ARTIFICIAL INTELLIGENCE AGENT DRIVEN TOKENIZED BANK PROTOCOL

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SUMMARY OF THE INVENTION

This patent application claims priority date of provisional patent application number 63/709,462 filed on October 20, 2024.

The Paris Agreement is a **legally binding international treaty on climate change**. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016. The Paris Agreement is **a landmark** in the multilateral climate change process because, for the first time, a binding agreement brings all nations together to combat climate change and adapt to its effects.

In order for governments and companies to comply with Paris Agreement as it is currently worded, they are required to purchase carbon allowances (permits to release CO2 equivalent GHG emissions) as well as carbon offsets (certificates purchased from other entities that have avoided or sequestered CO2 equivalent GHG emissions) to cover their CO2 equivalent GHG emissions annually. However, the practice of carbon offsetting has recently been brought under scrutiny. The forest carbon offsets approved by the world's leading certifier and used by Disney, Shell, Gucci and other big corporations are largely worthless and could make global heating worse, according to a new investigation.

The research into Verra, the world's leading carbon standard for the rapidly growing $2bn voluntary offsets market, has found that, based on analysis of a significant percentage of the projects, more

than 90% of their rainforest offset credits – among the most commonly used by companies – are likely to be “phantom credits” and do not represent genuine carbon reductions.

The analysis raises questions over the credits bought by a number of internationally renowned companies – some of them have labelled their products “carbon neutral”, or have told their consumers they can fly, buy new clothes or eat certain foods without making the climate crisis worse.

The investigation found that:

- Only a handful of Verra’s rainforest projects showed evidence of deforestation reductions, according to two studies, with further analysis indicating that 94% of the credits had no benefit to the climate.
- The threat to forests had been overstated by about 400% on average for Verra projects, according to analysis of a 2022 University of Cambridge study.

“Rainforest protection credits are the most common type on the market at the moment. And it’s exploding, so these findings really matter. But these problems are not just limited to this credit type. These problems exist with nearly every kind of credit.

“One strategy to improve the market is to show what the problems are and really force the registries to tighten up their rules so that the market could be trusted. But I’m starting to give up on that. I started studying carbon offsets 20 years ago studying problems with protocols and programs. Here I am, 20 years later having the same conversation. We need an alternative process. The offset market is broken.”

The inherent “Greenwashing” by the carbon offsetting process has now led to the European Union taking action to ban the practice of carbon offsetting altogether.

Companies selling in the European Union will no longer be able to claim that their products are carbon or climate neutral, the EU has provisionally agreed. This victory against greenwashing corresponds to longstanding demands from climate campaigners to eliminate the use of offsets and send a signal to the voluntary carbon market.

Following late night negotiations, the European Parliament and the Council of the EU struck a deal to ban advertisements that make “claims based on emissions offsetting schemes that a product has neutral, reduced or positive impact on the environment”.

This latest decision concludes negotiations on the Empowering Consumers for the Green Transition (ECGT) directive, which the European Commission published in March 2022, with the intention of updating existing EU consumer protection legislation that was no longer fit for purpose.

- Generic environmental claims and other misleading marketing tricks will be banned
- Ban will also apply to commercial communications about goods that contain a design feature introduced to limit product durability
- Only sustainability labels based on approved certification schemes or established by public authorities will be allowed
- Guarantee information to be more visible and a new guarantee extension label to be introduced

Parliament and Council have reached a provisional agreement on new rules to ban misleading advertisements and provide consumers with better product information.

The agreement updates the existing EU list of banned commercial practices and adds to it several problematic marketing habits related to greenwashing and early obsolescence of goods. The aim of the new rules is to protect consumers from misleading practices and help them make better purchasing choices.

What will be banned?

Negotiators from Parliament and Council agreed to proscribe the following:

- generic environmental claims, e.g. “environmentally friendly”, “natural”, “biodegradable”, “climate neutral” or “eco”, without proof of recognized excellent environmental performance relevant to the claim;
- commercial communications about a good with a feature that limits its durability if information is available on the feature and its effects on the durability;
- claims based on emissions offsetting schemes that a product has neutral, reduced or positive impact on the environment;
- sustainability labels not based on approved certification schemes or established by public authorities;
- durability claims in terms of usage time or intensity under normal conditions, if not proven;
- prompting the consumer to replace consumables, such as printer ink cartridges, earlier than strictly necessary;
- presenting software updates as necessary even if they only enhance functionality features;
- presenting goods as repairable when they are not.

Quote

After the deal, Parliament’s rapporteur Biljana Borzan (S&D, HR) said: “We have achieved an excellent deal for consumers. 60% of European consumers are not even aware a legal guarantee comes with all products. That changes today, with a reminder to be present in every shop in the EU and also in some cases on packaging. Also, a new extended guarantee label will show clearly which

products last longer, so it will be easier to buy more durable products. We have also negotiated a strong stance on early obsolescence. We shouldn't advertise products that fail too early. In addition to that, we are clearing the chaos of environmental claims, which will now have to be substantiated, and claims based on emissions offsetting will be banned."

"The EU is sending a powerful signal to the voluntary carbon market: the era of offsetting is over, and carbon credits can't make up for buyers' pollution," said Gilles Dufrasne, policy lead on global carbon markets at CMW. "This is also a message that the EU is sending itself, with a clear precedent for the CRCF (currently being negotiated) that carbon dioxide removals cannot offset greenhouse gas emissions and must not be used to advertise products as greener than reality."

One of the side effects on the voluntary carbon market from the investigation was companies rethinking carbon offsets. Corporations, previously engaged for years with buying carbon offsets as part of their climate strategy, have started changing their claims and shifting the priority towards more robust climate actions.

One such corporation is Nestlé. The world's largest food maker has a net zero greenhouse gas emissions target by 2050. It wants to cut its scope 1, 2 and 3 emissions by 20% by 2025 against a 2018 baseline and by 50% by 2030. Nespresso, one of its brands, has also been claimed as carbon neutral across its business operations since 2017, achieved through offsetting projects and some reduction interventions.

Just last week, however, the company announced a big shift in its carbon neutral strategy – instead of investing in carbon offsets, it will redirect resources to cutting its greenhouse gas emissions.

"We are moving away from investing in carbon offsets for our brands to invest in programs and practices that help reduce GHG emissions in our own supply-chain and operations, where it makes

the most difference to reach our net zero ambition… Our net zero roadmap does not rely on offsets. We focus on GHG emissions reductions and removals within our value chain to reach our net zero ambition," said a Nestlé spokesperson.

The luxury fashion house Gucci – one of the corporations most linked to buying carbon offsets verified by Verra, has reportedly deleted its claim of becoming "entirely carbon neutral" from its website back in May 2023. It is also no longer working with South Pole, a leading carbon offsets project developer that has received criticism for selling unreliable offsets.

Gucci announced back in 2019 it had become "entirely carbon neutral" in part using rainforest offsets certified by the Verra carbon offsetting standard.

The ASA (Advertising Standards Authority) – the UK's advertising watchdog told the Guardian in May 2023 that it will ban advertising making misleading or exaggerated climate-positive claims like 'carbon neutral', 'net zero' and 'recyclable' unless they can demonstrate they really are effective. Proving the validity of carbon offsets has been a major hurdle for buyers.

So, what is the answer to replace the carbon offset revenue stream that solar and wind farms, hydroelectric facilities, and building efficiency programs will lose due to the EU actions, and actions being taken by companies like Nestle and Gucci, who have decided to no longer purchase carbon offsets? The answer is the ASSET Carbon Accounting Reduction Program known as ASSET Protocol.

The ASSET Protocol allows solar and wind farms, hydroelectric facilities, landfill cleanup, CO2 equivalent GHG capture and storage, and building efficiency programs that will no longer be able to generate carbon offsets to instead generate a new carbon accounting reduction token called ASSET for each 1 ton of CO2 equivalent GHG emission avoided or sequestered by their operations. If done in a manner consistent with GHG Protocol accounting standards, these new ASSET tokens can then

be sold to companies that need to apply carbon reductions to their Scope 2 and Scope 3 carbon accounting standards per their corporate Environmental, Social, or Governance (ESG) policy. This not only will satisfy GHG Protocol accounting standards, but be a much-needed lifeline of revenue generation for GHG Projects that have been expecting financial support from the sale of carbon offsets.

ASSET is about getting away from carbon offsets and voluntary carbon markets that trade carbon offsets altogether. Let me explain the differences, and why.

Carbon offsets are created by identifying a carbon avoidance or sequestration in a corporate model, and turning that into a specific instrument called a carbon offset that can then be certified and sold in voluntary carbon markets to other companies that can then retire the carbon offset and apply it to their overall GHG emissions reductions in a manner consistent with government policy. The process to do so is the following:

1) Identify the carbon avoidance or sequestration as a business process.

2) Hire a 3rd party environmental engineer to assess the carbon avoidance or sequestration, and certify that business process as an ISO 14064-6 GHG Project consistent with preapproved GHG Methodologies from one of the voluntary carbon registries (Verra, Gold Standard, CDM Registry, etc.).

3) Have the same environmental engineering firm assess how many carbon offsets (representing 1 ton of CO2 equivalency will he avoided or sequestered) should be produced annually within a specific GHG Project.

3) The environmental engineering firm then provides all ISO 14064-6 documentation needed to confirm this to the company that produced the avoidance or sequestration.

4) The company then submits the carbon offset documentation to a voluntary market registry (Verra, Gold Standard, CDM Registry, etc.) for annual approval, and if approved, record all the documents in the voluntary carbon registry.

6) The carbon offsets stored in the voluntary carbon registry can then be listed in a voluntary carbon market like CBL Markets or Air Carbon for sale.

7) Under GHG Protocol, only 3% carbon offsetting can be purchased by another company and used towards their overall carbon reductions to achieve net zero, or comply with Paris Agreement requirements. However, now the EU has even decided to not allow the 3% to be applied as they are banning carbon offsetting as a practice altogether by 2026. Singapore is now proposing 5% carbon offsetting allowed, and markets like Japan and China are all based on carbon offsetting, so the practice is specific to each government policy for any country/region.

8) Once the carbon offset is purchased by another company, the company will "retire" the carbon offset and apply it to their overall carbon reductions for GHG Protocol carbon accounting and TCFD carbon reporting purposes.

Now for the ASSET explanation.

1) Identify the carbon avoidance or sequestration as a business process.

2) Hire a 3rd party environmental engineer to assess the carbon avoidance or sequestration, and certify that business process as a GHG reduction under EPA guidelines for corporate carbon accounting purposes:

GHG Reduction Programs & Strategies | US EPA

A wide range of strategies are available to help organizations reduce their greenhouse gas (GHG) emissions. Below are a list of resources and guides to help your organization identify and implement GHG reduction opportunities.

Energy Efficiency

Renewable Energy

Supply Chain

Waste Reduction and Diversion Strategies

Reduce Methane Emissions

Increase Fuel Efficiency in Transportation and Logistics

Additional Resources

3) Once the carbon reductions (representing 1 ton of CO2 equivalency avoided or sequestered) are calculated on an annual basis, they can then be recorded by Customer, and used to generate ASSET carbon accounting reduction instruments.

4) The ASSET instrument is then marketed by Customer for sale to companies in the same supply chain as the company that produced the ASSET instrument.

7) Under GHG Protocol carbon accounting standards, there is no limit as to how many carbon reductions can be applied to a company for compliance under Paris Agreement, or any government policies to date.

8) Once the ASSET instrument is purchased by another company, the company will utilize the EPA/GHG Protocol compliant carbon reduction to their overall carbon reductions for GHG Protocol carbon accounting and TCFD carbon reporting purposes.

Whereas carbon offsetting is extremely limited, as well as being banned in EU, carbon accounting reduction within supply chains has no such restrictions/limits on how many can be applied for carbon reduction to achieve Paris Agreement/Net Zero goals for any corporate entity, as long as the carbon reductions all come from the same supply chain. Any vendor in a supply chain creating carbon avoidance or sequestration (solar, wind, nature conservation, hydro, building efficiencies,

etc.) can apply those processes to any other company for scope 1, 2, or 3 carbon accounting purposes.

ASSET utilizes a carbon accounting system that incorporates the reductions gained by GHG Projects credited through scope 3 carbon accounting to companies that need it as a reduction from their supply chain pipeline. Think Walmart buying an ASSET token from one of their scope 3 suppliers that happens to be a solar farm...

ASSET tokens that can represent any carbon reduction approved by the EPA and regulatory bodies for carbon accounting purposes. The GHG Project instead of producing carbon offsets can simply measure the tonnage of reduction and generate ASSET tokens, which would be priced at the actual EUA price for European generated offsets, and sold to any companies that need the reduction for their scope 3 carbon accounting.

Each offset could produce an ASSET token instead to be sold at the compliance market price for the region it was generated in. Could even be sold to a company in another jurisdiction to be applied to their scope 3 carbon accounting requirements. It would work, and with carbon offsets getting crushed in the market, this could be the replacement for the industry...

Using EPA guidelines for carbon reductions in carbon accounting/reporting makes a lot more sense than using voluntary carbon registry methodologies, as we are now trusting government entity/regulated guidelines as opposed to voluntary processes that tend to benefit the provider.

If we work in D-MRV with all records on DLT/blockchain for transparency and immutability for the EPA reduction analysis, we have a superior process to the antiquated and outdated carbon offsetting process altogether. The ASSET token may be a crypto asset that conforms to the EU MiCA regulatory compliance standards for crypto assets, or it may take the form of an NFT, or it may simply be a software platform that provides a service as described herein. The software process that provides the tokenization of a carbon reduction should incorporate the services and aspects disclosed in this patent application.

What is carbon accounting?

Carbon accounting is the process of quantifying an organization's greenhouse gas (GHG) emissions.

This includes emissions resulting from the organization's direct operations and activities (for example, heating office buildings), as well as indirect emissions (for example, emissions generated by a company's suppliers or by end consumers using its products).

As well as corporate carbon footprints, organizations can use carbon accounting to quantify their product carbon footprints or the carbon footprints of their portfolios, trades or cargos. Carbon accounting can also be used for cities and projects.

What does carbon accounting measure? GHG, CO2 and CO2e

The standard unit in carbon accounting is CO2e (carbon dioxide equivalent). CO2e allows quantities of different greenhouse gases emissions to be expressed as a single unit. It includes carbon dioxide (CO2) plus all other greenhouse gases (such as methane and nitrous oxide) converted into CO2 using their global warming potential. For example, methane is 28 times stronger than carbon dioxide in its warming potential.

Scope 1, 2 and 3 emissions

In corporate carbon accounting, the globally-accepted practice is to categorize an organization's GHG emissions inventory into Scope 1, Scope 2 and Scope 3.

Scope 1 + Scope 2 + Scope 3 = Corporate carbon footprint

Scope 1: Scope 1 emissions are direct emissions. They result from direct activities of an organization, as well as assets like buildings and vehicles that the organization directly owns or controls.

Scope 2: Scope 2 emissions are indirect emissions resulting from purchased electricity, heating, steam and cooling.

Scope 3: Scope 3 emissions are all other indirect emissions across the organization's upstream and downstream value chain. Scope 3 is usually the largest source of a company's GHG emissions, so it represents the biggest opportunities to reduce emissions. However, measuring Scope 3 emissions accurately is the most challenging part of carbon accounting.

Note: Although corporate carbon footprints / GHG inventories are categorized into Scopes 1, 2 and 3, product carbon footprints are typically not.

How does carbon accounting work?

Like financial accounting, carbon accounting is a process that needs to be done rigorously, transparently and frequently, in line with international best practice and standards.

The Greenhouse Gas Protocol is the global standard-setter for carbon accounting. It provides methodological guidance for different types of carbon accounting. For example, there are different Standards for a full corporate GHG emissions inventory, for corporate value chain (scope 3) emissions, and for a product lifecycle.

However, all carbon accounting exercises will typically involve:

Defining organizational boundary (e.g. reporting period; consolidation approach, identifying any subsidiaries, joint ventures or investments included)

Establishing reporting boundary (e.g. identify relevant emissions sources; transparently justifying the rationale for exclusions, categorizing emissions under the three Scopes, and 15 Scope 3 categories)

Collecting and quality-checking data (e.g. raw input data about operational activity, facilities, purchased goods/services and supply chains, as well as emissions data from supplier reports, primary sources or secondary sources, following the relevant methodological requirements)

Calculating the carbon (undertaking calculations according to the appropriate methodology and emissions factors)

The quality of the input data is important; the more comprehensive and accurate the input is, the more reliable the carbon accounting output is.

What is the outcome of carbon accounting?

The basic outcomes of carbon accounting typically include:

A calculation of the organization's carbon footprint (whether at the organizational-, product-, trade-level or other);

Internal summary reports (including absolute emissions and carbon intensity figures, GHG emissions inventories, performance against previous years, and progress against targets);

External reports (for regulators, customers, financial institutions, shareholders). Preparing these reports usually requires some additional work. Different reporting and disclosure frameworks have different format and content requirements.

Carbon accounting can also lead to:

Setting science-based targets according to global standards

Identifying and acting on opportunities to reduce emissions

Calculating how many offsets to purchase, to compensate for residual emissions

Trading carbon credits in the carbon market (where one carbon credit is equivalent to one ton of CO2e emissions)

Fulfilling regulatory requirements for carbon disclosure

Demonstrating transparency to investors and customers

Developing verifiably low-carbon products

Why should my business invest in carbon accounting?

Carbon accounting enables businesses to succeed in the net-zero transition and manage climate-related risks. Organizations with robust carbon accounting practices are better placed to meet demand from regulators, investors and customers, and can identify risks and competitive opportunities. However, there are limitations to carbon accounting if it's not done properly.

Benefits and limitations of carbon accounting

1. Carbon accounting is an ESG imperative

Today's business leaders take sustainability seriously, and climate action is a core part of ESG (Environmental, Social and Governance) leadership. Carbon accounting underpins all credible climate action strategies by enabling organizations to identify, reduce and track their emissions towards net zero. Investors are evaluating ESG performance alongside financial performance.

2. Regulators are demanding carbon accounting across the value chain

Mandatory carbon disclosure is already coming into force in major economies in the world, including the UK and G7. The US Securities and Exchange Commission (SEC) will require companies to disclose carbon emissions from 2024, including Scope 3. The EU's Corporate Sustainability Reporting Directive (CSRD) will soon apply to over 50,000 companies.

3. Carbon accounting can provide a competitive edge

Companies representing $6.4 trillion in purchasing power requested their suppliers to disclose their emissions in 2022. Suppliers are stepping up to the challenge to report their corporate emissions and to provide product carbon footprints to demonstrate their goods are lower carbon than competitors'.

4. Carbon accounting reveals risks

Environmental risks in supply chains could cost up to US$120 billion by 2026. Carbon accounting enables organizations to pinpoint risks related to climate change and carbon regulation, from cost shocks and logistical impacts, to regulatory burdens and reputational damage.

5. Measuring GHG emissions reveals reduction opportunities

Calculating greenhouse gas emissions enables companies to clearly see their carbon footprint and find opportunities to reduce emissions across their value chain.

Limitations

When done right, carbon accounting can be a silver bullet for corporate climate action. However, comprehensive carbon accounting is extremely challenging. Inaccurate calculations can cause reputational risks like greenwashing, and can misinform carbon reduction plans.

Furthermore, carbon accounting alone is not enough. What's measured must then be managed. Organizations need to use their carbon accounting data and insights to take the right steps. This includes:

Making deep and rapid emissions reductions across their operations and supply chains

Improving transparency and communication of carbon data, to inform decision-makers

Engaging with their industry peers, financial institutions, suppliers, policymakers and customers to build decarbonization mechanisms, from sustainability-linked financing to carbon policies

More businesses than ever are measuring their emissions, but 90% are doing it incorrectly, and less than half are measuring their supply chain emissions. Therefore, there's an opportunity for organizations to show climate leadership and gain a potential competitive advantage by accounting for their carbon accurately and comprehensively.

Broadly, the three main methodologies of carbon accounting are:

1) Using supplier-specific emissions data

2) The activity-based approach

3) The spend-based approach

That being said, the menu of methodologies can vary, depending on whether the organization is developing a corporate GHG emissions inventory or a product carbon footprint or calculating its portfolio emissions. In each case, the relevant Standard from the GHG Protocol details the methodology(is) that should be followed.

What is the difference between those three carbon accounting methodologies?

Supplier-specific data means using emissions data (intensity or absolute) directly reported by an organization's suppliers. This approach is the most challenging, but generally increases accuracy.

The activity-based approach applies activity-based emissions factors to activities (e.g. distance traveled, water consumed, waste generated, electricity consumed).

The spend-based approach applies an emissions factor (based on the number of emissions produced per financial unit) to the financial value of a purchased good or service. This results in less accurate estimates than the other approaches, but can be an easier and quicker starting point for companies to estimate their emissions. However, today there are tools and software solutions that allow both improved accuracy and speed.

Carbon accounting is a relatively new field, but it's already become an essential tool in the fight against climate change.

Using carbon accounting, you can calculate your business's carbon footprint and understand where your emissions come from. This, in turn, enables you to report your sustainability impact to governments and stakeholders, implement carbon reduction and removal, and build your brand equity.

Put simply: carbon accounting empowers your business to fight climate change, stay compliant, and seize business opportunities.

What is carbon accounting? Carbon accounting is a way of calculating how much greenhouse gas an organization emits.

Like financial accounting, carbon accounting quantifies the impact of an organization's business activities – though instead of financial impact, it tracks climate impact.

Also known as "greenhouse gas accounting," carbon accounting is used to estimate carbon footprints for businesses, governments, and even individuals.

The foundations of carbon accounting can be traced back to Renaissance Italy – though carbon accounting as we know it today began in the early 2000's.

A famous management adage says that "you can't manage what you can't measure." Likewise, carbon accounting helps organizations understand their carbon emissions so they can identify hotspots, enabling them to begin their reduction efforts with high-impact actions.

And even when an organization has reduced its carbon as much as possible, calculating its carbon footprint will still help it estimate its residual emissions. The organization can then use climate investment to compensate its remaining emissions, completing its journey to net zero.

Along the way, organizations will want to share their progress with stakeholders like customers, investors, and employees – or they may even be required to report their emissions by law. Carbon accounting enables companies to report their climate impact.

How carbon accounting works

What is required for carbon accounting?

Carbon accounting requires two things: data collection and data processing. To account for their emissions effectively, businesses need to ensure that their data collection is comprehensive, and that their data processing methodology is sound.

Carbon accounting relies on two sets of data: business data and emissions factors. Business data describes the activities performed by a business. This can be either:

Spend data – how much money was paid to company X for a certain good or service, or

Activity data – how many liters of fuel or kilograms of material were bought.

The infographic below shows the business data required to calculate a business's full carbon emissions, including upstream and downstream sources:

Emissions factors are the second type data required for carbon accounting. They specify the amount of greenhouse gas emissions associated with a given unit of business data.

Once all the needed data has been collected, it can be translated into emissions estimates. How this is accomplished varies based on the methodology used.

Carbon accounting calculates an organization's greenhouse gas (GHG) emissions using two methodologies: spend-based and activity-based. The hybrid methodology combines spend-based and activity-based methods.

The spend-based method of calculating GHG emissions takes the financial value of a purchased good or service and multiplies it by an emission factor – the number of emissions produced per financial unit – resulting in an estimate of the emissions produced.

Spend-based emission factors are typically derived from so-called environmentally extended input-output (EEIO) models that depict the flow of resources between different sectors of the economy. Based on this, one can calculate the average amount of emissions associated with each unit of money paid to a company in some specific industry and region.

Since spend-based methods' emission factors are built on the industry average greenhouse gas emissions levels, spend-based calculations can lack specificity.

For example: if you buy a chair, a spend-based approach would only factor in that you bought a piece of furniture, and wouldn't account for whether the chair was made of iron or wood.

The activity-based method uses data to specify how many units of a particular product or material that a company has purchased. For example, it could be liters of fuel, kilograms of textile, etc.

The hybrid methodology combines spend-based and activity-based data

Like the spend-based method, the activity-based method also uses emissions factors to determine an activity's emissions output. These emission factors are often taken from scientific studies.

In carbon accounting, activity data generally allows for more accurate emissions estimates than spend-based data. But it's not as readily available as spend-based data, and can be time-consuming to gather.

Thus, the hybrid model methodology is recommended by the Greenhouse Gas Protocol, the most widely-used carbon calculation standard. Its pragmatic approach involves using all of the activity-based data possible, then using spend-based methods to estimate the rest.

Carbon accounting gives an organization an estimate of its carbon footprint.

The accuracy of this estimation depends on the comprehensiveness of the emissions sources calculated, the quality of the spend and activity data inputs, and the precision of the emissions factors used.

While accurate emissions data is vital for reaching net zero, businesses should not let imperfect initial calculations stop them from taking action. Even rough emissions estimates can help identify areas for improvement and set goals for emissions reduction. For businesses, the aim is to always be as accurate as they can be given where they are in their carbon accounting journeys.

Emissions estimates are often broken down into emissions “scopes,” based on where the emissions originated from. There are three scopes defined by the Greenhouse Gas Protocol:

Carbon accounting is an essential tool for any business that wants to reduce its carbon footprint – which, in addition to fighting climate change, also helps businesses attract customers, investors, and employees.

Because you can’t manage what you can’t measure, calculating carbon emissions is the first step toward reducing emissions, enabling your businesses to switch to lower-carbon activities or materials. But calculating emissions – especially value chain emissions – can be a difficult task, involving collecting many kinds of data from many sources and then translating that data into emissions totals.

Using a software that automates the process will save your business significant time compared to trying to achieve the same in-house or through sustainability consultants.

And the less time you spend data-hunting, the earlier you can begin developing and implementing reduction strategies.

For enterprise businesses, carbon accounting is especially valuable in the value chain: the smaller businesses that provide the services, products, and resources that go into the enterprise’s end products.

These value chain emissions are a large part of a business’s carbon footprint (on average accounting for 92%[CDP]) but don’t originate directly from the company, which makes them tricky to calculate and reduce. Enterprise businesses, which have suppliers numbering in the thousands, face particular difficulties calculating value chain emissions.

By using a hybrid methodology, enterprises can do a spend-based carbon footprint estimation to gain an initial overview of their value chain’s emissions sources, then refine the estimate by collecting activity-based data from their biggest emitters. This carbon accounting-enabled top-down

approach ensures that businesses, and especially big businesses, can begin with the highest-impact reductions.

Meet sustainability reporting requirements. For businesses in many parts of the world, sustainability reporting is swiftly becoming a legal requirement.

Carbon accounting enables businesses to meet the climate impact reporting requirements of these current and future legislations.

Governments are expanding emissions reporting requirements. The sooner you begin, the smoother the process will be. The savviest businesses are already getting their carbon accounting in shape for future reporting requirements. Our four-step plan for carbon reporting will help you take your organization from zero to compliance.

Companies that use carbon accounting also discover unexpected – and under-utilized – business benefits. These include minimizing risk, building brand equity, and reducing inefficiency.

We tend to think of greenwashing as intentional – and nefarious. In traditional examples, a company tries to trick consumers into believing it's doing environmental good when it's actually doing harm.

But in fact, many businesses are greenwashing without realizing it. With unintentional greenwashing, an organization believes that it's being environmentally responsible and communicates as such. But, unbeknownst to them, their environmental efforts are less effective or less comprehensive than they believe.

Unintentional greenwashing often begins at the first step of an organization's climate action: its carbon footprint calculation.

According to a 2021 survey from Boston Consulting Group, businesses estimate an average error rate of 30% to 40% in their emissions calculations. This is the accuracy gap: the delta between the emissions an organization thinks they're producing and the emissions they're actually producing.

The accuracy gap is one of the five most common greenwashing traps, because any action based on incomplete information will have incomplete results. This makes the accuracy gap a business liability – and comprehensive, accurate carbon accounting a risk mitigation necessity.

While compliance and risk reduction are driving forces for many companies, savvy businesses are using carbon accounting to go beyond box-ticking to create business value.

Consumers, employees, and investors increasingly demand businesses to take climate responsibility. Your business can appease these demands by sharing your climate journey.

Using carbon accounting to take demonstrable climate action – and validate your results – will help you build brand equity and protect it from allegations of greenwashing.

Reduce inefficiency

Quantifying your business's entire operational footprint enables you to identify inefficiencies, especially those in your value chain.

For example, the Scandinavian telecom services company Eltel used its carbon accounting results to optimize the driving routes for its technicians, minimizing time costs while saving fuel – and, of course, reducing carbon emissions.

Used properly, carbon accounting can be the gateway to the circular economy for your business.

What are the different methods of carbon accounting?

Carbon accounting methods include the spend-based and activity-based methods described by the Greenhouse Gas Protocol. Often, a blend of these two methods – called the hybrid method – is used to maximize the accuracy and comprehensiveness of carbon calculations.

Is carbon accounting hard?

Carbon accounting can be a complex and time-consuming process, especially for large businesses with complex value chains. Using software-based carbon accounting can simplify and speed up the process by helping with data collection and automating the data processing.

Why is carbon accounting important?

Carbon accounting is vital for enabling businesses to meet climate goals, stay compliant with carbon reporting legislation, and build brand equity.

How do I begin carbon accounting?

To begin carbon accounting, find a carbon accounting provider that suits your business's needs.

In summary

Carbon accounting empowers your business to reach net zero emissions and report its climate impact.

Carbon emissions calculations can be performed using spend-based data or activity-based data, or with a hybrid method that combines the two.

As governments around the world move to require climate impact reporting, carbon accounting is quickly becoming an essential tool for keeping businesses legally compliant.

Greenhouse gas emissions are classified into three scopes: scope 1, scope 2, and scope 3. These scopes are determined by where the emissions originate from. Scope 1 covers direct emissions that a company generates while performing its business activities, whereas scope 2 covers indirect emissions from purchased energy, and scope 3 covers indirect emissions in the value chain.

For most companies, the value chain is responsible for the vast majority of emissions, often around 90%. This makes it absolutely vital to include scope 3 when calculating your carbon footprint.

The terminology of scope 1, 2, and 3 was introduced in the Greenhouse Gas Protocol (GHG Protocol), which sets the standards for calculating GHG emissions all around the world. Virtually every

corporate sustainability reporting program in the world is based on the GHG Protocol, making it crucial to understand the framework.

Scope 1 emissions are direct GHG emissions that a company generates while performing its business activities. This includes:

Generation of electricity, heat, or steam.

Manufacture or processing of chemicals and materials, as well as waste processing.

Transportation of materials, products, and waste using vehicles owned or controlled by the company.

Fugitive emissions, such as equipment leaks of gases or vapors from pressure-containing equipment.

How to calculate scope 1 emissions

Best approach:

Direct measurement of GHG emissions by monitoring concentration and flow rate.

Alternative approach:

Calculated based on the purchased quantities of commercial fuels and emissions factors.

Scope 2 emissions are the indirect emissions generated by the production of purchased energy. This includes:

Purchased electricity

Purchased heating

Purchased cooling

How to calculate scope 2 emissions

Best approach:

Calculated from metered electricity consumption and supplier-specific emissions factor.

Alternative approach:

Local grid or other more general emissions factors can be used to calculate emissions starting from metered electricity or electricity bills.

Scope 3 emissions are all other indirect emissions that occur in the value chain of a company and are not already included within scope 2. These emissions are a consequence of the company's business activities but occur from sources the company does not own or control. They account for approximately 88% of an average company's emissions. Scope 3 emissions include the following:

Emissions generated in the company's supply chain, such as extraction, production, and transportation of purchased materials and fuels.

Emissions generated from the use of sold products and services.

Emissions generated from waste disposal. This includes the disposal of waste generated both in operations and in the production of purchased materials and fuels, as well as disposal of solid products at the end of their life.

How to calculate scope 3 emissions

Best approach:

Primarily calculated from activity data such as fuel use or passenger miles, as well as published or third-party emissions factors. In most cases, if source- or facility-specific emissions factors are available, they are preferable to more generic or general emissions factors.

Alternative approach:

For smaller scope 3 emissions contributors, a transaction-based method with general emissions factors can be used to reduce costs and complexity without overly compromising quality.

Value chain emissions in scope 3 are challenging – but vital – for businesses to address.

Take a deep dive into scope 3

Learn more about the value chain emissions in scope 3 which are challenging – but vital – for businesses to address.

Why calculate your scope 1, 2, and 3 emissions? The world's top-performing companies are committing to net zero: to reduce their emissions as much as possible, and then compensate any remainder with high-quality climate investment.

To reach net zero, the first step is to measure all of your emissions – scope 1, 2, and 3.

If your business is like most others, scope 3 is responsible for the majority of your carbon footprint.

Scope 3 – also called value chain emissions – accounts for around 90% of the average business's climate impact.

To comprehensively report and reduce your business's emissions, you need to know your full scope 3 emissions – and to achieve that, you will need to calculate your upstream and downstream emissions sources.

What is scope 3 emissions?

Scope 3 emissions are all the indirect emissions that occur in the value chain of a company. These emissions are a consequence of the company's business activities but occur from sources the company does not own or control.

According to the CDP, scope 3 emissions account for around 90% of an average company's emissions.

Value chain emissions in scope 3 are challenging – but vital – for businesses to address.

Scope 3 emissions, explained

What scope 3 emissions are, why they're important, and how your business can effectively manage them.

What are upstream and downstream emissions?

The Greenhouse Gas Protocol – the most widely-used framework for calculating business carbon emissions – divides scope 3 emissions into upstream and downstream sources.

Upstream emissions come from the production of your business's products or services, while downstream emissions come from their use and disposal.

Upstream emissions scope 3 categories

Upstream emissions occur during the production of goods or services that a business purchases or uses.

For example: if your retail business uses plastic to produce its products, the emissions resulting from the production and transportation of that plastic would be upstream emissions.

Upstream emissions occur during production

The table below contains a simplified version of the eight upstream emissions categories defined by the Greenhouse Gas Protocol:

Category Description

Purchased goods and services Extraction, production, and transportation of goods and services purchased or acquired by the company

Capital goods Extraction, production, and transportation of capital goods purchased or acquired by the company

Fuel- and energy-related activities

Extraction, production, and transportation of fuels and energy purchased or acquired by the company which are not already accounted for in scope 1 or scope 2

Upstream transportation and distribution Transportation and distribution of products purchased by the company, as well as other transportation and distribution services like inbound logistics, outbound logistics, and transpiration between company facilities

Waste generated in operations Disposal and treatment of waste generated in the company's operations, in facilities not owned or controlled by the company

Business travel Transportation of employees for business-related activities in vehicles not owned or operated by the company

Employee commuting Transportation of employees between their homes and their worksites in vehicles not owned or operated by the company

Upstream leased assets Operation of assets leased by the company and not included in scope 1 and scope 2

Refer to the Greenhouse Gas Protocol's Technical Guidance for Calculating Scope 3 Emissions for a more detailed breakdown of the categories.

Downstream emissions scope 3 categories

Downstream emissions result from the use or disposal of a business's products or services.

For example: if your company manufactures machinery, the emissions that result from the use of that machinery would be considered downstream emissions.

Downstream emissions occur during use

Category Description

Downstream transportation and distribution Transportation and distribution of products sold by the company between the company's operations and the end consumer

Processing of sold products Processing of intermediate products sold by downstream companies

Use of sold products

End use of goods and services sold by the company

End-of-life treatment of sold products Waste disposal and treatment of products sold by the company, at the end of the products' lives

Downstream leased assets Operation of assets owned by the company and leased to other entities

Franchises Operation of franchises in the reporting year, not included in scope 1 and scope2

Investments Operation of investments, including equity and debt investments and project finance

Refer to the Greenhouse Gas Protocol's Technical Guidance for Calculating Scope 3 Emissions for a more detailed breakdown of the categories.

Why classify emissions in this way?

By dividing its scope 3 carbon footprint into upstream and downstream sources, a business can better focus its emissions calculation and reduction efforts.

A company's business model will provide clues to its likely sources of emissions hotspots.

For instance, retailers will often have large upstream emissions due to the production of the goods they sell. While businesses in financial services, on the other hand, often find their carbon footprint concentrated in downstream sources due to their investments.

How to manage your upstream and downstream emissions

To manage your upstream and downstream emissions, you first need to measure them. But calculating these emissions manually is a time-consuming process, and one that's prone to human error.

Carbon accounting is key to managing emissions

Instead of manual calculations, businesses can use software-based carbon accounting to calculate, report, and reduce their upstream and downstream emissions.

Carbon accounting, like financial accounting, quantifies the impact of an organization's business activities – though instead of financial impact, it measures climate impact.

By using a comprehensive, automated, and science-backed carbon accounting provider, you empower your business to efficiently calculate its full carbon footprint, including the upstream and downstream emissions in your business's value chain.

You can then use these calculations to identify hotspots, implement reduction measures, and track your progress.

What is scope 1, scope 2, and scope 3 emissions?

Greenhouse gas emissions are classified into three scopes: scope 1, scope 2, and scope 3. These scopes are determined by where the emissions originate from. The terminology of scope 1, 2, and 3 was introduced in the Greenhouse Gas Protocol (GHG Protocol), which sets the standards for measuring GHG emissions all around the world.

You can learn more about scope 1, 2, and 3 emissions in our comprehensive explainer article.

What is scope 3 emissions categories?

Because scope 3 contains such a broad range of emissions sources, the Greenhouse Gas Protocol further breaks scope 3 down into 15 sub-categories. These categories are grouped into upstream or downstream sources. You can find these categories listed in the tables above.

What are upstream emissions?

Upstream emissions occur during the production of goods or services that a business purchases or uses.

What are downstream emissions?

Downstream emissions occur after the production of a company's products or services, during use or disposal.

GHG Reduction Programs & Strategies

A wide range of strategies are available to help organizations reduce their greenhouse gas (GHG) emissions. Below are a list of resources and guides to help your organization identify and implement GHG reduction opportunities.

1) Energy Efficiency
2) Renewable Energy
3) Supply Chain
4) Waste Reduction and Diversion Strategies
5) Reduce Methane Emissions
6) Increase Fuel Efficiency in Transportation and Logistics

Energy Efficiency

U.S. EPA's ENERGY STAR Program: Through its partnerships with more than 15,000 private and public sector organizations, ENERGY STAR delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices.

Buildings & Plants: ENERGY STAR certifies top performing commercial buildings and manufacturing plants and provides an innovative energy performance rating system which businesses have already

used for more than 96,000 buildings across the country. ENERGY STAR's Portfolio Manager is an online tool to measure and track energy and water consumption, as well as greenhouse gas emissions. Use it to benchmark the performance of one building or across an organization's entire portfolio of buildings.

Small Businesses: ENERGY STAR offers tools and resources to help small businesses improve their financial performance by reducing energy waste and energy costs.

Products: ENERGY STAR certifies products in more than 70 categories that use less energy, save money, and help protect the environment.

ENERGY STAR tips to save energy at work.

U.S. Department of Energy (DOE) provides a variety of programs that identify opportunities for integrating energy-efficiency measures into your facility.

Buildings Performance Database (BPD) unlocks the power of building energy performance data. The platform enables users to perform statistical analysis on an anonymous dataset of tens of thousands of commercial and residential buildings from across the country. Users can compare performance trends among similar buildings to identify and prioritize cost-saving energy efficiency improvements and assess the range of likely savings from these improvements.

Standard Energy Efficiency Data (SEED) platform is a software tool that provides a standardized format for collecting, storing, and analyzing building energy performance information about large portfolios. The platform provides an easy, flexible, and cost-effective method to analyze data about large portfolios of buildings and demonstrate the economic and environmental benefits of energy efficiency.

U.S. EPA’s Combined Heat and Power Partnership (CHP) promote the use of combined heat and power (CHP) to reduce the environmental impacts of power generation, increase your facility's operational efficiency, and decrease energy costs. The Partnership works closely with energy users,

the CHP industry, state and local governments, and other clean energy stakeholders to facilitate the development of new projects and to promote their environmental and economic benefits.

CHP Project Development Handbook provides information, tools, and hints on combined heat and power (CHP) project development, CHP technologies, and the resources of the EPA CHP Partnership.

U.S. EPA's State and Local Climate and Energy Program help state, local, and tribal governments develop policies and programs that can reduce greenhouse gas emissions, lower energy costs, improve air quality and public health, and help achieve economic development goals. EPA provides proven, cost–effective best practices, peer exchange opportunities, and analytical tools.

Renewable Energy

U.S. EPA's Green Power Partnership (GPP) is a voluntary program that encourages organizations to use green power as a way to reduce the environmental impacts associated with conventional electricity use. The Partnership currently has more than 1,300 Partner organizations voluntarily using billions of kilowatt-hours of green power annually. GPP supports the organizational procurement of green power by offering expert advice, technical support, tools, and resources. Green power is electricity produced from a subset of renewable resources, such as solar, wind, geothermal, biomass, and low-impact hydro. Partnering with EPA can help your organization reduce its carbon footprint and communicate its leadership to key stakeholders.

Guide to Purchasing Green Power provides current and potential buyers of green power with information about green power purchasing, including different types of green power products, the benefits of green power purchasing, and how to capture the greatest benefit from your purchase. The Guide is the product of a cooperative effort between the EPA, the U.S. Department of Energy, the World Resources Institute, and the Center for Resource Solutions.

National Renewable Energy Laboratory's (NREL) Innovations in Voluntary Renewable Energy Procurement: Methods for Expanding Access and Lowering Cost for Communities, Governments, and

Businesses (pdf) explores five innovative options for voluntarily procuring renewable energy generation or systems. These methods can be replicated by a variety of stakeholders—including local governments, not-for-profit organizations, businesses, and utilities.

Supply Chain

U.S. EPA's Green Suppliers Network works with large manufacturers to engage their suppliers in low-cost technical reviews to identify strategies for improving process lines, using materials more efficiently, and reducing waste. Working in collaboration with the U.S. Department of Commerce (Dock) National Institute of Standards and Technology's Manufacturing Extension Partnership (NIST MEP), the Green Suppliers Network helps small and medium-sized manufacturers stay competitive and profitable while reducing their impact on the environment.

Managing Supply Chain Greenhouse Gas Emissions: Lessons Learned for the Road Ahead (pdf) (8.66 MB, December 2010) highlights lessons learned by early movers that engaged their suppliers in GHG management.

Additional resources listed on The Center's Supply Chain webpage.

Waste Reduction and Diversion Strategies

U.S. EPA's Resources for Waste Reduction and Recycling provide resources related to waste reduction and recycling in the workplace, including guidance on starting or expanding a recycling collection program, initiatives to reduce everyday trash, and frameworks for food recovery programs.

U.S. EPA's Water Sense program partners with manufacturers, retailers and distributors, and utilities to bring Water Sense labeled products to the marketplace and make it easy to purchase high-performing, water-efficient products. Water Sense also partners with professional certifying organizations to promote water–efficient landscape irrigation practices.

Reduce Methane Emissions

U.S. EPA's Asgar program promotes the use of biogas recovery systems to reduce methane emissions from livestock waste. Asgar assists those who enable, purchase, or implement anaerobic digesters by identifying project benefits, risks, options, and opportunities. Asgar provides information and participates in events to create a supporting environment for anaerobic digester implementation.

U.S. EPA's Landfill Methane Outreach Program (LMOP) promotes the use of landfill gas as a renewable, green energy source. Landfill gas is the natural by-product of the decomposition of solid waste in landfills and is comprised primarily of carbon dioxide and methane. LMOP forms partnerships with communities, landfill owners, utilities, power marketers, states, project developers, tribes, and non-profit organizations to overcome barriers to project development by helping them assess project feasibility, find financing, and market the benefits of project development to the community.

U.S. EPA's Natural Gas STAR Program provides a framework for companies with U.S. oil and gas operations to implement methane reducing technologies and practices and document their voluntary emission reduction activities.

U.S. EPA's Natural Gas STAR Methane Challenge Program recognizes oil and natural gas companies that make specific and transparent commitments to reduce methane emissions.

Increase Fuel Efficiency in Transportation and Logistics

U.S. EPA's SmartWay is a public/private collaboration between EPA and the freight transportation industry that helps freight shippers, carriers, and logistics companies improve fuel-efficiency and save money. Acquiring U.S. EPA Certified SmartWay light-duty vehicles can help improve the overall fuel economy performance of a light-duty fleet.

To ensure the ASSET Carbon Accounting Reduction Program and ASSET Protocol are addressing issues that have historically existed with carbon offset production, ASSET Protocol will incorporate data backing of the token generation process through a process called Digital Measurement,

Reporting, and Validation (D-MRV), EPA supported GHG emissions reduction guidelines, and where possible, consistent with the Integrity Council for Voluntary Carbon Markets (IC-VCM) Core Carbon Principles (CCP).

Digital MRV is a newer approach to monitoring and evaluating climate change mitigation efforts that utilizes digital technologies and data analytics. It differs from traditional MRV in several ways:

- **Data collection**: Digital MRV uses digital technologies, such as sensors, satellites, and remote sensing, to collect and analyze data. This allows for more accurate, timely, and comprehensive data collection, as well as the ability to collect data on a larger scale.
- **Automation**: Digital MRV automates many of the data collection and analysis processes, which reduces the need for human intervention and improves efficiency. This can result in faster reporting and decision-making.
- **Transparency**: Digital MRV provides greater transparency and accountability by making data available in real-time and in a more accessible format. This can improve trust between stakeholders and increase the likelihood of achieving climate change goals.
- **Cost-effectiveness**: Digital MRV can be more cost-effective than traditional MRV, as it reduces the need for manual data collection and analysis. It also allows for more targeted interventions, which can improve the cost-effectiveness of mitigation efforts.
- **Scope**: Digital MRV can capture a wider range of data than traditional MRV, including indirect and long-term effects, which can provide a more comprehensive understanding of the impact of mitigation efforts.

Overall, Digital MRV has the potential to be a more efficient, effective, and comprehensive approach to monitoring and evaluating climate change mitigation efforts.

The Integrity Council for the Voluntary Carbon Market (Integrity Council) is an independent governance body for the voluntary carbon market. They do this by setting and enforcing definitive

global threshold standards, drawing on the best science and expertise available, so high-quality carbon credits channel finance towards genuine and additional greenhouse gas reductions and removals that go above and beyond what can otherwise be achieved, and contribute to climate resilient development.

What is GHG Protocol?

GHG Protocol establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions.

Building on a 20-year partnership between World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), GHG Protocol works with governments, industry associations, NGOs, businesses and other organizations.

What is GHG Protocol's decision-making process for updating standards and guidance?

GHG Protocol convenes governance bodies that guide the development of its accounting and reporting standards. Our governance bodies include an Advisory Group, Technical Working Group/s, Review Group, Pilot Testing Group, and the Secretariat. More details on the roles, composition, decision-making criteria.

Who Uses GHG Protocol?

GHG Protocol supplies the world's most widely used greenhouse gas accounting standards.
The Corporate Accounting and Reporting Standard provides the accounting platform for virtually every corporate GHG reporting program in the world.

Companies and Organizations

In 2016, 92% of Fortune 500 companies responding to the CDP used GHG Protocol directly or indirectly through a program based on GHG Protocol.

According to the EPA, the following activities can be considered for ASSET Protocol token generation:

GHG Reduction Programs & Strategies

A wide range of strategies are available to help organizations reduce their greenhouse gas (GHG) emissions. Below are a list of resources and guides to help your organization identify and implement GHG reduction opportunities.

- Energy Efficiency
- Renewable Energy
- Supply Chain
- Waste Reduction and Diversion Strategies
- Reduce Methane Emissions
- Increase Fuel Efficiency in Transportation and Logistics
- Additional Resources

Organizations' supply chains often account for more than 90 percent of their greenhouse gas (GHG) emissions, when taking into account their overall climate impacts. Over the last decade, leading organizations across many sectors have developed GHG inventories, instituted annual GHG-accounting practices, and succeeded in reducing their own Scope 1 and 2 GHG emissions. These entities are now tackling the next frontier in GHG management by finding ways to measure and lower their GHG emissions throughout their supply chains.

Reporting Corporate Climate Risks and Opportunities

Through climate risk and opportunity reporting, organizations can report to the public how they are identifying, assessing, and managing climate-related risks (physical and transition) and opportunities. This type of reporting allows organizations to report:

- Their governance structure for climate-related risks and opportunities.
- Actual and potential impacts of climate-related risks and opportunities on their strategy, businesses, and financial planning.
- Their methods to identify, assess, and manage climate-related risks.
- The metrics and targets they use to assess and manage relevant climate-related risks and opportunities.

Explore the following to learn more about reporting climate risks and opportunities:

- Steps to discover, assess, report, and manage climate risks and opportunities.
- Market developments around climate-related financial disclosures.
- How climate risks and opportunities are defined.
- EPA and other relevant resources.

EPA's guidance is aligned with the Task Force on Climate-related Financial Disclosures (TCFD) and the Greenhouse Gas (GHG) Protocol. EPA has developed resources to help organizations conduct, assess, and reduce their Scope 1, 2, and 3 GHG emissions – a key step to inform transition risk and opportunity assessments.

Please reverence FIGURE 6 for a full SDG diagram.

History

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015,

provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

The SDGs build on decades of work by countries and the UN, including the UN Department of Economic and Social Affairs

In June 1992, at the Earth Summit in Rio de Janeiro, Brazil, more than 178 countries adopted Agenda 21, a comprehensive plan of action to build a global partnership for sustainable development to improve human lives and protect the environment.

Member States unanimously adopted the Millennium Declaration at the Millennium Summit in September 2000 at UN Headquarters in New York. The Summit led to the elaboration of eight Millennium Development Goals (MDGs) to reduce extreme poverty by 2015.

The Johannesburg Declaration on Sustainable Development and the Plan of Implementation, adopted at the World Summit on Sustainable Development in South Africa in 2002, reaffirmed the global community's commitments to poverty eradication and the environment, and built on Agenda 21 and the Millennium Declaration by including more emphasis on multilateral partnerships.

At the United Nations Conference on Sustainable Development (Rio+20) in Rio de Janeiro, Brazil, in June 2012, Member States adopted the outcome document "The Future We Want" in which they decided, inter alia, to launch a process to develop a set of SDGs to build upon the MDGs and to establish the UN High-level Political Forum on Sustainable Development. The Rio +20 outcome also contained other measures for implementing sustainable development, including mandates for future programmed of work in development financing, small island developing states and more.

In 2013, the General Assembly set up a 30-member Open Working Group to develop a proposal on the SDGs.

In January 2015, the General Assembly began the negotiation process on the post-2015 development agenda. The process culminated in the subsequent adoption of the 2030 Agenda for Sustainable Development, with 17 SDGs at its core, at the UN Sustainable Development Summit in September 2015.

2015 was a landmark year for multilateralism and international policy shaping, with the adoption of several major agreements:

Sendai Framework for Disaster Risk Reduction (March 2015)

Addis Ababa Action Agenda on Financing for Development (July 2015)

Transforming our world: the 2030 Agenda for Sustainable Development with its 17 SDGs was adopted at the UN Sustainable Development Summit in New York in September 2015.

Paris Agreement on Climate Change (December 2015)

Now, the annual High-level Political Forum on Sustainable Development serves as the central UN platform for the follow-up and review of the SDGs.

Today, the Division for Sustainable Development Goals (DSDG) in the United Nations Department of Economic and Social Affairs (UNDESA) provides substantive support and capacity-building for the SDGs and their related thematic issues, including water, energy, climate, oceans, urbanization, transport, science and technology, the Global Sustainable Development Report (GSDR), partnerships and Small Island Developing States. DSDG plays a key role in the evaluation of UN systemwide implementation of the 2030 Agenda and on advocacy and outreach activities relating to the SDGs. In order to make the 2030 Agenda a reality, broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement the global goals. DSDG aims to help facilitate this engagement.

1. We, the Heads of State and Government and High Representatives, meeting at the United Nations Headquarters in New York from 25-27 September 2015 as the Organization celebrates its seventieth anniversary, have decided today on new global Sustainable Development Goals.

2. On behalf of the peoples we serve, we have adopted a historic decision on a comprehensive, far-reaching and people-centered set of universal and transformative Goals and targets. We commit ourselves to working tirelessly for the full implementation of this Agenda by 2030. We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development. We are committed to achieving sustainable development in its three dimensions – economic, social and environmental – in a balanced and integrated manner. We will also build upon the achievements of the Millennium Development Goals and seek to address their unfinished business.

3. We resolve, between now and 2030, to end poverty and hunger everywhere; to combat inequalities within and among countries; to build peaceful, just and inclusive societies; to protect human rights and promote gender equality and the empowerment of women and girls; and to ensure the lasting protection of the planet and its natural resources. We resolve also to create conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all, taking into account different levels of national development and capacities.

4. As we embark on this great collective journey, we pledge that no one will be left behind. Recognizing that the dignity of the human person is fundamental, we wish to see the Goals and targets met for all nations and peoples and for all segments of society. And we will endeavor to reach the furthest behind first.

5. This is an Agenda of unprecedented scope and significance. It is accepted by all countries and is applicable to all, taking into account different national realities, capacities and levels of development and respecting national policies and priorities. These are universal goals and targets which involve the entire world, developed and developing countries alike. They are integrated and indivisible and balance the three dimensions of sustainable development.

6. The Goals and targets are the result of over two years of intensive public consultation and engagement with civil society and other stakeholders around the world, which paid particular attention to the voices of the poorest and most vulnerable. This consultation included valuable work done by the General Assembly Open Working Group on Sustainable Development Goals and by the United Nations, whose Secretary-General provided a synthesis report in December 2014.

Our vision

7. In these Goals and targets, we are setting out a supremely ambitious and transformational vision. We envisage a world free of poverty, hunger, disease and want, where all life can thrive. We envisage a world free of fear and violence. A world with universal literacy. A world with equitable and universal access to quality education at all levels, to health care and social protection, where physical, mental and social well-being are assured. A world where we reaffirm our commitments regarding the human right to safe drinking water and sanitation and where there is improved hygiene; and where food is sufficient, safe, affordable and nutritious. A world where human habitats are safe, resilient and sustainable and where there is universal access to affordable, reliable and sustainable energy.

8. We envisage a world of universal respect for human rights and human dignity, the rule of law, justice, equality and non-discrimination; of respect for race, ethnicity and cultural diversity; and of equal opportunity permitting the full realization of human potential and contributing to shared prosperity. A world which invests in its children and in which every child grows up free from violence and exploitation. A world in which every woman and girl enjoys full gender equality and all legal, social and economic barriers to their empowerment have been removed. A just, equitable, tolerant, open and socially inclusive world in which the needs of the most vulnerable are met.

9. We envisage a world in which every country enjoys sustained, inclusive and sustainable economic growth and decent work for all. A world in which consumption and production patterns and use of

all natural resources – from air to land, from rivers, lakes and aquifers to oceans and seas - are sustainable. One in which democracy, good governance and the rule of law as well as an enabling environment at national and international levels, are essential for sustainable development, including sustained and inclusive economic growth, social development, environmental protection and the eradication of poverty and hunger. One in which development and the application of technology are climate-sensitive, respect biodiversity and are resilient. One in which humanity lives in harmony with nature and in which wildlife and other living species are protected.

Our shared principles and commitments

10. The new Agenda is guided by the purposes and principles of the Charter of the United Nations, including full respect for international law. It is grounded in the Universal Declaration of Human Rights, international human rights treaties, the Millennium Declaration and the 2005 World Summit Outcome Document. It is informed by other instruments such as the Declaration on the Right to Development.

11. We reaffirm the outcomes of all major UN conferences and summits which have laid a solid foundation for sustainable development and have helped to shape the new Agenda. These include the Rio Declaration on Environment and Development; the World Summit on Sustainable Development; the World Summit for Social Development; the Programmed of Action of the International Conference on Population and Development, the Beijing Platform for Action; and the United Nations Conference on Sustainable Development ("Rio+ 20"). We also reaffirm the follow-up to these conferences, including the outcomes of the Fourth United Nations Conference on the Least Developed Countries, the Third International Conference on Small Island Developing States; the Second United Nations Conference on Landlocked Developing Countries; and the Third UN World Conference on Disaster Risk Reduction.

12. We reaffirm all the principles of the Rio Declaration on Environment and Development, including, inter alia, the principle of common but differentiated responsibilities, as set out in principle 7 thereof.

13. The challenges and commitments contained in these major conferences and summits are interrelated and call for integrated solutions. To address them effectively, a new approach is needed. Sustainable development recognizes that eradicating poverty in all its forms and dimensions, combatting inequality within and among countries, preserving the planet, creating sustained, inclusive and sustainable economic growth and fostering social inclusion are linked to each other and are interdependent.

Our world today

14. We are meeting at a time of immense challenges to sustainable development. Billions of our citizens continue to live in poverty and are denied a life of dignity. There are rising inequalities within and among countries. There are enormous disparities of opportunity, wealth and power. Gender inequality remains a key challenge. Unemployment, particularly youth unemployment, is a major concern. Global health threats, more frequent and intense natural disasters, spiraling conflict, violent extremism, terrorism and related humanitarian crises and forced displacement of people threaten to reverse much of the development progress made in recent decades. Natural resource depletion and adverse impacts of environmental degradation, including desertification, drought, land degradation, freshwater scarcity and loss of biodiversity, add to and exacerbate the list of challenges which humanity faces. Climate change is one of the greatest challenges of our time and its adverse impacts undermine the ability of all countries to achieve sustainable development. Increases in global temperature, sea level rise, ocean acidification and other climate change impacts are seriously affecting coastal areas and low-lying coastal countries, including many least developed

countries and small island developing States. The survival of many societies, and of the biological support systems of the planet, is at risk.

15. It is also, however, a time of immense opportunity. Significant progress has been made in meeting many development challenges. Within the past generation, hundreds of millions of people have emerged from extreme poverty. Access to education has greatly increased for both boys and girls. The spread of information and communications technology and global interconnectedness have great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies, as does scientific and technological innovation across areas as diverse as medicine and energy.

16. Almost fifteen years ago, the Millennium Development Goals were agreed. These provided an important framework for development and significant progress has been made in a number of areas. But the progress has been uneven, particularly in Africa, least developed countries, landlocked developing countries, and small island developing States, and some of the MDGs remain off-track, in particular those related to maternal, newborn and child health and to reproductive health. We recommit ourselves to the full realization of all the MDGs, including the off-track MDGs, in particular by providing focused and scaled-up assistance to least developed countries and other countries in special situations, in line with relevant support programmed. The new Agenda builds on the Millennium Development Goals and seeks to complete what these did not achieve, particularly in reaching the most vulnerable.

17. In its scope, however, the framework we are announcing today goes far beyond the MDGs. Alongside continuing development priorities such as poverty eradication, health, education and food security and nutrition, it sets out a wide range of economic, social and environmental objectives. It also promises more peaceful and inclusive societies. It also, crucially, defines means of

implementation. Reflecting the integrated approach that we have decided on, there are deep interconnections and many cross-cutting elements across the new Goals and targets.

The new Agenda

18. We are announcing today 17 Sustainable Development Goals with 169 associated targets which are integrated and indivisible. Never before have world leaders pledged common action and endeavor across such a broad and universal policy agenda. We are setting out together on the path towards sustainable development, devoting ourselves collectively to the pursuit of global development and of "win-win" cooperation which can bring huge gains to all countries and all parts of the world. We reaffirm that every State has, and shall freely exercise, full permanent sovereignty over all its wealth, natural resources and economic activity. We will implement the agenda for the full benefit of all, for today's generation and for future generations. In doing so, we reaffirm our commitment to international law and emphasize that the agenda is to be implemented in a manner that is consistent with the rights and obligations of states under international law.

19. We reaffirm the importance of the Universal Declaration of Human Rights, as well as other international instruments relating to human rights and international law. We emphasize the responsibilities of all States, in conformity with the Charter of the United Nations, to respect, protect and promote human rights and fundamental freedoms for all, without distinction of any kind as to race, color, sex, language, religion, political or other opinion, national or social origin, property, birth, disability or other status.

20. Realizing gender equality and the empowerment of women and girls will make a crucial contribution to progress across all the Goals and targets. The achievement of full human potential and of sustainable development is not possible if one half of humanity continues to be denied its full human rights and opportunities. Women and girls must enjoy equal access to quality education, economic resources and political participation as well as equal opportunities with men and boys for

employment, leadership and decision-making at all levels. We will work for a significant increase in investments to close the gender gap and strengthen support for institutions in relation to gender equality and the empowerment of women at the global, regional and national levels. All forms of discrimination and violence against women and girls will be eliminated, including through the engagement of men and boys. The systematic mainstreaming of a gender perspective in the implementation of the agenda is crucial.

21. The new Goals and targets will come into effect on 1 January 2016 and will guide the decisions we take over the next fifteen years. All of us will work to implement the agenda within our own countries and at the regional and global levels, taking into account different national realities, capacities and levels of development and respecting national policies and priorities We will respect national policy space for sustained, inclusive and sustainable economic growth, in particular for developing states, while remaining consistent with relevant international rules and commitments. We acknowledge also the importance of the regional and sub-regional dimensions, regional economic integration and interconnectivity in sustainable development. Regional and sub-regional frameworks can facilitate the effective translation of sustainable development policies into concrete action at national level.

22. Each country faces specific challenges in its pursuit of sustainable development. The most vulnerable countries and, in particular, African countries, least developed countries, landlocked developing countries and small island developing states deserve special attention, as do countries in situations of conflict and post-conflict countries. There are also serious challenges within many middle-income countries.

23. People who are vulnerable must be empowered. Those whose needs are reflected in the agenda include all children, youth, persons with disabilities (of whom more than 80% live in poverty), people

living with HIV/AIDS, older persons, indigenous peoples, refugees and internally displaced persons and migrants. We resolve to take further effective measures and actions, in conformity with international law, to remove obstacles and constraints, strengthen support and meet the special needs of people living in areas affected by complex humanitarian emergencies and in areas affected by terrorism.

24. We are committed to ending poverty in all its forms and dimensions, including by eradicating extreme poverty by 2030. All people must enjoy a basic standard of living, including through social protection systems. We are also determined to end hunger and to achieve food security as a matter of priority and to end all forms of malnutrition. In this regard, we reaffirm the important role and inclusive nature of the Committee on World Food Security and welcome the Rome Declaration on Nutrition and Framework for Action. We will devote resources to developing rural areas and sustainable agriculture and fisheries, supporting smallholder farmers, especially women farmers, herders and fishers in developing countries, particularly least developed countries.

25. We commit to providing inclusive and equitable quality education at all levels – early childhood, primary, secondary, tertiary, technical and vocational training. All people, irrespective of sex, age, race, ethnicity, and persons with disabilities, migrants, indigenous peoples, children and youth, especially those in vulnerable situations, should have access to life-long learning opportunities that help them acquire the knowledge and skills needed to exploit opportunities and to participate fully in society. We will strive to provide children and youth with a nurturing environment for the full realization of their rights and capabilities, helping our countries to reap the demographic dividend including through safe schools and cohesive communities and families.

26. To promote physical and mental health and well-being, and to extend life expectancy for all, we must achieve universal health coverage and access to quality health care. No one must be left behind. We commit to accelerating the progress made to date in reducing newborn, child and

maternal mortality by ending all such preventable deaths before 2030. We are committed to ensuring universal access to sexual and reproductive health-care services, including for family planning, information and education. We will equally accelerate the pace of progress made in fighting malaria, HIV/AIDS, tuberculosis, hepatitis, Ebola and other communicable diseases and epidemics, including by addressing growing anti-microbial resistance and the problem of unattended diseases affecting developing countries. We are committed to the prevention and treatment of non-communicable diseases, including behavioral, developmental and neurological disorders, which constitute a major challenge for sustainable development.

27. We will seek to build strong economic foundations for all our countries. Sustained, inclusive and sustainable economic growth is essential for prosperity. This will only be possible if wealth is shared and income inequality is addressed. We will work to build dynamic, sustainable, innovative and people-centered economies, promoting youth employment and women's economic empowerment, in particular, and decent work for all. We will eradicate forced labor and human trafficking and end child labor in all its forms. All countries stand to benefit from having a healthy and well-educated workforce with the knowledge and skills needed for productive and fulfilling work and full participation in society. We will strengthen the productive capacities of least-developed countries in all sectors, including through structural transformation. We will adopt policies which increase productive capacities, productivity and productive employment; financial inclusion; sustainable agriculture, pastoralist and fisheries development; sustainable industrial development; universal access to affordable, reliable, sustainable and modern energy services; sustainable transport systems; and quality and resilient infrastructure.

28. We commit to making fundamental changes in the way that our societies produce and consume goods and services. Governments, international organizations, the business sector and other non-state actors and individuals must contribute to changing unsustainable consumption and production patterns, including through the mobilization, from all sources, of financial and technical assistance to

strengthen developing countries' scientific, technological and innovative capacities to move towards more sustainable patterns of consumption and production. We encourage the implementation of the 10-Year Framework of Programmed on Sustainable Consumption and Production. All countries take action, with developed countries taking the lead, taking into account the development and capabilities of developing countries.

29. We recognize the positive contribution of migrants for inclusive growth and sustainable development. We also recognize that international migration is a multi-dimensional reality of major relevance for the development of countries of origin, transit and destination, which requires coherent and comprehensive responses. We will cooperate internationally to ensure safe, orderly and regular migration involving full respect for human rights and the humane treatment of migrants regardless of migration status, of refugees and of displaced persons. Such cooperation should also strengthen the resilience of communities hosting refugees, particularly in developing countries. We underline the right of migrants to return to their country of citizenship, and recall that States must ensure that their returning nationals are duly received.

30. States are strongly urged to refrain from promulgating and applying any unilateral economic, financial or trade measures not in accordance with international law and the Charter of the United Nations that impede the full achievement of economic and social development, particularly in developing countries.

31. We acknowledge that the UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change. We are determined to address decisively the threat posed by climate change and environmental degradation. The global nature of climate change calls for the widest possible international cooperation aimed at accelerating the reduction of global greenhouse gas emissions and addressing adaptation to the adverse impacts of climate change. We note with grave concern the significant gap between the aggregate effect of Parties' mitigation

pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with having a likely chance of holding the increase in global average temperature below 2 °C or 1.5 °C above pre-industrial levels.

32. Looking ahead to the COP21 conference in Paris in December, we underscore the commitment of all States to work for an ambitious and universal climate agreement. We reaffirm that the protocol, another legal instrument or agreed outcome with legal force under the Convention applicable to all Parties shall address in a balanced manner, inter alia, mitigation, adaptation, finance, technology development and transfer, and capacity-building, and transparency of action and support.

33. We recognize that social and economic development depends on the sustainable management of our planet's natural resources. We are therefore determined to conserve and sustainably use oceans and seas, freshwater resources, as well as forests, mountains and drylands and to protect biodiversity, ecosystems and wildlife. We are also determined to promote sustainable tourism, tackle water scarcity and water pollution, to strengthen cooperation on desertification, dust storms, land degradation and drought and to promote resilience and disaster risk reduction. In this regard, we look forward to COP13 of the Convention on Biological Diversity to be held in Mexico in 2016.

34. We recognize that sustainable urban development and management are crucial to the quality of life of our people. We will work with local authorities and communities to renew and plan our cities and human settlements so as to foster community cohesion and personal security and to stimulate innovation and employment. We will reduce the negative impacts of urban activities and of chemicals which are hazardous for human health and the environment, including through the environmentally sound management and safe use of chemicals, the reduction and recycling of waste and more efficient use of water and energy. And we will work to minimize the impact of cities on the global climate system. We will also take account of population trends and projections in our

national, rural and urban development strategies and policies. We look forward to the upcoming United Nations Conference on Housing and Sustainable Urban Development in Quito, Ecuador.

35. Sustainable development cannot be realized without peace and security; and peace and security will be at risk without sustainable development. The new Agenda recognizes the need to build peaceful, just and inclusive societies that provide equal access to justice and that are based on respect for human rights (including the right to development), on effective rule of law and good governance at all levels and on transparent, effective and accountable institutions. Factors which give rise to violence, insecurity and injustice, such as inequality, corruption, poor governance and illicit financial and arms flows, are addressed in the agenda. We must redouble our efforts to resolve or prevent conflict and to support post-conflict countries, including through ensuring that women have a role in peace-building and state-building. We call for further effective measures and actions to be taken, in conformity with international law, to remove the obstacles to the full realization of the right of self-determination of peoples living under colonial and foreign occupation, which continue to adversely affect their economic and social development as well as their environment.

36. We pledge to foster inter-cultural understanding, tolerance, mutual respect and an ethic of global citizenship and shared responsibility. We acknowledge the natural and cultural diversity of the world and recognize that all cultures and civilizations can contribute to, and are crucial enablers of, sustainable development.

37. Sport is also an important enabler of sustainable development. We recognize the growing contribution of sport to the realization of development and peace in its promotion of tolerance and respect and the contributions it makes to the empowerment of women and of young people, individuals and communities as well as to health, education and social inclusion objectives.

38. We reaffirm, in accordance with the Charter of the United Nations, the need to respect the territorial integrity and political independence of States.

Means of Implementation

39. The scale and ambition of the new Agenda requires a revitalized Global Partnership to ensure its implementation. We fully commit to this. This Partnership will work in a spirit of global solidarity, in particular solidarity with the poorest and with people in vulnerable situations. It will facilitate an intensive global engagement in support of implementation of all the Goals and targets, bringing together Governments, the private sector, civil society, the United Nations system and other actors and mobilizing all available resources.

40. The means of implementation targets under Goal 17 and under each SDG are key to realizing our Agenda and are of equal importance with the other Goals and targets. The agenda, including the SDGs, can be met within the framework of a revitalized global partnership for sustainable development, supported by the concrete policies and actions as outlined in the outcome document of the Third International Conference on Financing for Development, held in Addis Ababa from 13-16 July 2015. We welcome the endorsement by the General Assembly of the Addis Ababa Action Agenda, which is an integral part of the 2030 Agenda for Sustainable Development. We recognize that the full implementation of the Addis Ababa Action Agenda is critical for the realization of the Sustainable Development Goals and targets.

41. We recognize that each country has primary responsibility for its own economic and social development. The new Agenda deals with the means required for implementation of the Goals and targets. We recognize that these will include the mobilization of financial resources as well as capacity-building and the transfer of environmentally sound technologies to developing countries on

favorable terms, including on concessional and preferential terms, as mutually agreed. Public finance, both domestic and international, will play a vital role in providing essential services and public goods and in catalyzing other sources of finance. We acknowledge the role of the diverse private sector, ranging from micro-enterprises to cooperatives to multinationals, and that of civil society organizations and philanthropic organizations in the implementation of the new Agenda.

42. We support the implementation of relevant strategies and programmed of action, including the Istanbul Declaration and Programmed of Action, the SIDS Accelerated Modalities of Action (SAMOA) Pathway, the Vienna Programmed of Action for Landlocked Developing Countries for the Decade 2014-2024, and reaffirm the importance of supporting the African Union's Agenda 2063 and the programmed of the New Partnership for Africa's Development (NEPAD), all of which are integral to the new Agenda. We recognize the major challenge to the achievement of durable peace and sustainable development in countries in conflict and post-conflict situations.

43. We emphasize that international public finance plays an important role in complementing the efforts of countries to mobilize public resources domestically, especially in the poorest and most vulnerable countries with limited domestic resources. An important use of international public finance, including ODA, is to catalyze additional resource mobilization from other sources, public and private. ODA providers reaffirm their respective commitments, including the commitment by many developed countries to achieve the target of 0.7% of ODA/GNI to developing countries and 0.15% to 0.2% of ODA/GNI to least developed countries.

44. We acknowledge the importance for international financial institutions to support, in line with their mandates, the policy space of each country, in particular developing countries. We recommit to broadening and strengthening the voice and participation of developing countries – including African countries, least developed countries, land-locked developing countries, small-island developing

States and middle-income countries – in international economic decision-making, norm-setting and global economic governance.

45. We acknowledge also the essential role of national parliaments through their enactment of legislation and adoption of budgets and their role in ensuring accountability for the effective implementation of our commitments. Governments and public institutions will also work closely on implementation with regional and local authorities, sub-regional institutions, international institutions, academia, philanthropic organizations, volunteer groups and others.

46. We underline the important role and comparative advantage of an adequately resourced, relevant, coherent, efficient and effective UN system in supporting the achievement of the SDGs and sustainable development. While stressing the importance of strengthened national ownership and leadership at country level, we express our support for the ongoing ECOSOC Dialogue on the longer-term positioning of the United Nations development system in the context of this Agenda.

Follow-up and review

47. Our governments have the primary responsibility for follow-up and review, at the national, regional and global levels, in relation to the progress made in implementing the Goals and targets over the coming fifteen years. To support accountability to our citizens, we will provide for systematic follow-up and review at the various levels, as set out in this Agenda and the Addis Ababa Action Agenda. The High-Level Political Forum under the auspices of the General Assembly and the Economic and Social Council will have the central role in overseeing follow-up and review at the global level.

48. Indicators are being developed to assist this work. Quality, accessible, timely and reliable disaggregated data will be needed to help with the measurement of progress and to ensure that no one is left behind. Such data is key to decision-making. Data and information from existing reporting

mechanisms should be used where possible. We agree to intensify our efforts to strengthen statistical capacities in developing countries, particularly African countries, least developed countries, landlocked developing countries, small island developing States and middle-income countries. We are committed to developing broader measures of progress to complement gross domestic product (GDP).

A call for action to change our world

49. Seventy years ago, an earlier generation of world leaders came together to create the United Nations. From the ashes of war and division they fashioned this Organization and the values of peace, dialogue and international cooperation which underpin it. The supreme embodiment of those values is the Charter of the United Nations.

50. Today we are also taking a decision of great historic significance. We resolve to build a better future for all people, including the millions who have been denied the chance to lead decent, dignified and rewarding lives and to achieve their full human potential. We can be the first generation to succeed in ending poverty; just as we may be the last to have a chance of saving the planet. The world will be a better place in 2030 if we succeed in our objectives.

51. What we are announcing today – an Agenda for global action for the next fifteen years – is a charter for people and planet in the twenty-first century. Children and young women and men are critical agents of change and will find in the new Goals a platform to channel their infinite capacities for activism into the creation of a better world.

52. "We the Peoples" are the celebrated opening words of the UN Charter. It is "We the Peoples" who are embarking today on the road to 2030. Our journey will involve Governments as well as Parliaments, the UN system and other international institutions, local authorities, indigenous peoples, civil society, business and the private sector, the scientific and academic community – and

all people. Millions have already engaged with, and will own, this Agenda. It is an Agenda of the people, by the people, and for the people – and this, we believe, will ensure its success.

53. The future of humanity and of our planet lies in our hands. It lies also in the hands of today's younger generation who will pass the torch to future generations. We have mapped the road to sustainable development; it will be for all of us to ensure that the journey is successful and its gains irreversible.

Sustainable Development Goals and targets

54. Following an inclusive process of intergovernmental negotiations, and based on the Proposal of the Open Working Group on Sustainable Development Goals, which includes a chapeau contextualizing the latter, the following are the Goals and targets which we have agreed.

55. The SDGs and targets are integrated and indivisible, global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities. Targets are defined as aspirational and global, with each government setting its own national targets guided by the global level of ambition but taking into account national circumstances. Each government will also decide how these aspirational and global targets should be incorporated in national planning processes, policies and strategies. It is important to recognize the link between sustainable development and other relevant ongoing processes in the economic, social and environmental fields.

56. In deciding upon these Goals and targets, we recognize that each country faces specific challenges to achieve sustainable development, and we underscore the special challenges facing the most vulnerable countries and, in particular, African countries, least developed countries, landlocked

developing countries and small island developing States, as well as the specific challenges facing the middle-income countries. Countries in situations of conflict also need special attention.

57. We recognize that baseline data for several of the targets remain unavailable, and we call for increased support for strengthening data collection and capacity building in Member States, to develop national and global baselines where they do not yet exist. We commit to addressing this gap in data collection so as to better inform the measurement of progress, in particular for those targets below which do not have clear numerical targets.

58. We encourage ongoing efforts by states in other fora to address key issues which pose potential challenges to the implementation of our Agenda; and we respect the independent mandates of those processes. We intend that the agenda and its implementation would support, and be without prejudice to, those other processes and the decisions taken therein.

59. We recognize that there are different approaches, visions, models and tools available to each country, in accordance with its national circumstances and priorities, to achieve sustainable development; and we reaffirm that planet Earth and its ecosystems are our common home and that 'Mother Earth' is a common expression in a number of countries and regions.

Sustainable Development Goals

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12. Ensure sustainable consumption and production patterns

Goal 13. Take urgent action to combat climate change and its impacts

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Goal 1. End poverty in all its forms everywhere

1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day

1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable

1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmed and policies to end poverty in all its dimensions

1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round

2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed

2.an Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries

2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round

2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

Goal 3. Ensure healthy lives and promote well-being for all at all ages

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births

3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol

3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents

3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmed

3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate

3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all

3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes

4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education

4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship

4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development

4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all

4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmed, in developed countries and other developing countries

4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States

Goal 5. Achieve gender equality and empower all women and girls

5.1 End all forms of discrimination against all women and girls everywhere

5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation

5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation

5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life

5.6 Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programmed of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences

5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws

5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels

Goal 6. Ensure availability and sustainable management of water and sanitation for all

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmed, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b Support and strengthen the participation of local communities in improving water and sanitation management

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.3 By 2030, double the global rate of improvement in energy efficiency

7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmed of support

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries

8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labor-intensive sectors

8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services

8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavor to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmed on sustainable consumption and production, with developed countries taking the lead

8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training

8.7 Take immediate and effective measures to eradicate forced labor, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labor, including recruitment and use of child soldiers, and by 2025 end child labor in all its forms

8.8 Protect labor rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment

8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products

8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all

8.an Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries

8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labor Organization

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

Goal 10. Reduce inequality within and among countries

10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard

10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality

10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations

10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions

10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies

10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements

10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmed

10.c By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons

11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning

11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and

adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

Goal 12. Ensure sustainable consumption and production patterns

12.1 Implement the 10-year framework of programmed on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries

12.2 By 2030, achieve the sustainable management and efficient use of natural resources

12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle

12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities

12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production

12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products

12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

Goal 13. Take urgent action to combat climate change and its impacts

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

13.2 Integrate climate change measures into national policies, strategies and planning

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management

plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information

14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation

14.7 By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism

14.an Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries

14.b Provide access for small-scale artisanal fishers to marine resources and markets

14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development

15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed

15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products

15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species

15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts

15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation

15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

16.1 Significantly reduce all forms of violence and related death rates everywhere

16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children

16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all

16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime

16.5 Substantially reduce corruption and bribery in all their forms

16.6 Develop effective, accountable and transparent institutions at all levels

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance

16.9 By 2030, provide legal identity for all, including birth registration

16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements

16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime

16.b Promote and enforce non-discriminatory laws and policies for sustainable development

Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

Finance

17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection

17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of ODA/GNI to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries

17.3 Mobilize additional financial resources for developing countries from multiple sources

17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress

17.5 Adopt and implement investment promotion regimes for least developed countries

Technology

17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism

17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favorable terms, including on concessional and preferential terms, as mutually agreed

17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology

Capacity-building

17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation

Trade

17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda

17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020

17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access

Systemic issues

Policy and institutional coherence

17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence

17.14 Enhance policy coherence for sustainable development

17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development

Multi-stakeholder partnerships

17.16 Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries

17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships

Data, monitoring and accountability

17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts

17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries

Means of implementation and the Global Partnership

60. We reaffirm our strong commitment to the full implementation of this new Agenda. We recognize that we will not be able to achieve our ambitious Goals and targets without a revitalized and enhanced Global Partnership and comparably ambitious means of implementation. The revitalized Global Partnership will facilitate an intensive global engagement in support of implementation of all the goals and targets, bringing together Governments, civil society, the private sector, the United Nations system and other actors and mobilizing all available resources.

61. The Agenda’s Goals and targets deal with the means required to realize our collective ambitions. The means of implementation targets under each SDG and Goal 17, which are referred to above, are key to realizing our Agenda and are of equal importance with the other Goals and targets. We shall accord them equal priority in our implementation efforts and in the global indicator framework for monitoring our progress.

62. This Agenda, including the SDGs, can be met within the framework of a revitalized global partnership for sustainable development, supported by the concrete policies and actions outlined in the Addis Ababa Action Agenda, which is an integral part of the 2030 Agenda for sustainable development. The Addis Ababa Action Agenda supports, complements and helps contextualize the 2030 Agenda's means of implementation targets. These relate to domestic public resources, domestic and international private business and finance, international development cooperation, international trade as an engine for development, debt and debt sustainability, addressing systemic issues and science, technology, innovation and capacity-building, and data, monitoring and follow-up.

63. Cohesive nationally owned sustainable development strategies, supported by integrated national financing frameworks, will be at the heart of our efforts. We reiterate that each country has primary responsibility for its own economic and social development and that the role of national policies and development strategies cannot be overemphasized. We will respect each country's policy space and leadership to implement policies for poverty eradication and sustainable development, while remaining consistent with relevant international rules and commitments. At the same time, national development efforts need to be supported by an enabling international economic environment, including coherent and mutually supporting world trade, monetary and financial systems, and strengthened and enhanced global economic governance. Processes to develop and facilitate the availability of appropriate knowledge and technologies globally, as well as capacity-building, are also critical. We commit to pursuing policy coherence and an enabling environment for sustainable development at all levels and by all actors, and to reinvigorating the global partnership for sustainable development.

64. We support the implementation of relevant strategies and programmed of action, including the Istanbul Declaration and Programmed of Action, the SIDS Accelerated Modalities of Action (SAMOA) Pathway, the Vienna Programmed of Action for Landlocked Developing Countries for the Decade

2014-2024, and reaffirm the importance of supporting the African Union's Agenda 2063 and the programmed of the New Partnership for Africa's Development (NEPAD), all of which are integral to the new Agenda. We recognize the major challenge to the achievement of durable peace and sustainable development in countries in conflict and post-conflict situations.

65. We recognize that middle-income countries still face significant challenges to achieve sustainable development. In order to ensure that achievements made to date are sustained, efforts to address ongoing challenges should be strengthened through the exchange of experiences, improved coordination, and better and focused support of the United Nations Development System, the international financial institutions, regional organizations and other stakeholders.

66. We underscore that, for all countries, public policies and the mobilization and effective use of domestic resources, underscored by the principle of national ownership, are central to our common pursuit of sustainable development, including achieving the sustainable development goals. We recognize that domestic resources are first and foremost generated by economic growth, supported by an enabling environment at all levels.

67. Private business activity, investment and innovation are major drivers of productivity, inclusive economic growth and job creation. We acknowledge the diversity of the private sector, ranging from micro-enterprises to cooperatives to multinationals. We call on all businesses to apply their creativity and innovation to solving sustainable development challenges. We will foster a dynamic and well-functioning business sector, while protecting labor rights and environmental and health standards in accordance with relevant international standards and agreements and other on-going initiatives in this regard, such as the Guiding Principles on Business and Human Rights and the labor standards of ILO, the Convention on the Rights of the Child and key multilateral environmental agreements, for parties to those agreements.

68. International trade is an engine for inclusive economic growth and poverty reduction, and contributes to the promotion of sustainable development. We will continue to promote a universal, rules-based, open, transparent, predictable, inclusive, non-discriminatory and equitable multilateral trading system under the World Trade Organization (WTO), as well as meaningful trade liberalization. We call on all WTO members to redouble their efforts to promptly conclude the negotiations on the Doha Development Agenda. We attach great importance to providing trade-related capacity-building for developing countries, including African countries, least-developed countries, landlocked developing countries, small island developing states and middle-income countries, including for the promotion of regional economic integration and interconnectivity.

69. We recognize the need to assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief, debt restructuring and sound debt management, as appropriate. Many countries remain vulnerable to debt crises and some are in the midst of crises, including a number of least developed countries, small-island developing States and some developed countries. We reiterate that debtors and creditors must work together to prevent and resolve unsustainable debt situations. Maintaining sustainable debt levels is the responsibility of the borrowing countries; however, we acknowledge that lenders also have a responsibility to lend in a way that does not undermine a country's debt sustainability. We will support the maintenance of debt sustainability of those countries that have received debt relief and achieved sustainable debt levels.

70. We hereby launch a Technology Facilitation Mechanism which was established by the Addis Ababa Action Agenda in order to support the sustainable development goals. The Technology Facilitation Mechanism will be based on a multi-stakeholder collaboration between Member States, civil society, private sector, scientific community, United Nations entities and other stakeholders and will be composed of: a United Nations Interagency Task Team on Science, Technology and Innovation

for the SDGs, a collaborative Multistakeholder Forum on Science, Technology and Innovation for the SDGs and an on-line platform.

• The United Nations Interagency Task Team on Science, Technology and Innovation for the SDGs will promote coordination, coherence, and cooperation within the UN System on STI related matters, enhancing synergy and efficiency, in particular to enhance capacity-building initiatives. The Task Team will draw on existing resources and will work with 10 representatives from the civil society, private sector, the scientific community, to prepare the meetings of the Multistakeholder Forum on Science, Technology and Innovation for the SDGs, as well as in the development and operationalization of the on-line platform, including preparing proposals for the modalities for the Forum and the on-line platform. The 10 representatives will be appointed by the Secretary General, for periods of two years. The Task Team will be open to the participation of all UN agencies, funds and programmed, and ECOSOC functional commissions and it will initially be composed by the entities that currently integrate the informal working group on technology facilitation, namely: UN Department of Economic and Social Affairs, United Nations Environment Programmed, UNIDO, United Nations Educational Scientific and Cultural Organization, UNCTAD, International Telecommunication Union, WIPO and the World Bank.

• The on-line platform will be used to establish a comprehensive mapping of, and serve as a gateway for, information on existing STI initiatives, mechanisms and programmed, within and beyond the UN. The on-line platform will facilitate access to information, knowledge and experience, as well as best practices and lessons learned, on STI facilitation initiatives and policies. The online platform will also facilitate the dissemination of relevant open access scientific publications generated worldwide. The on-line platform will be developed on the basis of an independent technical assessment which will take into account best practices and lessons learned from other initiatives, within and beyond the United Nations, in order to ensure that it will complement, facilitate access to and provide adequate information on existing STI platforms, avoiding duplications and enhancing synergies.

• The Multi-stakeholder Forum on Science Technology and Innovation for the SDGs will be convened once a year, for a period of two days, to discuss STI cooperation around thematic areas for the implementation of the SDGs, congregating all relevant stakeholders to actively contribute in their area of expertise. The Forum will provide a venue for facilitating interaction, matchmaking and the establishment of networks between relevant stakeholders and multi- stakeholder partnerships in order to identify and examine technology needs and gaps, including on scientific cooperation, innovation and capacity building, and also in order to help facilitate development, transfer and dissemination of relevant technologies for the SDGs. The meetings of the Forum will be convened by the President of the ECOSOC before the meeting of the High-Level Political Forum under the auspices of ECOSOC or, alternatively, in conjunction with other fora or conferences, as appropriate, taking into account the theme to be considered and on the basis of a collaboration with the organizers of the other fora or conference. The meetings of the Forum will be co-chaired by two Member States and will result in a summary of discussions elaborated by the two co-chairs, as an input to the meetings of the High-Level Political Forum, in the context of the follow-up and review of the implementation of the Post-2015 Development Agenda.

• The meetings of the HLPF will be informed by the summary of the Multistakeholder Forum. The themes for the subsequent Multistakeholder Forum on Science Technology and Innovation for the SDGs will be considered by the High-Level Political Forum on sustainable development, taking into account expert inputs from the Task Team.

71. We reiterate that this Agenda and the Sustainable Development Goals and targets, including the means of implementation are universal, indivisible and interlinked.

Follow-up and review

72. We commit to engage in systematic follow-up and review of implementation of this Agenda over the next fifteen years. A robust, voluntary, effective, participatory, transparent and integrated

follow-up and review framework will make a vital contribution to implementation and will help countries to maximize and track progress in implementing this Agenda in order to ensure that no one is left behind.

73. Operating at the national, regional and global levels, it will promote accountability to our citizens, support effective international cooperation in achieving this Agenda and foster exchanges of best practices and mutual learning. It will mobilize support to overcome shared challenges and identify new and emerging issues. As this is a universal Agenda, mutual trust and understanding among all nations will be important.

74. Follow-up and review processes at all levels will be guided by the following principles:

a. They will be voluntary and country-led, will take into account different national realities, capacities and levels of development and will respect policy space and priorities. As national ownership is key to achieving sustainable development, the outcome from national level processes will be the foundation for reviews at regional and global levels, given that the global review will be primarily based on national official data sources.

b. They will track progress in implementing the universal Goals and targets, including the means of implementation, in all countries in a manner which respects their universal, integrated and interrelated nature and the three dimensions of sustainable development.

c. They will maintain a longer-term orientation, identify achievements, challenges, gaps and critical success factors and support countries in making informed policy choices. They will help mobilize the necessary means of implementation and partnerships, support the identification of solutions and best practices and promote coordination and effectiveness of the international development system.

d. They will be open, inclusive, participatory and transparent for all people and will support the reporting by all relevant stakeholders.

e. They will be people-centered, gender-sensitive, respect human rights and have a particular focus on the poorest, most vulnerable and those furthest behind.

f. They will build on existing platforms and processes, where these exist, avoid duplication and respond to national circumstances, capacities, needs and priorities. They will evolve over time, taking into account emerging issues and the development of new methodologies, and will minimize the reporting burden on national administrations.

g. They will be rigorous and based on evidence, informed by country-led evaluations and data which is high-quality, accessible, timely, reliable and disaggregated by income, sex, age, race, ethnicity, migration status, disability and geographic location and other characteristics relevant in national contexts.

h. They will require enhanced capacity-building support for developing countries, including the strengthening of national data systems and evaluation programs, particularly in African countries, LDCs, SIDS and LLDCs and middle-income countries.

i. They will benefit from the active support of the UN system and other multilateral institutions.

75. The Goals and targets will be followed-up and reviewed using a set of global indicators. These will be complemented by indicators at the regional and national levels which will be developed by member states, in addition to the outcomes of work undertaken for the development of the baselines for those targets where national and global baseline data does not yet exist. The global indicator framework, to be developed by the Inter Agency and Expert Group on SDG Indicators, will be agreed by the UN Statistical Commission by March 2016 and adopted thereafter by the Economic and Social Council and the General Assembly, in line with existing mandates. This framework will be simple yet robust, address all SDGs and targets including for means of implementation, and preserve the political balance, integration and ambition contained therein.

76. We will support developing countries, particularly African countries, LDCs, SIDS and LLDCs, in strengthening the capacity of national statistical offices and data systems to ensure access to high-quality, timely, reliable and disaggregated data. We will promote transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, including earth observation and geo-spatial information, while ensuring national ownership in supporting and tracking progress.

77. We commit to fully engage in conducting regular and inclusive reviews of progress at sub-national, national, regional and global levels. We will draw as far as possible on the existing network of follow-up and review institutions and mechanisms. National reports will allow assessments of progress and identify challenges at the regional and global level. Along with regional dialogues and global reviews, they will inform recommendations for follow-up at various levels.

National level

78. We encourage all member states to develop as soon as practicable ambitious national responses to the overall implementation of this Agenda. These can support the transition to the SDGs and build on existing planning instruments, such as national development and sustainable development strategies, as appropriate.

79. We also encourage member states to conduct regular and inclusive reviews of progress at the national and sub-national levels which are country-led and country-driven. Such reviews should draw on contributions from indigenous peoples, civil society, the private sector and other stakeholders, in line with national circumstances, policies and priorities. National parliaments as well as other institutions can also support these processes.

Regional level

80. Follow-up and review at the regional and sub-regional levels can, as appropriate, provide useful opportunities for peer learning, including through voluntary reviews, sharing of best practices and discussion on shared targets. We welcome in this respect the cooperation of regional and sub-regional commissions and organizations. Inclusive regional processes will draw on national-level reviews and contribute to follow-up and review at the global level, including at the High-Level Political Forum on sustainable development (HLPF).

81. Recognizing the importance of building on existing follow-up and review mechanisms at the regional level and allowing adequate policy space, we encourage all member states to identify the most suitable regional forum in which to engage. UN regional commissions are encouraged to continue supporting member states in this regard.

Global level

82. The HLPF will have a central role in overseeing a network of follow-up and review processes at the global level, working coherently with the General Assembly, ECOSOC and other relevant organs and forums, in accordance with existing mandates. It will facilitate sharing of experiences, including successes, challenges and lessons learned, and provide political leadership, guidance and recommendations for follow-up. It will promote system-wide coherence and coordination of sustainable development policies. It should ensure that the agenda remains relevant and ambitious and should focus on the assessment of progress, achievements and challenges faced by developed and developing countries as well as new and emerging issues. Effective linkages will be made with the follow-up and review arrangements of all relevant UN Conferences and processes, including on LDCs, SIDS and LLDCs.

83. Follow-up and review at the HLPF will be informed by an annual SDG Progress Report to be prepared by the Secretary General in cooperation with the UN System, based on the global indicator framework and data produced by national statistical systems and information collected at the regional level. The HLPF will also be informed by the Global Sustainable Development Report, which shall strengthen the science-policy interface and could provide a strong evidence-based instrument to support policy-makers in promoting poverty eradication and sustainable development. We invite the President of ECOSOC to conduct a process of consultations on the scope, methodology and frequency of the Report as well as its relation to the SDG Progress Report, the outcome of which should be reflected in the Ministerial Declaration of the HLPF session in 2016.

84. The HLPF, under the auspices of ECOSOC, shall carry out regular reviews, in line with Resolution 67/290. Reviews will be voluntary, while encouraging reporting, and include developed and developing countries as well as relevant UN entities and other stakeholders, including civil society and the private sector. They shall be state-led, involving ministerial and other relevant high-level participants. They shall provide a platform for partnerships, including through the participation of major groups and other relevant stakeholders.

85. Thematic reviews of progress on the Sustainable Development Goals, including cross-cutting issues, will also take place at the HLPF. These will be supported by reviews by the ECOSOC functional commissions and other inter-governmental bodies and forums which should reflect the integrated nature of the goals as well as the interlinkages between them. They will engage all relevant stakeholders and, where possible, feed into, and be aligned with, the cycle of the HLPF.

86. We welcome, as outlined in the Addis Ababa Action Agenda, the dedicated follow-up and review for the Financing for Development outcomes as well as all the means of implementation of the SDGs which is integrated with the follow-up and review framework of this Agenda. The intergovernmental agreed conclusions and recommendations of the annual ECOSOC Forum on Financing for

Development will be fed into the overall follow-up and review of the implementation of this Agenda in the HLPF.

87. Meeting every four years under the auspices of the General Assembly, the HLPF will provide high-level political guidance on the agenda and its implementation, identify progress and emerging challenges and mobilize further actions to accelerate implementation. The next HLPF, under the auspices of the General Assembly, will take place in 2019, with the cycle of meetings thus reset, in order to maximize coherence with the Quadrennial Comprehensive Policy Review process.

88. We also stress the importance of system-wide strategic planning, implementation and reporting in order to ensure coherent and integrated support to implementation of the new Agenda by the UN development system. The relevant governing bodies should take action to review such support to implementation and to report on progress and obstacles. We welcome the ongoing ECOSOC Dialogues on the longer-term positioning of the UN development system and look forward to taking action on these issues, as appropriate.

89. The HLPF will support participation in follow-up and review processes by the major groups and other relevant stakeholders in line with Resolution 67/290. We call on these actors to report on their contribution to the implementation of the agenda.

90. We request the Secretary General, in consultation with Member States, to prepare a report, for consideration at the 70th session of the General Assembly in preparation for the 2016 meeting of the HLPF, which outlines critical milestones towards coherent efficient, and inclusive follow-up and review at the global level. This report should include a proposal on the organizational arrangements for state-led reviews at the HLPF under the auspices of ECOSOC, including recommendations on a voluntary common reporting guideline. It should clarify institutional responsibilities and provide guidance on annual themes, on a sequence of thematic reviews, and on options for periodic reviews for the HLPF.

91. We reaffirm our unwavering commitment to achieving this Agenda and utilizing it to the full to transform our world for the better by 2030.

BRIEF DESCRPITION OF THE DRAWINGS

FIGURE 14: RETRIEVAL-AUGMENTED GENERATION FLOW CHART COMBINES LLMS WITH EMBEDDING MODELS AND VECTOR DATABASES.

DETAILED DESCRIPTION OF THE EMBODIMENTS

What are AI Agents?

An artificial intelligence (AI) agent is a software program that can interact with its environment, collect data, and use the data to perform self-determined tasks to meet predetermined goals. Humans set goals, but an AI agent independently chooses the best actions it needs to perform to achieve those goals. For example, consider a contact center AI agent that wants to resolves customer queries. The agent will automatically ask the customer different questions, look up information in internal documents, and respond with a solution. Based on the customer responses, it determines if it can resolve the query itself or pass it on to a human.

Learn more about what is artificial intelligence (AI)

What are the key principles that define AI agents?

All software autonomously completes different tasks as determined by the software developer. So, what makes AI or intelligent agents special?

AI agents are rational agents. They make rational decisions based on their perceptions and data to produce optimal performance and results. An AI agent senses its environment with physical or software interfaces.

For example, a robotic agent collects sensor data, and a chatbot uses customer queries as input. Then, the AI agent applies the data to make an informed decision. It analyzes the collected data to

predict the best outcomes that support predetermined goals. The agent also uses the results to formulate the next action that it should take. For example, self-driving cars navigate around obstacles on the road based on data from multiple sensors.

What are the benefits of using AI agents?

AI agents can improve your business operations and your customers' experiences.

Improved productivity

AI agents are autonomous intelligent systems performing specific tasks without human intervention. Organizations use AI agents to achieve specific goals and more efficient business outcomes. Business teams are more productive when they delegate repetitive tasks to AI agents. This way, they can divert their attention to mission-critical or creative activities, adding more value to their organization.

Reduced costs

Businesses can use intelligent agents to reduce unnecessary costs arising from process inefficiencies, human errors, and manual processes. You can confidently perform complex tasks because autonomous agents follow a consistent model that adapts to changing environments.

Informed decision-making

Advanced intelligent agents use machine learning (ML) to gather and process massive amounts of real-time data. This allows business managers to make better predictions at pace when strategizing their next move. For example, you can use AI agents to analyze product demands in different market segments when running an ad campaign.

Improved customer experience

Customers seek engaging and personalized experiences when interacting with businesses. Integrating AI agents allows businesses to personalize product recommendations, provide prompt responses, and innovate to improve customer engagement, conversion, and loyalty.

What are the key components of AI agent architecture?

Agents in artificial intelligence may operate in different environments to accomplish unique purposes. However, all functional agents share these components.

Architecture

Architecture is the base the agent operates from. The architecture can be a physical structure, a software program, or a combination. For example, a robotic AI agent consists of actuators, sensors, motors, and robotic arms. Meanwhile, an architecture that hosts an AI software agent may use a text prompt, API, and databases to enable autonomous operations.

Agent function

The agent function describes how the data collected is translated into actions that support the agent's objective. When designing the agent function, developers consider the type of information, AI capabilities, knowledge base, feedback mechanism, and other technologies required.

Agent program

An agent program is the implementation of the agent function. It involves developing, training, and deploying the AI agent on the designated architecture. The agent program aligns the agent's business logic, technical requirements, and performance elements.

How does an AI agent work?

AI agents work by simplifying and automating complex tasks. Most autonomous agents follow a specific workflow when performing assigned tasks.

Determine goals

The AI agent receives a specific instruction or goal from the user. It uses the goal to plan tasks that make the final outcome relevant and useful to the user. Then, the agent breaks down the goal into several smaller actionable tasks. To achieve the goal, the agent performs those tasks based on specific orders or conditions.

Acquire information

AI agents need information to act on tasks they have planned successfully. For example, the agent must extract conversation logs to analyze customer sentiments. As such, AI agents might access the internet to search for and retrieve the information they need. In some applications, an intelligent agent can interact with other agents or machine learning models to access or exchange information.

Implement tasks

With sufficient data, the AI agent methodically implements the task at hand. Once it accomplishes a task, the agent removes it from the list and proceeds to the next one. In between task completions, the agent evaluates if it has achieved the designated goal by seeking external feedback and inspecting its own logs. During this process, the agent might create and act on more tasks to reach the final outcome.

What are the challenges of using AI agents?

AI agents are helpful software technologies to automate business workflows for better outcomes. That being said, organizations should address the following concerns when deploying autonomous AI agents for business use cases.

Data privacy concerns

Developing and operating advanced AI agents requires acquiring, storing, and moving massive volumes of data. Organizations should be aware of data privacy requirements and employ necessary measures to improve data security posture.

Ethical challenges

In certain circumstances, deep learning models may produce unfair, biased, or inaccurate results. Applying safeguards, such as human reviews, ensures customers receive helpful and fair responses from the agents deployed.

Technical complexities

Implementing advanced AI agents requires specialized experience and knowledge of machine learning technologies. Developers must be able to integrate machine learning libraries with software applications and train the agent with enterprise-specific data.

Limited compute resources

Training and deploying deep learning AI agents require substantial computing resources. When organizations implement these agents on-premise, they must invest in and maintain costly infrastructure that is not easily scalable.

What are the types of AI agents?

Organizations create and deploy different types of intelligent agents. We share some examples below.

Simple reflex agents

A simple reflex agent operates strictly based on predefined rules and its immediate data. It will not respond to situations beyond a given event condition action rule. Hence, these agents are suitable for simple tasks that don't require extensive training. For example, you can use a simple reflex agent to reset passwords by detecting specific keywords in a user's conversation.

Model-based reflex agents

A model-based agent is similar to simple reflex agents, except the former has a more advanced decision-making mechanism. Rather than merely following a specific rule, a model-based agent evaluates probable outcomes and consequences before deciding. Using supporting data, it builds an internal model of the world it perceives and uses that to support its decisions.

Goal-based agents

Goal-based agents, or rule-based agents, are AI agents with more robust reasoning capabilities. Besides evaluating the environment data, the agent compares different approaches to help it achieve the desired outcome. Goal-based agents always choose the most efficient path. They are suitable for performing complex tasks, such as natural language processing (NLP) and robotics applications.

Utility-based agents

A utility-based agent uses a complex reasoning algorithm to help users maximize the outcome they desire. The agent compares different scenarios and their respective utility values or benefits. Then, it

chooses one that provides users with the most rewards. For example, customers can use a utility-based agent to search for flight tickets with minimum traveling time, irrespective of the price.

Learning agents

A learning agent continuously learns from previous experiences to improve its results. Using sensory input and feedback mechanisms, the agent adapts its learning element over time to meet specific standards. On top of that, it uses a problem generator to design new tasks to train itself from collected data and past results.

Hierarchical agents

Hierarchical agents are an organized group of intelligent agents arranged in tiers. The higher-level agents deconstruct complex tasks into smaller ones and assign them to lower-level agents. Each agent runs independently and submits a progress report to its supervising agent. The higher-level agent collects the results and coordinates subordinate agents to ensure they collectively achieve goals.

How AI agents work

At the core of AI agents are large language models (LLMs). For this reason, AI agents are often referred to as LLM agents. Traditional LLMs, such as IBM® Granite models, produce their responses based on the data used to train them and are bounded by knowledge and reasoning limitations. In contrast, agentic technology uses tool calling on the backend to obtain up-to-date information, optimize workflow and create subtasks autonomously to achieve complex goals.

In this process, the autonomous agent learns to adapt to user expectations over time. The agent's ability to store past interactions in memory and plan future actions encourages a personalized experience and comprehensive responses.1 This tool calling can be achieved without human

intervention and broadens the possibilities for real-world applications of these AI systems. The approach that AI agents take in achieving goals set by users is comprised of these three stages:

Goal initialization and planning

Although AI agents are autonomous in their decision-making processes, they require goals and environments defined by humans.2 There are three main influences on autonomous agent behavior:

The team of developers that design and train the agentic AI system.

The team that deploys the agent and provides the user with access to it.

The user that provides the AI agent with specific goals to accomplish and establishes available tools to use.

Given the user's goals and the agent’s available tools, the AI agent then performs task decomposition to improve performance.3 Essentially, the agent creates a plan of specific tasks and subtasks to accomplish the complex goal.

For simple tasks, planning is not a necessary step. Instead, an agent can iteratively reflect on its responses and improve them without planning its next steps.

Reasoning using available tools

AI agents base their actions on the information they perceive. Often, AI agents do not have the full knowledge base needed for tackling all subtasks within a complex goal. To remedy this, AI agents use their available tools. These tools can include external data sets, web searches, APIs and even other agents. After the missing information is retrieved from these tools, the agent can update its

knowledge base. This means that each step of the way, the agent reassesses its plan of action and self-corrects.

To help illustrate this process, customer a user planning their vacation. The user tasks an AI agent with predicting which week in the next year would likely have the best weather for their surfing trip in Greece. Since the LLM model at the core of the agent does not specialize in weather patterns, the agent gathers information from an external database comprised of daily weather reports for Greece over the past several years.

Despite acquiring this new information, the agent still cannot determine the optimal weather conditions for surfing and so, the next subtask is created. For this subtask, the agent communicates with an external agent that specializes in surfing. Let's say that in doing so, the agent learns that high tides and sunny weather with little to no rain provide the best surfing conditions.

The agent can now combine the information it has learned from its tools to identify patterns. It can predict which week next year in Greece will likely have high tides, sunny weather and a low chance of rain. These findings are then presented to the user. This sharing of information between tools is what allows AI agents to be more general-purpose than traditional AI models.3

Learning and reflection

AI agents use feedback mechanisms, such as other AI agents and human-in-the-loop (HITL), to improve the accuracy of their responses. Let's return to our previous surfing example to highlight this. After the agent forms its response to the user, the agent stores the learned information along with the user's feedback to improve performance and adjust to user preferences for future goals.

If other agents were used to reach the goal, their feedback may also be used. Multi-agent feedback can be especially useful in minimizing the time that human users spend providing direction. However, users can also provide feedback throughout the agent's actions and internal reasoning to better align the results with the intended goal.2

Feedback mechanisms improve the AI agent's reasoning and accuracy, which is commonly referred to as iterative refinement.3 To avoid repeating the same mistakes, AI agents can also store data about solutions to previous obstacles in a knowledge base.

Agentic versus non-agentic AI chabots

AI chatbots use conversational AI techniques such as natural language processing (NLP) to understand user questions and automate responses to them. These chatbots are a modality whereas agency is a technological framework.

Non-agentic AI chatbots are ones without available tools, memory and reasoning. They can only reach short-term goals and cannot plan ahead. As we know them, non-agentic chatbots require continuous user input to respond. They can produce responses to common prompts that most likely align with user expectations but perform poorly on questions unique to the user and their data. Since these chatbots do not hold memory, they cannot learn from their mistakes if their responses are unsatisfactory.

In contrast, agentic AI chatbots learn to adapt to user expectations over time, providing a more personalized experience and comprehensive responses. They can complete complex tasks by creating subtasks without human intervention and considering different plans. These plans can also be self-corrected and updated as needed. Agentic AI chatbots, unlike non-agentic ones, assess their tools and use their available resources to fill in information gaps.

Reasoning paradigms

There is not one standard architecture for building AI agents. Several paradigms exist for solving multi-step problems.

React (Reasoning and Action)

With this paradigm, we can instruct agents to "think" and plan after each action taken and with each tool response to decide which tool to use next. These Think-Act-Observe loops are used to solve problems step by step and iteratively improve upon responses.

Through the prompt structure, agents can be instructed to reason slowly and to display each "thought".4 The agent's verbal reasoning gives insight into how responses are formulated. In this framework, agents continuously update their context with new reasoning. This can be interpreted as a form of Chain-of-Thought prompting.

Redo (Reasoning Without Observation)

The Redo method, unlike React, eliminates the dependence on tool outputs for action planning. Instead, agents plan upfront. Redundant tool usage is avoided by anticipating which tools to use upon receiving the initial prompt from the user. This is desirable from a human-centered perspective since the user can confirm the plan before it is executed.

The Redo workflow is made up of three modules. In the planning module, the agent anticipates its next steps given a user's prompt. The next stage entails collecting the outputs produced by calling these tools. Lastly, the agent pairs the initial plan with the tool outputs to formulate a response. This planning ahead can greatly reduce token usage and computational complexity as well as the repercussions of intermediate tool failure.5

Types of AI agents

AI agents can be developed to have varying levels of capabilities. A simple agent may be preferred for straightforward goals to limit unnecessary computational complexity. In order of simplest to most advanced, there are 5 main agent types:

1. Simple reflex agents

Simple reflex agents are the simplest agent form that grounds actions on current perception. This agent does not hold any memory, nor does it interact with other agents if it is missing information. These agents function on a set of so-called reflexes or rules. This means that the agent is preprogrammed to perform actions that correspond to certain conditions being met.

If the agent encounters a situation that it is not prepared for, it cannot respond appropriately. The agents are only effective in environments that are fully observable granting access to all necessary information.6

Example: A thermostat that turns on the heating system at a set time every night. The condition-action rule here is, for instance, if it is 8 PM, then the heating is activated.

2. Model-based reflex agents

Model-based reflex agents use both their current perception and memory to maintain an internal model of the world. As the agent continues to receive new information, the model is updated. The agent's actions depend on its model, reflexes, previous precepts and current state.

These agents, unlike simple reflex agents, can store information in memory and can operate in environments that are partially observable and changing. However, they are still limited by their set of rules.6

Example: A robot vacuum cleaner. As it cleans a dirty room, it senses obstacles such as furniture and adjusts around them. The robot also stores a model of the areas it has already cleaned to not get stuck in a loop of repeated cleaning.

3. Goal-based agents

Goal-based agents have an internal model of the world and also a goal or set of goals. These agents search for action sequences that reach their goal and plan these actions before acting on them. This search and planning improve their effectiveness when compared to simple and model-based reflex agents.

Example: A navigation system that recommends the fastest route to your destination. The model considers various routes that reach your destination, or in other words, your goal. In this example, the agent's condition-action rule states that if a quicker route is found, the agent recommends that one instead.

Goal-based agent diagram

Goal-based agent diagram

4. Utility-based agents

Utility-based agents select the sequence of actions that reach the goal and also maximize utility or reward. Utility is calculated using a utility function. This function assigns a utility value, a metric measuring the usefulness of an action or how "happy" it will make the agent, to each scenario based on a set of fixed criteria.

The criteria can include factors such as progression toward the goal, time requirements, or computational complexity. The agent then selects the actions that maximize the expected utility.

Hence, these agents are useful in cases where multiple scenarios achieve a desired goal and an optimal one must be selected.7

Example: A navigation system that recommends the route to your destination that optimizes fuel efficiency and minimizes the time spent in traffic and the cost of tolls. This agent measures utility through this set of criteria to select the most favorable route.

5. Learning agents

Learning agents hold the same capabilities as the other agent types but are unique in their ability to learn. New experiences are added to their initial knowledge base, which occurs autonomously. This learning enhances the agent's ability to operate in unfamiliar environments. Learning agents may be utility or goal-based in their reasoning and are comprised of four main elements:7

Learning: This improves the agent's knowledge by learning from the environment through its precepts and sensors.

Critic: This provides feedback to the agent on whether the quality of its responses meets the performance standard.

Performance: This element is responsible for selecting actions upon learning.

Problem generator: This creates various proposals for actions to be taken.

Example: Personalized recommendations on e-commerce sites. These agents track user activity and preferences in their memory. This information is used to recommend certain products and services to the user. The cycle repeats each time new recommendations are made. The user's activity is continuously stored for learning purposes. In doing so, the agent improves its accuracy over time.

Customer experience

AI agents can be integrated into websites and apps to enhance the customer experience by serving as a virtual assistant, providing mental health support, simulating interviews and other related tasks.8 There are many no-code templates for user implementation, making the process of creating these AI agents even easier.

Healthcare

AI agents can be used for various real-world healthcare applications. Multi-agent systems can be particularly useful for problem-solving in such settings. From treatment planning for patients in the emergency department to managing drug processes, these systems save the time and effort of medical professionals for more urgent tasks.9

Emergency response

In case of natural disasters, AI agents can use deep learning algorithms to retrieve the information of users on social media sites that need rescue. The locations of these users can be mapped to assist rescue services in saving more people in less time. Therefore, AI agents can greatly benefit human life in both mundane tasks and life-saving situations.10

Benefits of AI agents

Task automation

With the ongoing advancements in generative AI, there is a growing interest in workflow optimization using AI, or intelligent automation. AI agents are AI tools that can automate complex tasks that would otherwise require human resources. This translates to goals being reached inexpensively, rapidly and at scale. In turn, these advancements mean human agents do not need to provide direction to the AI assistant for creating and navigating its tasks.

Greater performance

Multi-agent frameworks tend to outperform singular agents.11 This is because the more plans of action are available to an agent, the more learning and reflection occur. An AI agent incorporating knowledge and feedback from other AI agents specializing in related areas can be useful for information synthesis. This backend collaboration of AI agents and the ability to fill information gaps are unique to agentic frameworks, making them a powerful tool and a meaningful advancement in artificial intelligence.

Quality of responses

AI agents provide responses that are more comprehensive, accurate and personalized to the user than traditional AI models. This is extremely important to us as users since higher-quality responses typically yield a better customer experience. As previously described, this is made possible through exchanging information with other agents, using external tools and updating their memory stream. These behaviors emerge on their own and are not preprogrammed.12

Risks and limitations

Multi-agent dependencies

Certain complex tasks require the knowledge of multiple AI agents. When implementing these multi-agent frameworks, there is a risk of malfunction. Multi-agent systems built on the same foundation models may experience shared pitfalls. Such weaknesses could cause a system-wide failure of all involved agents or expose vulnerability to adverse attacks.13 This highlights the importance of data governance in building foundation models and thorough training and testing processes.

Infinite feedback loops

The convenience of the hands-off reasoning for human users using AI agents also comes with its risks. Agents that are unable to create a comprehensive plan or reflect on their findings, may find themselves repeatedly calling the same tools, invoking infinite feedback loops. To avoid these redundancies, some level of real-time human monitoring may be used.13

Computational complexity

Building AI agents from scratch is both time-consuming and can also be very computationally expensive. The resources required for training a high-performance agent can be extensive. Additionally, depending on the complexity of the task, agents can take several days to complete tasks.12

Best practices

Activity logs

To address the concerns of multi-agent dependencies, developers can provide users with access to a log of agent actions.14 The actions can include the use of external tools and describe the external agents utilized to reach the goal. This transparency grants user's insight into the iterative decision-making process, provides the opportunity to discover errors and builds trust.

Interruption

Preventing AI agents from running for overly long periods of time is recommended. Particularly, in cases of unintended infinite feedback loops, changes in access to certain tools, or malfunctioning due to design flaws. One way to accomplish this is by implementing interpretability.

Maintaining control of this involves allowing human users the option to gracefully interrupt a sequence of actions or the entire operation. Choosing if and when to interrupt an AI agent requires some thoughtfulness as some terminations can cause more harm than good. For instance, it may be safer to allow a faulty agent to continue assisting in a life-threatening emergency than to completely shut it down.5

Unique agent identifiers

To mitigate the risk of agentic systems being used for malicious use, unique identifiers can be used.14 If these identifiers were to be required for agents to access external systems, there would be greater ease in tracing the origin of the agent's developers, deployers and its user. This would be particularly helpful in case of any malicious use or unintended harm done by the agent. This level of accountability would provide a safer environment for these AI agents to operate.

Human supervision

To assist in the learning process for AI agents, especially in their early stages in a new environment, it can be helpful to provide occasional human feedback. This allows the AI agent to compare its performance to the expected standard and adjust accordingly. This form of feedback is helpful in improving the agent’s adaptability to user preferences.5

Apart from this, it is best practice to require human approval before an AI agent takes highly impactful actions. For instance, actions ranging from sending mass emails to financial trading should require human confirmation.7 Some level of human monitoring is recommended for such high-risk domains.

Beyond generative AI

The most transformative promise of AI has always been its potential for autonomy, to create systems that can act intelligently on their own without human supervision. However, this kind of "Agentic AI" has remained out of reach for most enterprise use cases, until now.

Across industries, two related trends will change our perception of what is possible over the next year and a half, according to Sam Witteveen, CEO of Red Dragon AI, an AI agent-focused consultancy:

- **Agents in everything**: AI agent-embedded alternatives to many familiar software tools and services will become available, allowing users to interact with them in natural language instead of using specialized interfaces or code.
- **Building blocks for agents**: A new generation of tools and frameworks for building custom AI agents is arriving, which will allow businesses to develop AI-driven strategies for different facets of their operations.

This article is part one of a multi-article deep dive into Agentic AI, which promises to be the next evolutionary phase of AI adoption for enterprises across industries. Over the coming weeks, this series will explore the full impact of Agentic AI on how organizations of the future will function, including cybersecurity, IT administration, business operations, sales, marketing and more. We'll also explore the evolving ethical and regulatory landscape to help you stay oriented.

Since ChatGPT burst onto the scene, enterprises across the spectrum of industries have been swarming to integrate generative AI into their products, from image generation to enhanced customer service bots. Companies have adopted these products in areas ranging from content marketing to software development to threat detection, with a **Google Cloud study** showing 70% of companies had seen ROI on at least one use case. This impact will grow as solutions mature. According to a recent **McKinsey report**, generative AI technologies will add between $2.6 trillion to

$4.4 trillion of value across business sectors, and reduce the total amount of work required by all employees by 50%-70%.

However, another wave of innovation is on the horizon—one that promises to do much more than produce captivating visuals or human-like text. Agentic AI is poised to revolutionize the very core of how enterprises function, as applications arrive that can autonomously monitor events, make decisions and take real actions, all on their own. It is now time to look beyond the chatbots and content generators that have dominated headlines so far. From embedded agents managing cybersecurity threats in real-time to marketing AIs autonomously generating hyper-personalized campaigns, Agentic AI is not only a technical advancement but a true paradigm shift that will have profound effects on enterprises and society.

Join us in San Francisco today (Sept. 10) for the AI Impact Tour, where we'll dive into Agentic AI's future. Don't miss this opportunity to learn from industry leaders like Meta, Intuit and Asana. Seats are almost gone—apply for your spot today!

Defining Agentic AI: generative AI fused with classical automation

Agentic AI combines classical automation with the power of modern large language models (LLMs), using the latter to simulate human decision-making, analysis and creative content. The idea of automated systems that can act is not new, and even a classical thermostat that can turn the heat and AC on and off when it gets too cold or hot is a simple kind of "smart" automation.

In the modern era, IT automation has been revolutionized by self-monitoring, self-healing and auto-scaling technologies like Docker, Kubernetes and Terraform which encapsulate the principles of cybernetic self-regulation, a kind of agentic intelligence. These systems vastly simplify the work of IT operations, allowing an operator to declare (in code) the desired end-state of a system and then

automatically align reality with desire—rather than the operator having to perform a long sequence of commands to make changes and check results.

However powerful, this kind of classical automation still requires expert engineers to configure and operate the tools using code. Engineers must foresee possible situations and write scripts to capture logic and API calls that would be required. Agentic AI transcends these limitations in two radical ways: First, anyone who can use language can interact with the system, instead of access being limited to trained coders. Second, static scripts are replaced with LLM-generated code-on-demand to fit the unique situation.

In this new paradigm, intelligent AI agents can be assigned broad objectives or success criteria simply by describing them in language. These agents are then allowed to loop through cycles of assessing what needs to be done, validating what they've achieved so far, and deciding on the next steps toward the final objective–roughly what a human would do to solve the problem.

AI agents can also interact with external tools or APIs, querying data from external sources and triggering real-world actions. This can include sending communications or submitting payment transactions–not just finding you a nearby pizza restaurant, but actually ordering for you, as shown in this demo.

In financial services, for instance, AI agents can continuously monitor markets, automatically execute trades or adjust investment strategies based on real-time analysis. These systems can process far more data than any human, potentially allowing businesses to operate with increased efficiency, reduced risk and improved decision-making.

The following set of properties generally define Agentic AI systems:

- **Generation:** Modern Agentic AI systems harness the analytic and creative capacity of LLMs. Unlike simple gen AI apps, however, they don't simply output a generated text back to the

user as a result. Instead, they can use generated outputs as intermediate steps within a complex workflow, mimicking the role of human thought.

- **Tool Calling:** In agentic systems, AI can call upon specific tools or APIs, querying data and triggering events according to the reasoning generated by the LLM.
- **Discovery**: Agentic systems can access real-world data from a variety of tools and data streams, escaping the limitations of their training data. Further, they can harness LLM generation to decide what data they need and to ask for it, rather than being limited to human-provided input, as in retrieval-augmented generation (RAG). For example, an AI agent tasked with maintaining supply chain logistics might write its own queries to weather data APIs and supplier inventory databases, to predict shortfalls and determine possible solutions.
- **Execution**: Agents can take real-world actions, such as interacting with external systems or triggering processes, without human intervention. An AI agent might send emails or other communications to humans, send purchase orders or fund transfers, grant or revoke access to secure systems, or take any action that can be connected to an API.
- **Autonomy (Self-prompting)**: Agentic systems are "always on;" they do not need to be triggered to do a specific thing at a specific time, the way a simple chatbot can only respond to a prompt. Instead, once active they can monitor for the right moment to act, relieving humans from this kind of "watch and wait" labor. They can loop through cycles of acting, evaluating and planning, continually 'self-prompting' to proceed toward a desired end-state.
- **Planning**: Agentic systems can generate, prioritize and manage sets of subordinate tasks to pursue an overall goal.
- **Composition:** Agentic systems can assemble multiple components—such as queries, scripts or subroutines, calls to APIs or remote functions, into a cohesive action or response. Unlike a script in traditional automation, an AI agent composes a unique solution to a specific problem, using an LLM to reason out how to combine the available resources. This can

include delegating work to other AI agents, either by creating them on demand or by communicating across a service boundary.

- **Memory**: Agentic systems can build and maintain their own internal knowledge representations, allowing them to accumulate and utilize information extracted through discovery, and the output of previous actions. This capacity enables agents to function more autonomously, as they can index, store, and retrieve information about the world for use in further tasks. For example, a personal shopper agent for a retail website might maintain an idiosyncratic list of themes and facts about a user extracted from their chat interactions and purchase behavior, and use it to customize both conversation and recommendations.
- **Reflection**: Agentic systems can evaluate the solutions they generate and try again, if necessary, rather than delivering low-quality results. For instance, a marketing agent that generates user-customized campaign copy through a multi-step, retrieval-assisted process, might submit all documents to an evaluator AI that predicts the user's ratings and critical feedback, ensuring that customers only encounter the best possible results.

Transforming enterprises

The implications of agentic AI are enormous, complex and dynamic. Organizations in every sector must prepare to adapt.

AI agents are still under development, and the technology faces challenges as it matures. It depends at its core on LLMs, which are still prone to hallucination. If an agent does a web search for specific links, for example, it might bring slightly wrong backlinks. And that LLM might not know what to do with it, and find itself in an endless loop, running up costs for the agent's human creator as it consumes more and more tokens. But at the same time, developers have flocked to experiment with, and improve, these agents. Over time, smart design will prevail as engineers learn to combine the agentic components into robust systems.

Three main agent frameworks have emerged as particularly popular: Lan graph, Autogeny and Crew AI. One review found them roughly equal, though each has its advantages and disadvantages. Over the next few weeks, this series of articles will consider use cases in a variety of industries, reviewing leading product offerings for off-the-shelf AI agents, as well as considering the kind of projects that companies are building now with these DIY tools and frameworks.

Here are just a few examples of how agentic AI is already having an impact:

1. **Sales: Next-Generation Lead Management**

Agentic AI is revolutionizing the sales process by automating entire pipelines, allowing businesses to scale lead management like never before. Tools like Conversica and Relevance AI are already offering AI-powered assistants that autonomously engage with potential leads, qualify them and nurture prospects through the sales funnel. Convers Ica, for instance, uses AI-driven Revenue Digital Assistants to initiate conversations, answer inquiries and schedule follow-ups across email and SMS. These assistants ensure no lead is neglected, helping businesses achieve up to a 5x increase in qualified sales opportunities by ensuring timely, personalized interactions.

Similarly, Relevance AI provides AI agents like their AI Sales Development Representatives (SDRs), which automate repetitive tasks like lead qualification and follow-up. These AI agents analyze lead behavior in real time, scoring and prioritizing them for human sales reps to focus on high-value opportunities.

The ability to personalize at scale is a game-changer for sales teams, allowing human representatives to focus their time on high-value prospects while AI agents handle routine customer engagement. In fact, a Gartner report suggests that by 2025, 75% of B2B sales organizations will augment their teams with AI-driven agents to automate routine tasks and improve overall productivity.

2. **Marketing: Hyper-Personalized Shopping at Scale**

Agentic AI is transforming how businesses personalize customer interactions, with tools like Netcore's Co-Marketer AI and Salesforce's Agentforce leading the charge. Co-Marketer AI empowers brands to engage users across multiple channels, such as email, WhatsApp and SMS, by offering dynamic, personalized content based on real-time data. This AI-driven platform continuously learns from user behavior, allowing brands to deliver highly relevant recommendations and offers that adapt to individual customer journeys, significantly boosting engagement and conversions.

Salesforce's Agentforce uses AI agents to autonomously craft and optimize personalized marketing campaigns. These agents analyze customer data, such as past purchases and browsing history, to generate tailored campaigns and offers at scale. By automating these processes, businesses can focus on higher-level strategy while ensuring customers receive highly personalized, relevant content across every touchpoint, driving deeper customer relationships and increased revenue growth.

Both platforms showcase the power of agentic AI to deliver hyper-personalized, scalable marketing solutions that elevate customer engagement to new heights.

3. **Cybersecurity: Real-Time Defense**

Cybersecurity is one of the most obvious applications of agentic AI, where speed and accuracy are paramount. In this space, companies like Darktrace and Vectra AI have developed AI-driven agents that continuously monitor network traffic, identify threats and autonomously initiate responses.

Vectra AI uses AI-driven agents to autonomously detect and respond to security incidents across cloud, data center and enterprise networks. Vectra's agents continuously monitor network traffic, learning the patterns of legitimate behavior to better identify anomalies that could signal an attack. Once a potential threat is detected, the AI agents autonomously initiate the response—whether it's

isolating the compromised segment of the network, blocking malicious traffic or quarantining affected systems.

The shift to agentic AI will allow security teams to operate more effectively, handling threats in real-time without human intervention. This always-on, autonomous defense could be the key to preventing breaches and minimizing damage from cyberattacks, allowing businesses to operate securely in an increasingly digital world.

4. **Infrastructure and IT Operations: Proactive Management**

Managing IT infrastructure has traditionally involved a significant amount of manual oversight, configuration, and constant monitoring. However, with the rise of platforms like Qovery, the future of IT operations is becoming increasingly autonomous, leveraging agentic AI to transform how businesses manage their infrastructure.

Qovery's platform offers a glimpse into how agentic AI can reshape IT operations. Designed to automate the deployment of applications in the cloud, Qovery's agents perform tasks such as setting up environments, managing scaling and ensuring uptime through self-healing systems.

This is not just an extension of traditional IT automation tools like Kubernetes or Terraform—Qovery's AI agents act with higher-level decision-making capabilities. For instance, they can anticipate application needs, dynamically adjust environments, and even optimize costs by reallocating resources, all while requiring minimal human input.

AI agents interpret user commands in natural language, reducing the need for companies to maintain expertise in IT management. Qovery claims its platform "eliminates your DevOps hiring needs."

What's Next?

AI agents can empower businesses to operate with greater efficiency, agility and speed. This technology is in its early days, but as more robust offerings become available–and this is expected to happen very quickly–the business case for its adoption will grow.

However, the implementation of agentic AI requires thoughtful design, as these systems will not be one-size-fits-all. Specialized AI agents will need to be created for some jobs, and the right AI-enabled tool chosen for others. Whether developing their own or deploying third-party agentic AI, enterprises will need to understand the hype and reality, the promise and peril, of this new technology.

Throughout this series, we will explore how enterprises can build these systems, the tools and platforms they can use and the industries that are poised to benefit most from the rise of agentic AI. We will take a closer look at how agentic AI is reshaping marketing, sales, cybersecurity, customer service and business operations. We'll also explore the emerging regulatory landscape and how using sound principles of AI governance can help you maintain the trust of your users and partners while forging your path ahead. Stay tuned for the future of AI-driven business.

This disclosure describes all of the above 17 Sustainable Development Goals as an Agentic system. Each SDG should have an AI Agent specifically trained to understand methodologies that can pass some approval process to be included. Then the AI Agent is taught everything about its specific domain, as well as any methodologies associated. The SDG specific AI Agent should be able to approve any associated methodology as well as create an associated token as needed based on the specific SDG criteria. The AI Agent can be trained over time to fully understand a specific SDG and be able to handle inquiry, as well as token issuance for a specific SDG.

In medicine and statistics, sensitivity and specificity mathematically describe the accuracy of a test that reports the presence or absence of a medical condition. If individuals who have the condition are considered "positive" and those who do not are considered "negative", then sensitivity is a

measure of how well a test can identify true positives and specificity is a measure of how well a test can identify true negatives:

Sensitivity (true positive rate) is the probability of a positive test result, conditioned on the individual truly being positive.

Specificity (true negative rate) is the probability of a negative test result, conditioned on the individual truly being negative.

If the true status of the condition cannot be known, sensitivity and specificity can be defined relative to a "gold standard test" which is assumed correct. For all testing, both diagnoses and screening, there is usually a trade-off between sensitivity and specificity, such that higher sensitivities will mean lower specificities and vice versa.

A test which reliably detects the presence of a condition, resulting in a high number of true positives and low number of false negatives, will have a high sensitivity. This is especially important when the consequence of failing to treat the condition is serious and/or the treatment is very effective and has minimal side effects.

A test which reliably excludes individuals who do not have the condition, resulting in a high number of true negatives and low number of false positives, will have a high specificity. This is especially important when people who are identified as having a condition may be subjected to more testing, expense, stigma, anxiety, etc.

The terms "sensitivity" and "specificity" were introduced by American biostatistician Jacob Yerushalmy in 1947.

To understand the latest advance in generative AI, iCustomerne a courtroom.

Judges hear and decide cases based on their general understanding of the law. Sometimes a case — like a malpractice suit or a labor dispute — requires special expertise, so judges send court clerks to a law library, looking for precedents and specific cases, they can cite.

Like a good judge, large language models (LLMs) can respond to a wide variety of human queries. But to deliver authoritative answers that cite sources, the model needs an assistant to do some research.

The court clerk of AI is a process called retrieval-augmented generation, or RAG for short.

How It Got Named 'RAG'

Patrick Lewis, lead author of the 2020 paper that coined the term, apologized for the unflattering acronym that now describes a growing family of methods across hundreds of papers and dozens of commercial services he believes represent the future of generative AI.

Patrick Lewis

"We definitely would have put more thought into the name had we known our work would become so widespread," Lewis said in an interview from Singapore, where he was sharing his ideas with a regional conference of database developers.

"We always planned to have a nicer sounding name, but when it came time to write the paper, no one had a better idea," said Lewis, who now leads a RAG team at AI startup Cohere.

So, What Is Retrieval-Augmented Generation (RAG)?

Retrieval-augmented generation (RAG) is a technique for enhancing the accuracy and reliability of generative AI models with facts fetched from external sources.

In other words, it fills a gap in how LLMs work. Under the hood, LLMs are neural networks, typically measured by how many parameters they contain. An LLM's parameters essentially represent the general patterns of how humans use words to form sentences.

That deep understanding, sometimes called parameterized knowledge, makes LLMs useful in responding to general prompts at light speed. However, it does not serve users who want a deeper dive into a current or more specific topic.

Combining Internal, External Resources

Lewis and colleagues developed retrieval-augmented generation to link generative AI services to external resources, especially ones rich in the latest technical details.

The paper, with coauthors from the former Facebook AI Research (now Meta AI), University College London and New York University, called RAG "a general-purpose fine-tuning recipe" because it can be used by nearly any LLM to connect with practically any external resource.

Building User Trust

Retrieval-augmented generation gives models sources they can cite, like footnotes in a research paper, so users can check any claims. That builds trust.

What's more, the technique can help models clear up ambiguity in a user query. It also reduces the possibility a model will make a wrong guess, a phenomenon sometimes called hallucination.

Another great advantage of RAG is it's relatively easy. A blog by Lewis and three of the paper's coauthors said developers can implement the process with as few as five lines of code.

That makes the method faster and less expensive than retraining a model with additional datasets. And it lets users hot-swap new sources on the fly.

How People Are Using RAG

With retrieval-augmented generation, users can essentially have conversations with data repositories, opening up new kinds of experiences. This means the applications for RAG could be multiple times the number of available datasets.

For example, a generative AI model supplemented with a medical index could be a great assistant for a doctor or nurse. Financial analysts would benefit from an assistant linked to market data.

In fact, almost any business can turn its technical or policy manuals, videos or logs into resources called knowledge bases that can enhance LLMs. These sources can enable use cases such as customer or field support, employee training and developer productivity.

The broad potential is why companies including AWS, IBM, Glean, Google, Microsoft, NVIDIA, Oracle and Pinecone are adopting RAG.

Getting Started with Retrieval-Augmented Generation

To help users get started, NVIDIA developed an AI workflow for retrieval-augmented generation. It includes a sample chatbot and the elements users need to create their own applications with this new method.

The workflow uses NVIDIA NeMo Retriever, a collection of easy-to-use NVIDIA NIM microservices for large scale information retrieval. NIM eases deployment of secure, high performance AI model inferencing across clouds, data centers and workstations.

These components are all part of NVIDIA AI Enterprise, a software platform that accelerates development and deployment of production-ready AI with the security, support and stability businesses need.

Getting the best performance for RAG workflows requires massive amounts of memory and compute to move and process data. The NVIDIA GH200 Grace Hopper Superchip, with its 288GB of fast HBM3e memory and 8 petaflops of compute, is ideal — it can deliver a 150x speedup over using a CPU.

Once companies get familiar with RAG, they can combine a variety of off-the-shelf or custom LLMs with internal or external knowledge bases to create a wide range of assistants that help their employees and customers.

RAG doesn't require a data center. LLMs are debuting on Windows PCs, thanks to NVIDIA software that enables all sorts of applications users can access even on their laptops.

An example application for RAG on a PC.

PCs equipped with NVIDIA RTX GPUs can now run some AI models locally. By using RAG on a PC, users can link to a private knowledge source – whether that be emails, notes or articles – to improve responses. The user can then feel confident that their data source, prompts and response all remain private and secure.

A recent blog provides an example of RAG accelerated by TensorRT-LLM for Windows to get better results fast.

The History of RAG

The roots of the technique go back at least to the early 1970s. That's when researchers in information retrieval prototyped what they called question-answering systems, apps that use natural language processing (NLP) to access text, initially in narrow topics such as baseball.

The concepts behind this kind of text mining have remained fairly constant over the years. But the machine learning engines driving them have grown significantly, increasing their usefulness and popularity.

In the mid-1990s, the Ask Jeeves service, now Ask.com, popularized question answering with its mascot of a well-dressed valet. IBM's Watson became a TV celebrity in 2011 when it handily beat two human champions on the *Jeopardy!* game show.

Today, LLMs are taking question-answering systems to a whole new level.

Insights From a London Lab

The seminal 2020 paper arrived as Lewis was pursuing a doctorate in NLP at University College London and working for Meta at a new London AI lab. The team was searching for ways to pack more knowledge into an LLM's parameters and using a benchmark it developed to measure its progress.

Building on earlier methods and inspired by a paper from Google researchers, the group "had this compelling vision of a trained system that had a retrieval index in the middle of it, so it could learn and generate any text output you wanted," Lewis recalled.

The IBM Watson question-answering system became a celebrity when it won big on the TV game show Jeopardy!

When Lewis plugged into the work in progress a promising retrieval system from another Meta team, the first results were unexpectedly impressive.

"I showed my supervisor and he said, 'Whoa, take the win. This sort of thing doesn't happen very often,' because these workflows can be hard to set up correctly the first time," he said.

Lewis also credits major contributions from team members Ethan Perez and Douwe Kiela, then of New York University and Facebook AI Research, respectively.

When complete, the work, which ran on a cluster of NVIDIA GPUs, showed how to make generative AI models more authoritative and trustworthy. It's since been cited by hundreds of papers that amplified and extended the concepts in what continues to be an active area of research.

How Retrieval-Augmented Generation Works

At a high level, here's how an NVIDIA technical brief describes the RAG process.

When users ask an LLM a question, the AI model sends the query to another model that converts it into a numeric format so machines can read it. The numeric version of the query is sometimes called an embedding or a vector.

The embedding model then compares these numeric values to vectors in a machine-readable index of an available knowledge base. When it finds a match or multiple matches, it retrieves the related data, converts it to human-readable words and passes it back to the LLM.

Finally, the LLM combines the retrieved words and its own response to the query into a final answer it presents to the user, potentially citing sources the embedding model found.

Keeping Sources Current

In the background, the embedding model continuously creates and updates machine-readable indices, sometimes called vector databases, for new and updated knowledge bases as they become available.

Many developers find LangChain, an open-source library, can be particularly useful in chaining together LLMs, embedding models and knowledge bases. NVIDIA uses LangChain in its reference architecture for retrieval-augmented generation.

The LangChain community provides its own description of a RAG process.

Looking forward, the future of generative AI lies in creatively chaining all sorts of LLMs and knowledge bases together to create new kinds of assistants that deliver authoritative results users can verify.

Artificial intelligence on Windows 11 PCs marks a pivotal moment in tech history, revolutionizing experiences for gamers, creators, streamers, office workers, students and even casual PC users.

It offers unprecedented opportunities to enhance productivity for users of the more than 100 million Windows PCs and workstations that are powered by RTX GPUs. And NVIDIA RTX technology is making it even easier for developers to create AI applications to change the way people use computers.

New optimizations, models and resources announced at Microsoft Ignite will help developers deliver new end-user experiences, quicker.

An upcoming update to TensorRT-LLM — open-source software that increases AI inference performance — will add support for new large language models and make demanding AI workloads more accessible on desktops and laptops with RTX GPUs starting at 8GB of VRAM.

TensorRT-LLM for Windows will soon be compatible with OpenAI's popular Chat API through a new wrapper. This will enable hundreds of developer projects and applications to run locally on a PC with RTX, instead of in the cloud — so users can keep private and proprietary data on Windows 11 PCs.

Custom generative AI requires time and energy to maintain projects. The process can become incredibly complex and time-consuming, especially when trying to collaborate and deploy across multiple environments and platforms.

AI Workbench is a unified, easy-to-use toolkit that allows developers to quickly create, test and customize pretrained generative AI models and LLMs on a PC or workstation. It provides developers a single platform to organize their AI projects and tune models to specific use cases.

This enables seamless collaboration and deployment for developers to create cost-effective, scalable generative AI models quickly. Join the early access list to be among the first to gain access to this growing initiative and to receive future updates.

To support AI developers, NVIDIA and Microsoft will release DirectML enhancements to accelerate one of the most popular foundational AI models, Llama 2. Developers now have more options for cross-vendor deployment, in addition to setting a new standard for performance.

Portable AI

Last month, NVIDIA announced TensorRT-LLM for Windows, a library for accelerating LLM inference.

The next TensorRT-LLM release, v0.6.0 coming later this month, will bring improved inference performance — up to 5x faster — and enable support for additional popular LLMs, including the new Mistral 7B and Nemotron-3 8B. Versions of these LLMs will run on any GeForce RTX 30 Series and 40 Series GPU with 8GB of RAM or more, making fast, accurate, local LLM capabilities accessible even in some of the most portable Windows devices.

The new release of TensorRT-LLM will be available for install on the /NVIDIA/TensorRT-LLM GitHub repo. New optimized models will be available on ngc.nvidia.com.

Conversing With Confidence

Developers and enthusiasts worldwide use OpenAI's Chat API for a wide range of applications — from summarizing web content and drafting documents and emails to analyzing and visualizing data and creating presentations.

One challenge with such cloud-based AIs is that they require users to upload their input data, making them impractical for private or proprietary data or for working with large datasets.

To address this challenge, NVIDIA is soon enabling TensorRT-LLM for Windows to offer a similar API interface to OpenAI's widely popular ChatAPI, through a new wrapper, offering a similar workflow to developers whether they are designing models and applications to run locally on a PC with RTX or in the cloud. By changing just one or two lines of code, hundreds of AI-powered developer projects and applications can now benefit from fast, local AI. Users can keep their data on their PCs and not worry about uploading datasets to the cloud.

Perhaps the best part is that many of these projects and applications are open source, making it easy for developers to leverage and extend their capabilities to fuel the adoption of generative AI on Windows, powered by RTX.

The wrapper will work with any LLM that's been optimized for TensorRT-LLM (for example, Llama 2, Mistral and Nemotron-3 8B) and is being released as a reference project on GitHub, alongside other developer resources for working with LLMs on RTX.

Model Acceleration

Developers can now leverage cutting-edge AI models and deploy with a cross-vendor API. As part of an ongoing commitment to empower developers, NVIDIA and Microsoft have been working together to accelerate Llama on RTX via the DirectML API.

Building on the announcements for the fastest inference performance for these models announced last month, this new option for cross-vendor deployment makes it easier than ever to bring AI capabilities to PC.

Developers and enthusiasts can experience the latest optimizations by downloading the latest ONNX runtime and following the installation instructions from Microsoft, and installing the latest driver from NVIDIA, which will be available on Nov. 21.

These new optimizations, models and resources will accelerate the development and deployment of AI features and applications to the 100 million RTX PCs worldwide, joining the more than 400 AI-powered apps and games already accelerated by RTX GPUs.

As models become even more accessible and developers bring more generative AI-powered functionality to RTX-powered Windows PCs, RTX GPUs will be critical for enabling users to take advantage of this powerful technology.

One such AI architecture involving SDGs could be a RAG based network design where an AI Agent gets programmed to identify and measure each individual Sustainable Development Goal. Each AI Agent could be programmed to understand and assess individual projects based on a specific SDG so that 17 (many) AI Agents can assess whether or not the project addresses their individual SDG. The assessment performed by each AI Agent can provide a measurement on a scale, potentially 1-10, as to the specificity as well as the sensitivity and/or intensity of the project relative to the goal the AI Agent represents. Once all 17 AI Agents have performed these tests, the system can then provide a 3-dimensional score to the project. As an example, consider project A that scores as follows:

Specificity of 3 and sensitivity/intensity of 5 on SDG 1.

Specificity of 6 and sensitivity/intensity of 3 on SDG 3.

Specificity of 2 and sensitivity/intensity of 1 on SDG 8.

Specificity of 5 and sensitivity/intensity of 8 on SDG 13.

The specificity is whether the project fulfills an SDG to any degree, and the sensitivity/intensity is to what extent does the project fulfill the SDG relative to other projects that address the same SDG. This scoring system has at least 3 variables as output (specificity, sensitivity, and SDG number/category potentially organized as a 3D time/series graph, vector, or quaternion), and can be represented as a 3-dimensional or more waveform or simple vector/matrix representation. The above example project could then use a threshold on the scoring system to remove nascent or low scoring SDGs on specificity/sensitivity/intensity. As an example, the project above can use a threshold of 2 to be the cutoff and use the scores from SDGs 1, 3 and 13 for the assessment. The scoring system can then store these values in a database or on a blockchain and retrieve them later for comparison and search features. One use case could be once all the projects in the system are scored, the user can then use a visual waveform software tool to select any projects with SDG specificity scores for SDGs 1, 3, and 13 above a score of 2 and sensitivity score above 3, which would match the project above. The search tool could be just a simple selector for any of the 17 SDGs in any combination with any unique score for specificity, sensitivity and/or intensity. Other measurements can be included as well to the scoring system to make it more precise by including more parameters. In addition to the scoring system, this AI SDG architecture can integrate IoT sensors, satellite imagery and other data inputs by storing them in a database, blockchain, cloud or other data storage mechanism, and then using the new data in future AI based assessments for scoring projects. This way the AI Agent system can learn about specific SDGs on an ongoing basis and become more intelligent/trained over time. The AI Agents can be fed additional information over time to further improve the scoring accuracy, as well as provide reports specific to the SDG they are targeting for assessment. The AI Agents can be programmed to explain their logic flow as they are assessing the projects so that they can be further educated on the subject domain they

represent, and over time become more precise in measuring specificity, sensitivity, and intensity of a given project. This AI Agent framework can also aid in generating reports for GHG/SDG/ESG compliance like TCFD, IPCC, and GHG Protocol assessments for government and corporate reporting. Other AI system designs can utilize this SDG scoring system, and potentially measure and score the digital MVR and IoT data and network design to provide further scoring options, as well as provide data and information for registering projects or tokenized assets with both compliance and voluntary markets, as well as blockchain implementations involving cryptocurrency as well as Non-Fungible Tokens. This system can facilitate DeFi, ReFi and other blockchain based financial services such as payment systems and banking facilities, such as the one described next.

Bank not only maps the most legitimate Web3 tokenization model (RWAs) to the most profitable component in Web2 banking (lending), but we do so such that the profit mechanism becomes a fully transparent, smart contract-driven, and Basel IV compliant Web4 financial archetype. This financial alchemy allows Bank to become the first and only regulated and fully decentralized Web4 banking platform. Alternative pledged assets could include fiat, physical property such as land, a corporate legal entity, a mining operation, or any other asset that can be tokenized. Deposited assets could include stablecoins, deposit tokens, cryptocurrency, tokenized assets, tokenized business entities, tokenized land, minerals, rights of any sort, or any tokenized property or contract. Onboarded assets may undergo AI Agent based KYC/AML background checks, valuation assessments, title validation and ownership confirmation, as well as any other analysis or screening before accepted as a deposit in the tokenized Bank. Non-tokenized assets such as contracts, loan agreements, fiat, CDs, Treasury notes, bills or bonds can also be accepted as deposits.

How does Bank dramatically reduce interest and fees?

By throttling down the allowed velocity of monetary issuance during the process of credit creation, such that fees and interest to cover operational expenses are significantly reduced over existing banking practices.

How does Bank manage inflation/deflation, market bubbles, and Black Swan events?

By implementing the Bank 3-phase Quantitative Easing governance model, the Bank network can realign balance sheets systemically, on demand, in real-time to maintain fiscal prudence.

How does Bank asset-back a decentralized monetary system?

By utilizing the only asset recognized in all major financial markets worldwide that only exists in digital form – carbon. Incorporating the PARYS Carbon RWA as the primary deposit token allows Bank to remove physical custody, and more importantly, physical delivery pains associated with all other commodities suitable for asset-backing a decentralized monetary system.

DETAIL

To dramatically reduce interest and fees throughout the network, Bank employs 3 primary process strategies into both personal and commercial lending models, targeting profitability while reducing interest rates:

1) RWA Specific Accounting Methodologies.
2) Proxy-Tokenized Hypothecation.
3) Web4 Network Effect.

Bank consists of 6 core banking services: Deposit, Withdraw, Payment, Transfer / Swap, Personal Loans, and Commercial Loans. Bank utilizes 3 token categories to implement these core banking services; PARYS Carbon RWA as the primary **deposit token**, REMIT as the primary **loan token**, and REPAY as the primary **payment token**. Additional deposit tokens can include any Customer issued RWA, including PARYS Water RWA, PARYS Mineral RWA, PARYS Land RWA, PARYS Stablecoin, or Tether Stablecoins USD₮ and USA₮. The Bank base currency, or store of wealth, is the PARYS Carbon RWA as the primary deposit token. REMIT is issued to loan recipients with full network liquidity, like a stablecoin, but provides additional services to Bank to be able to manage loans more efficiently and reduce fraud. REPAY serves as a means of exchange and transfer of value for Bank customers. Each

of the three primary tokens have a native token associated that can be used to govern, pay dividends, or provide fundraising services for Bank.

Bank can also take advantage of the PARYS Carbon RWA proprietary carbon accounting methodology based on GHG Protocol to provide significant value for participants across all banking service tiers. PARYS Carbon RWA has a total of 5 yield inputs, 3 of which are circular by design, targeting 20-40% APY for all Bank depositors. In addition, the Commercial Loan Service leverages the Proxy-Tokenized Hypothecation and rehypothecation, and Web4 Network Effect strategies to achieve yield or interest for Bank,

To manage loan risk across multiple jurisdictions, Bank implements the 3-phase QE governance model described below:

Bank QE1 (mostly associated with inflation and market bubbles) - The Bank L1 bank purchases back a given threshold of bad or non-performing loans within Bank L2 banks to realign the banking system balance sheets overall to a safe operational level. Since this would be transactions within the banking system, it doesn't create additional new credit (i.e. mint more tokens), or create additional inflation within Bank. This would simply transfer bad loans from the Bank L2 balance sheet to the healthy Bank L1 balance sheet to be dealt with through legal means, or simply written off by the Bank L1 bank after Bank L1 internal review.

Bank QE2 (mostly associated with deflation and increased unemployment) - The Bank L1 bank creates credit for a failing Bank L2 bank or banks by purchasing assets outside of the banking system, which creates credit and hence mints tokens for the system. This has the ability to realign Bank L2 bank balance sheets systemically, or potentially target specific Bank L2 banks by purchasing assets that can facilitate the asset seller becoming a client of the Bank L2 bank.

Bank QE3 (referred to here as Country level Treasury QE, where the Treasury issues bonds with dramatic rate increases) - The Treasury could request that the Bank L1 bank provide a low-interest loan based on Customer RWA production and Bank commercial lending practices to facilitate core

public interests. This would be far better than the Treasury issuing high-rate bonds, which are far less liquid and far less beneficial.

Bank generates sustainable profitability while dramatically reducing fees and interest for customers, in a structurally superior banking model.

Subject: Legal Nature and Enforceability of Customer Pledge Structure under the 2016 ISDA VM CSA Framework.

I. INTRODUCTION AND SCOPE

This legal opinion explains the Bank asset depository process (the "Program") as structured under the 2016 ISDA Credit Support Annex for Variation Margin[1] (VM CSA) governed by New York law[2]. It analyzes how the pledge structure operates as a security financial collateral arrangement, its implications for beneficial ownership, default provisions under Section 5(a)(iii) of the ISDA 2002 Master Agreement[3], and limitation of liability for asset return obligations. The "Pledgee" takes a

[1] https://jollycontrarian.com/index.php?title=2016_ISDA_VM_NY_CSA
[2] https://jollycontrarian.com/index.php?title=Credit_Support_Obligations_-_NY_VM_CSA_Provision
[3] https://www.sec.gov/Archives/edgar/data/1065696/000119312511118050/dex101.htm

5. Events of Default and Termination Events

(a) ***Events of Default.*** *The occurrence at any time with respect to a party or, if applicable, any Credit Support Provider of such party or any Specified Entity of such party of any of the following events constitutes (subject to Sections 5(c) and 6(e)(iv)) an event of default (an "Event of Default") with respect to such party:*

(i) ***Breach of Agreement; Repudiation of Agreement.***

(ii) ***Credit Support Default.***

(1) Failure by the party or any Credit Support Provider of such party to comply with or perform any agreement or obligation to be complied with or performed by it in accordance with any Credit Support Document if such failure is continuing after any applicable grace period has elapsed;

(2) the expiration or termination of such Credit Support Document or the failing or ceasing of such Credit Support Document, or any security interest granted by such party or such Credit Support Provider to the other party pursuant to any such Credit Support Document, to be in full force and effect for the purpose of this Agreement (in each case other than in accordance with its terms) prior to the satisfaction of all

proprietary legal interest in the assets, but does *not* take legal title to them. The Pledgor pledges the pledged assets in favor of the Pledgee, who accepts, as first-priority pledge for the due and punctual discharge in full of all of the Secured Obligations.

The Pledgor hereby instructs the Custodian to mark the assets as pledged consistently with NY law. The Custodian also agrees to further safeguard the collateral by placing it in a Special or Sub-Custody Account, with the Pledgor as the sole beneficiary. If the collateral is already custodied by a licensed bank or custodian, a Sub-Account with the primary custodian can provide a suitable alternative under NY law.

II. BACKGROUND AND TRANSACTION STRUCTURE

Under the 2016 NY Law VM CSA, the Pledgor delivers eligible assets as collateral to the secured party, creating a security interest while retaining beneficial ownership. In the Program, the Pledgor delivers assets to Pledgee as Custodian. Pledgee accepts these assets as pledged collateral to secure its performance obligations to deliver APY or RWA-linked yield or dividend payouts. Pledgors have no payment obligations and therefore cannot default. A Credit Support Default under Section 5(a)(iii) may occur only if Pledgee fails to perform under this pledge agreement.

III. LEGAL CHARACTERIZATION UNDER NY AND ENGLISH LAW

A. Security Financial Collateral Arrangement

The 2016 NY Law VM CSA and English Law CSD are recognized as security financial collateral arrangements, where the secured party holds collateral under a security interest, not ownership[4].

> obligations of such party under each Transaction to which such Credit Support Document relates without the written consent of the other party; or
>
> (3) the party or such Credit Support Provider disaffirms, disclaims, repudiates or rejects, in whole or in part, or challenges the validity of, such Credit Support Document (or such action is taken by any person or entity appointed or empowered to operate it or act on its behalf).

[4] New York law Credit Support Annexes are not Transactions. Explicitly, they **are** Credit Support Documents, though you should not (according to the ISDA User's Guide) describe the parties to one as "Credit Support Providers". As New York law CSAs are not Transactions, they are old-fashioned

Under 2016 NY Law VM CSA, the act of Pledging allows the Pledgor to retain beneficial ownership, consistent with UCC Article 9 and EU Directive 2002/47/EC. Thus, the Program structure fits within this framework, allowing full Pledgor control and exit rights under an approved unlock schedule.

B. Trust-Like Effect of Pledge Arrangement

The arrangement functions like a private trust: the Pledgor is both Trustor and Beneficiary, and Pledgee acts as Trustee and Custodian. The pledged assets are segregated, perfected, and insulated from third-party claims, ensuring maximum protection for the Pledgor.

C. Full Waiver of Right to Title Transfer Custodied Collateral

Under this Agreement, the Custodian and any other Counterparties involved waive full right to transfer title of the collateral being pledged for any reason, including but not limited to, bankruptcy or insolvency.

IV. CREDIT SUPPORT DEFAULT AND LIABILITY FRAMEWORK

Under ISDA §5(a)(iii)[5], a Credit Support Default occurs when: (1) a party fails to perform under a Credit Support Document; (2) a Credit Support Document terminates prematurely; or (3) a party repudiates or invalidates it. Under this Agreement, a default arises only from Pledgee's failure to perform its obligations. The Pledgor cannot default. In such cases, the sole remedy is the return of pledged assets, limiting Pledgee's liability accordingly.

V. LIMITATION OF LIABILITY AND RISK SCOPING

Pledgee's liability is limited to the return of pledged collateral. Since ownership is never transferred and assets are held in a segregated Special Custody Account, there is no risk of loss or diminution.

security arrangements. Therefore, they are Credit Support Documents per ISDA guidelines, and must be enforced.

[5] Idem 3.

The structure isolates participant assets from operational or financial exposure, ensuring that even in the event of default, pledged assets remain unaffected.

VI. ENFORCEABILITY AND INVESTOR PROTECTIONS

The pledge is enforceable under New York law once delivery or control is established. Beneficial ownership remains with the Pledgor, preventing inclusion in Pledgee's estate in insolvency. The APY obligations are unsecured and secured solely by the pledged assets, functioning as self-insurance. Custodial control ensures no unauthorized movement of pledged assets. This provides superior investor protection compared to traditional broker-dealer or fund structures.

VII. CONSIDERATIONS FOR PLEDGING CUSTODIED ASSETS

Under NY law, two entities can custody an asset, particularly through a Sub-Custody arrangement. The NY State Department of Financial Services (DFS) has issued updated guidance emphasizing that if a Virtual Currency Entity (VCE) Custodian uses a third-party Sub-Custody arrangement, the customer agreement must clearly disclose the terms of that arrangement and the material risks involved. A Special Custody Account could also potentially serve to address NY regulatory requirements within this context.

The DFS expects such custodians to ensure that customer assets are properly segregated and that the custodial structure protects customers in the event of insolvency. The Parisii™ Pledging structure supports both requirements. While a primary custodian may delegate certain functions, the responsibility for proper custody and disclosure remains with the primary entity, which must ensure compliance with regulatory expectations.

VIII. CONCLUSION AND OPINION

1. The Parisii™ Pledge Structure qualifies as a security financial collateral arrangement under NY law, per the 2016 ISDA VM CSA Framework.

2. Beneficial ownership remains with the Pledgor.

3. Parisii's interest is limited to a contractual security interest securing its performance obligations.

4. Credit Support Default arises only from Parisii's non-performance.

5. Liability is limited to return of pledged collateral.

6. The structure is legally sound, enforceable, and investor-favorable.

IX. RECOMMENDATIONS

- Maintain segregated Special or Sub-Custody Accounts, and potentially Sub-Accounts under NY law, with Pledgor records.

- Include explicit limitation of liability clauses to include no title transfer for any reason.

- Require custodial control confirmations under UCC §9-313(a), or blockchain verification.

- Incorporate ISDA 2016 VM CSA and Section 5(a)(iii) references into all Program documents.

- Implement strict guidelines for full FDIC insurance coverage of the pledged collateral by depositing into Special Custody Accounts, Sub-Custody Accounts, or Sub-Accounts, and potentially Sub-Accounts, with no more than $250K in collateral per Sub-Account at all times.

If you want to know what the inspiration was for the PARYS RWA architecture, it wasn't stablecoins (although that turned out to be the best implementation model in Web3 for what we are doing). It was actually Special Drawing Rights:

https://www.imf.org/en/About/Factsheets/Sheets/2023/special-drawing-rights-sdr

whereby the IMF designed SDRs as a "basket of currencies" containing the 5 most issued fiat currencies. The SDR price index is an average price of all 5 in the basket. Customer is doing the same with PARYS Carbon RWA, but with four carbon asset types (EUAs, JCOs, ITMOs, and CBAMs) as the "basket of carbon", and the PCRWA price index being a weighted averaging of the value of assets.

That was the origin. From there I applied reinvestment into Sustainability projects since we could capture profits and carbon asset generation for additional input value into the basket. Then I applied the carbon accounting via GHG Protocol to further inflate the Treasury price over time as a multiplier. The latest enhancement was the addition of the Staking program, growing the PARYS Carbon RWA into the 6-yield input design it is today.

There simply is no more circular or compounding financial instrument on the planet, not even close. And it is tax free, fully secured under US law, and fully audited by a big 5 accounting firm quarterly for transparency.

1) Customer and DEFEF have a contract that specifies BANK can under no circumstances confiscate, put a lien on, or otherwise restrict or transfer ownership of any deposits made by customers into BANK 6-yield accounts.

2) Customer purchases PARYS Carbon RWAs from Customer, and funds go towards purchasing carbon assets for PARYS Carbon Treasury, which is then used as depository assets from Customer to BANK for loan issuance.

3) Customer decides to stake RWAs with Customer, which are then deposited into BANK 6-yield accounts on behalf of the RWA staker.

4) Market price is used to value carbon assets in the Treasury, as well as RWAs for use in the BANK loan program.

5) Both the Treasury value and the RWA value can be used for loans, so even if we only do 15x per, it collectively represents a 30x mint of PARYS Carbon RWA and a 30x mint of REMIT loan tokens overall initially, half from Treasury and half from RWA staking from the customer.

6) Both are put on Uniswap as a trading pair for full liquidity. However, since the 30x PARYS Carbon RWA is held by BANK for liquidity, it is a 30x asset for the bank. The REMIT loan tokens are then issued for loans, which will be repaid as PARYS Carbon RWAs, REPAY payment tokens, or PARYS stablecoins, purchased separately by the loan recipient. The full transaction puts 30x REMIT on the exchange for long-term circulation at 30-50% APY. The payback also produces 30x in additional tokens, which will be converted to PARYS Carbon RWA for BANK as additional profit.

One loan cycle generates 30x in PARYS Carbon RWA on Uniswap for liquidity, 30x in REMIT loan tokens for 30-50% APY long-term, and 30x in repayment tokens that are converted to PARYS Carbon RWA tokens upon receipt for BANK Reserve. That's 60x in PARYS Carbon RWA production (30x that has to stay on network for REMIT loan token liquidity but can be counted as collateral for additional loan issuance in the future, and 30x from loan repayment that is free to circulate as needed by BANK). The 30x in REMIT loan tokens issued will also generate 30-50% APY long term for BANK.

Customer is building a fully GAAP and IFRS regulatory compliant tokenized bank, the first in the financial sector worldwide. To confirm this, I am attaching two spreadsheets to explain, as well as each of our 3 launch business models for review.

A bank's internal business model is primarily an accounting exercise. In order to build an international bank, you have to consider that there are two primary accounting systems in use worldwide, GAAP for US banks, and IFRS for all other countries' banks.

To first build a fully tokenized bank, we normalized both GAAP and IFRS accounting standards from a banking standpoint, and then built in a third set of data elements to represent all similar banking transactions as tokenized entries via approved digital assets. If you look at the two attached spreadsheets ("Normalized US GAAP & IFRS Accounting Standards - Q4 2025.pdf" and "Bank eon - Chart of Accounts - Q4 2025.xlsx"), they show not only the normalized GAAP and IFRS accounting standards from a banking perspective, but you can see where we have mapped in digital asset

entries alongside to fully map our tokenized banking system, Bank, to both accounting systems in use. Bank can produce accounting reports for all jurisdictions worldwide (US and international) but also map all those transactions to crypto as digital asset entries. This is the first and only such attempt to do so for the banking sector that Customer is aware of.

Now, we can move onto the 3 digital asset programs we are building, but you can see how they interact with the Bank Accounting System.

What I'd like you to do is first work up an accounting flow with Steps:

1) $25M in through licensing or fundraising and distributes it as $10M bank license to PR Government, $5M for Parisii Asia, Ltd. investment to launch.

2) $100M in from Customer as purchase of PARYS Carbon RWA in full, which will put $100M into PARYS Treasury to purchase EUAs and JCOs (50/50%), and issue $100M in PARYS Carbon RWA (PCRWA) to CUSTOMER.

3) CUSTOMER then Stakes the $100M in PCRWA with Parisii, which in turn Pledges the assets to Bank for deposit, and subsequent Bank loan issuance per the Staking program.

4) Bank loans out with the $100M in PARYS Treasury and the $100M in Staked PCRWA, making the $200M in collateral at 15x become $3B in REMIT Loan Token issuance.

5) At prime + 3% loan interest, the $3B in loans generate about 100% profit on the $200M in collateral, which is $200M in profit after 1 year of loans. This will total $400M in total after 1 year of operation.

6) Then as expenses, pay out $20M to CUSTOMER for the Staking and $10M to Parisii Asia, Ltd. for bringing the client in, and subtract $10M for operational costs.

7) That should leave $360M on the books, not including yield from the PCRWA investment on both the Parisii and CUSTOMER side.

This invention is a new process for structuring real world asset tokenization as a primary/spot market software implementation. It encompasses asset valuation, tokenization, and price recognition of the asset not by exchange-driven price discovery, but through a structured process and methodology-based auditing mechanism. This process will allow collateral owners to pledge their collateral to a tokenization process involving a custody provider, as well as a licensed accounting entity for ongoing auditing of the asset class and reserves, to drive the price discovery based on audited valuation of the underlying collateral in combination with market demand. This process bypasses the current requirement of raising fiat and submitting it into the system to realize the audited valuation of collateralized assets in an RWA issuance. Instead, it works with regulated assessment providers to initiate the value as a token, and then works to audit and assess the RWA issuance to provide a pricing mechanism not derived from TVL or trading pair liquidity.

Existing RWA token issuances require the collateral provider to transfer/blindly title their collateral into a custody provider, and then have the token issuer raise funds in fiat or crypto in order to provide liquidity for the RWA issuance. The fatal flaw in this is that the existing crypto exchanges don't acknowledge the inherent price determined to the underlying collateral. Instead, the RWA token issuer has to not only purchase the collateral, but then pay for marketing the asset. All while being undercut by the "first RWA" as stablecoin.

Consider a new market design whereby advancements are introduced. This not only is fully unique in process flow and market design, but removes most of the problems in Web3 RWA issuance and benefit today.

1) RWA tokenomics and valuation are based on IFRS/GAAP Accounting standards.
2) Once the collateral provider assigns their collateral to the service, it is deposited into custody, and then assessed in authenticity and value.
3) From there, a token can be issued to represent the collateral in custody as valid, and doesn't need any further fiat purchasing to maintain price, bind to a trading pair for swap, and/or other trading activities.
4) The fallacy of all non-fiat backed RWAs issued to date is that once they provide full collateralization upon deposit, the crypto/Web3 exchange designs require any RWA tokens to be fully fiat-matched for liquidity while in use. That makes no sense for any RWAs other than stablecoins, which are expected to be immediately redeemable for fiat. All other RWAs shouldn't be considered or positioned as stablecoins, as the latter are simply proxies for US T-bond yield.

The design flaws mentioned earlier and again in number 4 above confirm that the only way to legitimize a non-fiat associated RWA issuance in blockchain-based exchanges today, is that it literally has to be double-collateralized due to the immaturity of the RWA market. Stablecoins don't have to be double-collateralized, and don't have to even explain their single collateralization.

Stablecoin Issuance Process

A stablecoin is issued **through a process that involves backing it with a reserve of assets to maintain its stable value**. Typically, the issuer holds an equivalent value of a reference asset, such as a fiat currency, commodity, or cryptocurrency, which ensures that each stablecoin can be redeemed for the corresponding value of the reference asset. For example, if a stablecoin is pegged to the US dollar, the issuer holds US dollars in reserve, and for every stablecoin issued, the same value in dollars is held.

The issuance process often involves a smart contract, which automates the minting of stablecoins when users deposit the corresponding collateral. When a user wants to obtain a stablecoin, they deposit the required amount of collateral, and the smart contract mints the token. Conversely, when a user wants to redeem their stablecoins, they return the coins to the smart contract, which then burns them and releases the corresponding amount of collateral.

In some cases, stablecoins are over-collateralized, meaning the value of the collateral exceeds the value of the stablecoins issued. This provides an additional layer of security, helping the stablecoin maintain its peg even during market stress.6 The specific mechanisms can vary depending on the type of stablecoin, such as fiat-collateralized, crypto-collateralized, or algorithmic.

Stablecoin vs Real Asset Token Costs

Stablecoins are designed to maintain a stable value relative to a real-world asset, typically the US dollar, through various stabilization mechanisms. The issuance cost of stablecoins depends on the type of stablecoin and the underlying assets used for collateral. For example, off-chain collateralized stablecoins require a custodian to hold reserve assets,

while on-chain collateralized stablecoins use smart contracts to manage collateral. The cost of issuing stablecoins can vary based on the reserve assets and the complexity of the stabilization mechanism.

In terms of usage fees, **stablecoins generally have lower transaction fees compared to traditional financial systems**. For instance, the transaction fees for stablecoins like USDT, USDC, and DAI are relatively low, ranging from 0.1% to 0.15%.4 These fees are significantly lower than the fees associated with traditional payment systems, which can be as high as 3.5% for credit card transactions. The lower fees make stablecoins an attractive option for users seeking affordable transaction costs.

Interest rates and gas fees are also important factors to consider. Stablecoin issuers can generate revenue through interest earnings on their reserve assets, which can make the stablecoin more attractive to users. However, the interest rate environment can affect the profitability of stablecoin issuers. Higher interest rates generally mean higher returns on reserve assets, which can increase the profitability of stablecoin issuers. However, higher interest rates can also make non-interest-bearing assets less attractive for consumers to hold.

Gas fees, which are the transaction fees paid to process transactions on a blockchain, can vary depending on the network. For example, Ethereum's gas fees can be relatively high, which can impact the cost of using stablecoins on that network.5 However, some blockchains, like Polkadot, offer lower gas fees and shared security, which can make them more suitable for stablecoin transactions.

When comparing stablecoin issuance costs, usage fees, and interest rates/gas fees to real-world asset token issuance, it is important to note that real-world asset tokens, such as tokenized real estate or commodities, may have different cost structures. These tokens are typically backed by physical assets and may involve additional costs related to the custody and management of the underlying assets. The issuance costs for real-world asset tokens can be higher due to the need for physical asset verification and the costs associated with tokenization. Usage fees for real-world asset tokens may also vary depending on the platform and the specific asset being tokenized. Interest rates and gas fees for real-world asset tokens would depend on the blockchain network used and the specific tokenization platform.

In summary, stablecoins offer lower issuance costs and usage fees compared to traditional financial systems, but the costs can vary based on the type of stablecoin and the underlying assets. Interest rates and gas fees are also important factors that can impact the overall cost of using stablecoins. Real-world asset tokens may have different cost structures, with higher issuance costs and varying usage fees depending on the specific asset and platform.

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Stablecoin vs. RWA Token Differences

Issuance Cost

- **Stablecoins**: The issuance cost for stablecoins is generally low due to their straightforward pegging mechanisms. Fiat-collateralized stablecoins, for instance, require the issuer to hold an equivalent amount of fiat currency in reserve, which involves minimal additional costs beyond the initial setup and ongoing compliance.
- **Real-World Assets (RWAs)**: The issuance cost for RWAs is typically higher due to the complexity involved in tokenizing physical assets. This includes legal, regulatory, and

technical costs, such as setting up smart contracts, ensuring compliance with securities laws, and securing the underlying assets.

Usage Fees

- **Stablecoins**: Usage fees for stablecoins are generally low, ranging from 0.5% to 3.0% of the transfer amount. This makes them particularly attractive for cross-border transactions, where traditional remittance services can charge up to 6.35% of the transfer amount.
- **RWAs**: Usage fees for RWAs can vary widely depending on the type of asset and the platform used. For example, tokenized real estate can involve transaction fees for buying and selling tokens, as well as management fees for the tokenization platform. These fees can be higher than those for stablecoins due to the additional layers of complexity and regulation.

Interest Rates

- **Stablecoins**: Stablecoins can offer interest rates through various DeFi protocols. For example, U.S. Treasury-backed stablecoins like Ondo's USDY and Hashnote's USYC offer yields directly to holders, functioning as tokenized money market funds. These yields can be attractive to investors seeking secure, passive income.
- **RWAs**: RWAs can also generate interest through DeFi protocols. For instance, tokenized real estate can earn yield through transaction fees or interest when contributed to liquidity pools. Additionally, platforms like LCX offer fixed returns on tokenized assets, such as a 7% return on Bitcoin-based bonds backed by real diamonds.

Gas Fees

- **Stablecoins**: Gas fees for stablecoin transactions depend on the blockchain network used. Popular networks like Ethereum and Tron have varying gas fees, which can fluctuate based on network congestion. However, stablecoins often benefit from layer-2 solutions and other optimizations to reduce these costs.
- **RWAs**: Gas fees for RWA transactions can be higher due to the complexity of the smart contracts involved. These contracts often require more computational resources to execute, leading to higher gas fees. However, the use of layer-2 solutions and other scalability improvements can help mitigate these costs.

Summary

- **Issuance Cost**: **Stablecoins have lower issuance costs compared to RWAs** due to simpler pegging mechanisms.
- **Usage Fees**: **Stablecoins offer lower usage fees**, making them more cost-effective for cross-border transactions.
- **Interest Rates**: Both stablecoins and RWAs can generate interest through DeFi protocols, with stablecoins often functioning as tokenized money market funds and RWAs earning yield through transaction fees or fixed returns.
- **Gas Fees**: **Gas fees for stablecoin transactions are generally lower than those for RWA transactions** due to the complexity of RWA smart contracts. However, layer-2 solutions can help reduce these costs for both types of tokens.

Stablecoin vs. RWA Token Differences

Issuance Cost

- **Stablecoins**:
    - **Fiat-Collateralized**: The issuance cost is relatively low, primarily involving the cost of holding and managing the equivalent amount of fiat currency in reserve. This includes operational and compliance costs.
    - **Crypto-Collateralized**: The issuance cost can be higher due to the need for over-collateralization and the volatility of the underlying crypto assets.
    - **Algorithmic**: The issuance cost is lower but involves complex smart contract development and ongoing maintenance.
- **Other RWAs**:
    - **Tokenized Real Estate**: Higher issuance costs due to legal, regulatory, and technical complexities. This includes property valuation, legal documentation, and smart contract setup.
    - **Tokenized Commodities**: Similar to tokenized real estate, with additional costs for storage and insurance of the physical commodities.
    - **Tokenized Securities**: High issuance costs due to compliance with securities laws, legal fees, and the need for trusted custodians.

Usage Fees

- **Stablecoins**:
    - Generally low, ranging from 0.1% to 0.5% of the transaction amount. This makes them cost-effective for everyday transactions and cross-border payments.

    - Examples: USDT, USDC, DAI.
- **Other RWAs**:
    - Can vary widely depending on the type of asset and the platform.
    - **Tokenized Real Estate**: Transaction fees for buying and selling tokens, management fees for the tokenization platform, and possibly custody fees.
    - **Tokenized Commodities**: Transaction fees, storage fees, and insurance costs.
    - **Tokenized Securities**: Transaction fees, management fees, and compliance costs.

Interest Rates

- **Stablecoins**:
    - Can offer interest rates through DeFi protocols. For example, U.S. Treasury-backed stablecoins like Ondo's USDY and Hashnote's USYC provide yields to holders.
    - Yields can be attractive for investors seeking secure, passive income.
- **Other RWAs**:
    - Can also generate interest through DeFi protocols.
    - **Tokenized Real Estate**: Earnings through rental income, appreciation, or dividends.
    - **Tokenized Commodities**: Earnings through lending or staking.
    - **Tokenized Securities**: Fixed or variable returns based on the underlying asset.

Gas Fees

- **Stablecoins**:

    - Depend on the blockchain network used. Ethereum and Tron have varying gas fees, which can fluctuate based on network congestion.
    - Layer-2 solutions and other optimizations can help reduce these costs.
- **Other RWAs**:
    - Can be higher due to the complexity of the smart contracts involved.
    - **Tokenized Real Estate**: Smart contracts may require more computational resources, leading to higher gas fees.
    - **Tokenized Commodities**: Similar to tokenized real estate, with potentially higher gas fees.
    - **Tokenized Securities**: High gas fees due to the complexity of compliance and regulatory requirements.
    - Layer-2 solutions and other scalability improvements can help mitigate these costs.

Summary

- **Issuance Cost**: Stablecoins generally have lower issuance costs compared to other RWAs due to simpler pegging mechanisms. Other RWAs, such as tokenized real estate and commodities, involve higher costs due to legal, regulatory, and technical complexities.
- **Usage Fees**: Stablecoins offer lower usage fees, making them more cost-effective for everyday transactions and cross-border payments. Other RWAs can have higher usage fees due to the additional layers of complexity and management.

- **Interest Rates**: Both stablecoins and other RWAs can generate interest through DeFi protocols. Stablecoins often function as tokenized money market funds, while other RWAs can earn yield through rental income, lending, or fixed returns.
- **Gas Fees**: Gas fees for stablecoin transactions are generally lower than those for other RWAs due to the simplicity of their smart contracts. However, layer-2 solutions and other scalability improvements can help reduce these costs for all types of tokens.

By recognizing that **stablecoins are a subset of RWAs**, we can see that they share many characteristics but also have distinct differences in terms of issuance, usage, interest generation, and transaction costs.

So, let’s assess stablecoins from an applied perspective:

1) They are high-yield Treasury funds wrapped in a stablecoin brand.

All fiat backed stablecoins are proxies to Treasury notes/bonds, that don't reward HODLers at all. Translated, the yield goes to the issuer, and the interest is paid by the recipient. The gap is exchange fees, and the rate is Payday Loan level for frequent traders.

2) Net income down despite revenue growth.

Dichotomy of an attractive investment vehicle.

3) They lose margin when people use it.

Therein lies the fraud of MEV theft on network, no means of basic accounting requirements in the stablecoin network usage currently, and no one rising up yet to provide a fully transparent exchange that doesn't require stablecoins to trade at all.

The real issue is that blockchain was designed to eliminate the "middle-man", as that is the primary source of fraud in market design. What Tether, Circle, and others are proving is that they are the "middle-man" in blockchain-based market design.

Speed is no longer an issue, and every exchange should design to eliminate the unnecessary stablecoin translation burden entirely.

Pricing fluctuations almost disappear with RWA swaps, so does regulatory oversight, which allows long term investment in RWAs without most of the market fraud encountered in SEC/NYSE trading venues.

A Tokenized Banking System and Application Of

What is a Real-World Asset?

Real World Asset (RWA) tokenization is an emerging concept that traces back to the advent of blockchain technology. The journey began with Bitcoin's introduction in 2009, which unveiled a decentralized, secure, and transparent ledger system.

This groundbreaking technology laid the foundation for turning physical assets into digital tokens recorded on a blockchain. However, the real leap forward came with Ethereum in 2015, introducing smart contracts —self-executing agreements coded directly onto the blockchain.

With smart contracts, it became possible to digitally represent physical assets like real estate, art, and commodities, bridging the gap between the physical and digital worlds. The potential for this technology to impact global economies and social structures quickly became apparent.

Why Do RWAs Matter?

To understand the significance of RWA tokenization, picture a large pizza you want to share with friends. Instead of giving each friend the whole pizza, you slice it into pieces, with each slice representing part of the whole.

Tokenization works similarly with assets. When an asset is tokenized, it's divided into smaller parts called "tokens," each representing a share of the asset. These tokens can represent anything valuable, from real estate to intellectual property. Managed and traded using blockchain technology, these tokens ensure secure and transparent ownership records, making assets more accessible, liquid, and tradable globally.

The Impact of Tokenization

Consider the real estate market in cities like New York or London. A $10 million property could be divided into 10 million tokens at $1 each. This enables individuals to invest as little as $100, owning a slice of high-value real estate.

Tokenization brings liquidity to the real estate market, which is traditionally illiquid and difficult for smaller investors to access. According to Markets and Markets, the global real estate tokenization market is projected to reach $1.4 trillion by 2026, growing at a CAGR of 22.8%.

The same principle applies to commodities. An ounce of gold worth $2,000 can be tokenized into 2,000 shares at $1 each. This lowers the barrier to entry, allowing more investors to gain exposure to commodities without needing significant capital. Grand View Research forecasts the tokenized commodities market to reach $4.5 billion by 2025.

Tokenization also empowers creators to monetize their intellectual property. A patent valued at $1 million could be divided into 1 million tokens at $1 each. Investors can purchase these tokens and share in the revenue generated, rewarding creators while opening up investment opportunities to a

broader audience. Juniper Research predicts the market for tokenized intellectual property rights will reach $320 million by 2025.

European Union Allowances as RWAs

EUAs are an ideal asset class to tokenize as an RWA. According to Chainlink Co-Founder Sergey Nazarov, Real World Assets have already surpassed DeFi in assets under management. Sergey believes RWAs will flip cryptocurrency for total value over the next 1-3 years. Chainlink is adopting RWA with companies including Fidelity and is specifically trying to adopt carbon as an RWA. Since private citizens and companies outside the EU can't purchase European Union Allowances (EUAs) directly, the best performing carbon instrument on the planet is destined to become an RWA for global investment purposes.

RWA TOKENS is conceived as a digital representation of real-world carbon assets, primarily EUAs with inclusion of other government issued carbon instruments as appropriate, operating on blockchain. To understand the real-world manifestation, we need to examine the RWA TOKENS components and how they interact with existing financial and environmental markets.

Collateralization: RWA Tokens are fully backed by a reserve of EUAs, or equivalent, held in custody. These financial instruments represent real-world government issued carbon assets. This direct linkage to physical carbon allowances is crucial for establishing RWA TOKENS's value and stability.

Price Discovery and Fungibility: RWA TOKENS leverages the ICEEUA index, a benchmark reflecting the market price of EUAs, for price discovery. This ensures that the value of RWA Tokens is closely aligned with the real-world carbon market dynamics. Additionally, the fungibility of EUAs, meaning they are interchangeable and tradable on multiple regulated secondary markets, enhances the liquidity and redeemability of RWA Tokens.

Regulatory Compliance: RWA TOKENS aims to operate within established financial regulations. It plans to register as a digital asset under MiCA, comply with KYC/AML laws, and undergo regular

audits to demonstrate proof of reserves. These measures aim to build trust and legitimacy, bridging the gap between the decentralized nature of blockchain and the requirements of traditional financial systems.

Bridging Traditional and Decentralized Finance: RWA TOKENS represents a convergence of traditional carbon markets and decentralized finance (DeFi). It enables investors to gain exposure to carbon assets through a digital token, potentially expanding market participation and increasing liquidity. Moreover, its integration with major L1 and L2 blockchains allows for the development of new financial products and services, such as decentralized carbon exchanges and carbon-based lending platforms.

Climate Positive Impact: By facilitating investment in carbon allowances, RWA TOKENS aims to contribute to global emissions reduction efforts. The protocol's Pigouvian Subsidy application, which rewards token holders, further incentivizes participation in climate change mitigation.

In essence, RWA TOKENS can be seen as a digital wrapper around a real-world asset—EUAs. It seeks to enhance the existing carbon markets by leveraging blockchain technology to improve transparency, accessibility, and liquidity, ultimately promoting climate action by channeling investment towards emissions reduction initiatives.

The RWA TOKENS Protocol real-world impact hinges on seamless interaction with existing carbon markets and regulatory frameworks. The success of RWA TOKENS will depend on its ability to navigate the complexities of these interconnected systems and fostering trust while demonstrating contribution to a more sustainable future.

Trump is trying to get mineral rights from Greenland, Canada and Ukraine because he's going to use the mineral rights to forward sell the assets into a Real-World Asset (RWA) tokenization play that will allow the US to mint trillions in digital currency RWAs representing all mineable minerals, oil and other natural resources. It will be the basis of massive wealth creation in the US.

This RWA application begins with a definition of the digital asset/property that the RWA will represent. The digital asset/property can be assessed for overall value in USD or another monetary denomination, and an NFT can be minted to represent the digital asset/property on the blockchain. The asset can be represented by any custody mechanism integrated into a Web3/blockchain ledger technology. The NFT of one or more digital assets/properties can also be used in a custodied or non-custodied collateral pool. Based on the value of the property in the collateral pool, crypto tokens can be issued as RWAs representing fractional or whole value representations of the collateral associated with the RWA. The collateral can be any real-world property including natural resources like land/real estate, minerals or their mining rights/ownership, oil, coal, energy, gold, silver, uranium, commodity or any other property that can be represented digitally through an NFT or crypto tokenization issuance. Once the RWA tokens are minted and in circulation, the smart contracts associated with the RWA or software that the RWA is constructed with can include logic that will serve to tax the use of the RWA on network across any potential decentralized ledger technology by sending a fee back to a tax collection software service on the network or accessible on the Internet. The fee or tax will be paid when the payable or transfer functions are called on the smart contract or software implementing the token itself.

This RWA transaction application should support paying a tax or fee per transaction from the token smart contract or token software during the transaction in which the RWA tokens are being transferred. For instance, if the tokens are issued to a wallet upon minting, then whenever the tokens are transferred to another wallet, they should assess a fee and transfer it to a wallet for tax collection. The transaction can calculate the fee based on a percentage of the overall transaction, or a set fee based on the tax collection service. The tax collection service should be a server or application at a specified IP address or blockchain address, and may be simply a digital wallet used for collection of taxes from the use of the RWA on the blockchain network. The fee/tax assessment can be restricted or assessed based on blacklisting or whitelisting the sending or receiving party, and

the lists can be based on either IP addresses or wallet addresses of the parties involved. One or more fees or taxes can be paid during a transaction with this application.

The RWA application should work in the following manner:

Identify the collateral (digital asset representing gold, silver, carbon, coal, oil, timber, or any other real-world property) that will be used to asset back the RWA issuance and assess its value, currently as well as on a cyclical basis in the future. For a mining, oil and gas, or forestry operation, it could be estimated annual or quarterly production from the facility.

Determine the collateral's value, and mint an NFT on blockchain to represent the collateral, and confirm the value associated with the collateral in USD or some other monetary instrument of measure.

Determine the tokenomics for the RWA including total number of tokens issued, who will own initial issuance and to what percentage, as well as how many will be sold long term to customers and investors with an unlock schedule for all tokens.

Issue the tokens and release some to the public on blockchain for purchase.

Once purchased, if the tokens are transferred to another wallet or owner, have the smart contract of software code that control and make up the RWA token contact the tax or fee collection service on the network (blockchain or Internet based) and have the tax or fee be calculated for the transfer of the RWA tokens between owners based on the value and size of the transfer.

Once the fee is calculated and sent back to the smart contract or invoking software, the fee or tax can then be removed from the sender's wallet and sent to the fee or tax collection service. The transfer of the RWAs initially requested can then be forwarded to the recipient to complete the transaction.

This will serve to collect a fee or transaction from the sending party for use of the RWA on the network as a store of wealth or medium of transfer / payment on the network.

The collateral can also be provided to a money market fund as collateral to generate an APY for the collateral held by the RWA provider, which may or may not be the tax collection service.

This RWA application can use the following software framework describing a RWA on blockchain software tokenization application as the basis for the taxable RWA tokenization application described above.

Money is one of the most powerful coordination mechanisms humanity leverages in order to thrive. The privilege of managing the money supply has historically been kept in the hands of sovereign leadership and the financial elite while being imposed upon an unwitting general public. Where Bitcoin has demonstrated the potential for a grassroots protest to manifest a store-of-value commodity asset, Ethereum gives us a platform to build Digital Property asset-backed synthetic instruments that can be protected from volatility and used as Digital Property collateral, or pegged to a reference price and used as a medium-of-exchange for daily transactions, all enforced by the same principles of decentralized consensus.

Permissionless access to Bitcoin for storing wealth and properly decentralized synthetic instruments on Ethereum will lay the foundation for the upcoming financial revolution, providing those at the fringes of the modern financial system the means to coordinate around building the new one.

In this paper, we introduce a framework for building Digital Property reflex indexes, a new asset type which will help other Digital Property synthetics flourish and will establish a key building block for the entire decentralized finance / regenerative finance industries.

We start by describing overall benefits of the RWA TOKENS ReFi ecosystem. We then detail Digital Property Allowances as Emissions Trading Schemes, as well as benefits of utilizing the European Union Emissions Trading Scheme (EU-ETS) as the Digital Property collateral of choice for initial RWA TOKENS implementation. By leveraging existing European Union Allowances (EUAs) as Digital Property Futures for collateralization, coupled with the Intercontinental Exchange European Union

Allowance (ICEEUA) index for price discovery and fungibility, RWA TOKENS can achieve optimal results as a ReFi protocol.

We then discuss the RWA TOKENS blockchain mechanics. We describe the Digital Property reflex indexes as a non-pegging to Digital Property collateral, then monetary policy and related global governance. We conclude by summarizing our product roadmap, the addressable market, as well as providing detailed diagrams for system visualization.

Benefits of the RWA TOKENS Digital Property Synthetic

RWA TOKENS Digital Property Synthetic assets carry a number of unique advantages. While there are no specific citizenship requirements to participate in the stock market, there are certain needs that investors must satisfy. Non-US persons must provide identification documents, pass Know Your Customer (KYC) screening, and comply with a number of laws that are intended to protect US interests.

However, Digital Property Synthetic assets feasibly provide investors of any location or jurisdiction exposure to the price action of stocks, commodities, and currencies. To trade these tokens, users would hardly need any of the requirements to enter the US equities market. This makes Digital Property Synthetic assets a favorable alternative for foreign investors experiencing barriers to entry. Moreover, Digital Property Synthetic assets are openly tradeable and transferable, meaning anyone can send and receive them using standard crypto wallets. The only need is access to the internet and a bit of technical know-how. Since DeFi is always on, synthetic tokens can be traded 24/7. This is in great contrast to traditional markets, where trading is limited to specific days and specific hours.

In addition, with Digital Property Synthetic assets, there are no central party restrictions or risks. This is in stark contrast to the recent reddit-fueled GME drama when thousands of retail investors were unable to sell select securities due to restrictions imposed by stock brokers such as Robinhood. In such cases, these controlling parties can halt or even execute trades—keeping their primary interest in mind, without prioritizing the trader.

The ethos of Digital Property Synthetic assets and decentralized finance (DeFi) lies in openness and transparency. Unlike traditional finance, DeFi does not rely on centralized authorities like banks or brokerages functioning as the intermediaries between transacting parties. Instead, a public ledger records and verifies transactions directly on a digital blockchain for all to reference, eliminating opacity and cumbersome bureaucracy. Since a centralized authority does not exist, investors are empowered with the autonomy to instantly access, trade, and transfer Digital Property Synthetic assets with ease.

DeFi works through smart contracts, which are automated, self-executed programs that cannot be altered. Once a certain set of requirements is met, the smart contract is automatically activated without the need for institutional intermediaries, thus removing any ambiguity in its terms. For example, a smart contract can be programmed to release salary funds for a bi-weekly payday or automatically issue payments to the winning party of a bet once the terms are met. By removing third parties, there is less room for missteps since issues of subjectivity and dishonesty are eliminated. The objective nature of smart contracts ensures that transactions are reliably fulfilled. By transitioning the concept of derivatives to DeFi in the form of Digital Property Synthetic assets, the possibility of global, borderless transactions becomes a reality, allowing anyone from anywhere to participate.

Digital Property Synthetic assets also allow investors to invest in new, emerging Digital Property commodity classes. Take European Allowance Units (EUAs) for instance. Historically, EUAs have been only accessible by a handful of EU registered Digital Property brokers, but the RWA TOKENS Digital Property Synthetics are innovating to bridge this gap. Through the tokenization of EUAs, anyone can buy into the token and reap the rewards of EU-ETS Digital Property allowance investing without ever personally needing to physically own or custody the EUAs directly.

Unlike derivatives, one unique selling point of Digital Property Synthetics has the potential to earn rewards or yield by staking or holding on to a Digital Property asset for an extended period of time.

The only such example to date, RWA TOKENS, is a Digital Property Synthetic asset whereby a token mimics the value of an underlying real-world Digital Property asset, in this case EUAs. By staking these Digital Property Synthetics as collateral for projects, investors have the potential to earn interest. This flexible trait makes Digital Property Synthetic assets attractive for more savvy investors.

A Digital Property Synthetic equity strategy can help investors who wish to maintain passive equity exposure while seeking one or more of the following:

Liquidity pool. Generate an additional source of funds to enhance portfolio liquidity.

Reduce foreign exchange risk. Passive equity futures contracts minimize the foreign exchange risk associated with foreign equity holdings.

Low transaction costs. These contracts provide “cheap beta,” with low transaction costs and without the management fees and expenses associated with cash equity products.

Generate higher portfolio yield. Fixed income products can provide an additional and predictable source of portfolio income.

Improve portfolio duration matching. Extending portfolio duration by adding Digital Property futures is especially useful for key rate duration matching for liability driven investors.

Flexibility in Risk Exposure

RWA TOKENS Digital Property Synthetic products are covered Digital Property allowances and Digital Property offsets, including derivatives such as futures and options, characterized by identical or similar profit and loss structures when compared with traditional Digital Property-based financial instruments.

Bank™ Digital Property investment services allow investors to decide on how much exposure they have to different forms of Digital Property assets, thereby allowing investors the ability to hedge risk

associated with investing in Digital Property derivatives such as Digital Property futures and options. By investing in diversified portfolios containing weighted percentages of EUAs with EUA Futures, investors can achieve greater potential return-on-investment. Of course, this comes with potential additional risk as well. Investors seeking the safest Digital Property investment strategy in a Bank portfolio may want to consider investing in 100% EUA holding as part of their RWA TOKENS Digital Property Synthetic investment.

It is the price of novelty, customization, and flexibility offered by RWA TOKENS Digital Property Synthetics as Structured Financial Instruments that can be expressed in one four-letter word: risk. Risk taking is welcome when one knows how to manage their exposure, but it can be a disaster when one doesn't – hence, the wisdom of learning ahead of investing the challenges posed by Digital Property derivatives and how to be in charge of risk control.

Digital Property Pricing Mechanisms are a Central Part of the Global Emission Reduction Policy Toolkit

Digital Property pricing mechanisms are becoming a ubiquitous part of the toolkit to tackle climate change. The higher the cost of a 'permit' or 'allowance' to produce Digital Property, the greater the incentive to implement abatement technology to reduce Digital Property output. There are several methods of achieving lower emissions, but the 'cap and trade' strategy is one of the most favored today. According to the World Bank, a total of 64 Digital Property pricing instruments is now in operation around the world, covering over 20% of global greenhouse gas (GHG) emissions and generating $53 billion in revenue. The World Bank data reveals the market is heavily fragmented and that represents some challenges. Firstly, there is no global price for Digital Property. That could incentivize some Digital Property emitters to change location of production to places where the cost of Digital Property cheaper (Digital Property leakage). Secondly, the less mature and less liquid Digital Property markets carry a lower Digital Property price. The social cost of underpriced Digital Property mechanism is the overproduction of Digital Property. Digital Property Market Year in

Review 2020, January 2021. Includes futures but excludes options. The majority of Digital Property prices remain far below the High-Level Commission on Digital Property Pricing's recommended range of $40-80/ton CO2 equivalent (tCO2e) for 2020 to meet the 'well below 2°C' temperature goal of the Paris Agreement. At this point, Digital Property prices in the recommended range cover less than 5% of global emissions.

SAFEs

In order to generate indexes, anyone can deposit and leverage their Digital Property collateral inside SAFEs. While a SAFE is opened, it will continue accruing debt according to the deposited collateral's borrowing rate. As the SAFE creator pays back their debt, they will be able to withdraw more and more of their locked collateral.

SAFE Lifecycle

There are four main steps needed for creating Digital Property reflex indexes and subsequently paying back a SAFE's debt:

Deposit collateral in the SAFE. The user first needs to create a new SAFE and deposit collateral in it.

Generate indexes backed by the SAFE's collateral. The user specifies how many indexes they want to generate. The system creates an equal amount of debt that starts to accrue according to the collateral's borrowing rate.

Pay back the SAFE debt. When the SAFE creator wants to withdraw their collateral, they have to pay back their initial debt plus the accrued interest.

Withdraw collateral. After the user pays back some or all of their debt, they are allowed to withdraw their collateral.

SAFE Liquidation

In order to keep the system solvent and cover the value of the entire outstanding debt, each SAFE can be liquidated in case its collateralization ratio falls under a certain threshold. Anyone can trigger a liquidation; in which case the system will confiscate the SAFE's collateral and sell it off in a collateral auction.

Liquidation Insurance

In one version of the system, SAFE creators can have the option to choose a trigger for when their SAFEs get liquidated. Triggers are smart contracts that automatically add more collateral in a SAFE and potentially save it from liquidation. Examples of triggers are contracts that sell short positions or contracts that communicate with insurance protocols such as Nexus Mutual, or Digital Property specific insurance programs like the Global Digital Property Trust.

Another method to protect SAFEs is the addition of two different collateralization thresholds: safe and risk. SAFE users can generate debt until they hit the safe threshold (which is higher than risk) and they only get liquidated when the SAFE's collateralization goes below the risk threshold.

Digital Property Collateral Auctions

To start a collateral auction, the system needs to use a variable called liquidationQuantity in order to determine the amount of debt to be covered by every auction and the corresponding amount of collateral to be sold. A liquidation penalty will be applied to every auctioned SAFE.

Proof of Reserves

RWA TOKENS and all additional tokenized Digital Property offerings defined in our Product Roadmap (section 22) including PCCA, PRGA, and PUKA, and potentially more to come. We will work with 3rd party accounting firms to provide monthly attestations to confirm the Digital Property reserves collateralizing each RWA TOKENS token. From launch, Bank, LLC will work with a major accounting firm to verify that the Digital Property backing RWA TOKENS is always held at a fully asset-backed level, and that Bank has made no material changes to the 'terms of service' that protects users.

In addition to attestations on a set schedule, Bank LLC will build a 'live attestation' dashboard. RWA TOKENS holders will be able to view a real-time dashboard of Bank LLC Digital Property Reserves, advancing transparency from months to minutes. The real-time dashboard will provide third-party confirmation, with Bank LLC as an exclusive client. The dashboard will be viewable via the Bank LLC website. Eventually, the real-time confirmation dashboard will replace the monthly attestations.

Creation and Redemption

One of the most important aspects of a collateralized Digital Property Synthetic is the ability to be able to freely purchase and redeem the digital token back into the underlying Digital Property and/or fiat currency consistently, without hassle, and in an inexpensive manner. With these facts in mind, Bank LLC has strived to make the RWA TOKENS redemption process as smooth and inexpensive as possible while complying with all necessary compliance measures.

Digital Property Synthetic Code of Ethics

Stablecoins are a foundational pillar for the blockchain-based financial system. A stable Digital Property Synthetic, when properly implemented, can serve as a medium of exchange for a new ecosystem of financial contracts, applications, and businesses.

But until recently, cryptocurrency markets have been hurt by a lack of Digital Property-backed stable instruments. While there has been a surge of new stablecoin projects, there has not yet been an industry-wide dialogue about what it will take for a stable Digital Property Synthetic to be trusted as an integral part of the industry's infrastructure.

In the future, regulators may establish clearer policies for digitized currencies. In the meantime, RWA TOKENS can take the initiative and hold ourselves to a high standard of ethics. While specific approaches may vary, there are at least a few lessons from the past that RWA TOKENS should not repeat.

In short, the core pillars of this code of ethics include:

Fully Backed - Every token will have the equivalent Digital Property value stored in the RWA TOKENS Reserve to back it.

Stable - The market should recognize the inherent value of RWA TOKENS as being equal to the price of the underlying Digital Property.

Redeemable - We will never prevent or discourage legitimate redemptions from verified customers.

Compliant - We will ensure the long-term survival of RWA TOKENS through regulatory compliance.

Planned Compliance Policy

RWA TOKENS plans to register as a regulated Money Service Business with the Financial Crimes Enforcement Network ("FinCEN"), Bank LLC is fully compliant with Bank Secrecy Act (BSA) / Office of Foreign Assets Control (OFAC) and Know Your Customer (KYC) / Anti-Money Laundering (AML) laws. A risk-based compliance program has been implemented that is designed to comply with these applicable requirements.

Bank LLC requests personal identification information and documentation from persons or entities and contracts with multiple third parties to verify and validate customer information including screening the names against various sanctions lists. Once all KYC/AML checks have been completed, the person or entity's account is created on the platform.

A third-party vendor performs fund origination verification on all persons or entities. This includes ensuring wires or checks submitted by the customer are in the name of the account holder, should the names and address not match, the wires are returned. From time to time, Bank LLC might reach out to an existing customer for additional information or documentation. Should this additional information or documentation not be sufficient, Bank LLC will not allow the customer to continue transacting on the platform.

In addition to identity verification and source-of funds validation, Bank LLC utilizes a third party to perform OFAC and other sanctions watch-list checks on all persons or entities. Bank LLC will not be doing business with any person or entity appearing on such a watch-list.

Addressable Market

We see RWA TOKENS as being useful in several significant use cases:

Portfolio Diversification: Investors use RWA TOKENS to get dampened exposure to an asset like Digital Property without the whole risk of actually holding Digital Property.

Collateral for Synthetic Assets: RWA TOKENS can offer protocols such as UMA, MakerDAO and Synthetix a lower exposure to the crypto market and give users more time to exit their positions in the case of scenarios such as Black Thursday from March 2020 when millions of dollars' worth of crypto assets was liquidated.

Long-term Institution-Grade Investment Vehicle for Digital Property: RWA TOKENS provides a safe and fully regulated environment to invest in Digital Property as an asset class with immediate liquidity and solid performance metrics.

A Climate Positive Structured Financial Instrument for Payment Systems: RWA TOKENS provides the world's first and only "green Digital Property Synthetic", which can serve as the basis for future climate mitigating payment systems.

Trading: At present, the majority of cryptocurrency trading on exchanges is done using stablecoin pairings. For example, on the largest cryptocurrency exchange, Binance, RWA TOKENS could be traded against many cryptoassets including Bitcoin and Ethereum. Prior to stablecoins, on cryptocurrency exchanges, you were only able to trade 1 crypto asset (e.g., Bitcoin) for other cryptoassets (e.g., Ethereum). This means that a trader is taking on double price risk. With stable instruments like RWA TOKENS, this price risk is mitigated.

Moving Money: stable digital instruments have proven to be transformational for moving money around the world. For <$1 USD, you are now able to send millions (or billions) of dollars in a single transaction. This use case has yet to be fully taken advantage of, but is happening on a small scale right now.

A Trusted Store of Value: Individuals in some countries face high barriers to entry to opening a simple bank account. Through RWA TOKENS, individuals and businesses around the world can access the economic security of the U.S. dollar and custody the value themselves.

Primary Loan issuances: As RWA TOKENS continues to tokenize additional Digital Property synthetics alongside fiat currencies (e.g., USD, EURO, British Pound, Hong Kong Dollar, Philippine Peso, Argentine Peso, etc.) this will enable the fast and inexpensive ability to Primary Loan token money around the world. At present, the costs associated with sending money from one country to another can be prohibitively high with fees eating up to 10% of the transferred asset's value. RWA TOKENS eliminates many of the fees charged by middlemen and allow for more assets to arrive back in the local countries. This is a net positive for governments as it allows for funds to be transferred back into local economies and not taken by foreign money Primary Loan recipients.

B2B and International Trade: The market for companies sending money between each other, and hedging between the currencies of their home market and markets they are doing business in, is well over $1T. It is antiquated that in 2019, companies still need to pay high fees to intermediaries to simply send funds between companies. Large companies (e.g., Apple) get bank-grade rates for transfers, but small-and-medium-sized businesses face high fees and friction.

Blockchain-based FX markets: Advanced traders may find additional use cases for FX Marketplaces composed of tokenized Digital Property collateral, e.g., RWA TOKENS / PCCA™ or RWA TOKENS / PCCER™.

Future Research

To push the boundaries of decentralized money and bring further innovation in decentralized / regenerative finance, we will continue to look for alternatives in core areas such as governance minimization and liquidation mechanisms.

We first want to lay the groundwork for future standards around protocols that lock themselves from outside control and for true “money robots” which adapt in response to market forces. Afterwards, we invite the Ethereum community as well as ETS and voluntary Digital Property markets to debate and design improvements around our proposals with a specific focus on collateral and debt auctions.

Risks and Mitigation

There are several risks involved in developing and launching a Digital Property reflex index, as well as subsequent systems that are built on top:

Smart contract bugs: the greatest risk posed to the system is the possibility of a bug that allows anyone to extract all the collateral or locks the protocol in a state it cannot recover from. We plan to have our code reviewed by multiple security researchers and launch the system on a testnet before we commit to deploying it in production

CAI failure: we will aggregate feeds from multiple CAI approved Digital Property pricing networks and there will be strict rules in place for upgrading only one Digital Property pricing input at a time so that malicious governance cannot easily introduce false prices

Collateral black swan events: there is the risk of a black swan event in the underlying collateral which can result in a high number of liquidated SAFEs. Liquidations may not be able to cover the entire outstanding bad debt and so the system will continuously change its surplus buffer in order to cover a decent amount of issued debt and withstand market shocks

Improper rate setter parameters: autonomous feedback mechanisms are highly experimental and may not behave exactly like we predict during simulations. We plan to allow governance to fine-tune this component (while still being bounded) in order to avoid unexpected scenarios

Failure to bootstrap a healthy liquidator market: liquidators are vital actors that make sure all issued debt is covered by collateral. We plan to create interfaces and automated scripts so that as many people as possible can participate in keeping the system secure.

Summary

We have proposed a protocol that progressively locks itself from human control and issues a low volatility, collateralized asset called a Digital Property reflex index. We first presented the autonomous mechanism meant to influence the index's market price and then described how several smart contracts can limit the power that token holders have over the system. We outlined a self-sustaining scheme for medianizing price feeds from multiple independent approved Digital Property pricing networks and then finished by presenting the general mechanism for minting indexes and liquidating SAFEs.

We discussed how the RWA TOKENS ReFi platform is leveraging existing European Union Allowances (EUAs) as Digital Property Futures for collateralization, coupled with the Intercontinental Exchange European Union Allowance (ICEEUA) index for price discovery and fungibility, to achieve best overall performance as the world's first "green stable Digital Property Synthetic". We have provided our product roadmap to give participants some insight into the RWA TOKENS development effort as it exists today. We conclude by summarizing the addressable market, as well as providing system diagrams for consideration.

Our goal is to provide Paris Agreement aligned Web3 financial applications as Digital Property-based synthetics; Pigouvian Subsidy while reducing pollution worldwide! We are working relentlessly to preserve a Sustainable Planet Earth for generations and centuries to come. We hope you join our RWA TOKENS ReFi community.

Now to describe the tokenized banking application. This application is a tokenized financial system that provides all the standard banking services present in Web2 online banking systems, but in a Web3 tokenized format. The bank application has 5 main services, which are Deposit, Withdraw, No-Fee Payment/Transfer, Personal (Point to point) Interest-Free Loans, and Commercial Interest-Free Loans. This application is comprised of one or more stablecoins, utility tokens, RWA tokens, or other forms of collateral. To further describe the banking application, there will be 3 RWA tokens utilized in the following example. The three tokens, each with an accompanying native token that can be used to pay dividends, yield, or provide governance services for the tokens.

The PRIMARY RWA TOKEN accomplishes all the goals mentioned in a much tighter, more financially legitimate model, without a required central banking support mechanism. The PRIMARY RWA TOKEN has a 2-input base price component (carbon allowances, offsets, etc. in custody, along with the carbon accounting bump) established by the half of the PRIMARY RWA TOKEN Treasury that Bank will be managing, with a more speculative 3 input yield methodology through Sustainability investments (financial profits, carbon accounting benefits, and additional carbon offset generation). The 5-input yield methodology for PRIMARY RWA TOKEN should generate the yields we want by having a base price component and an additional reinvestment component. To simplify explanation, we can just state that PRIMARY RWA TOKEN is half invested into government issued assets, and half invested into SCG's Sustainability projects. That's the easiest way to explain the PRIMARY RWA TOKEN model.

1) PRIMARY RWA TOKEN (40% target APY for owner, Primary native token) - fully asset backed, owner receives 40% target APY from the collateral increase, Bank receives 25 basis points per transaction in fees. This token will be the token used to store Deposits and provide Withdrawals as it is fully asset backed.

2) PRIMARY LOAN TOKEN (20% target APY for owner, Primary native token) - partially asset backed so only issued for commercial loans, has to maintain 30% collateralization with PRIMARY RWA

TOKEN Treasury, can be used by Bank Payments, owner receives 20% target APY, Bank receives 20% target APY + 25 basis points per transaction in fees.

3) PRIMARY PAYMENT TOKEN (5% target APY for owner, stable yield token, UNITE native token) - fully asset backed, can be used by Payments, customer receives 5% target APY from the collateral increase, bank receives 35% target APY + 25 basis points per transaction in fees.

Services will include:

1) Deposit/Withdraw - built in 40% APY target while deposited, automatically converts fiat or crypto into PRIMARY RWA TOKEN and deposits into account.

2) No-Fee Payment/Transfer - can use any of the 3 tokens to make payments with or transfer to external wallets, but can only purchase PRIMARY PAYMENT TOKEN for use if no tokens in account already.

3) Personal Interest-Free Loan - can lend out PRIMARY LOAN TOKEN tokens only, available for purchase using PRIMARY RWA TOKEN, PRIMARY PAYMENT TOKEN, fiat or crypto in the service. Lender chooses repayment schedule; recipient gets an interest free loan while lender still receives the 20% target APY built into PRIMARY LOAN TOKEN during the loan. Collateral goes into escrow during loan and is used to secure the loan until repaid. Partial or full failure to honor loan terms will refund the repaid amount to customer as PRIMARY RWA TOKEN, lender loses the outstanding amount as they were securing a personal loan to the recipient.

4) Commercial Interest-Free Loan - explanation of the Bank Commercial Loan Facility (PCLF) below.

1) $1B in PRIMARY RWA TOKEN is deposited into PCLF, which then allows for $3B in PRIMARY LOAN TOKEN issuance.

2) $3B in PRIMARY LOAN TOKEN Loans issued to be paid back over 1 year. Repayments must be made in a fiat, crypto, PRIMARY RWA TOKEN or PRIMARY PAYMENT TOKEN.

3) As loans are paid back, the funds collected are used to source more collateral and issue more PRIMARY RWA TOKEN.

4) Token generation over 1 year, $3B in PRIMARY LOAN TOKEN that stays in circulation, and $3B in PRIMARY RWA TOKEN from repayment. Profits are $1.35B from the $3B in PRIMARY LOAN TOKEN that goes into circulation, $3B in new PRIMARY RWA TOKEN issuance upon repayment with $600M in APY yield. Profit is $1.35 + $3B + $600M = $4.95B, or $4.5B gross profits from $1B collateral in 1 year, after 10% loan failure rate deducted.

$1B in loan facility as PRIMARY RWA TOKEN, provides loans for 1 year at 3x hypothecation.

$3B new PRIMARY RWA TOKEN minted for asset backing, and lending PRIMARY LOAN TOKEN.

$3B new PRIMARY LOAN TOKEN issued to go out to customers as loan tokens.

$3B new PRIMARY LOAN TOKEN issued to put in proxy to await loan repayment.

$3B PRIMARY LOAN TOKEN to customers generates 24.67%, or $740M.

$3B PRIMARY LOAN TOKEN in proxy cue generates 49.15%, or $1.475B.

$3B in stable coins paid back, PRIMARY RWA TOKEN generates 40% or $1,2B.

Initial PRIMARY RWA TOKEN $1B collateral supplied generates 40%, or $400M.

In summary, the $1B PRIMARY RWA TOKEN initially supplied generates $3B more PRIMARY RWA TOKEN, $3B more PRIMARY LOAN TOKEN, and ($740M + $1.475B + $1.2B + $400M = $3.815B). Since the $3B in repayment is in other forms of payment than the PRIMARY LOAN TOKEN, that will provide full liquidity for the $3B PRIMARY RWA TOKEN mint that occurred, and no other PRIMARY LOAN TOKEN tokens have to be asset backed for value. PRIMARY LOAN TOKEN is just tracking the pricing mechanism described above, so it can be daily compounded to generate 49.15%. Total value of tokens issued after 40% increase APY for one year is $11.834B, with $3B in new PRIMARY RWA TOKEN and $9.949B in new PRIMARY LOAN TOKEN. Total net profit is $8.955B with a 10% fail rate

after 1 year. $4.47B in PRIMARY LOAN TOKEN will be put in Bank Treasury. For providing capital, Bank will split new $3B PRIMARY RWA TOKEN mint + $1.2B annual increase with SCG as profit prorated minus loan failures. If the fail rate is 10%, SCG payout will be $1.89B PRIMARY RWA TOKEN + $1B initial PRIMARY RWA TOKEN collateral, or $2.89B after 1 year, representing 189% annual profit for SCG.

1) Start with **$1B** in PRIMARY RWA TOKEN.
2) Deposit PRIMARY RWA TOKEN into Bank Commercial Loan Facility (PCLF).
3) Because we can lend with 30% at most in collateral, we lend out for 1 year at monthly repayment schedule of 12 equal amounts, interest free.
4) This will require us to issue 3x the PRIMARY RWA TOKEN deposit in PRIMARY LOAN TOKEN to lendees, netting $3B in newly minted PRIMARY LOAN TOKEN for lending that goes onto the network for long term circulation.
5) If we get 25% of Tether trading volume for the PRIMARY LOAN TOKEN, it will generate $750M a year compounding.
6) If our loan failure rate is 33%, extremely conservative, then that is Bank getting paid back $2B in stablecoins we can use to mint more PRIMARY RWA TOKEN as the payments are being made. That creates another $2B in PRIMARY RWA TOKEN over the course of the year after the failure rate is factored in, net revenue from repayment.
7) Now the math - $1B loaned for 1 year at 40% PRIMARY RWA TOKEN yield and 66% success rate on repayment: ($1B in PRIMARY RWA TOKEN + 40% APY = $1.4B) + $750M in Sustainable Contribution + ($2B in loan repayment will generate $500M in PRIMARY RWA TOKEN) = $3.65B in profit from the $1B in PRIMARY RWA TOKEN to collateralize the PCLF, netting **$4.65B** in total PRIMARY RWA TOKEN collateral in 1 year, compounding.

The final modification went from the banking algorithm being a linear algebra equation that can handle basic hypothecation, to it now being a calculus differential equation that can handle infinite

input collateral amounts and output infinite profits all in a fully parameter driven model that never risks the collateral, never charges interest or fees, and always makes money on every single transaction. It's totally legal and full-out gamification of the entire financial system. And the best part is all of the logic is in the process itself or coded into executable web services hosted on our website. That means no smart contract code to implement the banking system aside from the tokens we are already open sourcing, so no one will ever see the code that is doing this except me, and it runs itself once done. In addition, I've finished design of the payment system, and it will print debit cards only. Our system won't have credit cards as anyone can get an interest free loan any time, they need it based on a repayment schedule they choose and can modify as needed during repayment to some degree, and the loan can be deposited into their primary bank account and accessed with the free debit card. The debit card will have special tamperproof features built-in along with QR codes on both sides, and won't require any extra POS hardware to make payments. It will simply be a double-sided phone-based scanning process that does a 2-step authentication of the payment through our website and back to the scanning device as a text message along with biometric scan if desired to confirm the payment. This will be way more secure than the current Visa and Mastercard systems, with no need for extra hardware aside from a smartphone and the debit card, and no fees for the merchant.

There are only 5 services, so that's not so bad. The 3 tokens (PRIMARY RWA TOKEN, PRIMARY LOAN TOKEN, AND PRIMARY PAYMENT TOKEN) are used by the banking services.

Hypothecation in banking is **a practice where a borrower pledges an asset as collateral for a loan while retaining ownership and possession of the asset**. The lender has a security interest in the asset, allowing them to seize and sell it to recover the loan amount if the borrower defaults on the loan.234

This practice is commonly used in secured lending, such as car loans and margin trading in securities markets.124 In car loans, for example, the borrower retains possession of the car but the bank has the right to seize it if the borrower fails to Primary Payment token the loan.56

Hypothecation allows borrowers to use their assets as collateral to obtain financing, making it easier for them to secure loans.14 However, it also involves risks, as the lender can take possession of the collateral in case of default.234

In some cases, lenders may engage in rehypothecation, where they use the collateral as security for their own obligations, potentially leading to a chain reaction of security sales if one borrower defaults.

One primary aspect of this banking application is the ability to issue new tokens through the loan issuance process so that the tokens can be hypothecated based on the available collateral, whether that collateral is any of the commodities listed herein, or another cryptocurrency, or another fiat currency, or any other accepted collateral. When the loan is issued, not only will the collateral for that loan be locked in custody by the bank, but additional tokens will be issued as needed and can be loaned out in a hypothecation mechanism. So, if one loan is taken out and one RWA or other collateral is put in custody to secure the loan, the bank will use hypothecation to issue additional tokens within legal banking standards, which may be a 3x to 10x hypothecation mechanism where additional tokens will be issued for additional loans like a traditional loan does. The hypothecated tokens can then be issued as new loans to other customers than the one that initiated the loan that locked up collateral for the life of the loan.

Another primary aspect of the banking application is the loans have to be paid back in any currency or means of payment other than the token types issued to the loan recipient. In other words, if the loan recipient receives LOAN TOKENS as part of a loan, the loan has to be repaid in any other form of currency other than LOAN TOKENS, preferably currency issued by another entity besides this bank application to create a network effect to issuing tokens on the network. This will force the LOAN

TOKENS to get used by the loan recipient and another type of token will need to be paid back to the bank application to service the loan repayment. This will allow for more bank application tokens to enter and stay in circulation. The bank reserves the right to not accept any of the tokens the application issues as a form of repayment of a loan, and may use this rule as a standard operating rule.

A cryptocurrency may be considered usable and correct in the Middle East if:

1. It is used as a medium of exchange or store of value—not gambling.

PRIMARY RWA TOKEN and the entire Bank Financial System can be used as a medium of exchange and store of value. We do not participate in any gambling venues.

2. It is acquired lawfully and not used for haram purposes.

The underlying collateral is acquired lawfully, and profits will be reinvested in large part into sustainability programs worldwide.

3. Trading is done without riba (no interest-bearing loans or futures).

Bank will never provide interest-bearing loans in association with our financial services. Bank only participates in spot trading of our crypto assets, and doesn't participate in any futures trading directly.

4. There is no deceptive practice or excessive uncertainty.

Bank doesn't participate in any deceptive loan programs or excessive leveraging of assets for any financial services. All financial services are being provided under government regulated financial bodies.

BTW, one more note since you were asking about other collateral types (minerals, natural resources, land, coal, oil, etc.).

DEFED can substitute token type 1) with any other RWA, and plug right into 2) and 3), with all other banking/monetization services available. The APY yield percentages will need to be adjusted based on the performance of the RWA collateral type we plug in, but DEFED Bank is fully modular, and can turn any natural resource into RWA collateral for the entire feature set. It scales both horizontally and vertically, with the only limits being the amount, value, and APY of collateral provided. I don't think any other natural resource we use as an RWA will get even close to PRIMARY RWA TOKEN Carbon RWA in overall performance and yield, but other RWAs can be plugged in as needed for monetization and full banking services.

Each RWA will need to be treated as a different division of DEFED, but any tokens can be converted into any other division's tokens as needed, so the whole ecosystem is interchangeable. We can also white label a completely customized DEFED system for any governments if interested.

So, here's today's update. I wasn't fully aware of how much development had been done over the past 2 years, but with the features we added, our PRIMARY RWA TOKEN Protocol is now 86 smart contracts and literally thousands of test cases for the platform. And we are likely going to go over 100 smart contracts as well as hundreds of thousands of lines of code to drive the PRIMARY RWA TOKEN Website. I think it's safe to say once we enable the other 2 tokens (PRIMARY PAYMENT TOKEN as our payment instrument, and PRIMARY LOAN TOKEN as our loan service collateral) needed for the banking system, it will almost triple the amount of code in the system. This is easily turning into the most sophisticated effort in Web3 worldwide. Nick is going to document what we are launching this week, and I'll share that when it's ready. He is running all of the thousands of test cases on PRIMARY RWA TOKEN and is only getting one error, and it's for the transaction model we added to be able to include charitable contributions of 10-25 basis points per transaction, or add in a tax for governments, or recover funds by claw back of the loan tokens from any loans that aren't paid on time. Nick said he should have that last bug fixed this evening, and we should be able to send test payments to you @David N01 Howard by tomorrow, so everything is on schedule. I have a

conference call with Cody Brown and his team on Friday to initiate the security audit. We are getting an ISO/IEC 27001 compliance certification through Cody's company, Security Research, which will security harden the platform. They will perform a pen test as well as perform a code inspection to identify and cure any potential security issues. Nick should have the PRIMARY RWA TOKEN Website up in the next couple of weeks, and I'm adding a few more engineers to ramp up support. We will eventually have a multisig enabled Digital Wallet on the website that will likely include an AI biometric video and audio analysis as part of a multi-step verification process that will be compatible with Ledger cold storage devices, so we can claim the best security model in Web3. Eventually we will move to a new ledger we will be developing over the next 6 months that will implement a patent I filed back in 2018 for our very own quantum impervious blockchain. It will include the only encryption mechanism that has never been and theoretically can't be brute force hacked by even Quantum computers; a technique called One Time Pad (OTP) encryption. It will also feature a Write Once Read Many (WORM) hardware storage facility so the system data can never be compromised once in storage on ledger, and a router/ network card design that will only allow one way data flow through the system to ensure no data requests can hack the system.

Glossary

Accounting Engine: system component which triggers debt and surplus auctions. It also keeps track of the amount of currently auctioned debt, unactioned bad debt and the surplus buffer.

Borrowing Rate: annual interest rate applied to all SAFEs that have outstanding debt.

Digital Property Allowances – also called “emissions trading schemes”, or “cap and trade” – are sometimes described as the economist’s solution to greenhouse gas emissions. They are tradeable government permits that allow polluters to pump Digital Property dioxide (CO2) into the atmosphere. Under these programs, polluters must surrender enough allowances to cover their pollution upon inspection. Governments ensure compliance, with large fines issued for non-compliance.

Digital Property Allowance Index (CAI): the external Digital Property futures contract index used for price discovery, fungibility, and redemption price in the RWA TOKENS protocol. This index should map to the Digital Property market RWA TOKENS is bound to for price discovery, fungibility and collateral redemption, initially the EU-ETS market with the ICEEUA Digital Property index. Other versions of RWA TOKENS may bind to other Digital Property markets in a similar capacity.

Digital Property Allowance Index Network Medianizer (CAINM): a smart contract that pulls prices from multiple approved Digital Property pricing sources, and medianizes them if a majority (e.g., 3 out of 5) returned a result without throwing, or on-network redundancy.

Digital Property Futures: are derivative financial contracts that obligate parties to buy or sell a Digital Property allowance at a predetermined future date and price. The buyer must purchase or the seller must sell the underlying Digital Property allowance at the set price, regardless of the current market price at the expiration date.

Digital Property Reflex index: a collateralized asset that dampens the volatility of its underlying Digital Property collateral.

Digital Property Synthetic: a Synthetic Instrument as defined by the International Financial Reporting Standards (IFRS) herein, utilizing Digital Property allowances, Digital Property offsets, Digital Property futures, Digital Property options, or any form of Digital Property asset or derivative available in any manner as a structured financial instrument.

Emissions Trading Scheme (ETS): an Emissions Trading Scheme works on the 'cap and trade' principle. A cap is set on the total amount of certain greenhouse gases that can be emitted by the installations covered by the system. The cap is reduced over time so that total emissions fall. Within the cap, installations buy or receive emissions allowances, which they can trade with one another as needed. The limit on the total number of allowances available ensures that they have a value. After each year, an installation must surrender enough allowances to cover fully its emissions, otherwise heavy fines are imposed. If an installation reduces its emissions, it can keep the spare allowances to cover its future needs or else sell them to another installation that is short of allowances. Trading brings flexibility that ensures emissions are cut where it costs least to do so. A robust Digital Property price also promotes investment in innovative, low-Digital Property technologies.

European Union-Emissions Trading Scheme (EU-ETS): the European Union’s cap and trade Digital Property market implementation.

Governance Ice Age: immutable contract that locks most components of a protocol from outside intervention after a certain deadline has passed.

Money Market Setter (MMS): a mechanism similar to RRFM which pulls multiple monetary levers at once. In the case of Digital Property reflex indexes, it modifies both the borrowing rate and the redemption price.

RWA TOKENS: the first Digital Property reflex index as a stable Digital Property Synthetic.

Pigouvian Subsidy: a subsidy that is used to encourage behavior that have positive effects on others who are not involved or society at large. Behaviors or actions that are a benefit to others who are not involved in the transaction are called positive externalities. This is closely related to the idea of a pigouvian tax.

Redemption Price: the price that the system wants the index to have. It changes, influenced by a redemption rate (computed by RRFM), in case the market price is not close to it. Meant to influence SAFE creators to generate more or pay back some of their debt.

Redemption Rate Feedback Mechanism (RRFM): an autonomous mechanism which compares the market and redemption prices of a Digital Property reflex index and then computes a redemption rate that slowly influences SAFE creators to generate more or less debt (and implicitly tries to minimize the market/redemption price deviation).

Restricted Governance Module (RGM): a set of smart contracts that bound the power that governance tokens holders have over the system. It either enforces time delays or limits the possibilities that governance has to set certain parameters.

Stablecoin: a digital asset, on a blockchain, that is designed to maintain a consistent value, typically by linkage to the value of another asset. Presently, there are 4 ways to design a stablecoin:

Algorithmic (derives value from a separate token specific to the stablecoin)

Commodity Collateralized (derives value from a commodity, e.g., Gold)

Cryptocurrency Collateralized (derives value from other cryptocurrencies, e.g., ETH, BTC)

Fiat Collateralized (derives value from a fiat currency, e.g., USD, EUR)

RWA TOKENS can act as a stablecoin in current crypto exchanges consistent with the 2nd category, Digital Property (commodity) collateralized.

Structured Financial Instrument: comprises of a range of products designed to repackage and redistribute risk. They are pre-packaged investments based on a single security, a basket of securities, options, commodities, debt issuance or foreign currencies, and to a lesser extent, derivatives. They include asset-backed securities (ABS) and collateralized debt obligations (CDOs).

Surplus Buffer: amount of interest to accrue and keep in the system. Any interest accrued above this threshold gets sold in surplus auctions that burn protocol tokens.

Surplus Treasury: contract that gives permission to different system modules to withdraw accrued interest (e.g., CAINM for Digital Property pricing index calls).

Synthetic Instrument: According to the International Financial Reporting Standards (IFRS), a synthetic instrument is a financial product designed, acquired, and held to emulate the characteristics of another instrument. For example, such is the case of a floating-rate long-term debt combined with an interest rate swap. This involves receiving floating payments, or making fixed payments, thereby synthesizing a fixed-rate long-term debt. Another example of a synthetic is the output of an option strategy followed by dealers who are selling synthetic futures for a commodity that they hold by using a combination of put and call options. By simultaneously buying a put option in a given commodity, say, gold, and selling the corresponding call option, a trader can construct a position analogous to a short sale in the commodity's futures market.