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Early career experts essential for planetary sustainability

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Early-career experts essential for planetary sustainability

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Early-career experts can play a fundamental role in achieving planetary sustainability by bridging generational divides and developing novel solutions to complex problems. We argue that intergenerational partnerships and interdisciplinary collaboration among early-career experts will enable emerging sustainability leaders to contribute fully to a sustainable future. We review 16 international, interdisciplinary, and sustainability-focused early-career capacity building programs. We conclude that such programs are vital to developing sustainability leaders of the future and that decision-making for sustainability is likely to be best served by strong institutional cultures that promote intergenerational learning and involvement.

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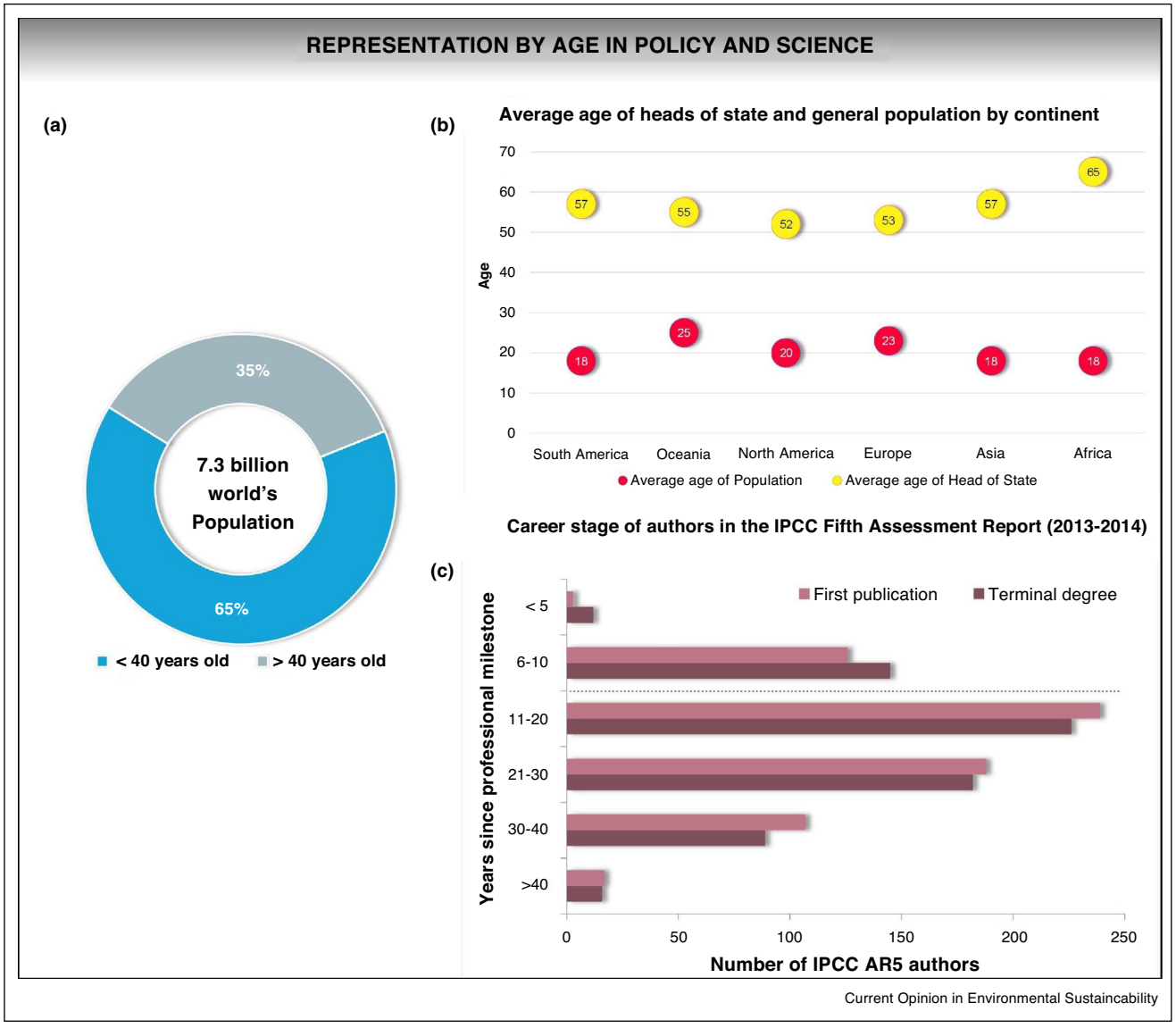
Emerging and future generations should have a more prominent role in decision-making and knowledge production

Human activity is pushing our planet beyond sustainable limits [1,2]. Systematic change in human behaviour is therefore needed to address growing threats to the environment and human well-being. It is important that younger generations play a key role in bringing about this required change. This is because younger generations will not only be the most affected by the realities of the Anthropocene, they also bring important generational perspectives to the development of sustainability solutions. A key problem, however, is that while younger generations (those under 40 years of age) constitute 65% of the world's population, they are insufficiently integrated into decision-making or science-policy interfaces (Figure 1). There is increasing recognition that global sustainability initiatives need to incorporate diverse knowledge systems and worldviews by using a broader range of stakeholders, disciplines, methods, and tools [3,4,5•,6,7,8•,9,10]. At the same time, intergenerational partnerships are critical to achieving effective decision-making and knowledge production [11].

Figure 1



Under-representation of younger generations in decision-making and science. Sixty-five percent of the world's population is below 40 years of age **(a)**. Those below 40 years of age are under-represented in decision-making (e.g. the age distribution of heads of state) **(b)**; and at the science-policy interface (e.g. career stage of authors of the IPCC 5th Assessment Report-represented by proxies of terminal degree and first publication). Early-career scholars represented as <10 years post-first publication/terminal degree (above line). Established scholars represented as ≥10 years post-first publication/terminal degree (below line) **(c)**.

The authors of this paper comprise all 16 Fellows of the Global Assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). IPBES assesses the state of biodiversity and of the ecosystem services it provides to society, in response to requests from decision makers. The expertise of the IPBES Fellows spans the disciplines of ecology, anthropology, economics, law, and governance. Our multidisciplinary fellow team thus brings together early-career experts from every inhabited continent to contribute to the key IPBES function of knowledge generation while building capacity for intergenerational collaboration for sustainability.

More than ever before, an integrated paradigm is needed to enable continued advancement of human societies and the maintenance of environmental systems underpinning human well-being [7,12,13]. Other authors have highlighted the need to re-evaluate the role and design of global initiatives to ensure inclusion of a greater diversity of perspectives (e.g. [11]). We add to this discourse by emphasizing that intergenerational

partnerships can facilitate new ways of conceptualizing and achieving global sustainability. We, therefore, offer intergenerational partnerships in decision-making and knowledge production and the empowerment of early-career experts (<10 years post-first publication or terminal degree) as means of facilitating continued human and planetary well-being. This echoes several calls to involve early-career experts in sustainability science and its application (see [14,15]).

Early-career experts can play a fundamental role in bridging generational and disciplinary divides. Capacity building programs are, however, essential to enabling early-career experts to contribute fully to global sustainability. We reviewed 16 international sustainability-focused capacity building programs that facilitate interdisciplinary collaboration between early-career experts. From this, we identify challenges and best practices for including early-career experts in science and decision-making. This, in addition to our focused review of the fellowship programs of the comparable Millennium Ecosystem Assessment (MA) and the Regional and Thematic Assessments of IPBES (which occur a decade apart), facilitates examination of the role that such programs can play in developing sustainability leaders of, and for, the future.

Intergenerational equity is essential for sustainability

The importance of sustainability has been reinvigorated globally by the United Nations' 2030 Agenda for Sustainable Development (2030 Agenda) [16] and its 17 Sustainable Development Goals (SDGs). When striving towards sustainable development, it is essential that intergenerational equity, a key pillar of sustainable development [17–20], is not overlooked.

The SDGs [16], for example, have a strong focus on *intra*generational equity with the terms 'equitable,' 'equal,' 'equality,' and 'address/combat inequality' occurring almost 50 times within the 2030 Agenda and across a range of goals and targets. Meanwhile, the term 'future generations' appears only three times in the Declaration and there is also no explicit reference to *inter*generational equity in any of the goals or targets or indeed any part of the 2030 Agenda.

It is important that intergenerational equity is not neglected in science and decision-making. This is not only for reasons of fairness, but also because generational diversity contributes to novel approaches to navigating the uncertainties of global environmental change. For example, achieving sustainability requires an integrated and interdisciplinary approach that incorporates systems thinking to address the challenges of the Anthropocene and social–ecological systems [14,21–23,24••,25,26••]. Also essential is the ability to collectively analyze complex systems across different sectors and scales [27].

Early-career experts are well positioned to facilitate systems approaches and to generate change through new research fields and innovative methodological approaches and to solve problems that have not been addressed by classical discipline-based methods [28]. Such experts are also among the first generations of scholars and practitioners to have interdisciplinarity embedded in their training and research. Of the world's 50 leading universities in the field of environmental sciences [29], 66% now have interdisciplinary postgraduate programs where students can choose training courses and thesis topics within research groups spanning social and natural sciences. There has also been a growing increase in interdisciplinarity in scientific publications [30]. These trends clearly show a shift to holistic and interdisciplinary approaches compared to traditional compartmentalized discipline-based publications [31].

While significant progress has occurred in the cross-fertilization of knowledge across disciplines, similar progress has not been observed across generations (Figure 1). A greater role for early-career experts in knowledge generation and policy-making is, therefore, important as it facilitates collaboration across disciplines and generations.

Partnerships with an emerging generation of scholars and practitioners, to whom interdisciplinarity and the use of new media and technologies are second nature, will facilitate the development of new research fields and innovative methodological approaches as well as innovative solutions to problems that have not been addressed by classical discipline-based methods. This aligns well with the notion of reverse mentoring (i.e. younger employees sharing expertise with their older counterparts), which has been adopted as best practice within the private sector [32]. At the same time, Ebadi and Schiffauerova [33••] suggest that while publication quantity generally grows with career age, younger researchers tend to produce higher quality publications. This is particularly so when they work in large teams. This highlights the benefits of including early-career experts in research endeavors.

Pathways to success through capacity building for intergenerational collaboration

Even with targeted programs of study and novel skill sets, early-career experts still require training to best contribute to decision-making, policy, and management for sustainability. Effective capacity building includes support from institutions, senior staff within those institutions, information and technical guidance, which create an atmosphere that fosters the development of intergenerational partnerships [31].

The larger goal of building capacity for intergenerational sustainability partnerships is not merely to assimilate

emerging professionals into existing academic, governmental, and non-governmental systems. Capacity building also has the important role of facilitating sustainability transformations by empowering and embracing diversity and fostering a range of skills, leadership styles, and values across generations. This can lead to improved professional environments and a more egalitarian and cooperative community [34]. The START Programme, for example, has demonstrated that building the research capacity of scientists and their ability to engage in participatory processes has enhanced the flow of information between academia and decision-makers. This has proved effective in putting knowledge into action [35]. More inclusive approaches to knowledge production also enhance the political legitimacy of environmental management decisions and contribute to the longevity of institutions responsible for implementing these decisions [10]. Meanwhile, the motivating effects of education and training opportunities contribute to staff retention particularly among early-career experts [36] while engendering intergenerational continuity within organizations. Such continuity is crucial to maintaining institutional memory, particularly during periods of change and crisis [37,38].

To support intergenerational partnerships, intergovernmental bodies, such as IPBES, are increasingly encouraging the participation of early-career experts in the co-production of information relevant to sustainability decision-making [39]. At the same time, emerging professionals recognize the multiple benefits of capacity building programs and have demonstrated an eagerness to develop and apply cross-cutting methods and interdisciplinary expertise beyond academic settings to address pressing sustainability issues. The Young Fellows Pilot Programme of IPBES, for example, attracted more than 400 applications from all over the world [40]. Along these lines, the emerging 'Global Young Academies' movement is also encouraging networks of interdisciplinary collaboration within the sciences [41,42]. Such initiatives are important for fostering intergenerational reciprocity as present generations may feel more inclined to make decisions in favor of the future [43]. Yet, for these aspirations to be reflected in practice, intergenerational interactions must be accompanied by continuous training opportunities and sustained funding support [44].

Our review of early-career capacity building programs highlights that participation by early-career experts can result in strong collaborative networks and scientific outputs that address current societal needs and those of future generations (Figure 2). We identified programs that use structured approaches to build individual, institutional, and societal capacity for addressing complex social–ecological challenges (Table S1). These programs have differing levels of funding, training, mentoring, and alumni support. They also vary in their primary objectives which range from conservation biology to human dimensions of global change. Each, however, aims to build — and maintain — capacity in their programs and professional networks by integrating early-career experts into knowledge generation and decision-making processes for environmental sustainability.

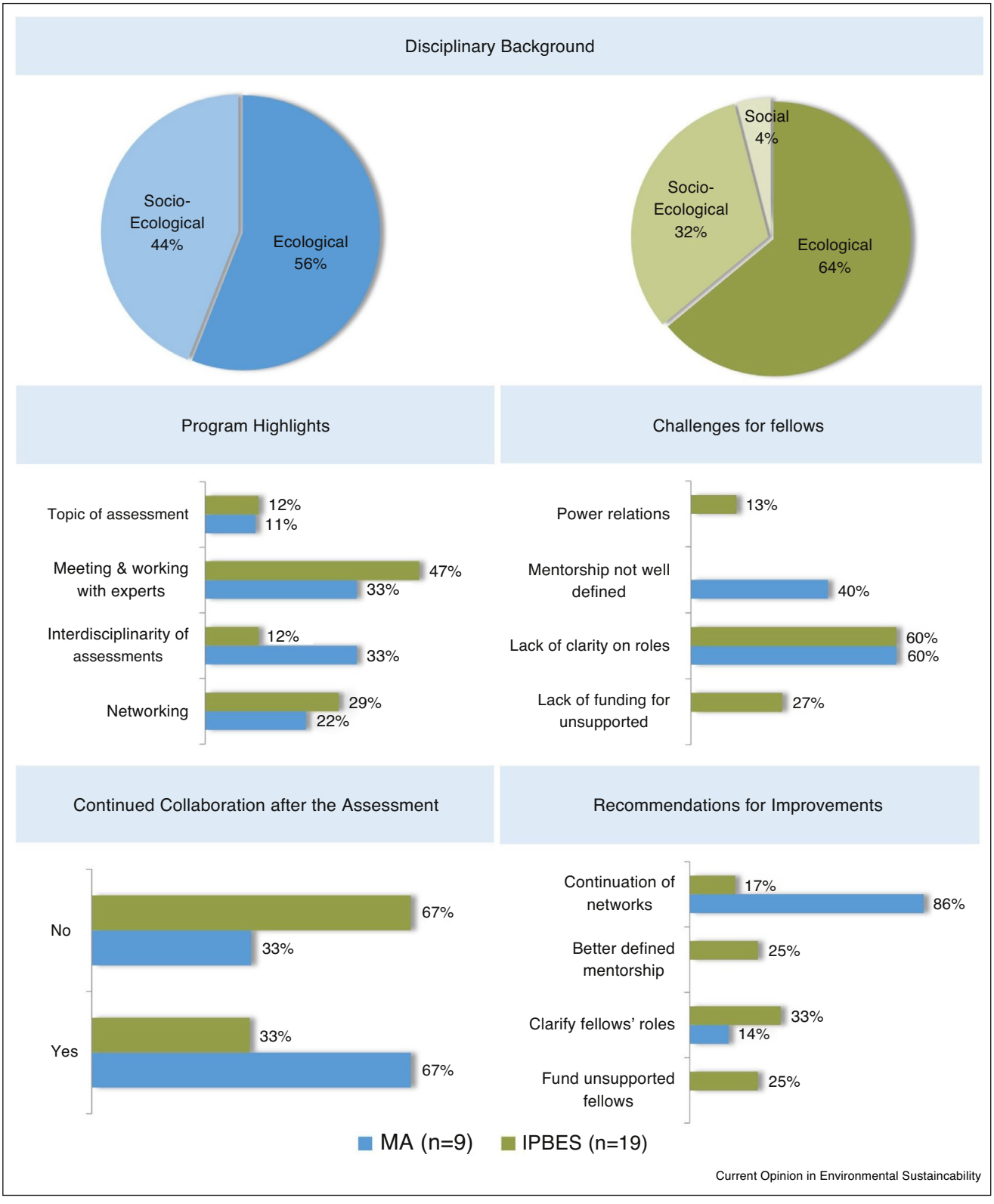
Our findings highlight that early-career capacity building programs can be fruitful long-term investments which bolster social capital in professional communities. These programs formalize connections between groups across career stage, discipline, and institutions. A common benefit of these programs is the capacity for professional development through the creation of strong interdisciplinary networks not only with established scholars but also with their peers. Early-career capacity building programs can, therefore, enhance professional networks, cross-disciplinary engagement, and a sense of community directed at addressing multi-faceted social–ecological challenges.

Examining these programs collectively underlines the invaluable nature of bringing together gender-balanced groups of emerging professionals from diverse geographical, cultural, and disciplinary backgrounds. Funding for all participants, effective mentorship programs, and continued formalized networks (e.g. alumni groups) are important for capitalizing on the investments made in the programs (Table S1). Our detailed analysis of the fellowship programs of the MA and the ongoing regional and thematic IPBES assessments echoed these best practices and illustrated the important role these fellowships play in aiding the necessary transfer of institutional knowledge to sustain productivity through membership and leadership transitions (Box 1).

Achieving a sustainable future through intergenerational contributions to today's decisions

The urgency with which threats to biodiversity and ecosystem services globally need to be tackled is increasingly recognized. Decision-making for sustainability is likely to be best served by a strong institutional culture which promotes intergenerational inclusion and capacity building. By institutionalizing intergenerational and interdisciplinary dialogues on sustainability decision-making, fellowship programs (e.g. those in Table S1) provide valuable pathways to nurture intergenerational networks. Fostering such an institutional culture is important in the global sustainability arena as it integrates the stewards of the future into the decisions of the present. Intergenerational partnerships which ensure broad participation of early-career experts are therefore essential to achieving intergenerational equity and ultimately planetary sustainability.

Figure 2



Description of early-career capacity building programs of Millennium Ecosystem Assessment (MA) and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) based on fellows' responses to a structured survey.

Box 1 Fellows of the Millennium Ecosystem Assessment (MA) and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Fellowship Programs.

We set up a survey to gain insight into the extent to which early-career capacity building programs achieve their aims. We focused on the MA and IPBES fellowship programs as a comparative case-study of two similar efforts across time. IPBES and its Fellowship Programme are ongoing and draw on the experience of the MA. The MA ran from 2001 to 2005 and assessed the consequences of ecosystem change for human well-being. Many MA authors also contribute to current IPBES Assessments. The assessment processes are of approximately the same length (i.e. 3–4 years).

A survey was completed by 38% of all the 73 fellows of both the MA and IPBES (excluding the fellows of the IPBES Global Assessment). Both the MA and IPBES fellowship programs aimed to build the capacity of early-career researchers to conduct assessments on biodiversity and ecosystem services. Both programs attracted fellows from all over the world, selected largely through institutional (IPBES) and government (MA) nominations. Fellows of the MA were mostly funded, whereas IPBES only funds fellows that are eligible for support under the IPBES Rules of Procedures. Based on the responses of our survey, most fellows in both assessments have backgrounds in ecology (16), closely followed by social–ecological sciences (11), with only one fellow from the social sciences.

The survey outcomes are summarized into the following areas: first, disciplinary background of fellows; second, program highlights and challenges, third, whether there was continued collaboration between fellows following the assessment, and fourth, suggestions for improvement in future fellowship programs (Figure 2). Fellows from both programs indicated that collaboration with scientific experts was the most positive aspect of such programs. The need to clarify fellows' roles in the assessment was highlighted as a 'challenge' for both programs. An important insight from the former MA fellows was the need to nurture and formally foster the network of fellows especially after the completion of the Assessment. Fellows reported that while they had interest in staying in contact and collaborating within their cohort, this was not always possible. Nevertheless, 67% of MA Fellows reported that the fellowship programme facilitated collaboration with other fellows. In contrast, only 21% of IPBES fellows responded in the affirmative. A likely explanation of the differences between the two programmes is that the 12 years since the MA have allowed MA fellows to build and reflect on networks which have emerged from their fellowship experience. These results suggest that even where formal structures are lacking, the networks formed through the fellowship process are valued as fellows advance in their careers. Overall, these programs are achieving their goals of building institutional capacity. For example, at least eight of the 37 MA fellows are currently in leadership roles in the ongoing IPBES assessment process. A program evaluation report on the MA concluded that 'The MA Fellows programme aimed at encouraging younger researchers was outstandingly successful at such capacity building' [45].

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at https://doi.org/10.1016/j.cosust.2018.02.004.

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