



# 2016 International Conference on Pulses

Concluding remarks

*CGIAR is a global research partnership for a food secure future*

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Marrakech, 16-18 April 2016

*Held under the auspices of the*

**Ministry of Agriculture and Fisheries  
Morocco**



Ministère de l'Agriculture  
et de la Pêche Maritime



**2016**  
International  
Conference on  
**PULSES**  
FOR HEALTH, NUTRITION AND  
SUSTAINABLE AGRICULTURE  
IN DRYLANDS

Marrakech, Morocco, April 18-20

=> 36 countries; 300 participants

=> 13 key note presentations

=> 41 oral presentations

=> 180 posters (7 themes)



# 1<sup>st</sup> portfolio of 16 CGIAR Research Programs (CRPs)

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- **MAIZE**
- **WHEAT**
- **GRiSP** (Global Rice Science Partnerships)
- **Roots, Tubers & Bananas**
- **Dryland Cereals**
- **Grain Legumes**
- **Livestock & Fish**

- **CRP for Managing & Sustaining Crop Collections**

- **Policies, Institutions & Market**

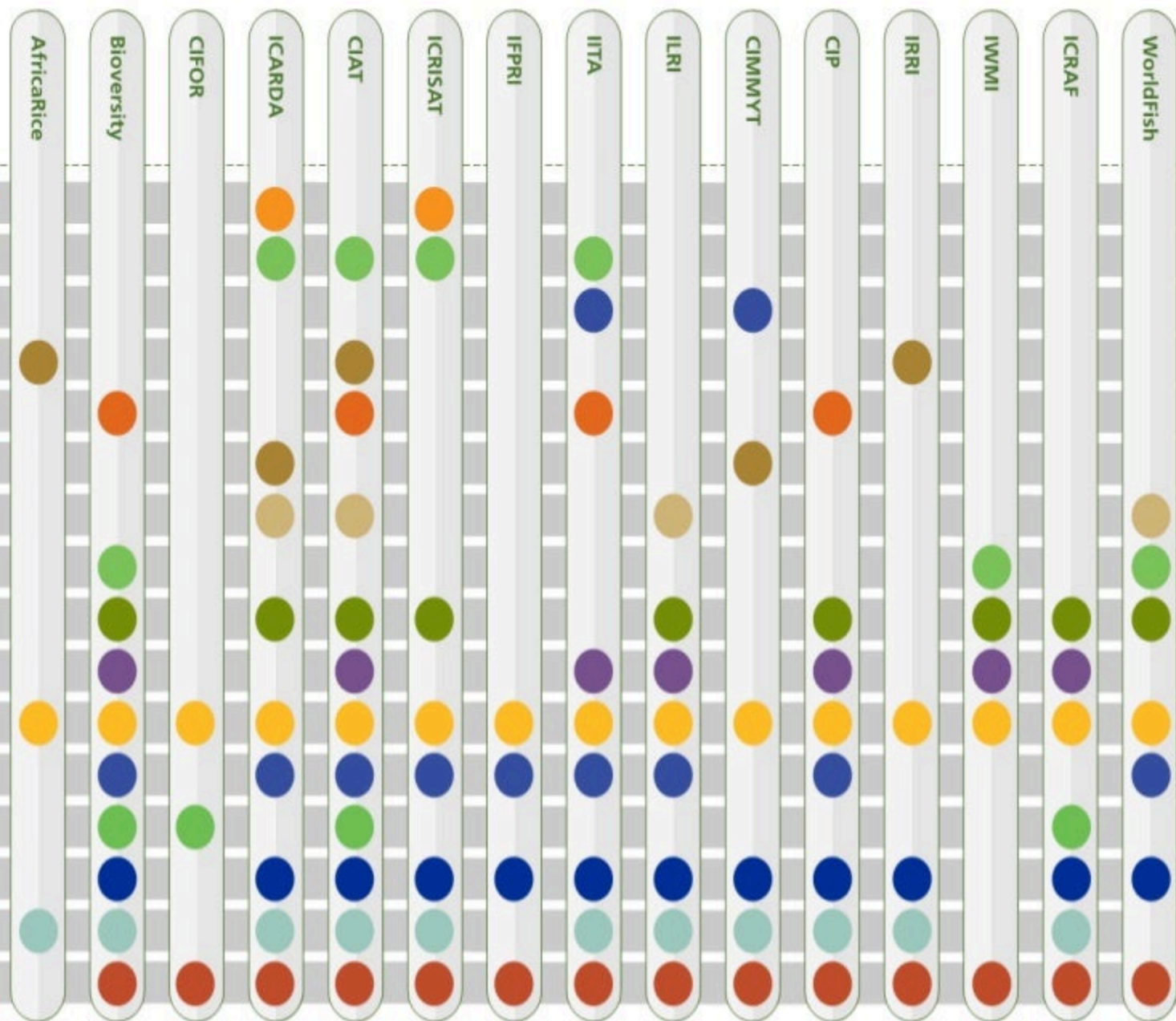
- **Agriculture for Nutrition & Health**

- **Humid Tropics**
- **Aquatic Agricultural Systems**
- **Dryland Systems**

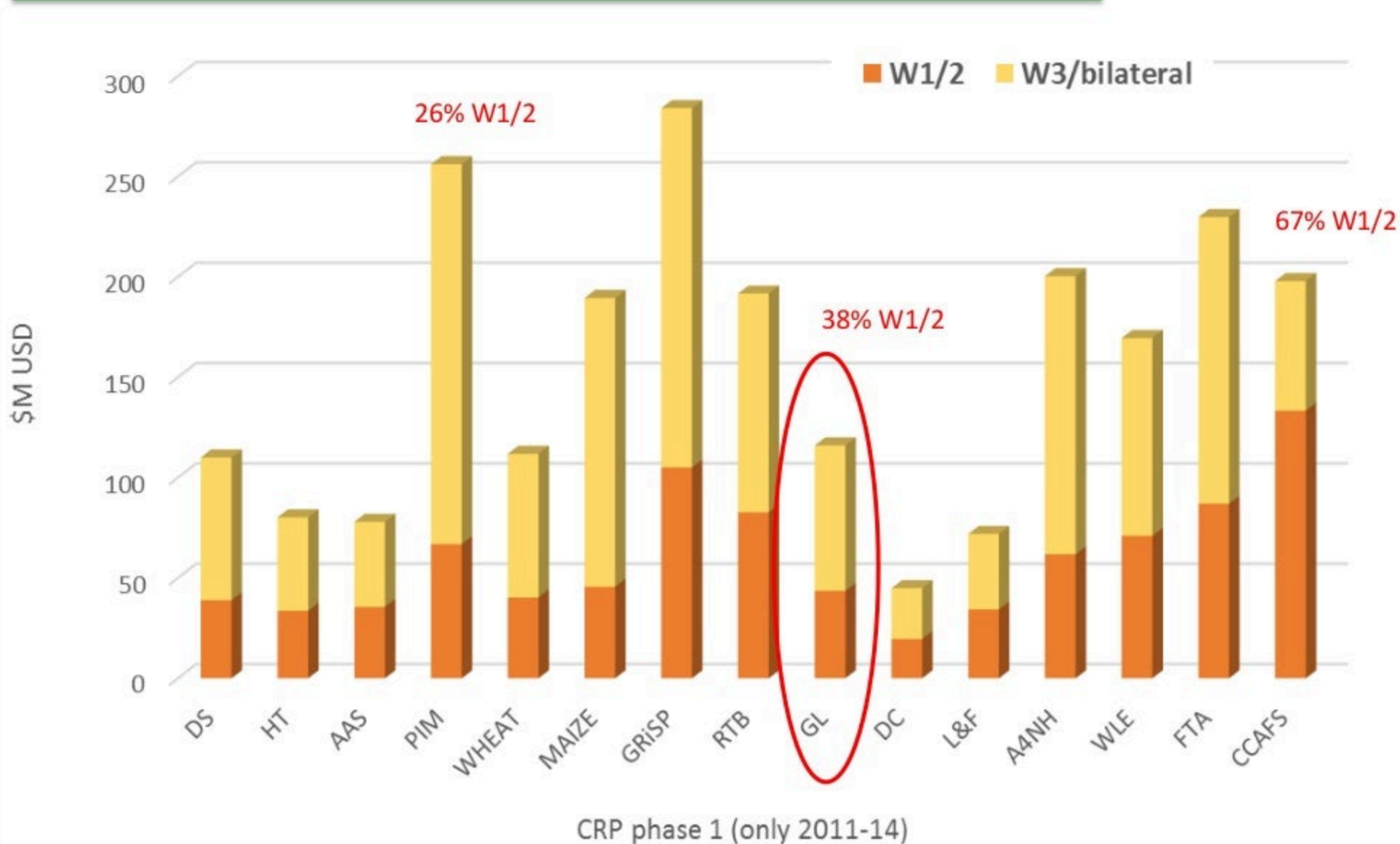
- **Climate Change, Agriculture and Food Security (CCAFS)**
- **Forests, Trees and Agroforestry (FTA)**
- **Water, Land and Ecosystems (WLE)**



# Research Programs



# CRPs total spent 2011-14



# CGIAR Strategy 2017–2030

**CGIAR's Strategy and Results Framework (SRF)** 2017–2030 is ambitious. It defines our aspirations and strategic actions to deliver on our mission.

**Our Vision:** A world free of poverty, hunger and environmental degradation

CGIAR has 3 ambitious goals, **System Level Outcomes (SLOs)** for 2030, through which we aim to:



REDUCE  
POVERTY

IMPROVE  
FOOD AND  
NUTRITION  
SECURITY

IMPROVE  
NATURAL  
RESOURCES AND  
ECOSYSTEM  
SERVICES

# System Level Outcome (SLO) 1

## Reduced Poverty



## 2030 Targets

- 350 million more farm households should have adopted improved varieties, breeds or trees, and/or improved management practices
- 100 million people, of which 50% are women, assisted to exit poverty

This outcome contributes directly to the achievement of the following United Nations Sustainable Development Goals



**1** NO POVERTY



**2** ZERO HUNGER



**3** GOOD HEALTH AND WELL-BEING



**5** GENDER EQUALITY



**8** DECENT WORK AND ECONOMIC GROWTH



**10** REDUCED INEQUALITIES

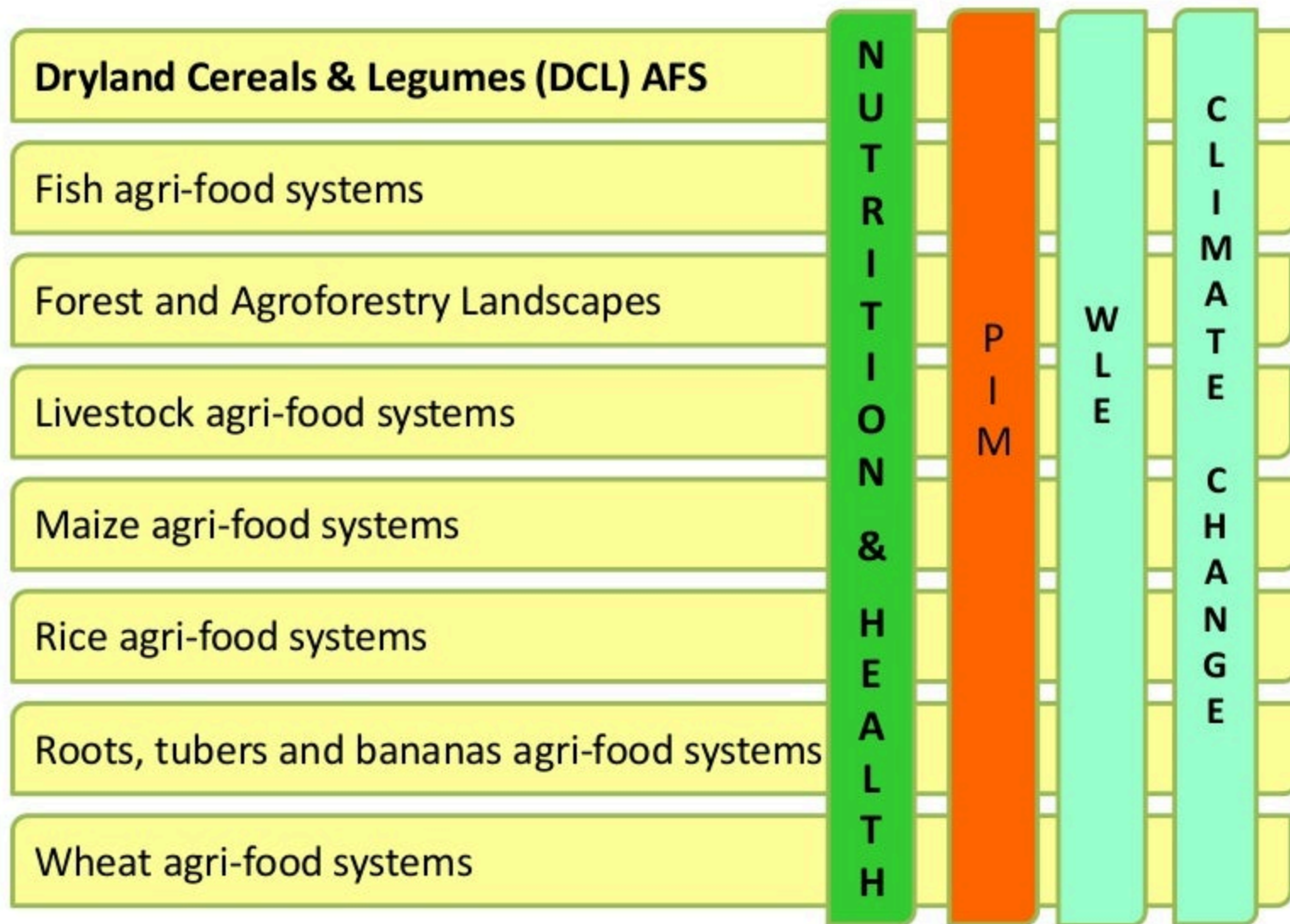


**17** PARTNERSHIPS FOR THE GOALS





## 8 Agri-Food System programs



4 Global Integrating programs

## 3 Platforms

Genebank

Genetic Gains

Big Data & ICT

# From Commodity to Agri-Food Systems CRPs

	Commodity CRP	Agri-Food System CRP
Focus	Crops	<ul style="list-style-type: none"> <li>• <b>Agri-Food System</b> = network of stakeholders, processes and interactions for <b>growing, processing, distributing, consuming, handling</b> a group of <b>crops/livestock/fish/trees</b></li> <li>• Complexity &amp; interconnections with <b>environmental factors</b> and the consequences of <b>globalization</b></li> <li>• From <b>inputs delivery</b> &amp; farmer training to product packaging and marketing, waste recycling, etc...</li> <li>• Emphasis on productivity through <b>sustainable intensification</b> and value adding along agri-food value chains</li> </ul>
SLOs / IDOs	<p>&gt; Increasing productivity</p> <p>&gt; Improved food safety</p>	<ul style="list-style-type: none"> <li>- Increasing productivity</li> <li>- Improved food safety &amp; nutrition</li> <li>- <b>Increased incomes and employment</b></li> <li>- <b>Enhanced smallholder market access</b></li> <li>- <b>Improved human and animal health through better agricultural practices</b></li> </ul>
Collaborating w/ GIs Global Integrated CRPs		<ul style="list-style-type: none"> <li>- <b>Improved diets for poor and vulnerable</b></li> <li>- <b>Natural capital enhanced and protected especially from climate change</b></li> <li>- <b>More sustainably managed agro-ecosystems</b></li> <li>- <b>Enhanced benefits from Ecosystems goods and services</b></li> </ul>

# Multi- & inter-disciplinarity

## Ecological Intensification

- Intercropping
- Integrated Pest Management
- Conservation farming
- Organic farming



## Genetic Intensification

- Higher yields
- Improving nutrition
- Resilience to pests and diseases
- Resilience to climate change
- Creating sustainable livelihoods



## Socio-economic Intensification

- Creating enabling environments
- Markets
- Building social capital
- Building human capital
- Creating sustainable livelihoods



# Dryland Cereals & Legumes AFS (Full proposal)



<http://www.cgiar.org/our-strategy/second-call-for-cgiar-research-programs/cgiar-research-programs-platforms-full-proposals-for-review/>

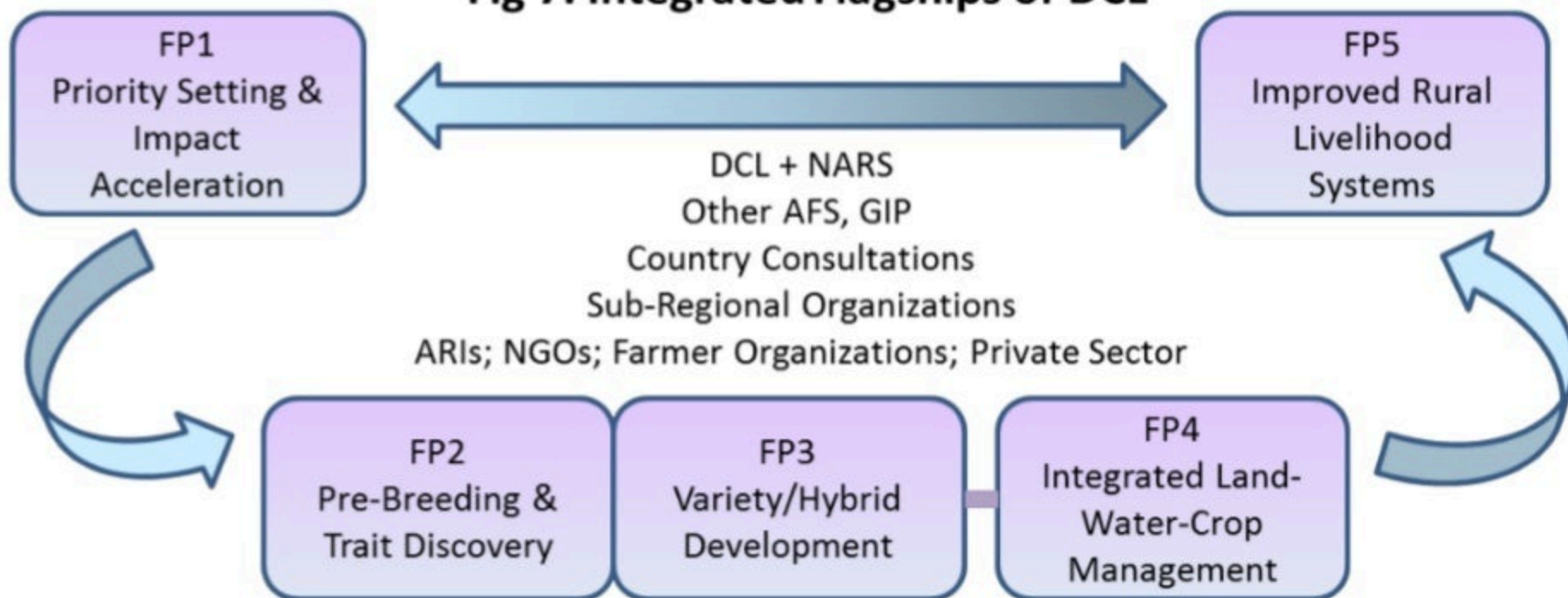
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# Dryland Cereals & Legumes AFS (Full proposal)

**Fig 7. Integrated Flagships of DCL**



## FP2 Pre-breeding & Trait discovery

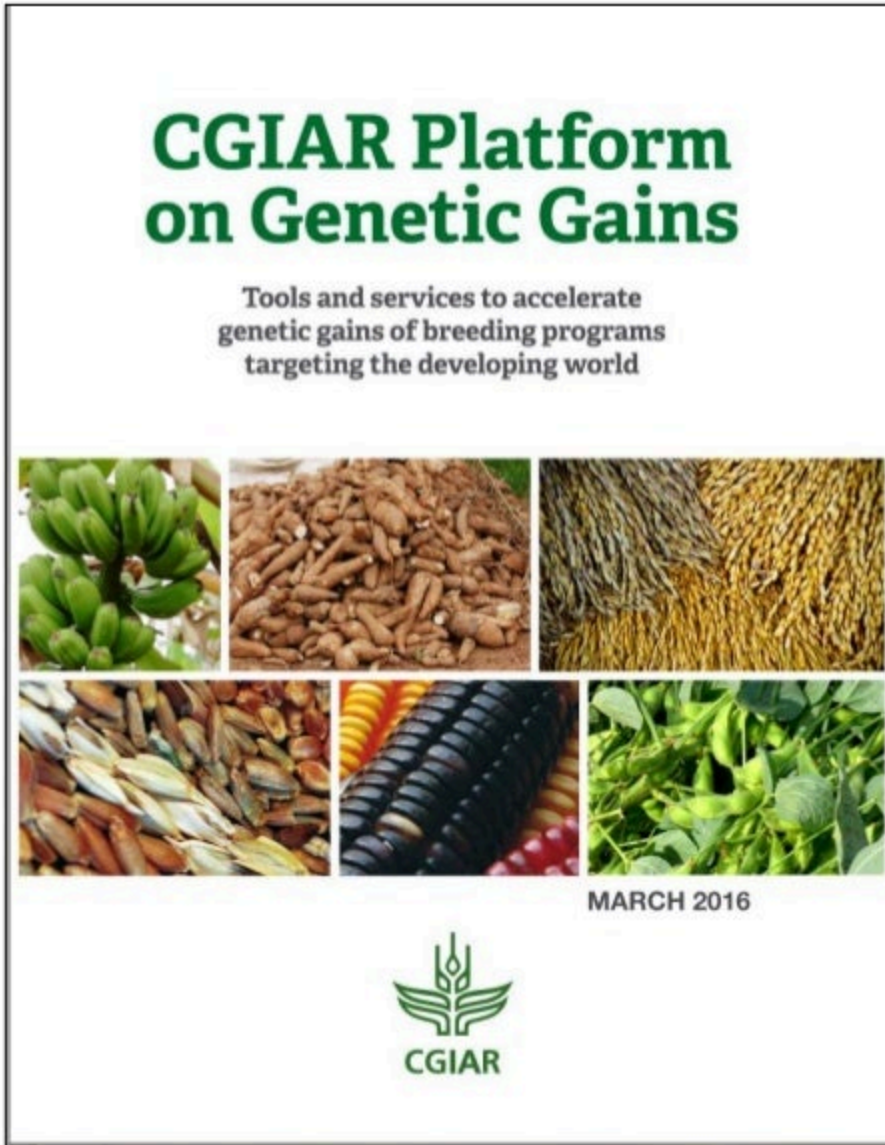
- CoA 2.1 Pre-Breeding
- CoA 2.2 Trait Discovery
- CoA 2.3 Enabling Technologies

### *Session 3 Innovations in Pulses Genomics*

- WGRS (whole genome resequencing) on chickpea (500) and diversity, gene loss, domestication
  - lentil genome assembly (4,3Gb!!!), 7 pseudomolecules, 6 high resequencing 400 accessions (RADSeq) => 4 pops w/ specific (phenotyping + MMs)
  - Genome-wide SNPs identification for new linkage maps, QTL mapping for seed mineral nutrient concentration
  - Sequence variation analysis in pigeonpea (3Tb of data, 416 lines, 5x to 12x)
- => genomics, mapping populations, QTL discovery, Trait performance, SNP discovery (and validation)



# Genetic Gains platform proposal (2017-22)



Module 1: Breeding Program Excellence

Module 2: Trait discovery, breeding tools & services

Module 3: Genotyping/sequencing tools & services

Module 4: Phenotyping tools & services

Module 5: Bioinformatics and data management tools & services

<http://www.cgiar.org/our-strategy/second-call-for-cgiar-research-programs/cgiar-research-programs-platforms-full-proposals-for-review/>



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## FP2 Pre-breeding & Trait discovery

- CoA 2.1 Pre-Breeding
- CoA 2.2 Trait Discovery
- CoA 2.3 Enabling Technologies

## Session 7

### *Innovation in Pulses Breeding*

- Earning from animal to plant breeding for increased genetic gain
  - Speeding up the generation time (flowering, growth, In vitro/in vivo, a-SSD)
  - GMOs, playing w/ heterosis, breeding for nutritional quality
- ⇒ Genome editing ?
- ⇒ Reverse breeding ?

### *Session 5 Pulses Genetic Resources: Conservation and Utilization*

- Efficient conservation (core/mini collection, FIGS, redundancy checking)
- Passport Data Management & Tool
- Characterization: HTP Genotyping (GbS, Resequencing), phenotyping, data mgt.
- Geo-location & data



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## FP3 Variety/hybrid development

- CoA 3.1 Environmental Classification and Target Population of Environments
- CoA 3.2 Phenotyping
- **CoA 3.3 Variety and Hybrid Development**
- CoA 3.4 Science of Seed Delivery

### *Session 6 Opportunities for Enhancing Pulses Production*

- Starting w/ **farmers' demand** [Whole crop focus ↔ grain focus], [biomass yield ↔ biomass quality], **leading to breeding decisions** (yield, stress, quality, etc...)
- Pulses => Multi-trait approach
  - => Multi-purpose crops
  - => Mix crop livestock system
- **Sharing facilities and knowledge:** eg NIRS ... but also genotyping, phenotyping, bioinformatics, seed multiplication, seed QC, etc... => Genetic Gains platform

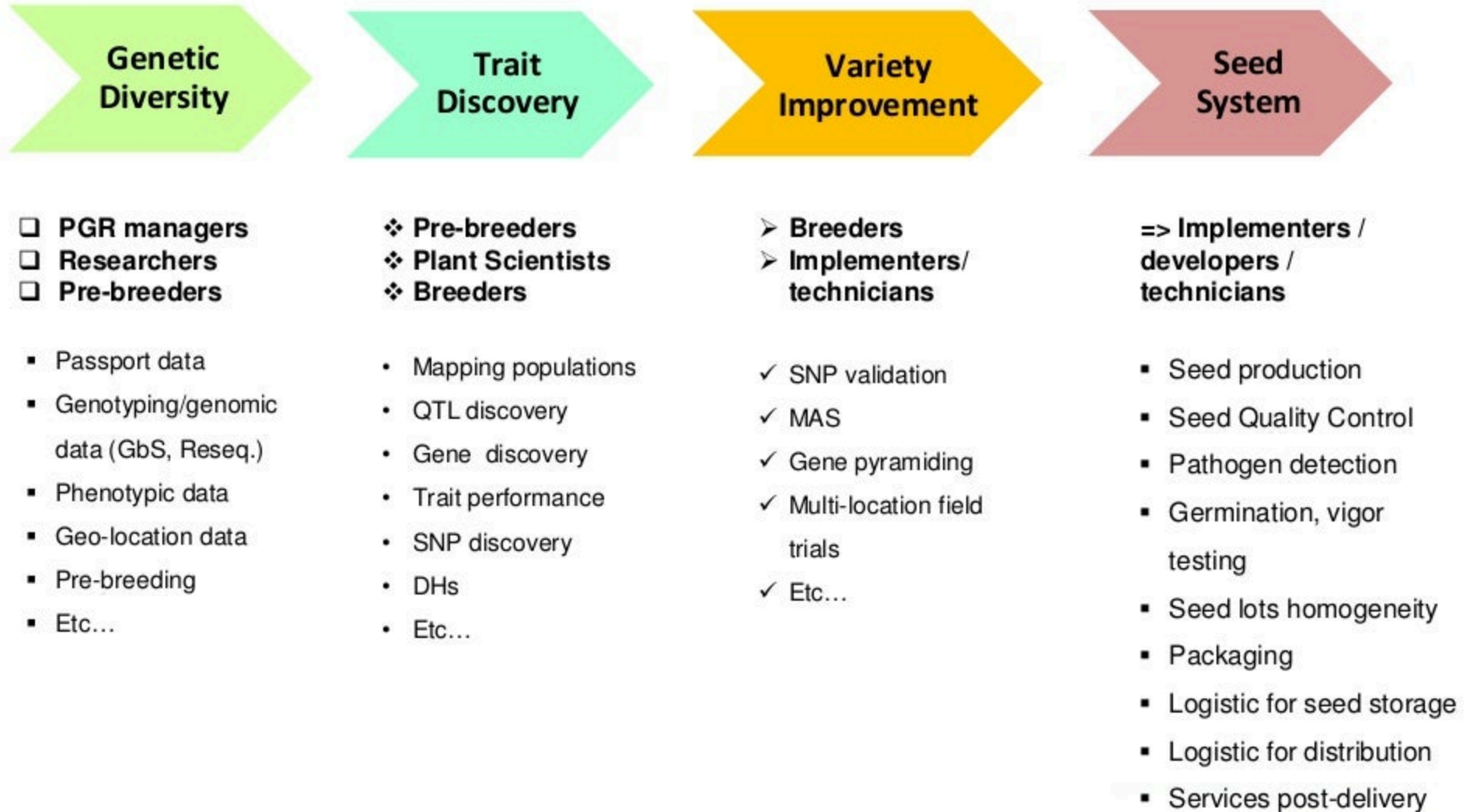
## FP3 Variety/hybrid development

- CoA 3.1 Environmental Classification and Target Population of Environments
- CoA 3.2 Phenotyping
- CoA 3.3 Variety and Hybrid Development
- **CoA 3.4 Science of Seed Delivery.**

### *Session 6 Opportunities for Enhancing Pulses Production*

- Filling the **yield gap** from research plots to farmers' real life (3,6 to 1,5 t/ha faba bean, Ethiopia... but same gaps in other countries and crops)
- => technician/developers for agronomic technology and know-how transfer ... "**seed & services**"?
- From 31 faba bean improved varieties to 10 produced => **seed production**
- Gap demand ↔ supply and 70% non adopters vs 25% full adopters and only 6% certified seeds => broader issue w/ the whole **seed system**

# Breeding pipeline and seed delivery



## FP3 Variety/hybrid development

### ➤ CoA 3.4 Science of Seed Delivery.

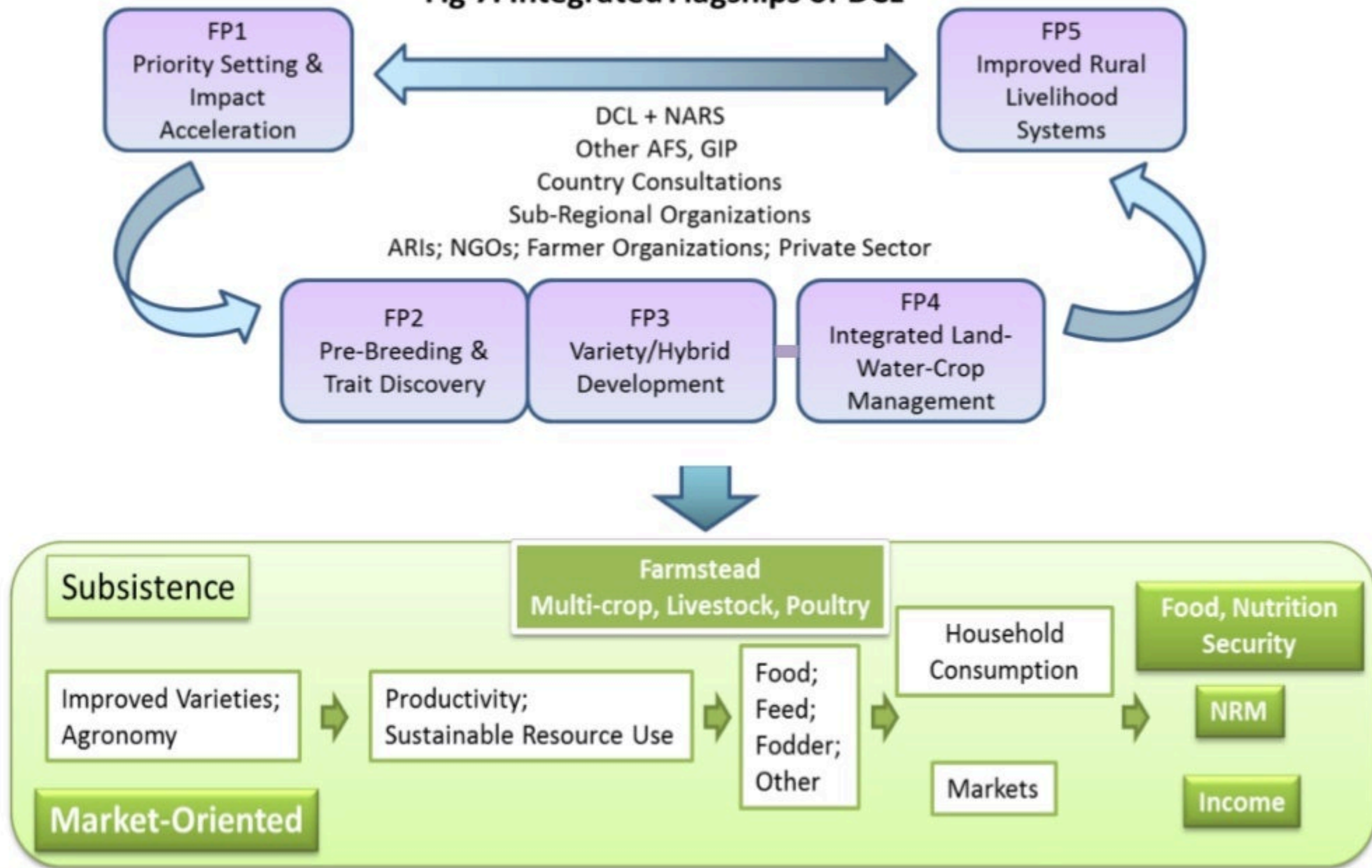
#### *Session 6 Opportunities for Enhancing Pulses Production*

**Urgent need** for sustainable & reliable **Seed System**: production, storage, dissemination

- **Funding support ???** if not highly profitable business (eg GL, DC)
- **Different models** to set up formal seed systems?
  - **VBSE**: Village Based Seed Enterprise; eg cowpea, chickpea in India, other
  - **Seed consortium** including farmers cooperatives, NGOs, CGIAR – donors' interest?- NARS, development agencies => Who must fund this effort?
  - **Innovation Platforms**
  - **Agribusiness Village Resource Centers**
- Bridging the gap between Research & Development => **more skilled developers**
- More **science on scaling out**, on **monitoring progress**, on **evaluating impact**

# Dryland Cereals & Legumes AFS (Full proposal)

**Fig 7. Integrated Flagships of DCL**



## Concluding remarks (i)

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- 1) Change in scientific culture: reality is **multidimensional**, so is knowledge
- 2) Complex challenges ahead require **more integrative** and **collaborative approaches for CRP phase 2**: (a) cross-Centers, eg DCL, (b) cross-CRPs and their stakeholders (eg Site integration)
- 3) **Multi- & inter-disciplinary** AND **multi- & inter-institutional** approaches w/ many partners produced + relevant, + robust results that uni disciplinary and uni institutional approaches ... “the nexus approach” (Pr. Rattan Lal)
- 4) Multi- and inter-disciplinary work with **transformative integration of many sciences** (life, natural, social, human health, mathematical, etc...) is still challenging (eg natural x social scientists)
- 5) Need of **truly innovative solutions** to large-scale, complex problems, **not only technological** = social, institutional, organisational & behavioural innovations (eg VBSE, Seed Consortia, Innovation platforms, etc...)

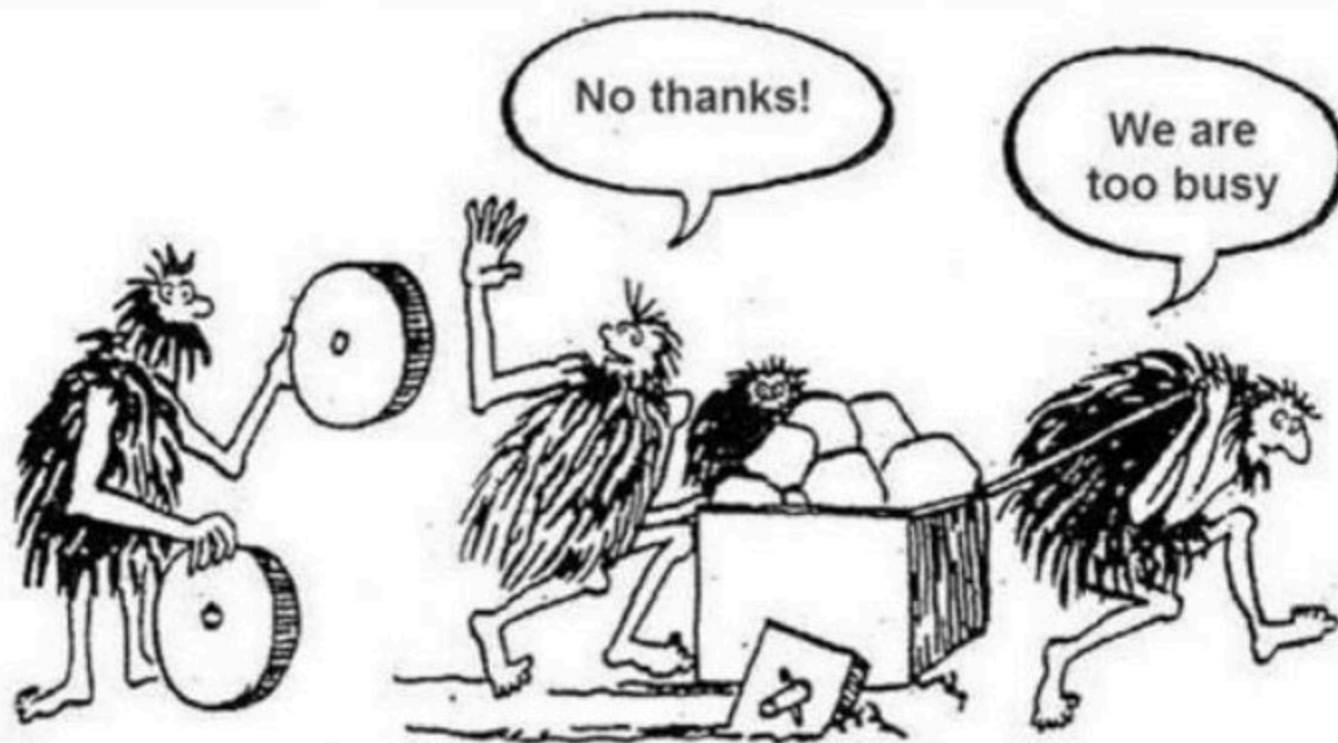
## Concluding remarks (ii)

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- 6) Challenge for 2050: **Sustainable Intensification of Agriculture**
  - Pulses key value: (1) Nutritional – protein, food and feed, (2) agronomic and environmental (soil fertilization, NRM), (3) socio-economic (poverty alleviation, employment, youth, gender)
  - **DCL makes sense**, eg dryland Agroecosystems, mix / rotation cropping systems for sustainability and diversification of targeted AFS.
  - Predictive models, big data, Ag-management practices and their combinations => innovative solutions to **improve resource use efficiency and productivity**
- 7) Programs better tuned to understanding processes in **scaling up innovations & policy influence** (eg science of scaling; actions on VCs)
- 8) Re-balanced **CRP structure** – eg commodity to AFS – **and Portfolio (8+4+3)** to squarely address nutrition, health, policy influence, environmental footprint
- 9) **Long-term funding stability (\$\$\$)**

## 10) "Accepting personal responsibilities" (Pr. Rattan Lal)

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*Thanks a lot for your attention...*



# Dryland Cereals & Legumes AFS (Full proposal)



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# Added-value of pre-breeding ? (CGIAR survey, Jan 2015)

