professional body frameworks	Vocational pathways (DACH); elite education model (France); trust-based systems (Nordics); Bologna Process partial harmonisation	Moderate within EU; moderate friction outside EU; EUR ING portable but not widely required	French and Dutch colonial legacy creates credential asymmetry in Francophone African contexts; DACH systems less implicated	Moderate — Bologna Process reduces intra-EU burden; engineers moving to Anglophone systems often face re-assessment	Bologna Process (EU harmonisation); EUR ING framework (FEANI); Washington Accord (some national signatories)	FEANI (2020); Faulconbridge & Muzio (2012)
Malaysia	*Registration of Engineers Act 1967* (Malaysia) registration + IR (Ingenieur) title; Washington Accord accredited degrees; Western credentials increasingly required for interntl projects	Hybrid: Board of Engineers Malaysia (statutory) + voluntary professional body registration	Local credentials establish domestic legal legitimacy; Western credentials associated with international project eligibility; post-colonial professional structure retains strong UK influence	Low internationally — REA registration not recognised outside Malaysia; Washington Accord accreditation aids graduate recognition but not practice rights	Direct British colonial legacy — UK model transplanted during colonial period; CEng retains disproportionate prestige; local credentials insufficient for international mobility	High — engineers on international projects routinely hold REA registration plus CPEng or CEng; credential burden falls disproportionately on practitioners seeking cross-border mobility	Washington Accord signatory; partial UK alignment; ASEAN Engineering Register (regional register, limited uptake)	REA (1967) Faulconbridge & Muzio (2012); Washington Accord (2024)
Post-colonial systems (Southeast Asia, South Asia, Sub-Saharan Africa)	Local professional registration + Western credentials (dual requirement pattern common in internationally mobile practice)	Hybrid colonial legacy + emerging national regulation; varying statutory force	Western credentials often carry greater prestige and project eligibility than local credentials in international contexts; local credentials legally necessary for domestic practice	Low to very low internationally — local credentials rarely travel; Western credentials required for international project eligibility but costly and administratively burdensome	Direct colonial legacy in most cases — professional frameworks established under British, French, or Dutch colonial administration; Western credentials retain structural advtge	High to very high — dual credential requirement common; financial cost falls disproportionately on individuals; government sponsorship is exception not rule	Washington Accord: South Africa full signatory (ECSA, 1999); Nigeria provisional (COREN, 2023); most Sub-Saharan Africa has no coverage; ASEAN Engineering Register (Southeast Asia only)	Faulconbridge & Muzio (2012); Washington Accord (2024)

Sources: Professional body frameworks (Engineering Council UK, 2020; NCEES, 2023; Engineers Australia, 2019; REA 1967; FEANI, 2020), accreditation documentation (Washington Accord, 2024; EUR ING framework; Bologna Process documentation), and the author's professional experience across UK, Australian, and Malaysian engineering contexts. The post-colonial systems row represents an analytical simplification across diverse national contexts and should be read as identifying a structural pattern rather than describing any specific national system in detail. International credential mobility ratings represent analytical assessments based on documented recognition frameworks and professional body policies rather than empirical measurement, and should be read as directional characterisations rather than empirical scores. Washington Accord covers academic programme accreditation and recognition of graduates for entry to professional practice; it does not directly confer practice rights or licensure, which remain subject to national and state-level regulatory requirements.

4. THE THREE DISTORTIONS OF QUANTIFICATION

4.1 The Compression Distortion: Reducing Complexity to a Single Indicator

Metrics compress rich, multidimensional realities into simplified numerical forms (Porter, 1995). This compression is necessary for comparison and decision-making at scale, but it operates by making certain forms of knowledge visible while rendering others structurally illegible. The question is not whether compression occurs — it always does — but whose expertise bears the cost.

In engineering credentialing, compression distortion is most visible in chartership. The process of becoming a Chartered Engineer in the UK requires demonstrating technical competence, ethical reasoning, communication ability, leadership, and sustained professional development — a multidimensional portfolio assessed through narrative evidence and professional interview. Yet once awarded, all that complexity is compressed into a single binary status: chartered or not. The richness of what the credential represents is organisationally invisible; what travels across institutional and national boundaries is the label. Licensure operates similarly. The Professional Engineer examination in the United States reduces diverse engineering competencies into a standardised assessment designed primarily for civil engineering contexts — a petrochemical engineer and a bridge designer sit the same framework, their distinct expertise compressed into a comparable score. Postgraduate qualifications introduce a further layer of compression: a PhD from a research-intensive university and a practice-based master's degree both produce the credential "postgraduate qualified," regardless of the substantially different forms of knowledge and capability they represent (Beagon and Bowe, 2023; Downey and Lucena, 2004).

When credentialing systems compress complex capability into binary indicators, tacit knowledge, contextual judgment, and experiential skill become structurally invisible — not because they are absent but because they have not been encoded in a form the metric can read. In global labour markets that rely on credential recognition rather than direct assessment, that gap can have significant career consequences. A parallel dynamic operates in academic evaluation — extensively documented in the existing literature (Espeland and Sauder, 2016; Hicks et al., 2015) and drawn on here for comparative purposes.

4.2 The Incentive Distortion: Metrics Shape Behaviour in Predictable Ways

Metrics do not simply measure performance — they reshape the decisions, strategies, and career trajectories of those subject to them (Espeland and Sauder, 2007). When organisations adopt numerical indicators as proxies for competence, individuals respond not by maximising their actual expertise but by maximising their visibility to the metric — aligning behaviour with what the system can see and reward rather than with what the work requires (Campbell, 1979). In engineering credentialing, this dynamic produces strategic distortions that are rational responses to the metric landscape rather than failures of professional commitment.

The choice between chartership and doctoral qualification illustrates this mechanism directly. For a mobile practitioner, the PhD offers a strategically superior metric profile — generating publications, citations, institutional affiliation, and cross-sector visibility that travel regardless of where the practitioner is based. Chartership, while rigorous and professionally meaningful within its jurisdiction, remains largely illegible outside engineering procurement contexts. For a practitioner with fifteen years of industry experience, the decision is not about which pathway better develops expertise — both are onerous — but about which produces credentials that the broadest range of metric systems can read. One can observe this calculation in career strategies that privilege doctoral qualification as a more portable cross-sector signal than chartered status.

Engineering organisations actively market chartership to industry clients as a quality signal — it appears in tender documents and contract requirements (Engineering Council UK, n.d.). But the process is structurally designed around career stability: it assumes access to mentors, sponsors, and professional reviewers who know the practitioner's work over time — an infrastructure that must be rebuilt with each jurisdictional transition. The documentation burden compounds this: evidence of past work required for chartership often does not cross jurisdictional boundaries, with databases, supervisory hierarchies, and professional review systems operating in ways that are not mutually legible across national contexts (Energy Safe Victoria, n.d.). The credential that purports to reward competence actually rewards a particular career pattern — the stable, single-jurisdiction, mentored career — and can structurally disadvantage engineers from post-colonial contexts, where cross-jurisdictional mobility is a structural necessity rather than a lifestyle choice.

These divergent incentives are predictable consequences of a metric system designed within a particular kind of engineering career, now applied to an internationally mobile workforce. A parallel dynamic in academic evaluation has been extensively documented (Marginson, 2019); it is referenced here for comparison only.

4.3 The Legitimacy Distortion: Metrics Gain Authority Simply by Being Quantitative

Of the three distortions, legitimacy distortion is the most insidious because it operates largely without detection. As Porter (1995) demonstrates, quantification acquires mechanical objectivity — an authority that derives not from accuracy but from the appearance of impartiality. Numbers do not appear to favour anyone. That appearance is the distortion.

In engineering credentialing, legitimacy distortion manifests most clearly in how credential checklists displace professional judgement. When a global engineering firm requires CEng or PE status as a hiring prerequisite, it is substituting a quantified proxy for the more difficult, more contextual, and more expensive work of actual capability assessment. The credential carries institutional authority — awarded by a recognised professional body, meeting a documented standard — and that authority is treated as sufficient regardless of whether it reflects the competence required. An engineer with thirty years of relevant experience but no chartered status becomes organisationally illegible, while a recently chartered engineer with narrower experience becomes organisationally legible. The credential has not measured competence — it has replaced the assessment of it.

This substitution is particularly consequential for engineers moving across jurisdictions. The burden of proof falls entirely on the individual, not on the system. Engineers from post-colonial credential systems often face this most acutely: their local credentials carry domestic legitimacy but may lack the institutional authority Western credentialing bodies have accumulated through decades of global standard-setting. They are not assessed as less competent — they are assessed as less legible, which the system treats as the same thing.

The same substitution dynamic operates in academia, where ranking position and citation metrics justify institutional decisions about hiring, promotion, and resource allocation regardless of whether those metrics accurately capture the scholarly contribution being evaluated (Espeland and Sauder, 2016) — a pattern well-documented in the higher education literature and noted here for comparative purposes only.

The Engineering Council's own employer-facing documentation illustrates this dynamic with clarity: professional registration is marketed not primarily as a mechanism for assessing competence but as a means of winning business, with chartership explicitly positioned as satisfying client tender requirements for evidence of engineering competence (Engineering Council UK, n.d.). The credential's institutional reach extends further still — ICE members are required to hold appropriate professional indemnity insurance, and many engineering contracts require bidders to demonstrate both PI cover and professionally registered personnel (ICE, 2017). Across procurement, insurance, and liability frameworks, the same credential simultaneously performs the work of commercial signalling, financial risk management, and legal accountability — none of these systems explicitly framing itself as defining legitimate engineering expertise, yet all collectively producing precisely that effect. This is a legitimacy distortion operating through institutional infrastructure rather than deliberate design: the credential has not been imposed as an epistemic authority but has become one through accretion across parallel institutional systems, each reinforcing the others without any single actor intending the cumulative outcome.

Legitimacy distortion resists challenge in a way the other two distortions do not. Compression distortion can, in principle, be countered by supplementary evidence. Incentive distortion can be partially mitigated by organisational awareness of metric gaming. But legitimacy distortion requires questioning the objectivity of the system itself — and as Desrosières (2011) argues, once statistical categories acquire the status of settled institutional facts, the political choices embedded in their construction become invisible.

4.4 The Three Distortions in Combination

Compression, incentive, and legitimacy distortions do not operate independently. Compression determines what becomes visible. Incentive distortion shapes how individuals and organisations respond to what is visible. Legitimacy distortion stabilises these responses by granting metrics an aura of objectivity that makes them resistant to challenge. Together they create the conditions for metrics to become self-reinforcing: each distortion amplifies the others, and all three compound over time through the dynamic captured in the Global Metric–Identity Feedback Loop introduced in the following section.

Table 1 summarises the three distortions, their mechanisms, and their consequences. Their underlying logic is consistent: metrics simplify, metrics incentivise alignment, and metrics acquire authority — tending to advantage forms of expertise already legible within dominant credentialing traditions.

4.5 A Worked Example: UK-Chartered Electrical Engineers Relocating to Australia

To make the framework's joint operation concrete, consider a recurrent pattern in the international engineering labour market. The dynamic described above is visible with particular clarity in the relocation of UK-chartered electrical engineers to Australia — a movement within the Western credentialing tradition, between two systems that are both Washington Accord signatories and both deeply rooted in the same professional lineage, yet Australia is itself internally fragmented into eight state and territory licensing regimes. The friction is therefore not primarily about epistemic distance between fundamentally different traditions; it is about how a particular form of credential recognition has become institutionally embedded.

A UK electrical engineer with CEng status and fifteen years of industry experience arriving in Australia encounters a credential landscape that does not directly recognise their qualifications for licensed electrical work. Each Australian state and territory operates its own electrical worker licensing regime through a separate regulator with its own competency requirements (Energy Safe Victoria, n.d.; Engineers Australia, 2023, 2019). Australian-licensed electrical workers move between most of these systems through the Automatic Mutual Recognition framework introduced by the *Mutual Recognition Amendment Act (2021)* (Cth), which amended the *Mutual Recognition Act (1992)* (Cth), with Queensland the sole jurisdiction not participating in the scheme. But this framework operates only between Australian state licences. UK qualifications do not trigger it. An engineer with CEng status must enter the Australian system through one state's full licensing pathway — qualification assessment, supervised hours, and practical examination under that state's regulator — before mutual recognition becomes available to them at all. CEng is not a substitute. CPEng recognition pathways may open design and consulting work, but CPEng too requires active application and assessment, and does not itself authorise hands-on electrical work in any state. The compression distortion operates here in textbook form, but asymmetrically: Australian-licensed engineers experience credential mobility within a relatively efficient internal market, while internationally trained engineers face a hard wall at first entry that has no relationship to their underlying competence. The same metric system that *enables* mobility for those already inside it *constrains* mobility for those approaching it from outside.

The incentive distortion shapes how engineers respond, and the response is not uniform. Observed patterns vary along lines that closely track financial resources rather than professional capability. Engineers whose parent company sponsors the relocation typically accept the supervised hours and assessment costs, treating re-licensing as a project expense — and often choose the state of entry strategically, prioritising jurisdictions inside the Automatic Mutual Recognition scheme so that subsequent interstate work becomes administratively cheaper. Engineers relocating without sponsorship more often reposition into adjacent roles — design consultancy, project management, technical advisory — where the licence is not required, accepting a narrowing of scope to preserve income. A third pattern is exit from hands-on practice altogether: senior engineers who calculate that the financial cost of reskilling outweighs the remaining career horizon move permanently into management or advisory work. All three responses are rational adaptations to the same metric landscape. None of them is a failure of competence. What appears at the surface as diverse career choices is, structurally, a single mechanism distributing burden according to financial capacity to absorb it.

The legitimacy distortion is what stabilises the system. Australian employers, professional bodies, and procurement frameworks do not generally question whether the additional licensure requirement reflects a genuine competence gap; the requirement is treated as a settled standard rather than as a political settlement between professional bodies, state regulators, and insurance frameworks. UK-chartered engineers themselves rarely contest it in public. Once they have completed the additional licensure, the pattern I have most often observed is engineers becoming advocates for it — advising newer arrivals through the same pathway, recommending the routes they themselves took, and in some cases participating in the assessment and mentoring of subsequent applicants. The feedback loop closes here: those who have absorbed the cost of the metric system become invested in its legitimacy, and that investment further entrenches the system for those arriving after them. By the time a senior engineer has the standing to challenge the framework, they will typically have built a substantial career operating within it. Resistance becomes structurally unaffordable in a different sense than the financial one — it would require disavowing the credential they have already paid to acquire.

The worked example illustrates the three distortions operating together within a single career, but it also gestures toward something the framework develops more fully in the next section: the dynamic by which professional identity, once shaped by the metric system, strengthens that system's authority.

5. THE GLOBAL METRIC–IDENTITY FEEDBACK LOOP

Metrics do not operate in isolation. The three distortions identified in Section 4 combine and compound through a dynamic process in which metrics shape identity and behaviour, and identity and behaviour in turn strengthen the authority of metrics. This section introduces the Global Metric–Identity Feedback Loop as a conceptual model for understanding how that process operates across national and institutional boundaries.

The model consists of five interconnected stages: Global Metric → Local Interpretation → Identity Formation → Behavioural Response → Reinforced Metric (Figure 1). Each stage is illustrated through the experience of a Malaysian engineering academic navigating the global metric landscape — used here as an illustrative analytical walk-through of dynamics observable across post-colonial engineering education contexts, not as an empirical case study of any specific institution or system. This case is selected not because it is unique but because it is representative: it illustrates dynamics that operate across post-colonial engineering education contexts where global metric systems were designed elsewhere and arrive carrying the authority of settled international standards. What follows traces what the framework predicts would happen at each stage rather than reporting any specific institution's experience; the analytical value of working through the prediction in concrete terms is to make the mechanism visible. Figure 1 presents the model schematically, showing how the three distortions operate throughout the cycle.

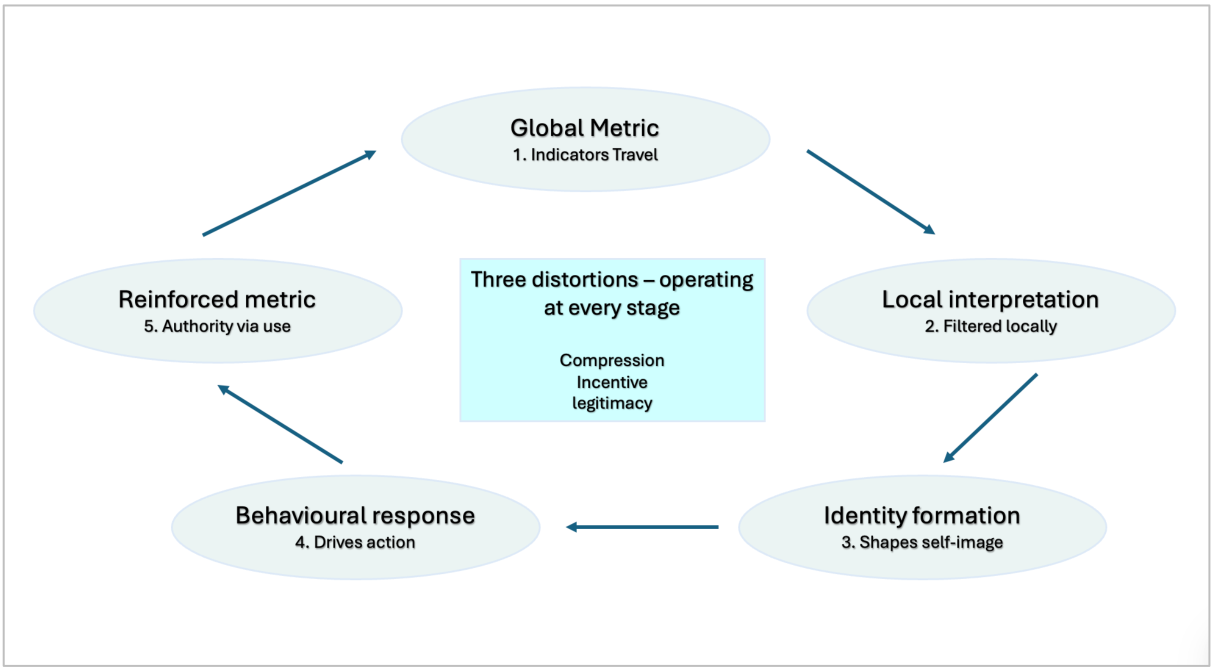

Figure 1. The Global Metric–Identity Feedback Loop showing five interconnected stages through which global metrics shape identity and behaviour and are in turn reinforced by them. Three characteristic distortions of quantification — compression, incentive, and legitimacy — operate throughout the cycle, each amplifying the others.

5.1 Global Metric: Indicators That Travel Across Borders

Global metrics circulate as portable, apparently comparable indicators of quality, competence, and institutional standing. In engineering education, these include global university rankings — particularly the QS World University Rankings and Times Higher Education rankings — citation indices such as Scopus and Web of Science, publication metrics including impact factor and h-index, and accreditation frameworks such as the Washington Accord. Their portability is presented as a virtue: they offer a shared language for evaluating scholarly contribution and institutional quality regardless of where the work was produced.

But portability does not guarantee neutrality. These metrics were developed within research-intensive universities in English-speaking Western contexts. They tend to privilege English-language publication, rapid-turnover citation cultures, and individual attribution over collective or community-engaged knowledge production.

5.2 Local Interpretation: Metrics Filtered Through Institutional and Cultural Logics

In this illustrative case, a Malaysian engineering academic encounters global university rankings as simultaneously aspirational targets and structural constraints. Their institution may be ranked outside the global top 500, not because its engineering education is poor but because the ranking methodology structurally disadvantages teaching-focused regional universities with strong community engagement missions by privileging research output volume, international faculty ratios, and citation counts.

The same logic applies to citation metrics. Research conducted in Malaysian contexts — on local infrastructure, regional water systems, community resilience, or post-colonial professional formation — may be highly relevant to Malaysian engineering practice and policy but attract fewer citations than research published in high-impact Western journals. The metric system does not distinguish between work that is locally irrelevant and work that is locally vital but globally invisible.

Local interpretation, therefore, involves constant negotiation between institutional survival within the global metric system and fidelity to the institution's actual educational and research mission.

5.3 Identity Formation: Metrics Shape Professional Self-Understanding

The identity formation stage of the loop can be observed in how prolonged engagement with global metric expectations shapes professional self-understanding. For the Malaysian academic in this illustrative scenario, whose research would address locally significant questions but who would consistently encounter the signal that this work is less visible, less cited, and less institutionally valued than work published in Western journals, the cumulative effect can be a form of credibility erosion that operates independently of actual scholarly quality.

Early-career academics, in particular, may absorb the message that legitimate scholarship looks a certain way: published in high-impact English-language journals, generating citations from an international community, and aligned with research agendas legible to Western peer reviewers. Work that does not fit this template — however rigorous, however significant to local engineering practice — can be experienced as professionally risky. Identity can begin to form around what the metric recognises rather than around scholarly mission. The question shifts from "what research matters here?" to "what research will be counted?"

5.4 Behavioural Response: Metrics Influence Action and Strategy

At the behavioural response stage, the Malaysian engineering academic makes a series of strategic calculations that would be unnecessary if local scholarly contribution were valued on its own terms. They may pursue publication in Western journals not because those outlets best serve their research questions but because impact factor scores feed into institutional performance metrics. They may frame locally grounded research in internationally recognised theoretical terms, not because the framing adds analytical value, but because it increases the likelihood of acceptance by international peer reviewers unfamiliar with Malaysian engineering contexts. They may invest time in citation visibility strategies — building international networks, attending Western conferences, collaborating with higher-ranked institutions — that consume resources otherwise available for the teaching, mentoring, and community engagement that constitute much of the actual work of a regional engineering university.

Read through the framework, these behaviours operate as rational responses to the metric landscape and simultaneously as distortions — redirections of scholarly effort toward global metric visibility. Where this pattern operates, the framework predicts an aggregate effect tending toward institutional convergence as universities progressively restructure research priorities around metric performance, displacing locally grounded missions.

5.5 Reinforced Metric: Metrics Gain Authority Through Use

As these dynamics play out, institutions aligning with global metric expectations find that those metrics gain further authority. Universities improving their ranking positions are celebrated as success stories; academics publishing in high-impact Western journals become models of scholarly achievement. This reinforcement closes the loop: the metrics shaped identity and behaviour, and identity and behaviour have now strengthened the metrics' authority — making them more entrenched and more resistant to challenge than they were before the cycle began.

5.6 Why the Feedback Loop Matters

The Global Metric–Identity Feedback Loop helps explain why metric authority tends to persist despite widespread recognition of metric limitations: each cycle of behavioural alignment strengthens the system, regardless of whether practitioners believe in it.

Table 3. The Global Metric–Identity Feedback Loop: Stages, Mechanisms, and Engineering Education Illustrations

Stage	Mechanism	Distortions Operating	Malaysian Academic Illustration	Systemic Consequence	Intervention Points	Theoretical Grounding
1. Global Metric	A portable, comparable indicator is established and circulates across national and institutional boundaries, carrying the authority of settled international standards	Legitimacy distortion: metrics arrive pre-loaded with institutional authority regardless of local fit	QS rankings, Scopus citation indices, impact factor scores, and Washington Accord accreditation standards circulate as globally recognised signals of scholarly and institutional quality — calibrated against research-intensive Western universities but applied universally	Institutions encounter metrics not designed for their context but carrying sufficient authority to reshape local priorities	Professional bodies and accreditation agencies can explicitly acknowledge the cultural situatedness of their frameworks; international standards bodies can build contextual flexibility into framework design rather than assuming universal applicability	Porter (1995); Espeland & Stevens (2008)
2. Local Interpretation	The global metric is filtered through existing national norms, resource constraints, and historical relationships with dominant knowledge systems	Compression distortion: the metric compresses diverse local realities into a single legibility standard; legitimacy distortion: the metric's authority makes non-compliance feel professionally risky	The Malaysian engineering academic would encounter global university rankings as both aspirational targets and structural constraints: their institution's regional teaching mission is rendered less visible by ranking methodologies calibrated for research-intensive universities	Diverse institutional missions are progressively reinterpreted through global metric compliance, producing divergence between stated mission and actual resource allocation	Institutional leaders can develop explicit dual-track evaluation frameworks that assess performance against both global metrics and locally defined mission criteria; transparency about the gap between the two can reduce the coercive force of global rankings	Merry (2016); Faulconbridge & Muzio (2012)
3. Identity Formation	Prolonged engagement with metric expectations shapes how practitioners understand professional legitimacy, scholarly worth, and career success	Incentive distortion: the metric landscape makes metric-aligned identity formation the rational career strategy; legitimacy distortion: metric authority makes non-aligned identities feel professionally illegitimate	The Malaysian academic would begin to experience locally significant research as professionally risky — work not generating international citations would feel like a career liability. Identity would shift from scholarly mission toward metric	Professional identity becomes partially decoupled from substantive expertise and mission and progressively coupled to metric visibility. This produces credential-optimising behaviour at the individual level and mission drift at the institutional level	Mentoring structures that validate locally grounded scholarship; promotion criteria recognising non-metric contributions; professional development addressing metric pressure as structural rather than individual	Espeland & Sauder (2007); Power (2013)

Stage	Mechanism	Distortions Operating	Malaysian Academic Illustration	Systemic Consequence	Intervention Points	Theoretical Grounding
			alignment: from 'what research matters here?' to 'what research will be counted?'			
4. Behavioural Response	Identity shaped by metric expectations drives concrete decisions about research agendas, publication strategies, credential pursuit, and time allocation	All three distortions operating simultaneously: compression makes non-metric work invisible, incentive distortion makes metric-aligned work the rational priority, legitimacy distortion makes the system feel natural and unchallengeable	The Malaysian academic would pursue publication in Western journals, frame locally grounded research in internationally recognised theoretical terms, and invest time in citation visibility strategies — consuming resources otherwise available for teaching, mentoring, and community-engaged work that constitutes much of the actual mission of a regional engineering university	Individual responses aggregate into institutional convergence: universities restructure research priorities and promotion frameworks around metric performance, displacing locally grounded missions. The burden falls on those least able to bear it	Dedicated funding streams for locally grounded research; alternative recognition pathways for practice-based expertise; formal institutional protection of non-metric work	Campbell (1979); Marginson (2019)
5. Reinforced Metric	Individual and institutional compliance with metrics strengthens their perceived legitimacy and authority, making them progressively harder to challenge or reform	Legitimacy distortion self-reinforces: each compliance cycle adds further institutional weight to the metric's authority and further obscures the political choices embedded in its construction	Where Malaysian institutions improve their ranking positions through strategic compliance, those rankings tend to become treated as natural and legitimate measures of engineering education quality rather than culturally situated indicators	Each iteration increases the political cost of reform. Institutions invested in metric compliance have structural incentives to defend the system; practitioners who have built careers around metric alignment have personal incentives to treat it as legitimate	Coalition-building across non-Western institutions to challenge dominant frameworks; policy advocacy at international accreditation bodies; development of alternative evaluation frameworks	Desrosières (2011); Espeland & Sauder (2016)

Note: The Malaysian illustration is developed from professional body documentation, Malaysian higher education policy frameworks, and the author's sustained engagement with engineering education in a Malaysian research university context. It is used as an illustrative representative case of post-colonial metric asymmetry rather than a country-specific empirical claim.

6. IMPLICATIONS

6.1 For Engineering Organisations

Engineering organisations operating internationally must navigate credential systems that signal different forms of expertise depending on the regulatory environment, disciplinary tradition, and national culture (Faulconbridge and Muzio, 2012).

First, credential portability remains limited despite harmonisation efforts. International frameworks such as the Washington Accord (IEA, 2024) and EUR ING (FEANI, 2020) aim to establish mutual recognition, yet local interpretations persist, and portability remains partial (Faulconbridge and Muzio, 2012). The compression distortion helps explain why: what tends to travel across borders is the credential label, not the competence it represents, and the label means different things in different systems.

Second, over-reliance on formal credentials can obscure practical expertise. Metrics such as chartership or postgraduate qualifications compress complex capability into simplified indicators (Porter, 1995) and legitimacy distortion compounds this: credential checklists can substitute for professional judgement (Bowker and Star, 2008), making that substitution feel rational even when it produces poor assessments of actual capability. Organisations that supplement credential screening with direct capability assessment — particularly for roles requiring tacit knowledge, contextual judgment, and cross-disciplinary integration — are less likely to mistake credential legibility for competence.

Third, global firms can inadvertently privilege credential cultures aligned with their institutional origins (Larson, 2020), with professional bodies defending these boundaries as jurisdictional claims (Abbott, 1988). The asymmetry produced disadvantages engineers from non-Western credentialing traditions for reasons unrelated to competence (Merry, 2016).

6.2 Cross-Sector Patterns

Academic institutions face structurally parallel challenges, extensively documented in the higher education literature (Espeland and Sauder, 2016; Hazelkorn, 2015; Marginson, 2019). Institutions treating metrics as situated indicators rather than objective measures are better positioned to resist homogenisation.

Despite differences in regulatory logic — engineering tied to legal accountability, academia to reputational competition — both sectors exhibit similar metric-driven dynamics. Two shared risks emerge. First, metrics tend to narrow the definition of excellence: formal indicators become proxies for capability, and what resists quantification becomes structurally devalued — the tacit expertise of the commissioning engineer, the teaching and mentoring contribution of the academic, the locally embedded competence of the practitioner working outside dominant credential systems. Second, global metrics can reinforce existing inequalities, often privileging credential systems, publication cultures, and institutional traditions aligned with dominant Western norms while disadvantaging alternative approaches.

These patterns persist not simply because metric systems are imperfect but because they are actively maintained. Organisations, professional bodies, and institutions that benefit from current metric arrangements have structural incentives to defend them — challenging a credentialing framework means challenging the professional body whose jurisdiction it defines, and challenging a ranking methodology means challenging the institutions whose reputations it validates. As Espeland and Sauder (2016) demonstrate, institutions become enrolled in the very systems that constrain them because the cost of disengagement exceeds the cost of compliance. Reform, therefore, requires not just better metric design but recognition that metric systems are political settlements whose contestation requires confronting the interests that produced them. This is the power-centred perspective that the sociology of quantification — from Porter's (1995) analysis of mechanical objectivity to Desrosières' (2011) account of statistical struggles — has consistently argued is essential for understanding how quantification actually operates in institutional life.

7. DISCUSSION AND CONCLUSION

7.1 Metrics as Situated Practices

The engineering credentials case extends what the sociology of quantification has long argued — that metrics are situated practices whose meaning is produced through local interpretation rather than inherent in the indicator itself (Espeland and Stevens, 1998; Merry, 2016) — by specifying the mechanisms through which situatedness tends to produce inequality rather than merely diversity. It is not simply that chartership means different things in different contexts; it is that those different meanings tend to be arranged hierarchically, with Western credentialing traditions frequently positioned as the standard against which all others are measured and found partially equivalent.

When credentialing systems are treated as universally applicable rather than culturally situated, the burden of non-equivalence falls asymmetrically on those outside the dominant tradition. Engineers from post-colonial contexts are not navigating a pluralistic landscape of equally valid systems — they are navigating a landscape with a clear centre and periphery, in which movement from periphery to centre requires translation, additional credentialing, and investment of resources that practitioners at the centre do not face.

The Global Metric–Identity Feedback Loop adds a dynamic dimension: metrics actively reshape the contexts in which they operate, producing progressive convergence around dominant metric cultures. Situatedness is therefore not stable but under continuous pressure from globally circulating metrics.

7.2 Metrics as Identity Technologies

The Global Metric–Identity Feedback Loop extends existing work on audit culture and commensuration (Espeland and Stevens, 2008; Power, 2013) by providing a mechanism that explains how identity formation operates dynamically rather than as a one-time imposition. Metrics do not simply tell practitioners who they are; they create conditions in which practitioners can progressively internalise metric expectations as legitimate definitions of professional worth, and then act in ways that further strengthen those expectations.

This dynamic has consequences for practitioners formed outside dominant metric cultures. The Malaysian case in Section 5 illustrates how sustained engagement with global metric expectations can lead to the gradual displacement of locally grounded professional values by metric-aligned ones — experienced not as coercion but as professional development and institutional survival.

The model contributes to the existing reactivity literature (Espeland and Sauder, 2016)by showing that reactivity can operate at the level of professional identity, not just institutional behaviour — and that by the time distortion is visible, identity formation has already occurred.

7.3 Metrics as Drivers of Global Inequality

Global metrics tend to privilege Western epistemic traditions, publication cultures, and credentialing systems, creating structural disadvantage for institutions and regions operating under different norms — not because their work lacks quality, but because quality itself is often defined through culturally specific indicators.

This asymmetry is particularly evident in post-colonial contexts (Table 2), where engineers and academics must navigate dual credential requirements: local credentials that establish domestic legitimacy but tend to travel poorly, and Western credentials that enable international mobility but require resources not equally available. Engineers working internationally from these contexts frequently navigate dual credential requirements because global systems tend to privilege Western epistemic traditions while devaluing locally developed expertise. The result tends to be a stratified system in which historical colonial relationships continue to shape which expertise counts as legitimate and which mobility is enabled.

The three distortions — compression, incentive, and legitimacy — tend to operate differentially across contexts, amplifying existing inequalities. Engineers from credential-intensive systems tend to experience greater mobility than those from experience-based systems. Scholars publishing in Western journals tend to accumulate citation advantage. Recognising these asymmetries is essential for developing more equitable evaluation frameworks.

7.4 Contributions and Future Directions

This paper makes four contributions to the study of professions, quantification, and global knowledge systems. First, it conceptualises metrics as epistemic infrastructure, extending work on commensuration and audit culture. Second, it identifies three characteristic distortions of quantification — compression, incentive, and legitimacy — offering a diagnostic vocabulary for analysing how metrics reshape professional practice and cross-national mobility. Third, it introduces the Global Metric–Identity Feedback Loop, extending the reactivity literature to the level of professional identity. Fourth, it shows how global metrics interact with local institutional logics to produce diverse outcomes and reinforce global inequalities.

Several limitations follow from this conceptual approach. The analysis draws on professional body frameworks, accreditation documentation, and practitioner experience rather than systematic primary data collection, and the framework should be treated as generative rather than exhaustive. The primary examples remain concentrated in Anglophone contexts — the UK, Australia, and, to a lesser extent, the United States — and the framework's propositions require testing in continental European, Latin American, East Asian, and sub-Saharan African contexts. The Malaysian case represents a step toward broader engagement rather than a resolution of this limitation. The analysis does not address how credential asymmetries intersect with gender and racial bias — a dimension that likely compounds the invisibility effects identified here and warrants dedicated attention in future research. Future empirical work is needed to examine how the distortions and feedback mechanisms manifest in specific settings and whether the framework requires modification beyond its current evidential base.

7.5 Concluding Observations

Metrics have become central to how engineering and academia define competence, legitimacy, and success. Yet their authority is not inherent — it is constructed through cultural assumptions, institutional logics, and global power dynamics. Understanding the epistemology of metrics — how quantification shapes what organisations believe is "real" — is essential for navigating an internationalised landscape in which success is measured but not uniformly understood.

Credentialing regimes, ranking systems, and citation metrics disproportionately reflect Western institutional histories, publication cultures, and epistemic traditions. As these metrics travel globally, organisations and individuals outside these traditions are required to adapt to standards not of their own making, often without equivalent recognition of locally valid expertise. The consequence is not simply distortion but stratification: systems aligned with dominant metric cultures tend to gain legitimacy and mobility, while alternative forms of knowledge and practice remain structurally undervalued. This dynamic helps explain why global metrics persist despite their limitations — they stabilise existing hierarchies while appearing objective. Making that dynamic visible is the first step toward more equitable and context-sensitive evaluation systems.

NOTES

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