



Impacts of Sustainable Agricultural Cold Chains and Opportunities to Expand Access to Finance

Ben Hartley

Programme Manager, Sustainable Cooling
Sustainable Energy for All

November 8, 2023





Discussion points

1. Global Challenges of a Lack of Access to Cooling
2. Drivers and Barriers for Sustainable Agricultural Cold Chains
3. Multidimensional Impacts and Access to Finance
4. Conclusions

- 2.3 bn people could be exposed and vulnerable to heatwaves (by 2030)
 - Urban spaces heating up at twice the global rate (world's 30 hottest cities are in developing countries)
- Over 1 billion people globally at immediate risk due to lack of access to cooling in sectors such as health and agriculture



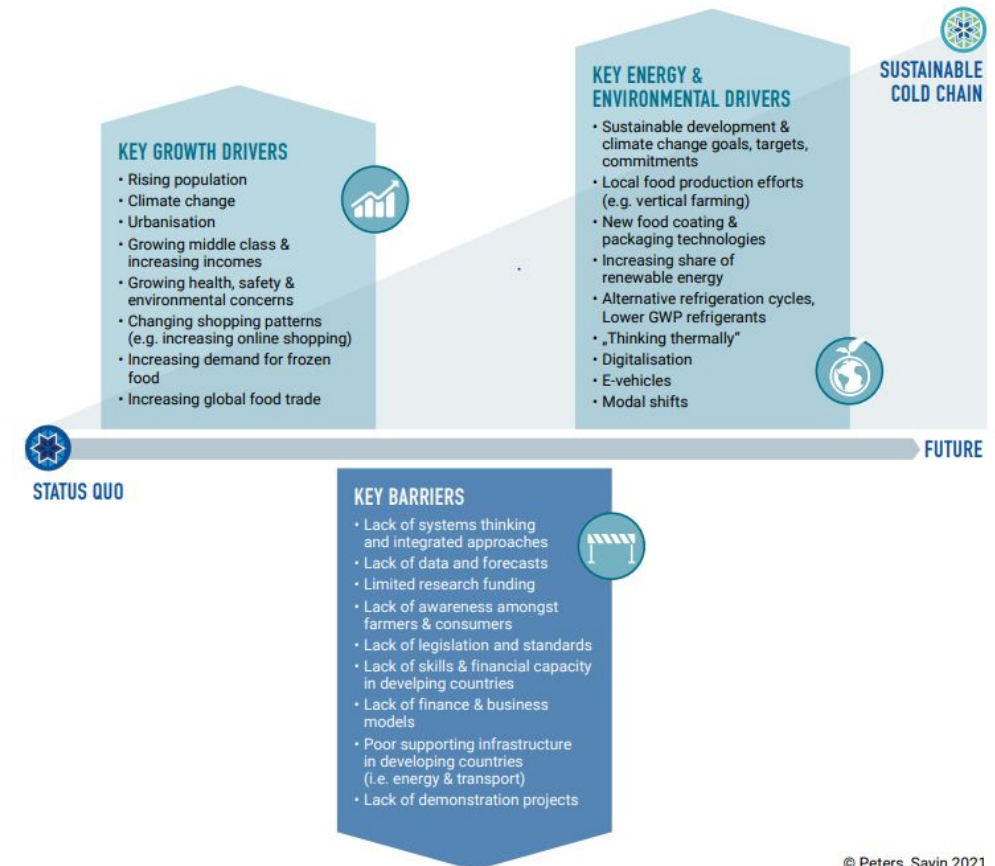
- Health & well-being impact
 - Heat is world's deadliest natural disaster; sensitive populations (children, elderly) at high risk
 - Uncooled indoor environments: reduced student performance; increased mental stress; difficulty sleeping
 - Lack of reliable cold storage damages and hinders access to medicine and vaccines; compromises food safety
- Productivity impact: By 2030, productivity loss due to heat reach 80 million full time jobs
 - Close to 5% in South Asia & West Africa - Almost 10% of working hours in agriculture in Bangladesh expected to be lost heat stress. Most affected sectors: agriculture & construction
- Food impact: African countries losing up to 80% of post-harvest food (e.g., fruit, vegetables, fish, meat, dairy)
 - 2/3 of global food wastage happens in Africa and Asia □ contributing to malnourishment, depressed farmers' income
 - Energy embedded in global annual food loss = ~38% of total energy consumed by agri-food chain
- Equity Impact: Without exception, negative effects of heat including climate impacts are disproportionately borne by poor and marginalized populations



Key Drivers for Agricultural Cold Chains

- Agricultural cold chains have a key role in improving nutritional outcomes for over 800 million malnourished people.
- Agriculture cold chains have a role in increasing rural incomes, by moving to higher-value production and markets
- Climate change benefits of reduced food waste.
- Energy access is both a driver and a barrier. Rural health farms require sustainable access to electricity to power cooling, but reliability and economic viability of systems remains a challenge.

Figure 3: Key drivers and barriers to a sustainable cold chain



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Cash Sales: Customers pay the full price of the product up front

- Suited to aggregators as they can afford to pay the total cost of the products compared to small-holder farmers
- Off-grid cooling companies earn more revenue upfront to support scale but may lock out access at first mile

PAYGo: Customers pay an initial deposit of the product price and make regular instalment repayments

- Low-income customers can purchase off-grid cooling products they could not afford otherwise
- Limited use by off-grid cooling companies

Asset Financing: Provision of loans by off-grid cooling companies to customers for purchase of cold storage

- Loans are repaid by the operator with repayment plans structured around seasonality of value chains they serve

Cooling as a Service (CaaS): Customers charged per day to store their products in a section of a cooling unit

- Aggregates demand for small farming communities
- Eliminates the burden of the upfront cost as well as the need to take out a loan for those that may not be able to afford the product or the financial risk

Key barriers to the development of markets for sustainable agricultural cold chains



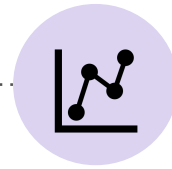
1. Policy and Legislation

Durable policy frameworks to unlock financing



2. Skills

Training and vocational opportunities to develop workforce capacity



3. Data

Proving financial viability and business cases

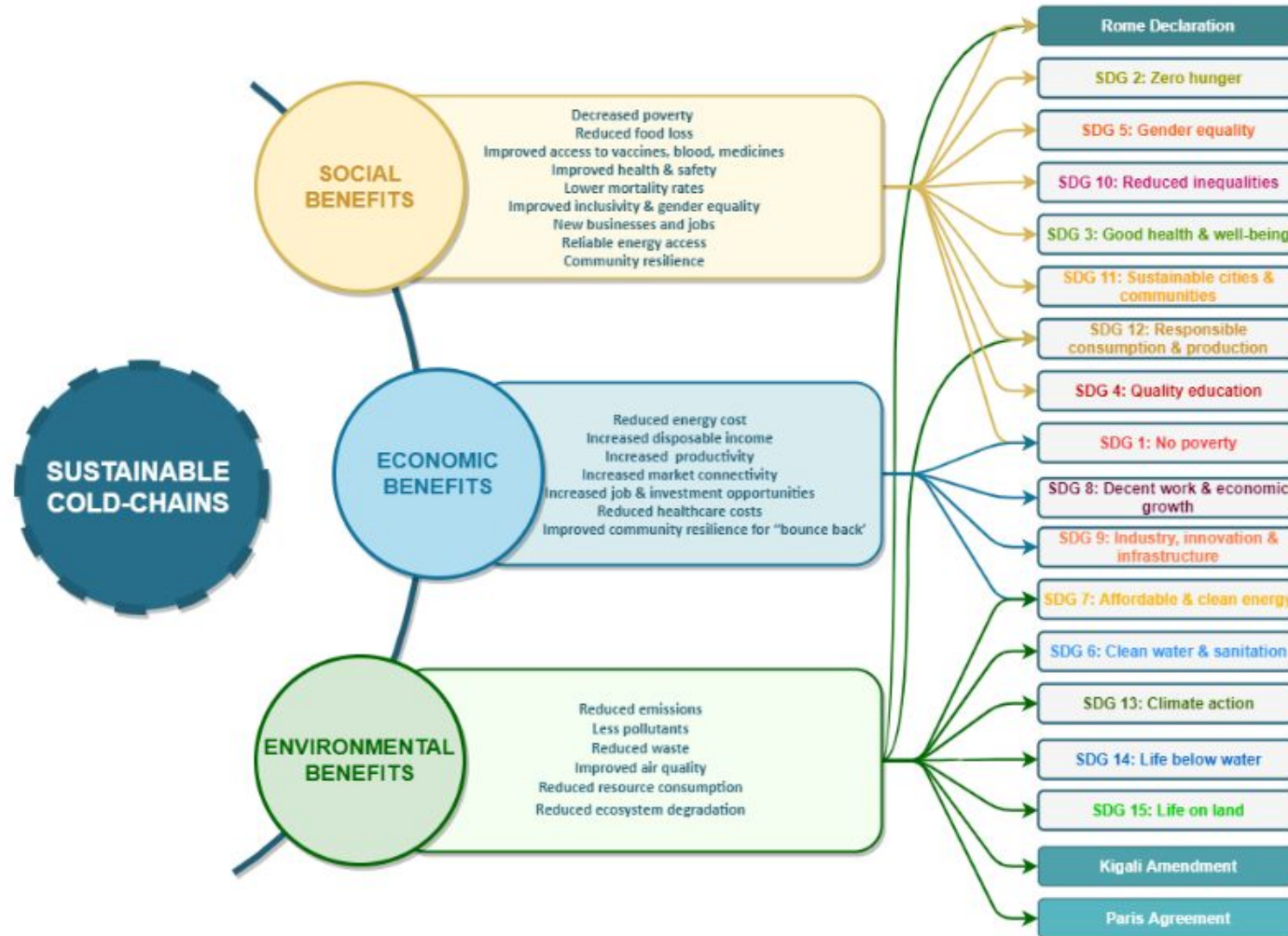


4. Finance

Low-cost, flexible financing options to support transition to commercial markets

Overarching barriers

- **Chicken and Egg:** Cold chain investors need volumes, whereas farmers need built out cold chain to invest. Requires scaling up from a small start
- **Gender-based Challenges:** Female farmers typically have more significant challenges in accessing finance compared to males
- **Integrated approaches:** Bringing commercial investors together with energy and agricultural stakeholders to developed holistic strategies



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These benefits create opportunities for better access to finance:

- Sustainable agricultural cold chains both mitigate climate change and expand adaptation capacity, in line with goals of climate financing institutions.
- They similarly increase the productive use of energy, a priority for development finance institutions and philanthropies working to catalyze action on SDG 7.
- Co-benefits of agricultural cold chain investments for hunger, gender-equality, and economic growth are important for economic development, but must be quantified.

- Sustainable agricultural cold chains drive multidimensional benefits across economic, climate, and social development impacts.
- Technology and business models for sustainable agricultural cold chains have been demonstrated and show promise.
- But moving from demonstration to commercial markets has not been achieved at scale in developing economies.
- Key barriers to moving to scaled-up commercial markets include:
 - Skills and capacity to support the industry
 - Bankable data on benefits to drive investment
 - Access to flexible, low-cost finance
 - Holistic approaches that meet the needs of both farmers/operators and investors





Thank you!

November 8, 2023





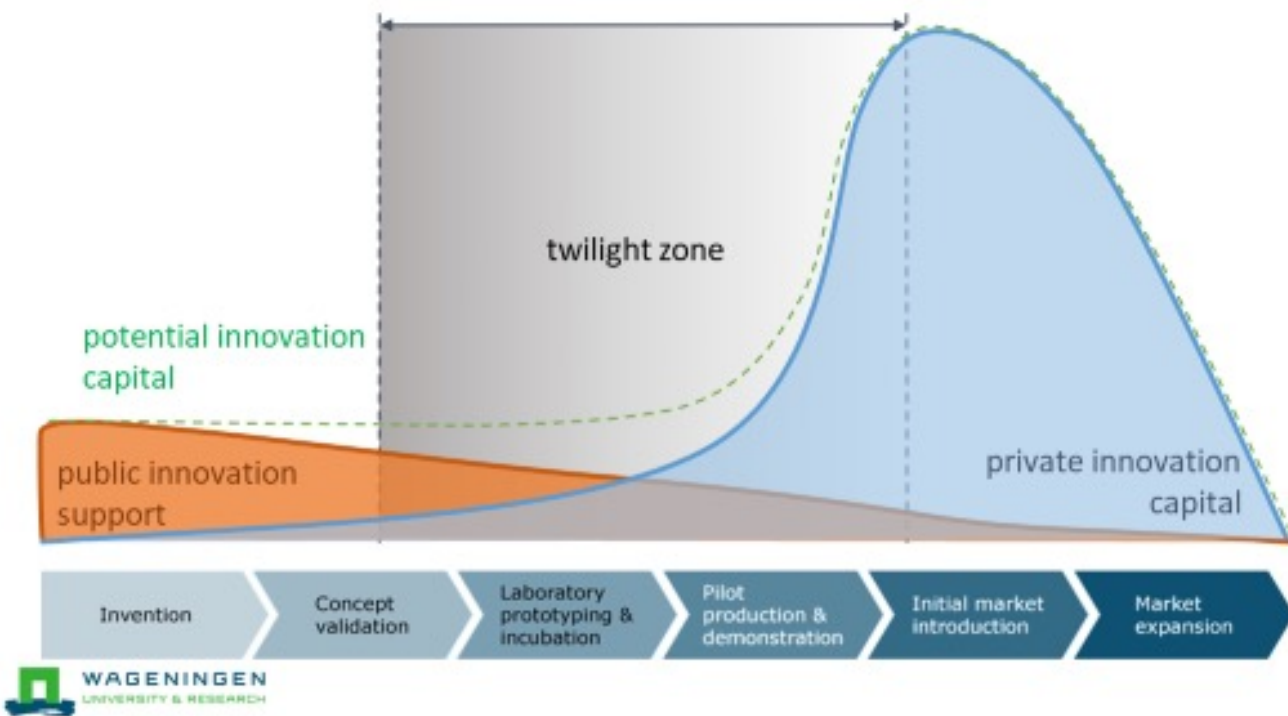
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Sabine Desczka

Wageningen Economic
Research

Mismatch between private and public funding



WEBINAR:

Cold Storage Financing in Agriculture

A typology of financial instruments for sustainable cooling

This work is financed by:



Agenda

What are the different typologies of financial instruments for cold storage?

1. Subjects and objects of finance
 2. Financing and funding
 3. The typology of private and public financing mechanisms
-

What are new instruments/options that should be explored for financing sustainable cooling?

Subjects and Objects of finance

Subject	Object	Considerations and examples
Farmer/Small scale producer	1 cold room	Often informal trading and no collateral assets, panic sales and price fluctuations
Community/Cooperative	1 or few rooms or community cooling hub	Needs strong cooperative governance for use of commonly owned assets
Cold chain tech. provider	100's of cold rooms	CAAS model much supported, however requires additional finance for construction and operations (also costs for farmers)
Aggregator/processor	5-25 cold rooms + 10-100 trucks	Different models, often own facilities to be used by farmers at no additional expenses, strong incentive for collaboration are off-take guarantees
Market (part of infrastructure)	3-10 cold rooms	Not provided on farm but at wholesale or distribution centre, first mile cooling?

Funding versus Finance

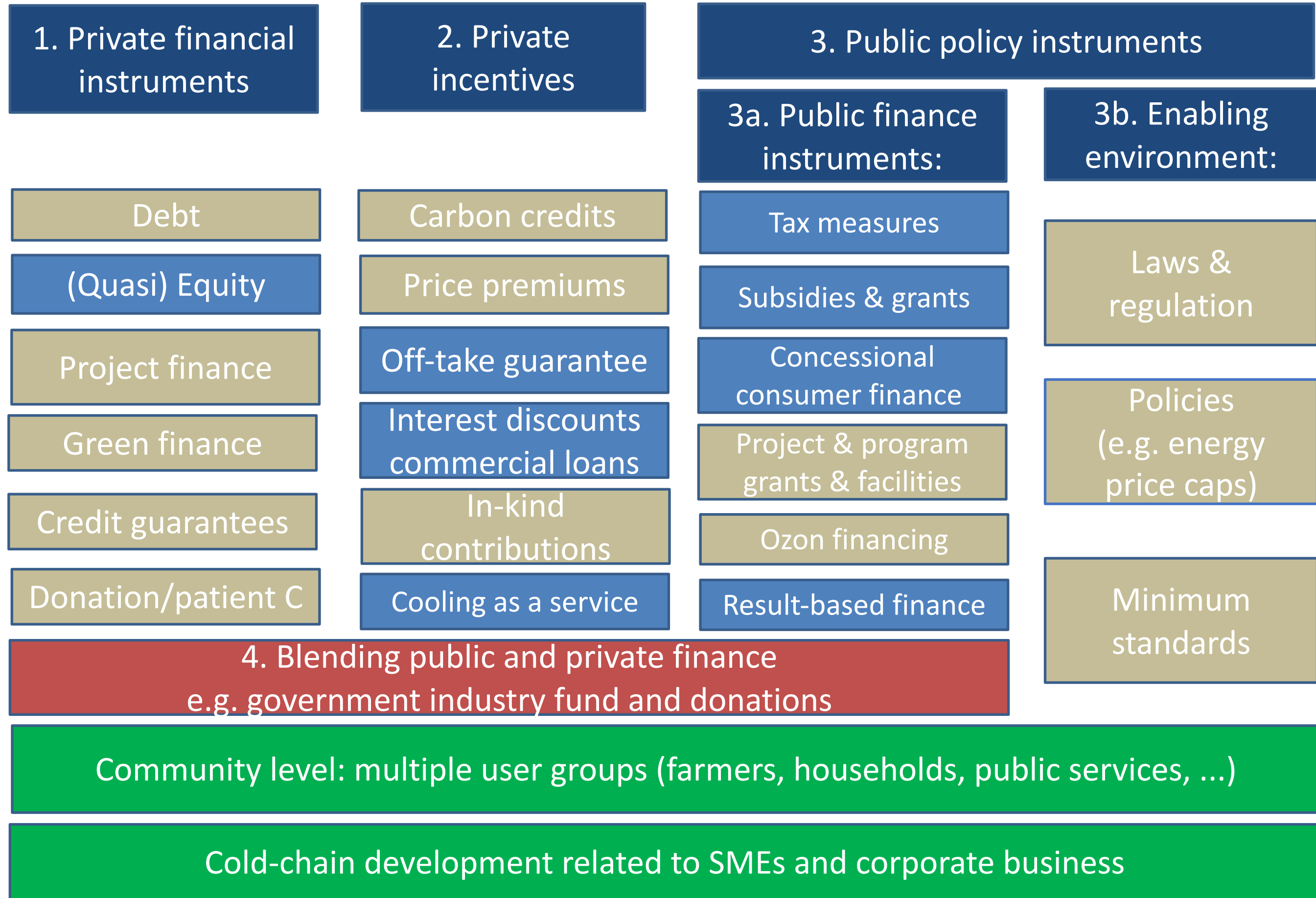
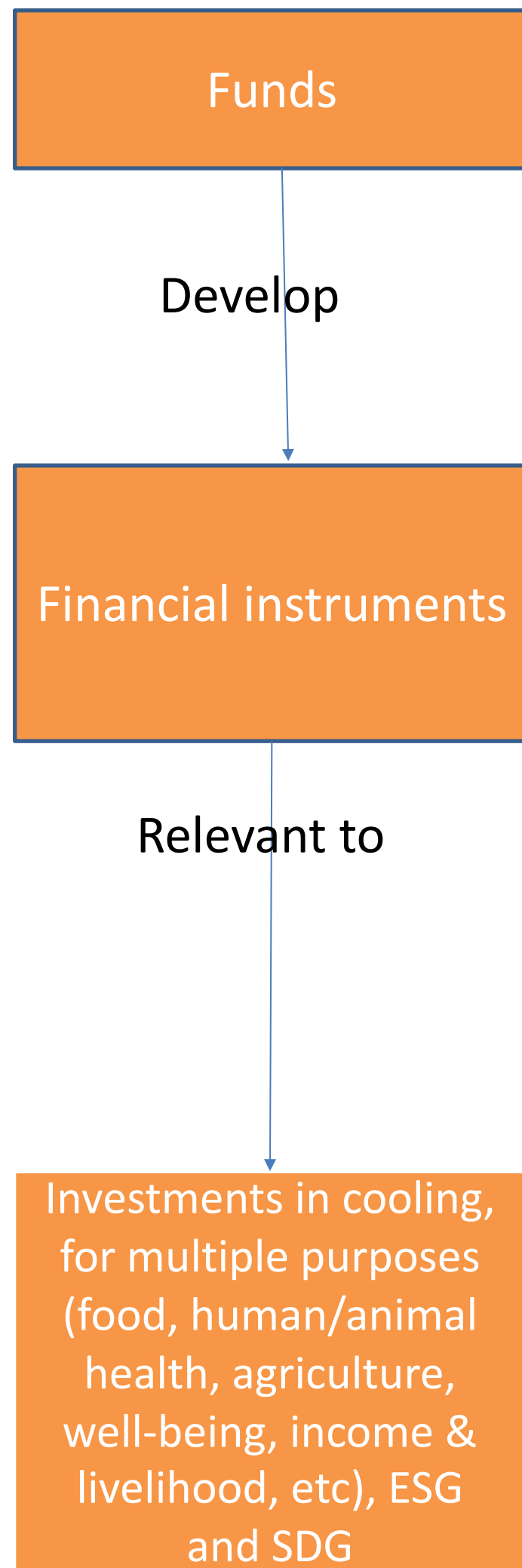
Public Funding:

- Funds for project/activity are there.
- Accountability: cost-efficiency, ensure impact, often targeted at vulnerable groups
- Based on “democratic”/ human rights decision/ competition for funds.
- Funds cannot be scaled

Private Finance:

- Need of money/ liquidity for activities.
- Business decision: economic feasibility.
- Impact needs to be proven from the start.
- Potential for scaling: unlimited as long as there is a need than can be met.

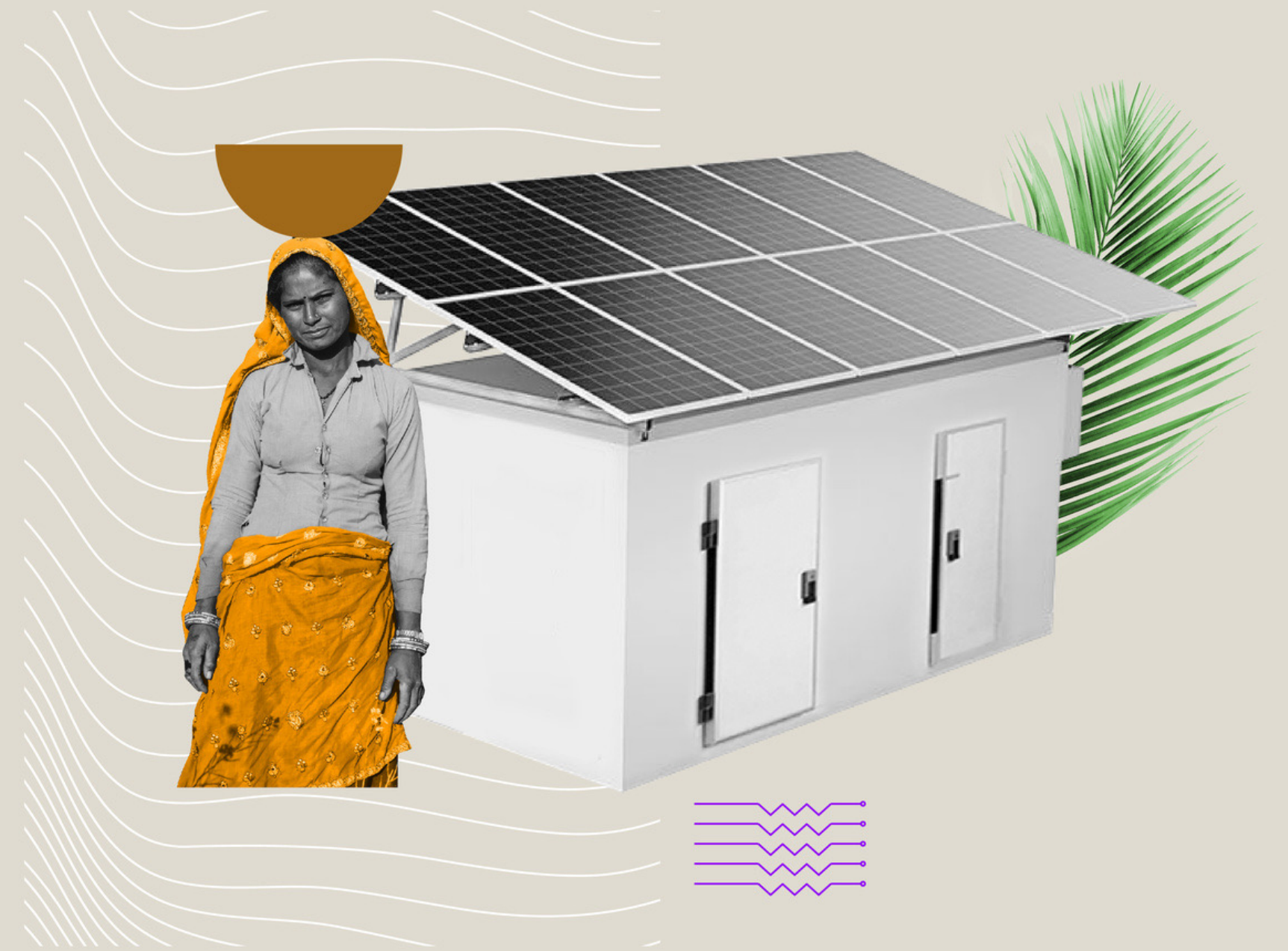
TYPOLOGY FINANCIAL INSTRUMENTS FOR COOLING



Example: Grants

Innovation grants

- Accessibility: public grants can be targeted towards innovators or piloting communities to achieve a breakthrough. (difficult to access as farmer)
- Affordability: depends on what can be financed from the grant (mostly assets as buildings, since 2018 also working capital and training)
- Applicability: to innovators
- Comprehensiveness: mixed results
- Experiences to date: good



What else than grants?

What are new instruments/options that should be explored for financing sustainable cooling?

- Green bonds
- Green finance/ozon finance (results based)
- Crowdfunding
-





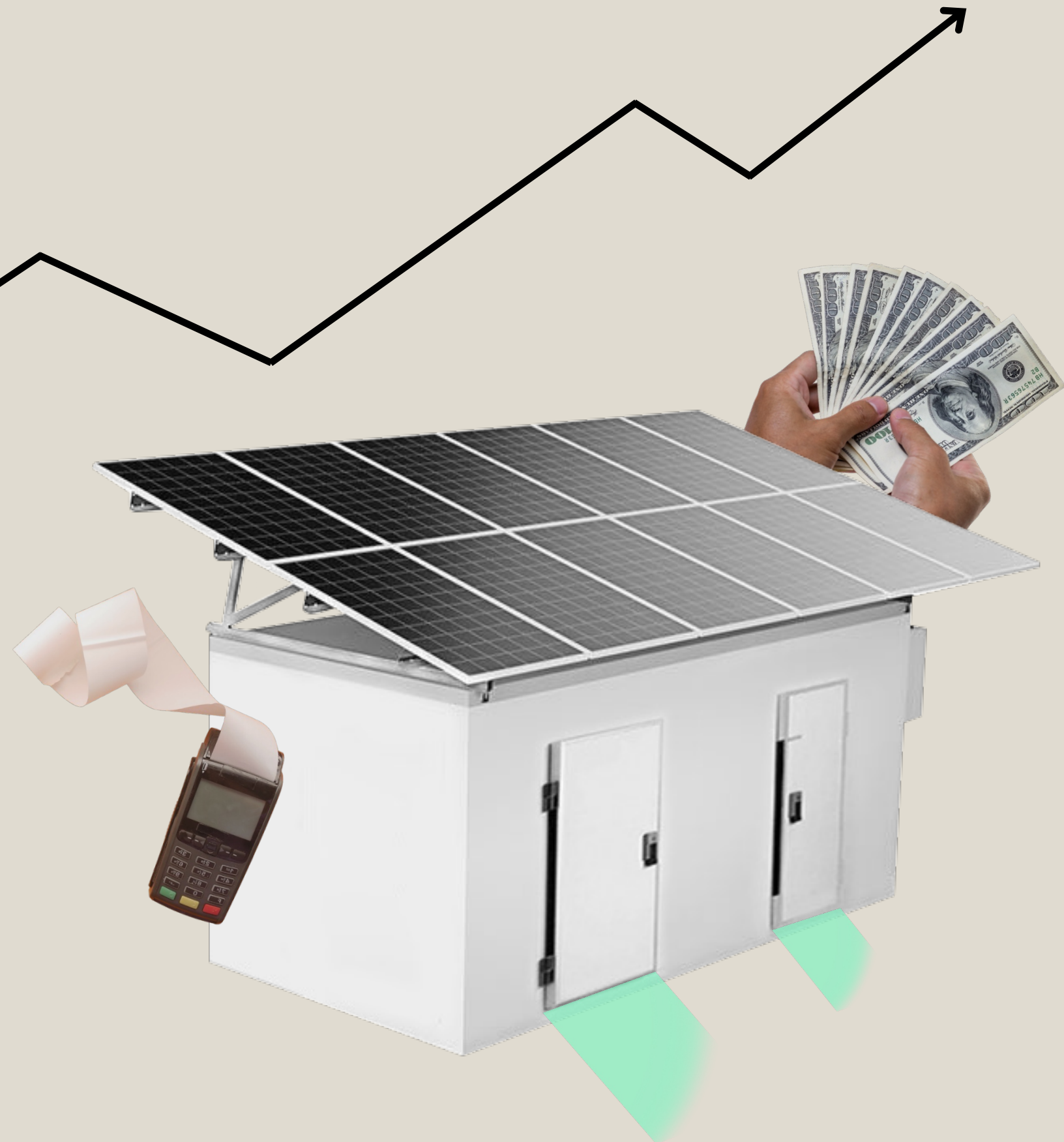
THANK YOU!

Contacts



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YOUR VIRTUAL COLD CHAIN ASSISTANT x SET ALLIANCE



CLIMATE
POLICY
INITIATIVE



Harsha Vishnumolakala
Analyst
Climate Policy Initiative

WEBINAR:

Cold Storage Financing in Agriculture

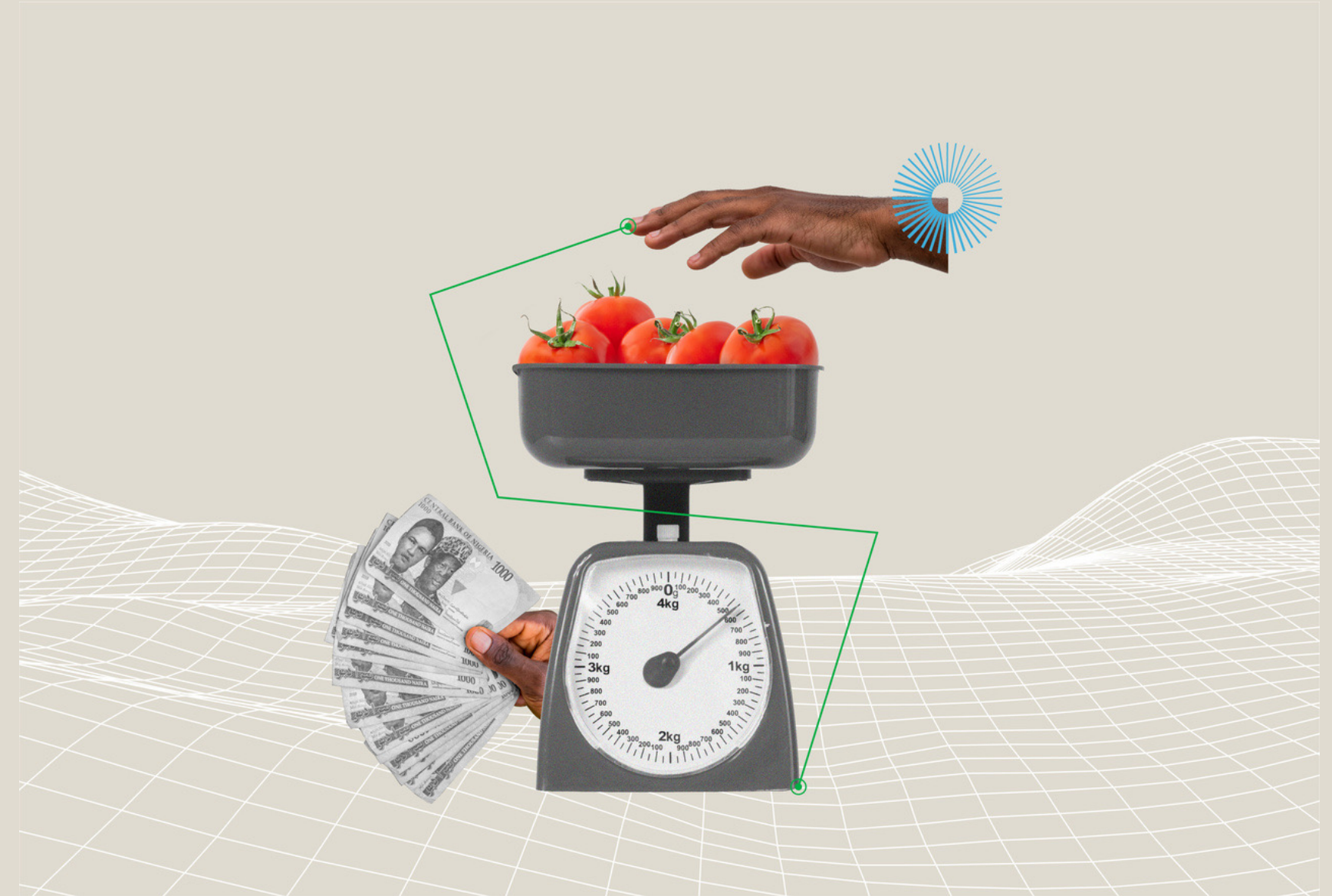
Financial instruments, commercial viability, & mapping investors

Agenda

1. Practical examples of financial instruments relevant for CaaS
2. Importance of commercial viability in the case of CaaS cold rooms
3. Mapping of investors

Financial instruments and approaches relevant for cold storage and CaaS

1. **Concessional Debt via Subsidized Impact Funds:** Financing offered at lower than market rates
2. **Private Equity:** Funds investing in SMEs
3. **Corporate Foundation Impact Investment**
4. **Recapitalization of CaaS transaction (sale-leaseback & SPV):** Financial restructuring to free up capital



Concessional Debt

Subsidized impact investing funds

AgDevCo

- Specialized subsidized impact investor and project developer
- **Early-stage** small and medium agribusinesses in Sub Saharan Africa
- Deploys long-term capital and technical assistance (USD 2-10 million)
- Currently has a presence in Sierra Leone, Ghana, Cote D'Ivoire, Rwanda, Kenya, Malawi, Mozambique, Tanzania, Uganda, and Zambia



Private Equity Funds investing in SMEs



- Early-stage fund and accelerator
- Blends capital from concessional (funds offered below-market rate) and commercial equity investors (seeking market level returns) to invest USD 200,000 in pre-seed portfolio companies
- Recently invested in KeepITCool – a cold chain company based in Kenya



Corporate Foundation Impact Investment



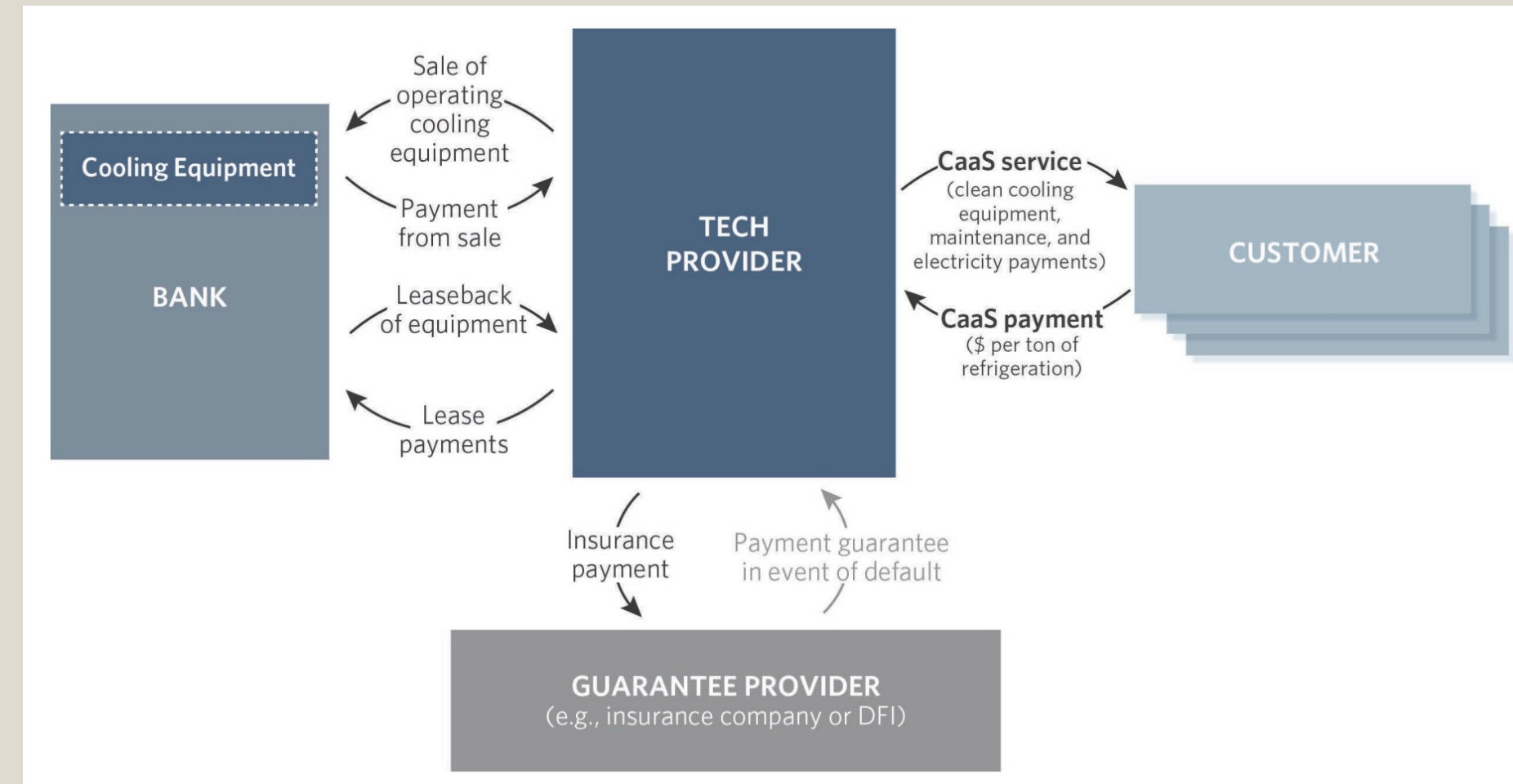
- Funded and run by AB InBev, Coca-Cola, Colgate-Palmolive, and Unilever
- Invests in companies from **Seed to Series B stage** and delivers 6 months of remote programming and training
- Accelerates collaboration and growth of cohort companies in addition to a pilot/alliance with partner companies



Recapitalization of CaaS

Sale-Leaseback explained:

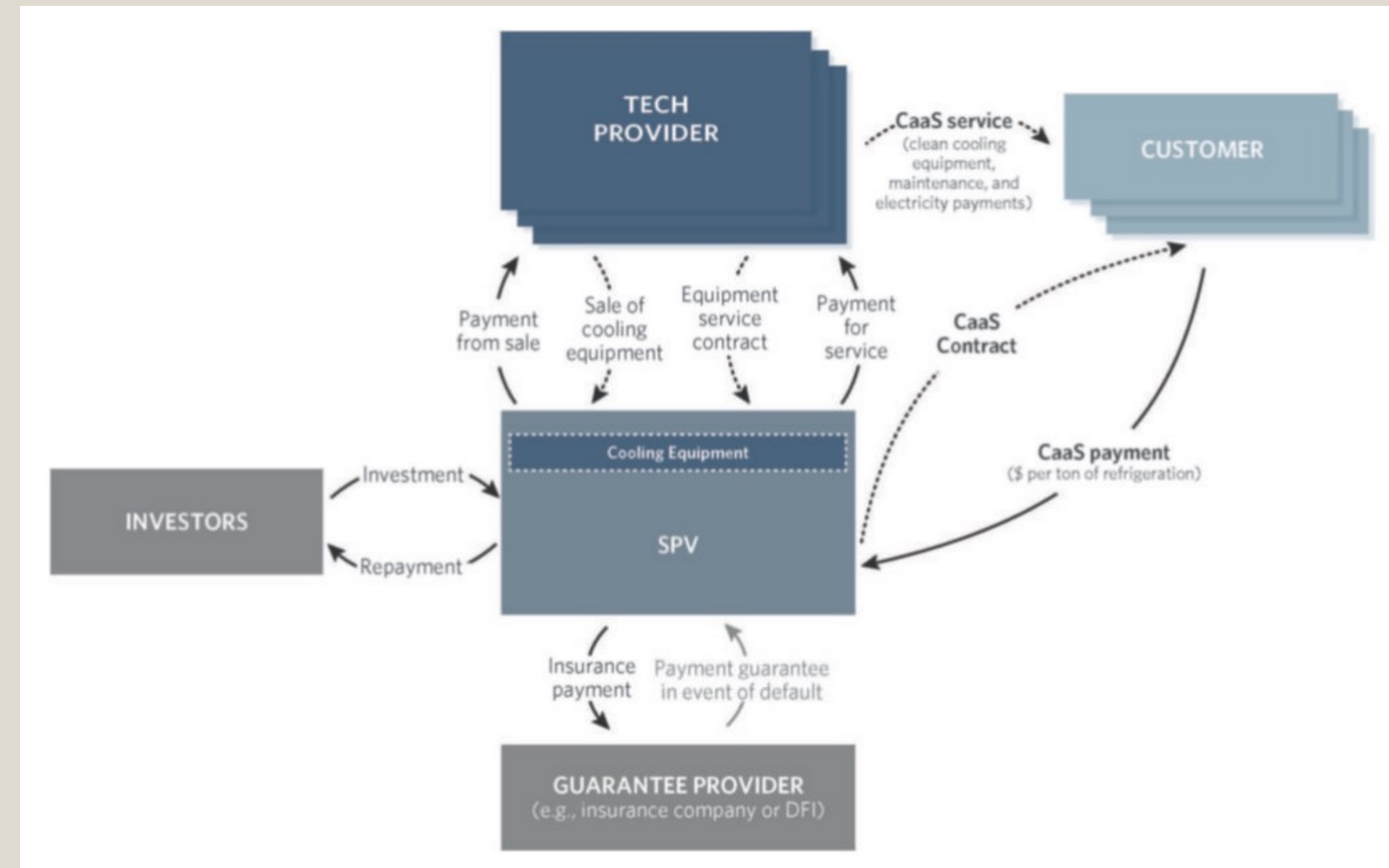
- A bank or financial institution purchases the cooling equipment and then leases it back to the company providing the cooling service
- Lease duration is typically no longer than the CaaS contract
- More secure for the finance provider & the contract between the provider and the customer is used as additional collateral



Recapitalization of CaaS

Special Purpose Vehicle (SPV)

- Investors set up an SPV
- The SPV buys the equipment from the technology provider and signs CaaS contracts with clients
- The provider is responsible for the maintenance & operation of the equipment but does not own it
- The SPV can engage with an insurance provider or a fund to establish a payment guarantee



Importance of Commercial Viability

- CaaS is designed to be a financially sustainable fully-commercial solution
- Relatively low reliance on concessional capital compared to other adaptation solutions
- Concessional capital is needed to support expansion to countries with less stable and established capital markets and emerging technology providers

Investor Mapping & Engagement

Development Finance Institutions (DFIs): Most DFIs invest or have recently invested in cooling or cooling-related projects in their regions of operation.

Foundations: Increasingly focused on cold storage. Gates Foundation for example is focused on the impact of cold chains on vaccine storage.

Commercial banks: Engaged in the context of an equipment sale-leaseback transaction with a single bank.

Private equity/Venture Capital: Range of funds are increasingly investing in cooling and cold storage technology companies. Examples include Catalyst Fund, GSMA Innovation Fund 2.0, Factor[e] Ventures, and Novastar Ventures

Investor Mapping & Engagement

Frame your impact thesis for the audience you have

1. **Adaptation:** know how to articulate the adaptation case for cooling and cold storage.
2. **Mitigation:** have a clear sense of the emissions reduction potential of your technology.
3. **Fintech angle:** if leveraging smart contracts and CaaS
4. **Health benefits:** e.g., benefits of cold storage for vaccines.

Call for Innovative Climate Finance Ideas

The Lab will support a record ten innovative climate finance solutions in 2024. Submissions should address barriers to climate investments in emerging markets and support the transition to a net zero economy.

Selected ideas receive guidance, analysis, stress-testing, and development by expert working groups and access to a network of high-level public and private investors.


SUBMIT

climatefinancelab.org/apply

DEADLINE

Dec 27



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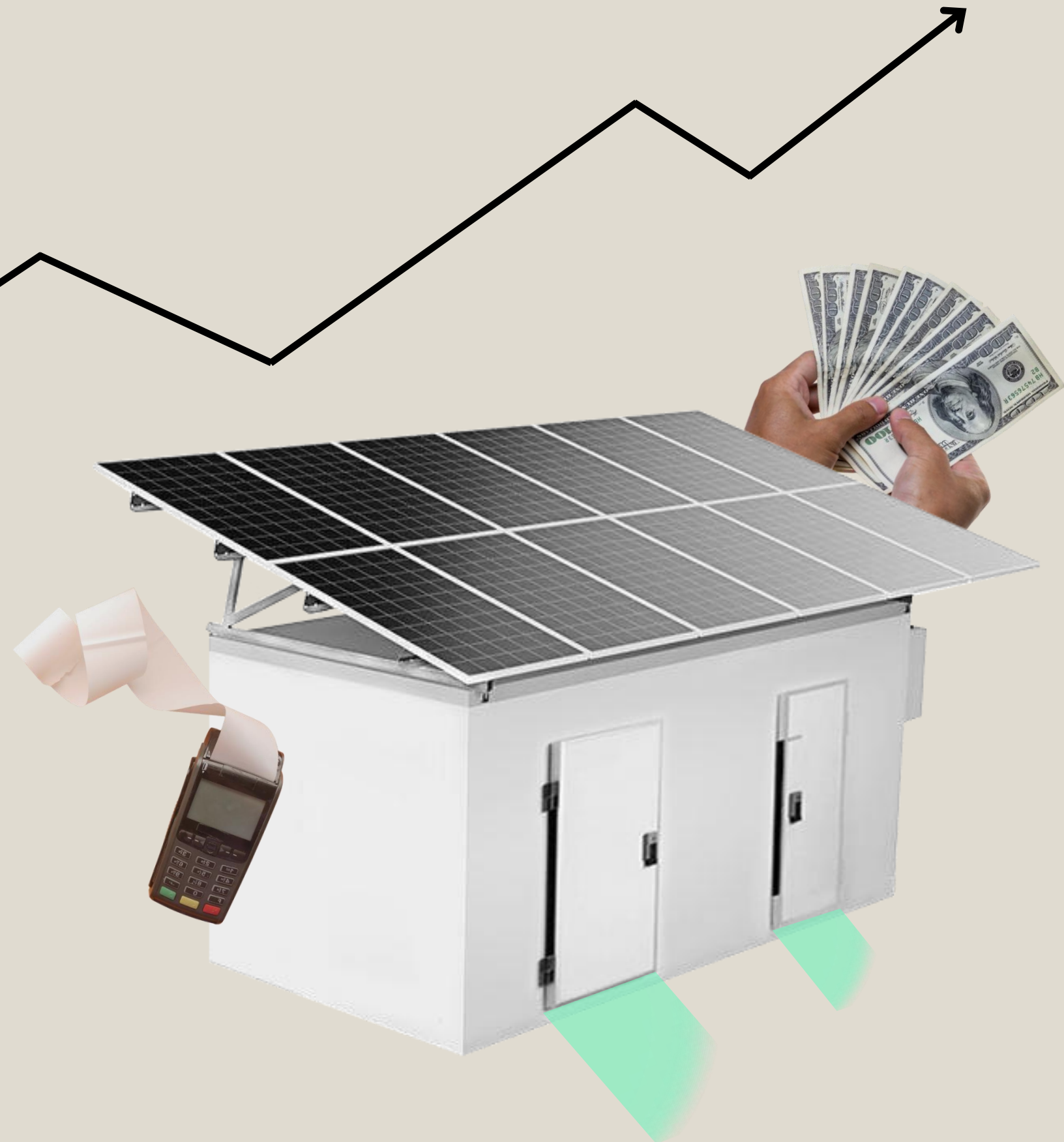
THANK YOU!

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Bas Hetterscheid

Manager Partnerships
at
Wageningen University
& Research

WEBINAR:

Cold Storage Financing in Agriculture

Tips and tricks for viable business cases

Presentation Structure

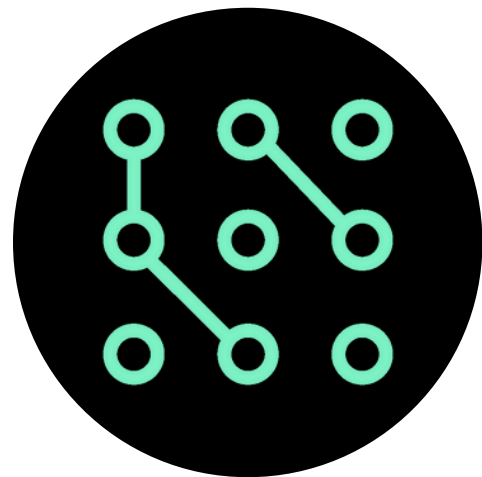
- White elephants
- Common mistakes & lessons learned
- How to make a viable business case / conduct Due diligence

White elephant in the room

Failed investments

- Across the continent
- Observed in almost all business models & governance structures

WHY ?



Mixed models – Mixed results

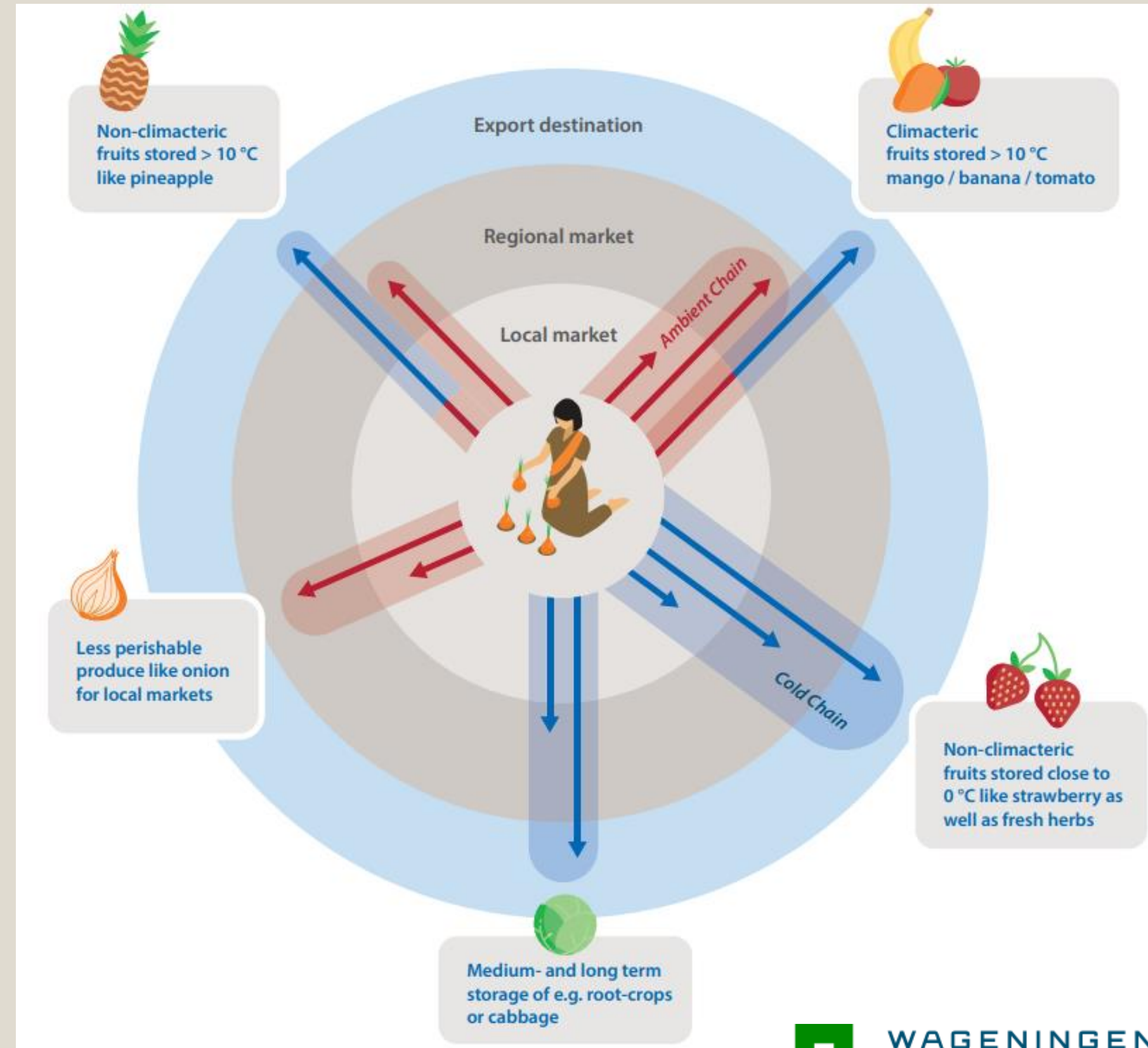
District	Management	Business model	Functioning & used
Rullindo	SAIP	CAAS	5 Facilities
Musanze	PSF	?	3 Facilities
Rubavu	Minicom	CAAS	5 Cold rooms
Karongi	SAIP	CAAS	
Rwamagana	SAIP & AEE	CAAS	2 Facilities
Ngoma	SAIP	CAAS	
Gatsubo	SAIP	CAAS	
Gasabo	Bloom Hill	Trader	2 Cold rooms
Kicukiro	NEAB	CAAS	4 Cold rooms
Kicukiro	Private	Trader	1 Cold room
Nyarungange	Eat Green	Trader	2 Cold rooms
Nyarungange	Sawa Citi	Trader	

Product – market match

- Cold chains for local markets are challenging
- Climacteric fruits ripen after harvest, make use of biology instead of cold chain.

Recommendations for a viable business case:

- Consider the product-market possibilities
- Aim at the blue-lined value chains
- High potential for green leafy vegs



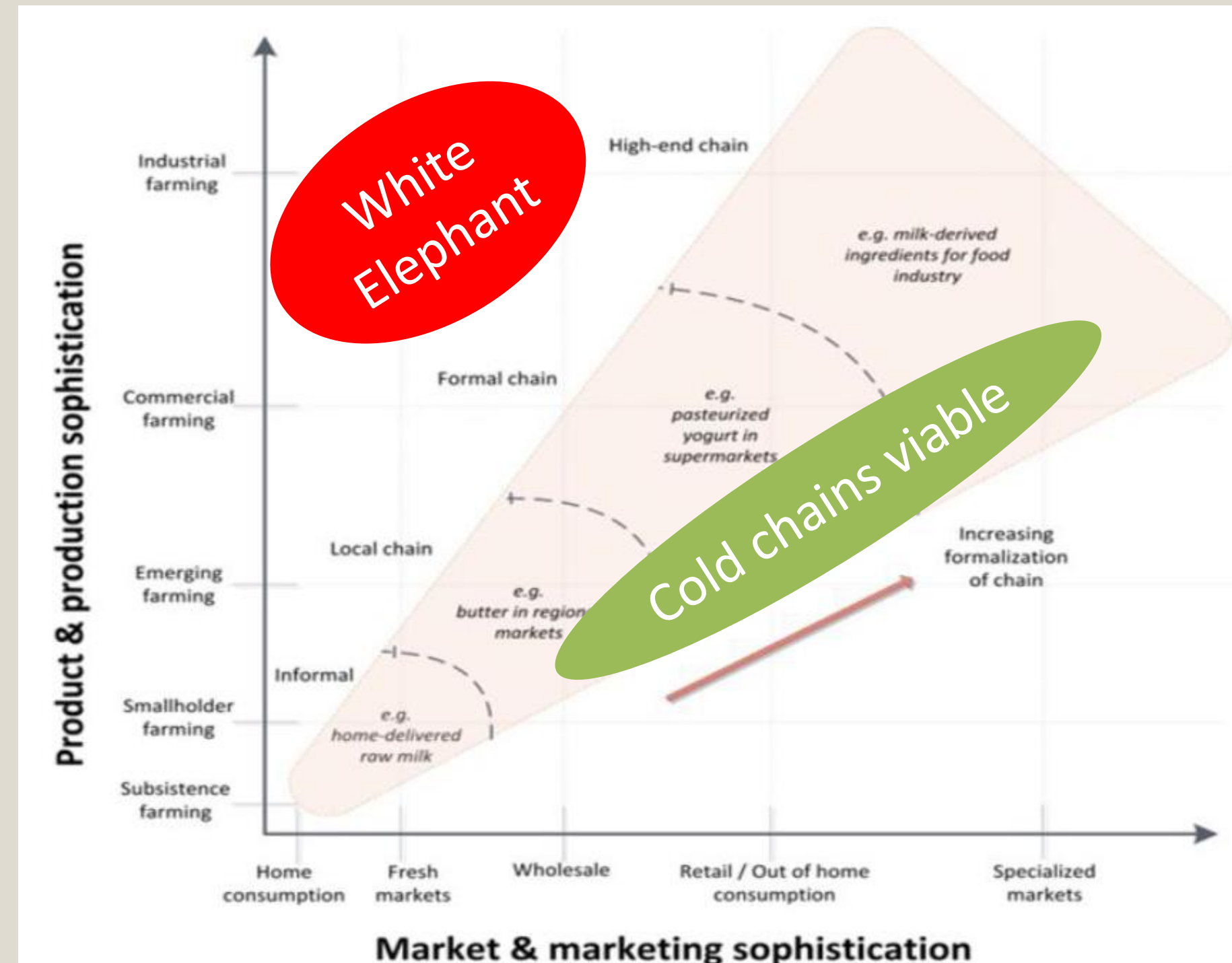
Consider investment narrative

Apply market driven approaches

- Food Loss & Waste = not market driven
- Successful implementation, match:
 - Market sophistication (leading!)
 - Technology sophistication

Recommendations:

- Think in terms of market access
- Get off-take guarantees
 - Of technology in case of CAAS
 - Of fresh product in case of trader model
- Rethink cold chains – ROI on public contribution



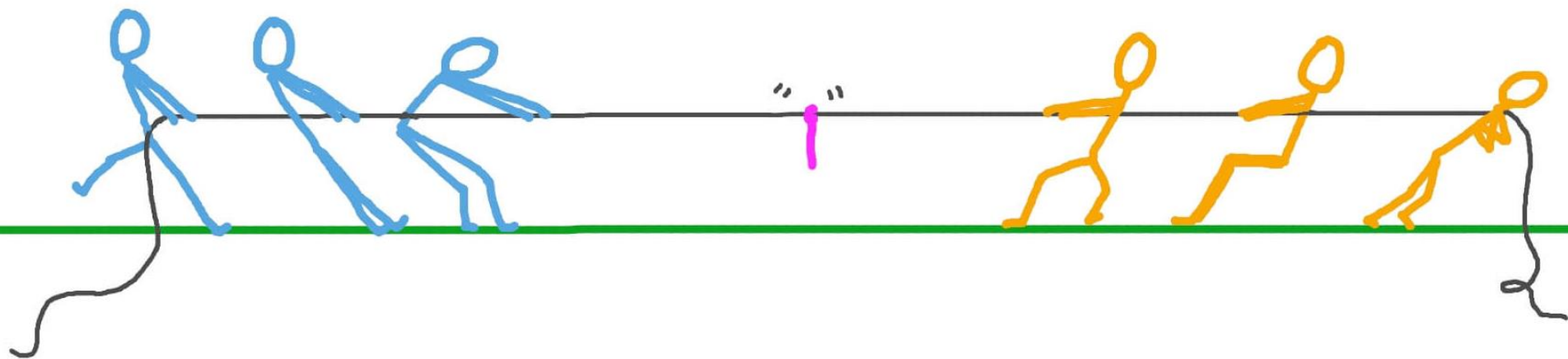
Competing technologies

Apply market driven approaches

- In some cases, it is cheaper to keep producing, than applying cold storage (i.e. tomatoes)

Recommendations:

- Consider competition from other technologies
 - Production
 - Conservation
 - Imported products



Bring together all lessons learned

Postharvest Assessment Methodology

Conceptual framework for a methodology to assess food systems and value chains in the postharvest handling of perishables as a basis for effective interventions

R.J.A. (Rene) Oostewechel, J.A. (Jan) Verschoor, F.I.D.G. (Fátima) Pereira da Silva,
S. (Bas) Hetterscheid, R.B. (Bob) Castelein

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Open access download link: <https://edepot.wur.nl/582556>


Step-based approach

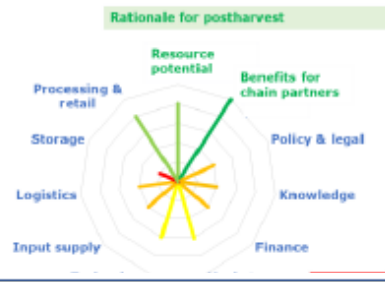
Viability check for cold chain interventions

- Based on lessons learned:
 - 4 level – 18 assessment steps
 - Covering market-based approach, crops selection, competing technologies, and much more.

Recommendations:

- Use the Postharvest Assessment Methodology
- Provide feedback to us 😊

Postharvest Assessment Methodology - summary overview 

Objective confirmation	1 Scope	Example scope: Concrete policy intervention/Pre-defined problem/Future policy development Example objectives: - Increased local food production/Feeding the cities - Food security and availability throughout the year - Improved nutrient rich diets - Improved income, employment - Food import substitution - Resilience to (international) supply chain disruptions - Resilience to climate change/Restoring Biodiversity - Restoring genetic diversity of crops as a means to food security - Restoring rural landscapes and/or erosion prevention - Food loss reduction - Water use efficiency - Development of a food processing sector - Export development / FOREX - Slowing down urbanisation rate - Circular agriculture objectives - Energy-efficient postharvest handling/storage - Protein transition (from animal to plant based) - Food safety - Gender and inclusiveness - ...	
	2 Objective		
Country- or Region level	3 Current situation	Based on selected objective. E.g. distinguish between crops based on PH characteristics and importance	
	4 Trends & initiatives	Middle class development, export etc.	
	5 Climate	Temperature, rainy seasons, elevations	
	6 Previous interventions	Find Key Success- and Key Failure Factors	
	7 Bottlenecks & possible solutions	Including application of ambient- or cold chain	
	8 Diagnostic	Modules (1) Resource potential (2) Benefits for chain partners (3) Policy & Legal (4) Knowledge (5) Finance (6) Markets (7) Technology (8) Input supply (9) Logistics	Criteria in relation to the objectives 
		9 Outline for intervention	
	10 Risk & impact analysis, m		

Example:

Step 5: Assess climate conditions

The country has two rainy seasons: a main season and a short season. There are also two dry seasons in between. There are some differences in production seasons between different regions.

Irrigation is practiced on a small scale, especially for fruit and vegetable production. Still, most of the F&V production is rain-fed. A price dip can be noticed during the harvest periods when supply is abundant. There is hardly any storage for fruit and vegetables available, and it is only suitable for extending shelf life for a maximum of one week.

Fruit mostly have a single harvest window and are transported when price differences and availability justify it. Price information is not transparent, nor can consumers afford high prices. This limits availability to some extent. Consumers also change from one fruit to another according to availability and season.

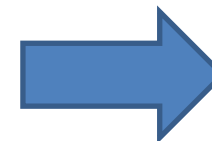
There are no mountainous areas, so natural cooling/ventilation with night air is hardly possible. Sunshine is abundant but not in the main season when electricity is required for cooling.


Intended users

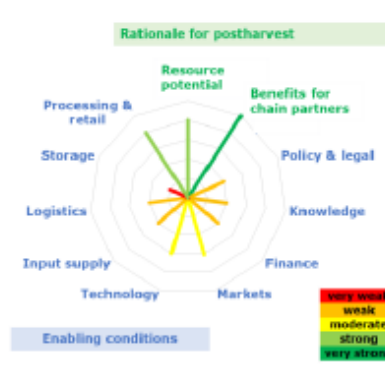


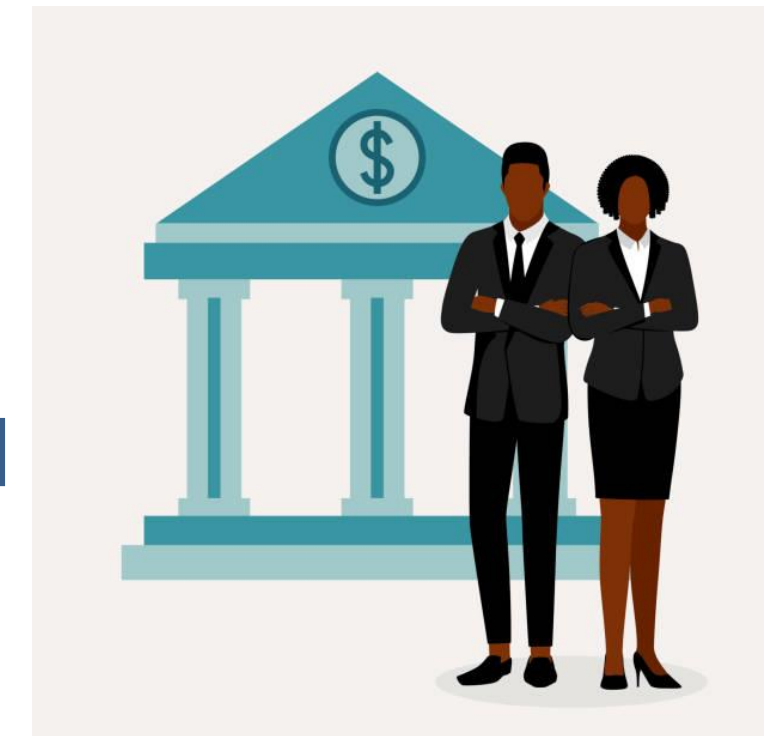
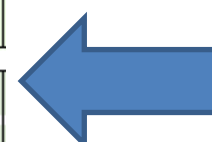
Cold chain entrepreneur
 Researchers & consultants

Viability check



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	8 Diagnostic	Modules Rationale for intervention (1) Resource potential (2) Benefits for chain partners (3) Policy & Legal (4) Knowledge (5) Finance Status enabling environment (6) Markets (7) Technology (8) Input supply (9) Logistics (10) Storage (11) Processing & retail	Criteria in relation to the objectives 
		9 Outline for intervention	Based on gathered information, now formulate the intervention that best suits the formulated objective.
	10 Risk & impact analysis, mitigation	Including goals and potential negative side effects in the food system	



Financial institutions
 Donor agents

Due Diligence

Learn more



KEEP IT COOL:

HARNESSING COLD STORAGE TO REDUCE FOOD LOSS & SUPPORT SUSTAINABLE FOOD SYSTEMS IN EMERGING ECONOMIES



Part of the
Efficiency for
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Wageningen University & Research

THE COLD TRUTH: UNCOVERING THE SECRETS OF (UN)SUCCESSFUL COLD CHAINS

Keep it cool paper: https://www.clasp.ngo/wp-content/uploads/2023/10/Keep-it-Cool_Oct-2023.pdf

Summary

Let us work together on viable cold chain models

For cold chain operators

- 1** Work with market driven approaches

- 2** Select viable product-market combinations and evaluate alternative supply chains and technologies

For investors & grant providers

- A** Standardize and conduct Due Diligence of cold chains. Check the investment narrative.

- B** Longer term: Work on narrative of cold chains as critical infrastructure to deliver public contributions

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THANK YOU!

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Questions posed by the audience:

Ben Hartley, SE4ALL

1. What is the average interest rate for financing in each of the sample business models, and how does one ensure that lenders do not employ crude methods to recover loans or debts from end-users or debtors, especially considering the potential emotional and psychological impact on individuals, such as women, who may experience significant pressure and shame in such situations? Additionally, what is the average tenor of the facility?

Answer: To be honest, we do not have data at that granular level regarding interest rates for financing. On the financing practices and lenders, this is also a bit outside my realm of knowledge. My assumption is that it would require social protection programs that are applied – and enforced – against loan providers.

2. Are there any emerging trends or business models facilitating the transition from a Capital Expenditure (Capex) to an Operational Expenditure (Opex) model in the industry? If so, where can I find more information about these developments?

Answer: I would encourage the person to investigate the experience of the PayGo model in the energy access sector – distributed renewable energy in particular and household energy services it provides.

Sabine Desczka, Wageningen University and Research

1. Has your organisation established a database or research paper explaining the financial instruments mentioned in the presentation? Where can this be accessed?

Answer: We did not establish a database, but the typology will be published soon on the WUR website including the reference list. Btw, a good idea to establish a database. We would be interested to help.

2. Your suggestion to explore crowdfunding specifically for sustainable cooling is quite intriguing. Are there any existing examples of such initiatives, and what barriers need to be overcome to scale up crowdfunding for this purpose? Similarly, with regard to carbon credits, there is a lot of discussion about these financing mechanisms, but there seems to be a limited track record to date. What are the challenges in scaling up the use of carbon credits in sustainable cooling projects?

Answer: I think it would be possible. I saw an example from Technoserve using crunchbase for cooling of Mangos. [TechnoServe - Crunchbase Company Profile &](#)

[Funding](#). However, as a scientist I would not start to invest without a proper market feasibility study, which WUR could provide of course. The same probably holds for carbon credits. A number of NGO's started to connect smallholder farmers to carbon markets by taking over their registration fees and providing apps for certification of carbon. There is more market intelligence necessary to evaluate, but first impressions are good.

Harsha Vishnumolakala, Climate Policy Initiative

1. Do you know if there are publicly available contract templates tailored to different models such as sale-leaseback, special purpose vehicle, cooling-as-a-service, etc., for Cold Rooms developers?

Answer: We're familiar with the helpful contract template on the CaaS initiative website (<https://www.caas-initiative.org/tools>), but not with any other templates.

All panellists

1. I would appreciate hearing the panellists' views on what is needed to unlock climate finance to complement commercial funding for the cold chain. For instance, the establishment of a UNFCCC-accepted methodology for measuring, quantifying, and monetising emissions reduction resulting from reduced food waste/loss, replacement of or reduction in fossil fuels for power, or reduced transportation needs, etc.

Answer by CPI: Our work in this space is fairly limited, but one area where CPI has done analysis is on advancing a proposed methodology for tracking cooling finance. Current cooling finance datasets do not include investment in several important types of cooling solutions and lack project-level information, preventing governments, development banks, and private investors from assembling comprehensive cooling transaction databases. Without the ability to track financial commitments to cooling projects over time, these actors will be unable to evaluate how actual cooling investment patterns compare to projected needs across sectors and geographies, limiting public and private institutions' ability to deploy capital where it is needed most.

To address this challenge, we propose a standardized Cooling Investment Tracking Framework (Framework) that integrates four aspects of cooling investment. More details on this Framework is available [here](#) in analysis CPI developed with SEforALL.

2. Is there a practical case study available that examines the various impact assessments of cold storage, encompassing both climatic and socioeconomic impacts?

Answer by CPI: Not that we're aware of – the main support we have undertaken at CPI for cold storage is our engagement with the BASE team on your work on Your VCCA, so

we won't have any specific case studies on this front beyond those the BASE team would be aware of.

Answer by Bas Hetterscheid, Wageningen University & Research:

On the climate impact of cold chains:

- <https://efficiencyforaccess.org/publications/life-cycle-greenhouse-gas-emissions-assessment-of-off-and-weak-grid-refrigeration-technologies> &
- <https://efficiencyforaccess.org/publications/note-for-policymakers-lifecycle-carbon-emissions-assessment-of-off-and-weak-grid-refrigeration-technologies>

Social economic impact is addressed to a lesser extent, but is part of the scope of work www.coolingafrica.org is working on.

For more questions on the environmental, please contact: Jakub Vrba Jakub.Vrba@est.org.uk