GRC Discussion Paper:

Working Together in Co-Creation to Address Global Challenges

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I. Co-Creation for Grand Challenges: Essence of a Holistic Approach

Grand challenges are characterized by their complexity, interconnectivity, and scale. Issues such as the "Water-Energy-Food-Ecosystem Nexus" (WEFE Nexus) and the diverse impacts of climate change require multifaceted solutions that address intertwined social, economic, and environmental issues and are supported by different technologies. The complexity of these challenges necessitates collaboration across various sectors and disciplines as well as with stakeholders affected by the challenges and the R&D activities performed. For instance, the impacts of climate change extend across various domains, including agriculture, health, infrastructure, and biodiversity. The interconnected nature of these impacts necessitates the development of solutions through a holistic approach that accounts for the cascading effects across different sectors and works for the communities. Mitigating climate change through the adoption of renewable energy, for example, influences energy security, economic development, and public health. This requires a collaborative approach that integrates diverse expertise and perspectives.

Addressing global risks that simultaneously impact multiple sectors—such as natural disasters, climate change, energy security, and labour imbalances—requires a transition to a more inclusive and holistic approach in science, technology, and innovation (STI) activities. The interconnected nature of these risks demands the active participation of all ecosystem stakeholders in the development of science and technology-based solutions, emphasizing the need for a **co-creation approach.** In this regard, this discussion paper endeavours to explore the theme of co-creation in addressing global challenges.

Co-creation is defined as the process of the joint generation of added value between research, industry, and possibly other stakeholders, such as civil society which is increasingly significant in a context of major transitions. **Co-creation differs from cooperation** in that it is a collaborative model where all relevant resources are strategically planned and mobilized according to a shared medium- to long-term roadmap and vision. In co-creation, all stakeholders are actively involved from the planning phase onward. Conversely, cooperation typically involves stakeholders coming together based on complementary skills to address immediate

needs, resulting in case-based associations that often do not evolve into long-term interactions once those needs are fulfilled. It facilitates multilevel dialogues on **co-planning, co-implementation, and co-monitoring/co-evaluation of activities to eliminate redundancy and as a possible means to optimise the impact of research findings.** By fostering shared ownership and accountability, co-creation significantly enhances the effectiveness and impact of initiatives aimed at addressing complex global issues deemed as grand challenges.

In this respect, **co-creation is** indispensable for addressing grand challenges as it consolidates diverse stakeholders from various disciplines, regions, nations, and sectors to develop innovative solutions collaboratively. This inclusive approach leverages the unique perspectives and expertise of participants from both developing and developed economies, as well as citizens, ensuring that solutions are holistic and sustainable.

Citizen engagement is a cornerstone of co-creation, reinforcing its social impact and effectiveness. Involving citizens directly in scientific research and decision-making processes ensures that the solutions developed are not only relevant but also widely accepted and supported by the civil society. This approach fosters transparency and trust, as it allows for open communication and feedback, thereby strengthening the sense of ownership and accountability among all stakeholders. Such participatory approaches help in building a collaborative environment where the insights and needs of local communities are integrated into the solution development process, thereby improving the overall impact and sustainability of co-created solutions.

Multilateral cooperation and engaging stakeholders from different geographical areas are crucial for addressing global issues through co-creation, particularly in the context of complex, cross-border challenges. This approach not only leverages local knowledge but also integrates diverse perspectives to adapt solutions to region-specific and global challenges alike. By involving both developed and developing economies, co-creation ensures that innovation is both inclusive and equitable, fostering a sense of shared responsibility and collective action. For example, collaborative initiatives that bridge economies can facilitate the exchange of knowledge and technologies, enhancing the development of scalable and sustainable solutions.

In the context of international collaboration, co-creation can address region-specific issues, such as water scarcity, while simultaneously contributing to global knowledge. This integrated approach helps in creating solutions that are not only locally relevant but also globally impactful, ensuring that diverse needs and constraints are effectively met across different contexts. By building robust international partnerships and leveraging collective expertise, co-creation can lead to more effective and innovative outcomes, driving progress on a global scale.

The Global Research Council (GRC) has a history of promoting international collaboration in research. By building on previous efforts and leveraging the lessons learned, the impact of co-creation initiatives can be enhanced. These interlinkages provide a solid foundation for understanding the potential of co-creation in addressing grand challenges. Additionally, the recent efforts and outcomes of the recent OECD CSTP 2024 Ministerial Meeting further emphasize the importance of co-creative approaches in science, technology, and innovation (STI) policies to achieve sustainable and inclusive growth.

II. The Role of Public R&D and Innovation Funding Institutions: Recommendations for Co-Creation in Global Challenges

Public R&D and innovation funding institutions are central to advancing impactful co-creation efforts aimed at addressing global challenges. These organizations are instrumental in designing funding mechanisms that promote collaborative research, facilitating international partnerships, supporting capacity building, and disseminating best practices. By strategically supporting these areas, funding bodies can drive significant progress and enhance the effectiveness of co-creation initiatives.

In addition to their role in fostering co-creation, these institutions play a pivotal role in supporting the translation of co-created knowledge into effective policies and practices essential for achieving sustainability goals. They are not only funders but also active enablers of participatory approaches, adaptive management strategies, and transdisciplinary research initiatives. By strategically allocating resources and supporting collaborative research, funding

bodies help transform innovative ideas into actionable solutions, ensuring that global challenges are addressed through informed and effective policies.

- **Strategic Funding Mechanisms and Designing Adaptive Co-Creation Platforms for Emerging Technologies:** In order to effectively support the advancement of emerging technologies, funders can design **co-creation platforms**, within which all stakeholders (research institutions, private sector, suppliers, customers, public bodies, representatives of civil society) jointly prepare a roadmap for the advancement of technology or for the creation of a technological solution. The roadmap will contain a bundle of RDI projects, altogether aiming towards the strategic objectives. Besides funding individual projects in the same research/technological area; RDI funders will fund the RDI project bundle in the roadmap, aiming to create similar solutions. This approach will lead to the formation of "Co-Creation Platforms" at which the planning (creation of the roadmap for a solution towards a grand challenge), performing of research and innovation activities, monitoring and evaluation will be conducted by pooling the resources among stakeholders. Based on stakeholders from diverse scientific and technological areas and diverse sectors, these platforms will contain diverse dynamics and technology readiness levels across various application domains. Emerging technologies such as quantum computing, gene editing, advanced energy systems, and next-generation materials each operate at different stages of development and present unique challenges and opportunities. Public R&D and innovation funding institutions play a pivotal role in advancing co-creation efforts to address global challenges effectively. These organizations are instrumental in designing incentive mechanisms that promote collaborative research across diverse disciplines and sectors.

  Besides maintaining the curiosity-driven research funding; by structuring grants and subsidies to prioritize projects with robust collaborative frameworks and significant societal impact, by paying attention to economic and social asymmetries, funding bodies can align various stakeholders towards common innovation goals. This strategic approach includes creating co-creation platforms that reflect the different readiness levels of emerging technologies and sector-specific needs. Such platforms should

integrate the diverse technology dynamics and address issues like regulatory challenges and market readiness. By focusing on these tailored approaches, funders ensure that resources are allocated to initiatives capable of driving meaningful and transformative outcomes, thus maximizing the impact of emerging technologies in solving global challenges.

According to the OECD report on "Anticipatory Governance of Emerging Technologies" which has been endorsed at OECD CSTP 2024 Ministerial Meeting, establishing frameworks that ensure the ethical use and security of emerging technologies is vital to prevent misuse and to promote trust among international partners. Funders should focus on creating co-creation platforms that are adaptable to the specific needs and development stages of different technologies. This includes designing funding mechanisms that consider each technology's readiness level, from foundational research to market readiness. For instance, the Natural Sciences and Engineering Research Council of Canada (NSERC) supports this through various programs: the Idea-to-Innovation program facilitates the transition of promising technologies from the lab to the market; the Lab2Market program helps researchers commercialize their innovations; the College and Community Innovation program fosters partnerships between colleges and local businesses and by supporting collaborative projects. This program helps address local industry needs and drives economic development through the application of research expertise and resources and the Alliance program supports collaborative research projects between academic researchers and industry partners.

By tailoring co-creation platforms to the distinct characteristics of emerging technologies and their development stages, funders can enhance the effectiveness of collaborative efforts. This approach ensures that platforms are equipped to drive innovation, address global challenges, and facilitate meaningful advancements in technology.

- **Maximizing Global Impact: Enhancing Co-Creation through Equitable International Partnerships in Tackling Grand Challenges:** RDI funding institutions are uniquely positioned to catalyse international collaboration by supporting joint research initiatives, exchange programs and global conferences. To further maximize the impact of co-creation efforts, funding organizations should focus on establishing partnerships that include both developing and developed countries. The opportunity divide between developing and developed countries in research for global challenges often stems from disparities in resources, infrastructures and ease of access to advanced technologies. This divide can hinder the ability of developing countries to contribute effectively to and benefit from global co-creation initiatives, potentially limiting their impact on addressing pressing global issues. Ensuring equitable access to research opportunities and benefits for all stakeholders is crucial. By addressing regional disparities and facilitating inclusive participation, funding bodies can enhance the development of innovative solutions to both global and region-specific challenges.

This approach not only bridges gaps between different regions but also amplifies the effectiveness and reach of co-created solutions, contributing to a more equitable and impactful global research landscape. Furthermore, public R&D and innovation funding institutions can support the development of comprehensive evaluation frameworks to ensure that co-created solutions are both impactful and equitable. This involves systematically monitoring and assessing funded projects to confirm they contribute to the broader objective of fostering a world that is both safe and just. In addition, it is crucial to integrate safeguards around sensitive and emerging technologies, especially if they could have unintended dual-uses. Concepts such as research security and responsible internationalization are essential to consider in the design of co-creation platforms. By incorporating these considerations, funders can enhance the effectiveness of collaborative efforts while ensuring that technological advancements are aligned with global security and ethical standards.

By ensuring that solutions address vulnerabilities and promote fairness, funding bodies help create environments where all individuals have equitable access to benefits and

protections, aligning their investments with global values of safety, justice, and sustainability. Through these integrated approaches, public R&D and innovation funding institutions significantly contribute to achieving sustainability goals and addressing complex global issues. The GRC 2022 Statement of Principles and Practices for Research Ethics, Integrity, and Culture in the Context of Rapid-Results Research" underscores the importance of reciprocity in research collaborations, highlighting that mutual benefit and shared responsibility are essential for fostering trust and long-term partnerships. By embedding reciprocity into funding strategies, institutions can ensure that all stakeholders, including those from underrepresented regions, are active participants in the co-creation process. This approach not only enhances the effectiveness of collaborative efforts but also ensures that research outcomes are equitable and culturally sensitive, thereby reinforcing ethical standards and integrity in rapid-results research.

- **Fostering the Next Generation of Innovators Through Co-Creation in Emerging Technologies for Addressing Global Challenges:** Developing the next generation of science and technology (STI) human resources is crucial for addressing global challenges through co-creation, particularly in the realm of emerging technologies. It is essential to focus not just on building a skilled workforce but also on ensuring the participation of less represented groups and a dynamic flow of knowledge and talents across borders to tackle complex issues such as artificial intelligence, blockchain, and advanced materials. International partnerships are pivotal in this process, as they facilitate the exchange of cutting-edge expertise and innovative ideas critical for advancing these technologies.

Further engaging young researchers in hands-on projects and real-world problem-solving experiences, especially those involving emerging technologies, equips them with the practical skills and insights needed for effective co-creation. This active involvement in pioneering projects ensures that emerging talents are not only versed in theoretical knowledge but are also adapt at applying it in high-impact scenarios. By harnessing the collective creativity and diverse insights of these talents through co-creation, we accelerate the innovation cycle in emerging technologies, leading to breakthrough solutions that redefine technological possibilities. These dynamic collaborations and shared knowledge

not only prepare the next generation of innovators but also ensure that they are equipped to tackle evolving global challenges with fresh and impactful solutions.

- **Leveraging Community Insights for Effective Policy Solutions:** Public R&D and innovation funding bodies should prioritize supporting citizen science projects and community-led research as a means to bridge the gap between scientific expertise and local knowledge. By funding initiatives that foster co-creation, where diverse stakeholders— including local communities, industry experts, and civil society organizations—collaborate in the research and policy-making process, these institutions can enhance the relevance and impact of policy solutions. Co-creation approaches ensure that policies are not only grounded in scientific evidence but also shaped by the practical insights and needs of those directly affected by global challenges. For example, supporting community-led research through co-creation can uncover region-specific issues and innovative solutions that might be missed in conventional research frameworks. This inclusive approach facilitates the development of policies that are both contextually relevant and globally impactful, addressing complex global issues with a nuanced understanding of local conditions. By integrating grassroots perspectives and fostering collaborative efforts, funding bodies can contribute to creating more effective, equitable, and sustainable policy solutions. Such strategic investments not only align with broader sustainability goals but also reinforce the value of co-creation in tackling both local and global challenges comprehensively.

- **Enhancing Resilience through Adaptive Management Strategies:** Public R&D and innovation funding bodies are encouraged to support adaptive management strategies as a critical component of addressing the evolving nature of global challenges. By investing in research and projects that integrate feedback loops and iterative processes, these institutions can significantly bolster the effectiveness of co-creation initiatives. Funding pilot programs that test new technologies or practices in real-world settings can facilitate continuous learning and adjustment, enabling more responsive and flexible approaches to emerging issues. Specifically, funding bodies should consider projects that incorporate adaptive management frameworks, which allow for real-time adjustments based on new data and changing conditions. This approach not only enhances the resilience of co-creation

efforts but also ensures that policies and practices remain relevant and effective over time. By supporting such adaptive strategies, funding agencies contribute to the development of more robust and dynamic solutions that can effectively address both current and future global challenges. According to the GRC's "Statement of Principles on Sustainable Research" (2024), integrating sustainability into research practices is crucial for crafting enduring solutions to global challenges. By aligning adaptive management strategies with these principles, funding bodies can ensure that research initiatives are both resilient and sustainable. This alignment fosters the responsible use of resources and the development of environmentally sound and socially equitable solutions. Supporting such strategies enables funding agencies to cultivate robust and dynamic solutions that effectively address current and future global challenges, reinforcing the GRC's commitment to sustainable research practices.

- **Promoting Transdisciplinary Research Initiatives:** Public R&D and innovation funding institutions are instrumental in advancing transdisciplinary research, which integrates knowledge from various disciplines and stakeholders. By funding projects that involve practitioners, policymakers, and community members, these institutions facilitate the development of holistic and innovative solutions. According to the GRC's "Statement of Principles on Sustainable Research" (2024), fostering transdisciplinary collaboration is essential for addressing the multifaceted nature of global challenges, as it encourages the integration of diverse perspectives and expertise to create sustainable and impactful solutions. For instance, funding for collaborative research initiatives like the Future Earth project exemplifies how interdisciplinary approaches can contribute to global sustainability goals. These initiatives demonstrate how public funding can bridge academic research with practical applications, fostering innovations that address complex global issues. The Global Research Centres and initiatives through the Belmont Forum further illustrate the power of transdisciplinary collaboration, as they bring together international research teams to tackle pressing environmental and societal challenges through integrated and cooperative efforts.

- **Leveraging Emerging Technologies as Enablers of Co-Creation Initiatives:** Emerging technologies such as artificial intelligence (AI), blockchain, and the Internet of Things

(IoT) are transforming the landscape of co-creation by providing powerful tools that enhance collaborative processes. These technologies offer unprecedented opportunities to streamline and elevate co-creation efforts. For instance, AI-driven platforms can revolutionize co-creation by enabling real-time data analysis and advanced decision-making capabilities, thus allowing participants to make informed choices and adapt quickly to evolving project needs. Blockchain technology, with its inherent features of transparency and immutability, can foster greater trust and accountability within collaborative projects, ensuring that all participants have access to accurate and secure information. Similarly, IoT can facilitate seamless integration and communication among various devices and stakeholders, creating a more interconnected and responsive co-creation environment. Future co-creation initiatives should strategically incorporate these technologies to maximize their impact. AI can be utilized to analyse large volumes of data generated during collaborative activities, offering insights that drive innovation and optimize project outcomes. Blockchain can be employed to establish decentralized and tamper-proof records of contributions and agreements, enhancing the reliability of collaborative efforts. IoT can enable real-time monitoring and feedback loops, improving the efficiency of coordination and execution. By harnessing the capabilities of these emerging technologies, co-creation initiatives can achieve higher levels of efficiency, transparency, and effectiveness, ultimately leading to more impactful and innovative solutions to complex global challenges.

- **Ensuring Accountability and Sustainability in Co-Creation:** Enhancing Impact on Global Challenges: Public R&D and innovation funding institutions are instrumental in enhancing the impact of co-creation-based collaborations, especially those focused on addressing global challenges. To maximize the effectiveness of these initiatives, it is crucial for funding bodies to implement robust accountability and sustainability measures. Establishing comprehensive monitoring and evaluation frameworks allows for the assessment of how well co-creation projects and platforms are advancing solutions to complex global issues. Through balanced oversight, funding institutions can ensure that resources are utilized efficiently and that the initiatives deliver impactful and sustainable outcomes. This approach not only supports the effective management of co-creation efforts

but also strengthens their capacity to produce meaningful solutions to pressing global challenges.

- **Enhancing Global Research Capabilities through Collaborative Infrastructure to Address Grand Challenges:** Investing in shared research infrastructure is vital for boosting efficiency and innovation, particularly when addressing global grand challenges. Funders should support projects that enable the collective use of high-tech facilities, such as laboratories, computing centres, and experimental resources. The DFG's Core Facilities funding programme exemplifies strategic investment in shared research infrastructure by providing financial support to establish and maintain cutting-edge facilities. This initiative enhances collaboration and innovation across institutions, demonstrating how shared resources can drive scientific progress and effectively address complex global challenges. By facilitating access to state-of-the-art equipment and resources across institutions, funders can enable researchers to undertake large-scale, complex projects that might be beyond the capabilities of individual entities. Encouraging partnerships between institutions to share infrastructure not only maximizes the utility of available resources but also fosters innovation through collaborative efforts. This approach is crucial for tackling grand challenges such as climate change, pandemics, and sustainable development, where coordinated, large-scale research initiatives are required to generate impactful solutions on a global scale.

- **Strengthening Global Impact with Open Science and through Robust Data Sharing Standards and Protocols:** Funders should advocate for and support open science practices to enhance transparency, accessibility, and collaboration in research, which is essential for addressing global grand challenges effectively. This involves investing in open-access platforms, data repositories, and standards that facilitate the sharing of research outputs and data. By promoting open-access publishing, funders can help eliminate barriers to information, ensuring that researchers, policymakers, and the public have equitable access to scientific advancements. The GRC's Responsible Research Assessment Working Group underscores the importance of evaluating research based on its openness and collaborative impact, rather than solely on traditional metrics. By incorporating these principles into

funding strategies, funders can promote practices that prioritize transparency and the sharing of knowledge. This approach not only enhances the quality and interoperability of research data but also fosters global collaboration, which is crucial for solving complex, interconnected global issues. Supporting data repositories and adherence to data sharing principles, such as the FAIR (Findable, Accessible, Interoperable, Reusable) Data Principles, is essential for enhancing the quality and interoperability of research data. Such practices enable the rapid dissemination of critical findings and foster global collaboration, which is necessary for solving complex, interconnected global issues. To improve the effectiveness of open science, funders should support the development and implementation of robust standards and protocols for data sharing, particularly in the context of addressing global grand challenges. Establishing clear guidelines for data management ensures that research data is of high quality, easily discoverable, and usable across different platforms. This can significantly enhance the reproducibility and reliability of scientific findings, ultimately contributing to more impactful research outcomes. By creating a standardized framework for data sharing, funders can facilitate more effective international collaboration, enabling researchers worldwide to build on each other's work and accelerate progress toward solutions for pressing global issues. Incorporating the CARE principles (Collective Benefit, Authority to Control, Responsibility, Ethics) for Indigenous Data Governance is crucial to safeguard the self-determination and data sovereignty of stakeholders. These principles ensure that open science approaches are equitable and respect the rights and interests of all communities involved, particularly Indigenous groups. By embedding these principles into data sharing practices, funders can promote inclusive and ethical research that honors the cultural values and autonomy of Indigenous peoples, thereby reinforcing the importance of equity in scientific collaboration.

III. Future Directions and Opportunities

In conclusion, GRC plays a crucial role in fostering impactful co-creation initiatives by supporting international collaboration, capacity building, and the sharing of best practices. As we continue to confront complex and interconnected global challenges, the principles and practices of co-creation will become increasingly vital for driving innovation and achieving sustainable development. To effectively advance co-creation, public R&D and innovation funding institutions are encouraged to take a proactive approach by promoting best practices and facilitating knowledge sharing within the co-creation ecosystem.

Advancing Co-Creation through Best Practices and Knowledge Sharing

Funding bodies should prioritize initiatives that support the dissemination of best practises of co-creation platforms. This can be achieved by organizing seminars, publishing research findings and creating online portals that provide stakeholders with access to valuable insights and practical guidance. By highlighting exemplary projects and sharing lessons learned, funding bodies can inspire and guide future co-creation efforts. This approach not only enhances the visibility of effective practices but also fosters a collaborative culture that drives continuous improvement and innovation across diverse sectors and disciplines. Through these actions, funding institutions can significantly contribute to maximizing the impact of co-creation efforts, ensuring they are both effective and transformative in addressing global challenges.

In order to trigger and facilitate the funding organizations to create this impact, the GRC may develop a structured framework that outlines the processes, methodologies, and best practices for collaborative research and innovation. This framework would guide how to engage various stakeholders, manage intellectual property, and ensure scalable and impactful solutions. The GRC may also facilitate targeted international collaboration by connecting research institutions, funding bodies and industry partners across different countries to address specific global challenges through joint RDI projects. This effort could be supported by organizing workshops, conferences, and exchange programs. Additionally, the GRC may facilitate joint funding

schemes and allocate joint resources specifically for co-creation initiatives; focusing on projects with a clear potential to tackle pressing global issues through collaborative and interdisciplinary approaches.

Furthermore, the GRC should promote capacity building and knowledge sharing by investing in programs that equip researchers and innovators with skills for effective co-creation, such as interdisciplinary collaboration and community engagement. Establishing platforms to share best practices and lessons learned from co-creation initiatives would enable continuous improvement across the global research community. To ensure the effectiveness of its initiatives, the GRC may search options to develop a comprehensive monitoring and evaluation system to assess the impact of co-creation projects, refine strategies and strengthen policy influence by working closely with policymakers. By advocating for evidence-based policymaking and enhancing stakeholder engagement, the GRC would ensure that co-created solutions are inclusive, equitable and effectively address complex global challenges.

In light of these possible roles for GRC to accelerate the co-creation activities of research community to effectively address global challenges, following points are for discussion among GRC members:

- How can co-creation platforms enhance RDI efforts directed to global challenges? How can GRC effectively provide a structured framework for co-creation in RDI which includes processes, methodologies and best practices?
- How can joint funding schemes and resource allocation support impactful co-creation initiatives? How can funding organisations enhance researchers' and innovators' skills in interdisciplinary collaboration and community engagement? What is the role of platforms for sharing best practices and lessons learned to promote continuous improvement in co-creation initiatives?
- Can policy influence and contribute to addressing global challenges through co-creation and How? What is GRC's role in advocating for evidence-based policymaking to ensure inclusive and equitable solutions? What are the strategies for enhancing stakeholder engagement and working closely with policymakers to effectively address complex global challenges?

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