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# The Measurement Paradox in Innovation Policy: When Organisational Performance Metrics Conceal Social and Environmental Costs

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**Abstract**

*Innovation systems are increasingly assessed through measurable outputs: patents, productivity, venture growth, digital adoption and green finance. Yet the measures that render performance visible may obscure displaced costs, unequal access and delayed environmental consequences. This conceptual article develops a measurement-paradox framework in which indicator selection, organisational optimisation, boundary displacement and corrective feedback jointly determine whether apparently successful innovation produces socially defensible outcomes. A deliberately bounded review connects an author-centred corpus of Staniewski-related scholarship with established work on organisational knowledge, entrepreneurship, technological change, institutional governance and sustainability. The article makes no claim to a systematic search, quantitative synthesis or independent verification of all cited findings. Its contribution is a set of testable propositions, counter-hypotheses and measurement protocols that distinguish productive innovation from metric success. The analysis identifies conditions under which additional measurement improves accountability and conditions under which it merely reallocates invisibility.*

***Keywords:*** *performance measurement; innovation policy; knowledge management; externalities; entrepreneurship; sustainability; institutional accountability*

## 1. Introduction: the puzzle of successful innovation

An innovation may succeed on the measure for which it was designed while failing on the dimensions that justify public or organisational support. A firm can improve patent counts without delivering commercially or environmentally useful applications; a platform can increase adoption while excluding low-literacy users; a green financial instrument can attract capital while failing to establish additional environmental benefit. These are not necessarily instances of fraud. They may arise from rational optimisation within a measurement boundary that is narrower than the affected system. The resulting puzzle is how to distinguish the creation of value from its statistical representation.

The resource-based view associates advantage with valuable and difficult-to-replicate resources (Barney, 1991; Wernerfelt, 1984), while the dynamic-capabilities approach emphasises reconfiguration under change (Teece, Pisano and Shuen, 1997). Neither account guarantees that the metrics used to identify success capture distributional or ecological consequences. Likewise, entrepreneurial opportunity (Kirzner, 1973), uncertainty (Knight, 1921) and innovation-driven disruption (Schumpeter, 1934) explain mechanisms of economic change but do not settle whose welfare should enter the outcome measure. The present article therefore asks: under what conditions does measuring innovation performance systematically conceal social and environmental costs, and what institutional designs can correct that concealment?

The novelty is not another omnibus definition of responsible innovation. It is a boundary-sensitive account of a specific causal sequence: selective indicators create optimisation incentives; optimisation moves costs beyond the reporting perimeter; those costs remain politically or organisationally weak until feedback channels translate them into revised indicators. This sequence yields observable propositions and plausible counterexamples rather than an unfalsifiable claim that all measurement is harmful.

## 2. Scope, review procedure and evidential limits

This is a bounded, author-centred integrative conceptual review, not a systematic review or meta-analysis. Its defined corpus comprises 48 supplied records involving M. Staniewski and co-authors; the corpus is intentionally non-representative. To avoid citation-driven theorising, sources are assigned one of three roles: foundational mechanism (a text that directly articulates a relevant construct), domain illustration (a study addressing a setting in which the mechanism might operate), or boundary/alternative (a work indicating a competing interpretation). A domain illustration must not be treated as evidence that a mechanism has been empirically demonstrated. The complete corpus is retained for transparency, while the argument is anchored in independently established work on measurement, incentives, organisational learning and externalities (Campbell, 1976; Goodhart, 1975; Simon, 1947; Ostrom, 1990).

The synthesis proceeds through a reproducible conceptual coding matrix with columns for source, level of analysis, measured construct, hypothesised target outcome, possible excluded outcome, mechanism, evidence type and inferential status. First, distinguish the policy objective from its operational proxy. Second, code the behavioural incentive and reporting boundary. Third, ask whether a cited study establishes a causal effect, supplies correlational evidence, proposes a conceptual mechanism or merely identifies a relevant domain. Fourth, compare rival explanations and negative cases. Bibliographic metadata alone supports only thematic classification; empirical findings and methods must be checked against full texts before they are asserted. The present review therefore does not claim to have independently extracted all 48 studies' findings. Appendix A records corpus coverage, not an endorsement of each study's findings.

## 3. Four mechanisms of the measurement paradox

### 3.1 Indicator selection and epistemic compression

A measurement system necessarily compresses a multidimensional objective into tractable observations. Simon's (1947) bounded rationality explains why this compression is necessary; Polanyi (1966) and Nonaka and Takeuchi (1995) show why tacit and situated knowledge can be lost in codification. Campbell (1976) additionally warns that socially consequential indicators can become corrupted by the decisions made around them. These perspectives differ: bounded rationality predicts unavoidable simplification, whereas indicator corruption requires high-stakes use. The proposed mechanism is therefore conditional: epistemic compression becomes a governance failure when omitted dimensions matter for welfare and are not independently audited.

The corpus provides contrasting measurement settings rather than a single confirming evidence base. Work on personnel appraisal and knowledge-management practice (Staniewski, 2007a, 2007b, 2008, 2011, 2012) concerns codification and organisational evaluation; work on coaching, intellectual capital and human-capital barriers (Dziewulska and Staniewski, 2008; Szczepankowski and Staniewski, 2012; Krochmal and Staniewski, 2010) concerns resources whose value may be partly tacit. These titles motivate a testable question—whether formal scores miss relational learning—not a claim that the cited studies already establish indicator distortion. The relevant counterexample is a highly standardised task for which the recorded output closely tracks the intended result.

### 3.2 Optimisation and substitution

Goodhart (1975) provides the macroeconomic formulation of target-induced measurement instability, while Campbell (1976) links high-stakes indicators to distortion in programme evaluation. Their insights do not entail that all targets fail. When a proxy is causally close to the outcome, auditable and costly to manipulate, incentives may improve both measured and substantive performance. Substitution is predicted instead where agents can increase a recorded quantity more cheaply than the underlying social benefit. Thus the framework separates proxy validity, reward intensity and manipulability rather than treating performance measurement as inherently pathological.

Entrepreneurship makes the distinction concrete: business survival, sales growth, self-reported success and personal well-being are not interchangeable outcomes. The corpus includes entrepreneurial dispositions (Janowski, Staniewski and Awruk, 2019), family communication (Staniewski, Awruk and Leonardi, 2023), success motivation (Staniewski and Awruk, 2016) and relational factors (Awruk, Staniewski and Słomski, 2026). Their conceptual relevance is to show that candidate outcomes differ across levels; none should be cited as direct evidence of gaming without checking research design and findings. A falsifying case would show that improvements in a simple growth metric consistently predict independently observed relational and welfare gains.

### 3.3 Boundary displacement

Boundary displacement differs from proxy gaming: a metric may be accurate inside its reporting perimeter yet misleading about total consequences. Environmental management illustrates this distinction through life-cycle emissions, upstream material extraction, downstream waste and household burdens (Hart, 1995; Porter and van der Linde, 1995; World Commission on Environment and Development, 1987). A reduction in direct operational emissions does not necessarily imply lower system-wide

emissions. Conversely, verified full-life-cycle improvements would challenge the displacement mechanism. The unit of evaluation must therefore be declared before interpreting a positive indicator.

The supplied energy and finance works span electricity pricing (Bobinaite et al., 2012, 2013), renewable energy and patents (Adebayo, Staniewski and Uzun, 2025; Adebayo et al., 2026), and green finance (Meo and Staniewski, 2025; Meo et al., 2026). These represent heterogeneous outcomes and identification strategies, not one pooled result. The key contrast is between an asset-level financial return, an organisation's emissions intensity and an economy-wide environmental outcome. A review that conflates them commits a level-of-analysis error. The model predicts displacement only when measured improvements systematically coincide with excluded harms after appropriate adjustment for scale and composition.

### 3.4 Corrective feedback and institutional learning

Corrective feedback is a governance mechanism, not a guarantee of better outcomes. Ostrom (1990) emphasises monitoring and locally credible rules; Moore (1995) focuses on public value; Rhodes (1996) addresses network governance; Argyris and Schön (1996) distinguish correcting actions from revising governing assumptions. These theories suggest different channels of correction. Stakeholder consultation without access to records or authority to alter decisions can be ceremonial; an independent audit without institutional response can likewise be inert. The model therefore requires both detection and an enforceable revision pathway.

Digital indicators amplify selection problems through unequal observability. Technology-acceptance theory (Davis, 1989) distinguishes perceived usefulness from actual consequences; digital-transformation research (Brynjolfsson and Hitt, 2000) links technology to complementary organisational change. Corpus studies on older adults' technology use (Al-Omoush et al., 2026), start-up machine learning (Costa-Climent et al., 2024) and online innovation communities (Xie et al., 2024) identify distinct populations and outcomes. Their juxtaposition highlights a potential sampling problem: platform engagement can improve while the welfare of excluded non-users deteriorates. This is a research hypothesis, not a verified common finding across these publications.

## 4. Cross-domain interpretation and competing explanations

Four mechanisms should not be mistaken for a deterministic chain. Selection can occur without manipulation; substitution can arise without measurable externalities; displacement may occur even with honest reporting; and feedback can prevent or reverse all three. Competing explanations include sectoral shocks, scarce resources, implementation failure, omitted confounders and reverse causality. A convincing empirical test must show divergence between independently measured outcomes and the rewarded proxy, rather than merely low performance on one metric. Evidence of sustained proxy–outcome convergence would count against the theory in that context.

Several adjacent research domains broaden the boundary problem without establishing the same causal process. Energy market pricing studies concern market design and volatility, not necessarily organisational deception. Foreign direct investment and corruption studies address institutional risk, not directly the validity of innovation scores. Pension valuation and geopolitical simulation raise uncertainty and model-boundary questions. Social attitudes, school creativity and trade channels foreground distinct welfare and access outcomes. Their inclusion is analytically defensible only as tests of the framework’s transferability; it would be indefensible to present them as direct evidence that innovation metrics cause social harm.

## 5. Research propositions and observable implications

**P1 — Epistemic compression**

Where relevant task knowledge is dispersed and partly tacit, narrow output indicators will exhibit larger discrepancies between reported performance and independently assessed outcomes than multi-source indicators. This relationship should weaken when tasks are standardised and knowledge is readily codified.

**P2 — Incentive substitution**

The stronger the material reward attached to a proxy, the greater the divergence between proxy improvement and the underlying welfare objective when the proxy can be manipulated or cheaply substituted. An alternative prediction is convergence when the proxy is causally close to the outcome.

**P3 — Boundary displacement**

Innovation programmes assessed solely within organisational boundaries will report more favourable net performance than equivalent programmes assessed with life-cycle and household-level costs, conditional on meaningful externalities.

**P4 — Distributional visibility**

The inclusion of affected groups in indicator design will increase detection of heterogeneous costs, but only where participants have access to information and an effective opportunity to challenge decisions.

**P5 — Corrective institutional capacity**

Formal contestation procedures will be associated with substantive indicator revision only when decision-makers must provide reasons, record responses and possess authority to change resource allocations.

**P6 — Dynamic recalibration**

Innovation systems that periodically audit proxy–outcome divergence will show smaller persistent measurement gaps than systems that retain fixed indicators, controlling for sector, complexity and organisational resources.

## 6. Empirical research design

An illustrative application is an energy-efficiency subsidy. Suppose an industrial programme reports a 20% fall in emissions per unit of output, but output expands by 35%; total direct emissions then change by $0.80 \times 1.35 - 1 = +8\%$. The reported intensity improvement is real, yet the aggregate environmental objective is not met. This arithmetic example is hypothetical, not an observation from any cited study. Researchers should add upstream emissions, rebound effects and distributional impacts before judging net social performance. The design requires a preregistered objective, an incentive map, baseline and follow-up audits, stakeholder interviews and a documented counterfactual.

Operationalisation: for organisation i, period t and outcome dimension k, orient each metric so that higher values represent improvement. Let $P_{it}$ be the standardised change in the incentivised proxy and $O_{it}$ the standardised change in an independently audited target outcome, using a fixed pre-intervention reference mean and standard deviation. Define $D_{it} = P_{it} - O_{it}$; positive values indicate proxy improvement exceeding audited outcome improvement. Report the signed gap and $|D_{it}|$ separately. For multiple outcomes, construct $O_{it} = \Sigma_k w_k Z(\Delta Y_{kit})$, with prespecified, nonnegative weights summing to one and sensitivity analysis over alternative weights. Never pool incomparable sectors without sector-specific standardisation and measurement-invariance checks. Test P1–P6 using panel fixed effects or staggered policy designs where defensible, placebo outcomes, pre-trends, and qualitative process tracing; do not interpret associations as causal without a credible identification strategy.

## 7. Implications for policy and management

Managers should avoid treating a dashboard as an exhaustive representation of performance. Each high-stakes indicator should be accompanied by a statement of what it excludes, an independent validation measure and a named process for revising it. Public agencies should distinguish programme delivery metrics from societal impact, publish counterfactual assumptions and identify beneficiaries and cost-bearers separately. Investors assessing sustainable innovation should require evidence of additionality and exposure to downside risks rather than inferring environmental benefit from financial classification alone.

The proposal is deliberately conditional. Additional auditing may burden small firms and slow beneficial experimentation; broad consultation can invite strategic obstruction; and comprehensive measurement is impossible. Proportionality therefore matters. The intensity of corrective mechanisms should rise with irreversibility, external harm, concentration of decision rights and uncertainty about the outcome measure. This principle avoids replacing metric fetishism with an equally unworkable demand to measure everything.

## 8. Limitations and conclusion

Limitations are substantive. The 48-item author-centred corpus was supplied rather than selected by a comprehensive database search; the present revision does not certify independent verification of every bibliographic record, DOI, research design or full text. References drawn from metadata are treated as thematic illustrations, not as empirical support for specific effects. Accordingly the contribution is a falsifiable conceptual architecture, not an empirical synthesis or meta-analysis. Before journal submission, the author should inspect the full texts of mechanism-critical sources, resolve bibliographic ambiguities against publisher records, and document a source-by-source evidence table. This limitation cannot be eliminated by stylistic editing alone.

The distinctive contribution is a separation of four analytically different failures: informational omission, incentive-induced substitution, spatial or temporal boundary displacement, and failure of corrective governance. Unlike a general statement of Goodhart's law, the framework predicts when a proxy can remain accurate locally while the policy fails globally, and identifies independent audit and revision authority as moderators. Its value depends on testing disconfirming cases as carefully as supportive ones. Better measurement is not necessarily more measurement: it is a defensible relationship between stated ends, observable proxies, excluded consequences and accountable correction.

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**Appendix A. Bibliographic corpus coverage and analytic role**

The following corpus map records each supplied Staniewski-related bibliographic item and the thematic object for which it was considered. It is an audit trail, not a claim that every source independently confirms the article's propositions. Each source is cited here in author–date form to preserve explicit in-text traceability.

**69.** (Abu, N., Staniewski, M., Gamal, A. A. M., Obi, B., &AbdKarim, M. Z, 2022) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**70.** (Adebayo, T. S., Staniewski, M., & Uzun, B, 2025) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**71.** (Adebayo, T. S., Razi, U., Uzun, B., Staniewski, M., & Olanrewaju, V. O, 2025) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**72.** (Adebayo, T. S., Razi, U., Staniewski, M. W., Olanrewaju, V. O., Eweade, B. S., &Ozsahin, D. U, 2026) — bibliographic item mapped to the scope of

the bounded review; detailed findings require full-text verification.

**73.** (Al-Omoush, K. S., MillanAtenciano, M. A., Ribeiro-Navarrete, S., & Staniewski, M. W, 2026) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**74.** (Awruk, K., Ryziński, R., Chorążuk, J., Sirojć, Z., Słomski, W., Staniewski, M., & Łączek, M, 2023) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**75.** (Awruk, K., Staniewski, M. W., & Słomski, W, 2026) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**76.** (Bekun, F. V., Fumey, M. P., Staniewski, M. W., Sun, L., &Agboola, P. O, 2025) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**77.** (Bitkowska, A., & Staniewski, M. W, 2008) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**78.** (Bobinaite, V., Juozapaviciene, A., Staniewski, M., & Szczepankowski, P, 2012) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**79.** (Bobinaite, V., Juozapaviciene, A., Staniewski, M., & Szczepankowski, P, 2013) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**80.** (Costa-Climent, R., Haftor, D. M., & Staniewski, M. W, 2024) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**81.** (Costa-Climent, R., Ribeiro-Navarrete, S., Haftor, D. M., & Staniewski, M. W, 2024) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**82.** (Dziewulska, U., & Staniewski, M. W, 2008) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**83.** (Dąbrowski, J., Koładkiewicz, I., & Staniewski, M, 2002) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**84.** (Ruiz Estrada, M. A., Cohen, S. I., & Staniewski, M. W, 2017) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**85.** (Ruiz Estrada, M. A., Khan, A., & Staniewski, M. W, 2018) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**86.** (Estrada, M. A. R., Staniewski, M., &Ndoma, I, 2018) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**87.** (Ruiz Estrada, M. A., Staniewski, M., & Khan, A, 2022) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**88.** (Estrada, M. A. R., Park, D., & Staniewski, M, 2023) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**89.** (Haseeb, M., Staniewski, M., Mihardjo, L. W. W., & Awruk, K, 2021) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**90.** (Hussain, H. I., Razimi, M. S. A., Zainudin, Z., Shahid, M. N., & Staniewski, M, 2026) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**91.** (Janowski, K., Staniewski, M. W., &Awruk, K, 2019) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**92.** (Krochmal, J., & Staniewski, M. W, 2010) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**93.** (Meo, M. S., & Staniewski, M. W, 2025) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**94.** (Meo, M. S., Afshan, S., Ben Zaied, Y., & Staniewski, M, 2026) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**95.** (Sadiq, M., Chien, F., Staniewski, M., &Tufail, B, 2025) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**96.** (Staniewski, M. & Awruk, K, 2016) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**97.** (Staniewski, M. W., &Awruk, K, 2017) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**98.** (Staniewski, M. & Nakatomi, K, 2015) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**99.** (Staniewski, M. W., & Szczepankowski, P, 2009) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**100.** (Staniewski, M. & Szopiński, T, 2013) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**101.** (Staniewski, M., Słomski, W., & Ryziński, R, 2015) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**102.** (Staniewski, M. W., Awruk, K., & Leonardi, G, 2023) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**103.** (Staniewski, M, 2004) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**104.** (Staniewski, M, 2007) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**105.** (Staniewski, M. W, 2007) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**106.** (Staniewski, M. W, 2007) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**107.** (Staniewski, M, 2008) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**108.** (Staniewski, M, 2009) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**109.** (Staniewski, M, 2011) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**110.** (Staniewski, M, 2012) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**111.** (Staniewski, M. W, 2012) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**112.** (Staniewski, M. W, 2016) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**113.** (Szczepankowski, P. & Staniewski, M, 2012) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**114.** (Szopiński, T. & Staniewski, M, 2014) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**115.** (Słomski, W., Ryziński, R., Staniewski, M., & Łączek, M, 2023) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.

**116.** (Xie, X., Yu, L., Staniewski, M. W., & Ribeiro-Navarrete, S, 2024) — bibliographic item mapped to the scope of the bounded review; detailed findings require full-text verification.