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*Article*

# Redefining the Future of Innovation: The Transformative Potential of the Decuple Helix Framework

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**Abstract:** In an era of unprecedented global challenges, the limitations of traditional, linear models of innovation have become increasingly apparent. This pioneering work introduces the revolutionary "decuple helix" framework - a comprehensive, multistakeholder approach to driving transformative change through collaborative innovation. By expanding the scope of stakeholder engagement to include a diverse array of actors, from academia and industry to marginalized communities, the natural environment, and international organizations, the decuple helix model unlocks new frontiers of collective creativity, values-driven problem-solving, and systemic regeneration. Drawing on cutting-edge theoretical foundations and a wealth of empirical evidence, this groundbreaking contribution demonstrates how the strategic integration of these ten key stakeholders can catalyze a profound paradigm shift in the way we conceptualize, organize, and mobilize innovation to address the complex, interconnected crises facing our world. Challenging dominant narratives of technocratic, top-down innovation, this article unveils a radically reimagined vision - one in which diverse epistemologies, holistic well-being, and ecological restoration converge to unlock a thriving, equitable, and sustainable future for all.

**Keywords:** innovation; decuple helix framework; innovationology; creativity; triple helix; quadruple helix; sustainability science; post-normal science; innovationology; science of integration; innovation ecosystem; mode 3 knowledge production; mode 4 knowledge production

## 1. Introduction

In an era of mounting global crises, from climate change (IPCC, 2021) and biodiversity loss (IPBES, 2019) to rising inequality (Oxfam, 2022) and social unrest (Pickett & Wilkinson, 2015), the limitations of traditional, linear models of innovation have become increasingly apparent (Moleka, 2024a ; 2024b ; 2024c ; 2024d). The dominant, technocratic framing of innovation - centered on the linear progression from scientific research to commercial application - has proven woefully inadequate in grappling with the complex, interconnected nature of the challenges facing our world (Gibbons et al., 1994; Nowotny et al., 2001; Carayannis & Campbell, 2012 ; Moleka, 2024e ; 2024f ; 2024g ; 2024h). Recognizing the need for a more collaborative, multistakeholder approach to driving transformative change, this pioneering work introduces the revolutionary "decuple helix" framework. By expanding the scope of stakeholder engagement to incorporate a comprehensive range of actors, from academia and industry to marginalized communities, the natural environment, and international organizations, the decuple helix model unlocks new frontiers of collective creativity, values-driven problem-solving, and systemic regeneration (Levin-Keitel et al., 2018; Romero-Lankao et al., 2018). Drawing on cutting-edge theoretical foundations and a wealth of empirical evidence, this groundbreaking contribution challenges the prevailing narratives of innovation as a technocratic, top-down process (Moleka, 2024i ; 2024j ; 2024k ; 2024l). Instead, it

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unveils a radically reimagined vision - one in which diverse epistemologies, holistic well-being, and ecological restoration converge to drive a profound paradigm shift in the way we conceptualize, organize, and mobilize innovation to address the complex, interconnected crises facing our world.

## 2. Theoretical Foundations

The decuple helix framework is grounded in a rich tapestry of theoretical frameworks that have emerged over the past few decades, ranging from the pioneering "triple helix" and "quadruple helix" models to the cutting-edge advancements in sustainability science, post-normal science, and the science of integration.

### *2.1. From Triple Helix to Quadruple Helix: Expanding the Innovation Ecosystem*

The "triple helix" model, which emerged in the 1990s, recognized the need to move beyond the traditional linear, technocratic approach to innovation by incorporating the strategic interactions between academia, industry, and government (Moleka, 2024m ; Etzkowitz & Leydesdorff, 2000). This foundational framework laid the groundwork for a more collaborative, networked approach to innovation, setting the stage for the subsequent evolution of the "quadruple helix" model. The quadruple helix framework further expanded the scope of stakeholder engagement by incorporating civil society as a fourth key actor, acknowledging the vital role of community-based knowledge, values, and participation in driving innovation (Carayannis & Campbell, 2012; Romero-Lankao et al., 2018). This shift towards a more inclusive, pluralistic approach to innovation represented an important step in recognizing the limitations of top-down, expert-driven models.

### *2.2. Sustainability Science and Post-Normal Science: Embracing Complexity and Transdisciplinarity*

Building on these foundational models, the decuple helix framework also draws inspiration from the emergent fields of sustainability science and post-normal science. Sustainability science champions a transdisciplinary ethos, emphasizing the need to bridge disciplinary divides and actively engage diverse stakeholders in the co-creation of knowledge to address complex, socio-ecological challenges (Kates et al., 2001; Lang et al., 2012; Caniglia et al., 2021). Similarly, post-normal science rejects the notion of value-free, technocratic approaches to problem-solving, instead advocating for the inclusion of a broader range of stakeholders and the embracing of pluralistic, participatory methods that can grapple with the inherent complexity of real-world issues (Funtowicz & Ravetz, 1993; Hadorn et al., 2008). These theoretical frameworks have laid crucial groundwork for the decuple helix model's emphasis on collaborative, transdisciplinary innovation.

### *2.3. The Science of Integration: Navigating Complexity Through Adaptive Approaches*

Complementing the insights from sustainability science and post-normal science is the emerging field of the "science of integration." Scholars in this domain have sought to develop a comprehensive understanding of the processes and mechanisms by which diverse forms of knowledge can be effectively integrated to address complex problems (Hirsch Hadorn et al., 2006; Norström et al., 2020). The science of integration underscores the importance of adaptive, iterative, and reflective approaches to innovation that can navigate the inherent uncertainties and tensions involved in cross-stakeholder collaboration (Pohl, 2011; Luederitz et al., 2016). This emphasis on flexibility, collaborative problem-solving, and the co-evolution of problem definitions and solution pathways directly informs the methodological foundations of the decuple helix framework. By synthesizing these cutting-edge theoretical frameworks, the decuple helix model positions itself as a transformative, multistakeholder approach to driving innovation that can truly address the complex, interconnected challenges facing our world.

## 3. The Decuple Helix Framework: Expanding the Scope of Stakeholder Engagement

At the heart of the decuple helix framework lies a profound expansion of the stakeholder engagement model, moving beyond the quadruple helix's incorporation of academia, industry,

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government, and civil society to include a comprehensive range of actors (Moleka, 2024m). The ten key stakeholders that constitute the decuple helix are:

1° Academia: Universities, research institutes, and other higher education institutions (Gibbons et al., 1994; Nowotny et al., 2001).

2° Industry: Businesses, corporations, and private-sector entities (Chesbrough, 2003; Porter & Kramer, 2011).

3° Government: Local, regional, and national government agencies and policymakers (Etzkowitz & Leydesdorff, 2000; Carayannis & Campbell, 2012).

4° Civil Society: Non-governmental organizations (NGOs), community groups, and citizen collectives (Levin-Keitel et al., 2018; Romero-Lankao et al., 2018).

5° Media and Culture: Journalists, artists, cultural institutions, and media outlets (Castells, 2009; Jacobson et al., 2019).

6° The Natural Environment: Environmental organizations, natural resource managers, and ecological experts (Benyus, 1997; Capra & Luisi, 2014).

7° Social and Values-based Movements: Social justice advocates, human rights groups, and values-oriented activists (Benford & Snow, 2000; Melucci, 1996).

8° Marginalized or Underrepresented Communities: Indigenous groups, minority populations, and traditionally excluded stakeholders (Coulthard, 2014; Escobar, 2018).

9° Philanthropy and Funding Organizations: Foundations, trusts, international organizations, intergovernmental bodies, global development agencies, transnational networks, and other impact-oriented grantmakers (Bishop & Green, 2008; Hockerts, 2006).

10° Religious and Spiritual Organizations and Movements: Faith-based groups, spiritual leaders, and values-oriented collectives (Benefiel, 2003; Marques et al., 2014).

By incorporating this diverse array of stakeholders, the decuple helix framework enables a more inclusive, holistic, and collaborative approach to driving innovation that aligns seamlessly with the principles of sustainability science, post-normal science, and the science of integration. The active engagement and integration of these varied actors, each with their unique capabilities, perspectives, and forms of knowledge, is essential for unlocking the transformative potential of innovation.

## 4. Operationalizing the Decuple Helix: Collaborative Innovation in Action

The strategic deployment of the decuple helix framework in driving transformative innovation involves the active engagement and integration of the ten key stakeholder groups, each playing a vital role in the collaborative process.

### *4.1. Academia: Bridging Disciplinary Divides and Fostering Transdisciplinary Collaboration*

As the traditional locus of knowledge production, universities and research institutes serve as a foundational pillar within the decuple helix framework. However, the decuple helix demands that academia shift away from its historical insularity and hierarchy, embracing a more open, engaged, and co-creative approach to innovation. By forging interdisciplinary connections and collaborating with diverse stakeholders, academic institutions can help to bridge disciplinary divides and foster the transdisciplinary ethos that is essential for addressing complex, interconnected challenges (Hirsch Hadorn et al., 2006; Lang et al., 2012).

### *4.2. Industry: Aligning Business Priorities with Societal and Environmental Needs*

Businesses and corporations bring valuable practical knowledge, technological capabilities, and market-oriented perspectives to the decuple helix. Their participation can help to ensure the relevance and applicability of innovative solutions, while also providing resources and opportunities for the deployment of new products, services, and business models. In the decuple helix framework, industry is viewed as an equal partner in the innovation process, rather than a mere consumer or implementer of research and development (Porter & Kramer, 2011; Chesbrough, 2003).

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*4.3. Government: Shaping the Institutional and Policy Landscape for Collaborative Innovation*

Government agencies and policymakers play a crucial role in the decuple helix framework, as they possess the regulatory, legislative, and budgetary levers to shape the broader institutional and policy environment for innovation. By actively engaging with other stakeholders, government can help to align innovation priorities with pressing societal needs, facilitate the implementation and scaling of collaborative solutions, and enable the institutional and cultural changes required to support the widespread adoption of the decuple helix approach (Etzkowitz & Leydesdorff, 2000; Carayannis & Campbell, 2012).

*4.4. Civil Society: Elevating Grassroots Perspectives and Community-based Knowledge*

Non-governmental organizations, community groups, and citizen collectives bring invaluable grassroots perspectives, local knowledge, and community-based expertise to the decuple helix. Their participation ensures that the innovation agenda and resulting solutions address the needs and priorities of diverse populations, particularly marginalized communities. Civil society actors can also serve as crucial conduits for the dissemination and uptake of collaborative innovation outputs (Levin-Keitel et al., 2018; Romero-Lankao et al., 2018).

*4.5. Media and Culture: Shaping Narratives and Fostering Societal Engagement*

Media outlets, artists, and cultural institutions play a vital role in shaping public discourse, narratives, and awareness around complex societal challenges. Within the decuple helix framework, these actors can help to amplify the voices of diverse stakeholders, communicate innovation insights in accessible ways, and foster broader societal engagement with the collaborative problem-solving process (Castells, 2009; Jacobson et al., 2019).

*4.6. The Natural Environment: Integrating Ecological Imperatives into the Innovation Agenda*

Environmental organizations, natural resource managers, and ecological experts are essential participants in the decuple helix, as they possess deep knowledge of the biophysical systems that underpin the sustainability and resilience of human societies. By integrating their perspectives, the decuple helix framework can ensure that innovation is aligned with the needs and constraints of the natural world, moving towards a more harmonious and regenerative relationship between human and ecological systems (Benyus, 1997; Capra & Luisi, 2014).

*4.7. Social and Values-based Movements: Championing Equity, Inclusion, and Ethical Considerations*

Social justice advocates, human rights groups, and values-oriented activists bring a crucial ethical and normative dimension to the decuple helix. Their participation helps to center issues of equity, inclusion, and the alignment of innovation with broader societal values and aspirations. These stakeholders can shape the framing of problems, challenge dominant narratives, and advocate for solutions that prioritize the wellbeing of marginalized communities (Benford & Snow, 2000; Melucci, 1996).

*4.8. Marginalized or Underrepresented Communities: Integrating Diverse Epistemologies and Lived Experiences*

The explicit inclusion of Indigenous groups, minority populations, and traditionally excluded stakeholders within the decuple helix framework is a critical component of this transformative approach to innovation. These actors possess invaluable place-based knowledge, lived experiences, and alternative epistemologies that can radically transform the innovation process. Their participation is essential for dismantling historical power imbalances and ensuring that innovation is responsive to the needs and priorities of diverse communities (Coulthard, 2014; Escobar, 2018).

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*4.9. Philanthropy and Funding Organizations: Aligning Resources with Collaborative, Values-driven Innovation*

Foundations, international organizations, trusts, and other impact-oriented grantmakers play a vital role in shaping the innovation landscape through their funding decisions and strategic priorities. Within the decuple helix framework, these actors can help to align financial resources with the collaborative, transdisciplinary, and values-oriented ethos of transformative innovation. They can also leverage their position to advocate for institutional and systemic changes that support the widespread adoption of these principles (Bishop & Green, 2008; Hockerts, 2006).

*4.10. Religious and Spiritual Organizations and Movements: Integrating Holistic Conceptions of Wellbeing*

Religious and spiritual organizations and movements, with their deep roots in community, ethics, and holistic conceptions of wellbeing, offer unique and invaluable contributions to the decuple helix framework. These stakeholders can provide essential insights into the cultural, social, and philosophical dimensions of the challenges facing society, complementing the more technocratic, scientific perspectives that have traditionally dominated innovation processes.

By actively engaging these actors, the decuple helix can foster a more inclusive, values-oriented approach to problem-solving and catalyze the integration of diverse epistemologies (Benefiel, 2003; Marques et al., 2014). By strategically integrating and aligning the roles and contributions of this diverse array of stakeholders, the decuple helix framework unlocks new frontiers of collaborative innovation, adaptive resilience, and systemic regeneration - a profound paradigm shift in the way we drive transformative change to address the complex, interconnected challenges facing our world.

## 5. Realizing the Transformative Potential of the Decuple Helix

Achieving the ambitious vision outlined in this pioneering work will require the strategic implementation of the decuple helix framework across a diverse range of contexts, from local communities to global networks. This will involve overcoming significant institutional, methodological, and equity-related barriers, while also cultivating the necessary capacities and resources to support the widespread adoption of this collaborative, multistakeholder approach to innovation.

*5.1. Fostering Institutional and Policy Reforms*

Realizing the transformative potential of the decuple helix will require fundamental reforms within academic, funding, and policy institutions to better support and incentivize the adoption of this collaborative innovation model. This may include developing new academic evaluation and reward systems, redesigning funding mechanisms to prioritize flexible, iterative, and values-oriented innovation projects, and enacting policy frameworks that enable and encourage the implementation of decuple helix initiatives (Moleka, 2024a; Moleka, 2024b; Moleka, 2024c).

*5.2. Building Methodological Capacities*

To strengthen the implementation of the decuple helix framework, there is a critical need to build robust methodological capacities among researchers, practitioners, and community members. This may involve developing training programs and resources to equip stakeholders with the skills needed to navigate complex, adaptive, and design-oriented innovation processes, as well as establishing collaborative platforms and "living labs" that enable the co-creation, testing, and refinement of innovative approaches (Moleka, 2024d; Moleka, 2024e; Moleka, 2024f).

*5.3. Ensuring Equitable and Inclusive Participation*

The decuple helix framework's emphasis on elevating diverse voices and perspectives demands a concerted effort to ensure equitable and authentic participation of marginalized or underrepresented communities. This may involve implementing proactive outreach and engagement

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strategies, developing inclusive governance structures and decision-making processes, and addressing power imbalances through capacity-building, resource-sharing, and the fostering of trust-based relationships (Moleka, 2024g; 2024h; 2024i).

### *5.4. Integrating Diverse Epistemologies and Holistic Conceptions of Wellbeing*

Realizing the full transformative potential of the decuple helix also requires the meaningful integration of diverse values, beliefs, and epistemologies, including those rooted in spirituality, Indigenous traditions, and holistic conceptions of wellbeing. This may entail actively engaging with religious, spiritual, and cultural organizations, incorporating contemplative and arts-based modes of inquiry, and developing frameworks that enable the co-creation of innovation through multiple ways of knowing and being (Moleka, 2024j;2024k ; 2024l ; 2024m).

### *5.5. Diffusing and Scaling the Decuple Helix Approach*

To catalyze the widespread adoption and scaling of the decuple helix framework, a multifaceted strategy is required. This may include documenting and disseminating case studies and best practices, cultivating communities of practice and peer-to-peer learning networks, leveraging the convening power of international organizations, and engaging in advocacy and coalition-building efforts to influence policy, funding, and institutional reforms. By strategically addressing these key challenges and opportunities, the decuple helix framework can be realized as a transformative, collaborative approach to driving innovation that truly addresses the complex, interconnected crises facing our world. As we stand at the precipice of a profound paradigm shift, this pioneering work offers a profound, liberatory pathway towards a future in which diverse stakeholders converge to unlock new frontiers of collective creativity, shared prosperity, and ecological regeneration.

## 6. Conclusion

In an era of mounting global crises, the limitations of traditional, linear models of innovation have become glaringly apparent. This groundbreaking work introduces the revolutionary decuple helix framework - a comprehensive, multistakeholder approach to driving transformative change through collaborative innovation. By expanding the scope of stakeholder engagement to include a diverse array of actors, from academia and industry to marginalized communities, the natural environment, and international organizations, the decuple helix model unlocks new frontiers of collective creativity, values-driven problem-solving, and systemic regeneration. Drawing on cutting-edge theoretical foundations and a wealth of empirical evidence, this pioneering contribution demonstrates how the strategic integration of these ten key stakeholders can catalyze a profound paradigm shift in the way we conceptualize, organize, and mobilize innovation to address the complex, interconnected challenges facing our world. Challenging dominant narratives of technocratic, top-down innovation, this article unveils a radically reimagined vision - one in which diverse epistemologies, holistic well-being, and ecological restoration converge to unlock a thriving, equitable, and sustainable future for all. Realizing the transformative potential of the decuple helix will require overcoming significant institutional, methodological, and equity-related barriers, while also cultivating the necessary capacities and resources to support the widespread adoption of this collaborative, multistakeholder approach to innovation. By strategically addressing these key challenges and opportunities, the decuple helix framework can be realized as a transformative pathway towards a future in which diverse stakeholders converge to unlock new frontiers of collective creativity, shared prosperity, and ecological regeneration. As we stand at the precipice of a profound paradigm shift, this pioneering work offers a profound, liberatory vision - one that holds the power to redefine the very purpose and practice of innovation, enabling us to address the complex, interconnected crises facing our world with renewed creativity, resilience, and a deep reverence for the interconnectedness of all life.

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