Task Force 6
**Accelerating SDGs: Exploring New Pathways to the 2030 Agenda**

# BUILDING A SUSTAINABLE SYSTEM FOR EMERGING HEALTHCARE TECHNOLOGIES: A GLOBAL SOUTH PERSPECTIVE

**September 2023**

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# Abstract

The Global South faces significant health challenges due to extreme poverty and poor healthcare infrastructure. The development and deployment of emerging advanced healthcare technologies based on new biotechnological approaches are essential to address these challenges. Governance plays a critical role in enabling the use of these technologies to address 'grand healthcare challenges' such as high disease burden, import dependency, and unaffordability. This policy brief outlines trends in the development of emerging advanced healthcare technologies and highlights the need for a holistic framework of 'Responsible Research Innovation' to govern the development and diffusion of need-centric emerging technologies. This can help the G20 address the grand healthcare challenges faced by the Global South in a sustainable way. Finally, this brief presents six major policy recommendations towards accelerating Sustainable Development Goals for health.

# The Challenge

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Healthcare is a fundamental human right and plays a significant role in shaping the socio-economic development of a society.[1] However, access to healthcare is disproportionately distributed globally, with the Global South facing common health challenges, poor health indicators, extreme poverty, resource-poor healthcare settings, staggeringly unequal health infrastructure, and market-oriented research strategies.[2,3] The development of emerging advanced healthcare technologies based on new biotechnological approaches holds the key to addressing healthcare challenges being faced by the Global South.[4,5] However, their development and deployment must be accompanied by foresight and governance practices that enable their usage to address health care challenges specific to the Global South. In this context, this policy brief calls for a holistic framework of 'Responsible Research Innovation' (RRI) to empower the countries of the Global South to govern their healthcare systems in ways that cater to need-based technological developments. The RRI framework is designed to facilitate the development of ethical, sustainable, and socially desirable innovations.

It holds significant relevance in the governance of science, technology, and innovation, particularly in emerging technologies like nanotechnology, synthetic biology, information, and communication technologies, and neurotechnologies.[6] The principles of the RRI framework were incorporated into the European Commission's sixth framework program (2002-2006), establishing them as crucial concepts and practices in European STI. More recently, countries in the Global South, such as China and Brazil, have begun adopting the RRI framework to address the interconnected challenges of science, society, and innovation.[7]

## Trends in the development of emerging technologies and healthcare system challenges of the Global South

'Emerging healthcare technologies' are technologies based on advanced biotechnological and biomedical engineering approaches that include gene editing, cell therapies, artificial intelligence, and personalised medicine.[8,9] Gene editing technologies, such as CRISPR-Cas9, have shown potential for treating and curing genetic disorders.[10] Cell therapies, such as

CAR-T cell therapy, have demonstrated remarkable success in treating certain types of cancers.[11] Artificial intelligence and machine learning have the potential to transform healthcare delivery by improving diagnosis, predicting outcomes, and facilitating personalised treatments.[12] Personalised medicine, a practice that is based on focussing on a patient's genetic profile, promises to revolutionise treatment and improve health outcomes by matching patients to the most effective treatments.[13] Hence, emerging healthcare technologies are transforming the healthcare sector by providing new solutions within different aspects of medical practice such as therapies, diagnosis, and imaging as shown in Table 1.

## Table 1: Potential solutions provided by emerging healthcare technologies that are transforming healthcare systems globally

| | |
|---|---|
| Early diagnostics | Early screening for disease prevention rather than end stage treatment of degeneration has been proposed as a key solution to tackling long term conditions. New advances in the treatment of chronic diseases require early identification, often prior to detection of major symptoms. |
| Biomedical complexity | Coping with the complexity of tissues and organs alongside the issues of multi-morbidity in patients requires new approaches in the targeting and specificity of drugs and other medical devices. Design for additive manufacturing (DfAM) aims to utilise the complexity of human systems for the development of medical devices. New nano-drug release strategies allow localised delivery to provide solutions to specific regions and organs in the body. |
| Personalised and bespoke medicine | Stratification of patient populations presents a new era of personalised medicine. The pharmaceutical industry is having to rethink how next generation drugs can be developed and delivered enabling more personalised approaches within populations through innovations in computational and *in silico* tools. |
| Precision and robotic surgery | Cardiovascular, ophthalmological, and other major organ surgical procedures are evolving and improving with clinically validated protocols. Precision surgical tools combined with robotics and virtual surgeries are some technological advances in this area. New technologies have reached the clinic in minimally and non-minimally invasive, transluminal endoscopic, and single site surgeries. |

| | |
|---|---|
| Stem cells for regeneration and therapy | Stem cell therapies and regenerative medicine require significant support in the form of enabling technologies to reach clinics. Delivering regenerative medicine therapies involve scalable production and application of standardised clinical grade biotherapies. This delivery is underpinned by effective supply chain capabilities combined with productive manufacturing and sourcing. These enabling technologies, such as bioreactors for growing cells and biomaterial systems, are identified within a new field termed as regenerative medical technology. |
| Big data | Large databases of patients' data are being captured in hospitals, which if accessed, provide a wealth of information about disease treatment and prevention. Analysing large data sets has become a major area of interest globally. Mobile medical technology is expanding with multiple diagnostic and monitoring platforms using mobile app systems, which require new ways of approaching data analytics. |

*Source: Compiled by the authors based on the writings of Haj and Alicia, 2020[14]*

While these emerging technologies hold great promise, their development and deployment face significant challenges in the Global South. Currently, the Global South performs poorly on most health indicators due to persisting lacunas in the healthcare system characterised by extreme poverty, resource poor healthcare settings, inferior health infrastructure, and the burden of existing diseases[a] coupled with re-emerging/newly emerging diseases. The persistence of these gaps in the system is caused by two complex policy challenges: (1) healthcare financing in these countries is shaped by market driven economic policies that lack an understanding of need-based innovations, resulting in insufficient funding for the country's emerging healthcare technology priorities,[15,16] and (2) suboptimal performance of the domestic manufacturing sector towards unmet medical needs, resulting in a dependency on costly imported technologies.[17,18,19,20] These challenges continuously compromise the healthcare systems of the Global South and make them victims of 'grand healthcare challenges'.[b,21] These grand challenges

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a    Communicable diseases, maternal and child health problems and undernutrition, and non-communicable diseases.

b    A grand challenge is envisioned as distinct from a simple statement of one of the many "big problems" in global health, such as HIV/AIDS, malnutrition, the lack of access to medical care, or the lack of adequate resources. A grand challenge is meant to direct investigators to a specific scientific or technical breakthrough that would be expected to overcome one or more bottlenecks in an imagined path towards a solution to one or preferably several significant health problems.

are mainly caused by a high incidence of mortality from communicable and non-communicable diseases, maternal, prenatal, and nutritional problems, abysmal government spending on healthcare, and a higher proportion of out-of-pocket expenditure on healthcare as shown in Table 2.

Emerging technologies can effectively deal with these grand challenges, provided their development and diffusion is shaped as per the needs of a specific healthcare system. In this context, we argue that a comprehensive framework is required that takes note of the existing challenges faced by the healthcare systems in the Global South. This framework must create effective strategies for the development and diffusion of emerging technologies, with dedicated research efforts focussed on articulating need-based innovations. We recommend the use of the challenge-based RRI framework for dealing with the deformities of the healthcare systems in the Global South. The RRI framework can provide a sustainable system for deploying emerging healthcare technologies and can make them significantly more effective in dealing with grand healthcare challenges.

## Table 2: Grand healthcare challenges faced by countries in the Global South (2000-2019)

| Indicators | 2000 | 2010 | 2015 | 2019 |
|---|---|---|---|---|
| Cause of death, by communicable diseases and maternal, prenatal, and nutritional conditions (per cent of total) | 39.1 | 27.1 | 29.1 | 32.0 |
| Cause of death, by non-communicable diseases (per cent of total) | 51.3 | 62.8 | 60.2 | 57.4 |
| Domestic general government health expenditure (per cent of current health expenditure) | 44.3 | 46.3 | 45.0 | 42.7 |
| Domestic general government health expenditure (per cent of GDP) | 2.3 | 2.7 | 2.6 | 2.3 |
| Out-of-pocket expenditure (per cent of current health expenditure) | 40.8 | 33.4 | 34.3 | 36.7 |

*Source: World Development Indicators (WDI) Online Database[22]*

## 'Grand healthcare challenges' of the Global South: The role of the RRI framework

The RRI framework offers a comprehensive approach to helping countries in the Global South govern their healthcare systems effectively in response to technological advancements while also addressing societal needs.[23,24] By aligning innovative processes and outcomes with societal values, this framework can help develop cutting-edge and sustainable solutions that prioritise equity, sustainability, and social justice to address grand health challenges. The RRI framework comprises four main elements: anticipation, reflexivity, inclusion, and responsiveness. Each element is explained in Table 3.

### Table 3: Elements of the RRI framework and their governance features for a system level analysis

| Elements | Features |
|---|---|
| Anticipatory governance | This involves identifying and addressing potential ethical, social, and legal issues associated with emerging healthcare technologies before they become problems. This involves conducting foresight studies to identify the potential risks and benefits of the technology. |
| Reflexive governance | This involves engaging stakeholders and considering their feedback in the development and deployment of emerging healthcare technologies. It requires engaging in dialogue and deliberation with stakeholders to ensure that their views and concerns are considered. |
| Inclusive governance | This involves ensuring that all stakeholders, including civil society members, have an equal opportunity to participate in the development and deployment of emerging healthcare technologies. This includes social sector actors like civil society collectives, patient groups, and other marginalised groups. |
| Adaptive governance | This involves continuously monitoring and evaluating the impact of emerging healthcare technologies and making adjustments as needed. It requires responding to the feedback and concerns of stakeholders and adapting the technologies accordingly. |

*Source: Adapted from Stilgoe et al,[25] and Declich et al, 2022[26]*

Each governance element of the RRI framework allows for a system-level analysis that helps shape the work of public institutions that determine the supply of new healthcare technologies. These institutions include health research funding agencies, public venture capitalists, technology transfer offices and incubators, as well as health policymakers who control demand through procurement policies, coverage and reimbursement decisions, and health technology assessment programmes. Hence, by including a wide range of stakeholders at an early stage, the RRI framework can help ensure that emerging healthcare technologies are developed and deployed in ways that are culturally and contextually appropriate, socially responsible, and beneficial to the communities they serve. This can be achieved through proper functioning and monitoring of the four governance elements and by creating a regulatory structure that includes various stakeholders like civil society groups, experts, and state and central government agencies.

# The G20's Role

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The G20 has long been committed to sustainable healthcare, which is crucial for achieving universal health coverage (UHC), one of the targets adopted in the 2030 Agenda and its Sustainable Development Goals. Its declarations have repeatedly reinforced the need for global collaboration on healthcare while also urging member countries to strengthen national healthcare systems. The G20 recognises that for resilient, inclusive, and sustainable health systems, collective action at a global level is required. In order to deal with future disease outbreaks and pandemics, the G20 aims to support research into the advancement of new tools and technologies that help predict and model future pandemic events. It aims to leverage emerging and existing technologies (like electronic technologies and the digital service delivery systems) to improve prevention, risk mitigation, crisis communication, and response measures, utilising both public and private resources. It also seeks to support countries with weaker health systems to ensure equitable access, embed a multisectoral 'One Health' approach, and enhance global surveillance.

The G20 and its Health Ministers' Meeting declarations since 2017 have continuously emphasised strengthening health systems and global health crisis management. After the Ebola outbreak and the COVID-19 pandemic, the forum's various efforts to prevent, respond and prepare for future pandemics have formed the fulcrum of the Health Ministers' declarations. The forum aims to support low- and middle-income countries to acquire competencies and build local and national manufacturing capacities, leverage synergies and build on expertise, facilitate data sharing, skill development, licensing agreements, and enable technology and know-how transfers on mutually agreed terms. There is also a need to invest in further developing inter-operable early warning information, surveillance, and trigger systems aligning with the One Health approach. The G20 also seeks to use digitalisation and emerging technologies to create an inclusive, sustainable, safe, trustworthy, and innovative society. As pandemic preparedness and sustainable health is a concern for several G20 countries, the G20 can serve as a platform for collaboration, international cooperation, and knowledge exchange to create a roadmap for emerging technologies governance.

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# Recommendations to the G20

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Considering the strength of the RRI framework in shaping and promoting a sustainable environment for the development and diffusion of emerging healthcare technologies, this brief suggests the following six recommendations to the G20.

First, equal participation of all stakeholders, including civil society groups, is crucial to ensuring that healthcare technologies are developed and deployed in a manner that benefits society at large. Civil society organisations represent the needs and concerns of different sections of society and there is a need to ensure that these are addressed in the development and deployment of healthcare technologies.

Second, strengthening domestic healthcare financing systems for target-based research and innovation is crucial to ensuring that healthcare technologies are developed and deployed sustainably and affordably. Such financing systems incentivise the development of healthcare technologies that address the most pressing health challenges faced by the population, particularly those in low-income communities. This can be achieved by prioritising funding for research and development that focuses on diseases and conditions that disproportionately affect the Global South, such as tuberculosis, malaria, and neglected tropical diseases.

Third, it is important to ensure that healthcare financing systems are sustainable and promote equitable access to healthcare technologies. This can be achieved by establishing UHC schemes that pool resources and provide comprehensive coverage for a wide range of health services, including diagnostics, treatments, and medicines. These schemes can help ensure that healthcare technologies are available and affordable to all, regardless of socio-economic status.

Fourth, encouraging partnerships between academia and industry is important to accelerate the development and deployment of healthcare technologies. Academia-industry collaborations can help to bridge the gap between basic research and product development, bringing promising new technologies to market faster and more efficiently. Such collaborations can also facilitate the transfer of knowledge and expertise

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between academic researchers and industry practitioners, enabling the development of more effective and innovative healthcare technologies.

Fifth, it is important to establish effective Health Technology Assessment (HTA) mechanisms that can aid in determining the benefits, barriers, and risks of new healthcare technologies. HTA mechanisms can help ensure that healthcare technologies are safe, effective, and cost-efficient, and can provide valuable information to decision-makers as they consider which technologies to adopt and deploy in their healthcare systems. Effective HTA mechanisms can also help ensure that healthcare technologies are used in a manner that is consistent with the principles of responsible innovation, considering the broader social, ethical, and environmental implications of their use.

Sixth, it is important to establish effective partnerships between the Global North and the Global South to promote an equitable development and deployment of healthcare technologies. These partnerships can facilitate knowledge transfers and capacity building and can provide resources and expertise to support the development of healthcare technologies that are tailored to the specific needs and contexts of low- and middle-income countries. Initiatives can be undertaken by international organisations such as the World Health Organisation (WHO), the United Nations Development Program, and the World Bank, which have the expertise and resources to drive collaboration. Past experiences offer valuable insights, with India successfully partnering with global entities to address public health challenges. Notable examples include the Global Polio Eradication Initiative, where India collaborated with organisations like WHO, the United Nations Children's Fund, and Rotary International, resulting in the country being declared polio-free in 2014. These experiences serve as crucial foundations for building effective partnerships and sharing knowledge and resources to enhance healthcare outcomes in the Global South.

## Endnotes

1    Anja Rudiger, "Human Rights and the political economy of universal health care: designing equitable financing," *Health and Human Rights* 18, no. 2 (2016): 67.

2    Benjamin Lysaniuk and Tabeaud Martine, "Les santés vulnérables des Suds," *L'Espace géographique* 44, no. 3 (2015): 229-244.

3    Mihajlo Jakovljevic et al., "The Global South political economy of health financing and spending landscape–history and presence," *Journal of medical economics* 24, no. sup1 (2021): 25-33.

4    Nidhi Singh, "Development of Molecular Diagnostic Innovation System in India: Role of Scientific Institutions," *Asian Journal of Innovation and Policy* 11, no. 1 (2022): 87-109

5    Sahalu Balarabe Junaid et al., "Recent Advancements in Emerging Technologies for Healthcare Management Systems: A Survey," In *Healthcare*, vol. 10, no. 10, p. 1940. MDPI, 2022.

6    Krishna Ravi Srinivas, "Responsible Research and Innovation and India: A Case for Contextualization and Mutual Learning*," In Ethics, Integrity and Policymaking: The Value of the Case Study*, 29-48, Cham: Springer International Publishing, 2022.

7    Srinivas, "Responsible Research and Innovation and India: A Case for Contextualization and Mutual Learning*".*

8    Mohd Javaid, Abid Haleem, Ravi Pratap Singh, and Rajiv Suman, "Sustaining the healthcare systems through the conceptual of biomedical engineering: A study with recent and future potentials," *Biomedical Technology* 1 (2023): 39-47.

9    Attila A Seyhan and Claudio Carini, "Are innovation and new technologies in precision medicine paving a new era in patients centric care?," *Journal of Translational Medicine* 17 (2019): 1-28.

10    Alyna Katti et al., "CRISPR in cancer biology and therapy," *Nature Reviews Cancer* 22, no. 5 (2022): 259-279.

11    Hilde Almåsbak, Tanja Aarvak, and Mohan C Vemuri. "CAR T cell therapy: a game changer in cancer treatment," *Journal of immunology research* 2016 (2016).

12    Mohammed Uddin, Yujiang Wang, and Marc Woodbury-Smith, "Artificial intelligence for precision medicine in neurodevelopmental disorders," *NPJ digital medicine* 2, no. 1 (2019): 112

13    Dean Ho et al., "Enabling technologies for personalized and precision medicine," *Trends in Biotechnology* 38, no. 5 (2020): 497-518.

14    Alicia J El Haj, "The grand challenges of medical technology," *Frontiers in medical technology* 2 (2020): 1.

15    Nidhi Singh and Dinesh Abrol, "In-vitro diagnostics (IVDs) innovations for resource-poor settings: The Indian experience," *African Journal of Science, Technology, Innovation and Development* 9, no. 5 (2017): 617-636.

16    Mihajlo Jakovljevic et al., "The Global South political economy of health financing and spending landscape–history and presence," 25-33.

17    Dinesh Abrol and Nidhi Singh, "Indian Pharmaceutical Industry," *Development with Global Value Chains: Upgrading and Innovation in Asia* (2019): 279.

18    Wei Wang et al., "All around suboptimal health—a joint position paper of the Suboptimal Health Study Consortium and European Association for Predictive, Preventive and Personalised Medicine," *EPMA Journal* 12 (2021): 403-433.

19    Nidhi Singh, "Economic liberalisation and the development of molecular diagnostics industry in India: An innovation system perspective 1," in *The Routledge Handbook of Post-Reform Indian Economy*, 361-390. Routledge India, 2021.

20    Nidhi Singh, "Development of Molecular Diagnostic Innovation System in India: Role of Scientific Institutions," *Asian Journal of Innovation and Policy* 11, no. 1 (2022): 87-109.

21    Harold Varmus et al., "Grand challenges in global health," *Science* 302, no. 5644 (2003): 398-399

22    "Data Bank: World Development Indicators," World Bank, https://databank.worldbank.org/source/world-development-indicators

23    Jack Stilgoe, Richard Owen, and Phil Macnaghten, "Developing a framework for responsible innovation," *Research policy* 42, no. 9 (2013): 1568-1580

24    Giovanna Declich, Maresa Berliri, and Alfonso Alfonsi, "Responsible Research and Innovation (RRI) and Research Ethics," In *Ethics, Integrity and Policymaking: The Value of the Case Study*, 13-27, Cham: Springer International Publishing, 2022.

25    Stilgoe, Owen, and Macnaghten, "Developing a framework for responsible innovation".

26    Declich, Berliri, and Alfonsi, "Responsible Research and Innovation (RRI) and Research Ethics".