



Incentives for Private Sector Participation in the Article 6.4 Mechanism

Discussion Paper

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Abstract

Article 6.4 of the Paris Agreement explicitly acknowledges the need to incentivize and facilitate the participation of private entities in the mitigation of greenhouse gas emissions. Under the Clean Development Mechanism (CDM), private sector actors had already the opportunity to participate in a new and fast-growing market. However, they faced numerous challenging investment barriers. The study provides an overview on key factors and barriers determining private sector participation in Article 6 mechanisms. It distinguishes between the three topics demand side factors, rules and standards for market mechanisms, and supply side factors and provides for each of them options to mitigate or overcome barriers.

In a short analysis, it further explores three of the identified options:

- ▶ Improving the design and support of national systems and capacities is an important pre-requisite for the private sector to be able to generate and sell ITMOs
- ▶ The up-scaling of mitigation activities e. g. through (sub-) sector level crediting, and policy crediting helps private sector actors to benefit from economies of scale
- ▶ Exploring the potential of digitization of measuring, reporting and verification (MRV), e. g. the use of sensors, internet of things, artificial intelligence and blockchain to make the project cycle more efficient and reduce transaction costs

Overall, the report stresses the importance of host country readiness to provide the private sector with a robust and trusted environment that allows for the adoption of Article 6 mechanisms.

Kurzbeschreibung

Private Akteure sollen sich verstärkt an der Minderung der Treibhausgasemissionen beteiligen. Dazu soll dies dem Privatsektor auch erleichtert werden. Artikel 6.4 des Pariser Übereinkommens erkennt diese Notwendigkeit ausdrücklich an. Im Rahmen des Clean Development Mechanism (CDM) hatten die Akteure des Privatsektors die Möglichkeit, an einem neuen und schnell wachsenden Markt teilzunehmen. Sie sahen sich jedoch verschiedenen Investitionshindernissen gegenüber. Die vorliegende Studie gibt einen Überblick über die wichtigsten Faktoren und Hindernisse, die die Beteiligung des Privatsektors an den Artikel 6 Mechanismen beeinflussen. Wir unterscheiden die drei Themen nachfrageseitige Faktoren, Regeln und Normen für Marktmechanismen sowie angebotsseitige Faktoren. Für jeden dieser Bereiche werden Optionen identifiziert, um Hindernisse abzubauen und zu überwinden.

In einer kurzen Analyse werden drei der identifizierten Optionen näher beschrieben:

- ▶ Damit der Privatsektor Emissionsreduktionen generieren und (international) verkaufen kann ist die Verbesserung der Ausgestaltung und die Unterstützung nationaler Systeme und Kapazitäten eine wichtige Voraussetzung.
- ▶ Die Möglichkeit, für private Akteure, von Skaleneffekten zu profitieren kann durch Up-scaling von Minderungsmaßnahmen unterstützt werden, beispielsweise durch Kreditierung auf (Teil-) Sektorebene oder Policy Crediting.
- ▶ Die Digitalisierung von Messung, Berichterstattung und Verifikation (MRV), z. B. durch den Einsatz von Sensoren, Internet der Dinge, künstlicher Intelligenz und Blockchain, birgt ein großes Potenzial. Digitalisiertes MRV kann insbesondere dazu beitragen den Projektzyklus von Minderungsmaßnahmen effizienter zu gestalten und Transaktionskosten zu senken.

Insgesamt ist hervorzuheben, dass es sehr wichtig ist, dass ein Gastland dem Privatsektor ein stabiles und vertrauenswürdiges Umfeld bietet und damit die Nutzung der Artikel 6 Mechanismen ermöglicht.

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Abbreviations

ACCUs	Australian carbon credit units
BAU	Business as usual
CMA	Conference of the Parties serving as Meeting of the Parties to the Paris Agreement
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CERs	Certified emission reductions from the CDM
CLI	Climate Ledger Initiative
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
ERU	Emission Reduction Units
ETS	Emission Trading System
EU ETS	European Union Emission Trading Scheme
GHG	Greenhouse gas
ITMO	Internationally Transferred Mitigation Outcomes
IMO	International Maritime Organization
IoT	Internet of Things
ITL	International Transaction Log
JI	Joint Implementation
LULUCF	Land use, land-use change and forestry
MRV	Measurement, Reporting, Verification
NDC	Nationally determined contribution
PDDs	Project Design Documents
PMR	Partnership for Market Readiness
RCCs	Regional Collaboration Centres
LT-LEDs	Long-term Low Emissions Development Strategies
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIDS	Small island developing states
UNFCCC	United Nations Framework Convention on Climate Change

Summary

The private sector is not only a large emitter of greenhouse gases, it also provides innovative solutions to address climate change. These multiple functions have been recognized by Parties when adopting the Paris Agreement and its Article 6.4, which explicitly aims to incentivize and facilitate the participation in the mitigation of greenhouse gas emissions by private entities (Art. 6.4 (b)).

Under the Clean Development Mechanism (CDM), private sector actors had the opportunity to participate in a new and fast-growing market but faced numerous challenging investment barriers. Given the more heterogeneous architecture of the Paris Agreement and the stronger role (host) country governments have been granted under the new regime, it appears that private sector actors might face even more barriers, in particular in countries with weaker institutions and authorities (e. g. for obtaining the authorisation).

For the following analysis, we distinguish between demand side factors, rules and standards for market mechanisms, and supply side factors.

Key factors determining private sector participation

Demand for units from the EU-ETS was the key driver of the earlier market under the CDM. However, the rules and standards of CDM and Joint Implementation (JI) were of limited robustness and allowed for the use of units which to a large share carried a high risk of being non-additional. As a result, CER and ERU prices remained far too low and provided no significant revenues compared with other cash-flows in a typical investment analysis of energy related projects. As a result, the private sector was stimulated by domestic subsidies (such as feed-in tariffs), but whether the flexible mechanism provided a source for additional activities is in many cases questionable.

So far, the stated demand for tradeable emission reductions by Parties under the Paris Agreement is minimal. Only very few Parties have indicated their plans to buy ITMOs in their NDCs while many Parties indicated they intend to sell units. Some Parties such as Switzerland and Sweden have indicated their interest to start purchasing mitigation outcomes from Article 6 pilot projects.

A certain level of demand for offsets may also be expected from the UN's International Civil Aviation Organization's (ICAO) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). However, this demand for new Article 6 activities will depend on the rules limiting the transitioning of CDM projects and legacy CERs, as existing legacy CERs may serve the expected CORSIA demand multiple times.

On the other hand, the emerging pilot schemes may lead to a certain demand for high quality ITMOs. This may be somewhat strengthened if such purchase schemes were scaled up, for instance, in the form of clubs of likeminded Parties aiming at higher ambition.

Rules and standards for market mechanisms are another key factor for the participation of the private sector. The dynamic evolution and some persistent ambiguities in rules and standards of the flexible mechanisms (e. g. regarding the concept of additionality and baseline setting) have led to complicated and time-consuming processes and uncertainty for investors under the CDM. These uncertainties led to considerable risks for private sector actors related to project approval, issuance of CERs and unit prices which are all barriers to investments in additional projects.

Under the Article 6 mechanisms of the Paris Agreement the situation for private sector actors may become even more challenging. The Article 6 text itself appears not to be free of ambiguities. Key topics generating uncertainty include single-year vs. multi-year accounting, timing and operationalization of corresponding adjustments, and avoidance of double counting in general. It has to be seen to which extent they will be solved by the expected Article 6 rulebook. With the weakening of centralized governance for the Article 6 mechanisms compared to a situation with the CDM EB as a centralized governing body in the CDM, it may be expected that the uncertainties for private sectors tend to increase compared to the situation under Kyoto.

Looking at *supply side factors*, host countries need investment readiness in order to facilitate private sector action. Article 6 activities are not fundamentally different from any other foreign direct investment project. Such investments are fostered, for instance, by sound institutional setting, sound regulatory setting, transparency, and competitive tax environment.

With the Paris Agreement, these domestically defined supply side challenges do not change in general. However, if for instance host countries define in the context of their Long-term Low Emissions Development Strategies (LT-LEDs) sectors in which they would like to see Article 6 activities, they may as part of their national mitigation planning provide incentives for the private sector to invest in that sector.

Overview of options to mitigate or overcome barriers

On the *demand side* the main option is the stimulation of demand for additional units that foster ambition raising in both acquiring and host countries. Acquiring countries committing to raise their ambition and strengthening demand for ITMOs is crucial for the establishment of a carbon market.

Possible instruments to foster ITMO demand by companies in acquiring countries are, for example, domestic emission trading systems (ETS) or carbon taxes that allow for the use of ITMOs to fulfil part of the obligations. This may include the so-called “insetting” approach, where companies invest into mitigation actions within their own supply chain.

Concerning Article 6 mechanisms and their potential of ambition raising, a combination of three approaches is favourable (Fuessler et al. 2019b):

- ▶ Direct ambition raising by adopting policies or mechanisms that result in more global emission reductions than targeted in countries’ NDCs. Two potential ways to achieve this are the voluntary cancellation of ITMOs by acquiring countries or the implementation of a requirement for “overall mitigation in global emissions” in combination with any international transfer.
- ▶ Implementing measures that encourage or foster raising ambitions through more stringent NDCs. This can be achieved by increased ambition levels coupled to participating in Article 6 mechanisms or by enhancing reporting and transparency to allow a broader coverage and ambition of NDCs.
- ▶ Ensuring environmental integrity and favourably defining policies that ensure an overall emission reduction by participating in Article 6 mechanisms.

Activities to raise ambition in host countries can be supported by Parties, bi- and multilateral institutions and initiatives. Particularly, target-setting and long-term planning are relevant as well as facilitated investments in new low-carbon technologies.

Regarding the *design of the rules and standards of the Article 6.4 mechanism* to support demand and facilitate private sector participation, rules should provide a clear framework to facilitate the role of national governments and enabling national systems and capacities. Further, the definition of clear and unambiguous rules and standards is crucial for private actors to participate in carbon markets. Private sector participation and demand for ITMOs can be supported by rules that allow for up-scaling of projects. Further, digitization of MRV and distributed ledger technologies have the potential to generate efficiency gains and increase trust in registries and unit tracking.

On the supply side, it is important to foster host country investment readiness facilitating private sector action. Many countries already receive support for investment readiness (e. g. through the World Bank, development agencies, etc.). This support has to be continued and expanded under the Paris Agreement. Sound institutional and regulatory settings and transparency are crucial to increase investment readiness in host countries. Regarding the investment sectors, it is favourable to build on domestic strengths of a host country’s specific market context. For this reason, host countries could be supported to develop strategy studies regarding Article 6 mechanisms, e. g. in combination with their LT-LEDs development.

Specific options fostering private sector participation

Based on the given overview, the study provides an explorative analysis focussing on three topics: the design and support of national systems and capacities, allowing for up-scaling of projects, and exploring the potential through digitization of MRV.

Any private sector activity depends on well *designed and supported national systems and capacities*. In countries that do not do their “transparency related homework”, the implementation of private sector Article 6 activities may sooner or later run into barriers, e. g. if the international transfer to a buying country cannot be executed or is delayed, because the tracking and registry information is not available to assure corresponding adjustments, or a host country takes back its authorization of a transfer because the mitigation action is not visible in the national GHG inventory.

Domestic rules for participation in carbon markets as outlined in Article 6 of the Paris Agreement have to be defined by host country governments. Countries with weaker governments will need assistance in defining and establishing these rules. Bilateral processes or partnerships are possible ways to foster this. An efficient and robust national system for authorizing the use and transfer of emission reduction credits to other countries is necessary, allowing for transparency and predictable revenues for private investors.

Allowing for up-scaling of projects is mainly driven by the need for rapid reduction of global GHG emissions and the perceived shortcomings of the Clean Development Mechanism (CDM). This is assumed to lead to a simplification of the process for registration of individual projects and the issuance of credits and reduce transaction costs. Up-scaled crediting may further foster private sector participation by aligning the crediting level with the national or sectoral policy-level which actually triggers private sector activities. Up-scaled crediting could also reduce investment risks and regulatory uncertainty for the private sector. Registering domestic policies internationally as Article 6.4 activities may provide some safeguard against sudden changes at the international level.

On the other hand, scaling-up poses new challenges. Transaction costs and risks are shifted from the private sector to the national regulator. At the same time, challenges related to the causality of emission reductions remain as up-scaled approaches will also have to ensure that the actual mitigation activities will actually be incentivised by these policies.

In order to increase the scale of mitigation activities under Article 6.4, one first step is to ensure that the provisions and definitions of the mechanism do not exclude such type of activities. Similarly, the governance functions of the Article 6.4 mechanism should be designed with policy-based mitigation activities in mind. Allowing scaled-up crediting will further require an entire new set of methodologies for additionality demonstration, baseline calculation and MRV. Top-down development of these methodologies and capacity building measures that support host Parties in developing policy-based crediting activities could foster the emergence of up-scaled crediting.

The use of *digital tools and processes for Measuring, Reporting and Verification (MRV)* has the potential to address and significantly reduce many of the related challenges and barriers along the entire project cycle:

Data coverage, accuracy and reliability can be improved drastically by using technology, such as sensors or mobile phones to capture data. Data collection and processing can be automated, e. g. by using Internet of Things (IoT). The combination of remote sensing with new data processing approaches including artificial intelligence potentially allows for the automated monitoring of forest areas and land use patterns. The emerging Blockchain (or “DLT”) technology can contribute to secure data logging, by making the recorded data immutable.

Regarding impact quantification and reporting, “smart contracts” (i. e. small programs on a blockchain that securely carry out certain calculations) and online applications linked to automated data capturing and processing have many advantages compared to counting up by hand using complex spreadsheets. Automated impact calculation, based on collected data and preset methodological approaches, would improve reliability, increase efficiency of this process and foster trust in outcomes.

In the process of impact verification, technologies like certified sensors and data transfer, smart contracts on blockchains could speed up and facilitate the process through real-time verification. Such systems allowing for automated quality assurance and quality control can be implemented by checking monitoring data for plausibility, consistency and outliers. Artificial intelligence can help to detect potential irregularities and areas of higher risk.

For the final issuance of units, technologies like registries building on blockchain or other distributed ledger technologies allow for trusted registry systems that are accepted by all stakeholders. The application of blockchain technology makes any changes immutable and allows for full transparency in tracking ITMO transactions. Besides information on carbon assets, such registries may also contain attributes of sustainability impacts of the mitigation actions. This kind of digital systems may also enable to link up with other registry systems and therefore allow for a linking of carbon markets beyond specific registry systems. This may require also the automated conversion of mitigation outcome units.

Digitizing MRV is only emerging and needs further research, development and field trials of approaches. Current issues range from technical aspects in data collection such as speed and lacking connectivity, to cost of monitoring equipment or needed capacities to train staff, interfaces for data reporting, adaptation of methodological approaches to digitization of MRV, to the need for strategies and harmonized implementation frameworks and governance for digital MRV.

Zusammenfassung

Der Privatsektor ist ein großer Verursacher von Treibhausgasemissionen. Er bringt aber auch viele innovative Lösungen zur Bekämpfung des Klimawandels hervor. Artikel 6.4 des Pariser Abkommens nennt deshalb auch ausdrücklich die Beteiligung privater Rechtsträger an der Minderung der Treibhausgasemissionen (Art. 6.4 (b)).

Der Clean Development Mechanism (CDM) erlaubte es den Akteuren des Privatsektors, an einem neuen und schnell wachsenden Markt teilzunehmen. Private Akteure sahen sich aber mit zahlreichen und herausfordernden Investitionsbarrieren konfrontiert. Angesichts der heterogeneren Architektur des Pariser Abkommens und der stärkeren Rolle, die den Regierungen der (Gast-)Länder im Rahmen der neuen Regelung zukommt, scheint es, dass Akteure des Privatsektors mit noch größeren Hindernissen konfrontiert sein könnten. Insbesondere in Ländern mit schwächeren Institutionen und Behörden wird dies eine Herausforderung (z. B. in Bezug auf die Genehmigung der Emissionsminderungen für den internationalen Handel).

Für die folgende Analyse unterscheiden wir zwischen *nachfrageseitigen Faktoren, Regeln und Standards für Marktmechanismen sowie angebotsseitigen Faktoren*.

Schlüsselfaktoren für die Beteiligung des Privatsektors

Die Nachfrage nach Einheiten aus dem EU-ETS war der wichtigste Treiber für den CDM Markt. Jedoch waren die Regeln und Standards des CDM, wie auch der Joint Implementations (JI), nur bedingt robust. Das führte dazu, dass auch Zertifikate verwendet werden konnten, die oft auch aus vermutlich nicht zusätzlichen Projekten stammten. Infolgedessen blieben die Preise für Emissionsreduktion (CER und ERU) viel zu tief und lieferten im Vergleich zu anderen Investitionen in energiebezogene Projekte keinen signifikanten Anteil an den Erträgen des Projekts. In solchen Projekten wurde der Privatsektor eher durch inländische Subventionen (z. B. Einspeisevergütungen) stimuliert. Ob die flexiblen Marktmechanismen einen Anreiz für zusätzliche Aktivitäten gesetzt haben, ist in vielen Projekten fraglich.

Bisher haben nur sehr wenige Länder ihre Absicht bekundet, in den Marktmechanismen des Pariser Abkommens als Käufer aufzutreten. Nur sehr wenige Parteien haben ihre Pläne zum Kauf von ITMOs in ihren NDCs mitgeteilt. Demgegenüber haben viele Parteien angegeben, dass sie beabsichtigen, Emissionsminderungen an andere Länder verkaufen zu wollen. Einige Vertragsparteien, wie die Schweiz und Schweden, haben ihr Interesse bekundet, mit dem Kauf von Minderungsergebnissen aus Pilotprojekten nach Artikel 6 zu beginnen.

Eine gewisse Nachfrage nach Emissionsminderungen ist auch vom Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) der Internationalen Zivilluftfahrtorganisation der Vereinten Nationen (ICAO) zu erwarten. Diese neue Nachfrage nach Aktivitäten nach Artikel 6 wird jedoch von den Regeln abhängen, die den Übergang von CDM-Projekten und älteren CERs einschränken, da bestehende alte CERs den erwarteten CORSIA-Bedarf an Emissionsminderungen mehrfach decken können.

Andererseits können die entstehenden Pilot-Marktmechanismen zu einer gewissen Nachfrage nach qualitativ hochwertigen ITMOs führen. Dies könnte etwa verstärkt werden, wenn Handelssysteme ausgeweitet würden, z. B. in Form von Clubs gleichgesinnter Parteien, die höhere Ambitionen in ihren Emissionsreduktionszielen verfolgen.

Regeln und Normen für Marktmechanismen sind ein weiterer Schlüsselfaktor für die Beteiligung des Privatsektors. Die dynamische Entwicklung und einige Unklarheiten, die weiterhin in den Regeln und Standards der flexiblen Marktmechanismen bestehen (z. B. hinsichtlich des Konzepts der Zusätzlichkeit und der Festlegung der Ausgangsbasis), haben zu komplizierten und zeitaufwändigen Prozessen sowie Unsicherheit für die Investoren im Rahmen des CDM geführt. Diese Unsicherheiten führten zu erheblichen Risiken für Akteure des Privatsektors im Zusammenhang mit der Projektgenehmigung, der Bereitstellung von CERs sowie den CER-Preisen und sie stellen somit Hindernisse für Investitionen in zusätzliche Projekte dar.

Unter den Mechanismen nach Artikel 6 des Pariser Abkommens kann die Situation für Akteure des Privatsektors noch schwieriger werden. Der Artikel 6 Text selbst scheint nicht frei von Unklarheiten zu sein. Zu den wichtigsten Themen, die Unsicherheiten generieren, gehört die Frage nach ein- oder mehrjährigen Anrechnungsperioden, der Zeitpunkt und die Operationalisierung der dazugehörigen Anpassungen sowie die Vermeidung von Doppelzählungen im Allgemeinen. Es muss sich zeigen, inwieweit sie durch das erwartete Regelbuch zu Artikel 6 gelöst werden. Mit der Schwächung der zentralisierten Leitung für die geplanten Artikel-6-Mechanismen im Vergleich zu der Situation unter dem CDM, mit dem CDM EB als zentralisiertem Leitungsorgan, ist zu erwarten, dass die Unsicherheiten für den Privatsektor im Vergleich zur Situation unter dem Kyoto-Regime tendenziell zunehmen.

Unter Berücksichtigung der *angebotsseitigen Faktoren* müssen die Gastländer die Bereitschaft für Investitionen schaffen, um die Aktivitäten des Privatsektors zu erleichtern. Artikel-6-Aktivitäten sind im Grundsatz nichts anderes als Direktinvestitionsprojekte im Ausland. Solche Investitionen werden beispielsweise durch einen soliden institutionellen Rahmen, einen soliden Regulierungsrahmen, Transparenz und ein wettbewerbsfähiges Steuerumfeld gefördert.

Mit dem Pariser Abkommen ändern sich diese nationalen Herausforderungen auf der Angebotsseite im Allgemeinen nicht. Wenn die Gastländer jedoch beispielsweise im Rahmen ihrer Long Term Low Emissions Development Strategies (LT-LEDs) definieren, in welchen Sektoren sie sich Aktivitäten nach Artikel 6 wünschen, dann können sie im Rahmen ihrer nationalen Pläne zur Minderung der Treibhausgasemissionen Anreize für den Privatsektor schaffen, damit stärker in diesen Sektoren investiert wird.

Überblick über die Möglichkeiten Barrieren abzubauen oder zu überwinden

Auf der *Nachfrageseite* ist die naheliegendste Möglichkeit die Nachfrage nach zusätzlichen Einheiten zu stimulieren, die zu einer Steigerung des Ambitionsniveaus sowohl in den Käufer- als auch in den Gastländern beitragen. Die Käuferländer, die sich verpflichten, ihre Ambitionen bezüglich Emissionsminderungen zu erhöhen und die Nachfrage nach ITMOs zu verstärken, sind entscheidend für den Aufbau eines Marktes für den Emissionshandel.

Mögliche Instrumente die Nachfrage nach ITMOs bei Unternehmen in Käuferländern zu steigern sind beispielsweise nationale Emissionshandelssysteme (ETS) oder CO₂-Steuern. Diese ermöglichen es, ITMOs zur Erfüllung eines Teils der Verpflichtungen zu nutzen. Dies kann den sogenannten „Insetting“-Ansatz beinhalten, bei dem Unternehmen in Minderungsmaßnahmen innerhalb ihrer eigenen Lieferkette investieren.

Was die Artikel 6 Mechanismen und ihr Potenzial zur Steigerung der Ambitionen betrifft, so ist eine Kombination von drei Ansätzen vorteilhaft (Fuessler et al. 2019b):

- ▶ Direkte Ambitionssteigerung durch die Annahme von Politiken oder Mechanismen, die zu mehr globalen Emissionsreduktionen führen, als in den NDCs der Länder angestrebt. Zwei Optionen, dies zu erreichen, sind die freiwillige Annullierung von ITMOs durch Käuferländer oder die Einführung von Anforderungen zur „gesamthafter Minderung der globalen Emissionen“ in Kombination mit einem internationalen Transfer von Einheiten.
- ▶ Umsetzung von Maßnahmen, die höhere Ambitionen durch strengere NDCs fördern. Dies kann erreicht werden, durch gesteigerte Ambitionen in Verbindung mit der Teilnahme an den Mechanismen nach Artikel 6 oder durch eine Verbesserung der Berichterstattung und mehr Transparenz, um eine breitere Abdeckung und strengere NDCs zu ermöglichen.
- ▶ Gewährleistung der Umweltintegrität und Einführung von Politiken, die eine Gesamtemissionsminderung, durch die Teilnahme an den Mechanismen nach Artikel 6, gewährleisten.

Aktivitäten zur Steigerung der Ambitionen in den Gastländern können von Vertragsparteien, bi- und multilateralen Institutionen und Initiativen unterstützt werden. Insbesondere die Zielsetzung und die langfristige Planung sind relevant, ebenso wie erleichterte Investitionen in neue kohlenstoffarme Technologien.

Was die *Gestaltung der Regeln und Normen des Mechanismus nach Artikel 6.4* zur Unterstützung der Nachfrage und zur Erleichterung der Beteiligung des Privatsektors betrifft, so sollten die Regeln einen klaren Rahmen bieten. Das ist wichtig, um den nationalen Regierungen ihre Rolle zu erleichtern und den Aufbau nationaler Systeme und Kapazitäten zu ermöglichen. Darüber hinaus ist die Definition klarer und eindeutiger Regeln und Normen von entscheidender Bedeutung für die Teilnahme privater Akteure an den Emissionshandelsmärkten.

Die Beteiligung des Privatsektors und die Nachfrage nach ITMOs können durch Regeln unterstützt werden, die eine Skalierung von Projekten ermöglichen. Darüber hinaus haben die Digitalisierung von MRV- und die Nutzung von Distributed-Ledger-Technologien das Potenzial, Effizienzsteigerungen zu erzielen und das Vertrauen in Handelsregister und die Nachverfolgung von einzelnen Emissionsreduktionseinheiten zu erhöhen.

Auf der *Angebotsseite* ist es wichtig, die Investitionsbereitschaft des Gastlandes zu fördern, um dem Privatsektor Aktivitäten zu erleichtern. Viele Länder erhalten bereits Unterstützung zur Verbesserung der Investitionsbereitschaft (z. B. durch die Weltbank oder Entwicklungsagenturen). Diese Unterstützung muss im Rahmen des Pariser Abkommens fortgesetzt und ausgebaut werden. Gesunde institutionelle und regulatorische Rahmenbedingungen und Transparenz sind entscheidend, um die Investitionsbereitschaft in den Gastländern zu erhöhen. Was die Sektoren anbelangt, in welchen investiert werden soll, so ist es vorteilhaft, auf den inländischen Stärken des spezifischen Marktumfelds eines Gastlandes aufzubauen. Aus diesem Grund könnten Gastländer bei der Entwicklung von Strategiestudien zu den Artikels 6 Mechanismen unterstützt werden, z. B. in Kombination mit ihrer LT-LEDS-Entwicklung.

Spezifische Optionen, wie die Beteiligung des Privatsektors gefördert werden kann

Die Studie liefert, basierend auf dem gegebenen Überblick, eine explorative Analyse, die sich auf folgende drei Themen konzentriert: die Konzeption und Unterstützung nationaler Systeme und Kapazitäten, die Möglichkeit Projekte zu skalieren und die Erforschung des Potenzials durch die Digitalisierung von MRV.

Die Handlungen des Privatsektors hängen von gut *konzipierten nationalen Systemen und ausreichenden Kapazitäten* ab. In Ländern, die ihre „transparenzbezogenen Hausaufgaben“ nicht machen, kann die Umsetzung von Artikel-6-Aktivitäten durch den Privatsektor früher oder später auf Hindernisse stoßen. Beispielsweise, wenn der internationale Transfer in ein Käuferland nicht durchgeführt werden kann oder sich verzögert, weil die Tracking- und Registrierungsinformationen nicht verfügbar sind, um entsprechende Anpassungen zu gewährleisten oder weil ein Gastland seine Genehmigung für einen Transfer zurücknimmt, weil die Minderungsmaßnahmen im nationalen Treibhausgasinventar nicht sichtbar sind.

Die inländischen Regeln für die Teilnahme an den CO₂-Märkten gemäß Artikel 6 des Pariser Übereinkommens müssen von den Regierungen der Gastländer festgelegt werden. Länder mit schwächeren Regierungen werden bei der Definition und Festlegung dieser Regeln Unterstützung benötigen. Bilaterale Prozesse oder Partnerschaften sind mögliche Wege, dies zu fördern. Ein effizientes und robustes nationales System für die Genehmigung der Verwendung und Übertragung von Emissionsreduktionsgutschriften an andere Länder, das Transparenz und kalkulierbare Erträge für private Investoren ermöglicht, ist notwendig.

Die Möglichkeit, Minderungsmaßnahmen zu skalieren, wird hauptsächlich durch die Notwendigkeit einer raschen Reduzierung der globalen Treibhausgasemissionen und die wahrgenommenen Mängel des Clean Development Mechanism (CDM) getrieben. Dies soll das Verfahren zur Registrierung einzelner Projekte und zur Vergabe von Gutschriften vereinfachen und die Transaktionskosten reduzieren. Die Skalierung von Minderungsmaßnahmen könnte zudem die Beteiligung des Privatsektors fördern, indem das Crediting-Level an dem Level der nationalen oder sektoralen Politik ausgerichtet wird, welches in der Regel ohnehin die Maßnahmen privater Akteure antreibt. Durch die Skalierung von Minderungsmaßnahmen könnten darüber hinaus Investitionsrisiken und regulatorische Unsicherheiten für den Privatsektor verringert werden. Die internationale Registrierung nationaler Politiken als Artikel 6.4-Maßnahmen könnte dem Privatsektor einen gewissen Schutz vor unvorhergesehenen Änderungen auf internationaler Ebene bieten.

Andererseits bringt die Skalierung neue Herausforderungen mit sich. Transaktionskosten und Risiken werden vom Privatsektor auf die nationale Regulierungsbehörde verlagert. Zugleich bleiben Herausforderungen hinsichtlich der Kausalität von Emissionsminderungen bestehen und auch skalierte Ansätze müssen sicherstellen, dass die Minderungsmaßnahmen tatsächlich durch sie angestoßen wurden.

Um Minderungsmaßnahmen unter Artikel 6.4 zu skalieren, gilt es zunächst sicherzustellen, dass die Vorgaben und Definitionen des Mechanismus solche Maßnahmen nicht ausschließen. Auch die Governance-Funktionen des Mechanismus unter Artikel 6.4 sollten unter Berücksichtigung sektoraler und politikbasierter Maßnahmen ausgestaltet werden. Die Skalierung von Crediting-Maßnahmen wird darüber hinaus eine ganze Reihe neuer Methoden für den Zusätzlichkeitsnachweis, die Baseline-Festlegung und das MRV erfordern. Die Top-Down-Entwicklung dieser Methoden sowie Maßnahmen zum Kapazitätsaufbau, die Gastgeberländer bei der Entwicklung politikbasierter Minderungsmaßnahmen unterstützen, könnten die Skalierung von Crediting-Maßnahmen fördern.

Der Einsatz *digitaler Hilfsmittel und Prozesse für die Messung, Berichterstattung und Verifizierung (MRV)* der Emissionsreduktionen hat das Potenzial, viele der damit verbundenen Herausforderungen und Barrieren entlang des gesamten Projektzyklus anzugehen und deutlich zu reduzieren:

Die Datenabdeckung, Genauigkeit und Zuverlässigkeit können durch den Einsatz von Technologien, wie Sensoren oder Mobiltelefonen zur Datenerfassung, drastisch verbessert werden. Die Datenerhebung und -verarbeitung kann automatisiert werden, z. B. über das Internet der Dinge (IoT). Die Kombination von Fernerkundung mit neuen Datenverarbeitungsansätzen, einschließlich künstlicher Intelligenz, eröffnet möglicherweise die automatisierte Überwachung von Waldflächen und Landnutzungsmustern. Die aufkommende Blockchain- (oder DLT-) Technologie kann zur sicheren Datenerfassung beitragen, indem sie die aufgezeichneten Daten unveränderbar macht.

In Bezug auf die Wirkungsquantifizierung und -berichterstattung haben „Smart Contracts“ (d. h. kleine Programme auf einer Blockchain, die bestimmte Berechnungen sicher und automatisiert durchführen) und Online-Anwendungen, die mit der automatisierten Datenerfassung und -verarbeitung verbunden sind, viele Vorteile gegenüber der manuellen Zählung mit Hilfe komplexer Tabellenkalkulationen. Eine automatisierte Wirkungsberechnung, die auf den gesammelten Daten und vordefinierten Methoden basiert, würde die Zuverlässigkeit verbessern, die Effizienz dieses Prozesses steigern und das Vertrauen in die Ergebnisse fördern.

Bei der Erfassung und Berechnung der Minderungswirkung können Technologien wie zertifizierte Sensoren, automatisierte Datentransfers und Blockchain basierte Smart Contracts den Prozess durch Echtzeit-Verifizierung effizienter machen und beschleunigen. Solche Systeme erlauben auch eine automatisierte Qualitätssicherung und Qualitätskontrolle. Diese kann durch das Einbauen einer Prüfung der Messdaten auf Plausibilität, Konsistenz und Ausreißer erreicht werden. Künstliche Intelligenz kann helfen, potenzielle Unregelmäßigkeiten und Bereiche mit erhöhter Unsicherheit zu erkennen.

Für die endgültige Ausgabe von Zertifikaten ermöglichen Handelsregister, die auf Technologien wie Blockchain oder anderen Distributed-Ledger-Technologien aufbauen, vertrauenswürdige Registersysteme zu schaffen, die von allen Beteiligten akzeptiert werden. Der Einsatz der Blockchain-Technologie ermöglicht vollständige Transparenz bei der Verfolgung von ITMO-Transaktionen. Neben Informationen über die Emissionsminderung und das Projekt, können solche Register auch Attribute der Nachhaltigkeitsauswirkungen der Minderungsmaßnahmen enthalten. Diese Art von digitalen Systemen kann auch eine Verknüpfung mit anderen Registersystemen ermöglichen und somit eine Verknüpfung der Emissionshandelsmärkte über bestimmte Registersysteme hinaus ermöglichen. Dies kann auch die automatisierte Konvertierung von Ergebniseinheiten zur Risikominderung erfordern.

Die Digitalisierung von MRV ist erst im Aufbau und erfordert noch weitere Forschung, Entwicklung und Feldversuche von Ansätzen. Die aktuellen Themen reichen von technischen Aspekten der Datenerhebung wie Geschwindigkeit und fehlende Konnektivität, über die Kosten der Messausrüstung, fehlende Kapazitäten für die Schulung des Personals, Schnittstellen für die Datenberichterstattung, notwendige Anpassung methodischer Ansätze zur Digitalisierung von MRV, bis hin zur Notwendigkeit von Strategien und harmonisierten Umsetzungsrahmen sowie Richtlinien für digitales MRV.

1 Introduction

Private actors are key for the implementation of GHG emission reductions of the scale required by the Paris Agreement's long-term temperature goal. The private sector is both a large emitter of greenhouse gases while also providing for innovative solutions to address climate change. Furthermore, private sector investments can make an important contribution to mitigate climate change. These multiple functions have been recognized by Parties when adopting the Paris Agreement and its Article 6.4, which explicitly aims to incentivize and facilitate the participation in the mitigation of greenhouse gas emissions by private entities (Art. 6.4 (b)).

Under the Clean Development Mechanism (CDM), private sector actors had the opportunity to participate in a new and fast-growing market, but also faced numerous barriers challenging investments. Given the more heterogeneous architecture of the Paris Agreement and the stronger role (host) country governments have been granted under the new regime, it appears that private sector actors might even be confronted with more challenges, in particular in countries with weaker institutions and authorities (e. g. for obtaining the authorisation). At the same time, the Article 6.4 mechanism constitutes a fresh start. The need to develop a new mechanism from zero provides an opportunity to take on board positive lessons from the Kyoto mechanisms and to avoid the problems they were associated with.

With regard to the role of the private sector in Article 6 activities, two types of actors can be distinguished:

- a) **Infrastructure:** Investors and developers of infrastructure for mitigation activities such as new wind farms, equipment for the utilization of landfill gas or electric busses. These actors are responsible for the main infrastructure investment.
- b) **Transaction:** Carbon developers, aggregators, consultants, validators, verifiers, private carbon standards etc. who enable the monetization of the mitigation outcomes generated. These actors are responsible for enabling the transaction under Article 6.

In the following, we focus on incentives for private sector actors related to infrastructure (a).

2 Key factors determining private sector participation in Article 6 mechanisms

Three types of main barriers for increased private sector participation may be distinguished, based on history with the CDM and outlook on Article 6 mechanisms: demand side factors, factors related to rules and standards for market mechanisms and supply side factors.

A. Demand side factors

The history of the CDM is characterized by a learning-by-doing approach. With the introduction of CERs as a global currency for emission reductions, mitigation measures were increasingly seen as attractive investment opportunities. Entrepreneurs, governments and NGOs were engaging in tapping existing mitigation potential and develop strategies for realizing this potential under the CDM. These commercial activities were made in expectation of financial returns which in turn were linked to the demand for CERs and respective prices. Measured by the number of projects, the mechanism has been highly successful. The CDM registry currently records nearly 8,000 projects. The CDM Policy Dialogue in 2012 concluded that the mechanism had mobilised USD 215 billion in investments (CDM Policy Dialogue 2012).

However, there is a question mark on the extent to which these projects actually constituted additional private sector activity that would not have happened in absence of the CDM. With the exception of the “golden era” of high demand and attractive prices of the CDM 2007 – 2008, lack in demand and low prices for units has defined most of the period of the flexible mechanisms under the Kyoto protocol as the EU was the only larger scale buyer and other players with potential large-scale demand such as the US pulled out early. When demand took up from EU-ETS installations in 2007, the price difference between the EU-ETS allowance price and units from the Flexible Mechanisms lead to significant influx of CERs and ERUs in the EU-ETS. However, the rules and standards of CDM and JI were of limited robustness and allowed for the use of units which to a large share carried a high risk of being non-additional (e. g. from the massive expansion of power generation from wind and hydro as prescribed in the Chinese 5-year-plans) (cf. Cames et al. 2016, pp. 105 ff.). As a result, CER and ERU prices remained far too low and provided no significant revenues compared with other cash-flows in a typical investment analysis of energy related projects. For instance, the impact of the revenues from CERs on the project IRR is the lowest for renewables including hydro and wind (increase of IRR by 2–3 percentage-points), fuel switch (4 percentage-points), and energy efficiency in power generation (5 percentage-points) (see section 2.4 in Cames et al. 2016). As a result, the private sector was stimulated by domestic subsidies (such as feed-in tariffs), but whether the flexible mechanism provided a source for additional activities is in many cases questionable.

In order to be sure to trigger private sector investments that would not happen anyhow, market mechanisms would need to provide much higher cash flow contributions that are more in the order of related fuel savings or fuel price uncertainties, i. e. be more in the order of 20 – 300EUR/tCO₂ (see section 2.4 in Cames et al. 2016). Even at the height of the CDM market in 2008, secondary CERs fetched only a maximum at around 20 EUR/tCO₂, while the offtake of primary CERs from projects barely reached the 14 EUR threshold (World Bank, State and Trends of the Carbon Market 2009, section 2.1.1).

With the Paris Agreement, stated demand from Parties so far is minimal. Only very few Parties have indicated their plans to buy ITMOs in their NDCs while many Parties indicated they intend to sell units (Obergassel and Gornik 2015). Some Parties such as Switzerland and Sweden have indicated their interest to start purchasing mitigation outcomes from Article 6 pilot projects.

The UN’s International Civil Aviation Organization (ICAO) is launching its Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This may lead to a certain level of demand. However, if no steps are taken to severely limit the transitioning of CDM projects and legacy CERs, this demand would be annihilated, as forecast CORSIA demand until 2035 could be served multiple times with existing or dormant legacy CERs from the period until 2020 (Warnecke et al. 2019).

On the other hand, the emerging pilot schemes may lead to a certain demand for high quality ITMOs. This may be somewhat strengthened if such purchase schemes were scaled up e. g. in the form clubs of likeminded Parties aiming at higher ambition.

B. Rules and standards for market mechanisms

The dynamic evolution and some persistent ambiguities in rules and standards of the flexible mechanisms have led to complicated and time-consuming processes and uncertainty for investors under the CDM. These uncertainties led to considerable risks for private sector actors related to project approval, issuance of CERs and unit prices which are all barriers to investments in additional projects.

An example are the rules on how to deal with climate related policies in the host country and to which extend they need to be taken into account (“E+/E- inconsistency”, see Fuessler 2012). The application of these conflicting rules in the concrete country context of CDM interventions brought lots of uncertainty. On a governance level, the CDM Executive Board was for a long time not able to solve such fundamental questions in particular around the interpretation of additionality and baseline rules, and many of the more political questions remained unsolved.

On a more technical level, there was a better progress of reforms. The CDM methodologies and MRV provisions were improved, revised and consolidated over time, and the CDM EB streamlined its processes and the project cycle, which brought more clarity for project developers. However, for some project types, in particular for smaller dispersed emission sources such as cookstoves and vehicles, or less standardized project situations, the transaction costs for MRVing were still rather high (in particular compared to the very low CER revenues in the later years of the CDM), which limited the use of carbon market revenues to scale up these project types. MRV costs can, for instance, rise to 1.20 EUR/tCO₂ and above for diffused small-scale projects (see Shishlov & Bellassen 2016, pp. 706ff.).

Given the limited level of clarity of some of the CDM rules, in particular regarding additionality or in the determination of baseline emissions, the role of designated national authorities (DNAs) and designated operational entities (DOEs) led to uncertainties and cost increases, as the project approval and the cost for its validation and verification were not clearly predictable for all project types. This was particularly the case for projects which are less standardized in baseline setting, such as wind turbines but where each project was different, e. g. as in individual industrial energy efficiency measures, where e. g. the determination of baseline emissions was less straightforward and required specific technical knowledge.

Because of these uncertainties, the additional CER revenue has been subject to high risks. Ex ante, project developers could not be sure whether their project would be registered, whether it would actually achieve the expected amount of emission reductions and which price they would receive for the CERs. Relying on CER revenues to make an otherwise unprofitable project profitable was therefore a very uncertain proposition.

Another challenge has been that projects often require financing before the start of the project. CERs, however, are only generated when the project is already operational. While there have been some purchasing programmes where it has been possible to receive part of the CER revenue upfront, the dominant market model has been “payment on delivery” which increased the vulnerability to uncertainties related to rules and standards.

Under the Article 6 mechanisms of the Paris Agreement the situation for private sector actors may become even more challenging. The Article 6 text itself appears not to be free of ambiguities. For example, there is no formal definition of environmental integrity, and its not clear how it should be operationalized, and what governance is needed to be put in place (ADB 2018). Also, the current draft of the related rulebook seems to again push the ambiguities from the negotiations down to the operational level. Key topics generating uncertainty include single-year vs. multi-year accounting, timing and operationalization of corresponding adjustments, and avoidance of double counting in general. It has to be seen to which extend they will be solved by the expected Article 6 rulebook. With the weakening of centralized governance for the Article 6 mechanisms compared to a situation with the CDM EB as a centralized governing body in the CDM, it may be expected that the uncertainties for private sectors tend to increase compared to the situation under Kyoto.

C. Supply side factors

Host countries need investment readiness in order to facilitate private sector action. Article 6 activities are not fundamentally different from any other foreign direct investment project. Such investments are fostered by sound institutional setting, sound regulatory setting, transparency, competitive tax environment etc.

This is probably the most important barrier preventing the wider private sector action based on direct foreign investment (and carbon markets) and may be the main factor in preventing a geographically equal distribution of carbon market projects.

A strong development of robust climate policies and rules on a national and international level is a necessary pre-condition to foster Article 6 activities. However, an underlying lack of general investment readiness in potential host countries can barely be influenced by the design and rules of carbon market projects, although there have been attempts to do so, e. g. by allowing for simplified MRV procedures for LDC/ SIDS countries. Similarly, the introduction of Programmes of Activities, which allowed targeting smaller and geographically dispersed emission sources which are found in many countries previously neglected by the CDM, was also intended to reduce the geographic unequal distribution of the CDM (Kreibich et al 2017).

With the Paris Agreement, these domestically defined supply side challenges do not change in general. However, if for instance host countries define in the context of their Long-term Low Emissions Development Strategies (LT-LEDs) sectors in which they would like to see Article 6 activities, they may as part of their national mitigation planning provide incentives for the private sector to invest in that sector.

3 Overview of options to mitigate or overcome barriers

This section provides an overview of options to improve key factors for Article 6 participation and to mitigate the above-mentioned barriers to private sector participation. The mitigation options are grouped in the same manner as the factors and barriers: (A.) demand side, (B.) rules and standards for market mechanisms and (C.) supply side. A selection from these options will be explored in further detail in the subsequent chapter 4.

A. Demand side: Stimulation of demand for additional units that foster ambition raising in both acquiring and host countries

Acquiring countries committing to raise their ambition and strengthening demand for ITMOs is crucial for the establishment of a carbon market. This can be achieved by a number of approaches (CCAP 2017, Warnecke et al. 2018, Fuessler et al. 2019a, Fuessler et al. 2019b, Michaelowa et al. 2019):

Demand for additional units can be stimulated by increasing NDC goals and purchasing additional ITMOs. As overall compliance costs can be reduced with trade of emission reductions, acquiring countries could revise their NDC targets for emission reductions and cover a part of it with additional ITMOs. In this way, more emission reductions could be achieved, while the cost of compliance for the acquiring country might be the same. Revised NDCs would further send a signal to the market about increased ITMO demand.

Possible instruments to foster ITMO demand by companies in acquiring countries are, for example, domestic emission trading systems (ETS) or carbon taxes. In the case of ETS, participating installations may acquire and use ITMOs towards meeting their emissions cap. In carbon tax systems, taxed entities may purchase (domestic) mitigation outcomes to lower their net emissions that are subject to the tax and therefore reduce their tax burden. The policy design has to make sure that at least part of the gains from trade are captured and translated into increased ambition at the national level. Therefore, if entities under the domestic carbon pricing instruments are allowed to use lower cost international offsets, stringency of the national systems has to be increased, e. g. by setting more ambitious overall caps in domestic ETS or higher carbon taxes. A big advantage of creating demand by increased stringency of domestic carbon pricing instruments is that these instruments are reliable and tested policies with more certainty of an adjustments' outcome.

Savings from reduced compliance costs by using imported ITMOs can also be invested directly in low-carbon technologies as a form of climate finance. Results-based financing, for instance, helps to overcome market failures constraining private sector activities in this field by payment upon delivery of prespecified results. Further, private compliance entities under domestic carbon pricing instruments could be obligated to reinvest savings generated from ITMO use.

In the so-called “insetting” approach, companies invest into mitigation actions within their own supply chain. E. g. a coffee company invests into low carbon drying technologies for coffee beans in the country of origin in order to generate ITMOs to offset production emissions in Europe.

Concerning Article 6 mechanisms and their potential of ambition raising, a combination of three approaches is favourable (Fuessler et al. 2019b):

- ▶ Direct ambition raising by adopting policies or mechanisms that result in more global emission reductions than targeted in countries' NDCs. Two potential ways to achieve this are the voluntary cancellation of ITMOs by acquiring countries or the implementation of a requirement for “overall mitigation in global emissions” in combination with any international transfer.
- ▶ Implementing measures that encourage or foster raising ambitions through more stringent NDCs. This can be achieved by increased ambition levels coupled to participating in Article 6 mechanisms or by enhancing reporting and transparency, which improves data availability and quality and thereby facilitates a broader coverage and higher ambition of NDCs.
- ▶ Ensuring environmental integrity and favourably defining policies that ensure an overall emission reduction by participating in Article 6 mechanisms.

Purchase programs may also be operationalized through the design of a bilateral or multilateral facility to purchase emission reductions generated under Article 6 mechanisms, including price guarantees for higher cost project activities, general guarantees, up-front financing, and derisking approaches.

Other instruments for ambition raising are government credit acquisition funds (Michaelowa et al. 2019). Australia's Emission Reduction Fund, for instance, supports activities that provide important environmental, economic, social and cultural benefits for farmers, businesses, landholders, Indigenous Australians and others. It sets incentives and provides opportunities for these private actors by allowing them to generate Australian carbon credit units (ACCU) that can be sold to the Australian Government or to other businesses seeking to offset their emissions.¹

Activities to raise ambition in host countries can be supported by Parties, bi- and multilateral institutions and initiatives. Particularly, target-setting and long-term planning are relevant as well as facilitated investments in new low-carbon technologies. This can, for instance, be achieved by defining positive lists for (high cost) emerging technologies and negative lists for mature technologies (Warnecke et al. 2018). Transformational non-market approaches using climate finance are essential for long-term low emission development. Even though the results of these approaches cannot be linked directly to emission reductions, they set an important basis for the future development of carbon markets and NDC cycles. Institutional, regulatory, and capacity innovations through non-market approaches are particularly relevant in host countries. The enhanced transparency framework under the Paris Agreement might support this development. Besides the ambition raise in host countries, long-term strategies can also foster a higher ambition level in acquiring countries: by linking ITMOs and higher ambition, they could clearly show the role of markets and ITMOs in the economy transformation of acquiring countries (Fuessler et al. 2019b, pp. 13 ff).

Besides the above-mentioned options to raise ambition levels and increase demand, a major source of additional demand for tradeable emission reductions is expected from the emission reduction targets by the International Civil Aviation Organization (ICAO²) and potentially by the International Maritime Organization (IMO)³. However, the effectiveness of schemes like CORSIA depends on the ruleset concerning the accountability of emission reductions (as described in section 2A).

B. Design of Article 6.4 mechanism to support demand side factors (A.) and to facilitate private sector participation

National systems and capacities should be designed and supported in order to help host countries fulfil the higher requirements of the Paris Agreement. The burden for developing host countries under Article 6.4 can be reduced by delegating the issuance of emission reductions to the Article 6.4 supervisory body (similar to the Executive Board under the CDM). In addition to relieving host countries of administrative burdens, international issuance would also help to reduce the risk of non-issuance for private sector actors.

The definition of clear and unambiguous rules and standards is crucial for private actors to participate in carbon markets. Ambiguities of negotiations shouldn't be pushed down to project level rules and standards but should be defined on a market level. Further, risks related to uncertainties in baseline setting (e. g. by definition of methodologies or benchmarking), as well as length and renewal of crediting periods should be reduced wherever possible.

Private sector participation and demand for ITMOs can be supported by rules that allow for up-scaling of projects, (sub-)sector level crediting (such as sector wide or inter-branch agreements), and policy crediting (where useful). Further, digitization of MRV and distributed ledger technologies have the potential to generate efficiency gains and increase trust in registries and unit tracking (e. g. CLI 2018a).

1 www.environment.gov.au/climate-change/government/emissions-reduction-fund/about

2 www.icao.int/environmental-protection/CORSIA/Pages/default.aspx

3 carbonmarketwatch.org/our-work/aviation-emissions/shipping

C. Supply side: Host country investment readiness facilitating private sector action

Many countries already receive support for investment readiness (e. g. through the World Bank, development agencies, etc.). This support has to be continued and expanded under the Paris Agreement. Sound institutional and regulatory settings and transparency are crucial to increase investment readiness in host countries. Regarding the investment sectors, it is favourable to build on domestic strengths of a host country's specific market context. For this reason, host countries could be supported to develop strategy studies regarding Article 6 mechanisms, e. g. in combination with their LT-LEDS development (cf. Fuessler et al. 2019b, pp. 47 ff).

4 Explorative analysis of selected options

The explorative analysis in this section concentrates on options related to the “Design of Article 6.4 mechanism” (B.) with a focus on three options:

- ▶ Design and support of national systems and capacities
- ▶ Reduce risks related to uncertainties through rules that allow for up-scaling of projects, (sub-) sector level crediting, and policy crediting
- ▶ Explore potential through digitization of MRV

The rationale for focusing on cluster B is that these are issues that are specific to the design of the Article 6.4 mechanism. By contrast, demand side issues are the same for all kinds of mechanisms and supply side issues are also mostly the same for all kinds of foreign direct investments.

4.1 Design and support of national systems and capacities

Private investors, generally, weigh risks and the expected yields of an investment in their investment decision. If they do not fit together, no investments are made. Specifically, international investments depend strongly on often complex and unpredictable national regulatory frameworks. This makes it difficult for investors to assess potentials and risks of an investment from an economic perspective. A major risk arises from potential ambiguities or changes of the regulatory framework. Governance mechanisms are therefore crucial to attract private investors (adapted from Ammermann 2015).

Under Article 6, host countries need a national institutional setting that allows them to decide whether they want to authorize international transfers of emission reductions or not. In order to take that decision, host countries need basic information on their emissions, their mitigation potential and on how they intend to meet their NDCs. Based on this, they have to define in which sectors and what kind of project types international transfers should be possible, and how many units could be transferred in order not to endanger meeting their own NDC target. National systems and capacities are also key to enable the private sector to be actively involved in carbon markets. The systems and capacities have to set a transparent and stable framework for the private sector to plan emission reduction projects, trade emission reductions, and calculate potential revenues. If host countries fail to properly define national systems, this uncertainty could lead to disinvolvement of the private sector. The following key aspects of national systems and capacities should be met by host countries to provide a stable and transparent environment for private sector participation under the Paris Agreement:

Host country transparency framework

The Paris Agreement lays down specific provisions for Parties about how to define and monitor the achievement of their national emission reduction targets. Parties shall develop NDCs (Art. 3 and Art. 4.2), communicate them (Art. 4.8), and Parties shall account for their NDCs (Art. 4.13). Further, Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies (LT-LEDS) (Art. 4.19). Information on implementation has to be made available as demanded under the enhanced transparency framework with the requirement for biennial reports (Art. 13). The corresponding national inventory reports (NIR) shall contain detailed information about all green-house gas emissions and removals (Art. 13.7(a)). Countries shall also provide information to track progress regarding the NDC targets (Art. 13.7(b)). The Capacity-building Initiative for Transparency (CBIT)⁴ and other partnerships⁵ support developing countries, for instance, to meet the enhanced transparency requirements of Article 13. While this framework helps host countries to fulfil their reporting duties under the Paris Agreement, they are also instrumental in enabling the host country to decide in a timely manner on the authorization of Article 6 activities of private sector participants.

⁴ www.cbitplatform.org

⁵ For example: Low Emission Development Strategies Global Partnership (LEDS GP): ledsgp.org
Partnership on Transparency in the Paris Agreement: www.transparency-partnership.net

The national emission reduction targets (e. g. NDC targets) should be laid down in national transparency frameworks. This is particularly important if host countries are participating in Article 6 mechanisms under the Paris Agreement. Robust accounting shall be applied, inter alia, to avoid double counting (Art. 6.2) and emission reductions resulting from article 6.4 mechanism shall not be used for the host country’s NDCs if the emission reductions are used by another country to demonstrate NDC achievements (Art. 6.5). Countries need to determine and keep track of the share of emission reductions that are not needed to fulfil the NDC targets. Monitoring of their domestic development of emissions in total and in defined sectors is essential to ensure that the internationally tradeable crediting permits are not endangering the meeting of NDC targets. National transparency frameworks could, for instance, be built up on a national GHG inventory and its monitoring system. This has to be matched with the NDC target path. Realized or expected overachievements of specific sectors could then be entitled to be internationally traded. While these activities primarily help the host country government in the fulfilment of their reporting duties under the Paris Agreement, they also form the basis for the design and definition of domestic rules for carbon markets and provide the transparency related basis for enabling the secure international transfer of mitigation outcomes. In countries that do not do their “transparency related homework”, the implementation of private sector Article 6 activities may sooner or later run into barriers, e. g. if the international transfer to a buying country cannot be executed or is delayed, because the tracking and registry information is not available to assure corresponding adjustments, or a host country takes back its authorization of a transfer because the mitigation action is not visible in the national GHG inventory. The latter may be the case, if the host country’s GHG inventory does not follow the level of detail (“tier”) in the reporting methodology, as on which the actual mitigation action took place. For instance, if the national inventory calculates methane emissions from waste water treatment based on population and default factors and does not take into account any methane recovery and utilization or destruction that may have been implemented on the ground (See Schneider et al. 2019).

Domestic rules for carbon markets

Building on the information from the transparency framework, domestic rules for participation in carbon markets as outlined in Article 6 of the Paris Agreement have to be defined by host country governments. This should include clear rules on which sectors and technologies, and under what circumstances mitigation actions are eligible to participate in carbon markets. For instance, such rules may define that a particular sector or technology is entitled to generate a certain amount of internationally tradeable emission reductions over the next x years. Host countries could define these “crediting windows” and auction a limited amount of total capacity of projects that can be entitled with internationally tradeable crediting permits (Schneider et al. 2017, p. 43). Applying an auctioning mechanism would also create benefits for the private sector. The transparent allocation of allowed tradeable emission reductions to specific sectors reduces uncertainties for private investors. It is important to private investors to know upfront how many units they are allowed to trade internationally in order to assure predictability of future revenue streams.

Countries with weaker governments will need assistance in defining and establishing these rules. Bilateral processes or partnerships are possible ways to foster this. The NDC Support Cluster⁶, for instance, helps developing countries to implement their NDCs by providing guidance and advisory services on cross-cutting capacity building and knowledge management in the fields of political and institutional frameworks, sector approaches, financing, as well as data and transparency. Also, the World Bank’s Partnership for Market Readiness (PMR⁷) supports potential host countries in designing and building domestic regulatory structures enabling its private sector in the participation in national and eventually international carbon markets.

⁶ www.ndc-cluster.net

⁷ www.thepmr.org

Authorizing body at national level

Market mechanisms under the Paris Agreement are voluntary (Art. 6.1). Countries have to authorize the use and transfer of emission reduction credits to other countries (Art. 6.3). Compared to the situation under the Kyoto Protocol, host countries have more responsibilities under the Paris Agreement, specifically under the voluntary cooperative approach under article 6.2. The use of internationally transferred mitigation outcomes (ITMOs) has to be authorized by participating countries (Art. 6.3). This implies the need for an authorizing body that defines allowances for ITMOs and keeps track of the NDC targets and the country's emissions development. Therefore, a country's authorizing body should regularly review the national and sectoral emission levels (Schneider et al. 2017, p. 43). The levels should be in line with the domestic emission reduction targets.

In the view of the private sector, authorization should happen through fast and transparent processes, based on clear and public criteria. Depending on the design of the domestic system for participation in Article 6 activities, the national authorizing body could in a first step authorize a specific Article 6 activity, checking the eligibility of the sector or technology and the status of the remaining contingents within a targeted crediting window. In a second step after implementation of the activity, the private sector entity reports the verified mitigation outcomes to the national authorization body. If all criteria are met, the mitigation outcomes will be authorized for international transfer and can be issued in a designated registry. Delays in and uncertainties about ITMO authorization should be avoided, as this has negative effects on the private sector participation.

Transparency and predictable revenues for private investors

The above-mentioned need for national systems, domestic carbon markets rules, and authorizing bodies are key elements of a transparent framework enabling private sector involvement. This is one of the most relevant factors to scale up private sector participation, as transparency and planning security are key elements for private investors (cf. Ammermann 2015). Thus, it is of particular importance in countries with weaker institutions and authorities to have predictable and transparent processes for authorization of Article 6 activities.

Efficient, transparent and predictable governmental authorities are even more important in aggregated level mitigation actions for international transfers, such as sectorial approaches or policy crediting. Here, revenues from international transfers would tend to go primarily to the government level or to overarching implementing bodies such as industry associations. In order to compensate the actors who are actually implementing the mitigation action on a lower level – the private sector – the government needs to find ways to trickle down the Article 6 revenues to the private sector players in a transparent way. In particular in countries with weaker governments and less trust in their ability to distribute revenues, this may be a major barrier to implement action on the ground.

The following section will discuss the potential of upscaling for private sector engagement in more detail.

4.2 Reducing private sector risks through up-scaling

4.2.1 Background

The debate on increasing the scale of crediting activities has a long track record and was mainly driven by the need for rapid reduction of global GHG emissions and the perceived shortcomings of the Clean Development Mechanism (CDM). Some of the expectations associated to up-scaled crediting approaches also relate to the goal to support private sector participation as critics have claimed that the process leading to the registration of individual projects and the issuance of credits is too cumbersome and costly. One important step in addressing these concerns was made with the introduction of the programmatic CDM. Building on a decision taken at the CMP 2005 in Bonn, where Parties had decided “that project activities under a programme of activities can be registered as a single clean development mechanism project activity” (Decision 7/CMP.1 para 20), the CDM Executive Board approved the official templates for the design and implementation of PoAs at its thirty-six meeting in November 2007 (UNFCCC 2007). These allowed an unlimited number of component project activities (CPAs) to be registered under one single Programme of Activities (PoA) with a streamlined procedure for the inclusion of additional activities. While initial uptake of the programmatic CDM was slow (Kreibich, Arens, & Fechtner, 2011), the number of programs has increased steadily, also in Africa, a largely underrepresented region under the CDM (Kreibich, Hermwille, Warnecke, & Arens, 2017). Despite these achievements of the programmatic CDM, the debate on up-scaling continued, with the CDM Policy Dialogue also recommending to further increase the scale of the CDM (CDM Policy Dialogue, 2012). The debates on reforming the CDM finally fed into discussion on the design of future market mechanisms which are to become operational by 2020 under the Paris regime.

4.2.2 What are up-scaled crediting approaches?

Up-scaled crediting can be distinguished from project and programme based approaches through the following features (Broekhoff, Füssler, Klein, & Schneider, 2017):

- ▶ Baseline emissions are established collectively for a predefined group of greenhouse gas emission sources;
- ▶ Credits are issued based on aggregate reductions achieved across all GHG sources within this predefined group;
- ▶ GHG mitigation actions can be diverse and may be undertaken by multiple entities responding to incentives;
- ▶ Credits may be issued to a single entity responsible for establishing and implementing policies that foster emission reductions across all GHG sources targeted.

Up-scaled crediting can further be differentiated into sectoral crediting and policy-based crediting.

Under **policy-based crediting**, a host country is supported in its efforts to introduce and implement a national climate policy instrument by being provided financial assistance. In exchange of the support received the country exports (a portion of) the emission reductions achieved by the national climate policy. These emission reductions could then be used by another country for NDC attainment (offsetting), ambition raising or for complying with climate finance commitments. The mitigation outcomes transferred are contingent on the results of the specific policy. Policy crediting is also possible if the policy has already been introduced: In this case, the host country is assisted in its efforts to increase the ambition level of the policy concerned (Kreibich & Obergassel, 2018).

One key question for policy crediting is whether the supervisory body would be politically and technically able to judge the robustness of national policies. Policy crediting may therefore in many cases be most suitable for Article 6.2 rather than 6.4. Under Article 6.2, host Party government and investors may negotiate volumes of mitigation outcomes to be transferred. However, it may be possible for some policies to establish robust methodologies on how to demonstrate their additionality and determine mitigation outcomes. Crediting of such policies could be suitable for the Article 6.4 mechanism.

Sectoral crediting, by contrast, would be based on an agreed emissions threshold or a “no-lose target” at sectoral level. The host country would define a level of emissions for a specific sector. This threshold could be either in terms of absolute emissions or intensity-based, for example in terms of emissions per unit of gross domestic product (GDP), emissions per unit of electricity generated, etc. The host country government could then undertake actions (i. e. implement policies) to reduce the emissions in the sector to (or below) the agreed level. If emissions are reduced below the target level, the host would receive credits (Sterk, 2010). Another possibility would be to allow private entities, such as industry associations, to assume this role. As outlined by Sterk et al. (2015), the main question here is whether private entities would be able to prevent a situation where some individual installations successfully reduce emissions but others do not and thus the sector as a whole does not. If installations that reduce emissions run the risk of not being rewarded because of the failures of others, the system would hardly provide an incentive to reduce emissions. Governments generally have more means at their disposal to enforce participation by all installations than private entities. Nonetheless, sectors that feature only few installations and/or are dominated by a publicly owned company may be able to arrange sufficient means to ensure compliance. Switzerland provides one example of a working privateled sector initiative. In 2008–2012, the Swiss cement industry successfully implemented a sectoral emission target. The distribution of the overall effort and the rules for the distribution of the related revenues depending on the installations performance had been agreed within the Swiss cement industry association before-hand.

Table 1 shows key features of market-based approaches and highlights the focus of this analysis.

Table 1: Key features of crediting approaches and focus of the analysis

	Project-based crediting	Programmatic crediting	Sectoral crediting	Policy crediting
Recipient of the credits	Project	Program	National government or other sectoral coordinator	National government
Role of host Party government	Approval	Approval	If scheme is coordinated by government: Baseline setting, Target setting, policy implementation and MRV If scheme is coordinated by private entity: Approval	Additionality demonstration, baseline setting, policy implementation and MRV

4.2.3 (How) can up-scaled crediting foster private sector participation?

Given the central role governments would have in policy crediting and sectoral crediting, one may ask what role private companies would play. In line with the other sections of this report, we will in the following focus on the role of the private sector as an investor and developer of the infrastructure needed for the implementation of mitigation activities by asking how can its participation be fostered through up-scaled crediting.

Aligning the crediting level with the actual incentive level

Experience under the CDM showed that ensuring the additionality of individual mitigation activities is challenging. An entire set of methodologies has been developed to assist project proponents in demonstrating that their project would not have been implemented without the existence of the CDM. And numerous processes were installed to ensure that the information provided by project developers is sound and allows for a final assessment of project additionality. Despite these measures, additionality is at least questionable for a comparatively high number of CDM projects. This means that there is a high probability that these projects would have been implemented also in the absence of the crediting mechanism. Non-additional projects are hence triggered by other framework conditions, including the following:

- ▶ Economic/financial: e. g. project implementation provides economic gains
- ▶ Legal: e. g. legal requirement to take action (e. g. increase energy efficiency) that (indirectly) leads to reduced emissions
- ▶ Cultural/social: e. g. intrinsic motivation to act on climate change

In this regard, domestic policy plays an important role, as it can influence framework conditions, in particular the economic and legal conditions which are key for implementing mitigation activities. Therefore, as discussed in section 2, many CDM projects have (at least partially and indirectly) been triggered by domestic policies, while the incentive provided by the international mechanism might have played a subordinate role. Policy crediting recognizes the key role policies can play by aligning crediting with the actual incentive level of many subnational mitigation activities. To safeguard environmental integrity and ensure that crediting contributes to ambition raising, these policies would have to be additional, for instance by going beyond what is required for NDC attainment. Under a policy crediting scenario, credits are issued when domestic policies are successful and incentivise the desired activities to be implemented. Under project-based crediting, by contrast, credits have been issued to projects that were implemented because policies were shown not to be in place or not to be successful.

Reducing the transaction costs of the private sector

The challenge with ensuring the additionality, or rather the causality of individual project activities is that the actual, real and known project development scenario is compared to a large number of unknown and hypothetical scenarios. The problem is further exacerbated by information asymmetry that gives advantages to the project proponent. The project proponents know their project, why it has been implemented and through which incentives it was triggered. The regulator, by contrast, does only have limited access to this information. This allows the project proponent to portray the project in a way that is in line with the regulatory provisions. This problem is inherent to crediting mechanisms and cannot be fully resolved. It can, however, be shifted to another level through up-scaling: Under a policy crediting scenario, it is the government of the jurisdiction that has to demonstrate that the policy is additional and would not have been implemented in the absence of Article 6. Similarly, the task of defining the baseline accrues to the government level.

The private sector benefits from these changes: It must no longer demonstrate the additionality of its project using complex methodologies and engaging auditors for the validation and verification of the project and its emission reductions but can focus on how to enrol its business taking into account relevant framework conditions, which are mainly driven by policies. This can be expected to lead to a reduction of transaction costs for the private sector.

Reduction of investment risks and regulatory uncertainty

Private sector benefits of policy-based crediting are not limited to a reduction of transaction costs. As discussed in chapter 2, under the CDM, regulatory uncertainties regarding how to effectively demonstrate additionality of projects or how to calculate emission reductions have led to considerable investment risks for the private sector. Furthermore, revenues from the sale of CERs have shown to be highly volatile. Under policy-based crediting approaches, these risks are transferred to the domestic policy level. Domestic policies may also change, but having them registered internationally as Article 6.4 activities may provide some safeguard against sudden changes. One key challenge of up-scaled approaches, however, is to ensure that the entities implementing the actual mitigation activities will actually be incentivised by these policies.

4.2.4 How must the Article 6.4 mechanism be designed in order to allow for and foster up-scaled crediting?

In order to increase the scale of mitigation activities under Article 6.4, one first step is to ensure that the provisions of the mechanism do not exclude such type of activities. In addition, up-scaled activities could further be fostered by adapting the provisions to specific requirements these activities have. This section therefore analyses different aspects of the Article 6.4 mechanism asking what is needed to allow for policy crediting and how such activities could be fostered.

Definitions

In order to allow for policy crediting under Article 6.4, the definitions of the rules, modalities and procedures must be sufficiently generic. Terms such as “project cycle” or “project proponent” would restrict the scope of possible mitigation activities and not allow for policy-crediting activities to take place. They should therefore be avoided and replaced by terms that are also applicable to up-scaled crediting such as “activity cycle” and “mitigation activity proponent”. Further differentiation among the different types of activities (policy crediting, programmatic, project-based) would take place at the implementation level, for instance by establishing methodologies applicable to the specific types of activities.

Governance

The operation of the Article 6.4 mechanism entails numerous and diverse governance functions including the authorization and registration of activities, issuance of credits and the strategic review of the mechanism (Oberghassel, 2018). All these governance functions of the Article 6.4 mechanism should be designed with policy-based mitigation activities in mind and by ensuring legitimacy of the actors involved. With the supervisory body of Article 6.4 being responsible for the registration (and rejection) of proposed mitigation activities and policies, this body must have high legitimacy. Legitimacy could be achieved through a composition of the Supervisory Body that ensures a sound representation of (different groups of) countries. Similar rationale should apply to the entities responsible for the validation and verification of policies: In order to allow private sector auditors to assess the success of a public policy as part of the verification process, their legitimacy must be ensured. This legitimacy could be ensured by adapting the accreditation process of auditors. Accreditation could therefore not only be based on technical requirements but also require acceptance from individual Parties and other stake-holders. To increase legitimacy, the acceptance of DOEs could be required for each policy individually with countries providing justification in case specific DOEs are excluded from the policy evaluation. Such an expanded accreditation process could be cumbersome and increase related transaction costs. However, if legitimacy of DOEs is not ensured, the risk of individual countries appealing against the validation and verification outcomes of DOEs increases, potentially resulting in even higher costs. Therefore, such an expanded accreditation process could increase the likelihood of individual Parties and other stakeholders accepting the outcome of evaluation processes.

Methodologies and procedures

Methodologies for additionality demonstration, baseline calculation and MRV must be made available also for policy-based approaches. To demonstrate additionality, for instance, Parties would have to show that the policy has clearly been triggered by the existence of the Article 6.4 mechanism and that no other framework conditions at the global or national level would have incentivised the adoption and implementation of this policy. While there are different approaches of how additionality of a policy could be demonstrated, ensuring additionality of policies can be considered to be very challenging. The introduction and implementation of climate policies is usually motivated by several policy objectives including a government’s policy preferences and the country’s political economy, making it extremely difficult to prove the additionality of a policy. One potential solution to this problem might be to explore input-based transfers where credits are issued on the basis of the funding provided. As long as the NDCs of the Parties involved are robust enough and their ambition levels sufficiently high, this could be a pragmatic approach in dealing with this problem (Kreibich & Oberghassel, 2018).

Measures to support policy crediting

In addition to ensuring that policy-based crediting is not excluded from Article 6.4, the mechanism could actively support the role of up-scaled mitigation activities. Possible measures include top-down development of methodologies applicable to policy crediting and capacity building measures that support host Parties in developing policy-based crediting activities.

With up-scaled crediting assigning a key role to host countries, strong domestic capacities become a key prerequisite for the implementation of such activities. Limited technical capacities and political awareness could be a barrier to up-scaled crediting, in particular in developing countries. Capacities could be fostered by international level initiatives similar to the Regional Collaboration Centres (RCCs) under the UNFCCC, through multilateral organisations and initiatives such as World Bank's Partnership for Market Readiness or bilaterally. These activities could enhance the host country readiness to identify mitigation potential and develop measures to tap this potential in the context of Article 6.

4.3 Explore potential through digitization of MRV

An important barrier to private sector participation lies in the potentially high transaction costs for Measuring, Reporting and Verifying mitigation outcomes. Practicality, efficiency, and the high costs of today's MRV systems are major barriers for the private sector (see section 2B). Since the onset of Kyoto Flexible Mechanisms, about two decades ago, the potential of digital technology has evolved while the project cycle processes in crediting standards has largely remained "PDF-driven", with a lot of manual labour related to Project Design Documents (PDDs), validation, registration, monitoring reports, emission reduction calculations, issuance etc.

Many challenges and barriers related to MRV can be addressed and significantly reduced by the use of digital tools and processes. Digitization can particularly facilitate processes on the operational level. It can help to increase data quality, as well as the value of impact data (e. g. thanks to faster data processing, availability, and transparency, as well as the inclusion of information about other sustainable development impacts of a project). With a view to the three MRV elements and the subsequent issuance of units, digitization can have a vast range of positive effects (CLI 2018a, pp. 30 ff.).

As an example: data from an improved cookstoves project can be collected directly, using digital Stove Usage Monitors (SUMs). The automatically collected data, by the temperature loggers, is uploaded directly to a server. Typically, data about "heating events" had to be collected in user surveys which are much more time consuming and prone to errors. Impact quantification is based on the number and duration of heating events and thus can be calculated automatically, based on the project specific methodology. The following data verification can be automated to a large extent as well, since mainly the calibration of the monitoring devices needs to be checked, e. g., by using specific control algorithms and comparable datasets from similar projects.

The following areas along the project cycle may be considered for the use of increased levels of digitization to improve efficiency and automation of processes and reduce transaction costs for the private sector (CLI 2018a, pp. 32 ff.). For each area, we identify particular private sector needs and the potential for new digital technologies:

1. Data collection

Safe, secure, and reliable data capture and transfer are key elements of data collection associated with MRV of mitigation actions. Data collection tends to be particularly complex and costly for individual and dispersed mitigation action e. g. in sectors such as cook stoves, efficient appliances, transportation, but also in LULUCF. A particular issue poses the access to project data in remote areas.

Private sector needs: The private sector needs to trust in emission reduction projects and generated impacts. Improved data integrity is a benefit to monetize carbon reduction (and sustainable development) impacts in a trustworthy manner. Further, private project developers can specifically profit from efficiency gains, when data capturing, transfer and processing is automated. Reliable, fast, and simple data collection reduces barriers for private sector participation, as this is the first step to facilitate the process of monetizing emission reductions. Cost savings, however, depend vastly on the project type (e. g. regarding the scope and complexity of required data sampling) and on the available monitoring technologies (e. g. cost of required sensors).

Digitizing MRV potentials: Data coverage, accuracy and reliability can be improved drastically by using technology, such as sensors or mobile phones to capture data. Data collection and processing can be automated e.g. by using Internet of Things (IoT). The combination of remote sensing with new data processing approaches including artificial intelligence potentially allows for the automated monitoring of forest areas and land use patterns.

The new Blockchain⁸ technology can contribute to secure data logging, by making the recorded data immutable. The Blockchain concept builds on two fundamental technological pillars: decentralization and cryptography. They set the basis that blockchains can claim to be immutable. Data is stored on all servers of a network using a blockchain (e.g. all participants in a carbon market) and is constantly monitored and validated. Cryptography creates “hashes” that can be seen as unique digital fingerprint of any imaginable set of data that is stored in “blocks”. The last block (of a blockchain) always contains the whole transaction history of a network. Altering any of the information stored earlier (e.g. changing information about a completed transaction) would result in the distortion of the chain of blocks and consequently lead to the exclusion of the participant whose record is not matching the records of the rest of the network’s participants. The unique information, containing the complete fingerprint of all transactions, in combination with the decentralized stored and constantly validated datasets ensures immutability and security of the technology (CLI 2018b).

However, depending on its design and consensus algorithm, the operation of Blockchains may lead to a very high power consumption. A well know example is the crypto-currency Bitcoin, which builds on a so called “prove of work” consensus algorithm, where participating nodes enter into a useless number-crunching competition each time a new block is to be generated in order to determine, which node will “mine” the block and get paid. However, there are other designs for Blockchains building on much less power consuming consensus mechanisms, such as the “proof of stake” (CLI 2018a, pp 83f).

On a practical level, automation and use of digital technologies reduces the need for manual interventions and with that the potential for human errors and forgery. This result in increased confidence in data, improved transparency of MRV, as well as in higher trust and integrity (CLI 2018a, pp. 32 ff.).

2. Impact quantification and reporting

Today, the calculation of emission reductions is often carried out manually, on the basis of simple spreadsheets. These processes are slow, costly and prone to introduce errors in the calculations and data sets.

Private sector needs: Efforts to impact quantification and reporting should be as efficient as possible for project developers/owners. The more automated this process is and the quicker the impacts are quantified, the easier it is for project owners to set their projects into value. Required time and costs are potential barriers to private investors, as it reduces the revenues on generated emission reductions.

Digitizing MRV potentials: Instead of using complex spreadsheets, technology could enhance impact quantification and the reporting process, for instance, by using smart contracts (i.e. small programs on a blockchain that securely carry out certain calculations) and online applications linked to automated data capturing and processing. Automated impact calculation, based on collected data and preset methodological approaches, would improve reliability, increase efficiency of this process and foster trust in outcomes (CLI 2018a, pp. 32 ff.).

3. Verification

The verification process involves the review and checking of all data collected. Data is checked for integrity, accuracy, and methodology conformity.

Private sector needs: Project owners have to hire independent third-party verifiers to verify emission reductions (and potential sustainable development benefits) of their mitigation projects or programmes. This verification process is rather expensive and time consuming for the private sector.

⁸ For the sake of simplicity, the common term „blockchain“ is used as a placeholder for the much broader concept of distributed ledger technologies (DLT)

Digitizing MRV potentials: Technologies like certified sensors and data transfer, smart contracts on blockchains could speed up and facilitate verification through real-time verification. Such systems allowing for automated quality assurance and quality control can be implemented by checking monitoring data for plausibility, consistency and outliers. Artificial intelligence can help to detect potential irregularities and areas of higher risk. Therewith, it becomes easier to spot where checks are needed, thus reducing the need for comprehensive and costly site visits. This could increase the efficiency of the verification process significantly (CLI 2018a, pp. 32 ff.).

4. Issuance of units to a registry

Under the Kyoto Protocol, while registries are operated by Annex-I-countries, one centralized platform, the International Transaction Log (ITL), serves as hub for emissions trading mechanisms. The centralized ITL – operated by the UNFCCC Secretariat – is considered trustworthy and is seen as a generally successful system. The availability of an internationally operated CDM-registry that is independent from national institutions has been an important success factor for the CDM, as private sector could rely on issuance once emission reductions were verified.

Under the Paris Agreement, although a centralized Article 6.4 registry may be developed and a Central Accounting Database for corresponding adjustments is foreseen, the general reporting and transparency framework as well as the architecture of Article 6 mechanisms is more party-driven and decentralized than under the Kyoto protocol.

Private sector needs: In countries where there is a lack of trusted (international) registry for ITMOs, it is key for private sector that any bi- or multilateral registries are reliable, secure and trustworthy, so that project developers can count on the ability to transfer their mitigation assets and benefit from their monetization.

Digitizing MRV potentials: In this situation, technologies like registries building on blockchain or other distributed ledger technologies allow for trusted registry systems that are accepted by all stakeholders (CLI 2018a). The application of blockchain technology makes any changes immutable and allows for full transparency in tracking ITMO transactions. Two general options may be considered: Either the full registry would be stored in a blockchain (which currently faces challenges in terms of capacity and speed of blockchain systems), or the registry is implemented in a conventional database of which regularly a hash is generated (i. e. a kind of digital fingerprint of the entire status of the database) that is stored in an underlying blockchain.

Besides information on carbon assets, such registries may also contain attributes of sustainability impacts of the mitigation action, e. g. the quantification of indoor air quality benefits for efficient cook stoves. With the secure demonstration of sustainability impacts, private sector may gain higher revenues for their ITMOs from some market segments.

This kind of digital systems may also enable to link up with other registry systems and therefore allow for a linking of carbon markets beyond specific registry systems. This may require also the automated conversion of mitigation outcome units.

Overcoming barriers to scale – reducing transaction costs

Applying technology along the activity cycle steps of MRV and issuance helps to address current challenges in MRV and barriers to scale. Particularly, high transaction costs are hindering the private sector to be more involved. This can be addressed by digitization of MRV (as described above) and access to carbon markets (or other finance schemes) for the private sector can be facilitated (CLI 2018a, p. 13).

Another major hindering factor for the private sector is the uncertainty about returns on investments. Facilitated trade of emission reductions, e. g. also through tokenization and new distribution channels for mitigation outcomes, can contribute to overcome this barrier. However, it is important to note that digital MRV and blockchain, while being important tools, are no silver bullet to solve all the existing issues regarding private sector involvement. Demand side factors, domestic rules, and design of carbon markets on an international level will be more relevant to foster private sector participation.

Digitizing MRV is only emerging and needs further research, development and field trials of approaches. Current issues range from technical aspects in data collection such as speed and lacking connectivity, to cost of monitoring equipment or needed capacities to train staff, interfaces for data reporting, adaptation of methodological approaches to digitization of MRV, to the need for strategies and harmonized implementation frameworks and governance for digital MRV (CLI 2018a, pp.37).

5 Conclusions

Private actors are key for the implementation of GHG emission reductions of the scale required by the Paris Agreement's long-term temperature goal. The private sector is both, a large emitter of greenhouse gases and a provider of innovative solutions to address climate change. Furthermore, private sector investments can make an important contribution to mitigate climate change. These multiple functions have been recognized by Parties when adopting the Paris Agreement and its Article 6.4, which explicitly aims to incentivize and facilitate the participation in the mitigation of greenhouse gas emissions by private entities (Art. 6.4 (b)).

Under the Clean Development Mechanism (CDM), private sector actors had the opportunity to participate in a new and fast-growing market but faced numerous challenging investment barriers. Given the more heterogeneous architecture of the Paris Agreement and the stronger role (host) country governments have been granted under the new regime, it appears that private sector actors might even be confronted with more barriers, in particular in countries with weaker institutions and authorities (e. g. for obtaining the authorisation).

Although this analysis focusses on factors and barriers related to the design of the emerging carbon markets under Article 6, it has to be acknowledged that host countries need general investment readiness in order to facilitate private sector action. Article 6 activities are not fundamentally different from any other foreign direct investment project. Therefore, they need, for instance, a sound institutional and regulatory setting, government transparency, and competitive tax environments. As long as the country's general investment readiness is not conducive, Article 6 rules may only improve private sector investments to a limited extent.

The present paper highlights the importance of two key factors for private sector participation: the need for demand and the need for host country readiness:

Without higher ambition of acquiring countries and their willingness to purchase ITMOs, there will be only little trading on international carbon markets. The renewed interest in accelerated climate change mitigation action in some countries with the IPCC 1.5 degrees report and the emerging "Fridays for Future" initiatives may lead some acquiring countries (at least in the short term) to raise their ambition levels and consider the purchase of ITMOs at scale.

On the other hand, Parties to the Paris Agreement granted themselves a lot of sovereignty and bottom-up rulemaking compared to the earlier Kyoto scheme. This leads to a considerable amount of work for a potential host country, to be able to participate in Article 6 mechanisms, related to its transparency framework, the setting of domestic rules for carbon markets, and for the creation and operation of an authorizing body at national level. If host countries are not ready, there is a limited role for the private sector, because the lack of a national system leads to too many barriers and bottlenecks along the project cycle.

Scaling up market mechanisms may help to overcome some of the barriers and streamline the processes for private sector entities. However, this would require a stronger role of the regulator, which would need to be underpinned by adequate resources and institutions.

On a technical level, the digitization of Measuring, Reporting and Verification (MRV) has a high potential to make project cycle processes more efficient and reliable, thus reducing transaction costs and allowing private sector players to define profitable business models. New approaches to data acquisition and monitoring, including the use of sensors and internet of things, may enable the tracking of emission reductions of smaller and distributed sources. Further, the applications of artificial intelligence may allow for new monitoring approaches, e. g. in combination with remote sensing in LULUCF. The largest benefit from new digital technologies may lay in the applications of blockchain technology for trusted and immutable registry and unit tracking systems, in particular in the context of weaker governmental settings where trust in governmental databases may be limited.

In summary, upscaling and digitization may help to reduce barriers, but will not be the silver bullet to solve all issues related to the design and implementation of Article 6 market mechanisms. The key factors to successfully foster private sector involvement are increased international demand for high quality units by acquiring countries (units that require additional activities than what otherwise would have happened) and established domestic frameworks by host countries.

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