



Investing in agricultural research and agricultural biotechnologies **2 March 2010, ABDC – 10, Mexico**

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Enabling poor rural people
to overcome poverty

I. Recent trends: Rural poverty and hunger is stable or increasing in much of sub-Saharan Africa and some other low income countries in Latin America and Asia



- 2 billion live on less than \$2 per day
- Over 1 billion hungry people in the world (June 2009), 100 million more than in 2007
- 642 million in Asia and the Pacific
- One third of the population affected in sub- Saharan Africa
- Food emergencies in 31 countries

II. The ARD challenge: drivers of the soaring food prices

- Increased demand from rapidly developing countries, e.g., China
- Poor harvests due to variable weather, possibly related to human induced climate change
- Lack of agriculture investment and consequent reduction in productivity growth
- Increased use of biofuels, especially maize in the US
- High energy prices, hence fertilizer prices
- Export bans from some large exporting countries
- Speculation on the commodity markets

III: Agricultural supply problems due to:

- Lack of agriculture investment and consequent reduction in productivity growth
 - Cereal yields increasing at 1-2% p.a. now, compared to 3-6% p.a. in the 1960s-1980s
- Low investments in agricultural research: 0.42% of agricultural output in Asia, 0.65% in Africa, 1.1% in LAC (over 5% in developed countries)
- Transport, marketing and farm input price increases as oil prices increase
- Land degradation
- Substitution of bio-fuels for food (for maize)
- Government policy deficiencies, panic in food markets
- Climate change may be exacerbating the slow food production response, and exacerbating poverty

Investment in the agricultural sector: Government spending and donor aid declining

Share of total government spending on agriculture

Year	Africa	Asia	Latin America	Total (weighted average)
1980	6.4%	14.8%	8%	11.3%
1990	5.2%	12.2%	2%	7.9%
2002	4.5%	8.6%	2.5%	6.7%

Source: DFID/ World Bank 2007

Donor Aid to developing countries: Share of agriculture

1980	20%
1990	15%
2006	4%

Source: IFPRI, April 2009

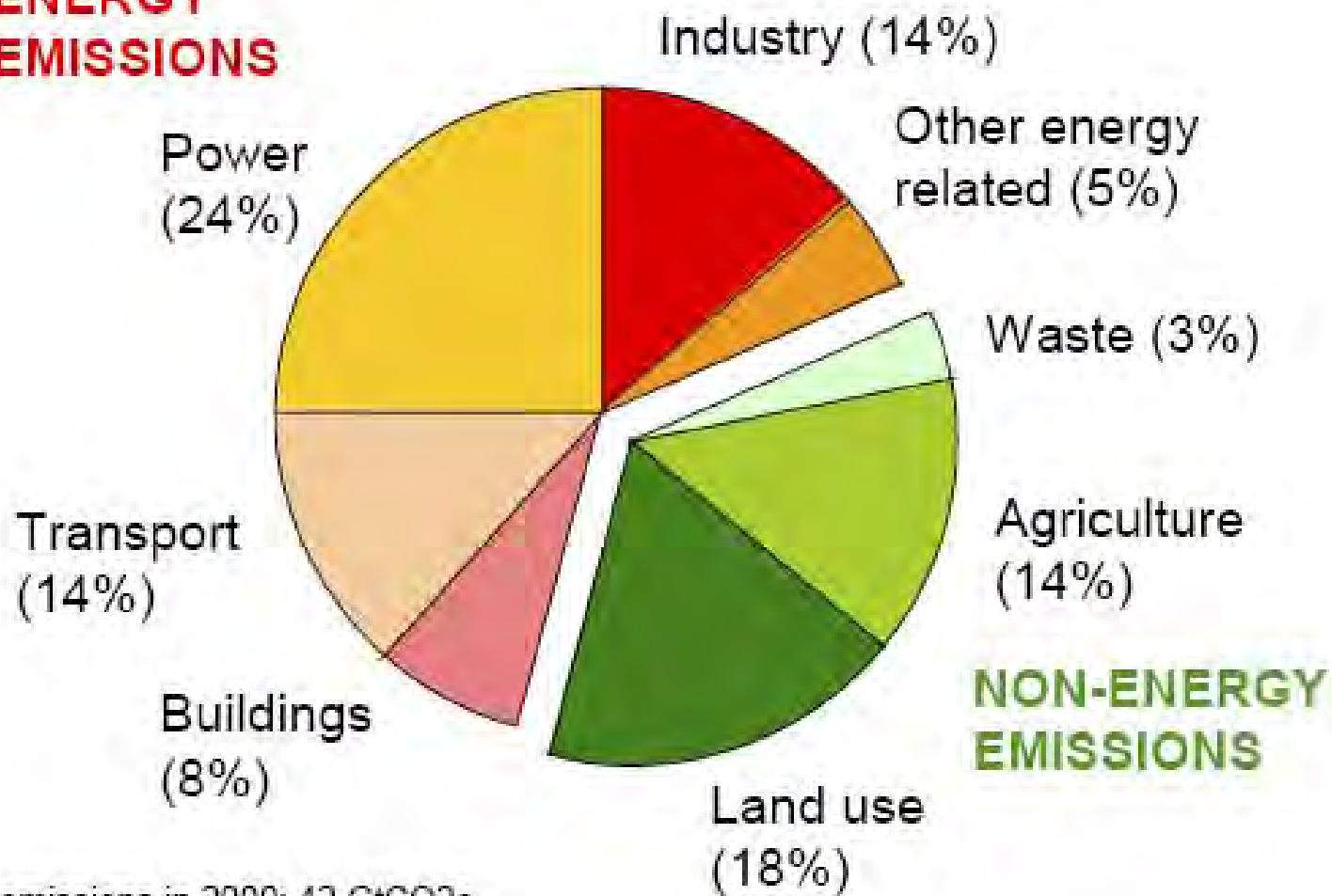
Is low expenditure on agriculture justified?

- A 1% p.a. increase in agriculture growth, on average leads to a 2.7% increase in income of the lowest 3 income deciles in developing countries (WDR 2007)
- Agriculture is 2.5 to 3 times more effective in increasing income of the poor than is non-agriculture investment (WDR 2007)
- Agriculture growth, as opposed to growth in general, is typically found to be the primary source of poverty reduction (IFPRI, 2007)
- Agricultural growth the pre-cursor to overall economic growth: Europe and North America (in the early part of the 20th century), in Japan a little later, and more recently in China and India

Linkages between agriculture and climate change

- Agriculture is considered one of the most vulnerable sectors to climate change:
 - ❑ Threats to food security
 - ❑ Increased stress on fragile farming system
 - ❑ Loss of biodiversity
 - ❑ Decrease in water availability
 - ❑ Reduction of crop resilience to climate variability
 - ❑ Negative impact on animal health, livestock production and fisheries
- At the same time it is also one of the main contributor to GHGs emissions:
 - ❑ CO₂ emissions mainly from land use change;
 - ❑ methane emissions from the livestock sector and from rice production;
 - ❑ nitrous oxides from the use of fertilizers

ENERGY EMISSIONS



Total emissions in 2000: 42 GtCO₂e.

Energy emissions are mostly CO₂ (some non-CO₂ in industry and other energy related).

Non-energy emissions are CO₂ (land use) and non-CO₂ (agriculture and waste).

The Changing Context: Impacts

Biophysical drivers

- Temperature
- Extreme events frequency, intensity
- Rainfall patterns
- Seasonal shifts
- Sea level rise

RURAL LIVELIHOODS

(migration, labor availability, food insecurity, conflict, forced sale of livestock and other assets)

e.g. food insecurity in Niger, rural livelihoods in the high Andes (Altiplano) in Peru.

e.g. damage to irrigation systems and other agricultural infrastructure in Viet Nam

RURAL INFRASTRUCTURE
(rural roads, storage and processing, irrigation systems)

AGRICULTURAL PRODUCTIVITY
(food and cash crops, livestock and fisheries)

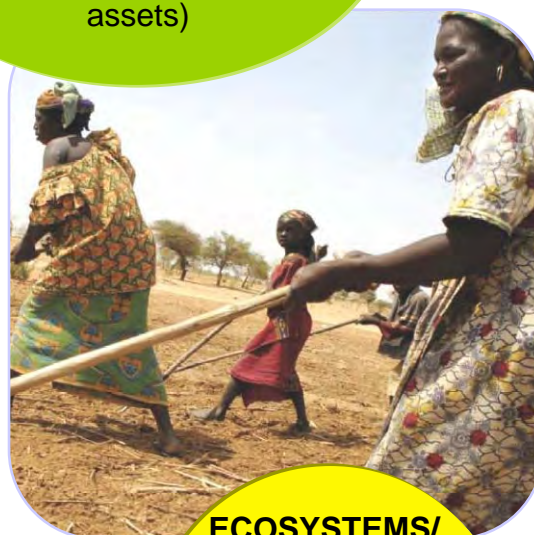
e.g. rice production in Sierra Leone, rain-fed agriculture in Yemen, livestock sector in Mongolia (drought and Dzud)

**ECOSYSTEMS/
ENVIRONMENTAL
PROCESSES
SUSTAINING
AGRICULTURAL
PRODUCTION**

e.g. coastal ecosystems in Sri Lanka; rangeland ecosystems of Eastern Morocco

Global Rules Response

- Global carbon target
- Finance
- Adaptation Framework
- Land use mitigation rules



Solution: Countries to better incorporate adaptation to climate change and environmental concerns in investments and policies

■ **Adaptation**

- ❑ Drought resistant cultivars
- ❑ Crop diversification
- ❑ Alternative tillage and erosion control
- ❑ Payment for environmental services
- ❑ Weather insurance
- ❑ Drought contingency and early warning systems
- ❑ Water management, including flood response

■ **Mitigation** of climate change through agriculture

- ❑ Reduce subsidies for high greenhouse gas-emitting agriculture practices
 - Reduce expansion of new irrigation schemes, farm machinery, chemical fertilizer, land and forest clearing, livestock development, fuel use
- ❑ Subsidize low greenhouse gas emission processes
 - water management, conservation agriculture, reforestation

Possible interventions in the agricultural sector

■ Mitigation

- ❑ Switching to "no-tillage" or "low-tillage" techniques to preserve carbon stored in soil;
- ❑ Reducing methane's emissions from rice production through better tillage practices, water management, integration with aquaculture, and crop rotation;
- ❑ Reducing GHG emissions from livestock by improving animal nutrition, breed selection and manure management;
- ❑ Using nitrogen fertilizer more efficiently to reduce nitrous oxide;
- ❑ Improving land use and management practices: e.g. better management of grazing systems;
- ❑ Forestry: sustainable agro-sylvo-pastoral systems;
- ❑ Coastal management and fisheries: e.g. carbon sequestration in mangrove plantations and culture of seaweed and algae for food and biofuel.

Why invest more?



- Falling Government expenditures and ODA to agriculture
- Correlations of low expenditures with poverty
- Agricultural R&D often has highest impact on poverty
- Calculations of high returns to agricultural research

Rural Development Policies



***The twin challenges
of poverty and
environmental
degradation***

Awakening Africa's Sleeping Giant (W.B. 2009) Priorities

- Policy Reforms
 - Macro policy, e.g. regional trade, export taxes
 - Land policy, e.g. certification of community/individual land rights
- Strengthened Institutions
 - Public sector reform
 - Management of environment impacts
 - Management of social impact (value chains, market reforms)
- Scaled up investments
 - Infrastructure
 - R & D
 - Advisory services

The Evolving Framework for Investment in Pro-Poor Science and Technology

- Empowers rural communities and poor people
- Draws on farmers' capacities to participate, experiment, innovate, communicate among themselves
- Farmers and scientists as partners, pooling local and external (“modern science”) ideas
- Public funding to facilitate and raise capacity for the above
- Public funding aimed at “public goods” technology
- Public cost-sharing for adoption of some pro-poor innovations

Pro-poor technology



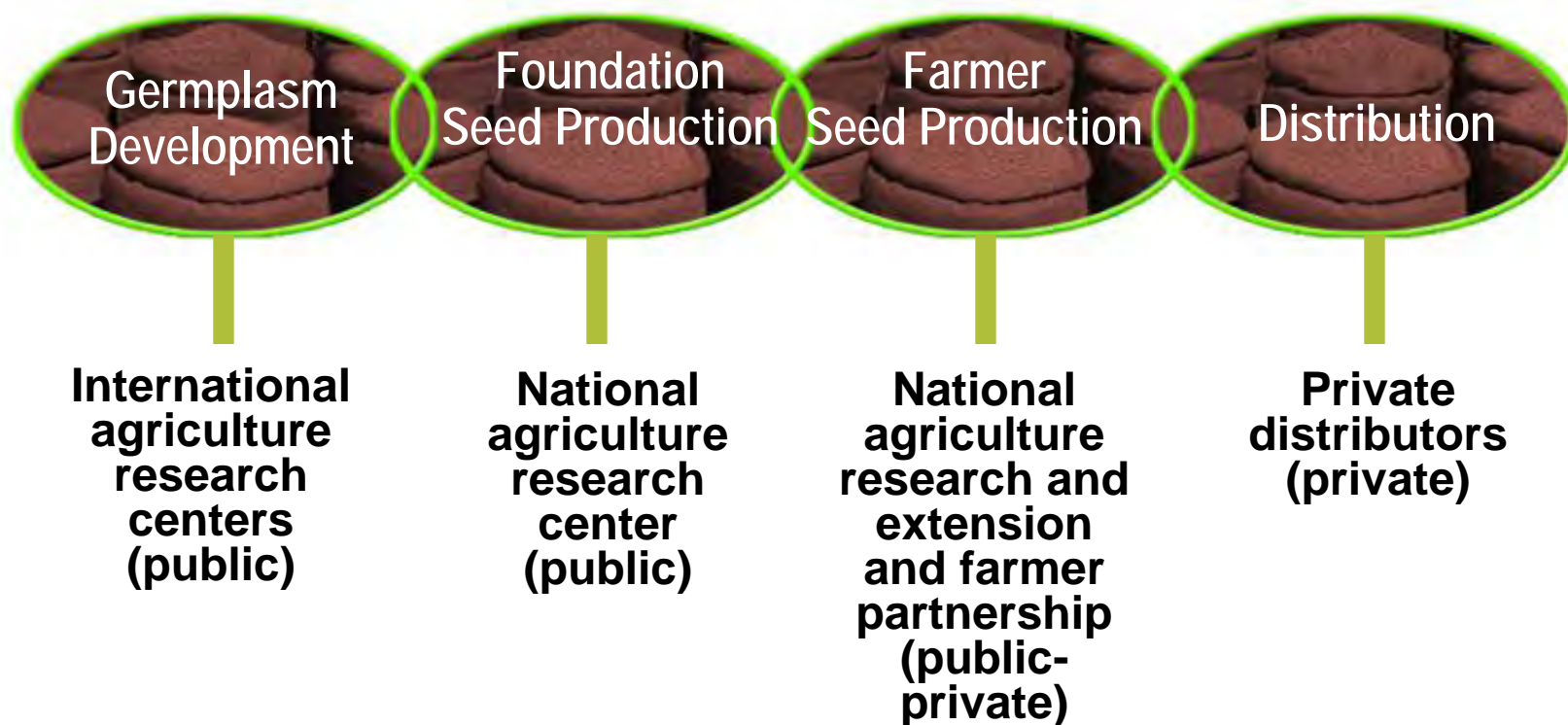
- Unless the poor have the power to participate in deciding which technology to use, they are unlikely to benefit from it
- Better farm technology will most benefit the farmers who are active partners in setting priorities

Characteristics of successful innovation stories

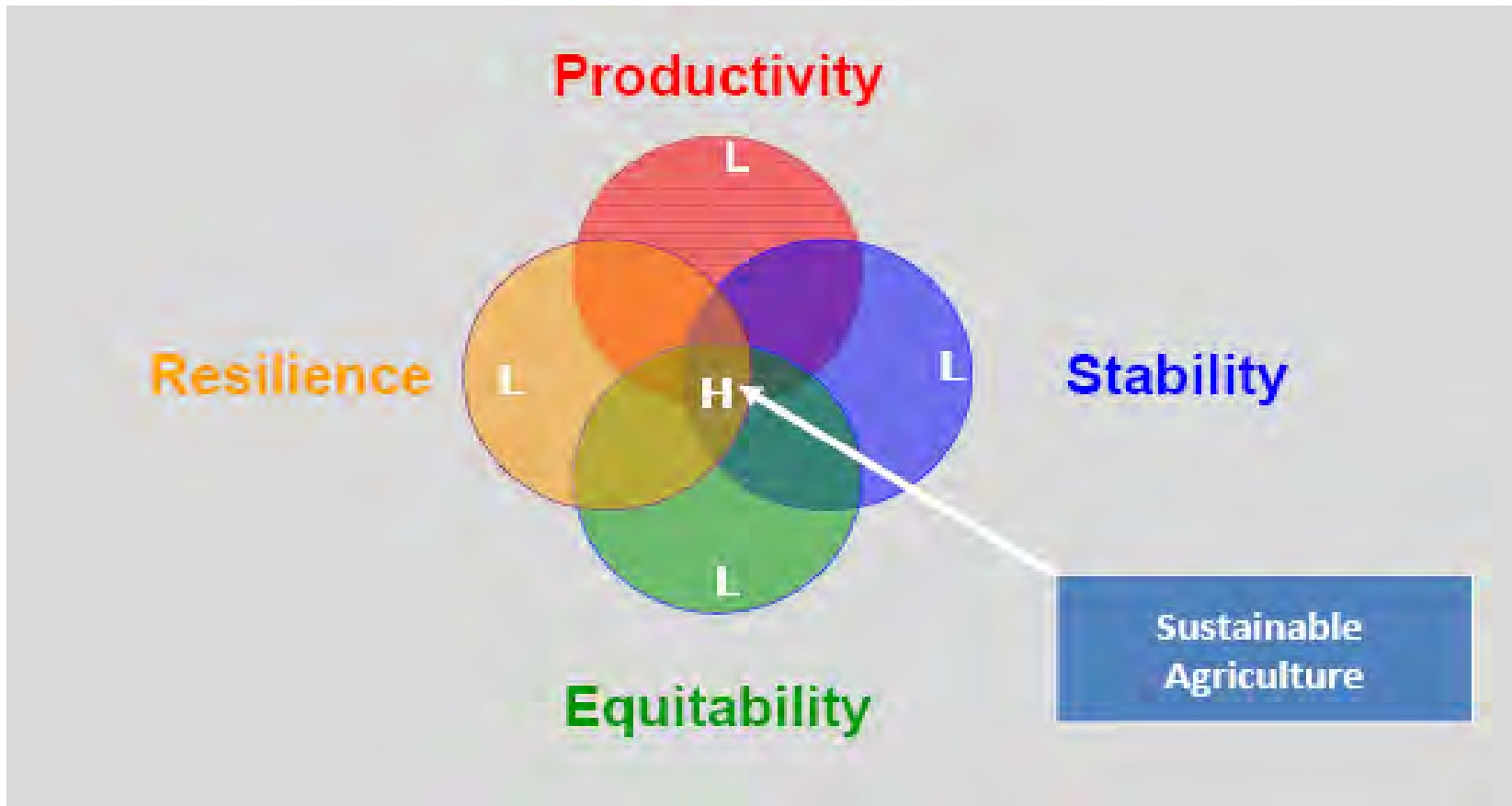
- The initiative may come from the research or the business side
- The market and private sector drive large part of the change
- Interaction between producers, traders and researchers in a favorable context
- Inducing innovation requires more than funding research or promoting knowledge generation
- Investment requirements to develop a sub-sector

Public-private partnerships

Example: Smallholder seed sector



Minimising the trade-offs



Source: G Conway, 2009

A sustainable production system exhibits most of the following attributes:

1. Utilises crop varieties and livestock breeds with high productivity per externally derived input;
2. Avoids the unnecessary use of external inputs;
3. Harnesses agro-ecological processes such as nutrient cycling, biological nitrogen fixation, etc;
4. Minimises the use of practices that have adverse impacts on the environment and health;
5. Makes productive use of human and social capital in the form of knowledge and capacity to adapt and innovate and social capital to resolve common landscape-scale problems;
6. Minimises the impacts on externalities such as GHG emissions, clean water availability, carbon sequestration, conservation of biodiversity.

Ex Reaping the benefits; Royal society, 2009

Options to increase food availability

- Today's hunger problems may be addressed with appropriate use of current technologies, (e.g., no/low till, IPM, INRM, improved water management), coupled with decreased post-harvest losses, trade reform and reducing yield gaps
 - Small-scale farmers need access to information, the best seeds, financing and access to markets – its rural development
- Advanced biotechnologies may be needed to address future demands for increased productivity in the context of climate change and new plant and animal pests – but the risks and benefits must be understood
 - Need sustainable intensification, not extensification
 - Modern genomics can assist both traditional plant breeding and GM

Priorities for Biotechnology in developing countries (ex. ABDC 10/3.1) - Sequence is key:

1. Policy development and priority setting:
 - Countries should develop expertise to make sovereign decisions about adopting biotechnologies, and to carry out their own risk/benefit analyses of implementing such technologies
2. Linkages Biotechnology/ Other agricultural R&D
1. Capacity development
4. Regulation of biotechnology utilization
5. Shared access to technologies
6. Uptake of biotechnologies
7. Documentation of development and impact
8. Investments in Biotechnology R&D

Role of GM

- Potential to improve productivity, drought, temperature and pest tolerance and enhanced nitrogen use efficiency
- But GMOs continue to cause concern for some consumers and governments
 - Health risks – little evidence, robust EU safety processes in place
 - Environmental risks – need improved understanding of gene transfer and management
 - Role of companies – some lack consumer trust
 - Potential negative impact on poor farmers in developing countries – reliance on large multi-nationals

Importance of the institutional framework to biotechnology

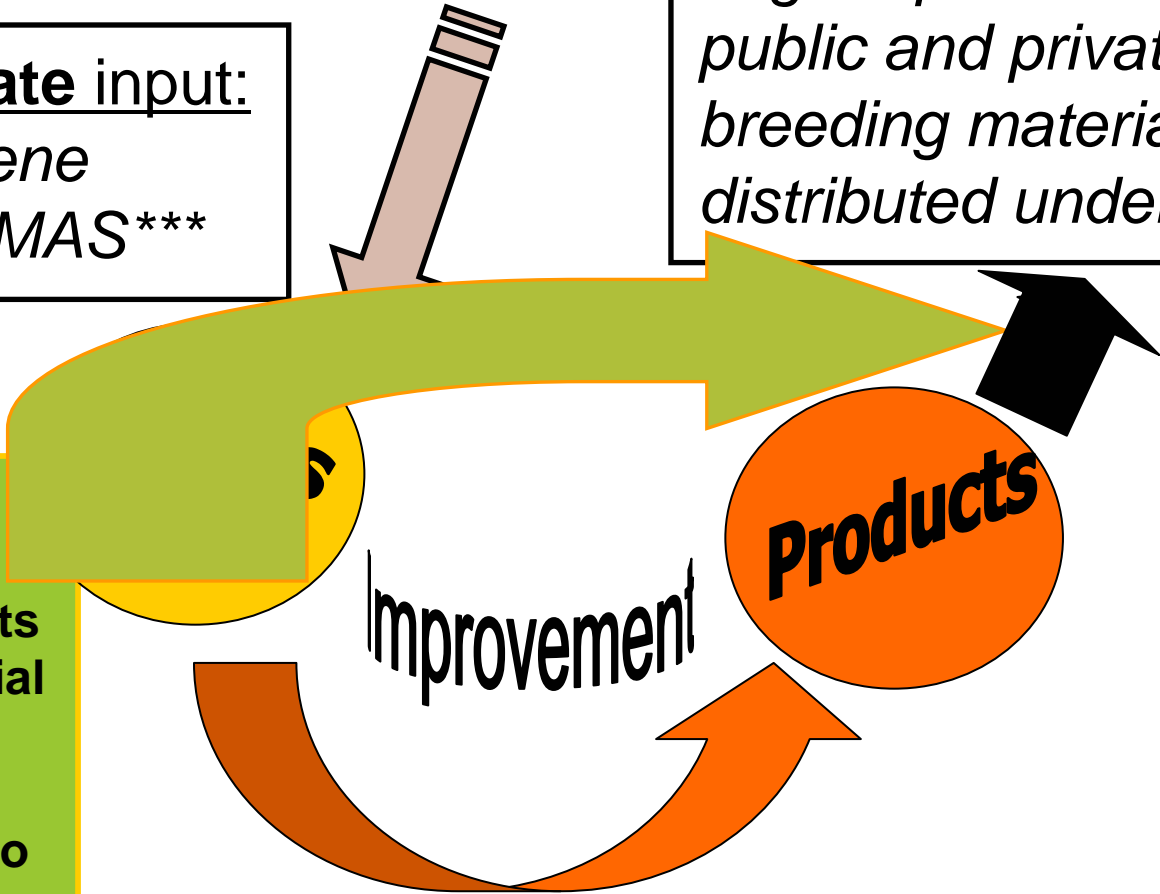
- By analysing the institutional framework, possible limitations/strengths can be determined and necessary changes can be identified that need to be in place for the generation, approval and adoption process of biotechnology. Special attention should go to:
 - Considering socio-cultural realities in order to respond effectively to needs and aspirations of end users - build trust and public confidence to facilitate acceptance of biotechnology
 - Ensuring a conducive policy and regulatory environment with strong public institutions and support from the state for enforcement
 - Ensuring existence of strong and dynamic research institutions/organizations
 - Providing services support and adequate technology uptake capacity
 - Harnessing interest of the private sector to invest in pro-poor technology
 - Ensuring availability of credit services
 - Promoting collaboration between government, industries and research institutions (through public-private partnerships – currently seen as an effective mechanism for translating the potential of biotechnology into products that will help in enhancing agricultural productivity).

Example **public** input: *Elite material, containing combination of genes from public and private germplasm*

Example **private** input: *Proprietary Gene sequence for MAS****

Example **public good** output: *MAS***- improved germplasm, containing combination of germplasm from public and private breeding material, distributed under SMTA*

Public Institutions have entered into the Tripartite Agreements for the joint development of improved material under conditions that do not restrict the IP or other restrictions



Agro-biodiversity & seed systems

- Food security in the future requires that we protect crop genetic diversity
- Member States should:
 - promote innovation in both the commercial seed system and in farmers' seed systems.
- In order to balance the needs for innovation, for the preservation and enhancement of crop diversity, and for improving the livelihoods of small-scale farmers

Agro-biodiversity & seed systems

- Ensure that seed certification schemes do not lead exclude farmers' varieties (such varieties should be in approved seed lists and distribution programmes, included in participatory plant breeding schemes).
- Support local seed exchange systems such as community seed banks and seed fairs.
- Set mechanisms ensuring the active participation of farmers in decisions on sustainable use of plant genetic resources.
- Increase public agricultural research and incentives for the private sector for research into the crops that benefit poor farmers.

Plant resources in Dryland Africa, methodologies:



- Seed diversity fairs for information flow and seed exchange
- Farmer field schools
- Approaches to improved seed storage and community-genebanks



I THANK YOU