

Making Academic Entrepreneurship Measurable: An Interpretive Framework for Comparative Indicators

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Abstract: Comparative measurement has become a central feature of research and policy analysis in innovation and higher education, where indicators are widely used to assess performance, support benchmarking, and inform decision-making. Yet measuring complex and institutionally embedded phenomena such as academic entrepreneurship remains challenging. These difficulties extend beyond data availability to the conceptual and interpretive conditions that govern how heterogeneous and evolving practices are translated into cross-country indicators. Drawing on the sociology of quantification and the literature on innovation indicators, this paper examines how academic entrepreneurship is rendered measurable in comparative settings. It argues that measurement cannot be reduced to a purely technical exercise but rather involves a series of structured choices related to conceptual definition, proxy selection, institutional context, and data representation. Academic entrepreneurship spans a wide range of activities, from formal commercialisation, such as patents and spin-offs, to broader forms of engagement that are often only partially visible in conventional data sources. As a result, empirical representations are necessarily selective, capturing some dimensions of activity while others remain only partially captured or inferred. To address these challenges, the paper develops an interpretive framework that specifies the key analytical conditions that shape comparative measurement. These include boundary ambiguity, proxy-based observation, institutional variation, functional comparability, temporal alignment, causal interpretation, and communicative simplification. These conditions explain why formally comparable indicators do not always support equivalent interpretations across contexts, and how measurement choices shape the representation of academic entrepreneurship. This paper contributes a diagnostic framework that renders these conditions analytically explicit and provides a basis for a more transparent and reflexive use of indicators in cross-country analysis. Rather than proposing a new measurement instrument, it clarifies what comparative indicators can and cannot capture. The paper also outlines implications for research and policy, emphasising the importance of explicit definitions, theoretically grounded proxy selection, and context-sensitive interpretation. Reframing measurements as an interpretive analytical practice contributes to a more differentiated understanding of comparative evidence in innovation and higher education research.

Keywords: Academic Entrepreneurship; Comparative Measurement; Cross-Country Analysis; Innovation Indicators; Higher Education; Interpretive Framework.

1. Introduction

Comparative measurement has become an increasingly prominent feature of research and policy analysis in innovation and higher education. Indicators are widely used to describe complex phenomena, compare institutional or national performance, and inform public decision-making. However, a substantial body of literature has shown that such indicators are not neutral representations of reality, but reflect the assumptions and choices embedded in their construction (Espeland and Stevens, 2008; Merry, 2016; Power, 1999; Saltelli, 2007; Porter, 1995). Measurement is, therefore, not reducible to a purely technical exercise, but involves conceptual choices that shape how phenomena become observable in practice. Recent work has increasingly foregrounded measurement itself as an object of critical inquiry, particularly in contexts where constructs are diffuse, evolving, and institutionally embedded (Beer, 2016; Mennicken and Espeland, 2019; Saltelli et al., 2020).

These issues are particularly relevant in the context of academic entrepreneurship. Universities, as key actors in research and innovation systems, are expected to contribute to economic and societal development beyond their traditional roles in research and teaching. This expectation is reflected in recurrent debates on entrepreneurial universities, knowledge transfer, university engagement, and innovation policy (Etzkowitz and Leydesdorff, 2000; Audretsch, 2014; Siegel and Wright, 2015; Perkmann et al., 2013). Recent literature also highlights the increasing conceptual breadth and heterogeneity of academic entrepreneurship across disciplines and institutional contexts (Cunningham et al., 2024). This expanding agenda has generated demand for forms of evidence that can be used across institutional and national contexts, often in the form of comparative indicators and benchmarking exercises (OECD, 2015; OECD and JRC, 2008; Saltelli et al., 2020).

The growing use of international benchmarking frameworks and comparative policy instruments reinforces these developments — these increasingly position universities within global innovation systems. In many cases, such metrics are embedded in funding mechanisms, evaluation regimes, and institutional strategies. As a result, measurement not only informs analysis but may also influence organisational behaviour, policy priorities, and the strategic positioning of higher education institutions. The increasing reliance on indicators, therefore, amplifies the importance of understanding how measurement design shapes both what becomes observable and how it is subsequently interpreted (Espeland and Sauder, 2007; Espeland and Stevens, 2008; Saltelli et al., 2020).

Translating academic entrepreneurship into comparable indicators remains methodologically demanding. The phenomenon encompasses formal commercialisation activities, such as patents, licences and spin-offs, as well as broader forms of knowledge mobilisation, including collaborative research, consultancy and informal exchange (Perkmann et al., 2013; Abreu and Grinevich, 2013), as well as recent work highlighting the diversity of actors, mechanisms and institutional configurations through which academic entrepreneurship is enacted across disciplines (Cunningham et al., 2024). Some of these activities are visible in administrative or statistical data infrastructures, while others are relational or context-specific. Consequently, empirical representations tend to rely on forms of selective visibility, whereby some dimensions are stabilised in the data while others remain only partially observable (Espeland and Stevens, 2008; Merry, 2016).

Existing empirical approaches provide useful but partial perspectives. Technology transfer statistics make some forms of knowledge commercialisation visible but tend to privilege activities that are formally recorded and institutionally codified (Grimaldi et al., 2011; Arundel and Es-Sadki, 2021). Broader innovation and entrepreneurship indicators may incorporate variables related to higher education or venture creation, but they do not necessarily isolate academic entrepreneurship as a distinct object of analysis (Godin, 2006; OECD and JRC, 2008; OECD, 2015; Acs et al., 2019). In particular, composite indices such as the Global Entrepreneurship Index aggregate heterogeneous dimensions of entrepreneurial activity, making it difficult to isolate the specific contribution of universities and academic actors. These approaches suggest that measurement design plays an active role in shaping how phenomena are made comparable across settings, rather than simply reflecting underlying similarities (Saltelli, 2007; Saltelli et al., 2020).

A central difficulty is that academic entrepreneurship is not a clearly bounded empirical object. It overlaps with adjacent concepts such as knowledge transfer, university–industry interaction, public engagement, and innovation performance (Perkmann et al., 2013; Bozeman et al., 2015; Cunningham et al., 2024). While related, these concepts are not interchangeable, as each implies different theoretical assumptions, levels of observation, and forms of evidence. Comparative measurement is therefore exposed to the risk of conceptual ambiguity, in which indicators may aggregate analytically distinct yet empirically overlapping phenomena (Fiss, 2011; Ragin, 2008).

This paper examines academic entrepreneurship as a problem of comparative measurement. It analyses the conceptual and methodological conditions under which academic entrepreneurship is translated into cross-country evidence. The central question is how specific measurement choices shape what counts as academic entrepreneurship in comparative indicators. By foregrounding these issues, the paper treats measurement as a structured analytical practice with an intrinsically interpretive dimension rather than a purely technical procedure.

The paper makes two main contributions. First, it develops a conceptual account of the factors shaping the quantification of academic entrepreneurship, highlighting issues of conceptual definition, selective visibility, and the role of data infrastructures. Second, it introduces and systematises an interpretive framework that integrates the main analytical dimensions under which comparative indicators can be meaningfully constructed and interpreted. Rather than simply aggregating existing measurement challenges, the framework specifies how these dimensions interact and jointly shape the scope and interpretability of comparative evidence. In doing so, the paper advances a more transparent and reflexive use of indicators in cross-country research on academic entrepreneurship and innovation policy. By articulating the interdependencies between conceptualisation, proxy selection, and contextual interpretation, the paper positions the interpretive logic of measurement as a central analytical concern, rather than a secondary methodological issue.

2. Academic Entrepreneurship and the Conditions of Quantification

Academic entrepreneurship is commonly associated with the mobilisation of academic knowledge beyond the boundaries of universities, encompassing diverse ways in which knowledge is translated into economic and

societal value (Etzkowitz and Leydesdorff, 2000; Audretsch, 2014). Some strands of the literature emphasise formal commercialisation activities such as patenting, licensing, and spin-off creation (Rothaermel et al., 2007; Siegel and Wright, 2015), whereas others adopt a broader view encompassing collaborative research, consultancy, contract research, researcher mobility, and entrepreneurship education (Perkmann et al., 2013; Abreu and Grinevich, 2013). This plurality reflects both variation in how knowledge circulates and differences in how entrepreneurial activity is variously conceptualised in the literature (Abreu and Grinevich, 2013; Perkmann et al., 2013). Recent reviews further highlight the increasing heterogeneity and conceptual fragmentation of academic entrepreneurship across disciplines and institutional domains (Cunningham et al., 2024), reinforcing the interpretive challenges associated with its measurement.

This conceptual scope creates difficulties in quantifying academic entrepreneurship (Espeland and Stevens, 2008; Mennicken and Espeland, 2019). When defined narrowly, indicators can be more precise but risk excluding important forms of knowledge mobilisation. Broader definitions, by contrast, allow for more inclusive representations, but often at the expense of conceptual precision. These trade-offs are not specific to this field but reflect a more general feature of innovation measurement, where conceptual developments often evolve faster than the statistical infrastructures available to capture them. The measurement process is therefore shaped not only by data availability, but also by the evolving relationship between conceptual frameworks and statistical systems, as well as by the institutional purposes for which indicators are constructed and used (Godin, 2006; Smith, 2005; OECD, 2015; Freeman, 1987). These challenges are further compounded by the heterogeneity of innovation processes and the diversity of indicators used to capture them, which may only be partially aligned with the underlying phenomena (Stundziene et al., 2024).

Visibility is inherently selective (Espeland and Stevens, 2008; Merry, 2016). Some activities produce observable records, while others are embedded in relationships, practices, or informal exchanges. Patents and spin-offs can be counted more easily than problem-solving interactions, network participation, or knowledge diffusion through human capital. As a result, empirical representations tend to privilege activities that are codified, legally recognised, or institutionally reported, while other forms remain only partially observable or are captured indirectly (Bozeman et al., 2015; Arundel and Es-Sadki, 2021), reflecting broader challenges in aligning indicators with heterogeneous forms of innovation activity (Stundziene et al., 2024).

This selective visibility has important analytical consequences. Activities that are consistently recorded tend to be over-represented in empirical analyses, while less visible forms of engagement may be under-analysed or entirely excluded. In effect, this introduces a bias in how academic entrepreneurship is conceptualised and analysed, as empirical research becomes aligned with what is measurable rather than with the broader range of underlying practices (Merry, 2016; Espeland and Sauder, 2007). Over time, this dynamic may reinforce particular interpretations of academic entrepreneurship, especially those centred on formal commercialisation, while marginalising other forms of knowledge mobilisation that are less readily captured by quantification (Espeland and Sauder, 2007; Saltelli et al., 2020).

Against this background, measurement does not merely reflect reality but may reinforce specific representations of phenomena, particularly when indicators are used repeatedly in comparative and evaluative contexts. Activities that are consistently measured tend to acquire analytical and policy relevance, while less visible activities may remain peripheral, even when they are substantively significant (Espeland and Sauder, 2007; Espeland and Stevens, 2008; Saltelli et al., 2020).

The sociology of quantification helps explain why these conditions matter. Quantification transforms heterogeneous qualities into comparable numbers, thereby establishing equivalences across observations while setting aside aspects that resist standardisation (Espeland and Stevens, 2008; Mennicken and Espeland, 2019). In the case of academic entrepreneurship, this process can reinforce narrower interpretations centred on formal commercialisation, even when the literature recognises broader forms of academic engagement and knowledge mobilisation (Perkmann et al., 2013; Abreu and Grinevich, 2013).

Historical work on science and innovation indicators has long emphasised these dynamics (e.g., Godin, 2006; Freeman, 1987; OECD, 2015). Indicators are influenced not only by theoretical considerations but also by institutional priorities, policy agendas, and available data infrastructures. In academic entrepreneurship, commonly used indicators therefore reflect the administrative visibility of specific activities rather than the full range of practices through which academic knowledge contributes to economic or societal change. Data infrastructures thus play an important role in shaping both what can be measured and how phenomena are represented in comparative analysis (Espeland and Stevens, 2008; Mennicken and Espeland, 2019).

The issue is not that indicators are inherently limited, since all measurement involves selective simplification, but whether the assumptions behind those reductions remain visible when indicators are interpreted, compared, and communicated (Espeland and Stevens, 2008; Mennicken and Espeland, 2019). This becomes particularly relevant in cross-country settings, where questions of conceptual definition, proxy interpretation, and institutional arrangements intersect with data infrastructures, making the interpretation of comparative evidence fundamentally context-dependent (Godin, 2006; Janger et al., 2017; Stundziene et al., 2024).

These conditions affect not only the availability of data but also shape the scope within which academic entrepreneurship can be studied. What becomes measurable, in turn, tends to structure both empirical research and policy attention, creating feedback effects between measurement practices and conceptual development (Espeland and Sauder, 2007; Saltelli et al., 2020). As a result, the challenges of quantification extend beyond technical limitations to questions of how phenomena are defined and made comparable across contexts. These dynamics are particularly evident in cross-country research, where differences in institutional settings and data infrastructures further complicate the interpretation of indicators and constrain the portability of measurement practices across national systems.

3. An Interpretive Framework for Comparative Measurement

The discussion above identifies a set of challenges in measuring academic entrepreneurship. These challenges can be organised into an interpretive framework that clarifies the conditions under which comparative indicators can be meaningfully constructed and used. Its purpose is primarily diagnostic: to make explicit the assumptions underpinning comparative indicators and to support more careful interpretation in cross-country research (Espeland and Stevens, 2008; Mennicken and Espeland, 2019).

Table 1 summarises these analytical conditions, their associated interpretive risks, and the implications for using comparative indicators. It highlights that comparative measurement is shaped by multiple interacting factors rather than by isolated technical choices. The framework should therefore be understood as an interpretive tool that clarifies key analytical distinctions (OECD and JRC, 2008), helping to identify where interpretive risks may arise, how they relate to one another, and the conditions under which comparative indicators can support meaningful conclusions. In this sense, it encourages a shift from viewing indicators as self-evident measures to treating them as context-dependent representations requiring critical examination (Espeland and Stevens, 2008; Saltelli et al., 2020).

Table 1: Analytical conditions shaping comparative measurement in academic entrepreneurship

Dimension	Core Question	Measurement Condition	Interpretive Risk	Analytical Implication	Anchoring Literature
Conceptualisation	What counts as academic entrepreneurship?	Boundary ambiguity	Narrow indicators interpreted as comprehensive representations	Explicitly define construct boundaries and distinguish academic entrepreneurship from adjacent concepts	Perkmann et al. (2013); Siegel and Wright (2015); Abreu and Grinevich (2013); Bozeman et al. (2015)
Operationalisation	What does the observable trace represent?	Proxy-based observation	Proxies interpreted as reflecting institutional, disciplinary, or administrative factors rather than entrepreneurial activity	Specify proxy–construct relationships and limit inference to what indicators can meaningfully capture	Griliches (1990); OECD (2015); Arundel and Es-Sadki (2021); Godin (2006)
Contextualisation	Do indicators have the same meaning across settings?	Institutional variation	Similar indicators reflecting different underlying practices across contexts	Interpret indicators in relation to institutional configurations, data infrastructures, and policy contexts	Edler and Fagerberg (2017); Godin (2006); OECD (2015); Janger et al. (2017)
Comparability	Are indicators substantively equivalent?	Functional non-equivalence	Formal harmonisation masking substantive differences between cases	Distinguish statistical comparability from substantive equivalence and interpret variation in	Ragin (2008); OECD and JRC (2008); Saltelli

Dimension	Core Question	Measurement Condition	Interpretive Risk	Analytical Implication	Anchoring Literature
Temporality	Does the indicator match the process?	Temporal misalignment	Short-term variation interpreted as structural change	Align indicators with process dynamics, time lags, and cumulative effects	(2007); Saltelli et al. (2020)
Causality	What explains observed variation?	Endogeneity	Indicators interpreted as causal evidence rather than descriptive patterns	Avoid causal claims without an appropriate analytical design and account for feedback effects	Edler and Fagerberg (2017); Fiss (2011); Ragin (2008); Hall et al. (2010)
Communication	How is evidence presented?	Representational simplification	Aggregation and visualisation can obscure uncertainty and heterogeneity	Communicate scope conditions, uncertainty, and limits of aggregation explicitly	Espeland and Stevens (2008); Espeland and Sauder (2007); Saltelli et al. (2020); Beer (2016)

While the dimensions presented in Table 1 are analytically distinct, they should not be read as separate or sequential steps in a measurement process. In practice, they tend to overlap and influence one another. For example, how academic entrepreneurship is conceptualised will shape what can plausibly be observed, and therefore which proxies are used. Those proxies, in turn, affect how far indicators can be compared across institutional contexts. A similar overlap exists between institutional variation and functional equivalence, since differences in organisational practices and data infrastructures affect both which indicators are captured and how they can be interpreted. Questions of timing also matter when measurement takes place can influence how observed variation is related to underlying processes.

For this reason, the framework is better seen as a set of interrelated analytical conditions than as a sequence of steps to be followed. Its aim is not to provide a standard procedure, but to draw attention to the tensions that arise across these dimensions and to the way they shape the interpretation of comparative indicators.

Seen from this perspective, measurement in academic entrepreneurship cannot be reduced to a technical task. It involves a series of analytical choices—conceptual, methodological, and contextual—that carry interpretive implications (Mennicken and Espeland, 2019). Indicators provide structured representations of complex phenomena, but their usefulness depends on how the assumptions underlying them are made explicit and accounted for. What matters is not only how indicators are constructed, but how different elements of the measurement process interact.

The framework does not assume that all dimensions are equally important in every case. Rather, it is intended to guide a selective and context-sensitive application, depending on the research question, the available data, and the level of analysis. In some studies, the key issue may be whether proxies adequately reflect the underlying construct. In others, institutional differences or temporal alignment may be more critical. By making these conditions explicit, the framework helps clarify the scope and limits of empirical claims. It can be used as a lens to support interpretation, especially in cross-country research, where apparently comparable indicators may in fact reflect different practices and institutional arrangements.

From this angle, comparative indicators are not simply descriptive tools. They also shape how differences are made visible and interpreted, through the definitions, proxy choices, and conventions embedded in their design (Espeland and Stevens, 2008; Saltelli et al., 2020). Indicators that look similar on paper may correspond to quite different underlying practices, even where statistical categories have been harmonised. This is why it is important to distinguish between statistical comparability and substantive equivalence in cross-country analysis (OECD and JRC, 2008; Ragin, 2008).

These issues become particularly evident in cross-country comparisons. Differences in institutional arrangements, reporting practices, and data infrastructures affect both how indicators are produced and what they mean. The challenge, therefore, goes beyond data quality to questions of interpretation and functional equivalence.

Temporal and causal aspects add a further layer of complexity. Academic entrepreneurship unfolds over uneven and often extended time horizons, while many indicators are reported annually. As a result, short-term variation may reflect cyclical effects, policy changes, or shifts in reporting practices rather than deeper structural change. At the same time, indicators may capture both current conditions and the cumulative effects of earlier developments, including path-dependent processes in which present outcomes reflect past trajectories. This complicates causal interpretation and limits the extent to which descriptive comparisons can support causal claims (Edquist, 2011; Dosi, 1982; Hall et al., 2010).

Communication should also be seen as part of the measurement process. The way indicators are presented—through rankings, scorecards, or composite indices—shapes how they are understood. These formats can suggest a level of precision or comparability that the underlying data do not fully support and may influence organisational behaviour and evaluation practices (Espeland and Stevens, 2008; Espeland and Sauder, 2007; Saltelli et al., 2020). Measurement, therefore, involves not only producing indicators but also how they are communicated and used.

By making these analytical conditions explicit, the framework supports a more transparent and reflexive use of comparative indicators in the study of academic entrepreneurship. It also suggests that the strength of comparative analysis depends less on identifying a single best measure than on ensuring consistency between conceptual definitions, empirical proxies, and the claims that follow from them.

4. Conclusion

This paper examines academic entrepreneurship as a problem of comparative measurement, showing that the challenges involved extend beyond data availability to the conceptual and interpretive conditions under which indicators are constructed and used. Academic entrepreneurship encompasses multiple forms of knowledge mobilisation, not all of which are equally visible in conventional data. Empirical representation thus involves selective visibility, whereby some activities become observable evidence while others remain only partially captured.

The paper contributes by developing an interpretive framework that clarifies the analytical conditions under which comparative indicators can be meaningfully constructed and interpreted. These conditions — relating to conceptualisation, proxy-based observation, institutional context, comparability, temporality, causality, and communication — highlight that formally comparable indicators do not necessarily support substantively equivalent interpretations. Rather than neutral descriptors, indicators shape how academic entrepreneurship is represented and interpreted through the assumptions embedded in their design and use.

More generally, this perspective contributes to ongoing debates on the role of indicators in innovation and higher education research. It highlights that the analytical value of comparative measurement lies less in producing definitive representations than in enabling structured, transparent engagement with complex and context-dependent phenomena. Indicators are therefore most useful when understood as tools that support interpretation rather than as self-contained measures of performance.

This does not suggest that comparative measurement should be rejected. Indicators nevertheless remain essential for research, policy analysis, and institutional learning. Their analytical value, however, depends on the transparency of conceptual definitions, the explicit articulation of proxy–construct relationships, and sensitivity to institutional and contextual variation. Comparative evidence is most informative when treated as partial and interpretable, rather than as a complete or definitive representation of academic entrepreneurship.

Measurement is thus better understood not simply as a technical exercise, but as a structured analytical practice with an inherently interpretive dimension. This paper contributes by making explicit the conditions under which comparative indicators can support meaningful analysis and by showing how these conditions shape both the production and interpretation of evidence in cross-country contexts. These insights have implications for both research and policy. For researchers, the framework highlights the importance of clearly defining the object of analysis, specifying proxy–construct relationships, and interpreting comparative evidence in relation to institutional context rather than relying on formal comparability alone. It also underscores the value of combining quantitative indicators with qualitative evidence on data production, institutional meaning, and user interpretation. For policy and practice, the findings underline the need for caution in using rankings and composite indicators, emphasising the importance of communicating scope conditions, data limitations, and the interpretive nature of comparative evidence.

The framework also opens an agenda for future research. Further work is needed to examine how specific indicators behave across institutional settings, how data infrastructures shape the visibility of academic entrepreneurship activities, and how measurement practices influence organisational behaviour and policy choices. Comparative research would benefit from approaches that combine quantitative indicators with qualitative insights, as well as from greater attention to the processes through which indicators are constructed, interpreted, and used in practice.

These considerations suggest that the value of comparative indicators lies less in their ability to provide definitive assessments than in their capacity to support informed and context-sensitive analysis. When used reflexively, indicators can contribute to a more nuanced understanding of academic entrepreneurship, even amid conceptual ambiguity and partial observability. On the other hand, when treated as self-evident measures, they risk narrowing the analytical space and reinforcing simplified representations of complex phenomena. The paper does not seek to resolve the measurement problem, but to clarify its analytical boundaries. By making explicit the conditions under which comparative evidence is produced and interpreted, it supports a more transparent and analytically grounded use of indicators in research and policy.

Acknowledgments

This work was supported by the Portuguese Foundation for Science and Technology (FCT) through the Research Centre for Natural Resources, Environment and Society – CERNAS (UIDB/0681/2025) and the Research Centre for Business Sciences – NECE (UIDB/04630/2020).

Ethics Declaration

Ethics approval was not required for the present study.

AI Declaration

The author acknowledges the use of AI-assisted tools for language refinement.

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