Breeding Crops to Feed 2.5 Billion Africans by 2050

The Value of SMART Breeding in Demand-Led Plant Breeding

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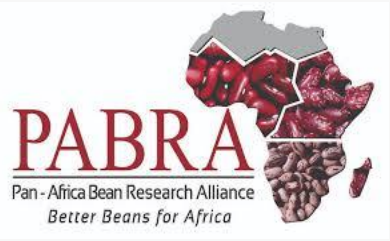
Outline

- DLB in brief: Definition and road map
- SMART Breeding: Definition, content and importance
- SMART Breeding and DLB implementation
- Use of Smart Breeding by DLB alumni
- Concluding remarks

What's DLB: African-Australian-Swiss Food Security Alliance



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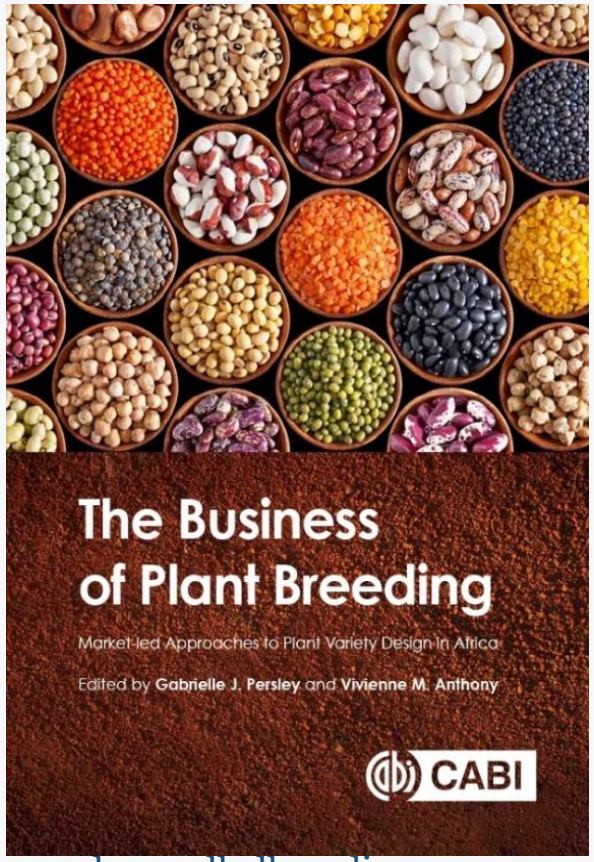
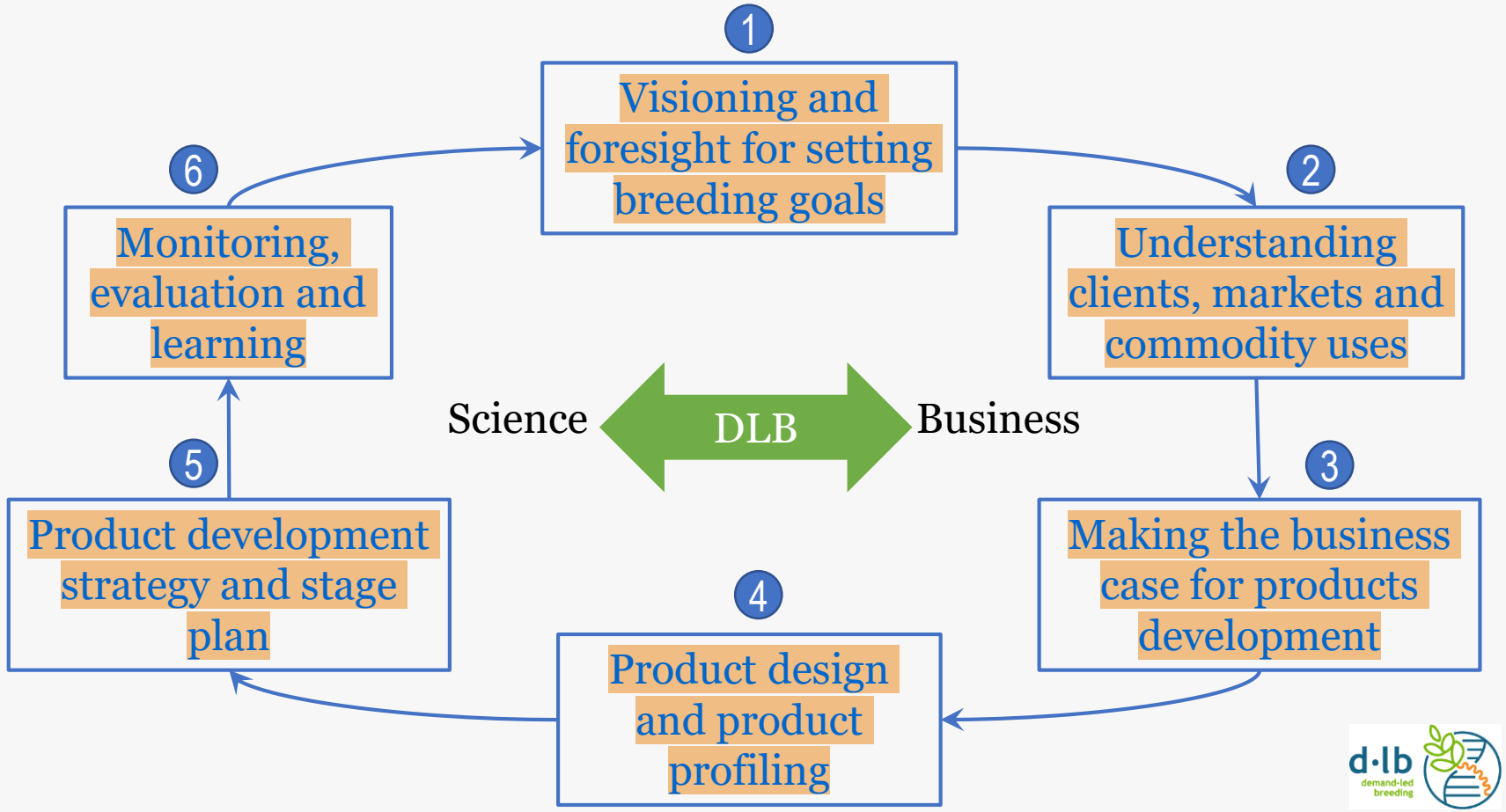
What's DLB: Definition and road map

DLB is NOT PPB but a new lens of developing modern, high-performing crop/livestock commodities sought after by smallholders and their markets





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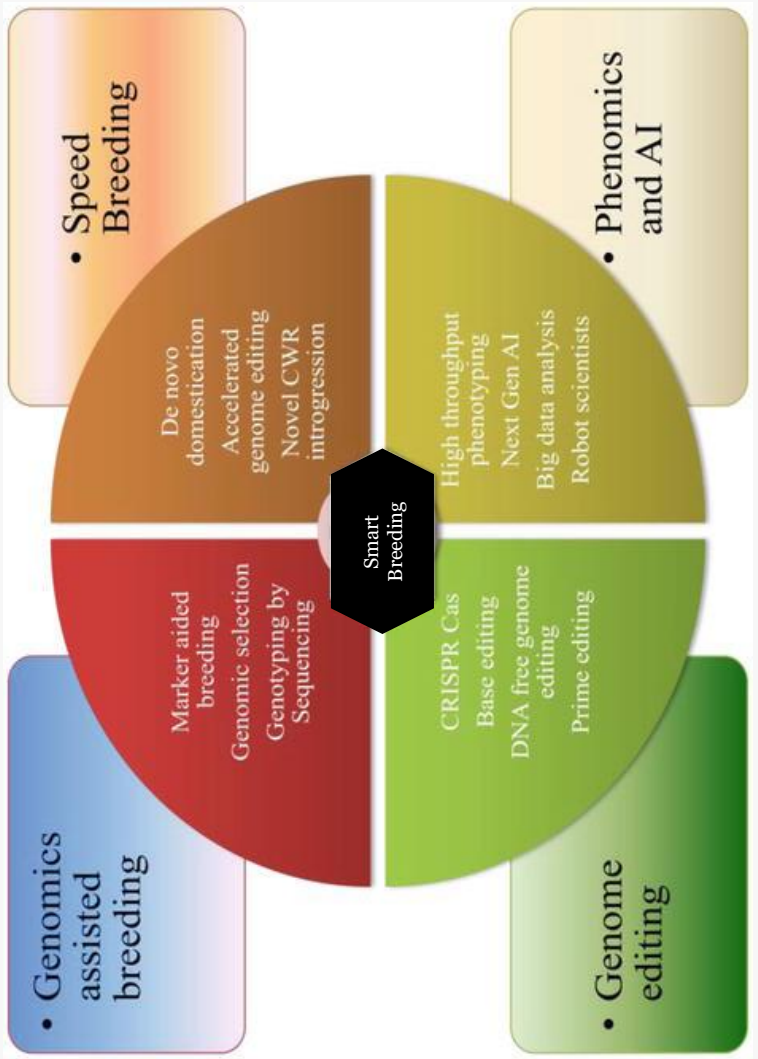
SMART Breeding: Definitions

- Breeding by **S**election with **M**arkers and **A**dvanced **R**eproductive **T**echnologies

- A combination of **conventional breeding** strategies with **advanced molecular, genomic and phenomic tools** to efficiently and effectively breed resilient crop cultivars with enhanced target traits.
  - * Common breeding approaches (RGA, DH, MABC, MARS, GS)
  - * Biotechnology-based breeding technologies (MAB, GM, GE)

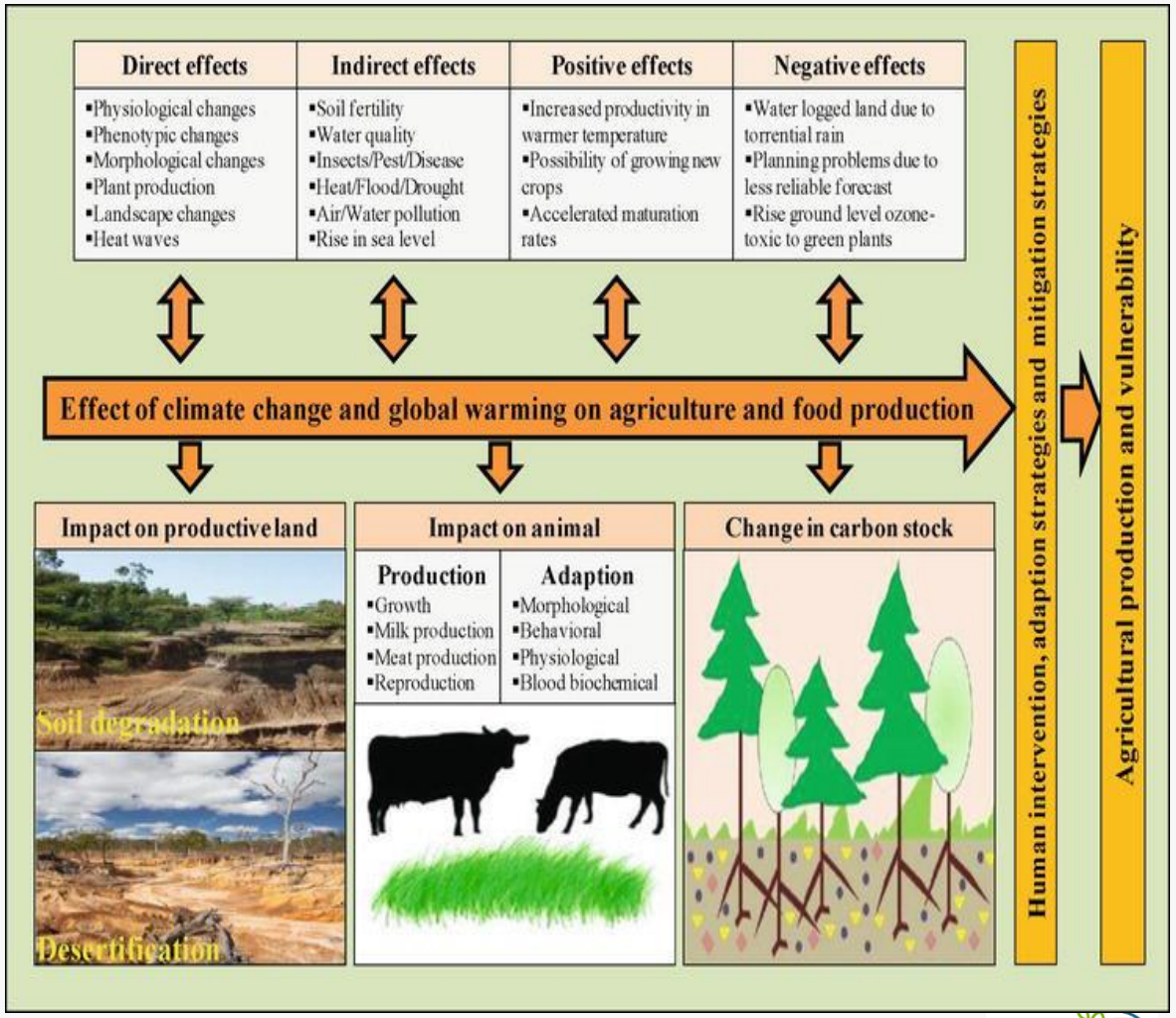
- A package including all strategies used for release of innovated commodities

- **DLB = Smart Breeding**



Visioning and foresight for setting breeding goal:

Artificial/Market Intelligence for constraints/opportunities identification

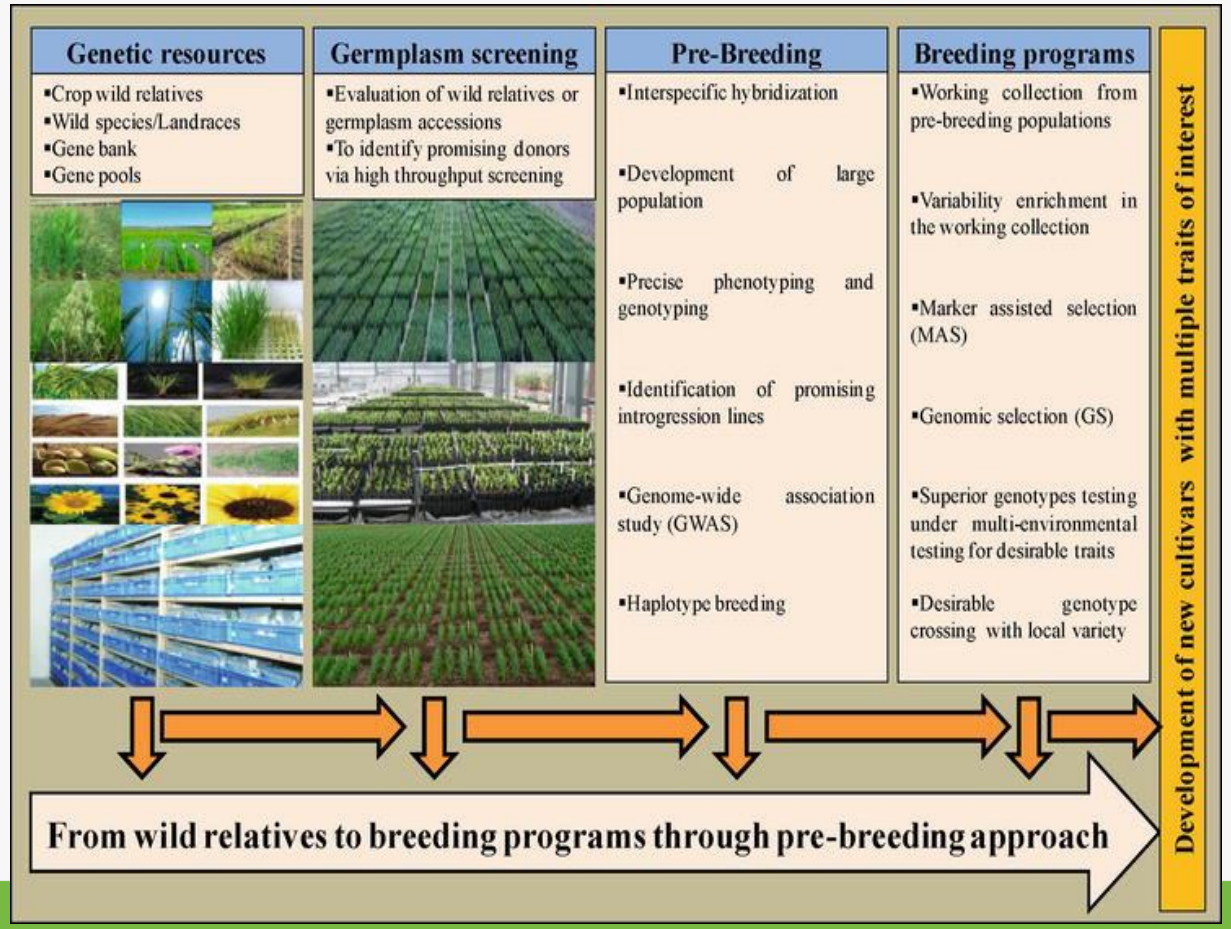


Visioning and foresight for setting breeding goal:

Artificial/Market Intelligence for constraints/opportunities identification

Strengthening pre-breeding

- ❖ Variability enrichment
  - Introduction of new/exotic germplasm
  - Artificial variability creation
- ❖ Genomic resources development
- ❖ Populations development (NAM, MAGIC)
- ❖ Population Enhancement
- ❖ TPEs



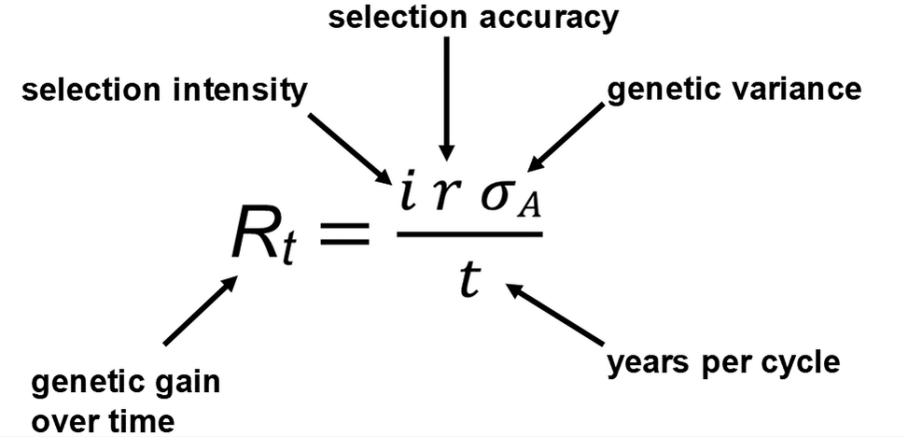
Making the business case for product development: Cas study for developing climate smart products

Market/Artificial intelligence inform on the opportunities and foresighted challenges for product development

Market/artificial intelligence for **economic and social** values estimation

The strength of the **pre-breeding program** informs on how efficient it can be in the timely release of the product

Genetic gain informs on how much progress is achieved or can be achieved

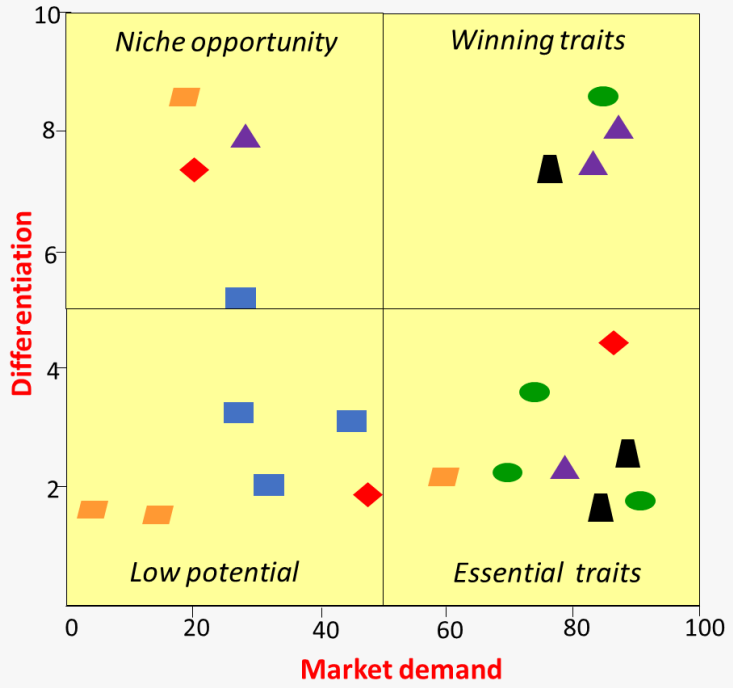


Product profile, trait prioritization and market segments

- Traits with **low genetic gain** can be dropped or given low credit in trait prioritization

- Index selection
  - * Traits with low genetic gain (allocate low weight)
  - * Traits negatively correlated (weight according to economic value and external standards)

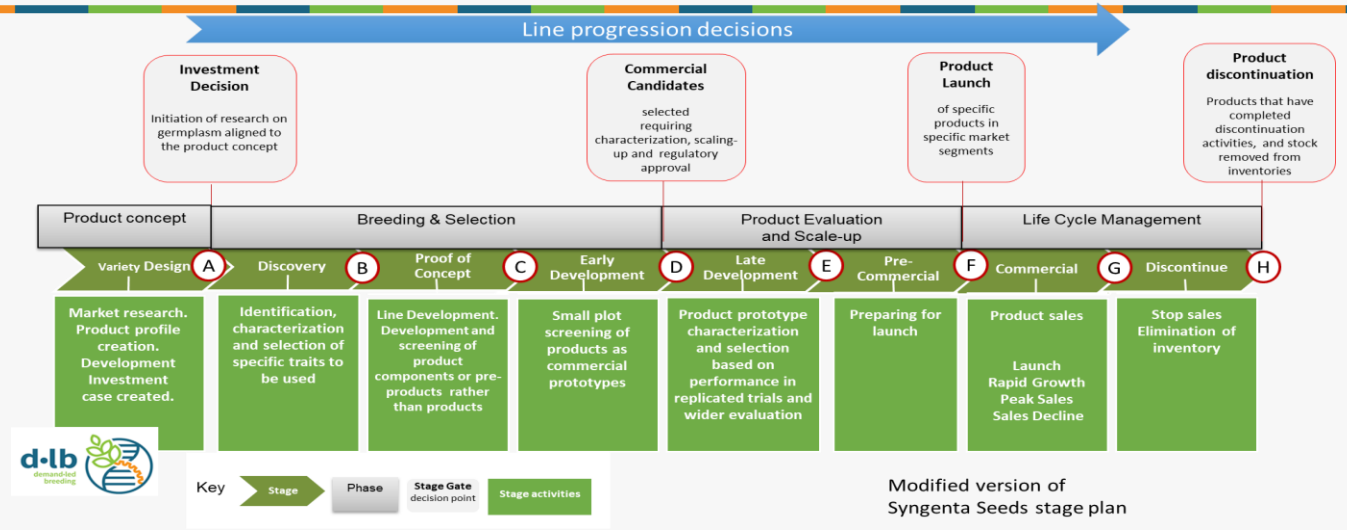
- Correlation analysis for indirect selection
  - * Trait hard to phenotype or negatively correlated

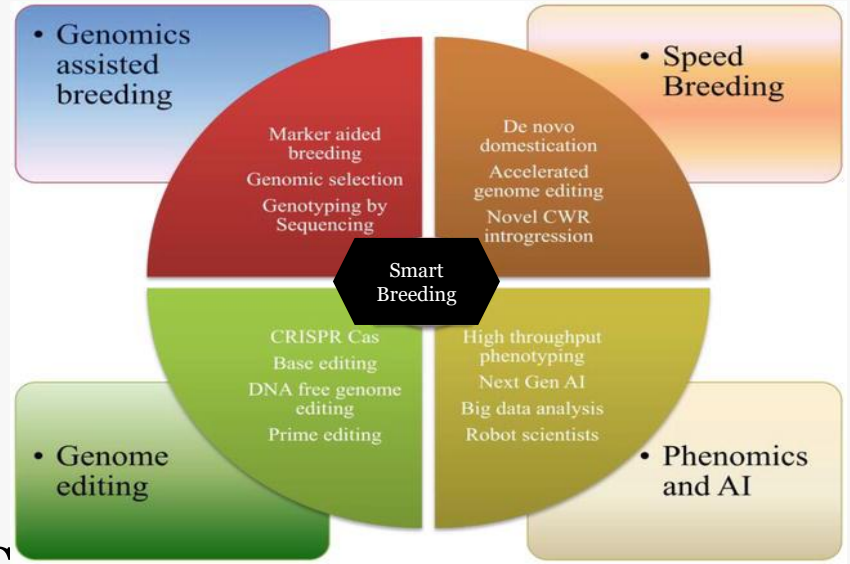


Technical feasibility

1. Genetics
2. Regulation constraints
3. Costs/budget

Product development strategy and stage gate system





- Application of molecular breeding tools: MAS, MABC, MARS, GS, GE
- High throughput phenotyping**:** Accurate experimental design, electronic data capture, drone
- Index selection**:** Multiple traits selection based on economic value, trait classification and ease to breed
- Quality control/Quality assessment tools
- Speed breeding/shuttle breeding

Monitoring, evaluation and learning

Branding of product for varietal identification and easy follow up

- Introducing a marker/branding trait for product/varietal identification (through GE?) during varietal development
- Branding trait may be allocated low weight during the **index selection** process
- Unique packaging/branding to differentiate the product on the market

Application of SMART breeding approaches by DLB Alumni

Prof Andrew Efisue

Target product profiling for several market segments for rice in Nigeria

Dr Bunmi Olasanmi

MAS to complement conventional breeding for disease resistance and high content beta carotene in Cassava

Dr Daniel Adewale

African yam bean diversity panel for low ANF and AYB reference genome through NGS technology

Dr Blessing Odogwu

GWAS for KASP markers associated with rust resistance for common bean improvement

Application of SMART breeding approaches by DLB Alumni

Mathieu Ayenan

Breeding tomato through DLB lens

Dr Luka Awata

Introgression and field validation of MLN QTLs into susceptible maize populations through MABC

Dr Astere Bararyenya

Continuous storage root formation and bulking study in Sweetpotato for accurate parental lines selection

Merci Wamalwa Zerehun Tadesse

Understanding allelic diversity in bread wheat in East Africa using KASP assay as a key to resilience

Concluding remark:
Mitigating the drawing back covariates in breeding!!!!!!

Build a strong foundation: Strong pre-breeding program

Right Approach: Breeding smartly

Breeding with a human face: DLB

Acknowledgements

THANK YOU

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