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Cisix: Technology for Net-Zero Carbon Ecosystem

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Abstract: Farmers represent one of the largest untapped sources of carbon sequestration potential globally, yet they remain almost entirely excluded from carbon markets. This paper presents Cisix, a technology-mediated carbon trading platform designed to bridge the structural gap between rural agricultural producers, Sustainable project Developers and Carbon credit buyers. Unlike conventional carbon market infrastructure — which demands technical literacy, legal capacity, and upfront capital that most smallholder farmers simply do not have, Cisix embeds farmer training and certification directly into the trading pipeline, treating knowledge transfer not as a peripheral service but as a core market function. Drawing on platform design principles and inclusive finance frameworks, we examine how Cisix addresses three compounding barriers to farmer participation: awareness deficits around carbon credit mechanisms, absence of accessible verification pathways, and the intermediary-heavy structures that erode farmer earnings. The platform operationalizes a four-stage model — assessment, training, credit generation, and direct marketplace access of ours — supported by multilingual outreach and website which supports at local village areas. Early deployment data suggest that co-locating financial participation with structured capacity building significantly improves both onboarding rates and long-term farmer retention in carbon programs. We argue that carbon market inclusion is not merely a technical challenge but a design and governance problem, and that platforms which treat farmers as informed economic agents — rather than passive land managers — are better positioned to deliver durable climate and livelihood outcomes.

Keywords: Carbon credits, Carbon Trading platform, Voluntary Carbon Market, AgriTech, Farmer Inclusion, Sustainable Projects, Rural Capacity Building, Climate Action, Indian Carbon Trading Platform.

I. INTRODUCTION

Carbon markets have grown as a vital tool in global climate policy, yet two key stakeholders remain underserved — smallholder farmers who can generate carbon credits but lack market access, and industries that emit carbon but cannot easily quantify or offset it.

In India, millions of smallholder farmers practice agroforestry, reduced tillage, and solar-powered irrigation that qualify for carbon sequestration credits. Meanwhile, industries across manufacturing and logistics face pressure to measure and offset emissions but lack simple tools to do so.

Cisix bridges both sides. Farmers are onboarded, trained in local languages, and issued verified carbon credits. Industries use a dedicated portal to calculate their carbon emissions from fuel and electricity consumption data, which then determines how many credits they need to purchase. These credits are bought directly from farmers through the Cisix marketplace — creating a direct, transparent link between rural producers and industrial buyers.

II. SYSTEM ARCHITECTURE

Cisix is built as a hybrid software and manpower-driven platform, recognizing that technology alone cannot bridge the gap between rural communities and carbon markets. The system combines a multi-portal digital infrastructure with a structured manpowered network who manually visit the farmer sites, ensuring farmers who lack digital literacy or connectivity are not excluded.

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A. Overall Architecture The platform follows a three-tier architecture — a presentation layer for user-facing portals, an application logic layer for business rules and credit calculation, and a data layer for secure storage of farmer records, emission data, and transaction history. All four portals — Farmer Portal, Industry Portal, Marketplace, and Admin Dashboard — operate on this shared backbone, ensuring data consistency and real-time synchronization.

B. Ground Agent Network A defining feature of Cisix is its field agent model. Trained agricultural agents are deployed to visit registered farmers directly in their villages. These agents physically verify farmer credentials, assess land details, document sustainable practices, and record carbon sequestration data on behalf of farmers. For solar project sites, agents additionally verify installation details, system capacity, energy generation logs, and displacement of fossil fuel consumption. All data collected is entered through a dedicated agent interface, feeding directly into the farmer or project profile for credit calculation and verification.

C. Farmer Portal The farmer portal allows registered smallholder farmers to view their profile, track land assessment status, access training modules, monitor credit issuance, and check earnings. Farmers onboarded through field agents have their data entered at the website and all the updates are received at the portal interface on the website when they sign in using their credentials ensuring transparency in the transaction.

D. Solar Project Module For producers operating solar energy projects — including solar-powered irrigation, community solar installations, and rooftop solar setups — Cisix includes a dedicated technical assessment module. Key parameters fed into the system include:

- Installed capacity (kWp)
- Monthly energy generation (kWh)
- Grid displacement factor — units of fossil-fuel-based electricity replaced
- Emission factor (kg CO_2 per kWh, based on regional grid emission standards)

Using these inputs, the platform calculates avoided emissions in tonnes of CO_2 equivalent,
Generated credits are verified against satellite and metering data where available, certified by the admin, and issued to the project owner's Cisix wallet for listing on the marketplace.

E. Industry Portal The industry portal provides companies with a self-service carbon footprint calculator. Organizations enter operational data including fuel consumption, electricity usage, and production volumes. The platform applies standard international emission factors to compute total carbon output in tonnes of CO_2 equivalent and generates a detailed emission report. The system then automatically calculates the number of credits required and directs industries to the marketplace.

F. Marketplace The marketplace connects verified credit producers — farmers and solar project owners — with industrial buyers. Full visibility into credit origin, project type, verification status, and pricing is maintained for every listing. Credits are priced dynamically based on supply, demand, and credit category, with agricultural and solar credits listed as distinct asset classes.

G. Admin Dashboard The admin dashboard gives administrators complete oversight of platform operations — field agent visits, farmer and solar project verifications, credit issuance and marketplace transactions.Automated alerts are triggered for pending verifications, incomplete documentation, or flagged transactions.

H. End-to-End Data Flow The data flow begins with the field agent visit for credential and technical verification, moves through farmer or solar project registration, progresses to training completion or energy data submission, and concludes with credit issuance and marketplace listing for industrial purchase. The admin dashboard maintains full visibility at every stage.

III. METHODOLOGY

The methodology of Cisix is structured around a four-phase operational model that addresses both the supply side — farmers and solar project owners — and the demand side — industries seeking to offset their carbon emissions. The approach integrates field operations, digital tools, and standardized carbon accounting methods into a single cohesive workflow.

A. Farmer Registration and Credential Verification The process begins with farmer registration, initiated either through the Cisix website or through a field agent visit. Trained agricultural agents visit prospective farmer participants to verify identity credentials, land ownership documents, and current farming practices. Land coordinates are recorded

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and cross-referenced with satellite imagery to confirm land use patterns. For solar project owners, agents additionally verify system capacity, installation certificates, and energy generation records. Only farmers and projects that pass this verification stage are approved for credit generation.

B. Carbon Sequestration Calculation for Farmers Once verified, the carbon sequestration potential of each farmer's land is calculated based on the following parameters:

- Land area under sustainable practice (hectares)
- Type of practice — agroforestry, cover cropping, reduced tillage, or organic farming
- Soil organic carbon measurement from field data
- Duration of practice adoption

The platform applies internationally recognized methodologies like ,Verra Verified Carbon Standard (VCS) protocols, to convert these inputs into tonnes of CO_2 equivalent sequestered annually. Credits are issued proportionally based on verified sequestration values.

C. Carbon Emission Calculation for Solar Projects For solar energy producers, avoided emissions are calculated using the formula:
Avoided Emissions (tCO_2) = Energy Generated (kWh) × Regional Grid Emission Factor (tCO_2/kWh)
Energy generation data is sourced from inverter logs or agent-recorded meter readings. The regional grid emission factor is applied based on Central Electricity Authority (CEA) published values for India. The resulting avoided emission figure is converted into carbon credits and issued to the project owner's wallet upon admin verification.

D. Industry Carbon Footprint Assessment On the demand side, industries access the Cisix portal and input their operational data across three categories:

- Fuel consumption — diesel, petrol, LPG, coal (converted using standard calorific and emission factors)
- Electricity consumption — monthly units consumed, mapped against grid emission factors
- Production and logistics data — where applicable, for scope 3 emission estimation

The platform computes total emissions in tonnes of CO_2 equivalent and generates a structured emission report. Based on this report, the system calculates the precise number of carbon credits required to achieve full or partial offset and presents the industry with available listings on the marketplace.

E. Credit Verification and Issuance All credit calculations — whether from agricultural sequestration or solar energy generation — are reviewed by Cisix administrators before issuance. The admin dashboard flags incomplete data, inconsistencies, or unverified agent submissions for manual review. Upon approval, credits are digitally issued to the producer's wallet after the issuance from the standard registries and listed on the marketplace with full metadata including source, type, quantity, and verification date.

F. Marketplace Transaction and Settlement Industries browse available credits on the marketplace, filtered by credit type, project category, and region. Upon purchase, the transaction is recorded, credits are transferred from the producer's wallet to the buyer's account, and payment is settled directly to the farmer or solar project owner. A transaction certificate is generated for the industry as proof of offset for compliance and reporting purposes.

IV. LITERATURE REVIEW

Several studies have explored carbon credit trading, blockchain-based verification, IoT-driven emission monitoring, and agricultural carbon platforms. While these works have made significant contributions, most focus on either industrial emission management or blockchain transparency in isolation. None simultaneously address smallholder farmer inclusion with embedded training, solar project credit calculation, an industry-facing carbon footprint calculator, and a unified two-sided marketplace. The following table summarizes the key related works and their limitations.

TABLE I: LITERATURE REVIEW SUMMARY

Ref	Author(s)	Year	Proposed Work	Key Contribution	Limitation
[1]	Vidhya K et al.	2025	AI-based Carbon Footprint Tracking and Reduction	IoT real-time monitoring with Random Forest Classifier; 100% training accuracy, 96% validation accuracy; automated load	Focuses only on industries; no farmer inclusion, no agricultural carbon sequestration, no rural training.

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Ref	Author(s)	Year	Proposed Work	Key Contribution	Limitation
				management and carbon trading marketplace.	
[2]	Kalaiselvan S A et al.	2024	Blockchain Powered Carbon Credit Marketplace	Decentralized ledger with smart contracts; multi-stakeholder governance involving NGOs, governments, and industries; eliminates over-crediting.	No farmer onboarding, no carbon calculation tools, no training framework, no solar project support.
[3]	Prapulla S B et al.	2024	Blockchain-Powered Carbon Credit Management	Ethereum smart contracts with MQTT-IoT integration; real-time CO_2 tracking; automated credit deduction and purchase with transparent records.	No farmer training or onboarding; no solar module; inaccessible to low-literacy or low-connectivity users.
[4]	Vishal S Chavan et al.	2025	CarboNexFarm: MERN and ML-Based Carbon Credit Trading Platform	Random Forest ML model calculates credits from crop type, land area, soil NPK; blockchain marketplace for farmer-to-company trading.	No industry emission calculator; no field agent model; no solar integration; no multilingual training.
[5]	Ashley & Johnson	2018	Blockchain of Custody for Renewable Energy Credits and Carbon Credits	Near-real-time autonomous credit generation via blockchain smart contracts; transparent audit trail from generation to retirement; deployed in LCFS program.	Limited to energy sector; no agricultural inclusion; no farmer or industry onboarding tools.

V. COMPARATIVE ANALYSIS

Carbon trading has existed for decades, yet the systems built around it were never designed with inclusivity in mind. Traditional carbon markets are complex, broker-heavy, and built for large corporations — not for a farmer in rural who has been practicing agroforestry for years without ever hearing the words "carbon credit." The table below highlights exactly where traditional systems and existing platforms fall short, and how Cisix addresses each gap directly.

TABLE II: COMPARATIVE ANALYSIS OF EXISTING PLATFORMS VS CISIX PLATFORM

The Problem	What Traditional Markets Do	What Existing Platforms Do	What Cisix Does
Farmers have no awareness of carbon credits	Nothing — farmers are simply not part of the system	Assume users already understand the concept	Train farmers first in their local language before anything else
Rural farmers cannot access digital platforms	No digital infrastructure for farmers whatsoever	Digital-only registration that excludes low-literacy users	Field agents visit farmers physically and complete onboarding on their behalf
Carbon calculation is complex and inaccessible	Manual audits by external agencies — slow and costly	ML or IoT-based tools built only for industries	Separate calculation engines for farming practices and solar energy, both farmer-friendly
Solar farmers get no credit for switching from diesel to solar	Solar contributions are completely ignored	Rarely addressed or only partially covered	Dedicated solar module using inverter data and CEA grid emission factors

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Industries struggle to know how many credits they need	They hire expensive external auditors and wait weeks for reports	Partial tools available but not linked to a marketplace	Self-service portal — enter fuel and electricity data, get instant credit requirement, buy directly
Brokers and middlemen reduce farmer earnings	Multiple layers of intermediaries take a significant cut	Partial direct payments in some platforms	Credits sell directly on the marketplace, payment goes straight to farmer's bank or UPI
Double counting and fraud undermine trust	Centralized systems with poor and opaque audit trails	Blockchain transparency for transactions only	Two-layer verification — field agent on ground + admin digital check before any credit is issued
Farmers in poor connectivity areas are excluded	No consideration for rural infrastructure at all	Web and app-based, requires stable internet connection	Low-data mobile app with SMS fallback for areas with limited connectivity
No single platform serves both farmers and industries	Separate systems exist for producers and buyers with no direct link	Most platforms focus on one side of the market only	Unified two-sided marketplace connecting farmers, solar producers, and industries in one place

CONCLUSION

Cisix presents an intelligent and inclusive platform that connects farmers, solar project owners, and industries within a unified carbon trading ecosystem. By integrating carbon credit generation, emission assessment, verification, training, and marketplace access into a single framework, the platform improves transparency, accessibility, and participation in sustainable carbon markets. The proposed system not only supports climate action and carbon reduction goals but also creates economic opportunities for rural communities through technology-driven environmental solutions.

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