Navigating the Straits: Pull Financing for Climate and Development Outcomes

Ranil Dissanayake

Abstract

An increasing share of official development assistance is being used for climate-related activities. This trend is continuing despite the lack of comprehensive cost-effectiveness evidence to guide spending decisions and continuing concerns that few applications are effective or efficient mechanisms for either climate or development outcomes. This represents both a waste of scarce resources and a missed opportunity. This paper proposes that a well-designed pull financing mechanism, which identifies specific problems for which it will pay a pre-specified price for solutions that can scale up, has the potential to navigate these problems. When they work, a pull instrument can solve problems at scale at low cost by incentivizing private innovators to produce a socially beneficial product that people want to buy and use. However, the design challenges associated with them are not trivial: firstly, the identification and selection of technologies or problems for which the pull financing facility would be a sufficiently large portion of the market to shift incentives for innovators or producers (for technologies that exist but have not been taken up widely yet); and secondly, the ability to design contracts that incentivize socially beneficial innovation that are bought and used. This paper sets out the case for pull financing for climate and development activities, the challenges that need to be addressed to do it well, criteria for judging potential applications of pull financing and an initial indication of some sectors to which pull financing may be applied.

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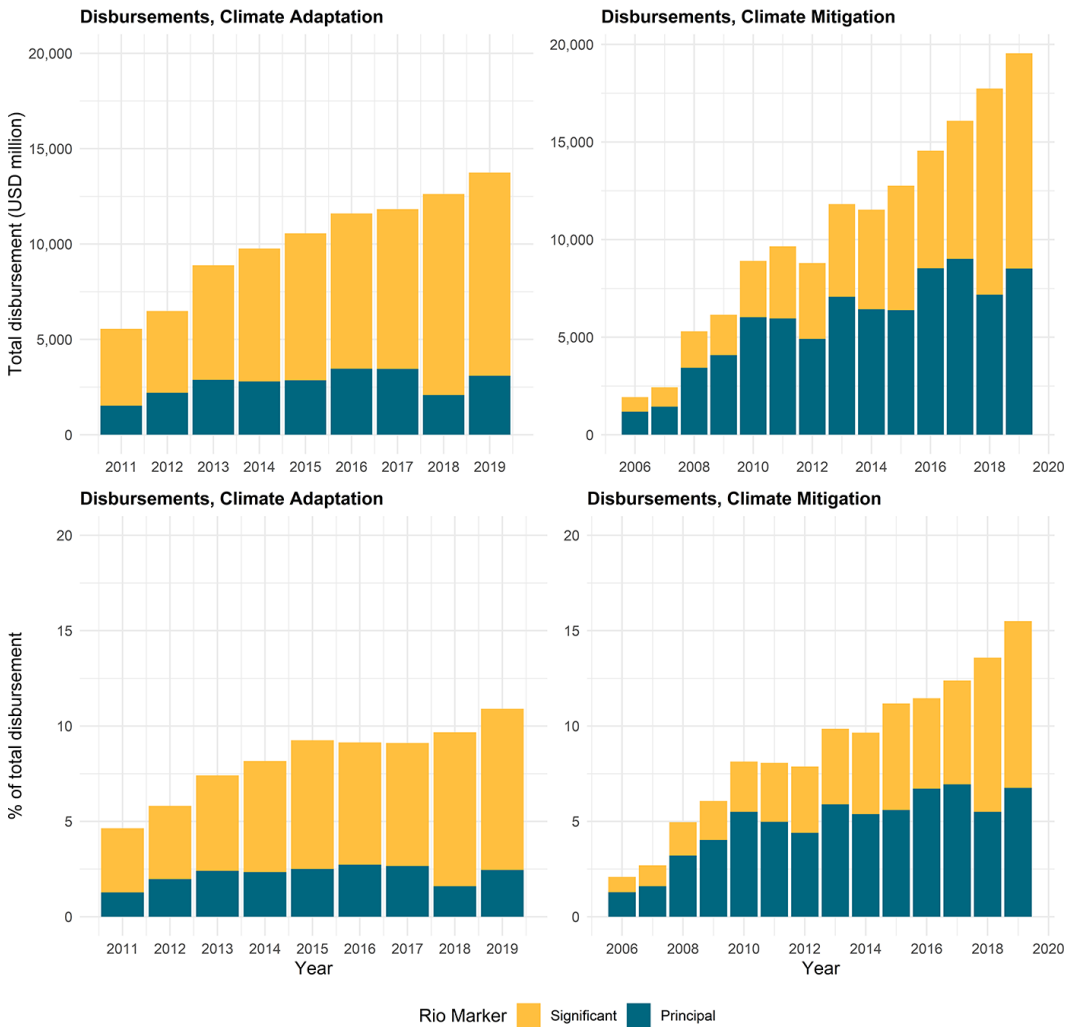
Introduction

In both absolute and relative terms more official development assistance (ODA) is being spent on climate change-related activities. Around 84 percent of bilateral climate finance is provided using official development assistance (Ritchie & Kenny, 2021); in 2019 almost 20 percent of bilateral ODA was spent on climate mitigation activities, double the additional 10 percent spent on adaptation. Yet policy and spending on climate change and development are typically best thought of not as substitutes or complements, but as independent (Dissanayake, 2021). That is, programmes and policies may be effective vis a vis the policy objective of either combating climate change or furthering development, but only rarely work to achieve both objectives[1] (an exception being reliable, affordable, and scalable renewable energy). This dilemma poses a particular challenge for donor countries, which are for the most part only leaning more heavily into the funding of climate challenges, in particular mitigation, using ODA.[2] This paper argues that the use of pull financing mechanisms to induce technological innovation in carefully specified areas for which the climate *and* development are substantial (or where adaptation benefits are sufficiently large and potentially widespread) offers a way to use ODA effectively and efficiently to support both climate and development objectives. Such a mechanism would meet a need that neither private finance or existing donor mechanisms are suited to meeting; and can complement research and development spending using non-ODA financial resources. New proposals for pull financing mechanisms such as President Biden's First Mover's Coalition are welcome, but the approach should also be used to meet developing country needs.

[1] Though in large part, we simply don't know given the paucity of good evidence available.

[2] This is a particularly hard circle to square: adaptation spending can at least be justified on pure development grounds when done well, as it improves development outcomes relative to the counterfactual of no adaptation to expected future climatic conditions.

Figure 1. Climate ODA, DAC donors only



Source: OECD CRS database. Data for the Rio marker for climate adaptation activities begins only in 2010.

A pull financing can help address four specific problems. First, policies around climate impacts in developing countries have often given primacy to climate outcomes with marginal global impact over development outcomes with substantial local impact. Even worse, some policies are actively harmful for non-climate development outcomes, for little global return, such as blanket bans on funding fossil fuel projects in developing countries, which may compromise their own growth path for marginal or even negative climate returns (Ramachandran, 2021).[3] Critics argue persuasively that climate interventions in developing countries should have net local payoffs that themselves justify the return on investment—be they benefits of adaptation to climate change, or unrelated development benefits.

[3] For example when external finance might be otherwise used to switch energy generation from coal to natural gas.

Secondly, we know surprisingly little about what we get for what we pay—the cost effectiveness of climate spend is surprisingly under-researched, particularly on climate mitigation. Where estimates do exist, there is striking variation—often orders of magnitude—in within- and across-sector cost-effectiveness estimates (Mitchell & Juden, 2021).

Thirdly, domestic rather than development action has a much larger scope for climate impact in most high-income countries—how they structure their own economies, change their own practices and so on will have a bigger impact on the future path of climate change than any actions most developing countries can take, given that under almost any plausible growth and carbon intensity scenario, developing countries will make up a small minority of global emissions (Mitchell & Baker, 2020; Nakate, 2021; Dercon, 2014; Moss, 2020).

And finally, to achieve scale and sustainability solutions to climate and environmental solutions must be close to market—that is, they need to be sufficiently attractive on their own terms (or fairly nearly so) to induce widespread take-up and use, without a large net subsidy to recover costs or lost opportunities from take-up. If we care about both development and climate outcomes, then action to make the optimal development path consistent with the optimal—or at least better—climate and environment paths is necessary. This suggests that we want climate-friendly technologies to be used on their own merits as individuals, firms and Governments take action to improve their own welfare on development grounds.

Given the increasing ambition of most donors in terms of climate spending there is an urgent need for ways of spending that navigate the narrow path that addresses these concerns. Pull financing—including, but not limited to advanced market commitments—is one possibility, providing they are well structured, target the right problems and are large or high-powered enough to have a market impact. This paper proceeds as follows: It briefly considers the underlying economics of innovation and pull financing mechanisms; the rationale for their use in the climate environment space; sets our five tests pull financing proposals would need to pass to represent a good investment of ODA or non-ODA resources; and briefly considers some candidate sectors or technologies in which pull financing might make a substantial difference.

The economics of innovation and pull financing

Innovation—the generation of a new idea—is close to a pure public good. Once an idea has been developed and expressed, there is no upper limit on the number of people who can use the idea itself (as distinct from a specific application of it); and it requires active policy to prevent people from using it. In the language of economics, pure ideas are non-rival and non-excludable. This makes them susceptible to the classic problem of public goods: missing markets, or the non-provision of the good at all. Unless mechanisms are provided that protect the returns to an idea—such as patents, which restrict entry into the application of an idea and hence the ability to enter the market and compete away the returns to implementing it—economic theory predicts that potential innovators will, at the margin, choose not to

invest in the generation of new ideas, leading to at least some potential ideas never being realised.[4] For an accessible and elegant discussion of the non-rivalry of ideas, see section 1 of Jones, 2019. The non-rivalry of ideas in turn suggests that the social returns to innovation will be much larger than the private returns, as has been shown (Jones & Summers, 2020; Nordhaus, 2005).

In order to overcome the under-provision brought on by non-rivalry and non-excludability of ideas, active policy choices, designed to reward innovators, have provided innovators with the opportunity to make monopoly profits from innovations. This creates an incentive to invest in the generation of useful ideas, increasing their supply. However, this incentive is uneven. By construction it trades off the development of new ideas with their widespread application, since monopoly provision is associated with lower supply and higher prices (see, for example, Goldman & Lakdawalla, 2011). The problem of under-provision of innovation is particularly acute in low-income settings. Since such settings are typically characterized by low ability to pay, weak access to credit and high transactions costs for aggregating consumers, they face two problems. First, there is lower incentive to invest in generating innovations that benefit only low-income settings, since the value of monopoly provision to such settings is much lower. And secondly, where innovations that are primarily generate for high-income settings are nevertheless useful for low-income settings, they reach a far smaller portion of the potential market.

There are, broadly, two kinds of solution to this under-provision of innovation. One is for the state or public/philanthropic actors to fund the generation of new ideas directly by identifying researchers or consortia of researchers, sometimes tying funds to the resolution of specific problems. This attempts to boost the supply of innovation directly. This is 'push' financing for innovation. The other is to address the effective demand for innovation by supplementing the purchasing power of low-income consumers or states through financial support, a credible commitment to buy on their behalf or by reducing or taking on the transactions costs of aggregating existing buyers in sufficient numbers to make the market viable potential innovators. By credibly signaling the existence of profitable market for private innovators or producers, this 'pull' financing induces the entry of innovators into the market and creates incentives for them to 'race' each other to fill the gap in the market that has been signaled.

Both push and pull financing is important for the generation of innovation. But they solve slightly different problems. Pull financing is particularly valuable when funders have better information on the problem to solve, and how much a solution is worth, than on who is best placed to solve it. The classic example is the 1714 Longitude Act, which established a prize for the production of a precise method for determining a ship's longitude (Burton & Nicholas,

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[4] Note that this does not mean that no innovation would happen in the absence of intellectual property rights or similar policies. Some—perhaps large—share of innovation is happens for reasons of intrinsic motivation, non-pecuniary rewards such as fame and even by accident. However, to the extent that innovation needs to be funded—as much pursuit of knowledge does—the absence of a mechanism for rewarding it reduces the supply of innovation.

2017); the most famous recent example was the use of an Advance Market Commitment (AMC) to incentivize the rapid development of a pneumococcal vaccine for rollout in low-income countries, which CGD was centrally involved in (Advance Market Commitment Working Group, 2005; Berndt et al., 2005). Prizes and AMCs have different characteristics: prizes induce entry into the innovation space, but do not in themselves reward take-up and use of the innovation—the Longitude prize, for example was a complement to patenting, not a substitute. AMCs can reward take-up by specifying that payout will be dependent on purchase, or use, of the innovation provided. This means that scale can be built into AMC design—indeed, the pneumococcal AMC reached 150 million children, saving around 700,000 lives. For a fuller treatment of these issues, see (Kremer et al., 2020).

We now have more than a decade of learning about AMCs in particular and pull financing more generally. The case for extending the use of AMCs to climate and environment technologies in developing countries is made below.

The case for pull financing

A well-structured and carefully targeted pull financing mechanism can resolve each of the four issues associated with the scale-up of concessional climate finance identified in the introduction. One of the main constraints in navigating them successfully is that climate and environment solutions that work on their own terms for developing countries are scarce, and those that exist have yet to achieve widespread take-up. Solutions that achieve widespread adoption in developing countries must achieve the objectives of the people in them directly—whether that objective be increased, reliable energy use; higher farming productivity or easier-to-implement technologies; or more convenient, better cooking appliances with lower healthcare costs. Currently, the technologies available either prioritise the global objective (reduced emissions, for example) over the local objective, or are simply too expensive or not user-friendly enough to be a sustainable and scalable solution to the local problem.

The instinct in global climate policy has sometimes been to make any energy-generation technologies in that emit carbon more expensive in developing countries. This is the underlying rationale for banning the use of concessional finance for natural gas power projects which represent a middle way between increasing energy use and climate impact, given the existing energy sources at work. This makes development more expensive and slower, but without an alternative option which is preferred by developing countries, since optimal paths to net zero in Africa still involve some new gas generation capacity, especially when balancing the need to address energy poverty, that is likely to be all it does in the longer term (Moore, 2021; van der Zwaan et al., 2018). Since these superior alternatives don't exist, or are too expensive, innovation is required.

Pull financing structured to induce technological innovations can resolve these tensions by eliminating the trade-off between climate and development outcomes. In the example above that would be by making gas redundant rather than banning it without a better alternative.

By targeting finance at the solution to problems with large local development benefits, it can focus financing clout on problems that developing countries would like to solve on their own merits. By setting out the cost, and willingness-to-pay for these solutions, it reduces essentially fixes cost-effectiveness by either paying for a solution at an acceptable rate for participants, or not paying out at all. Thirdly, non-ODA (or only part-ODA) pull mechanisms can generate solutions that are also applicable for use in high-income settings, where per-capita emissions remain many multiples of those in developed countries and will remain so for the foreseeable future under any plausible growth scenario. And finally, incentives for scale can be built in to the contracting design of a pull mechanism, and focus can be directed to areas where the distance to market viability is relatively small. And where supply chains or the path to market suffers from multiple imperfections, pull financing can reward only those solutions that navigate them successfully (indeed, a sufficiently powerful pull mechanism should induce solutions all through the chain), while with push financing the optimal distribution of innovator effort is much more heavily weighted to the generation of the technology itself.

This potential to navigate these four issues is a function of how pull mechanisms work. At root, their operation mechanism is simple: by creating a sufficiently large, credible market of buyers for a solution to a problem at a specified cost, it induces entry into production by actors who can provide a solution at that cost and do not need to be identified in advance. If the pull mechanism is sufficiently high-powered (which may mean sufficiently large financially, or backed by a sufficiently strong regulatory signal), it induces entry into the production space at sufficient scale to generate entirely new solutions, or entry at scale into the production of existing solutions, thereby driving costs down. In the context of climate and environment outcomes in developing countries, this mechanism has particular appeal. It is precisely the lower purchasing power and contracting credibility in developing countries that has led to an under-investment in innovation for problems specific to developing countries, or that disproportionately affect them. And because much of the donor-funded response to this under-investment has been distant to the market, there has been a relative neglect of scalability, usage and take-up among the final target population.

Pull financing solves three big problems in driving innovation. The first is informational: we often—though not always—have better knowledge of the problem we want to solve than either the best way of solving it or who is best placed to do so. Pull financing resolves this problem by allowing any actor who meets the payout criteria to enter the race to first fulfill them. This crowds in innovation from beyond the 'usual suspects'. The second is around risk to the funder: by specifying what payment is conditional on (be that characteristics of the solution itself, its price, it's scale or who uses it), the mechanism avoids paying out unless a satisfactory solution is generated, at a satisfactory cost and in a way that is consistent with end-user preferences. This contracts with grant financing where the money is spent even if the project is a failure, or not cost-effective. The third is around scale and take-up: whether the mechanism specifies a minimum scale to qualify for payout, or a per unit of take-up fee to be paid, it creates the incentive to deliver at the maximum achievable scale for the innovation.

Pull financing can also meet a gap that neither private finance or existing donor mechanisms are able to meet. Private finance is not forthcoming for precisely the problems set out above: the limited ability to pay in poor countries, coupled with high transactions costs for aggregating consumers (which means that even when potential consumers exist they are difficult to reach in sufficient scale to make provision profitable), make the returns to monopoly provision of privately generated innovations too low to incentivize investment at scale. The risk of patent expropriation exacerbates this. At the same time, public financing for climate change-related technology in developing countries has focused overwhelmingly on the use of push financing in the form or grants, loans, blended finance or equity. While push finance is an important part of the innovation landscape for climate technology, this nevertheless leaves a gap, not least in incentivizing final consumer take-up and usage (Jeuland et al., 2020). Pull financing, targeted at the right problem, and at the right scale, can solve different problems to push finance.

The challenges of implementation

However, these gains are neither costless nor trivial to realise. There are four central difficulties in establishing an effective pull financing mechanism. The first is selecting which problem to address. For the purposes of more effective and efficient spending to support developing countries and climate objectives, this means selecting problems for which the resolution is a direct payoff to developing countries, but for which there is also a substantial climate benefit—be that in mitigation or adaptation. Win-win investments using existing technologies are relatively rare; pull financing allows focus on potential win-wins that could be realized if the technologies could be developed. Scalable, reliable and cheap clean energy, for example, could—if scalable, reliable and cheap enough—be a more attractive way of addressing energy poverty in developing countries than fossil fuel alternatives, if such technologies can be developed and implemented.[5] But simply selecting a unicorn is not enough to make an effective pull mechanism—the solution needs to be close enough to the market, and the pull mechanism strong enough, to bring the solution to fruition within an acceptable time frame. The strength of the mechanism also depends on the existing resources applied to the problem: if billions of dollars are already being invested in, say, battery technology, a pull mechanism of hundreds of millions is unlikely to make a material difference unless targeted specifically at last mile modifications for low-income countries that suffer from a specific lack of investment.

The second problem is knowing how much to pay. When establishing a pull mechanism funders may worry about providing rewards to innovators much larger than those required to

[5] Finding globally significant mitigation benefits will typically be a more restrictive condition, given the relatively trivial role of most developing countries in global emissions. However, again, for a pull mechanism focusing on mitigation in developing countries to be efficient and effective on this dimension, it simply needs to be achieve enough in mitigation terms to justify the outlay, a lower bar than making a tangible global difference to total emissions.

induce innovative effort, or paying for an innovation that would be provided anyway. Neither party—the funders of the mechanism or the potential innovators—has full information on the willingness to pay or required payoff to innovation and production effort of the other. In the context of scarce resources "overpaying" the amount required to induce innovation has real consequences for investment in other public goods.[6] Simply 'following the market' and replicating the willingness-to-pay of end-users fails to solve this problem: eliciting the true willingness-to-pay from atomized potential buyers is difficult, and there may be a subsidy component built in to provision, especially early on, to induce entry into the market and drive down costs in the future, as well as to increase take-up by consumers. Pull financing changes the structure of the information problem funders of innovation face; it doesn't remove it altogether.

The third problem is the basis of payment, or knowing what to pay out on. This is a conceptual problem as well as a practical one. We might know that, for example, there is a local health benefit as well as an environmental benefit (not entirely captured in the local economy) to clean cooking technologies. It is fairly trivial to pay out on the development of a technology that shows reduced emissions of fine particulate matter in the lab. But lab performance is not real-world use: there are many clean cookstoves which reduce emissions in lab and even field tests but aren't used because they fail to meet other user requirements (such as convenience and cooking performance). The pay-out condition therefore needs to be further down the causal chain to impact—we ideally want to pay out when the technology is being used and having an impact on the development and climate problem it was designed for. This could be field tests of performance, but really, the true impact is determined by usage over time, and performance over time. The trade-off is that while the strongest conceptual case for payout is as close to final impact on the causal chain as possible, monitoring is usually correspondingly more difficult. Contracting is at the heart of a pull financing mechanism, and—ill-defined—can play an outsize role in its probability of failure. However, it can only be assessed and resolved on a case-by-case basis. This brings us to the fourth problem.

Designing a vehicle to administer a new pull financing mechanism, and writing contracts that are simultaneously complete enough to incentivize the right innovations, enforceable and attractive to potential investors requires a great deal of thought and perhaps adjustment over time. The lessons from previous successful AMCs, prizes and pull mechanisms are only partly informative on the best way to resolve them. The ideal contracting and mechanism design for a climate-related pull mechanism will depend on the problem(s) it is aimed at, and the specific information already available about potential solutions, costs and benefits and metrics that are feasible for monitoring their effectiveness. This means that to explore the design of a pull financing mechanism, it is necessary to start from what we know about specific candidate sectors.

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[6] In one sense, this issue is easy to solve. Payments up to the social welfare created by the take-up and usage of the technology are defensible on economic grounds. However, in practice, this would lead to the full social value of the innovation being captured by the innovator, and would—for large development and climate problems—likely substantially outweigh the payment required to incentivize investment in innovation, production and marketing.

Five criteria for selecting between candidate applications

To assess what a pull financing mechanism can achieve in a specific sectoral context, five criteria should be assessed.

The first is the *magnitude of development gains* from resolving the identified problem that accrue to the developing country directly, and—for ODA-eligible financing—the proportion of those gains would accrue to those living in poverty. Without sufficient local development gains, the odds of a market for the innovation provided being sustainable are low. A sub-clause of this criteria, worth spelling out explicitly, is that we need solid evidence of development impact.

The second is—for innovations that aim to make some climate change mitigation impact—the *size of the climate or environmental externality* generated by take-up of the innovation. These may vary in type and extent, but, if the objective of the mechanism is both climate and environment and development outcomes, they need to be substantial enough to make dent in—at least—local environmental outcomes. Innovations aimed at adaptation to climate change should not be assessed on this criteria, since the adaptation benefit should be calculated as a development gain from the adoption and scale-up of the innovation.

The third is the *distance to market* of acceptable solutions. In some sectors, there may already be appropriate existing technologies that can solve the development and climate problems identified, which nevertheless would benefit from high, predictable demand to incentivise investment in production capacity to drive down prices to make them market-viable. In other sectors, there may be a well-defined problem to which no known workable solution has been trialled. The distance from market is an indication of how high-powered the mechanism needs to be in order to have good odds of incentivising a timely solution.

The fourth is the realistic *achievable scale* of a solution. One of the rationales for using pull financing is to prioritise scalability and take-up. Pull financing is more complicated to contract and manage than more traditional ways of funding innovation. Part of the reason to use it is to achieve outcomes that usual methods find harder to deliver: particularly tricky problems, or take-up at scale. At the heart of the success of the original AMC for the pneumococcal vaccine was the vast take-up it achieved, with 150 million children vaccinated. Not all pull financed sectors need to achieve that kind of scale to be worth it, but it gives an idea of the potential of the mechanism.

The fifth is the *availability of appropriate metrics*. Contracting is one of the central problems of a pull financing mechanism: conceptualising the right outcome(s) to incentivise; the ability to monitor them; and the ability to enforce contracts. Where it is difficult to fully specify the outcomes to be paid out on, or where it is difficult to verify their achievement, pull financing mechanisms can fail—indeed, even the longitude prize was paid out only after a direct appeal to the King, rather than being settled within the terms of the contract.[7] The ideal metric is

[7] See here: https://www.ft.com/content/a4040a4e-c7bd-11dc-a0b4-0000779fd2ac.

as close to final impact as is measurable and monitorable. This might be purchase of the technology, or even better, use—if it can be monitored and contracted over effectively.

It is unlikely that any candidate sector for a climate and environment pull mechanism will fully satisfy all criteria perfectly. However, to assess them, these are the design parameters that should be interrogated.

Some candidate sectors

Future work will investigate a number of problems which appear amenable to a pull financing mechanism in depth, considering each of the five criteria above. However, a few are worth mentioning to give a sense of the breadth of the potential applications of the technology.

- *Stubble burning:* Technologies to make the practice of stubble burning (burning crop residues after mechanical paddy harvests) redundant have the potential to generate huge local returns. The practice has staggering health implications, particularly for children, and emits substantial carbon dioxide, nitrogen oxides and carbon monoxide (Abdurrahman et al., 2020). Technologies to replace this practice exist, but take-up has been low, in part because they are much less convenient. A convenient, end-user focused alternative to stubble burning, a mechanism for monitoring it (to allow for the targeting of subsidies to farmers who use alternative practice or to target penalties at farmers using the worst practices) or a technology to increase the commercial value of stubble could generate large welfare gains.
- *Cooling systems*: Cooling is both a climate adaptation and mitigation problem. Cooling systems have local economic returns—through direct productivity and health channels (Somanathan et al., 2021). Both less harmful cooling technologies and more efficient versions of existing cooling technologies can deliver both local returns and global externalities. One question to consider is if and how the existing investment in this sector can be supplemented and accelerated by a well-structured pull mechanism.
- *Early warning systems*: Recent evidence suggests that the welfare benefits of pre-emptive action to support victims of natural disasters before the disaster hits are substantial (Pople et al., 2021). The constraints to achieving this are not just the existence of an infrastructure to get support out, but the use of locally reliable early warning systems (Drechsler & Soer, 2016). At present, a key technological constraint is the need for local adaptation: a universal system does not exist. A pull financing mechanism designed to incentivize local adaptations and use would be a potentially important climate adaptation technology.
- *New crop varieties:* The development of crop varieties that either respond to changing climatic conditions could have substantial local payoffs, and—depending on coverage—substantial positive externalities. The difficulty, however, is likely to lie in contracting. Since seeds have varying performance against multiple dimensions, and the combination of characteristics that will prove attractive to farmers is difficult

to predict ahead of time designing payouts can be difficult. However, given the size of the development gains more productive crop varieties, better suited to climatic conditions, could have, they warrant deeper investigation.

- *Clean cooking:* The primary attraction of clean cooking technologies is the local health benefits. 4 million people die prematurely each year from illnesses associated with household air pollution associated with cooking. However, the technologies developed to date have not achieved nearly enough scale in usage. A pull financing mechanism that pays out on end-user take-up and use could incentivize greater efforts to design more usable cookstoves (Abdul Latif Jameel Poverty Action Lab, 2020). Some clean cooking technologies are also associated with household energy access systems and mini-grid systems—it is possible to incentivize the rollout of each.
- *Soil based carbon sequestration:* a pull financing mechanism for soil-based carbon sequestration could also yield both local and global benefits. A number of issues remain to be resolved: firstly, the length of sequestration, and the ease of reversals; and secondly that the optimal market structure for such technologies may be more like plantation farming than smallholdings—minimizing the poverty impact. Incentivising innovation in this sector may nevertheless yield new approaches or better management systems.

A forthcoming working paper digs more deeply into a number of potential applications (including those outlined above), assessing them against the five criteria laid out in this paper, and considering if and how an efficient and effective pull financing mechanism may be applied to each, and what the key risks to consider and mitigate are.

Conclusion

To optimize the impact of climate finance in developing countries, it needs to deliver both local development gains and positive global externalities. In a number of areas where there is potential for both, however, existing technologies are either insufficient or too expensive to achieve take-up at scale. The use of pull financing mechanism to resolve these issues, but the design challenges are not trivial. The five criteria set out above provide a way of assessing the suitability of a sector or candidate problem for pull financing. A number of problems show promise, but further work is required to investigate their suitability in depth.

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