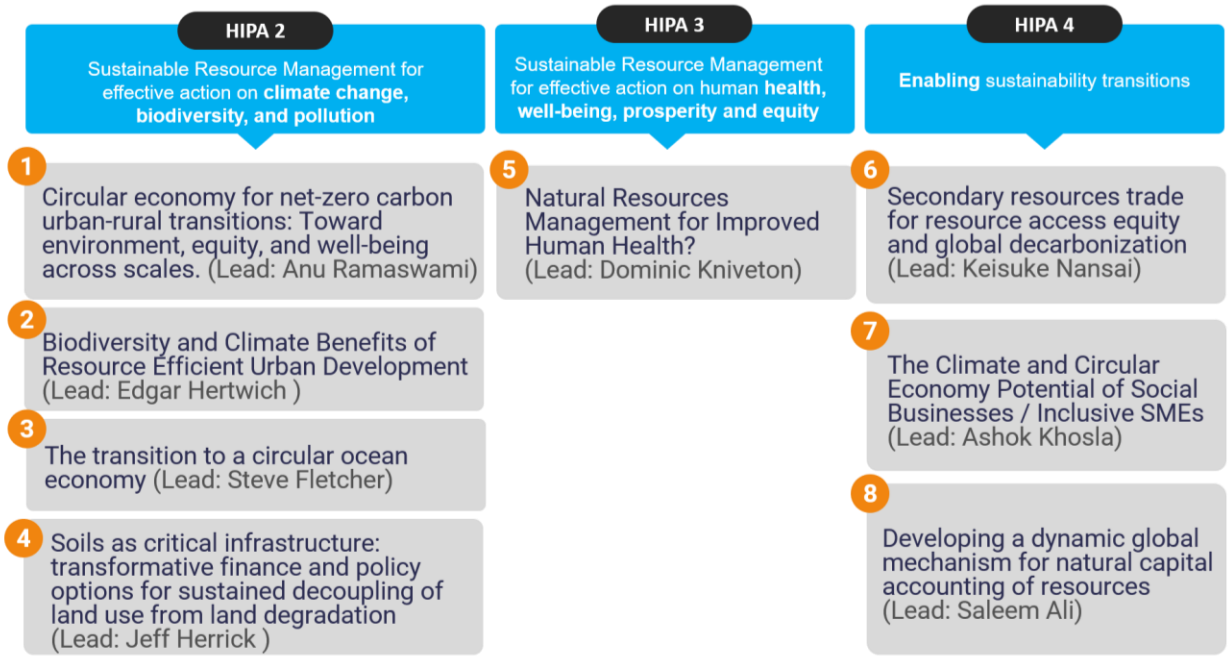
Annex 2

Proposals submitted during the 2021 Strategic Planning Exercise

Table of Contents

2021 SPE RESEARCH PROPOSALS

This Annex includes all research proposals submitted by IRP members during the 2021 Strategic Planning Exercise. These proposals were used as input for the preparation of Chapter 4 of the 2022-2025 IRP Work Programme. They are included in Annex 2 for reference only. Throughout the 2022-2025 cycle, Panel members may prepare Terms of Reference in accordance with the 2022-2025 IRP Work Programme and the policies and procedures of the IRP.



Research Suggestions for HIPA2: Sustainable Resource Management for effective action on climate change, biodiversity and pollution.

1. Circular economy for net-zero carbon urban-rural transitions: Toward environment, equity, and well-being across scales.

[*Updated on 27 April 2021*]

Anu Ramaswami[1], Bhartendu Pandey[1] , and IRP members (Herrick, Hertwich, Hellweg, Chu)
[1]Department of Civil and Environmental Engineering, Princeton University, USA

***Priority Theme and Topic*:** climate and resources; *waste management and circularity*; *equity and well-being; Innovations for a transition towards decoupling*

Rationale: Many cities and nations have committed to the 1.5℃ target, which implies going to net-zero emissions by 2050 in many parts of the world. Broad strategies oriented towards resource-efficient, low-carbon urban areas have been developed in prior IRP and UNEP reports (Swilling et al., 2018; Ramaswami et al., 2018;). However, getting to net-zero, and getting to net-zero emissions while advancing equity and wellbeing requires radical transformations and systems science leveraging circular economy principles.

Knowledge Gaps & Emerging Methods: Currently, urban areas lack a roadmap to cost-effective, equitable, and sustainable net-zero carbon pathways. Urban areas often draw resources from rural hinterlands. Owing to multiple urban-rural connections, there are new possibilities for resource circularity and regenerative strategies across spatial scales. However, we do not have methods to quantify and assess the relative importance of various big levers in different city and country types. Additionally, methods are needed to evaluate how the actions/interventions at the local, urban and rural hinterlands scale add up to national decarbonization. Recent papers in our group are beginning to address these gaps by: 1) Articulating urban carbon and resource accounting frameworks for a net-zero transition (Ramaswami et al., 2021); 2) developing a

pathways framework toward net-zero transitions in urban systems (Seto et al., 2021), and, 3) developing data for all urban-rural areas in a nation to enable scale up from local to national scales (Tong et al., 2021).

Proposal & Policy Relevant Questions: We propose a new IRP initiative on "Circular Economy for Net-Zero Transitions in Urban-Rural Systems", with three key policy-relevant questions.

1. What are strategic pathways/levers for individual urban areas and their rural surroundings to achieve net-zero emissions, leveraging circular economy principles and resource circularity? How do priority strategies differ in different city types? What are the co-benefits to environmental sustainability, equity, and well-being/human development?
2. How do the actions of individual urban-rural areas scale up to national strategies and goals?
3. How do we better integrate bottom-up urban-scale data and methodologies to national and (potentially global) Integrated Assessment Models?

Scope and Methodology: The proposed project will focus on net-zero emissions potential across seven infrastructure sectors—**energy, mobility & connectivity, waste & sanitation, water, food, buildings, public/green space**—and identify scalable levers/pathways (Ramaswami et al. 2021; Seto et al., 2021). We propose to evaluate key circular economy and resource circularity pathways, addressing urban-rural interactions, in four regions: the USA, India, Southeast Asia, and Brazil. To enable scaling-up across multiple urban areas in a nation, the project will offer multiple data science advances centered on novel methodologies for carbon stock and flows measurement across all urban areas using multi-source datasets (including, satellite imageries, national surveys & census, and government reports).

Expected route-to-impact: We plan to engage with the city, state, NGOs (ICLEI, WRI, C40), UNEP Cities and national governments in the four regions (the US, Southeast Asia, India, and Brazil), disseminate our findings and co-produce potential policy mechanisms for net-zero carbon transitions. The actors include cities; national governments; and sector-specific actors including energy utilities, mobility companies, construction/civil sector, food-agriculture & ICT.

Possible role of the proponent in this work (lead author or working group member): ***Anu Ramaswami*** will lead the report and provide the conceptual and methodological framework, based on recent peer-reviewed articles (See below). We propose IRP members and additional country experts will refine methods, and contribute country specific data. Our team includes IRP members working on global resources and resource efficiency (*Hellweg; Hertwich; Chu*); Weight of City report co-lead (*Hager*), and, land use/agriculture important for the rural-urban linkages (*Herrick*). Key collaborators will be Dan Hoornweg, Professor OIT and former Lead Urban Specialist at World Bank, and leads at ICLEI. Additional collaborators (to be invited) include: Karen Seto (Yale University); Tasso Azvedo (MapBiomas, and Amazonia Project).

How different from the proposal by Hertwich et al (Proposal 2 below)*?*

1) *This project addresses all seven sectors - energy, mobility & connectivity, waste & sanitation, water, food, buildings, public/green space*
2) *It incorporates multiple levers – compact design, sustainable lifestyles, emerging technologies including new technologies for resource circularity anchored on a low cost net-zero grid, and regenerative agriculture.*

3) *This proposal is bottom-up, i.e., begins with studying individual urban regions and surrounding rural areas, and then develops national-global models;*
4) *Focuses first on on emerging economies first where data are needed; we will use satellite data to develop scalable models.*
5) *Models will be consistent and track with land, water, fossil fuels, biomaterials – in a manner consistent with resources covered in GRO.*

References

Ramaswami A, Tong K, Canadell JG, Jackson RB, Stokes EC, Dhakal S, et al. Carbon Analytics for Net-Zero Emissions Sustainable Cities. Nature Sustainability 2021. (forthcoming)

Ramaswami A, Tabory S, McFarlane AA, Pelton RE. Sustainable Urban Infrastructure Transitions in the ASEAN Region: A Resource Perspective 2018.

Karen C. Seto; Galina Churkina; Angel Hsu; Meredith Keller; Peter W.G. Newman; Bo Qin; Anu Ramaswami; From Low- to Net-Zero Carbon Cities: Separating Fact from Fiction; Annual Review of Environment and Resources, 2021. 46:X–X (In Press).

Swilling M, Hajer M, Baynes T, Bergesen J, Labbé F, Musango JK, et al. The weight of cities: Resource requirements of future urbanization. IRP Reports 2018.

Tong, K., Nagpure, A. S. & Ramaswami, A. All Urban Areas' Energy Use Data Across 640 Indian Districts: For Year 2011, Scientific Data, 2021 (forthcoming)

2. Biodiversity and Climate Benefits of Resource Efficient Urban Development

1 Proposers

Edgar Hertwich and Francesca Verones, Norwegian University of Science and Technology
Maarten Hajer, Utrecht University
Ester van der Voet, Leiden University
Stefan Pauliuk, University of Freiburg
Stefanie Hellweg, ETH Zurich
Anu Ramaswami, Princeton University

2 Priority Theme and Topic

HIPA2: Resource Efficiency, Climate Change, Biodiversity, and Pollution. In particular: Efficiency and circularity for the mitigation of greenhouse gases and biodiversity impacts from construction, urban planning, and urban transport

3 Title

Biodiversity and Climate Benefits of Resource Efficient Urban Development [*Updated April 27th*]
Material efficient buildings and infrastructure contribute to climate, biodiversity, and pollution targets – synergies and trade-offs

4. Policy relevant questions

- When implementing material efficiency, material substitution, clean material production methods, and circular economy strategies, what are the expected reductions of climate, biodiversity and pollution impacts? Where do synergies and trade-offs occur?
- What are the opportunities for governments to reduce the climate and biodiversity impacts of cities through local planning decisions, building codes, infrastructure and service development?
- What are relevant trends, activities, technologies?
- Which specific strategies may achieve the largest reductions?
- Can we conceive of policy strategies that have greater public appeal?

- What are policy levers? What is the experience with policies?

The built environment is well recognized as a central area for an effective climate policy. Recently the insight has grown that the extraction and production of materials also contributes significantly to GHG emissions. Production of steel and cement together is responsible for 15% of total global GHG emissions. This percentage is expected to rise in the future: whereas other materials are able to reduce their emissions as a result of the energy transition, this is not the case for steel and cement, where GHG emissions are inherent to the production process. Moreover, in *The Weight of Cities* (2018) we have calculated the resource requirements of future urbanization and shown that continuing to build cities with concrete and steel will make it close to impossible to reach the 2015 goals of the Paris agreement. In *Resource Efficiency and Climate Change* (2020) we showed that the extraction and production of construction materials is now a major contributor to CO2 emissions. We have demonstrated that low-rise multifamily residences have lower material and carbon footprints than single family residences and further enhance the ability engage in car sharing and ride sharing, reducing the number and size of vehicles required.
Developing countries and emerging economies are in the process of building up their stock of buildings and infrastructure to reach a decent level of development. It is not possible and not desirable to aim for a stock stabilization at global level already now. That implies we must *intensify the search for alternative building materials and alternative approaches to urban planning* to build up this stock in a sustainable way. This study will (1) quantify the potentials of resource efficient building and (2) explore roads to supplying urban form with a much lower ecological footprint. Moreover, we will (3) try to create story lines that show pathways to a more sustainable urban future, based on resource efficiency and related interventions in urban planning strategies, that can be used in the IRP scenario work and feed in to the next GRO.

5. Suggested scope and methodology

1. Review of the literature, expert interviews/workshop
2. Extension of the *Resource Efficiency and Climate Change* (RECC) model in terms of impacts (adding biodiversity through land use/water use change, pollution based on life cycle impact assessment methodology) and product scope (adding non-residential buildings, infrastructure, public transport). The biodiversity and pollution impact modeling will be consistent with the approach taken for the *Global Resources Outlook* 2023.
3. Modeling of demand and supply of renewable / biobased raw materials and associated land use and biodiversity impacts using IMAGE and its materials module, and GLOBIO.
4. Urban form/morphology of existing cities and potential future developments
5. Analysis of potential of positive storylines / 'imaginaries' of biobased cities.
6. Specific bottom-up scenario models for urbanization in one or several regionally-focused case studies
7. Review of policies and policy evaluations
8. Stakeholder workshop/process

***6.* Format / length (*thematic study, rapid study, think piece, supporting material, see descriptions here*)**
Thematic Study

7. Expected route-to-impact (which priority core audiences, international processes and debates this piece could inform over the next 4 years)

UNFCCC, UNCBD, UN HABITAT, UNDP, C40, ICLEI

There is a substantial level of activity related to cities and construction. Providing further insight into and awareness of distinct urban developments in terms of structure, materials, construction methods and their impact on multiple indicators of sustainable development will be of interest to many actors. It is suggested to partner with organizations that systematically address urban development, such as ICLEI, C40 and others.

8. Possible role of the proponents in this work (lead author or working group member)
Either lead authors or WG members.

3. The transition to a circular ocean economy

1. Name of the expert submitting the Proposal
Professor Steve Fletcher, University of Portsmouth, UK

2. Priority Theme and Topic
HIPA2: Resource Efficiency, Climate Change, Biodiversity, and Pollution.
New research priorities.

3. Title
The transition to a circular ocean economy. [Updated May 3rd]

4. Policy relevant questions
The move to a circular ocean economy is a key defining challenge of the transition to a sustainable blue economy. A sustainable blue economy is one in which the sustainable use and conservation of ocean, coastal and aquatic resources generate equitably and inclusively distributed benefits for people, protects and restores healthy ocean ecosystems, and contributes to the delivery of global ambitions for a sustainable future (UNEP, draft 2021). Relevant policy questions include:

- What are the defining characteristics of a circular ocean economy?
- What can we learn from terrestrial descriptions of the circular economy?
- How can we take account of ocean resource activities that are considered to be inherently unsustainable?
- What are the key policies that can unlock the transition to a circular ocean economy?
- How can we build on existing policies to support the transition to a circular ocean economy?
- How can a circular ocean economy support the delivery (and acceleration) of national development priorities / SDGs / tackle the triple ocean crises of pollution, biodiversity loss, and climate change?
- How do emergent new structures around the governance of areas beyond national jurisdiction enable (or constrain) the transition to a circular ocean economy?

5. Suggested scope and methodology
The focus would be on two key questions:

1) What could the circular economy look like with respect to ocean resources (including benefits to ocean biodiversity, pollution and climate action) ?
2) How might the transition to a circular economy take place in an ocean resource context (including key leverage points, innovation, policy drivers)?

Methods:

- Review of circular economy models using academic, practitioner sources and global guides as a starting point.
- Assessment of the applicability of circular economy models to the ocean context using specific ocean resources as examples (e.g. deep-sea minerals, fisheries, plastic pollution).
- Workshop with representatives of key sectors and analysis of circular models relevant to each sector.
- Analysis of transitional methods.
- Development of possible transitional pathways to a circular ocean economy.

6. Format / length (thematic study, rapid study, think piece, supporting material, see descriptions here)
Think piece (50-60 pages).

7. Expected route-to-impact (which priority core audiences, international processes and debates this piece could inform over the next 4 years)
Priority audiences:

- National ocean resource planners involved in sustainable blue economy processes.
- Sector-specific resource planners
- Regional seas bodies and intergovernmental bodies
- Ocean conservation and resource organisatisons

International processes and debates:

- UNEA, SDG14 delivery, circular economy transitions (e.g. EU)
- Regional and national sustainable blue economy strategies

8. Possible role of the proponent in this work (lead author or working group member)
Happy to be lead author.
Happy to convene a working group to take this proposal forward.

4. Soils as critical infrastructure: transformative finance and policy options for sustained decoupling of land use from land degradation

Overview
We propose to write a [------ TBD – see #6 below] on the topic of "**Soils as Critical Infrastructure**". We will explore how re-classifying the global soil resource as a form of "critical infrastructure" can support dramatic increases in resource efficiency and achievement of the SDGs through changes in how they are valued, and the financial and policy instruments that are applied to maintain and improve them. This report would build on previous IRP land-related reports (see selected references below) as well as, more generally, the GRO and reports such as The Weight of Cities that have had an infrastructure focus. It will draw on the unique strengths of the Panel, and in particular the diversity of members working on infrastructure, and infrastructure-related themes.

Soils represent a unique natural resource in that they both support most other forms of infrastructure (e.g. buildings, transportation and power generation and distribution networks) and

the same general rules and principles affect their value: they can be created and destroyed, and they require continued investments to ensure continued delivery of vital services such as climate regulation, food & biomass provision, and supporting biodiversity above and below ground. However, because most soil infrastructure in use today was created through natural processes (rather than through public or private sector investments), policies and financing needed to maintain them as critical infrastructure have generally been ad-hoc, uncoordinated and largely ineffective. The ineffectiveness is clearly reflected in the high discount rate that is often applied to agricultural land, as reflected in high rates of land degradation and agricultural land abandonment in many regions (FAO 2015). This alone is sobering, but even moreso when the cost of regenerating soil is taken into account: while some soils can be "rebuilt" as easily as railroad tracks, others are nearly impossible to restore, at any cost.

This [------] will explore the (a) need, (b) value, and (c) implications of reclassifying soils as critical infrastructure. We will conclude with the development of policy and finance options, drawing from existing infrastructure management literature and practices. We will present examples of how some of these options have already been implemented, in a piecemeal fashion, in various countries, and examples of how they could be applied more systematically. This will also allow us to move beyond the Panel's sometimes/often simplistic treatment of soil as a component of the land resource that is valued based simply on its area. Just as a kilometer of Shinkansen track has far more value as infrastructure than the same kilometer of Amtrak rails, so a hectare of deep, loamy soil in a region with adequate precipitation is worth more than a shallow, stony soil in a desert.

We note that this is a completely new concept. It was generally introduced in a *Nature* Comment, "The Business Case for Soil", by Professor Davies in 2017 and will be introduced in the literature more fully in a paper later this year. Thus, it represents a unique opportunity for the Panel. It is also well-suited to the Panel's transdisciplinary strengths, and provides a unique opportunity to address decoupling.

1. Name of the expert submitting the Proposal: Jeff Herrick (Panel member).

2. Priority Theme and Topic: We would address two of the new priority themes.

a. "Innovations for a transition towards decoupling". The topic addressed is "Business Model Innovation".

b. "Trade & finance for transition toward decoupling". The topic addressed is "Valuation of resources and natural capital in economic and financial systems", though it would go far beyond traditional approaches to valuation as we would be proposing reclassification of an entire asset class as critical infrastructure, which would open a much broader range of finance options to explore.

3. Title. *Soils as critical infrastructure – transformative finance and policy options for sustained decoupling of land use from land degradation*

4. Policy relevant questions. (see "Overview" for context)

- What does "soils as critical infrastructure" mean for national policy?
- What does it mean for investors?
- What would the impact be on financial markets and mechanisms?

- How can the reclassification of soils as critical infrastructure reduce land degradation and promote restoration while driving innovation in land management and land-based production systems?
- What are specific policies that would help countries realize the benefits of reclassifying soils as critical infrastructure?
- Could reclassifying soils as critical infrastructure result in a higher return on investment in sustainable land management by more effectively reflecting the *long-term* value of multiple services provided by soils?

5. Suggested scope and methodology

Scope: global.

Methodology:

1. Literature review of soils, land policy and existing infrastructure literature to identify where current policies deliver to the needs of managing soils as a critical infrastructure and opportunities for policy innovation.
2. Structured interviews of global infrastructure policy and industry leaders to better understand how they currently view soils as an asset class, and how changes in policy learning from infrastructure approaches might facilitate soil management.
3. Develop conceptual framework and review with policy and industry leaders.
4. Complete simple "ballpark" quantitative analyses to define value of soil as critical infrastructure, drawing on existing analyses while explicitly incorporating differences in how discount rates are currently applied land to vs. critical infrastructure.
5. Draft primary text defining (a) need, (b) value, and (c) implications of reclassifying soils as critical infrastructure.
6. Develop policy and finance options that would follow from reclassifying soils and critical infrastructure.
7. Identify/develop case studies illustrating how some of these options have already been implemented, in a piecemeal fashion, in various countries, and examples of how they could be applied more systematically.

6. Format / length (thematic study, rapid study, think piece, supporting material (descriptions here - p 9)
TBD based on consultation with Steering Committee. We are open to all of the above.

7. Expected route-to-impact (which priority core audiences, international processes and debates this piece could inform over the next 4 years).
Countries throughout the world are rethinking their approach to infrastructure in the face of climate change, food shocks, and population growth. Our goal would be to use the concept of "infrastructure" to get soils invited into the global finance conversations (especially private and public-private sector partnerships) from which they are currently excluded.

8. Possible role of the proponent in this work (lead author or working group member)
Jeff Herrick would co-lead author with Jess Davies (Lancaster University). We would engage an economist with experience working on other types of infrastructure.
9. Timing. Initiate work mid-late 2022 to allow completion of preparatory work in advance, ensuring that Panel resources and engagement would be efficiently applied, and allow for timely publication.

Selected references

Davies, J. 2017. The business case for soils. Nature.
FAO. 2015. Status of the World's Soil Resources. FAO, Rome.
Herrick, J.E., J. Neff, A. Quandt, S. Salley, J. Maynard, A. Ganguli, B. Bestelmeyer. 2019. Prioritizing land for investments based on short- and long-term land potential and degradation risk: A strategic approach. Environmental Science and Policy 96: 52-58.

Previous IRP reports including in particular "Unlocking the Sustainable Potential of Land Resources" and "Assessing Global Land Use" as well as "Land Restoration for Achieving the Sustainable Development Goals", "Food Systems and Natural Resources" and "The Weight of Cities", among others. It will also both draw from and contribute to the GRO.

Research Suggestions for HIPA3: Sustainable Resource Management for effective action on human health, well-being, prosperity and equity

5. Natural Resources Management for Improved Human Health[1]

1. Name of the expert submitting the Proposal: Professor Dominic Kniveton

2. Priority Theme: High Impact Priority Area of Equity and well-being

Topic: Human health/human well-being

3. Title: Natural Resources Management for Improved Human Health?

4. Policy relevant question: Improving human health outcomes through natural resource management.

5. Suggested scope and methodology:

Scope: *This Rapid Study aims to explore the multi-layered linkages between natural resources and human health and explore potential policy entry points for improving health outcomes from these linkages.*

The state, use and governance of natural resources affects human health, in a variety of direct and indirect ways. At the national level, in some countries with abundant natural resources, a 'resource curse' narrative has been posited, to explain declining national standards of living and poor health outcomes (Cockx and Franken 2014). At the meso-scale the extraction of natural resources has been linked to the spread of zoonotic and vector borne diseases (e.g. Karesh et al. 2012; Kebede et al 2005); with COVID-19 being cited as one possible global example (Kenyon 2020). While at the local level the COVID pandemic and lockdowns have highlighted the positive role of nature and natural resource management programs, on mental health (Schirmer

[1] During the 2021 SPE, the USA asked to clarify whether the work would be targeted at health organizations to advocate for resource efficient policies. If so, it was suggested to add organizations like the Strategic Approach to International Chemicals Management to the list of target audiences.

et al 2013; Tester-Joneset al. 2020). These multi-layered interactions beg the question of how to facilitate the management of natural resources to benefit human health outcomes.

In economic terms two recent interventions have emerged that may act as avenues to improve health outcomes from natural resource management: Environmental Social and Governance (ESG) investment and local community renewables. These civil-society-led movements attempt to incorporate environmental and social interests into dominant institutional forms under the theme of 'glocalization' (Okuma 2019). In the former environmental and social concerns are attempted to be integrated in global finance decisions. While the later attempts to use local natural resources to create businesses that contribute to entrepreneurial regional development. Tangentially they both influence health outcomes without explicitly mentioning them. In this research piece, we will explore the potential of these and other policies to mainstream health outcomes into natural resource relevant decisions.

Methodology:
The study will undertake a series of systematic reviews of natural resource-health linkage studies to build up systems understandings of the social, political, economic, environmental and demographic contexts for these linkages. The systematic reviews will be performed according to the 2015 Preferred Reporting Items for Systematic reviews and Meta-Analysis guidelines (Moher et al 2015). They will consider both peer reviewed and grey literature (Mahood et al. 2014) and include a combination of mixed methods, qualitative and quantitative studies.

Particularly the study will focus on the following sub-topics:

1. The resource curse and health outcomes
2. Extractive industries and community health
3. Deforestation, land use change and emerging infectious diseases
4. Deforestation, land use change and vector borne diseases
5. Dams and disease
6. Natural resources and mental health
7. Natural resources and health in Environmental, Social and Governance investments

6. Format / length (thematic study, rapid study, think piece, supporting material): Rapid Study and Assessment:

7. Expected route-to-impact (which priority core audiences, international processes and debates this piece could inform over the next 4 years):
Core audiences: World Health Organisation (WHO); WHO Office at the UN (WUN), ESG investment fora; Lancet Countdown and Planetary Health Alliance.

8. Possible role of the proponent in this work (lead author or working group member): Lead author

References
Cockx, L. and Francken, N., 2014. Extending the concept of the resource curse: Natural resources and public spending on health. Ecological Economics, 108, pp.136-149.

Karesh, W.B., Dobson, A., Lloyd-Smith, J.O., Lubroth, J., Dixon, M.A., Bennett, M., Aldrich, S., Harrington, T., Formenty, P., Loh, E.H. and Machalaba, C.C., 2012. Ecology of zoonoses: natural and unnatural histories. The Lancet, 380(9857), pp.1936-1945.

Kebede, A., McCann, J.C., Kiszewski, A.E. and Ye-Ebiyo, Y., 2005. New evidence of the effects of agro-ecologic change on malaria transmission. The American journal of tropical medicine and hygiene, 73(4), pp.676-680.

Kenyon, C., 2020. Emergence of zoonoses such as COVID-19 reveals the need for health sciences to embrace an explicit eco-social conceptual framework of health and disease. Epidemics, 33, p.100410.

Mahood, Q., Van Eerd, D. and Irvin, E., 2014. Searching for grey literature for systematic reviews: challenges and benefits. Research synthesis methods, 5(3), pp.221-234.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P. and Stewart, L.A., 2015. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Systematic reviews, 4(1), pp.1-9.

Okuma, K., 2019. Potential mechanisms for the social regulation of economies on global and local scales: an institutional analysis of ESG investment and community renewables. Evolutionary and Institutional Economics Review, 16(2), pp.523-541.

Schirmer, J., Berry, H.L. and O'Brien, L.V., 2013. Healthier land, healthier farmers: Considering the potential of natural resource management as a place-focused farmer health intervention. Health & place, 24, pp.97-109.

Tester-Jones, M., White, M.P., Elliott, L.R., Weinstein, N., Grellier, J., Economou, T., Bratman, G.N., Cleary, A., Gascon, M., Korpela, K.M. and Nieuwenhuijsen, M., 2020. Results from an 18 country cross-sectional study examining experiences of nature for people with common mental health disorders. Scientific reports, 10(1), pp.1-11.

Research Suggestions for HIPA4: Enabling Sustainability Transitions

6. Secondary resources trade for resource access equity and global decarbonization

1. Name of the expert submitting the Proposal
Keisuke Nansai (panel member)

2. Priority Theme and Topic
Trade & finance for transition toward decoupling / Trade

3. Title
Secondary resources trade for resource access equity and global decarbonization

4. Policy relevant questions
Creating a decarbonized economy and society calls for the drastic reduction of greenhouse gases (GHG) emissions associated with the life cycle of resource use. To achieve this, it is necessary

not only to limit resource extraction by reducing the demand for resources but also to increase the share of recycled resources, i.e. secondary resources.

Secondary resources are resources as metals stocked in durable goods and durable consumer goods with a longer product life. Therefore, most secondary resources tend to be rich in industrialized and high-income countries that already have complied a large stock. Some goods, such as used cars, are already traded globally, but huge stocks like infrastructure tend to remain in a country until they are demolished. Furthermore, under the circular economy policy, those countries presently are accelerating the domestic or regional circulation of secondary resources. It allows us to infer that the oligopoly of secondary resources by such countries will become stronger and stronger.

On the other hand, in developing countries and low-income countries, the future demand for resources will be glowing, driven by population growth and economic development. Nevertheless, given the global decarbonization will gradually constrain primary resource use and historically poor stock accumulation has been implemented, it would be evident that the potential of secondary resource in those countries is far from enough for the growing demand. In other words, without the establishment of an economic system where secondary resources recovered from stock in industrialized countries can be used smoothly in developing countries, it is expected that the access of developing countries to resources will be unfairly restricted, resulting in a decarbonized society lacking equity in resource use.

To this end, there are four policy issues that industrialized countries should address. The first is to understand the amount of secondary resources needed for developing countries in line with the 1.5/2-degree climate goal and share the long-term availability of secondary resources supplied overseas. Quantitative knowledge of the gap between the demand and supply is critical to stimulate an international discussion on decarbonization and equity in resource. The second is to set standards for proving the quality and safety of secondary resources considering their applications in developing countries, and the third is to establish rules for international trade that enhance the flows of secondary resources from industrialized countries to developing countries. The fourth is collaborative developing technologies and institutions for the use of secondary resources as tertiary resources again in developing countries.

5. Suggested scope and methodology

A stock-flow model with GHG emission constraints calculates the supply of secondary resources needed to meet future resource demand scenarios for the G20 and major developing countries under the climate target limiting the use of primary resources. The demand scenarios are taken into account equity in resource use between industrialized countries and developing countries.

The future availability of G20 secondary resource is decomposed into domestic use and export potential considering the domestic resource demand and the constraint of primary resources. The quality of secondary resources is defined by the type of stock recovered, and the matching of it with the quality of resources required in developing countries is examined. This allows us to examine an impact of the absence of mechanisms to ensure the quality and security of resources on the global availability of secondary resources.

Narrative descriptions demonstrate how the rules of international trade showed be established so that the international market and trade in secondary resources can cope with the volume of secondary resource trade required.

6. Format / length (thematic study, rapid study, think piece, supporting material, see descriptions here)
A thematic study is the first option, but a think piece is also possible if equity issue in resources sounds sensible.

7. Expected route-to-impact (which priority core audiences, international processes and debates this piece could inform over the next 4 years)

Priority core audiences includes policy makers in industrialized countries engaged in the circular economy (CE) as they should be encouraged to design their CE systems with the intention of future supply to developing countries, rather than limiting the circulation of secondary resources to domestic use (domestic oligopoly). Key business audiences are infrastructures and material industries, which are responsible for creating a mechanism to share information on the quality and safety of secondary resources across borders and time. The expansion of the market and international distribution of secondary resources will be communicated to the World Trade Organisation and, to the Conference of the Parties (COP) if any inconsistencies with the Basel Convention are detected.

8. Possible role of the proponent in this work (lead author or working group member)

A lead author

7. Developing a dynamic global mechanism for natural capital accounting of resources[2]

1. Name of the expert submitting the Proposal
Saleem H. Ali

2. Priority Theme and Topic
Trade finance and transition toward decoupling with some overlap also with innovation toward decoupling (particular focal area from scoping document noted as "Valuation of resources and natural capital in economic and financial systems".

3. Title
Developing a dynamic global mechanism for natural capital accounting of resources
4. Policy relevant questions
How can changes in natural capital be most effectively be used in policy planning and cost-benefit analysis of development decisions?
What are the technological tools and the kinds of data that can facilitate more nimble policy responses to change.
5. Suggested scope and methodology
Review the existing work the UN has undertaken for five countries and see how some of those methods can be applied with a resource accounting perspective:

[2] The IRP Steering Committee requested not to pursue any work on natural capital accounting in 2022-2025 given upcoming work by other international groups on the topic.

Consider the ecosystem service tools available such as Invest and Aries and investigate how they can be adapted for resource linked natural capital evaluations through Microsoft's Planetary Computer.
Use case studies from GEF projects to consider the ways such accounting mechanisms can provide improved natural capital accounting which can also assist in policy decisions.
6. Format / length
Think piece with policy recommendations (Under 15,000 words) and interface with Microsoft's planetary computer and a possible short guide for use by GEF Implementing Agencies.

This would be a starting point for potentially a larger global assessment of natural capital accounts with a strong set of social science caveats that note the critiques of solely numerical valuation of nature (that has also led to extensive criticism of the Dasgupta Review and earlier work by environmental economists).
7. Expected route-to-impact (which priority core audiences, international processes and debates this piece could inform over the next 4 years)
The idea for this effort comes from a meeting held jointly between GEF, IRP and Microsoft. The 18 GEF lead agencies would be an important audience with a vast network for impact through projects as well as Microsoft's stakeholders and partners on the Planetary Computer
8. Possible role of the proponent in this work (lead author or working group member).
As a member of both the IRP and the GEF Science Panel (STAP), I can act as a bridging convener but we would need to recruit topical expertise through a small working group to help research and write the document.

8. The Climate and Circular Economy Potential of Social Businesses / Inclusive SMEs

1. Name of expert submitting the proposal: Dr. Ashok Khosla and the research team at Development Alternatives

2. Research area and potential topic(s):
A **Think Piece** is proposed to develop a perspective on the potential of green and inclusive SME models to deliver circular economy – climate mitigation – pollution reduction – biodiversity protection - outcomes coupled with socio-economic and human health and well-being benefits, in emerging rapidly urbanising economies and the policy imperatives for the same.

The Research Area falls under **SAG 3: New High-Impact Priority Areas**.
Systemically, it will address: **The Circular Economy – Climate Action – Pollution Reduction Nexus, studying SME and Social business models** and their climate action (mitigation and / or adaptation) and resource decoupling potential **in:**

- resource intensive systems, e.g. housing and in specific economic sectors and value chains (steel, cement, bricks, concrete)
- Approaches to urban waste management

(*Associated co-benefits, socio-economic impacts and trade-offs to be studied*)

Thematically, the research would be linked to **one identified potential new priority research themes** as a primary focus with strategy and impact assessment across other themes (fig. 1):

Fig:1: The Study design

Identified priority research theme	**Core Research Theme**	**Impact and synergy analysis**	**Strategy and solution analysis**
	waste management and circularity	equity and well-being	innovation for transition towards decoupling
	1. Resource efficiency/circular economy 2. Municipal waste management- waste water, municipal solid wastes, construction debris, plastics	3. Distributional implications of decoupling strategies 4. Human health/human well-being	5. Business model innovation

Proposed Research hypothesis: In the context of rapidly urbanizing emerging economies, **SME** driven circular business models in resource intensive sectors such as housing and in integrated municipal waste management services have a high potential to build-in distributional equity into the design of business models to deliver multiple outcomes of de/re-materialization, climate mitigation, ecosystem concervation and benefits to local economies, human health and well-being.

Suggested Key Research Questions:

1. What is the potential of **SME**s in circular economy strategies to provide multiple benefits of distributional equity, decoupling resource and environmental impacts from economic development and GHG mitigation at scale?
2. What may be the policy and institutional systems, especially in the realm of fiscal reform and resource governance that enable and support the proliferation and sustenance of green and inclusive business models?
3. What may be the technological imperatives and potential of digital innovations for scaling up /out inclusive and circular businesses and the trade-offs therein with respect to GDP growth, consumption patterns and jobs in the context of emerging economies of the Global South?

3. Scope:

- Rapidly urbanising emerging economies of Asia and Africa and Latin America - 4 country situations India, South Africa or Kenya or Ghana, Malaysia or Indonesia or Vietnam, Mexico or Chile
- Resource intensive sectors – urban housing and building construction, urban waste management (municipal solid waste and waste water, plastic waste)

4. Methodology:

- **Case study based** - empirical evidence of ongoing public, private, public-private, public-private-community and start-up business models that are designed to deliver products and services in the highly resource intensive sectors such as urban housing and building

construction, urban waste management with a potential for resource circularity, emission reduction and pollution abatement.

- **Applying LCA, MFA and Social Impact Assessment methodologies** and resource efficiency and waste management strategies in the specific sectors to understand the micro and macro impacts at national and sub-national levels.
- **Studying trends of SME, especially green SME growth** through the national policy and instructional systems existing in each context over a time horizon extending from independence from colonization, economic structural reform (for most emerging economies this was in the late 1980s and 1990s), period of MDGs and until late 2020s (five years into the SDGs).

5. Policy relevant questions – *to be developed (questions would around: the role of public investment and private finance, the "External Rate of Return" of social businesses and SMEs, the mainstreaming and integration of SMEs in country strategies for SDG and NDC and possible net-zero strategy achievement)*

6. Expected route to impact (*which core priority audiences, international debates could this piece inform over the next 4 years*) –National Governments and the investor community, the focus of Green / Climate Finance, "means of implementation" of the SDGs.

7. Possible role of the proponent in this study – PI, Research coordinator of a research group across IRP members or researchers from the 4 countries**.**

8. Working Title: The Climate and Circular Economy Potential of Social Businesses / Inclusive SMEs.

Annex 1 of research suggestion 8: Background – 1

Holcimroundtable
for sustainable construction

Shrashtant Patara: We-materialize, re-materialize, re-materialize

De-materialize this...?

The material intensity of mainstream building practices is unsustainable. Gains in material efficiency have been nullified by the rapid growth in construction volumes to fulfill unmet demand and aspirational consumption. In India for example, steel output has grown 300% from 1995 to 2009, while in the last decade cement production has risen by 56% and brick production has grown from about 150 billion units per annum to over 200 billion. And yet, this is just the tip of the iceberg. Basic housing needs of over 700 million people are still to be met. Infrastructure needs of India and other emerging economies are expected to grow exponentially for at least the next three decades.

So, how do we de-materialize construction in a scenario where people across large parts of the world use virtually no material at all and communities are yet to build schools, roads, shops and factories? Clearly, growing nations will have to aggressively set forth on a path of relative de-coupling between infrastructure development and the intensity of material and energy use. In more mature economies, significantly greater emphasis will have to be placed on strategies for absolute de-coupling between resource use and service delivery.

Efforts aimed at de-materializing construction must go beyond the relatively narrow boundaries of technological innovation and the application of industrially produced building materials on a large scale. To de-materialize, we must also de-centralize and equip micro- and small-scale service providers with the tools to deliver high-performance habitat solutions from within local production systems; employing processes in which they are able to add value to renewable resources.

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for sustainable construction

Supply chains that transport finished products across vast distances and through a large number of intermediaries are more than likely to get stretched and eventually, broken. Large businesses of the future will therefore be compelled to market goods and services that empower the micro-and small-scale service provider. Typically, as big brands would continue to be an asset for both large corporations and small entrepreneurs, franchising models would be the most competitively placed to deliver solutions at scale; particularly to the hundreds of millions of households that still have unmet shelter needs. The corporation could use its access to cutting edge research on materials and processes to put together "enterprise-in-a-box" packages of technology, know-how and a few critical inputs for local entrepreneurs.

There is an urgent need to develop and support the widespread adoption of processes that serve any, or a combination, of the following goals:

- "We-materialize" – people become an integral part of the material production and application value chain; not being reduced to just consumers of goods made by machines and robots.
- "Re-materialize" – material flows emanate much more significantly from waste that is generated within local communities, particularly dense urban settlements; or, through the intelligent use of composite materials, aeration and other innovations that rely on the laws of physics.
- "Xe-materialize" – next generation solutions from the realm of chemistry, biology and information technology in which symbiotic relationships are created between material, energy flows within a building and its structure, e.g waste water can provide insulation inside walls made of intelligent membranes, then treated and cycled back for use.

These goals stand out as absolute imperatives, not only from the point of view of maintaining a healthy balance of our material resources, but also on account of the broader environmental, social and economic goals of sustainable development.

Annex 2 of research suggestion 8: Background - 2

LafargeHolcim Forum

6th International Forum for Sustainable Construction

American University in Cairo, April 4-6, 2019

Abstract of Proposition by Shrashtant Patara

"Blue Workshop" – From Manual to Digital and Vice Versa: Digitalization, Labor and Construction

Globally, the need for housing and infrastructure is largely unmet. In India alone, over 40 million families lack a decent home. Demand continues to outstrip supply on account of growth in numbers and the legitimate aspirations of people to live in a significantly better built environment. The material and energy intensity of mainstream building practices are unsustainable. Their negative effects on the economy, environment and society should now become unacceptable.

Creating value by capturing intelligence, across scales, sectors and stakeholders.

In previous Roundtables for Sustainable Construction, we have discussed how people must become an integral part of the housing value chain, as against being reduced to passive consumers of goods made by machines and robots. And, how material flows must emanate much more significantly from waste that is generated within local communities.

Recent innovation in materials, production systems and business models, aided by digital technology, indicate how an alternate growth trajectory can be put in place for positive impact at scale, which is sustainable. Our strategy to fulfill demand, create widespread economic and social well-being, as well as regenerate the resource base must necessarily be based on:

i. A vast network of decentralized nodes for production of building elements and supply of construction services; particularly as large industrial scale supply chains become increasingly unviable.
ii. Competence within the stakeholder eco-system to deal with diversity in raw materials, that will increasingly be found in wastes, and the complexity of demand in which building solutions will need to be customized locally.
iii. Easy and effective access to know how, using which large numbers of people with hitherto uncertain skills are able to deliver high quality products and services.

Material flows, that are largely unidirectional from source to application in buildings, need to be replaced with "packages of intelligence" that help the local producer, possibly a franchisee, create competitive value propositions for their customers. This is where digital technology can play a game changing role, particularly in ensuring that skill deficits are overcome and that local micro-entrepreneurs have the basic know how and easy access to information to deal with the complexity of demand and diversity of the material base.

In the reverse direction, digital technology makes it possible for precious data, information and insights on demand to be aggregated and analyzed in a manner that accelerates the development of context specific and yet efficiently replicable building solutions.

Rapid and seamless movement of knowledge across scales, sectors and stakeholders will lead to the establishment of an eco-system in which "we" – as in large numbers of people – begin to "re-materialize" the construction sector.

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