

Governing Difference as an Innovation Resource: A Cross-Cultural Review Essay on Self-Different Fractals and Innovation

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Author note

This review essay develops from an earlier Chinese-language reflection on the book, published online at <https://mp.weixin.qq.com/s/s81N3XuJhuhuCfFY14OMoQ>. The present version is substantially reframed and expanded for an international readership.

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Abstract

David F. J. Campbell and Elias G. Carayannis' *Self-Different Fractals and Innovation: Academic Firm and the Entrepreneurial University in Epistemic Governance* is a compact yet conceptually demanding book. It brings together debates on the entrepreneurial university, the academic firm and epistemic governance through the notion of 'self-different fractals'. This review essay reads the book from the perspective of higher education and innovation studies, while extending the discussion through a Chinese philosophical lens. The book's main contribution is not another model of innovation, but a shift in attention from actor coordination to the governance of epistemic and institutional difference. It asks how innovation systems can work with differences among universities, firms, governments, society and the natural environment, rather than treating such differences as problems to be eliminated. The review argues that the book is most valuable as a conceptual provocation. It reopens a difficult question for higher education and innovation research: how can systems preserve difference as a source of creativity without allowing it to become fragmentation, conflict or empty coordination?

Keywords Self-Different Fractals, Epistemic Governance, Entrepreneurial University, Academic Firm, Triple Helix, Higher Education Governance, Innovation Systems.

From modelling innovation to governing difference

Innovation theory is not short of models. Over the past few decades, researchers and policymakers have worked with national and regional innovation systems, the Triple, Quadruple and Quintuple Helix, Mode 2 and Mode 3 of knowledge production, entrepreneurial ecosystems and other formulations. These concepts have helped us move away from linear accounts of innovation. They show that innovation rarely arises from isolated inventors, single firms or simple technology transfer. It emerges through relations among universities, firms, governments, civil society, users, publics and, increasingly, the natural environment.

Yet the multiplication of models also creates a slight unease. Diagrams can clarify, but they can also make innovation appear more settled than it is. Once actors are placed in

their proper boxes, the harder question may slip from view. What is being governed when we speak of innovation governance? Coordination among actors? Allocation of resources? Management of institutional boundaries? Production of new knowledge? Or the negotiation of different values, expectations and understandings of quality?

Campbell and Carayannis' book enters this already crowded field by refusing to add yet another actor category. Its interest lies elsewhere. It asks how knowledge-producing systems handle difference. The book brings together the entrepreneurial university, the academic firm, Mode 3 knowledge production, epistemic governance, cross-employment, higher education quality, knowledge democracy and sustainability. It clearly grows out of earlier debates on the Triple Helix and the entrepreneurial university, especially the changing relations among universities, industry and government and the expanded role of universities in knowledge-based development (Etzkowitz & Leydesdorff, 2000; Etzkowitz, 2008; Cai & Etzkowitz, 2020). At the same time, it pushes the Mode 3 and Quadruple/Quintuple Helix discussions further by asking how different knowledge regimes, societal actors and ecological concerns can coexist within innovation systems (Carayannis & Campbell, 2009, 2010; Cai, 2022). The connecting idea is the 'self-different fractal'.

This review reads the book's main contribution as not another innovation model. It marks a shift of attention from actor coordination to the governance of epistemic and institutional difference. The book is strongest as a conceptual provocation. Its limitation is the absence of a fully operational research method or policy toolkit. This is why it reads better as an invitation to rethink the governance of difference than as a completed model.

A conventional fractal is usually associated with self-similarity: a pattern that repeats across scales. Campbell and Carayannis shift attention from self-similarity to self-difference. In their reading, innovation systems do not simply reproduce the same form at local, national and global levels. They generate recurring yet non-identical structures. Actors, institutions and knowledge modes may display family resemblances across levels, but they remain distinct in their internal logics, values and forms of knowledge production.

The point is evident in the tension between academic openness and commercial ownership. This tension may appear within a research laboratory, a university-industry partnership, a regional innovation ecosystem and a national innovation policy. It recurs without taking the same form. Each setting has its own actors, rules, incentives and criteria for success. Difference is fractal in this sense: not a mechanical repetition of the same pattern, but the reappearance of related tensions across different levels of the system.

The authors develop this argument through an interesting interpretive move. They draw loosely on Hegelian dialectical language, positioning the entrepreneurial university as the thesis, the academic firm as the antithesis, and epistemic governance as the synthesis. This should not be read as a strict application of Hegelian philosophy. Rather, the schema explains how differences among universities, firms, and governance arrangements can generate productive tensions for innovation.

In this framing, the entrepreneurial university represents the university's outward movement towards application, innovation, social engagement and economic development. The academic firm represents a movement in the other direction, as firms adopt, or seek to adopt, certain academic characteristics, such as research autonomy, long-term knowledge creation and cultures of inquiry. Epistemic governance then refers to the challenge of holding these orientations together without allowing one to absorb or dominate the other.

The force of the argument lies here: collaboration is difficult not only because organisations pursue different interests, but also because they differ in what they regard as valid, useful, legitimate and appropriate.

The entrepreneurial university and the academic firm

The entrepreneurial university is a familiar concept in higher education and innovation studies. It captures the transformation of the university from an institution primarily concerned with teaching and research into one also engaged in knowledge transfer, regional development, patenting, start-up formation, industry collaboration and social engagement. In Triple Helix theory, this expanded role is central to the transition from an

industrial to a knowledge-based society (Etzkowitz, 2008; Etzkowitz & Leydesdorff, 2000). The university does not merely supply graduates or scientific knowledge from outside the innovation system. It becomes an institutional actor within the system.

Campbell and Carayannis accept this broad development, but they give it a sharper dialectical role. The entrepreneurial university is not treated simply as a managerial reform or an institutional success story. It signals a broader shift in knowledge production. Universities increasingly move across teaching, research, application, commercialisation, social engagement and public responsibility. Their task is to produce knowledge while moving among different knowledge modes and making these modes work in relation to one another.

The academic firm is the more unusual counterpart. If the entrepreneurial university describes a university moving towards innovation, the academic firm describes a firm moving towards forms of knowledge production usually associated with academia. Such a firm does not merely purchase knowledge externally, nor does it use research only as a strategic label. It develops internal conditions in which exploratory inquiry, longer-term research and knowledge accumulation can take place. Corporate research laboratories and advanced technology firms may serve as partial examples, but the concept goes beyond the mere existence of a research and development unit. The academic firm, as presented in the book, is an ideal-typical form in which academic values enter the corporate setting, even if only partially and unevenly.

The difficulty should not be understated. Firms remain accountable to commercial strategy, market position and, in many cases, shareholder value. Academic inquiry depends on autonomy, openness, publication, peer judgement and time horizons that do not always align with commercial urgency. This makes the academic firm a normatively unstable form. Its value depends on whether academic practices are protected or absorbed into corporate strategy.

Park's review of the book notes that the tensions between profit orientation and the public good, and between proprietary and open knowledge regimes, are not fully explored in the volume (Park, 2026). This matters because the academic firm can easily become a settled

label for an unsettled problem. The question is not only whether firms have research institutes, publish papers or hire PhDs. More demanding questions concern how internal research cultures are governed, whether researchers have room for open inquiry, how firms manage publication and intellectual property, and whether long-term knowledge creation survives changes in commercial strategy.

The value of the academic firm lies less in naming an existing organisational type than in revealing the fragile conditions under which academic values may survive within corporate knowledge production.

Epistemic governance: beyond coordination

The tension between the entrepreneurial university and the academic firm raises the book's deeper governance question: how can different knowledge regimes be brought into relation without being reduced to one another? The concept of epistemic governance is important here.

Governance is often discussed in administrative or organisational terms: steering mechanisms, accountability systems, funding instruments, performance indicators, quality assurance, coordination structures, and stakeholder participation. Campbell and Carayannis are interested in something less visible yet arguably more consequential. Epistemic governance concerns the assumptions actors use to judge what counts as valid knowledge, valuable research, good quality, meaningful innovation, and legitimate impact.

Many failures in university-industry-government cooperation are not simply failures of coordination. Universities may value originality, peer recognition and disciplinary contribution; firms may prioritise speed, applicability, intellectual property and market advantage; governments may emphasise measurable outputs, strategic alignment and public accountability; while civil society may seek inclusion, transparency and social relevance. None of these logics is inherently wrong, but they do not translate easily into one another. Earlier work on the Triple Helix in China has shown that such relations cannot be understood merely by asking whether interaction exists, since interaction itself is shaped by the institutional logics through which actors define legitimate roles,

appropriate practices and desirable forms of innovation (Cai, 2014).

Here, institutional logics analysis is necessary to understand the book's wider implications. Collaboration may be hindered not only by conflicting interests but also by differing assumptions about what constitutes valuable knowledge, research quality, legitimate impact and appropriate governance. Coordination theory alone cannot explain these problems. Institutional logics analysis makes these assumptions visible, particularly in higher education settings where multiple logics are identified, translated and contested across levels (Cai & Mountford, 2022; Cai, 2026). It explains why actors may endorse collaboration in principle while continuing to judge it by different criteria.

Epistemic governance, understood in this sense, sits at the centre of innovation governance. If actors disagree about what knowledge is valuable, what quality means, or which kind of innovation deserves support, collaboration can remain superficial. It may still generate projects, platforms and funding schemes, but not necessarily shared knowledge work. The deeper problem is not the absence of meetings or policy rhetoric. It is the lack of workable arrangements for dealing with epistemic plurality. The governance problem lies in making different criteria of knowledge and value mutually intelligible, not merely in connecting actors.

This also means that epistemic governance cannot remain merely a philosophical idea. It must eventually be translated into institutional arrangements: funding rules, evaluation criteria, intellectual property regimes, research ethics, career structures, quality assurance, stakeholder participation, and mechanisms for protecting longer-term inquiry. The governance problem is therefore not only how to connect actors, but also how to make their different criteria of knowledge and value mutually intelligible.

This argument links the book to earlier debates on Mode 3 knowledge production and the Quadruple Helix. Carayannis and Campbell (2009) described Mode 3 as involving the co-existence and co-evolution of different knowledge and innovation paradigms. That argument already moved beyond a linear view of innovation. The present book gives difference a more explicit philosophical and governance status. Difference is not noise to be reduced, nor is it automatically productive. It becomes valuable only when systems

recognise and work with it.

The point is immediately relevant to contemporary higher education. Universities are expected to excel in research, respond to industry, be accountable to society, be globally competitive, be locally embedded, be entrepreneurial, be inclusive and be sustainable. These expectations rarely align without friction. They reflect different knowledge cultures and value regimes. Epistemic governance names this friction more accurately than the usual language of partnership or alignment. It asks how higher education systems can govern contradictions among objectives, rather than simply accumulating more objectives.

Self-different fractals as a productive metaphor

The notion of self-different fractals is the book's most striking idea. It is also the one that requires the most careful handling.

Its value lies in resisting the assumption that innovation systems become more effective as their actors become more alike. Universities need not become firms. Firms need not present themselves as universities. Governments should not manage knowledge production as if it were a simple administrative process. Civil society should not be reduced to user feedback or public acceptance. Innovation depends on interaction, but interaction does not require institutional sameness.

There is clear resonance with the Triple Helix idea of "taking the role of the other". In Triple Helix theory, universities, industry and government retain their primary roles while selectively entering one another's domains. Universities may engage in entrepreneurship and knowledge capitalisation. Firms may engage in research and training. Governments may support venture formation, create policy frameworks and, at times, act entrepreneurially. However, role-taking is not role-collapse. The productivity of the Triple Helix depends on interactions among actors who remain distinct (Cai & Etzkowitz, 2020).

Campbell and Carayannis extend this logic by asking how difference recurs across levels. The university, the firm, the state, civil society and the natural environment do not appear

once in a diagram and then remain fixed. Their logics reappear within institutions, across regions, within national systems and within transnational innovation networks. At each level, tensions may arise between autonomy and accountability, openness and ownership, exploration and application, democracy and expertise, and ecology and growth. Such tensions are not accidental disturbances. They are part of the structure of innovation systems.

The metaphor also has a geometric and aesthetic dimension. Fractals are useful not only because they describe complexity, but because they make complexity visible. They allow us to see how repetition can contain variation, and how a form can remain ordered without becoming uniform. This gives the idea of self-different fractals a wider significance than a purely analytical concept. It creates a possible bridge between scientific and artistic research: science may use fractals to think about recursive, non-linear and emergent structures, while art may use them to explore perception, form and beauty. For a book on innovation, this matters. Innovation often begins not only with a new model, but with a different way of seeing relations and differences.

One should not overstate what the concept currently delivers. Self-different fractals are theoretically stimulating, but they are not yet a fully operational analytical tool. The book offers us a way of seeing rather than a ready-made method for study. How would one empirically identify a self-different fractal? What would distinguish productive epistemic difference from ordinary institutional complexity? Under what conditions does difference generate creativity, and under what conditions does it produce confusion, delay or failure? Park (2026) raises a similar concern. The book is compelling when it asks how self-different fractal systems might be governed, but less concrete when it shows how such governance would work in practice. This is a real limitation. It also clarifies the book's proper status. Its contribution is not to close the debate with a completed model, but to change the question: how can the differences that make alignment both necessary and difficult be governed?

Reading difference through Chinese thought

This treatment of difference also invites a cross-cultural reading of the book. The aim here is not to relocate Campbell and Carayannis' argument within Chinese philosophy,

but to use Chinese relational thinking to clarify why difference requires governance rather than elimination.

Although Campbell and Carayannis write primarily within Western philosophical and innovation-studies traditions, their argument invites comparison with other intellectual resources. From a Chinese perspective, the book's treatment of difference recalls older ideas about relationality, complementarity and transformation.

The Daodejing (道德经) suggests that things become intelligible through relation: beauty through its contrast with what is not beautiful (天下皆知美之为美，斯恶已), being through non-being (有无相生), difficulty through ease (难易相成), long through short (长短相形), and high through low (高下相倾). The Yijing (易经) likewise treats change as emerging from the interaction of forces rather than from isolated entities. These traditions should not be too quickly folded into Hegelian dialectics. Hegelian dialectics places particular emphasis on contradiction, negation, and synthesis. Daoist and Yijing thought tend to emphasise mutual dependence, transformation, and dynamic balance. The distinction matters.

Precisely because the traditions differ, the comparison is useful. Campbell and Carayannis' book invites a related reflection: difference need not be treated solely as an obstacle. It may be the condition through which change becomes possible. In innovation systems, tensions between the university and the firm, autonomy and application, public value and private benefit, and openness and ownership may be uncomfortable. Without such tensions, however, innovation would lose much of its generative force.

This cross-cultural reading also warns against a familiar policy instinct. Governance is often imagined as the reduction of difference: standardise procedures, align incentives, harmonise indicators, and define common objectives. Such measures may sometimes be necessary, but they are not enough. Excessive harmonisation may make collaboration easier on paper while weakening the diversity that gives it intellectual value. A university-industry partnership can be administratively efficient yet intellectually thin if both sides are required to speak only the language of short-term outputs.

Chinese relational thinking sharpens this point. Difference is produced and transformed through relations, not simply located between fixed entities. A university becomes more entrepreneurial by reconfiguring its relationships with the application of knowledge, society, and industry, while remaining a university. A firm becomes more academic by creating conditions in which inquiry and knowledge accumulation can develop, rather than by imitating the university as an institution. Governance, then, concerns the cultivation of productive relations across difference.

From helix models to epistemic governance

The book can also be read as part of the ongoing development of helix models. The Triple Helix model foregrounded interactions among universities, industry and government in knowledge-based innovation. Later, the Quadruple and Quintuple Helix models extended the framework to include civil society, culture, media-based publics and the natural environment (Carayannis & Campbell, 2010). These extensions responded to real limitations in earlier innovation thinking. Innovation is not only economic or technological. It is also social, democratic, cultural and ecological.

At the same time, moving from three to four or five helices has raised conceptual questions. Additional helices may increase inclusiveness, but they can also make the model harder to use analytically. The issue is less how many actors should be included than how relations among different systems, logics and values are theorised. The neo-Triple Helix model offers one way to address this difficulty by distinguishing university-industry-government interactions at the level of innovation dynamics from broader interactions among innovation dynamics, social structures and the natural environment (Cai, 2022). Such layered thinking may help retain analytical breadth without allowing conceptual expansion to become inflationary.

Campbell and Carayannis' book contributes to this debate by moving helix thinking towards epistemic governance. The question is no longer simply whether civil society or the natural environment should be added to the model, but what kinds of knowledge, quality criteria and value assumptions underpin different innovation arrangements. Epistemic governance may therefore be understood as a deeper layer beneath helix interaction. Helix models show which actors and spheres interact; epistemic governance

asks how their knowledge assumptions are made visible, negotiated and institutionally supported.

This matters particularly for transnational innovation cooperation. International collaboration spans not only organisational boundaries but also national, cultural, regulatory and epistemic ones. Research on EU-China innovation cooperation has shown that international university collaboration can help build transnational university-industry co-innovation networks by matching partners, building trust, providing access to resources, enhancing reputation and creating new collaboration models (Cai, 2023). Yet cooperation also depends on institutional compatibility, shared expectations and translation across different knowledge regimes. Campbell and Carayannis' notion of epistemic governance provides useful language for addressing these translation problems.

What the book leaves open

The book leaves three issues particularly open. The first concerns operationalisation. If self-different fractals are to become more than a philosophical metaphor, researchers need ways to identify and compare them. This may require organisational, network, discourse, and comparative case-study analyses. The object of analysis would not be the mere presence of multiple actors, but the recurrence of epistemic tensions across levels. Do similar tensions between academic autonomy and application appear within a research group, a university, a regional innovation ecosystem, and a national policy framework? If so, how are they governed differently at each level?

The second concerns the academic firm. A firm may employ scientists, run laboratories, publish papers or collaborate with universities. These features alone do not make it academic in a strong sense. The more demanding question is whether the firm sustains inquiry under conditions that respect academic values: openness, peer scrutiny, cumulative knowledge and tolerance of uncertainty. There is a risk that the academic firm becomes an attractive label for corporate research, without sufficient attention to power, ownership and the public value of knowledge.

The third concerns governance itself. Epistemic governance is a persuasive concept, but its instruments require clearer specification. It cannot mean only dialogue about the

values of knowledge. It must also involve institutional arrangements: funding rules, evaluation criteria, intellectual property regimes, research ethics, career structures, quality assurance, stakeholder participation, and mechanisms for protecting longer-term inquiry. If epistemic governance is to influence practice, it needs to connect philosophical insight to institutional design.

These limits are consistent with the book's scale and ambition. It opens a research agenda rather than closing one. Its achievement is to render familiar problems strange again. We may think we already understand university-industry collaboration, entrepreneurial universities and innovation governance. Campbell and Carayannis remind us that beneath these familiar terms lie unresolved questions about knowledge, value and difference.

Relevance beyond Europe and North America

The book is largely written within European and North American debates, reflecting the authors' intellectual trajectories and the literature they engage with. Its concepts can travel beyond those contexts, provided they are not applied mechanically.

China may be read as a context in which these questions are particularly salient. University-industry cooperation is often discussed in policy vocabularies such as research commercialisation, industry-university-research collaboration, integration of education and industry, and national innovation capacity. These terms are important, but they do not fully capture the epistemic issues at stake. A deeper question concerns whether universities, firms and the state can develop workable understandings of the value of basic research, the meaning of high-quality innovation, the role of academic autonomy, and the balance between strategic priorities and open-ended inquiry.

In this context, epistemic governance serves as a useful lens rather than a ready-made solution. Chinese higher education and innovation governance can draw on administrative, academic, and market logics. These logics may reinforce one another in some circumstances and pull in different directions in others. The challenge is to make collaboration intellectually and institutionally meaningful, not merely to expand it. Without attention to knowledge standards and value assumptions, university-industry cooperation may remain at the level of projects, resources, and indicators.

A cross-cultural reading is therefore productive. The point is not to impose Chinese philosophy on Campbell and Carayannis' framework, nor to claim that Daoist or Yijing thought offers an alternative theory of innovation. The point is more modest: a different intellectual tradition helps illuminate a shared problem, namely how difference can be understood, sustained and transformed. If innovation governance is only about reducing friction, it may overlook the generative role of tension. If it romanticises difference without governance, it may produce fragmentation. The difficult task lies between these two errors.

Conclusion: from eliminating contradiction to governing it

Self-Different Fractals and Innovation is not an easy book, despite its brevity. It moves quickly across philosophy, higher education governance, innovation theory and institutional analysis. Some readers may find the concept of self-different fractals too abstract. Others may wish for more empirical cases, clearer policy instruments, or a fuller treatment of the tensions within the academic firm. These criticisms matter, especially because the book's strongest claims remain at the level of conceptual framing.

The book nevertheless deserves attention because it unsettles a common assumption in innovation policy and higher education governance: that actors mainly need to be more effectively aligned. Alignment matters, but it is not enough. Innovation systems become productive when differences in knowledge, values and institutional logic are recognised, protected where necessary, and governed where possible. Higher education governance, in this sense, is also a matter of epistemic judgement, not only of efficiency, accountability or responsiveness.

For higher education research, this is a useful provocation. It discourages treating collaboration as a self-evident good. Collaboration has value only when the differences it brings together are understood. For innovation policy, the book cautions against excessive simplification: systems that appear messy may contain the conditions for creativity. For international higher education, it suggests that cross-border cooperation depends on the governance of differing epistemic expectations, not only on mobility, funding and institutional partnerships.

The book's strongest contribution is reframing a problem rather than providing a new operational model. It makes it harder to treat innovation governance as coordination alone. The difficult differences among universities, firms, governments, society and the natural environment should not be smoothed over too quickly; they are often where the real work of innovation begins. This is the value of Campbell and Carayannis' book. It brings the stubborn differences among knowledge, institutions and values back into view.

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