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CGIAR



Scaling readiness flash drying: CRP-RTB project on scaling up small cassava drying units

ALEJANDRO TABORDA, ARNAUD CHAPUIS, THIERRY TRAN.

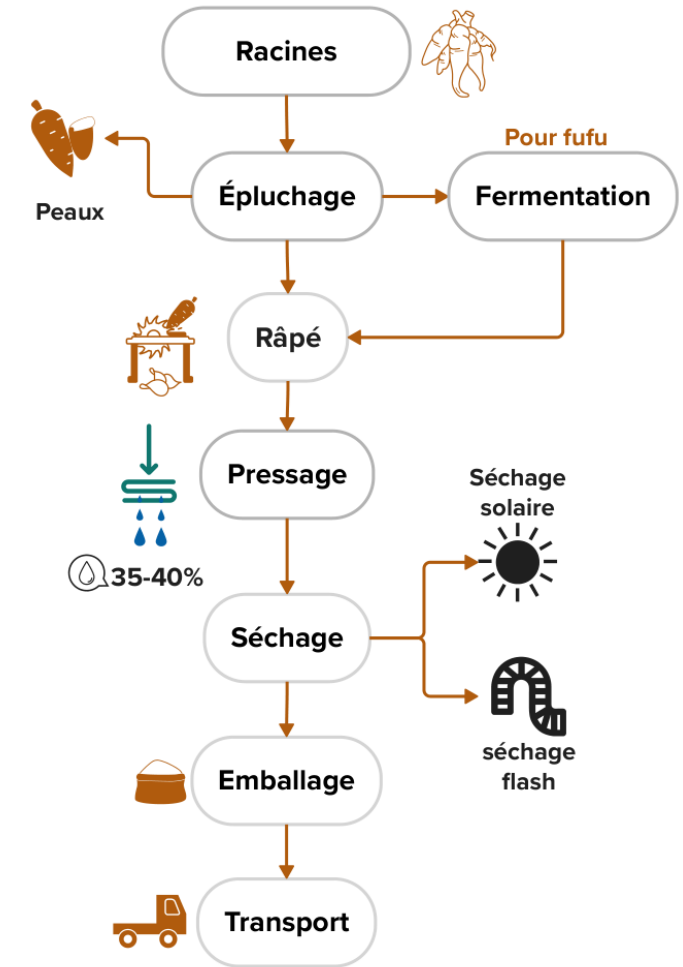
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JANUARY, 2025

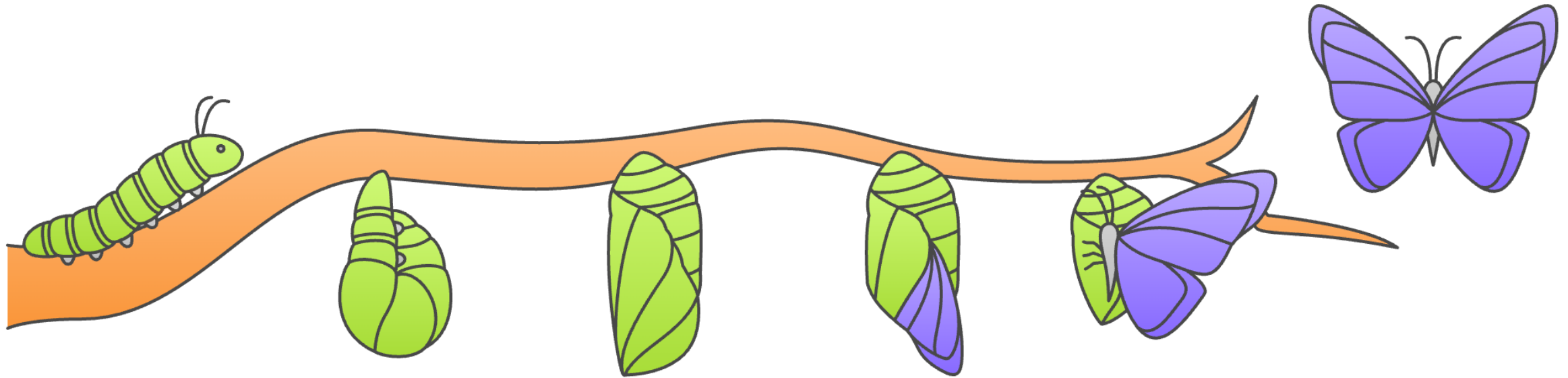
Introduction

Cassava and its derivatives, are key for food security in countries like Nigeria, Colombia, and D.R. Congo.

For example, fufu (cassava flour) is consumed by over 90% of the population with an average annual intake of 250 kg per person in DR Congo.



How Has the Scaling of Flash Dryers Been Planned?



Challenges of Small-Scale Processing

Low energy efficiency of drying,
High production costs

Baseline surveys

High energy efficiency of large-scale processing factories

Optimize Energy Efficiency

Optimization of small-scale processing through numerical modeling

Pilot Testing

Implement small-scale pilot flash dryer

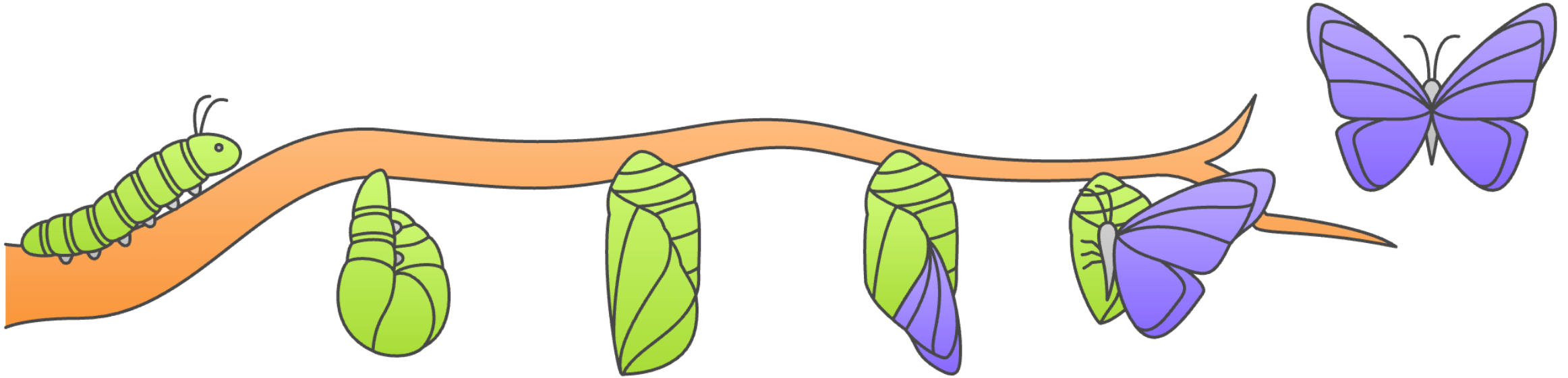
Scale up Innovations

Extend solutions to processors using SR approach

Energy Efficient Small-scale FD adoption

Adoption of improved small-scale flash dryers with comparable efficiency to large scale

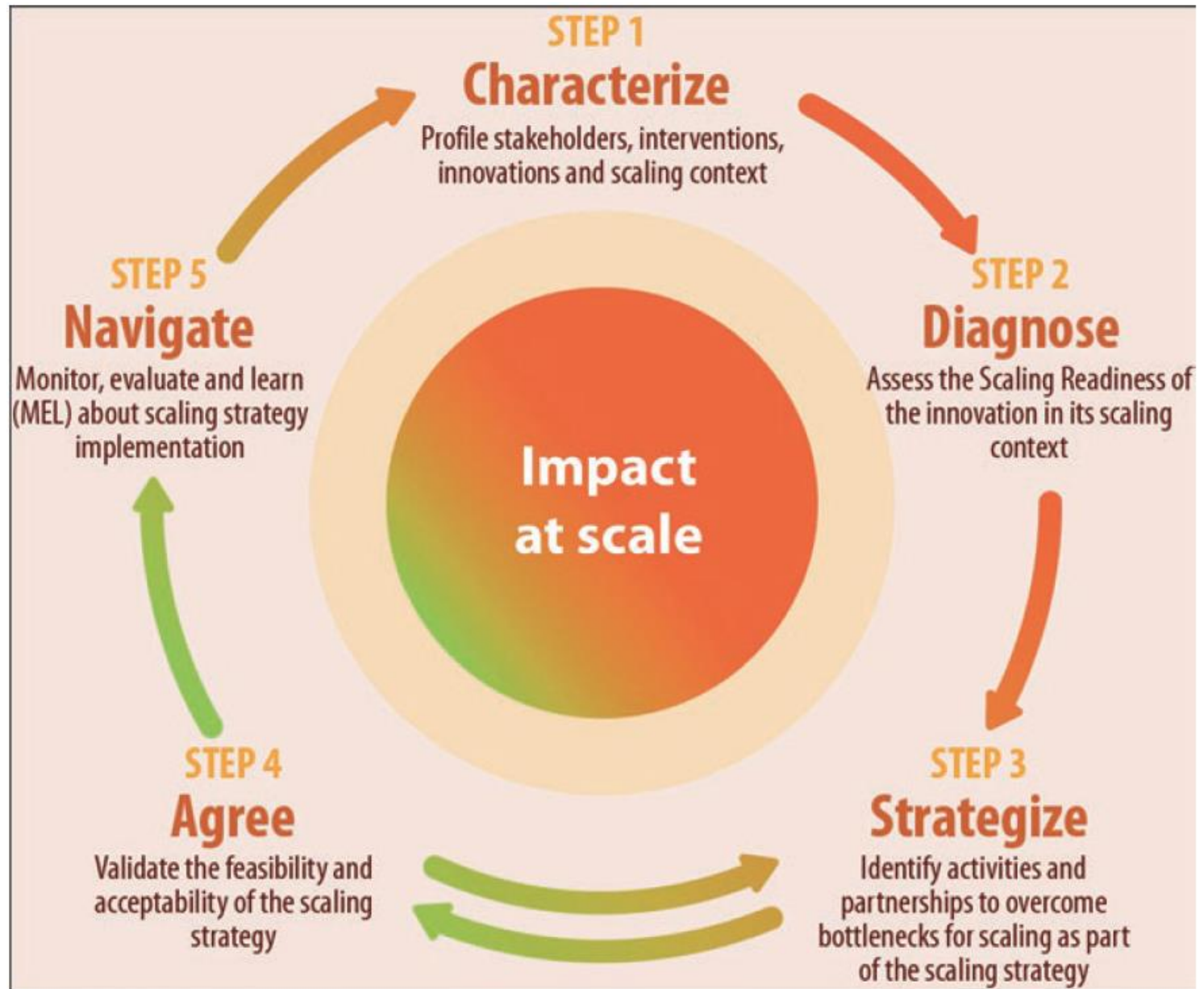
How Has the Scaling of Flash Dryers Been Planned?



Using the Scaling Readiness framework to guide/pilot the process of scaling up the optimized small-scale flash dryer

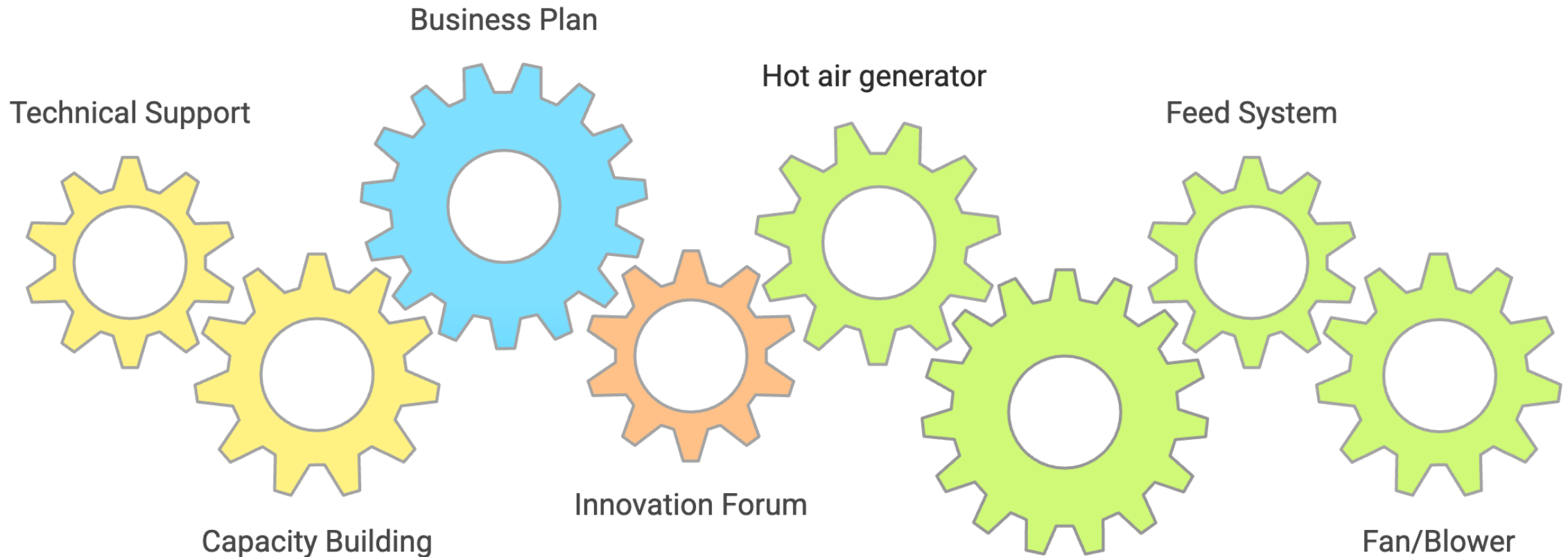
Scaling of Flash Drying Innovations and Scaling Readiness

Steps to Achieve Impact at Scale Using the Scaling Readiness Framework.

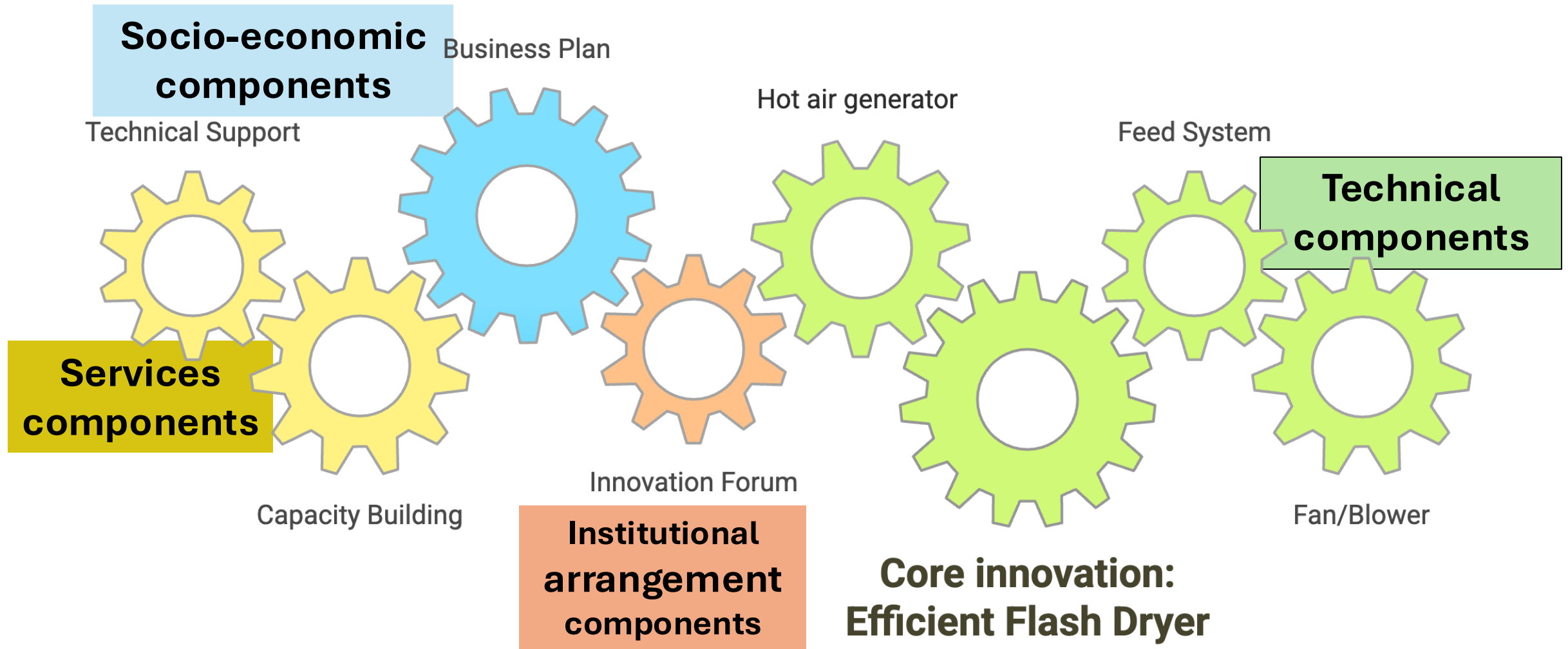


(Source: Sartas et al. 2020)

Innovation package applied to small-scale flash dryer

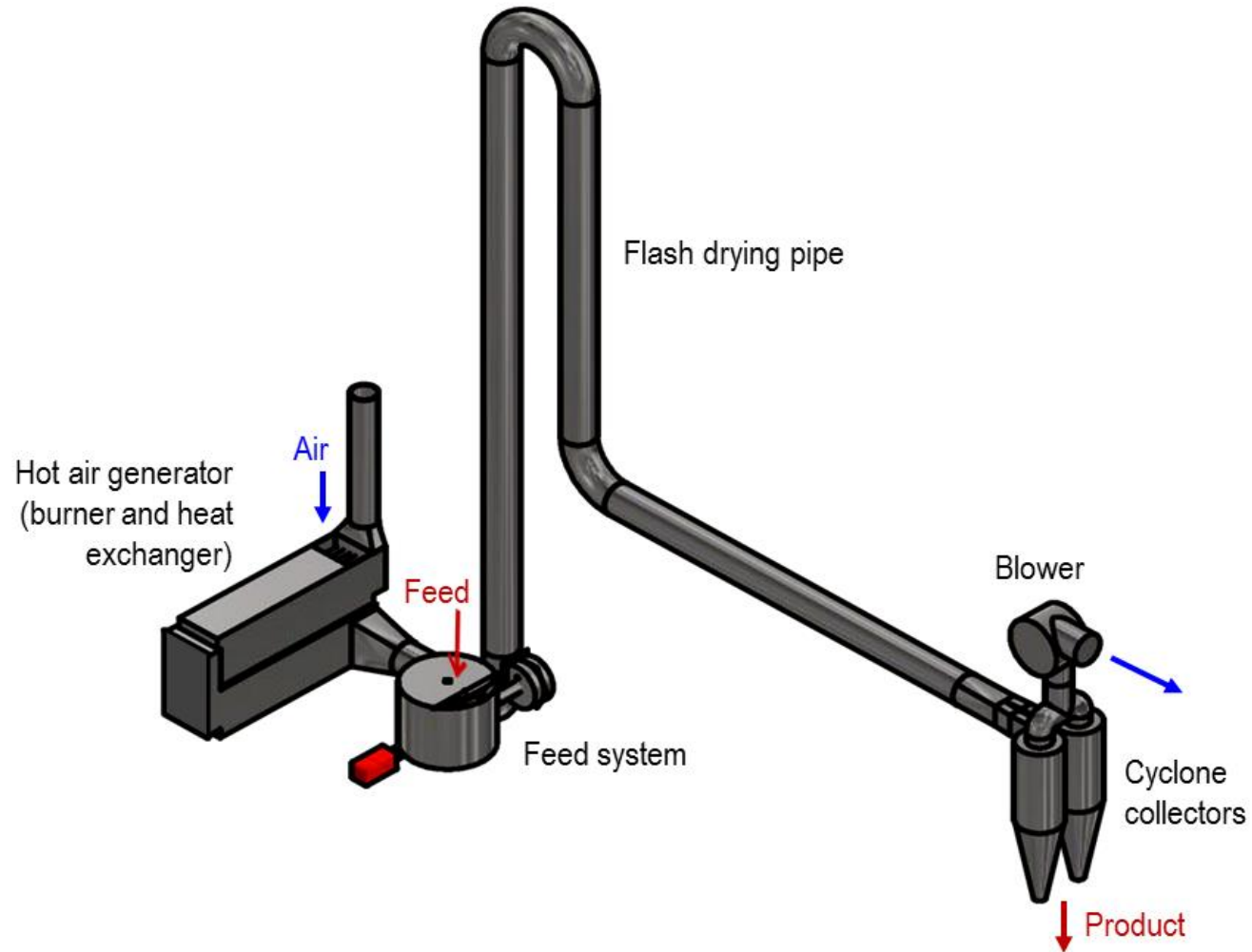


Step 1: Innovation package characterization



Scaling readiness integrates different dimensions in the process of scaling an innovation (holistic approach)

Technical components

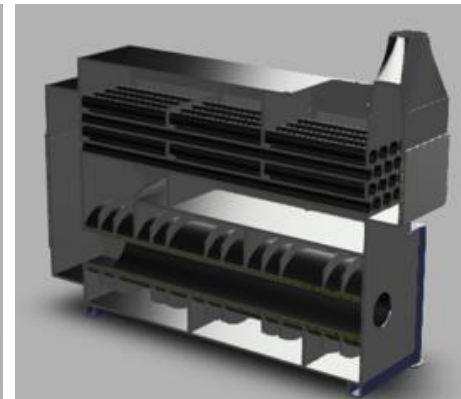
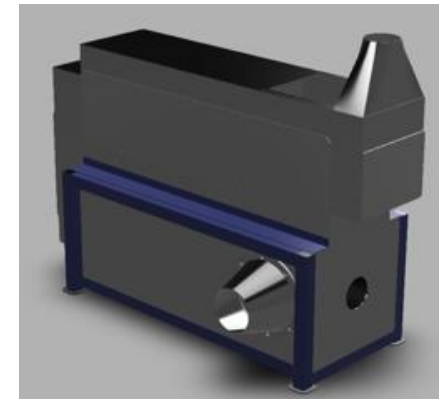


Hot air generator

Feed System



Core innovation:
Efficient Flash Dryer





Innovation Forum



Institutional arrangement component: Innovation Forum



Socio-economic components: Business plans on cassava drying using flash dryer equipment

Business Plan



Cassava Flour investment project feasibility

This tool uses predetermined information based on averages of business plans of multiple cassava flour processors from D.R. Congo, Nigeria and Colombia. This study was conducted during the development of the **Scaling Readiness Flash Dryer project** during 2019 and 2020. Although the information used could be significantly different with respect to other countries, this exercise could be used as a rough estimate to a pre-feasibility study of investment in cassava flour processing using flash drying technology. However, it is recommended that before making an investment, a complete study and business plan with updated data in your specific locality should be carried out. For inquiries and further information please contact us at latabordaa@unal.edu.co

Please select your location (more approximate)

DR. Congo (intermediate investment cost)

If you have conducted a previous market survey, do you know what is the demand (estimated or projected) for cassava flour in your target market? (in Ton/week)



Approximately how many tons of cassava roots would be available weekly for processing at your location



The quantity of roots available in your locality **is enough** to process the quantity of flour demanded

Will you also invest in complementary technology for cassava flour processing? (Press, Granulator, Gas burner (or Diesel heatexchanger), PID control system,... Note:The costs of the complementary technology may vary from country to country, however, the information collected indicates that of the total investment costs, the flash dryer corresponds on average to 70%. For practical purposes of the analysis, we will use this approximate value to estimate the total investment costs)

yes

What is the cost of one(1) Ton of cassava roots in a locality (in \$USD)?



What is the selling price per 1 Ton of HQCF (at factory gate) (in \$USD)?



Considering that the dryer will be operating for 6 days/week and 8 hours/day, the required capacity of the flash dryer (in Kg/hr) is:

300

The price (in US Dollars) of the Flash Dryer that you need is:

Flash Dryer Price

US\$ 34716 Name: DRC_Price, dtype: int64

Cassava roots required (Ton/week)

Ton 48.9 Name: Roots_demand, dtype: float64

Complementary technology Price

US\$ 14878 Name: DRC_complementary, dtype: int64

The total investment (in USD) is:

0
US\$ 49594

Data collected in the countries under study allow us to conclude that the price of roots is on average 75% of flour

Tool available online:



Services components: Capacity building Theoretical and practical training on the basics of flash drying equipment.



<https://youtu.be/FpeM1zdwoSs>



Capacity Building



Services components: On demand technical support for building and using cassava flash dryer equipment

Technical Support



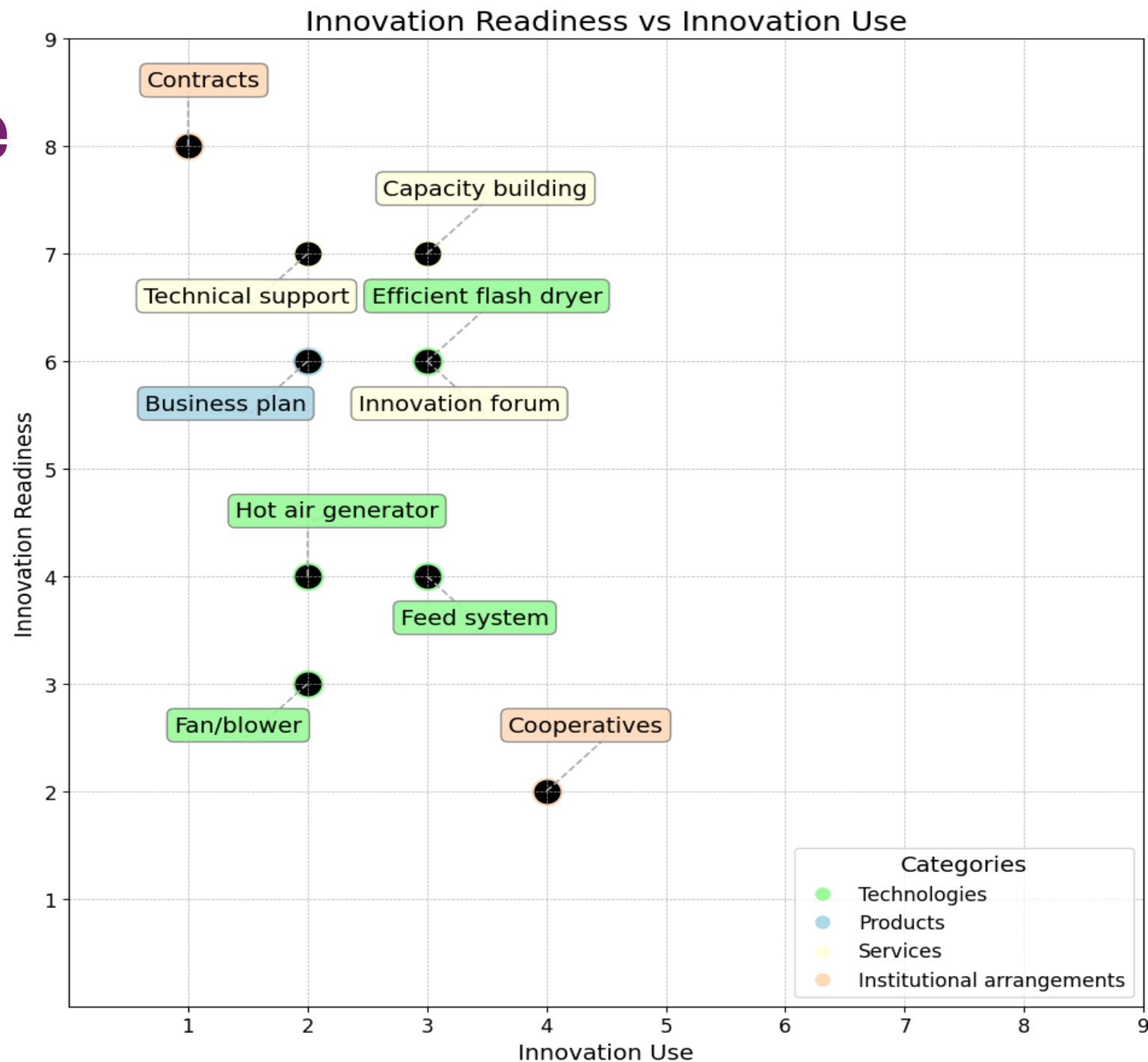
Step 2: Diagnose

Stage	Innovation readiness	Innovation Use
1	Idea	Intervention team
2	Basic Model (testing)	Direct partners (rare)
3	Basic Model (proven)	Direct partners (common)
4	Application Model (testing)	Secondary partners (rare)
5	Application Model (proven)	Secondary partners (common)
6	Application (testing)	Unconnected developers (rare)
7	Application (proven)	Unconnected developers (common)
8	Innovation (testing)	Unconnected users (rare)
9	Innovation (proven)	Unconnected users (common)

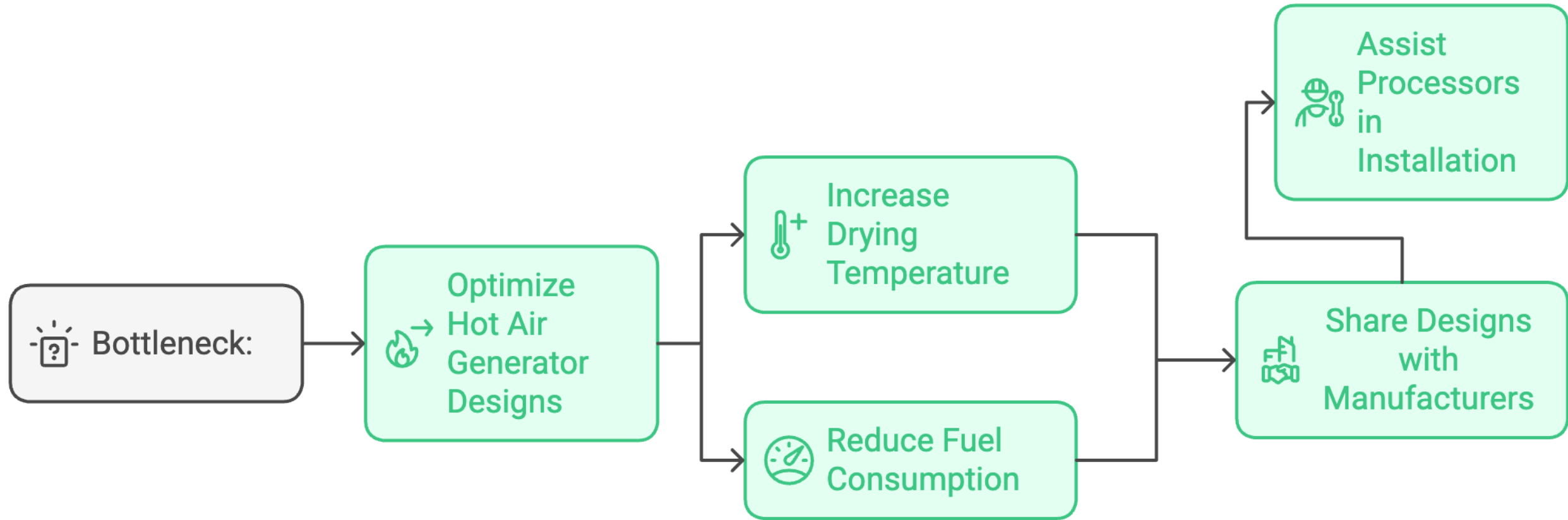
*Sartas M, Schut M, Proietti C, Thiele G, Leeuwis C (2020a) Scaling readiness: science and practice of an approach to enhance the impact of research for development. *Agric Syst* 183:102874

Step 2: Diagnose

Assessment of the innovation readiness and innovation use of the Cassava flash dryer innovation package in D.R. Congo



Step 3: Strategize (Example hot air generator bottleneck)



Step 4: Agree

Acuerdo de participación

El taller "Secadores flash de bajo costo para almidón y harina de yuca a pequeña escala" fue organizado y financiado por el proyecto RTB del CGIAR titulado "Enfoque de escalonamiento para la tecnología de secado flash de almidón y harina de yuca a pequeña escala". Como requisito para esta financiación, se solicita al proyecto que siga las Directrices de RTB sobre documentación y reporte del progreso de la "idoneidad del escalonamiento", en particular para documentar las actividades de seguimiento a los participantes del taller sobre el uso de los sistemas de secado flash de bajo costo y sus contribuciones para usar esta tecnología en los procesos de transformación de la yuca. Para cumplir con este requisito, le solicitamos amablemente que acepte lo siguiente:

1. Llenar encuestas trimestrales sobre el progreso de la adopción de la tecnología ("idoneidad del escalonamiento"), después del taller. Le enviaremos recordatorios oportunos para esto (resp.: Murat Sartas).
2. Aceptar visitas periódicas del equipo del proyecto en su fábrica para (i) proporcionar asistencia técnica si es necesario y (ii) medir y documentar el desempeño de su equipo de secado rápido (resp.: Arnaud Chapuis, Alejandro Taborada, Thierry Tran). El propósito de recopilar estos datos es para la investigación sobre la difusión y la adopción de tecnología mejorada de secado flash. Garantizamos la confidencialidad y el anonimato de los datos recopilados contra terceros.

A cambio de su colaboración, el proyecto RTB del CGIAR "Enfoque de escalonamiento para la tecnología de secado flash de almidón y harina de yuca a pequeña escala", proporcionará de forma gratuita, además del apoyo financiero brindado para asistir al taller:

1. Soporte especializado en línea sobre la construcción, instalación y uso de secadoras flash de yuca de bajo costo, después del taller y hasta diciembre de 2020, mediante la plataforma y comunicaciones por correo electrónico.
2. Actualizaciones periódicas sobre los avances del proyecto en sistemas de secado rápido de yuca de bajo costo después del final del taller y hasta diciembre de 2020.

Dr. Thierry Tran
Project Manager
September 13, 2019

Christina Castro
General Manager
Exportadora e Importadora
ANGAVE SRL

Agreement of Participation

The "Low cost flash drying of cassava starch and flour at small scale" workshop was organized and funded by the CGIAR RTB project "Scaling approach for flash drying of cassava starch and flour at small scale". As a requirement for this funding, the project is requested to follow the RTB Scaling Readiness Documentation and Reporting Guidelines, in particular to document the follow-up activities of the workshop participants on the usage of the low-cost Cassava Flash Dryer system and their collaborations for using Cassava Flash Dryer. In order to comply with this requirement, we kindly request your agreement to the following:

1. Complete quarterly surveys on Scaling Readiness starting from a few days after the end of the workshop. We will send you timely reminders of this (resp.: Murat Sartas).
2. Accept regular visits of the project team to your factory, to (i) provide technical support if needed, and (ii) measure and document the performance of your flash dryer equipment (resp.: Arnaud Chapuis, Alejandro Taborada, Thierry Tran). The purpose of collecting this data is for research on the diffusion and adoption of improved flash drying technology. We guarantee confidentiality and anonymity of the collected data against any third parties.

In return for your support, in addition to the financial support provided for attending the workshop, the CGIAR RTB project "Scaling approach for flash drying of cassava starch and flour at small scale" will provide free of charge:

1. Online expert support on construction, installation and usage of low-cost cassava flash dryer after the workshop and until December 2020, using the whatsapp platform as well as e-mail communications.
2. Periodic updates on the project advances in low-cost cassava flash dryer systems after the end of the workshop and until December 2020.

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Project Manager
September 13, 2019

Jimon Lambo Akande
General Manager
AROGUNJO FARMS
Nigeria

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Dolly Rodriguez
Directora
Programa de Ingeniería
agronómica
Universidad de La Salle

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September 13, 2019

Adeniyi Ganiyu Ogunkeya
General Manager
DEBAN FAITH
Nigeria

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Project Manager
September 13, 2019

Adedotun Emmanuel Alade
Manager of process
OYO IFELODUN CASSAVA PROCESSING
CICS LTD
Nigeria

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Dr. Thierry Tran
Project Manager
September 13, 2019

Abdilas Niangisi'Utono
General Manager
ECOSAC
Democratic Republic of Congo

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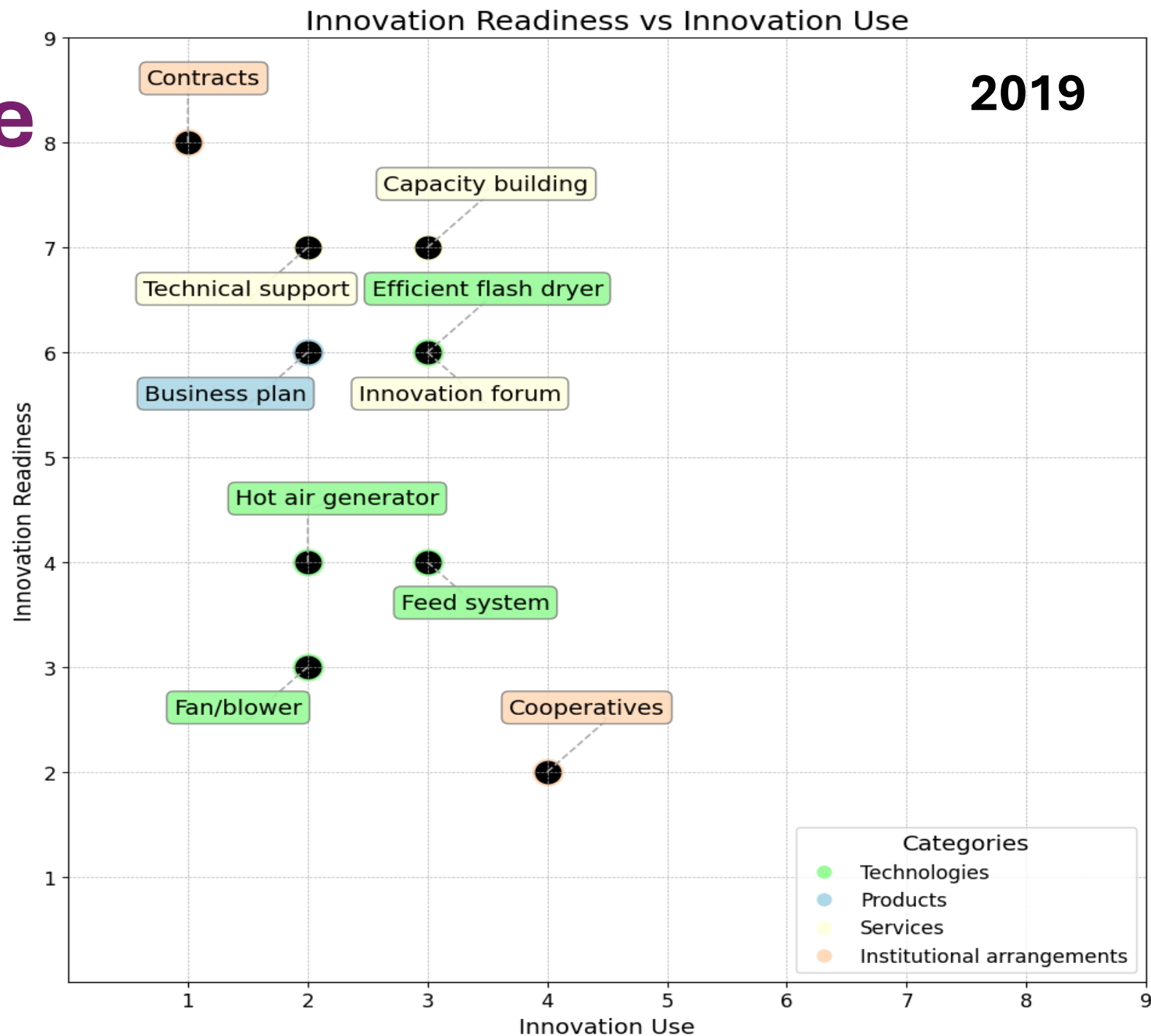
Dr. Thierry Tran
Project Manager
September 13, 2019

Lukman Adekunle ISHOLA
General Manager
HICKMAN VENTURES
Nigeria



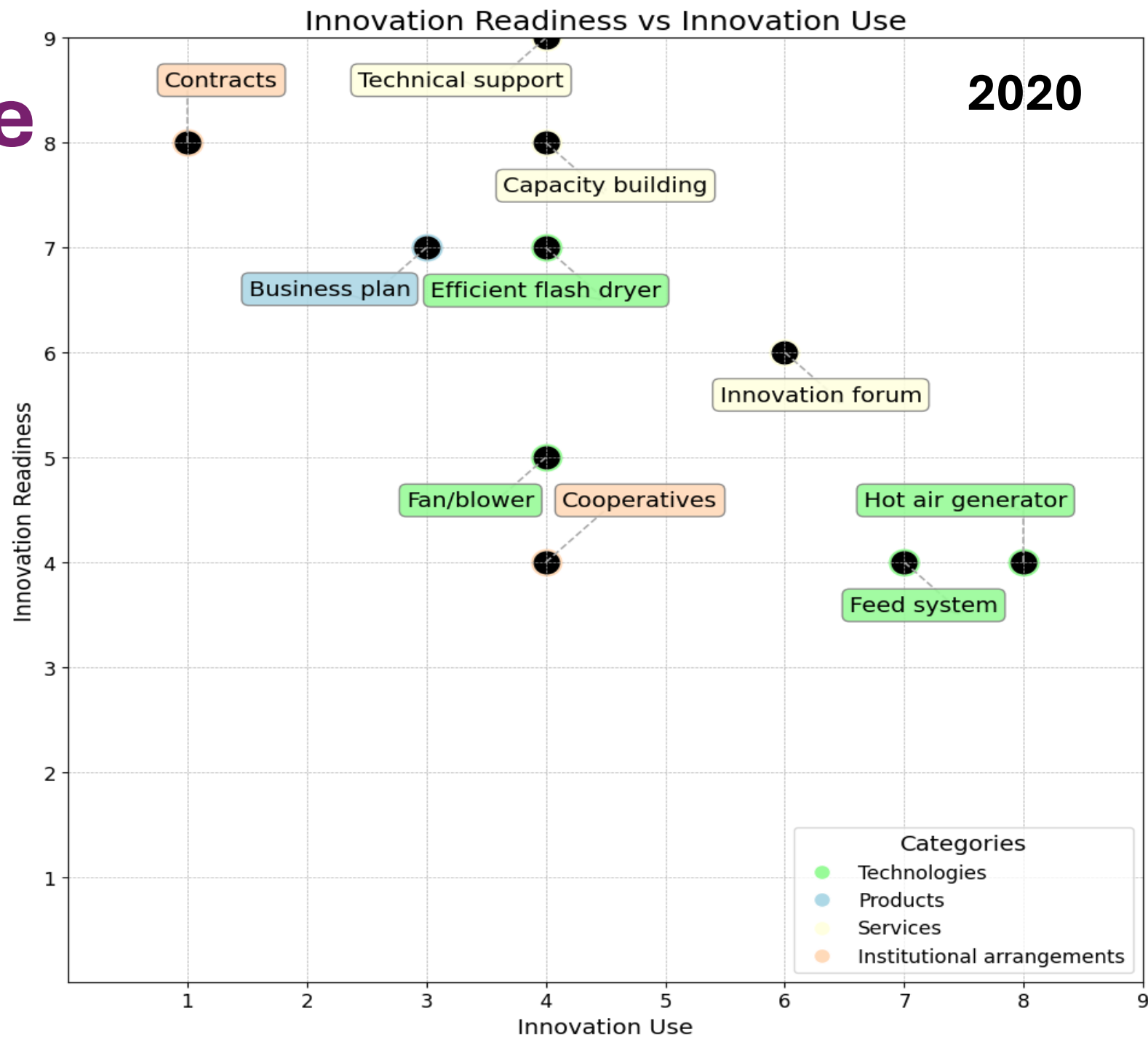
Step 5: Navigate

Evaluation of the innovation readiness and adoption progress of the Cassava flash dryer package in **D.R. Congo**, highlighting scaling differences between 2019 (project start) and 2020 (project end).



Step 5: Navigate

Evaluation of the innovation readiness and adoption progress of the Cassava flash dryer package in **D.R. Congo**, highlighting scaling differences between 2019 (project start) and 2020 (project end).



Step 5: Navigate



July 2019

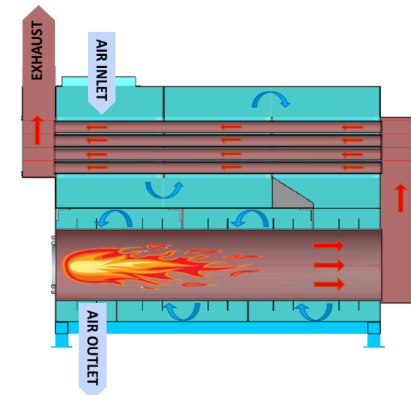


December 2019



December 2021

Example heat exchanger bottleneck:
Layuka- D.R. Congo



Step 5: Navigate



July 2019

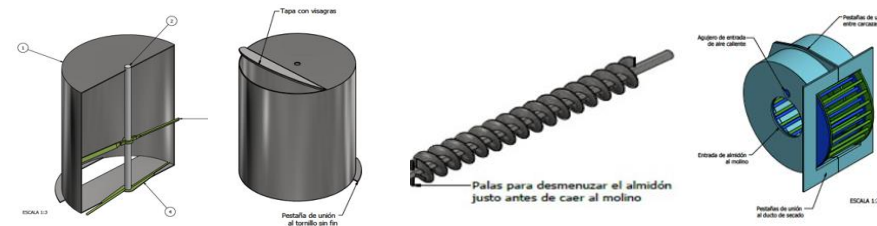


December 2019



December 2021

Example feeder system bottleneck:
NUTRIPRO D.R. Congo

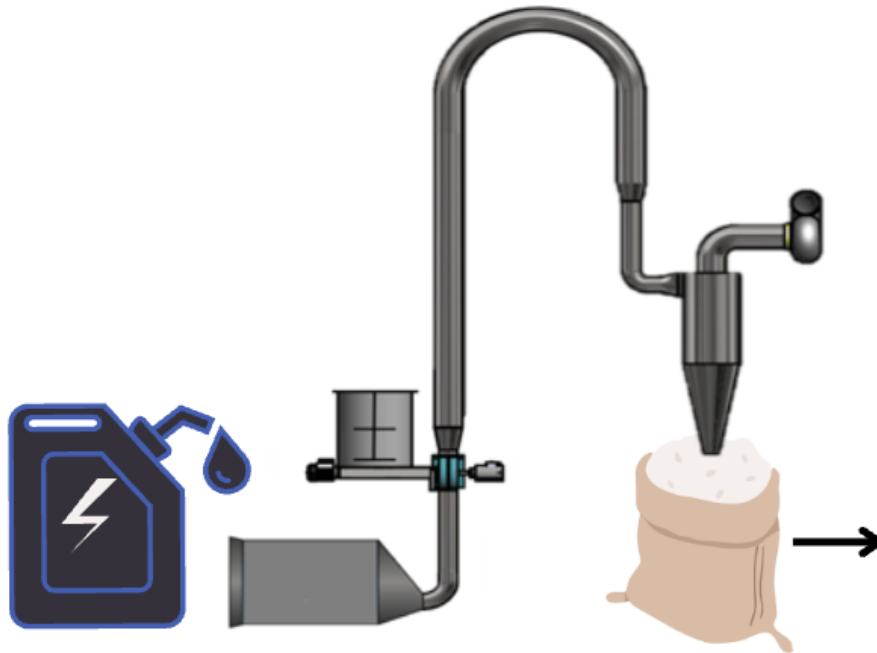


Step 5: Navigate

Performance tests applied to flash dryers in D.R. Congo demonstrate that the adoption of RTB flash drying innovations increases energy efficiency

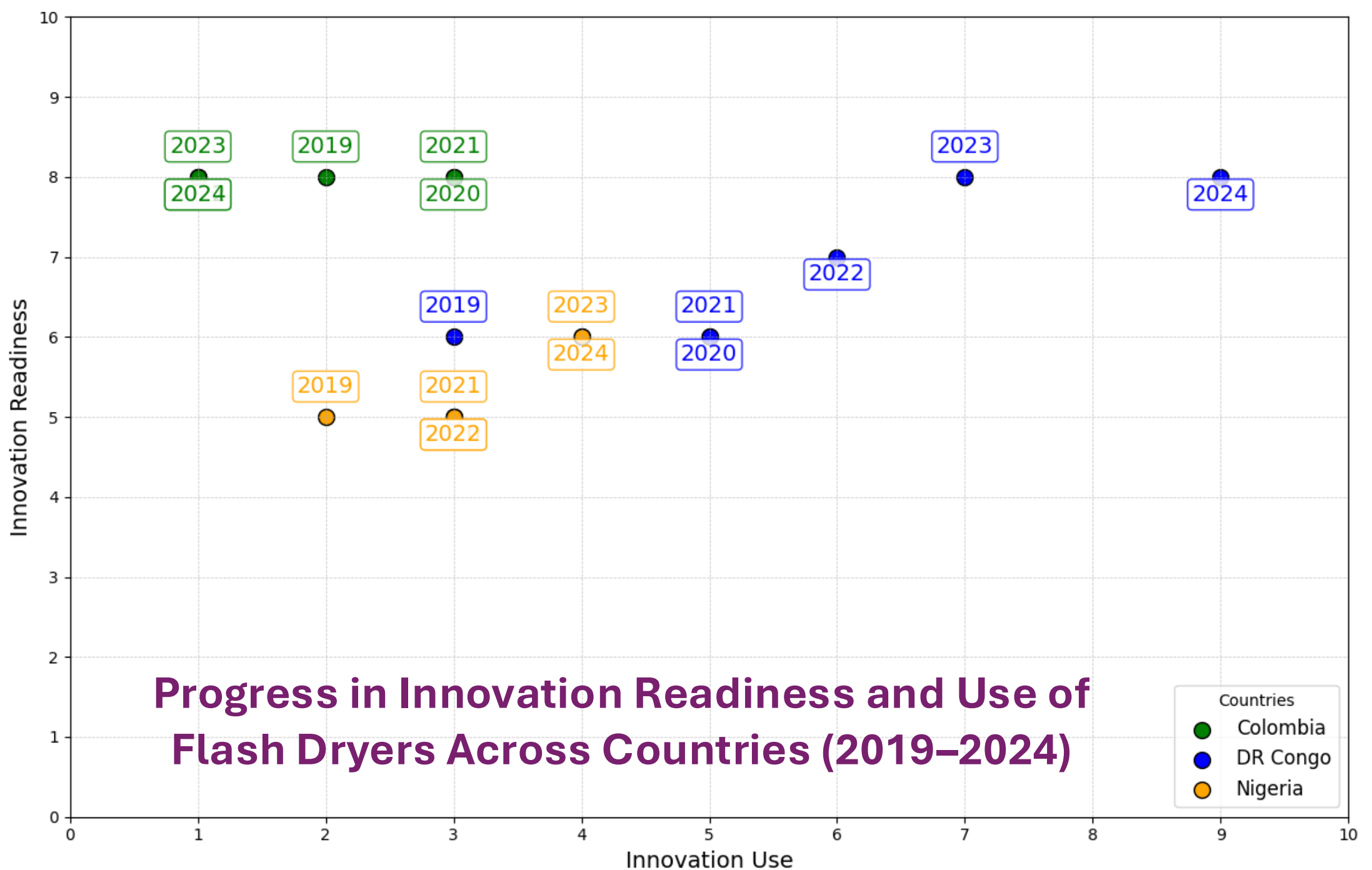
The blog presents how the performance tests applied to flash dryers in D.R. Congo in 2019 and 2022 demonstrate that the adoption of RTB flash drying innovations increases energy efficiency

Diagnosis at Nutripro in 2022 compared to 2019

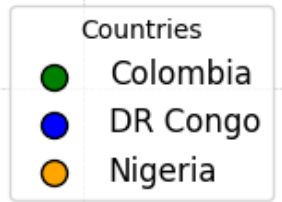


Diagnosis	2019	2022
Capacity	75-90 (Kg/hour)	245 (Kg/hour)
Fuel consumption	132 liters/ton	74 liters/ton
Fuel consumption rate	8 Kg cassava flour dried per liter of fuel	14 Kg cassava flour dried per liter of fuel

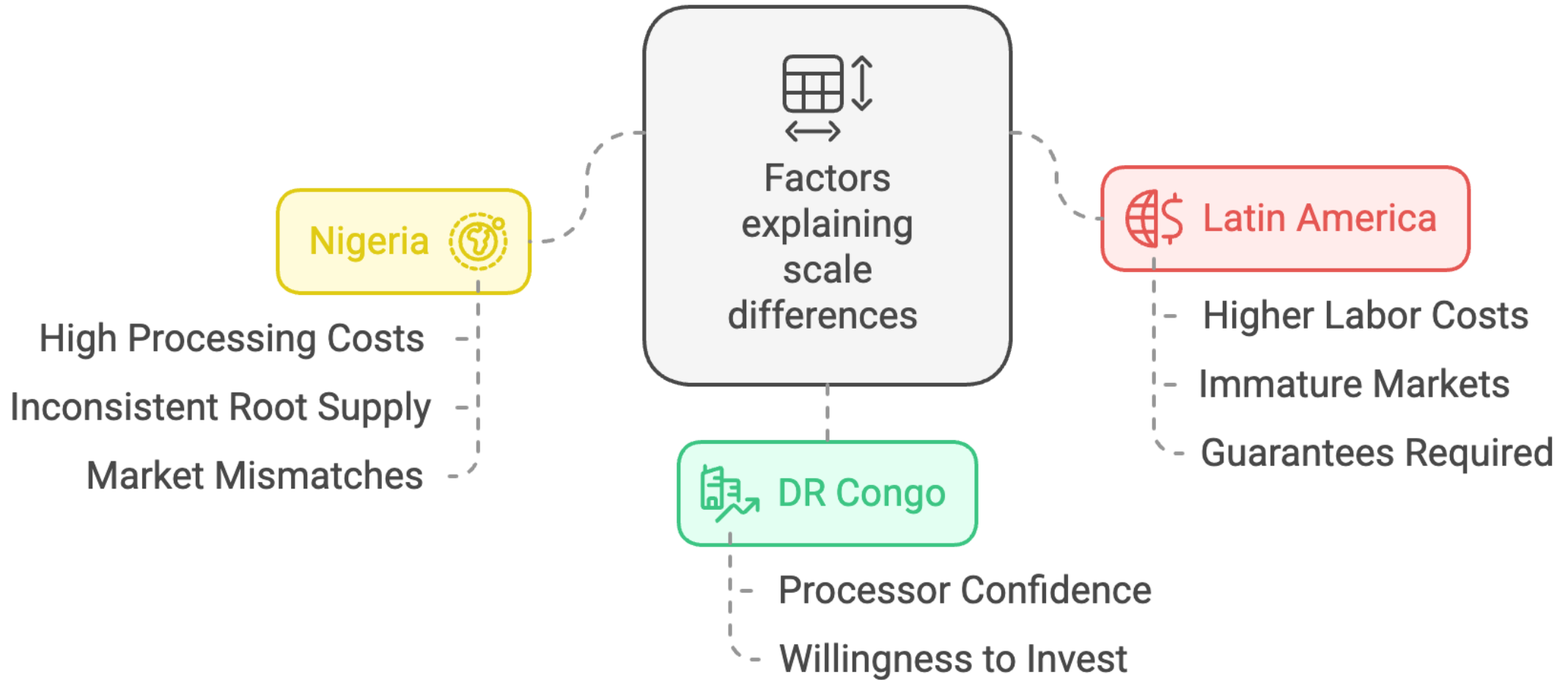




Progress in Innovation Readiness and Use of Flash Dryers Across Countries (2019–2024)



Variations in Innovation Adoption Across Three Countries



Conclusion: Pros and cons of scaling readiness

Holistic approach: take into accounts specific context and different dimensions of scaling: technical, socio-economic, local context and constraints, etc.

Separation of the innovation into smaller components (innovation package)

Visual mapping of the progress of each component, and prioritization of the components that need more attention

Relatively heavy to implement information to collect with partners at regular intervals during the scaling process -> requires dedicated time and funding.

Thank you



Please visit our web site:

<https://flashdryer.cirad.fr/>

