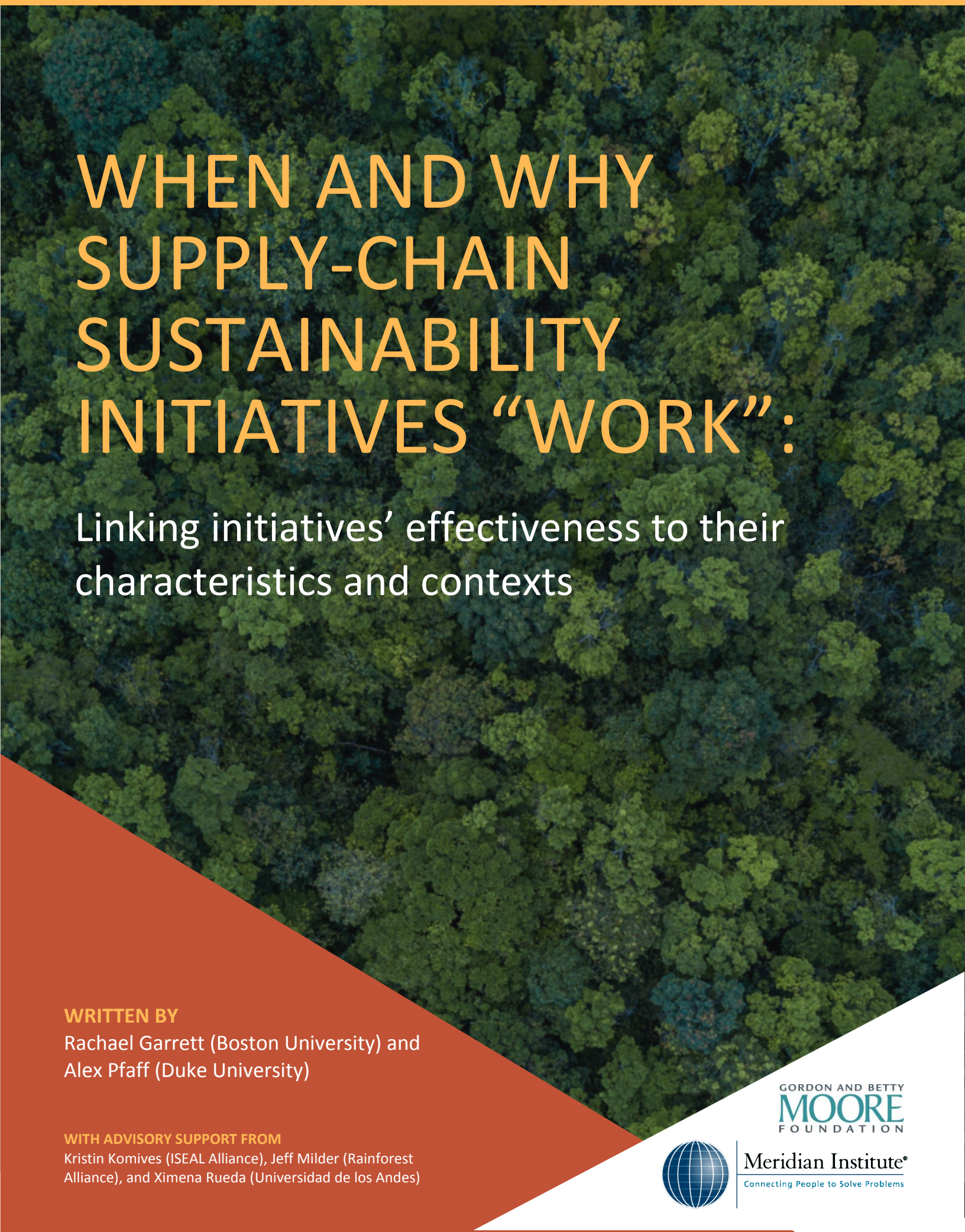

WHEN AND WHY SUPPLY-CHAIN SUSTAINABILITY INITIATIVES "WORK":

Linking initiatives' effectiveness to their characteristics and contexts

WRITTEN BY

Rachael Garrett (Boston University) and
Alex Pfaff (Duke University)

WITH ADVISORY SUPPORT FROM

Kristin Komives (ISEAL Alliance), Jeff Milder (Rainforest Alliance), and Ximena Rueda (Universidad de los Andes)

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INTRODUCTION

Prior research conducted as part of the Supply Chain Sustainability Research Fund asked if existing 'Supply-Chain Sustainability Initiatives' (SSIs) initiated by a firm, or firms, had led to improved conservation − given their implementation mechanisms or lack thereof. *Here we consider the conditions under which we would expect SSIs, as implemented, to be effective in supporting conservation or other sustainability goals.* We aim to offer guideposts for forming expectations about when SSIs are "effective" (defined below). We suggest some factors that affect SSIs' effects on both narrow and broader goals. With improved understanding of how those factors affect behaviors and outcomes, actors developing and improving SSIs can better predict which efforts will improve sustainability and can better organize empirical SSI studies.

The many recent SSIs have included company pledges, codes of conduct, and sectoral standards (see Table 1). SSIs differ substantially in ambition, coverage, and implementation.[1] Most are voluntary for adoption (i.e., are not state mandates), yet if one is adopted by a powerful downstream firm (retailer, manufacturer, trader) in a market with few alternative buyers, compliance with that SSI may well be mandatory *de facto* if a supplier wants to be in the market. By power or other means, in agricultural as in other supply chains, SSIs aim to influence sustainability by altering actors' net benefits from production and other decisions − specifically reducing net benefits of undesirable behaviors and increasing net benefits of desirable ones.

Thus, implementation mechanisms that effectively shift net benefits are necessary to impact sustainability. We thereby distinguish: [1] SSI commitments – the specific ambitions within the commitments and the coverage of promises; [2] SSI implementation mechanisms – ways of having influence or doing monitoring and enforcement; and [3] SSI implementation contexts – relevant characteristics of regions, producers, and time periods.

Defining Effectiveness

We distinguish "individual effectiveness" – fulfilling stated sustainability commitments at the farm or supply chain level − from "broader effectiveness" or achieving some broader sustainability outcome(s). Individual effectiveness may not require any changes in practices beyond verifying ongoing compliance. Broader effectiveness, in contrast, may include a demand for changes relative business as usual and even consideration of spillovers – impacts on non-targeted actors, supply chains, regions, and time periods. For instance, if there is significant leakage of negative activity across space, SSIs are not broadly sustainable, while negative local socioeconomic spillovers could undermine SSIs in the eyes of producers or consumers.
Below we consider varied objectives that could be included in defining "effectiveness," any of which may be included in the promises made within any SSI commitment itself or may go beyond what was promised.

Individual Effectiveness

Promise Fulfillment

"Effectiveness" must include 'doing what you said', i.e., ensuring that the promises within the definition of the SSI were achieved. Narrower versions of this individual effectiveness involve promises about one producer's behaviors or one supply chain. Thus, if an individual producer promises not to use a given harmful practice on a farm, and that practice is not used on that farm, the SSI was "effective" on that farm. This definition of individual effectiveness is, then, simply the same as any adopter complying with any given adopted SSI.

Broader Effectiveness

Additionality: Impacts Relative to Baseline

Promise fulfillment alone may not imply any changes in behavior relative to baseline (business as usual counterfactual). In some cases, a manufacturer or retailer may simply want to publicize that a chain is free from a practice, even if suppliers had never used it prior to adopting the SSI. In other cases, what is promised by an SSI achieves additionality – a change that goes beyond a business as usual scenario, including requirements of existing policy and enforcement.[2, 3, 4] Even when an SSI does not promise additional changes or impacts, this may be what consumers want and, in that case, additionality is not part of "individual effectiveness" but instead "broader effectiveness."

Spillovers Across Objectives: Jointly Produced Co-benefits or Co-losses

Firms that establish SSIs, or the consumers and civil society actors pushing them to do so, may care about not only environmental, but also social outcomes. Yet, in many cases, SSIs explicitly involve only a subset of all of the outcomes of possible interest, e.g., environmental (social) but not social (environmental) goals. Still, social changes may be "jointly produced:" if a conservation-oriented SSI creates local economic gains, it can aid conservation by stimulating demand and thus price and access. In contrast, if conservation gains are associated with local socioeconomic loss, either producers or consumers may lose interest in the SSI. More generally, even if not a focus, jointly produced outcomes can affect gains of interest. For example, even if neither retailers nor consumers value SSIs' socioeconomic impacts, impoverishing local suppliers may undermine desired gains through departures or conflicts that undermine production and governance.

Impacts beyond SSIs' explicit foci also arise along other environmental dimensions. For instance, actions that achieve promised carbon neutrality (i.e., no loss of carbon stocks), could have positive co-benefits for biodiversity if conserving forests for carbon reasons also protects wildlife habitat. Yet carbon storage maximization that prioritizes harvest and regrowth over habitat may jointly produce a loss of biodiversity. (These divergent possibilities actually explain disagreements per carbon payments between environmental non-governmental organizations (NGOs).)

Table 1. Types of SSIs [5]

Type of SSI		Actions Initiated by Firms	Interaction with Public Actions
Collective Aspirations *(multiple companies)*		Stating hopes may encourage companies to adopt SSIs with implementation elements but *per se* includes none of them.	National governments at the country-level set specific targets, plus definitions of scope (e.g., a definition of "deforestation").
Company Pledges *(single company)*		Specifying individual corporate targets may, again, encourage adoption of implementation but *per se* does not include it at all.	Most company pledges include "legality" criteria. Thus, pledges can help enforce existing policies. In some cases, however, pledges contradict government policy.
Codes of Conduct *(single company)*	Internal verification	Specifies an internal policy but only implemented if also forms of consequential internal audits.	
	External verification	Specifies supplier practice but only implemented if also forms of consequential external audits.	
Standards: Incentive-based	NGO or 3rd party-led certification	Requires suppliers to verify and maintain compliance with targets and undergo audits.	Many standards develop national interpretations to bring criteria into alignment with national definitions and laws.
	Roundtable certification		
	Government certification		
Standards: Sanction-based	Bans or moratoria	Requires suppliers to register their property and maintain compliance with targets, which is verified through remote sensing.	Often requires support via public property registration systems, regional monitoring, and alignment of other positive and negative incentives such as access to credit or effective punishment for breaking the law.
	Jurisdictional approach	Requires whole regions to maintain compliance with targets and establish monitoring practices to assess and enforce compliance.	Requires regional monitoring and alignment of other positive and negative incentives such as access to credit or effective punishment for breaking the law.
Standards: Designation-based	Land use plans/zoning	May require suppliers to register their property and verify that they are outside HCV or HCS, but generally only implemented through certification programs.	Standards can be improved via systematic national mapping efforts.

Spillovers Across Space and Time: Impacts on Non-targeted Actors, Locations, Supply Chains, and Time Periods

SSIs can be individually effective at levels of the farm or supply chain, yet harmful at greater spatial scales, or, at least, on net less beneficial, should negative spillovers arise for non-targeted actors and locations. An SSI may lead to conservation of forests on one farm but forest loss in surrounding areas by displacing production activities to farms not under the SSI. Similarly, an SSI could improve wages in one region, yet, by driving up production costs, displace demand to other regions where labor conditions are more troubling (e.g., wages are lower, health and sanitation services are lacking, working conditions are more hazardous).

Companies that adopt SSIs, in light of pressures and opportunities they perceive,[6] differ in priorities – for instance, objectives may include none or all such spillovers. And spillovers could hurt, as above, or help if non-SSI firms observe improved practices and adopt those practices, with the SSI or without it. Either way, unless they promised positive spillovers or a lack of negative spillovers, this would not affect whether a farm or supply chain is "individually effective" but only perceptions of "broader effectiveness."

All spillovers occur over time, in a sense of responding to an initial impact, or change in relevant behavior. Some are more strongly temporal. For instance, setting a future cut-off date for a negative behavior can cause a rush of it now, before the deadline. Also, effects of increasing income or capacity, including via technological innovations, play out over time, any of which can raise production nearby in future periods. Temporal spillovers can be positive for an actor who adopts an SSI too – learned habits could endure even after an SSI ends. For neighboring actors, learning over time about positive habits can spread an SSI's gains and, more broadly, the demonstration effect of a functioning SSI can inspire entirely distinct chains to try.

Spatial Spillovers

Commitments that target small areas may suffer from negative spatial spillovers if negative activities shift. SSI-based restrictions on the use of some lands may, for instance, alter uses of the producer's other lands, in particular if labor or capital scarcity limits production. For instance, zero-deforestation commitments could function perfectly where resources are focused, yet displace activities that cause deforestation to unconstrained actors or regions.[7, 8] If SSI restrictions are compensated with some form of resources, those provided resources can reduce limits on production, in particular where credit constraints are likely (for example, see PES example in Alix-Garcia et al.[9]). Lichtenberg and Smith-Ramirez[10] show that other subsidies and cash transfers, such as cost-sharing programs to promote conservation, can reduce farm vegetation cover.

If production drops due to SSIs are large, they can shift market prices and, so, land uses elsewhere.[11, 12] Lower output supplies and input demands can provide incentives for changes in the usage of other lands.[13, 14] If demand for labor were to fall enough, that could lead to out-migration,[15] which could reverse the direction of local spillovers, overall lowering the environmental loss close in vicinity to SSIs.[15] Yet, it would not eliminate SSI spillovers globally, if migrants just end up pursuing deforestation activities in a new region.

Spillovers can vary considerably by setting,[16, 17] plus are likely to differ across types of restrictions. SSIs that restrict extraction sufficiently to affect timber prices, for example generating leakage to other forests[18] including in other countries.[19, 20] The extent of these effects will depend on the price elasticities of the supply and demand for the products in question[19, 21] and the effect sizes could vary considerably.[18]

SSIs that restrict firms and producers upstream also could influence their motivations to adopt practices. To start, those impacted by an SSI may compare their treatment with the treatment of others not in SSIs, which could yield positive or negative perceptions of the SSI in terms of key issues like fairness or equity. There is growing evidence of the importance of such nonmonetary concerns within conservation,[22-24], e.g., judging appropriateness of actions via comparisons.[25, 26] Also, SSIs that support community norms might yield beneficial spillovers, while those which violate norms could be subject to 'retaliatory leakage' (examples exist in mining[27] and collective upstream watershed decisions[28]). For instance, Cardenas et al.[29] find that a new fine for behaviors that damage the forest leads to more of those behaviors than under local norms. Further, the creation and then removal of rewards for desired practices might crowd out prior motivations to conserve under local norms, yielding negative spillover effects over time.[28, 30]

Ecological or physical processes function – much as do economic processes − as transmission mechanisms across locations and time periods. For instance, when species richness increases in one site in one period as the result of an SSI, the biodiversity in non-targeted forest corridors can benefit as well.[31] Similarly, within fisheries, ecosystem interactions can propagate effects of SSIs to nearby areas.[32] In addition to such ecology-based spillovers due to species' migration and reproduction, purely physical processes could spread SSI impacts. Underground extraction of oil and groundwater is subject to the laws of pressure, so extraction in one location shifts marginal costs of extraction and thus extraction itself elsewhere.[33, 34]

Temporal Spillovers

If SSIs promote new practices, producers lacking information about practices' net benefits or costs can learn by adopting and complying, while producers who do not adopt may learn from observing others. Producers may then persist in practices even if adopters exit the SSI,[35-37] which is a positive spillover. In contrast, if SSIs set a date by which an undesirable practice must be ended in order to access a market, that could push forward in time a rush to get such undesirable practices done before that date has passed.

Forming Expectations

As noted, we aim to suggest factors that affect the outcomes of SSIs. In particular, we will distinguish SSI commitments as well as mechanisms and contexts for implementation. Having defined effectiveness, the expectations we wish to inform concern how some key factors within each of those three categories influence adoption, compliance – to achieve individual effectiveness by carrying out the promises – and the two elements of broader effectiveness, additionality – impacts beyond business as usual – and spillovers – joint production of other outcomes and/or effects outside of SSIs.

Figure 1 below shows that commitments and implementation mechanisms – two elements chosen by SSIs – and SSI contexts – one element that may be influenced by SSI location choice but has exogenous parts – are likely factors in both the adoption of and compliance with SSIs. Adoption and compliance choices, in turn, imply whether behaviors and outcomes change relative to business as usual and spillovers arise.

In examining SSI implementation mechanisms, we consider: the types of incentives applied to change net benefits of (un-)desirable behaviors; timelines for applying incentives; and how compliance and progress are verified. We also indicate the importance of elements of contexts: existing public and third-party roles; the costs of alternative behaviors; market conditions; and attributes of supply chains, households, and producers. How these factors affect behaviors aids design for both SSIs and complementary policy.

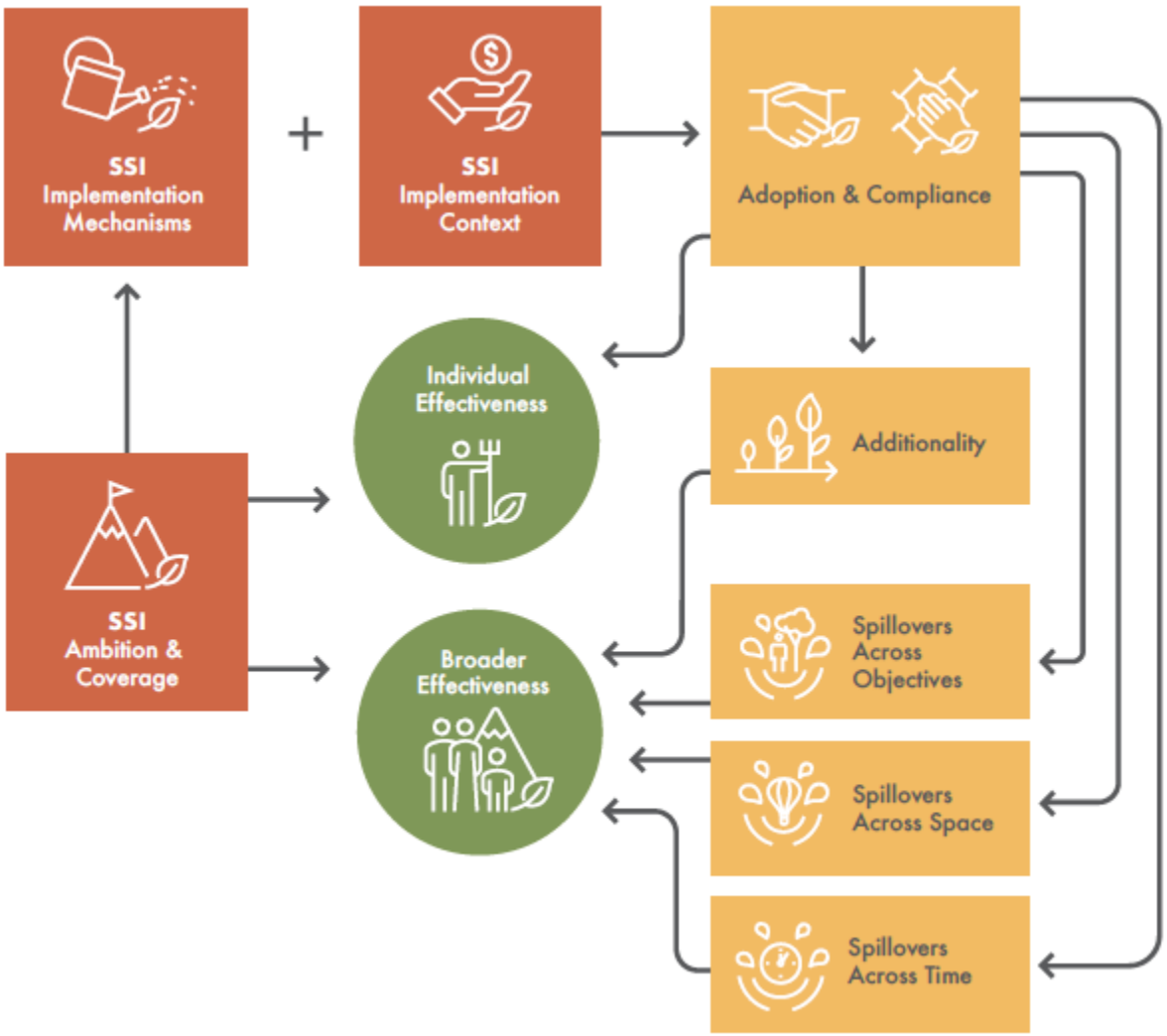

Figure 1. Linking SSI characteristics and contexts to effectiveness

Below, we examine three categories of factors that may influence achievement of effectiveness: commitment ambition and coverage; implementation mechanisms; and implementation contexts. Each section offers hypotheses, some implications of which are summarized in Table 2 (below). The final section, Designing for Effectiveness, offers an initial consideration of what combinations of conditions would appear to be most likely to lead to various types of effectiveness. All along, we refer to cases with snippets that support the relevance of the issues that are being discussed. Finally, we also have placed a compressed version of all of this into a separate, brief Executive Summary.

ACHIEVING EFFECTIVENESS

SSI Commitment Ambition and Coverage

Ambition

How stringent (i.e., strict, tough) an SSI is considered depends on the *absolute* and *relative* magnitude of its promises. All else equal, higher targets are clearly more stringent than lower targets (e.g., cutting a negative rate like carbon loss in half is less stringent than cutting it to zero, or paying a "minimum" wage is less stringent than paying a "living" wage). Further, the magnitude of a target is not always defined by those numbers. It can depend on whether the target allows gains in the outcome variable to offset losses (e.g., allowing no "gross" loss is considerably more stringent than allowing no "net" loss). However stringency is raised, the more stringent the SSI target, the higher the burdens or costs for firms are likely to be.[1, 39]

Effective stringency also depends on whether a target is tougher than requirements of public regulations. This is particularly important if additionality is part of effectiveness. For example, an SSI banning the use of slave labor will be a redundant to requirements in a region where the use of slave labor is already illegal, so long as the definitions of slave labor for the SSI and national laws are the same. Even then, given gaps in enforcement, it is possible that SSI implementation will change outcomes relative to not having an SSI.

Cut-off dates also affect stringency. SSIs that require or prohibit certain behavior or outcomes in the past must specify a date by which those behaviors or outcomes must have occurred. The later the cut-off date, the lower the stringency (implying a greater "amnesty" for negative actions that occurred earlier). Yet this may permit more suppliers to be included, and change practices, instead of being excluded and continuing a negative behavior and selling to other buyers. Further, it may permit SSI mechanisms for influencing behavior to be improved, raising trust in the SSI. A middle ground would be to allow improvements over time – some SSI cut-off dates can be historical or immediate ('Day Zero'), while others could be more gradual. Implementing historical cut-offs can be challenging, yet feasible using past remotely sensed data.

Hypotheses: Ambition

1. Generally, greater stringency lowers farm-level adoption and compliance (and reduced eligibility), yet likely raises additionality, as the target is more likely to exceed what currently is required and is done.
2. Early/immediate cutoff-dates lower adoption and compliance but raise additionality per adopter.

Example 1. Selective adoption lowers additionality, despite high compliance levels

Oil palm producers adopting standards by the Roundtable on Sustainable Palm Oil (RSPO) commit that they have not deforested their land since November 2005. Carlson et al[39] found that deforestation rates and fire usage are lower in RSPO certified properties versus comparable ones. Yet those who adopted RSPO had very little forest left before certification. These results highlight that selection bias in adoption decisions can imply that very little behavior is changed.

Supply Chain Coverage

Supply chain coverage by an SSI refers to which actors in a product's lifecycle are covered under the SSI. An SSI that commits not to purchase from actors that have done certain practices is committing to restrictions on behavior by suppliers who sell directly to a firm in the SSI. Yet, that does not cover indirect suppliers who sell to direct suppliers (e.g., restricting cattle-fattening operations does not restrict calf producers who sell to fattening operations[40]). In contrast, a commitment to buy only from those actors who can verify that certain practices were not done at any point in the production process covers the entire supply chain.

Hypothesis: Supply chain coverage

1. Greater supply chain coverage raises farm-level adoption and compliance and lowers the spillovers in a supply chain. Yet if this raises additionality in the chain, it could raise spillovers across supply chains. Therefore, global effects across supply chains depend on substitutability and scales of commitments.

Spatial Coverage

SSIs that target small areas may be more effective locally or regionally, compared to spatially more broadly delineated scale for promises, because the corporations making pledges could theoretically direct more resources to enforcing compliance within that place, versus spreading resources across many locations. However, targeting smaller areas also leaves open more neighboring areas for leakage of negative actions.

To start, SSIs operating at the level of the farm should be differentiated from those at the level of a chain. Effectiveness at one level could be achieved without effectiveness at the other due to shifts in behaviors. If farms do not meet requirements, for example, chains could shift suppliers in order to meet requirements. Conversely, farms might meet requirements, yet other stages of the chain, and thus the chain as a whole, might not.

Hypotheses: Spatial coverage

1. Greater spatial coverage should raise the incentive for farm-level adoption, as well as compliance, since the options to avoid the SSI are reduced and the relative costs for meeting requirements are lower.
2. Greater spatial coverage, as implemented to include more actors with gaps from existing behaviors, should also improve additionality, at least relative to when selection bias focuses SSIs on the smaller gaps.
3. Greater spatial coverage lowers spatial (spatio-temporal) spillovers in regions and supply chains, by virtue of including more actors, yet whether spillovers rise at larger scales remains an open question, one whose answer could be affected by global-scale commitments, but also is affected by output markets.

Implementation Mechanisms

Our core theory of behavioral change is that producers' choices to adopt and comply with SSIs depend on the perceived net benefits of that choice relative to other options. Generally, if producers are heterogeneous we predict that SSI mechanisms reliant on voluntary behavioral change will face selection bias – adoption by those producers who face lower costs of adoption and compliance – for instance those who already are doing desired practices.[1] That reduces cost but also impacts of SSIs.

Land-Use Incentives and Support

Companies have several options available to steer supplier behavior to more desirable land use practices, including price premia; market access; sanctions upon or exclusions of non-adopters, and funding for technologies to reduce costs. Impacts depend on net private and public benefits of desired behaviors. For instance, voluntary mechanisms that use positive incentives to influence behaviors will have limited impacts where the net private costs of adoption exceed net private benefits.[41] Thus, where the costs of behavior change are high, payments or premia for adoption must also be sufficiently high to compensate.

Net benefits can be generated by a range of supports as parts of bundles of services offered within an SSI. The type of mechanism used − e.g., positive or negative incentives with or without support for capacity − influences not only the direct effects of the SSI but also the spillovers and broader sustainability impacts. Such impacts are, in turn, dependent on producers' characteristics – critically the assets of households – and on existing land-use practices, as well as existing public and civil society governance and capacity for support. The specific choice of mechanisms can be particularly consequential for an SSI's impacts on smallholders – a group that may often have been overlooked by any pre-existing policies or incentive programs.[42-46]

Positive incentives tend to be voluntary at all scales, i.e., for the supply-chain leaders and at the farm-level. Negative incentives, in contrast, differ along this dimension for the large actors versus for the smallholder; they are adopted voluntarily by the leading supply chain actors, yet can be *de facto* mandatory for individual farmers if the lead actors are powerful, supply is not abundant so marketing is competitive, and the farmers want to sell in that chain. If they do not comply, they must sell elsewhere or not produce.

The set of motivations underlying SSI responses – i.e., influencing perceived costs and benefits – can be wide ranging. While commentary may often focus on expected monetary net benefits, fairness also enters.[47] For instance, environmental mandates may be perceived as unfair by smallholders, such that even if they seem efficient otherwise, SSIs may be pushed toward the use of positive incentives.[48]

Positive incentives also face inclusion and fairness challenges. Smallholders may be unable to participate in voluntary certification schemes offering positive rewards due to upfront costs and complexity.[2, 49-51] Indeed, in cases it appears larger producers support such schemes because they can effectively exclude smallholder competition. That may lead to considering ways to lower costs for smallholders in SSI design. For instance, incentives could function at the group level and be coupled with resources to defray costs.

Hypotheses: Land-use incentives and support

1. Building capacity raises adoption, compliance, and additionality at least for smallholder producers.
2. Greater positive incentives – like capacity building – allow higher-cost firms to adopt practices.
3. Adoption, compliance, and additionality rise with positive incentives (benefits for behaviors).
4. Negative incentives force adoption yet could lead producers to make compliance harder to verify.
5. Even if not a goal, local socioeconomic gains or losses affect sustainability of environmental SSIs.

Example 2. Importance of support for building capacity

The most commonly cited enablers of practice adoption, within a recent systematic review,[52] were external financial, technical, and institutional support. Examples cited include support from donors, government, NGOs, actors higher up the supply chain, and packages offered by certification systems themselves. This reflects the strong focus upon developing countries and small-scale producers, who are more frequently a significant amount from meeting requirements of international sustainability standards. Thus, while certification is often viewed as a market mechanism, it may be most effective when the inability to access markets is addressed. Capacity can rise for certified smallholder producer groups via adoption of management practices, although many comments have emphasized that support needs to be sustained. Repeated training may be needed for previously infrequent practices, while the concepts of both agency within and even responsibility for outcomes may also be new. In sum, support appears to be important.

Verification of Compliance and Progress

Effective implementation of any SSI requires a system for monitoring and verification of compliance. That system's spatial (e.g., plot-level) and temporal (e.g., near-real-time) resolution must be sufficiently high to assess the environmental and social outcomes of interest – with possibly very different methods for environmental versus social outcomes. Even SSIs that set goals at the cooperative or jurisdictional level may require assessment at a more detailed (sub)property level to identify noncompliance that can be addressed locally. (However, information may not need to be formally available outside of the cooperative unit.) At the formal level, a database is required to verify compliance with relevant standards (e.g., proof of certification or record of infractions) to be checked by third-party auditors or at the point of sale.[53]

If an SSI is adopted at downstream stages in a chain and involves promises about production of the product offered to retailers and consumers, some tracking of products is required back to their origins.[54, 55] Some crops (e.g., oil palm) can be more difficult to trace through a chain, however, due to losses of genetic information and the degree to which products from various origins are mixed at the processing stage.[56]

Given these challenges, who bears the burden of proving compliance can shift costs of SSIs considerably. Further, burden of proof varies across SSIs. If voluntary at the land-user scale (e.g., farm certification), SSIs tend to place a burden of proving compliance on producers who choose to showcase their attributes. Yet mandates not chosen by producers, such as banned practices, region- or company-level monitoring and traceability, can shift burdens down a chain. If monitoring is by a trusted 3rd party (i.e., government or civil society rather than adopting firms), that may reduce opportunities for false reporting and corruption.

Hypotheses: Verification of compliance and progress

1. For exclusions, higher spatial/temporal resolution monitoring raises compliance and additionality.
2. Monitoring by trusted third parties can raise acceptance and, if cost is covered, support adoption.

Example 3. Importance of monitoring and verification of compliance and progress

The frequency of audits within monitoring and verification has varied considerably.[57] That said, various cases support the assertion of its importance, including within incentives to both adopt and comply (forestry in Cubbage et al. 2010,[58] fisheries in Gorham et al. (submitted)[59]). Raising non-conformities using an auditing focus on field performance contributed to Norwegian forest managers' improved management.[60] Gains include efforts to control illegal activities, as in Forest Stewardship Council (FSC)-certified forests in the Congo Basin where FSC required compliance with applicable laws and regulations.[61] This can aid worker training and safety (Cubbage et al., 2010,[58] for Chile and Argentina).

Implementation Context

Characteristics of households, supply chains, and regions involved in an SSI affect constraints to adoption and implementation. They include: [1] existing public and third-party roles (regulations, politics, resources); [2] business-as-usual activities in the region and costs of alternative behaviors; [3] macroeconomic conditions relevant for the commodities in question; [4] characteristics of the supply chain; and [5] characteristics of the producers who are affected by an SSI.

Existing Public and Third-party Roles

SSIs are more likely to be implemented when complementary rather than antagonistic to regional statutes[62] and when public and/or civic actors provide complementary financing, services, and infrastructure. Some roles feature economies of scale, so that public roles make SSIs more feasible. Generally, the performance of private resource-governing institutions may depend on interactions with public agencies.

NGOs or, more generally, civil society also can have critical roles in enhancing probabilities of effective SSIs, through their capacities and chosen activities. Certification programs, for instance, rely upon cooperatives to help organize the many producers involved, verify behaviors, and disseminate information and premia. If such local civil cooperatives do not function well, certification programs do not work as planned.[63]

For SSIs with significant reach (i.e., a large number of participants), an intermediary actor is required to link between the initiating entities and the SSI participants on the ground. This could often be an NGO, or other type of organization from civil society. Yet, not infrequently, it could be an actor in the supply chain, such as a trader. Shifts in the actor, and thus incentives, can significantly shift the implementation of SSIs, starting from the choice of which SSI to 'push' in a given site, or where to 'push' each locally relevant SSI. For instance, a trader might avoid costs by avoiding stringent SSIs in environmentally sensitive locations, where other parties most want them to be implemented. NGOs focused on local livelihoods may make similar choices or – relative to third parties focused on environmental outcomes – more often employ positive incentives and capacity-building support.

Such differences in perspective could affect the intensity of monitoring. Monitoring and verification also depend upon local geospatial monitoring capacities, the existence of private or collective property rights, and producers' ability to map and register their properties.[64, 65] When producers can lean on the state or NGOs for these activities, costs of adoption and implementation are lower while compliance increases.

Hypotheses: Existing public and third-party roles

1. Complementary public regulations and services improve SSI adoption and compliance.
2. A strong and supportive NGO and civil actor presence increases SSI adoption, compliance, and additionality.
3. Incentives of intermediaries who affect adoption across SSIs also affect which goals are achieved.

Example 4. Importance of complementary public roles

In 2008, most major soybean traders and processors in the Brazilian Amazon agreed to not source soy in the Brazilian Amazon that was produced on land deforested after June 2008 (original cutoff June 2006). This 'Soybean Moratorium' has had very high compliance with committed firms fulfilling promises. The success of this moratorium is linked to the presence of complementary public policies. Federal regulations in the Brazilian Amazon already limited legal deforestation to 20% of a private property and committed companies could take advantage of public databases of properties and deforestation monitoring to prevent noncompliant properties from receiving loans or selling products.[66]

Costs of Alternative Behaviors

The cost to a producer of adjusting to desired practices proposed within an SSI depends on the gap between current and desired behaviors and, thereby, the cost of switching to desired alternatives. Those costs of switching practices are, in addition, affected by local capacity building as well as how many farmers adopt the SSI. New technologies may feature economies of scale, with lower costs as more adopt. Compliance is likely to be lower where the costs of changing from existing to desired behaviors are low. However, in direct contrast, the additionality from any such changes will be higher in those places where negative practices were commonplace (i.e., where there is a large gap between existing and desired behaviors).

Hypotheses: Costs of alternative behaviors

1. Farm-level adoption and compliance are lower where there is a greater gap from BAU to desired.
2. Additionality per adopter/complier will be higher where there is a greater gap from BAU to desired.

Example 5. Gaps between business-as-usual activities and desired practices

The Soybean Moratorium relied on public roles and benefitted from business as usual activities, making it easier for farmers to find "alternatives" to deforestation. Soy occupied only a small amount of the land area and there was a large reservoir of pasture area that generated low returns but was suitable for expanding soy.

Market Conditions

Opportunities to motivate adoption, compliance, and behavioral changes relative to baseline activities are affected by macro-level market characteristics for the target commodity. In times of over-supply, there may be low prices and less opportunity for price premia (though premia can be countercyclical[67]). Further, in such conditions, there can be increased payoffs from the differentiation of one's outputs and, assuming differentiation is possible, it can lead to higher adoption. Likewise, there is ambiguity concerning periods of growing demand. There might be less retail or consumer attention to the nuances of production; however, there is greater potential that retailers or consumers are willing to pay for desired characteristics.

In sum, one needs to be aware not only of the direction of broad trends but also of differentiation details.

Distinct from generally high or low demand conditions is the challenge of volatility in commodity prices. Fluctuation in demand conditions itself may matter to SSI use and outcomes, for instance leading to more demand for, and impacts of, SSIs if they lower volatility, for example, through countercyclical premia or price floors.

Example 6. Differentiation versus substitution and the potential for spatial and temporal spillovers

A prominent SSI example of commodity substitutability, instead of differentiation, is the substitutability of palm oil and soy oil within vegetable-oil markets. If SSI adoption in palm oil continues to outpace that of soybean production, and has high costs, it raises the international price of palm oil relative to soy oil. Higher relative soy returns could then lead to large negative conservation spillovers via greater soybean area expansion, especially since soybean requires greater cropland area per unit of oil that is produced.

Hypotheses: Market conditions

1. Demands for differentiated products generate incentives for improving adoption and compliance (in higher macroeconomic demand, where premia may be higher, or lower demand, with more exclusion).
2. Fluctuating demand raises adoption of and compliance with SSIs that lower the effects of volatility.
3. Many factors considered in hypotheses above will also affect signs and magnitudes of spillovers. Easier substitution for a commodity, versus differentiation, will raise spatial spillovers if SSIs increase costs. Further, public capacity and intent can make it easier to structure an SSI over space that limits spillovers. Extensive landscape opportunities for low-cost adjustments in production should lower spatial spillovers. Better information networks among producers increase the likelihood of learning and positive spillovers.

Supply Chain Characteristics

When buyers have more leverage over upstream suppliers via vertical integration (i.e., as suppliers themselves) or via market concentration (i.e., there are few alternative buyers), farmers will have more difficulty finding alternative markets. That should increase the costs of non-compliance and ease enforcement.[68]

Example 7. Significant differences in buyer leverage within supply chains affect SSI outcomes

Sugar, palm oil, and bananas tend to be highly integrated, allowing buyers to force adoption and compliance. In contrast, within the supply chain there are many smallholders in cocoa, coffee, rubber, or even soy. Buyers of cattle products have little control over much of the land use associated with their supply chain – e.g., calf producers can sell to cow-finishing operations and bypass direct sales to processers within SSIs.

Division in the supply chain of any surplus from an SSI affects net benefits from adopting and complying. That division depends on competition within the chain, horizontal – same production stage – and vertical – between firms at different stages of production – plus which end of the chain dictates the terms of trade. Over time, there has been a shift toward capture of surplus within supply chains − including from SSIs − by lead firms in advanced economies,[69, 70] irrespective of efforts to shift trade costs or elasticities.[71]

Example 8. Surplus in coffee – tough global conditions for suppliers; useful local organization by SSIs

Coffee beans have long been a commodity with differentiation at the roaster level. The global commodity chain is a highly competitive scenario downstream, with 70% grown in farms less than five hectares in the late 1990s.[72] Yet the top 10 global importers control more than 60% of trade, and buyers can collude to lower prices at farm gate, while the top five European roasters control over half the market. Often there are zero or negative rents at the bottom of the chain and price movements suggest that local traders are more aware of market dynamics, exploiting small farmers' lack of price information.[73]

Yet exceptions are possible with local organization. In Uganda, Chiputwa et al.[74] found the size of the coffee premium affected outcomes. Fairtrade certification was linked to a 30% improvement in household living standards, lowering the prevalence and depth of poverty, as the average price for certified coffee was over twice the price of uncertified. This, in turn, linked to the role of the local cooperatives in managing the certification. The cooperative linked directly to high value export markets and negotiated higher prices.

Hypotheses: Supply chain characteristics

1. If buyers control chains, they can force adoption, compliance and − if promised − additionality.
2. When farmers can capture more surplus from an SSI, its adoption and compliance will rise.
3. Positive/negative joint production (co-benefits/losses) spillovers can raise/lower gains from SSIs for the producers involved, which also affects adoption, compliance and willing to generate additionality.

Household and Producer Characteristics

Natural, human, and manufactured assets of producers play both direct and indirect roles in SSIs,[75, 76] while asset accumulation is affected by culture, gender, location, and land use[77, 78] Such feedback, as well as conservation or its lack, may be resilient to external incentives,[79, 80] including from policy or SSIs. Thus, some sets of households and producers will be more likely than others to respond to any given SSI.

Those with lower financial capital, labor, or land endowments and social or knowledge capital are more constrained.[81] Low financial assets and access to credit make SSI costs more challenging to overcome, be they for mapping and registering properties, restoration, or management practices. Low land or labor endowments raise the cost of shifting land or labor away from consumption or income diversification. Low technical knowledge of best practices in agriculture and conservation practices, or small networks, raise the costs of gaining and applying the knowledge of how to undertake the behavior changes required.

Hypotheses: Household and producer characteristics

1. Higher household financial assets tend to increase the capacity to adopt and comply with SSIs.
2. Better information networks tend to increase required knowledge (though incentives are still necessary).

Example 9. Importance of household assets

Fairtrade coffee certification in India (Andrah Pradesh) has been shown to have a positive effect on market access, prices, and overall household income.[82, 83] Additionally, among adopters, the poorest farmers experienced the greatest change in household income. However, adoption was higher for farmers with greater household income and greater assets, such as livestock.[82]

DESIGNING FOR EFFECTIVENESS

Summarizing Hypotheses

The hypotheses above for SSI implementation mechanisms and context, as well as ambition and coverage, are summarized in Table 2. Colors indicate hypothesized relationships between SSI characteristics (rows) and elements of effectiveness (columns). Green indicates that the expected relationship is positive – in the sense of good for conservation or the environment by raising a positive or lowering a negative – while dark orange indicates a negative relationship of the SSI characteristic to the outcome. Yellow indicates mixed results – either some aspects of an SSI characteristic lead to positive outcomes but others to negative or in some conditions more of the SSI characteristic leads to positive outcomes but in others it is negative.

Facing Tradeoffs

Table 2's speculations concerning the relationships of individual SSI outcomes also highlight the degree to which tradeoffs may exist. In some cases, achieving one dimension of effectiveness undermines achievement of other dimensions. For instance, as in Table 2, some of the conditions more likely to promote additionality for adopters reduce adoption and compliance. Further, characteristics that raise adoption, compliance, and additionality within individual supply chains may be associated with greater negative spatial spillover.

For example, the use of negative incentive systems within SSI implementation mechanisms, creating a situation with farmer mandates, is likely to result in high compliance – and, if promised, additionality − within a given supply chain, so long as the costs of non-compliance are high (e.g., with good enforcement). Yet when negative incentives impose high costs, it can result in large spatial spillovers through out-migration or typical market dynamics. In contrast, voluntary incentives may result in fewer spillovers to other regions of undesired behaviors, but more likely suffer from selection bias, reducing additionality.

Table 2. A summary of implications and tradeoffs/synergies and combinations/interactions

	FARM ADOPTION	FARM COMPLIANCE	ADDITIONALITY	SPILLOVERS
SSI COMMITMENT AMBITION AND COVERAGE				
Ambition				
Greater Ambition	Higher farmer burden/costs	Higher farmer burden/costs	Behavior beyond prior decisions	Push negative practices elsewhere
Coverage				
Longer Chain Coverage			Reduces options for leakage w/in chain	Drives effects across chains
Larger Spatial Coverage	Costs of non-adoption rise	Costs of non-adoption rise, but enforcement resources spread thin	Including more actors changing behaviors	Limiting areas easily accessed for leakage
SSI IMPLEMENTATION MECHANISMS				
Influence Approaches				
More Positive Incentives	Benefits outweigh costs	Benefits conditional on compliance	Desired practices seen as beneficial, but some may already be doing behaviors	Neighbors observe benefits and shift practices
Earlier Implementation	High adjustment costs	High adjustment costs	Could force changes or only allow those that are already doing practices	Avoids surges in negative behaviors (due to later cut-off dates)
Monitoring & Verification				
Higher Resolution Monitoring	Higher costs (unless compensated)			
Traceable Through Chain	Higher costs (unless compensated)			
SSI IMPLEMENTATION CONTEXT				
Public and Third-Party Roles				
Strong and Complementary Public and Civil Society				Reduce leakage if restricting actions nearby
Costs of Alternative Behaviors				
Gap from Business as Usual to Desired Behaviors			Desired behavior is likely part of baseline	Neighbors learn from and adopt practices
Market Characteristics				
Demand Quality Differentiation	Incentives can be higher	Incentives can be higher		
Producer Characteristics				
Higher Household Capital Assets				

Promising Combinations

Table 2 also suggests combinations of factors that may work well for specific outcomes (adoption, compliance, additionality, and spillovers) across SSI commitments, implementation mechanisms, and contexts. For many or all contexts, coupling negative incentives or mandates with capacity building, to reduce the costs of adoption and compliance, may greatly improve promise fulfillment as well as local additionality (although without attention across space, one should consider if greater local impacts increase spatial leakage).

For positive incentives, adoption tends to be much easier, as producers of course like to receive rewards, but coupling that with monitoring and enforcement may be needed for compliance, which can have costs, in particular when additionality is a goal (either one promised within SSIs or more generally an objective). Across contexts, higher spatial and temporal resolution of monitoring is likely to improve outcomes. Yet, as that has costs, when interested local parties are willing to contribute that helps. In addition, the credibility of trusted third parties can raise adoption levels if processes to determine rewards are more locally accepted.

Applying the above in looking across contexts, in some settings state and civil society policies or services are not strong, and business as usual land uses differ greatly from desired practices, raising compliance costs, while assets of producers are low. Yet if product differentiation in markets is possible, SSIs might succeed with positive incentives and significant bundles of capacity building, while allowing continuous practice improvements.

If state and civil society policies or services are strong, business as usual land uses are similar to desired practices, producer assets are high, and product differentiation in markets is difficult yet brand risks exist, SSIs might do better to use negative incentives or mandates, without extensive capacity building within the SSI, while setting immediate cut-off dates for undesirable behaviors, without any grace period.

In light of tradeoffs, SSI priorities across objectives clearly matter. If high compliance and adoption are valued above broader impacts, lower stringency – such as less ambitious targets (e.g., “net” versus “gross”) and later cut-off dates for behaviors and outcomes – may be preferred. If high additionality, low spillovers, and broader impacts are the most important outcomes for stakeholders, targets with higher absolute and relative stringency, greater supply chain and spatial coverage, and earlier cut-off dates are necessary.

Looking across contexts, if adoption and compliance are valued above additionality, SSIs might aim where state and civil society policies, services, regulations, or capacities are strong, shifts from business as usual to desired land uses are low cost, reputational or market gains are apparent, and assets of producers are high. For such conditions, good practices may already exist. Highlighting them can be additive and may be done with low-cost monitoring intensity sufficient to verify compliance with less ambition.

If broader effectiveness (e.g., additionality, net beneficial spatial spillovers, positive socioeconomic impacts) is highly valued by stakeholders, SSIs instead might best employ more stringent targets, with greater coverage along the supply chain and across space, earlier cut-offs, and, even if instrumentally, positive incentives, with capacity building for low-asset producers. Broad effectiveness is also more likely when the product is not highly substitutable in its end markets, markets differentiate the target commodity based on the sustainability attributes of the product, consumers are willing to pay a higher price for this differentiation, and where farmers retain surplus from such differentiation.

SSI Design Decision Trees

The above reflections concerning conditional decision-making involved a significant number of dimensions. Clearly, it is not possible to maximize all objectives in all settings. Rather, SSI designers must face choices. That said, there are exogenous elements that bound SSI possibilities, which could guide efficient design. Further, those designing SSIs can make the judgement calls about which outcomes are most important and thus, in principle, decision rules could link contexts and objectives to best choices of SSI mechanisms.

Initial thoughts about possible such rules are implied above, acknowledging that they are very partial, including in that the precise expectations of impacts of an SSI design choice would require further detail. However, at this broader level intended merely to suggest the value of pursuing such thinking and detail, we might also transform such rules into ordered questions or 'decision trees' indicating best mechanisms.

For instance, if we started by ranking objectives, and if outcomes for local smallholders were important as goals or as instrumental necessities, an SSI might count on providing some capacity building. Further, in the choice between positive and negative incentives, the SSI designer might immediately ask whether support exists in an agency or civil society to support costly local mandates. Then, if mandate costs are to be imposed, an SSI designer will want to be confident of strong enforcement.

Remaining Considerations

While we have attempted to present a fairly straightforward summary of important SSI implementation and design considerations and highlight opportunities for synergies, we should at least flag here that the complexities of measuring various outcomes, including within spillovers, may impede empirical validation. More generally, we have not attempted an exhaustive review here, either of all issues involved, globally across cases, or of all possibilities for these issues.

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