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FORUM

Is there a case for or against patents to incentivize green technologies?: A critical evaluation of innovation incentives for the global north and global south

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Abstract
The world society is in urgent need for new ecological problem solutions on a global scale. However, the current system to incentivize invention and innovation for green technologies is only limitedly able to provide effective solutions—particularly in the "global south". Since patents that exert distortionary effects remain the dominant mechanisms for incentivizing innovation, the debate about alternative incentivization instruments for fostering green invention and innovation has recently been renewed. Yet, some of these instruments run the danger of a so-called *"projectitis"*, an obsession with static small-scale projects. Instead, this article argues that we need scalable experiments for a better institutional support of systemic invention and innovation activities by improving the global governance regime that moves beyond individual organizations, industries, sectors, states, and geopolitical blocks. From a sustainability nexus perspective, required scalable innovation ecosystems must therefore account for the interconnections between technological, economic, political, social, and environmental issues. A reformed order that combines patents and alternative incentivization instruments may help to redirect resources towards fostering a more systemic, market-based, and consumer-oriented path of legitimate sustainable global development, as proposed by the 2030 Agenda and its sustainable development goals (SDGs), without leaving particular countries behind, while at the same time maintaining companies' systemic dynamism in the long run.

Keywords Green technology · Patent · Innovation · Innovation policy · Governance · R&D

JEL Classification O31 · O33 · O34 · O38 · O43

1 Introduction

Our world society faces an urgent need for innovative problem solutions. Climate change is just a case in point, with scientists calling for "immediate, rapid and large-scale reductions" in the emission of greenhouse gases (GHGs) (IPCC, 2021). Meeting the ambitious maximum temperature increase targets of the Paris Agreement (Bednar et al. 2021; DeAngelo et al. 2021) would require achieving net negative CO_2 emissions before 2050 (Detz and van der Zwaan 2019). This is an enormous innovation challenge (Mowery et al. 2010). To deal with it, new green technologies must be invented and diffused to effectively provide climate mitigation on a global scale. This requires a systemic approach that can cope with polycentrism, uncertainty, and pluralism (de Ridder et al. 2023), necessitating the strengthening of global governance that transcends organizations (e.g., Pies and Schultz 2023), industries, sectors, states, and geopolitical divisions (e.g., West vs. East, North vs. South) in pursuit of our common goal of sustainable development.

Historically, economic literature has emphasized the cruciality of patents as the dominant facilitator of innovation (Moser 2016). However, there has evolved doubt among some scholars on whether, and to what extent, patents are functional incentivization instruments for promoting innovations (e.g., Boldrin and Levine 2005, 2013; Trerise 2016). Thus, Boldrin and Levine (2013, p. 3) even formulated "*the case against patents*" that can be summarized by their statement: "[T]here is no empirical evidence that [patents] serve to increase innovation." On the other hand, there has

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appeared research that promotes the idea of patents as facilitators of innovation (e.g., Haber 2016; Spulber 2015, 2021). In line with Spulber (2021) who has formulated *"the case for patents"*, Haber (2016, p. 814) argues that "the weight of the evidence supports the claim of a positive causal relationship between the strength of patent rights and innovation." Whereas this debate has principally been centered around the investigation of *private goods*, the case for the invention (i.e., idea creation: *0 to 1*) and innovation & diffusion (i.e., idea commercialization: *1 to n*) of "green technologies" is rather characterized by a *public goods* phenomenon. Thus, recent scholarship has acknowledged that the current system for incentivization is only limitedly able to provide effective solutions when there is insufficient financial interest in specific problems related to *public goods* (Thorp 2020). This is of particular importance for situations where market failures result in huge negative impacts on human health and wellbeing (i.e., climate change). Yet, the crucial question on *how green invention and innovation can be effectively accelerated in the global north as well as in the global south* has only been discussed to a minor extent.

In the light of the minor results of the COP 28 in Dubai, the global consensus on the organization of effective incentivization instruments that work for both, countries in the "global north" and "global south", is now more important than ever. Nevertheless, functional heuristics, in-depth understanding, and viable incentivization mechanisms to enable and diffuse innovation—not only in the "global north"—require more attention in the public, political, and scientific debates since emerging economies are expected to play a key-role in the reduction of global GHGs (IPCC, 2022). Yet, the incentives to innovate and diffuse green technologies are commonly weaker in those countries because they typically lack effective environmental regulation and a substantial price on emissions (caused by limited access orders; see, e.g., North et al. 2007) compared to some forerunner countries in the "global north".

Figure 1 illustrates the trends in green technology patenting across the global north and south from 2002 to 2023, comparing the global south both with and without China's contribution. The global north demonstrates a continuous increase in green technology patents, particularly driven by innovations in renewable energy sectors such as solar and wind, with notable contributions from Japan, Germany, and the United States. In contrast, the global south experiences significant growth primarily due to China's major contribution to green technology, especially in solar energy. However, when China is excluded, the global south exhibits more modest growth, reflecting the need for governance that facilitates innovation and investment in these regions.

To address these challenges from a sustainability nexus perspective, it is essential to consider how innovation ecosystems for green technologies intersect with pluralistic social, economic, and environmental systems, particularly in the global south. By developing scalable and coordinated approaches to innovation governance that align across sectors and policy levels, we can create inclusive solutions that integrate market-based incentives with the SDGs, ensuring that technological progress supports global sustainability efforts.

This forum article proceeds in Sect. 2 with describing our method and continues in Sect. 3 with situating our article in the relevant literature streams. We then present our contribution to the debate in Sect. 4, followed by our conclusions in Sect. 5.

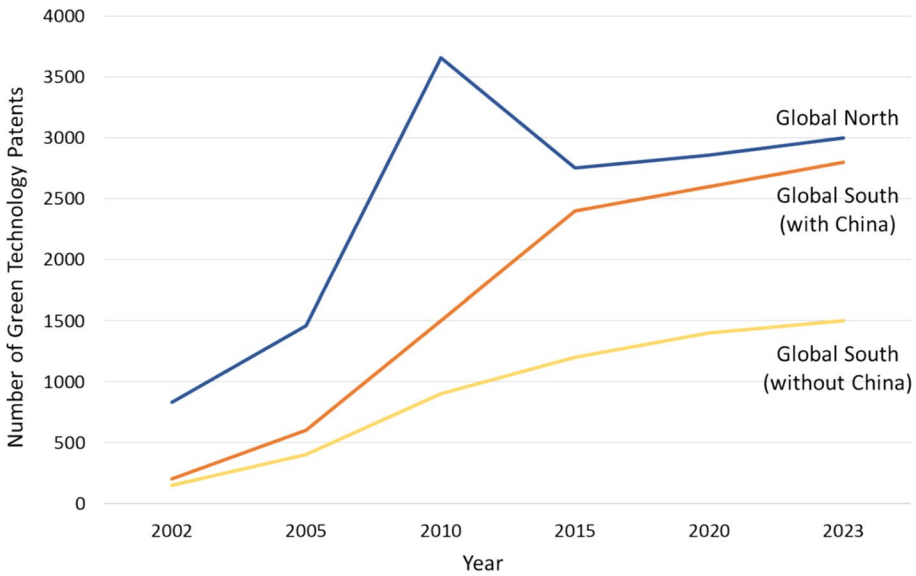

Fig. 1 Green innovation patents: global north and global south. The data was retrieved from the World Intellectual Property Organization (WIPO) database, using Patent Cooperation Treaty (PCT) filings as a proxy for green technology innovations, with analyses of renewable energy patent trends from 2002 to 2019 (WIPO, 2024; Fushimi et al. 2018)

2 Method

Instead of conducting a systematic literature review focusing on "gap spotting," this article adopts Alvesson and Sandberg's (2011) method of "problematization," addressing the growing critique of the dominance of gap-spotting approaches in research (e.g., Bartunek et al. 2006; Daft and Lewin 2008). Problematization encourages a critical re-examination of the foundational assumptions underlying established concepts with the aim to generate thought-provoking and impactful research questions (e.g., Delanty 2005; Starbuck 2006). This article applies problematization to critically discuss the current system to incentivize invention and innovation for green technologies referring to the tensions between the global north and the global south. In doing so, we aim to contribute to a more profound and nuanced discussion in this important research field. Our article aims to avoid relying on prepackaged perspectives, instead fostering interesting insights in the context of green innovation debates aimed at addressing climate change, social issues, and advancing ideas to address respective SDGs from a sustainability nexus perspective.

To inform our problematization approach, we applied an integrative review strategy (Snyder 2019; Torraco 2005) that focused on green invention and innovation. Our approach involved evaluating peer-reviewed and non-peer-reviewed articles that addressed both "invention" and "innovation" for green technologies. Using Clarivate Web of Science, Elsevier's Scopus, and Google Scholar, we applied the following search query: "invention" OR "innovation" OR "R&D" AND ("green" OR "green technology" OR "environment" OR "incentive" OR "patent" OR "governance" OR "mechanism" OR "instrument"). This literature search provided us an overview of relevant literature. We then refined the search, specifically identifying publications with substantial content on green invention and innovation. Each selected publication was carefully reviewed by all contributing authors. Throughout the review process, we concentrated on identifying patterns and challenges relevant to our research question, with particular attention to the characteristics of green innovation in both the global north and global south.

3 Synthesis of theoretical insights

3.1 Patents for incentivizing (green) technologies

Historically, there has been a long tradition in the discussion on whether patents are viable instruments to foster incentivization for innovation of new technologies (Moser 2016; Nicholas 2014). Within this vibrant discourse, there exist proponents of patents (e.g., Haber 2016; Spulber 2015, 2021) and opponents of patents (e.g., Boldrin and Levine 2005, 2013; Trerise 2016), holding antagonistic opinions on whether patents "OR" other alternative incentivization instruments should be used to incentivize innovation activities for creating and distributing *private goods*. While, for the "global north" (for the sake of argument) "it seems likely that, despite their limitations and imperfections, patents will continue to be the cornerstone of the IP legal architecture into the future" (Nicholas 2014, p. 421), the "global south" may require different mechanisms to incentivize invention and diffusion since patent systems are influenced by the broader institutional and economic contexts unique to each country, rather than operating in isolation (Lerner 2002). However, the incentivization for invention and diffusion for green technologies (i.e., *public goods characteristics*) is hardly to accomplish by patents only – particularly in the "global south". Therefore, the literature on green innovation and patenting has also proposed alternative instruments to facilitate green innovations largely discussing the impact of subsidies (e.g., Heyl et al. 2022; Kumar, 2017; Rezai and van der Ploeg 2016).

3.2 In the search of incentivization instruments for green technologies

Politicians and scholars have recently resurged concerns regarding the opportunity cost of patents and renewed the interest in the discussion of alternative incentivization instruments for fostering invention and innovation, particularly in cases where business firms lack sufficient financial interest (e.g., Thorp 2020). The most popular discussed alternative is a Prize Competition (grants also fall into this category). The core concept is a promise to pay the originator of a new idea right after invention, tied to specific ex-ante defined criteria (Kremer 1998; Tjornbo, and Westley 2012). In fact, this instrument has the potential to reproduce (some) benefits of patents but with less costly (second-order) effects.

Additionally, scholars, politicians, and practitioners have investigated novel mechanisms such as Advanced Market Commitments (AMCs), or similar instruments. They initially aimed to resolve drawbacks from patents, particularly in the "global south", by proposing new forms of funding for vaccines (e.g., Kremer and Glennerster 2004; Kremer and Williams 2010). The core idea of AMCs has been that one or more sponsors (e.g., philanthropic organizations, governmental funds) legally commit—in advance of product development and licensure—to underwrite a guaranteed price for a maximum number of predefined purchases. Green innovations (e.g., renewable energy technologies, CO_2

removal technologies, etc.) can also be enabled by AMCs. Since "mankind likely needs to achieve negative CO_2 emissions before 2050" (Detz and van der Zwaan 2019, p. 1) to achieve the 1.5 °C target of the Paris Agreement (see also e.g., Bednar et al. 2021; DeAngelo et al. 2021), we would need to permanently remove huge amounts of CO_2 from the atmosphere. But existing solutions for carbon removal are not available at large scale to date. AMCs could be an opportunity for creating markets for carbon removal (in the "global north" and "global south"). This would incentivize the innovation of scalable carbon removal technologies by providing a strong demand signal without picking a winning technology upfront (Athey et al. 2021).

Another instrument for incentivization that has emerged is an Impact Fund, such as the recently announced "Green Impact Fund for Technology" (GIFT) (Pogge 2023). It pays the innovator ex-post right after an impact assessment confirms the socially or environmentally added value of the innovation. This specific instrument relies on patents in the "global north" and complementarily incentivizes innovation diffusion of green technologies in the "global south" by providing annual impact rewards (Azhgaliyeva et al. 2022). Therefore, it offers a voluntary hybrid mechanism to gratify the impact of GHG-reducing innovations in communities that need it most, whereas the current patent system largely often hampers such diffusion processes for countries in the "global south".

In fact, all these instruments aim at promoting a spectrum of activities, from technological invention (basic research), defined as the creation of infinitely copy-able ideas, to innovation (applied research), which transforms these ideas to reproducible commercial goods and services directly impacting human welfare. Take green energy technologies (like carbon capture) as a case in point: Patents provide both invention and innovation incentives, but the monopoly phase leads to high costs that restrict the diffusion of new products, especially in "low-income" areas. In contrast, Prize Competitions that pay upfront for the technology, AMCs that condition payments to the use of products/services, or Impact Funds that pay ex-post for measured delivery results are more likely leading soon(er) to a competitive market solution and thus may provide larger quantities of carbon capture (more GHG emission reductions) than patents only. However, these alternative instruments also suffer from potential drawback effects that are—to date—still in large parts un(der)researched.

As shown in Fig. 2, (i) patents, (ii) prize competitions, (iii) advance market commitments (AMCs), (iv) impact funds, and (v) R&D tax credits all reward inventions (i.e., basic research) after the ideas are developed. This retrospective approach means businesses must make investment decisions based on uncertain profit expectations. The instruments used to reward innovation (applied research) have distinct characteristics, each with its own strengths and weaknesses as summarized in Table 1:

(i) Patents are by design fully customer-oriented instruments driven by expected monopoly profit. However, monopoly prices largely exceed marginal costs and hence impede during the lifespan of the patent the spreading of new ideas and products, thus wasting resources. This inefficiency is amplified for countries in the "global south" where impoverished citizens cannot afford paying high prices. This means that often these people can only be served after patents have run out and competition sets in, driving prices towards marginal costs. Another inefficiency refers to "patent battles". In some cases, business firms redirect their efforts from value creation to rent seeking. Patents can then be abused to handicap competitors (e.g., by raising

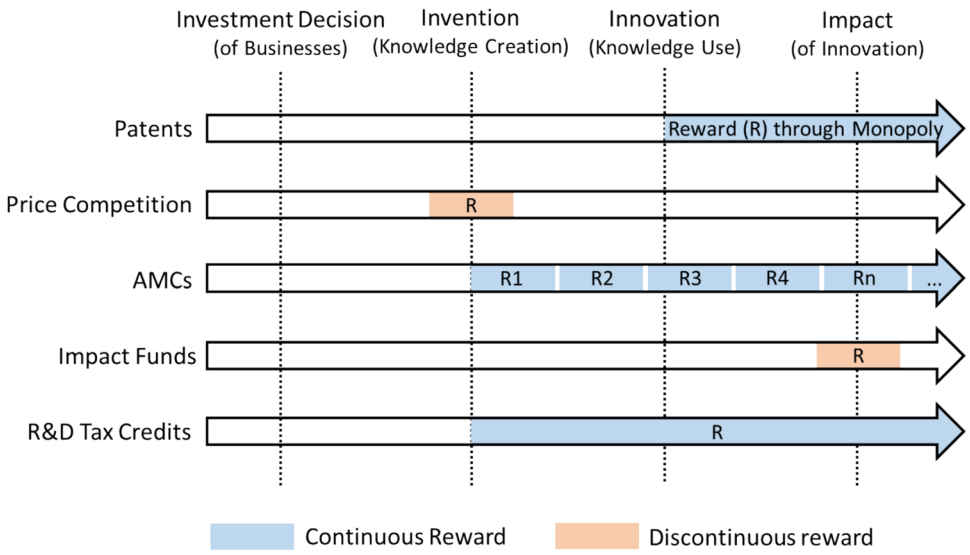

Fig. 2 Profit expectations for patents, price competitions, AMCs, impact funds, and R&D tax credits

Table 1 Summary of incentivization instruments

Instrument	Characteristics	Strengths	Weaknesses	Consequences
(i) Patent	- Secured markups or licensing fees - Transitory monopoly rent	- Full customer orientation - Based on economic self-interest	- Inefficiencies (even amplified for countries in the "global south" – discrimination) - "Patent battles" - "Anticommons" - Patent aggregation - Ambiguous effects on follow-on innovation	- No/insufficient supply in "global south" during patent term
(ii) Prize Competition	- Pays upfront for ex-ante criteria - No monopoly rent	- Potential to provide solutions to problems related to public goods, even when firms initially lack financial interest	- No costumer orientation - Based on philanthropic funding - "Pretence of knowledge" - Reward of invention, not innovation - Hardly ex-post learning processes	- Demonstration projects - Low probability to provide systemic solutions
(iii) AMC	- Pays per used unit - No monopoly rent	- Subsidy per used unit/service - Incentive for firms to supply in the "global south" at marginal cost	- Based on philanthropic funding - Customer needs and preferences have to be homogeneous in the "global north" and "global south" - Rewards per use may lead to inefficiencies in e.g., distribution effects (within easy reach) - Re-imports must be prevented - Cluster risk	- Awards input of social process (specific targets)
(iv) Impact Fund	- Pays ex-post for impact - No monopoly rent	- Customer needs and preferences can be heterogenous in the "global north" and "global south" (output orientation) - Reward added value to society by an innovation - Supply in the "global south" at marginal cost	- Based on philanthropic funding - Static performance incentives - Re-imports must be prevented - Deferred gratification	- Awards output of social process (general targets)
(v) R&D tax credits (and subsidies)	- Promotes innovation by reducing the cost of R&D through tax relief	- Fosters knowledge spillovers and long-term innovation activities	- No direct promotion of technological diffusion	- May increase investment in innovation activities

rivals' costs) in a way that even deters future invention and innovation activities. In addition, there may occur the issue of the "anticommons" that is characterized by paradoxically underusing scarce resources due to a variety of property rights interfering with each other (e.g., Heller and Eisenberg 1998). There is also a discussion in the literature about to what extent patents promote or prevent follow-on innovation. The implementation of new technology often consists of a whole series of patents, which can sometimes be held by a single company. Williams (2010) finds that patents hinder follow-on innovation in the short run while newer studies (e.g., Sampat & Williams, 2019) find no significant effects of patents on follow-on innovation.

(ii) If Prize Competitions promise to pay an amount of money that is equal to the value of the monopoly rents (earned by patents), this would have the same effect on the supply of inventions. With regard to innovations, however, Prize Competitions have advantages and disadvantages in comparison with patents (Kremer 1998; Shavell and van Ypersele 2001). On the one hand, since there is no need (and no chance) for monopoly profits, innovations can be supplied at competitive prices near marginal costs. Furthermore, this instrument has the

potential to provide solutions to problems related to public goods even when there exists initially insufficient financial interest by business firms. On the other hand, due to its lack in customer-orientation, this philanthropic instrument has also its drawbacks, especially with regard to bringing about sustainably rolled-out large-scale innovation projects. This problem arises from the fact that a committee has to define success criteria upfront (ex-ante). While patents are customer-oriented by design, since they depend on a market demand's willingness to pay, an element of "pretence of knowledge" is inherent to the instrument of a Prize Competition. This implies two disadvantages: (a) Since the incentivization structure focuses on pleasing the jury rather than potential users, it tends towards leading to demonstration projects. (b) Once the prize is won, the winner has no further incentives to promote the innovation to users. Therefore, the spotlight on ex-ante success criteria and the according absence of ex-post learning processes likely prevent the development of inventions to scalable innovations for providing systemic solutions.

(iii) AMCs guarantee a price to the inventor, e.g., a subsidy per removed ton of CO_2, to incentivize firms to supplying their product/service in the "global south" at marginal cost (Kremer and Williams 2010). The price difference is then paid by a private or public funding institution. While AMCs enlarge the circle of customers or clients served, four disadvantages have to be noted. First, in sharp contrast to patents, the instrument requires philanthropy. Second, customer needs and preferences need to be homogeneous in the "global north" and "global south" due to the input-oriented specific targets of AMCs (e.g., CO_2 removal technologies, clean water technologies; renewable energy technologies). Third, a reward per use may lead to inefficiencies due to distorted incentives during the roll-out phase. As a case in point, people within easy reach may receive larger amounts of clean water or renewable energy than people living farther away, leading to a cluster risk, and people may get services that are of low benefit to them or may even be harmful. Fourth, AMCs have to deal with a re-import issue (Kremer and Glennerster 2004). They run the danger of a leakage of subsidized products to the "global north". Such re-imports must be prevented in order to protect high monopoly prices in the regions covered by the patent. Otherwise, short-run profits diminish, and long-run invention and innovation incentives are even weakened. The risk is that corrupt actors in both the public and private sector may be tempted to support leakage in order to personally benefit from re-imports. Such rent-seeking activities in turn cause companies to set equal global prices for innovative products that, however, jeopardize value creation potentials in the "global south".

(iv) Impact Funds reward the originator of invention and innovation only ex-post after an impact assessment of environmentally and/or socially added value. This is in many respects very similar to AMCs. Both instruments aim at providing innovations to the "global south" at marginal cost. Therefore, both run into the problem of preventing re-imports (Kremer and Williams 2010). And both rely on philanthropic funding. The crucial difference refers to the intervention point in the social process of rolling-out a successful innovation. AMCs gratify on a continuous basis, while Impact Funds, in contrast, gratify ex-post, and thus address more general targets (e.g., quality-adjusted life years) (ibid). Since customer needs and preferences can be heterogenous between the "global north" and "global south", an Impact Fund is more likely to address such problems more effectively due to its output-orientation. However, special challenges of Impact Funds are (i) deferred gratification that necessitates additional advanced financing making Impact Funds less attractive to potential funders and (ii) the definition of appropriate metrics for ex-post impact that are closely tied to the actual development and deployment of innovations. This requires ex-post assessment of added social and/or environmental value. Such an assessment can be quite challenging if (a) the ideas and their originators are difficult to identify, (b) substitutes or complements of other products on the market exist, (c) ex-post discretion issues occur, and/or (d) the added social and/or environmental value is difficult to measure (ibid). To compensate some of the disadvantages of Impact Funds, actors can use specific contracts that shift (parts of) the ex-post payment to the present with the aim to pragmatically adjust Impact Funds' incentive compatibility for firms and funders (e.g., risk-sharing agreements, pay-for-performance agreements, time-limited-agreements).

(v) R&D tax credits (and subsidies) reduce the cost of research and development through tax relief. While R&D tax credits do not directly accelerate the diffusion of technologies, they promote knowledge spillovers and long-term innovation (Byun, 2023). By alleviating financial constraints for companies, particularly in high-tech sectors, they encourage firms to invest in new technologies, including green innovations, that align with environmental goals. For example, studies have shown that R&D tax credits increase patenting activities in the United States (Melnik and Smyth 2024) and China (Chen and Yang 2019). Furthermore, R&D tax credits may facilitate the transfer of green technologies to the global south through global supply chains, as firms in the global north develop cutting-edge tech-

nologies that can spill over into emerging economies (Dechezleprêtre et al. 2023).

4 Refocus from "projectitis" to global governance

Why is all this of importance and of general interest? We would like to draw public, academic, and political attention to two reasons, a minor and a major one.

First, the 'state-of-the-art' development policy runs the danger of "projectitis": an obsession with static small-scale projects. They are easy to evaluate but have difficulty in generating dynamic large-scale effects. New incentivization schemes for invention and innovation may help to redirect resources towards fostering a more systemic, market-based, and consumer-oriented path of development.

Second, the current regime of global governance leads to conflicts of interest between dynamic business firms, located in the "global north", and the citizens and governments, located in the "global south", who—for understandable reasons—lack the patience of waiting for patents to expire, especially with regard to innovations where the stakes are so high that delivery delays cost human lives. Under current circumstances, creative business firms run the danger that their intellectual property rights are violated. "Forced technology transfers" (e.g., compulsory licensing) are just a case in point (Davidson et al. 2022), with the negative consequence that a short-term advantage (cheap access to a specific product) leads to long-term disadvantages (weaker incentives to create knowledge and disseminate new products). Against this background, it would be helpful to come up with new ideas and initiatives for a global regime that incentivizes business firms to provide faster technology transfers on a voluntary basis and thus brings about a stronger bond of worldwide solidarity than is currently in place.

Instead of an "either OR" discussion (i.e., patents vs. alternative instruments) that can largely been observed in the contemporary discourse (e.g., Boldrin and Levine 2013; Spulber 2021), this article proposes a complementary approach, i.e., optimal patent regimes in the "global north" AND alternative instruments in the "global south" that accounts for the *public good* characteristics of green technologies and for the governance instabilities (e.g., limited access orders) in large parts of the "global south".

An optimal patent regime in the "global north" that favors "an optimal level of intellectual property rights regulation above which further enhancement reduces innovative activities" (Yi 2007, p. 436) requires national and transnational governance that needs to be continuously refined and revised since the rapidly and disruptively changing business environments, industry circumstances, and the necessity to reach global net negative CO_2 emissions before 2050 will likely affect the equilibrium of optimality for (green) patent regimes in the near future. This may require a continuous adjustment of patent regimes and policies in the "global north" according to the (expected) intensity and direction of environmental changes. Hence, maintaining a dynamic perspective on incentives for invention and innovation is crucial for fostering technological advancement and promoting green growth across the global north and south (e.g., Borel-Saladin and Turok 2013; Spash 2013; Schultz 2021, 2022; Schultz and Reinhardt 2022, 2023; Schultz and Pies, 2024 Schultz et al., 2024).

In the "global south", *complementary* incentivization mechanisms should be considered as long as we expect strong positive externalities (e.g., Orjuela-Ramirez et al. 2024; Wong 2020). According to our analysis, the impact funds for green technologies provide a vibrant instrument to incentivize the diffusion of green technologies in the "global south", since they account for heterogenous customer needs and preferences (output orientation), reward added value to society by innovation, and diffuse green technologies at marginal cost to the citizens awarding the output (i.e., ex-post impact) of environmental-friendly progress rather than the input (ex-ante project-plan). This combination of patents and alternative instruments requires global governance reformations in form of viable arrangements between public ordering (1st order) and private ordering (2nd order) that create a rule-based framework, which ensures (1) financing of projects concerning their societal impact; (2) transparency in competition processes between projects for basic research and applied research ensuring comparability and reproducibility; (3) evaluation of projects based on reliable, transparent, and comparable data to create an entry in an institutional feedback loop (i.e., virtuous cycle), fostering an enabling environment for mitigating climate change on a global scale without leaving some countries or even continents behind, as recently criticized by Mutiso (2022) in her article stating that "[n]et-zero plans exclude Africa … leaving out more than one billion people."

5 Conclusions

Summing up, the world not only needs experiments for more invention and innovation. It also needs experiments for a better institutional support of invention and innovation. Further mechanisms could be designed in the form of global tax incentives for differential pricing, global agreements on tax incentives for soft licenses in selected countries, discussion rounds on the re-import issue at a G20 level, and innovative processes for avoiding compulsory licensing. Therefore, we call for further political and academic efforts on investigating, creating, and utilizing viable incentivization mechanisms to realize experimental pilots. In general,

we hold that the political and scientific debate should be recentered from the current status quo of "projectitis" to innovative "global governance" with the aim to ensure the diffusion of new technologies on a global scale, but without (a) leaving particular countries behind, while at the same time (b) maintaining companies' systemic dynamism in the long run. Concludingly, this study highlights that our world society increasingly depends on policies like a reduction of CO_2 or the fight against pollution that are effective on a planetary scale, both in the "global south" and in the "global north". Addressing such challenges in the future requires not only enhanced invention and innovation activities but also an improved innovation regime that intelligently combines green patents with alternative incentivization mechanisms, fostering a sustainability nexus approach to facilitate sustainable global development.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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