Demand-Led Plant Breeding

Chapter 2

Visioning and Foresight

Nasser Yao, Appolinaire Djikeng and Jonathan Shoham

Chapter 2
Visioning and Foresight for Setting Breeding Goals

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Chapter 2 Objectives

1. To empower plant breeders and R&D leaders to consider future agricultural landscapes in Africa.

2. To equip breeders with methodologies to design new varieties that will remain relevant and satisfy market demands over time.

3. To identify drivers that may affect whether farmers adopt new varieties in the future.

Chapter 2 Contents

1. Introduction

2. African Agricultural Outlook, Challenges and Policy

3. Visioning and Foresight, using STEEP Analysis and Scenario Creation

4. Integrating Foresight into New Variety Design

5. Risk Management

1. Introduction

Group Discussion

- What is your timeframe to create and release a new variety?
- How do you forecast the future demand of your varieties?

2. African Agricultural Outlook, Challenges and Policy

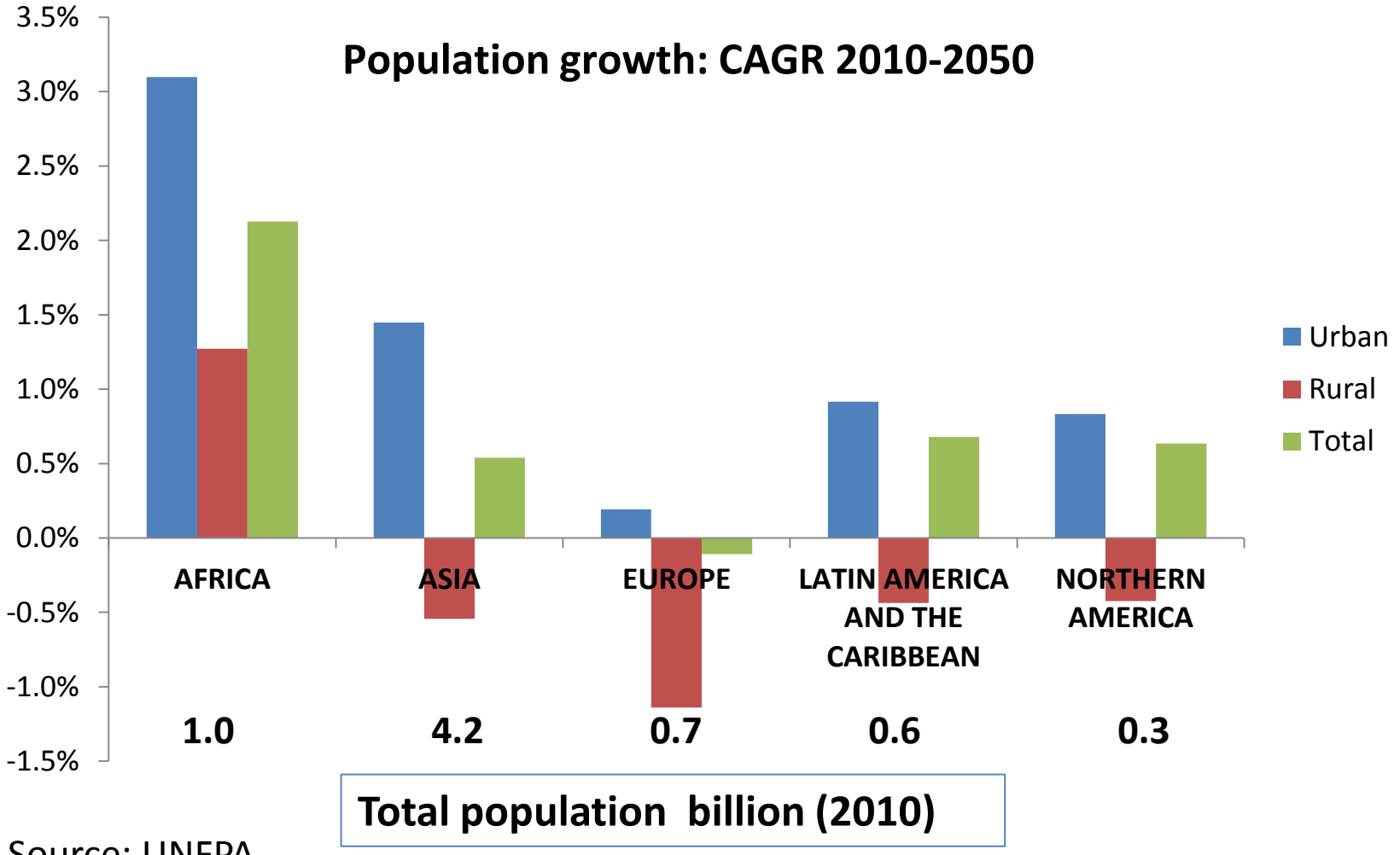
Africa at a Glance: Agricultural landscape

Food supply vs. demand

Demand

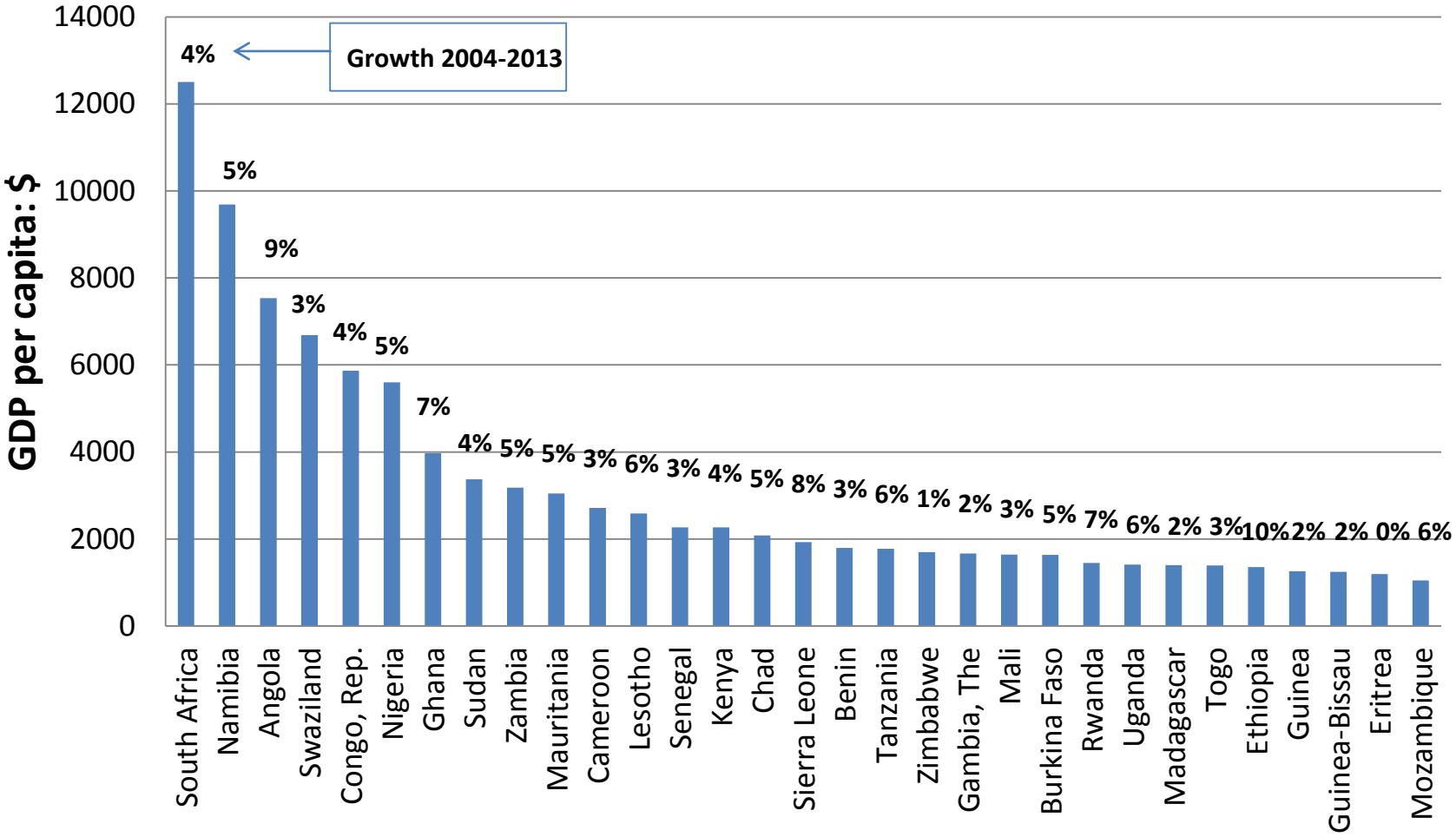
- Demand growth is fastest in the world
- SSA population c. 800 million
- 220 million undernourished
- Mean population growth in SSA is c. 3%
  (-ve Europe, 0.5% Rest of the World)
- Population size expected to double in 35 years
- Population growth is double in urban vs. rural areas

Africa at a Glance:
Highest Rate of Population Growth



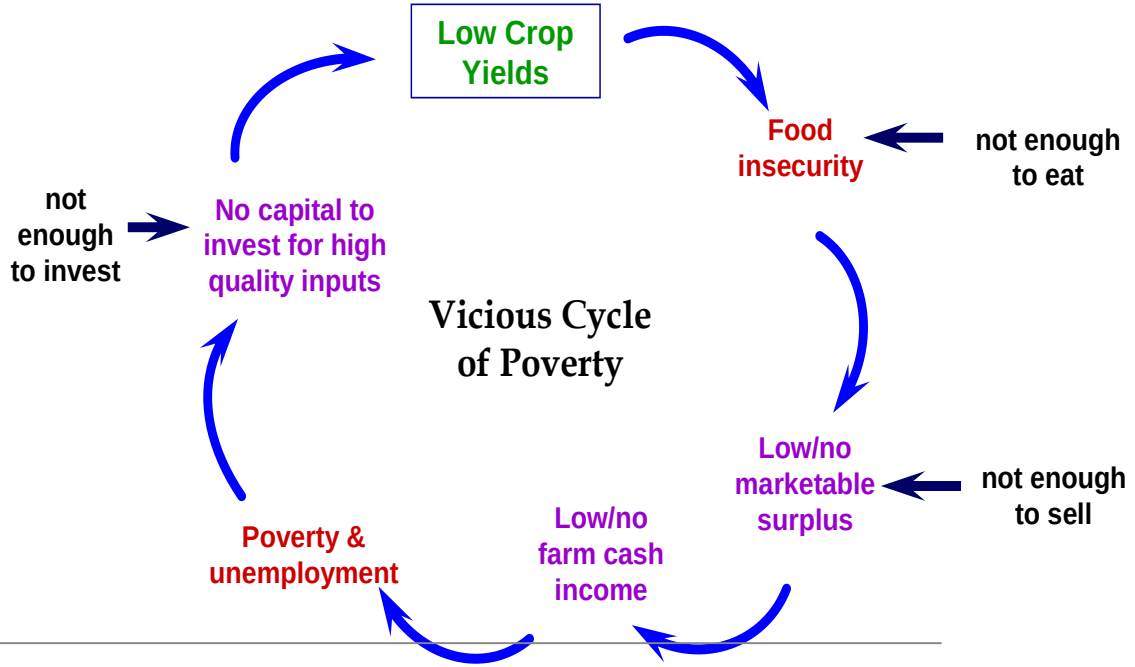
Source: UNFPA

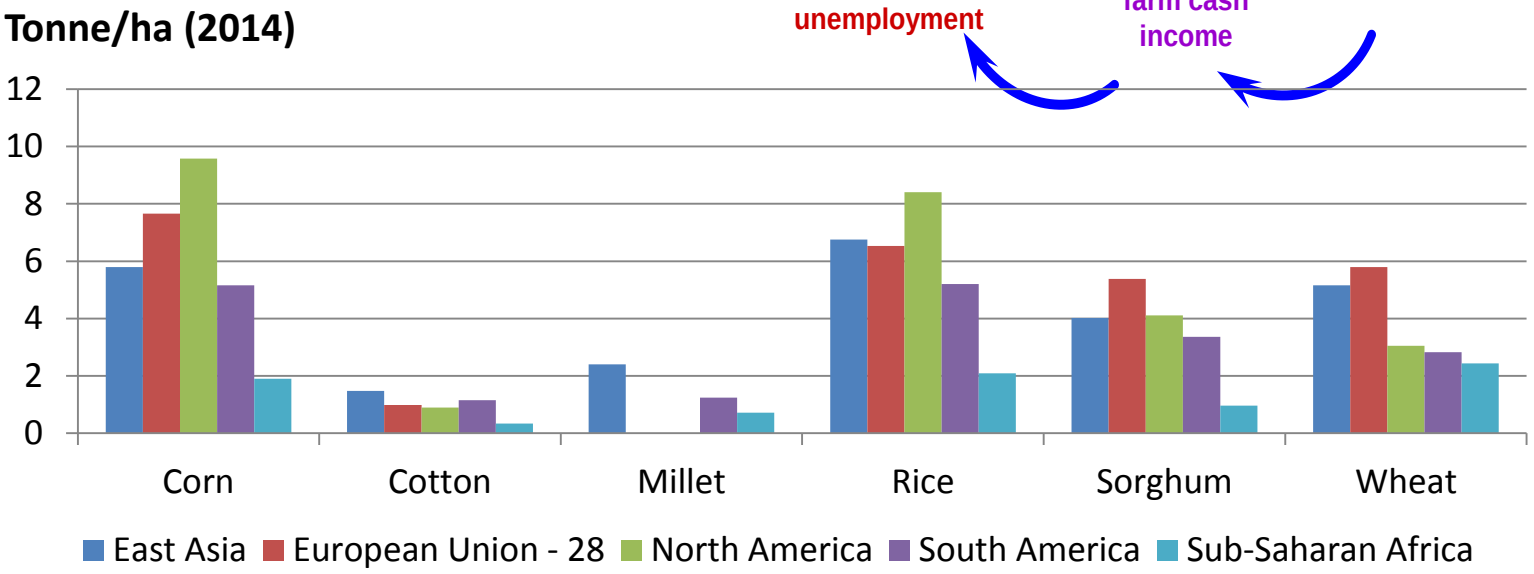
Africa at a Glance:
High GDP per Capita Growth: 2004 – 13



Source: World Development Indicators (World Bank); SFSA analysis

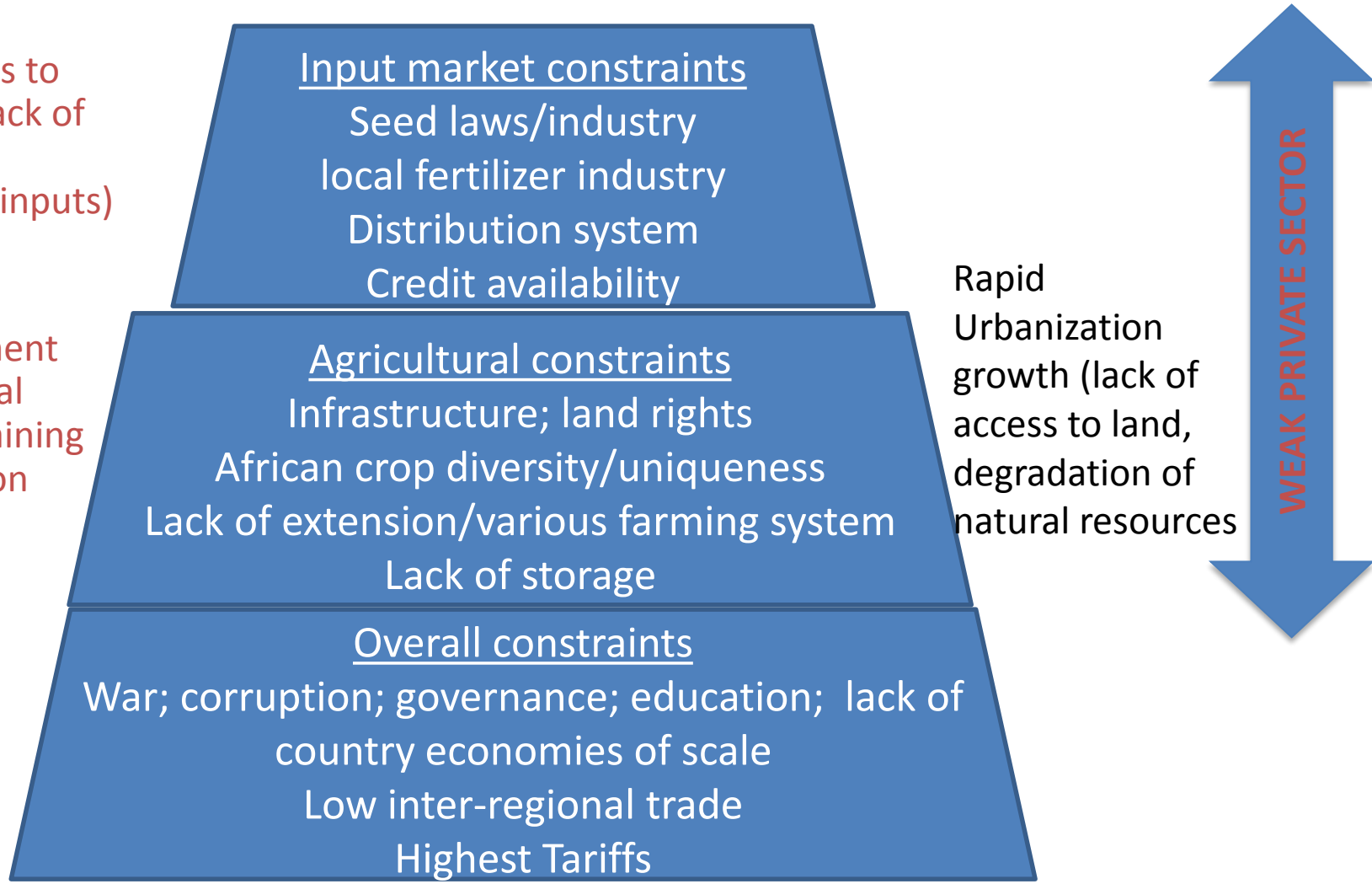
Challenges of SSA Agriculture: Low Productivity in Smallholder Farming





Source: PSD (USDA)

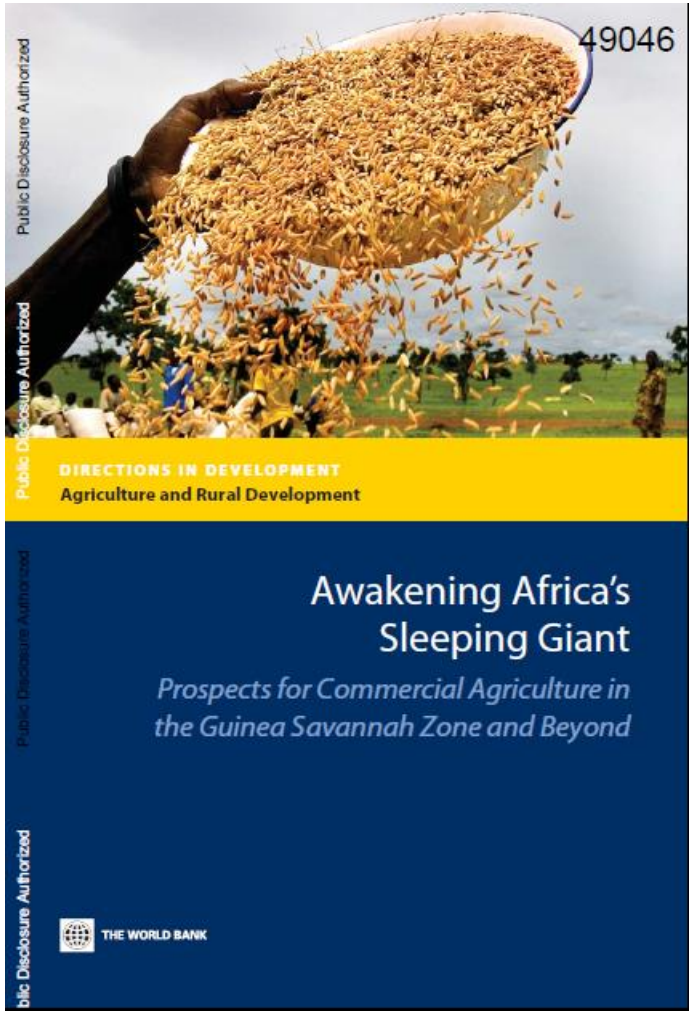
Reasons for the Low Productivity



Source:
J L Shoham

However we are now in a period of renewing optimism….

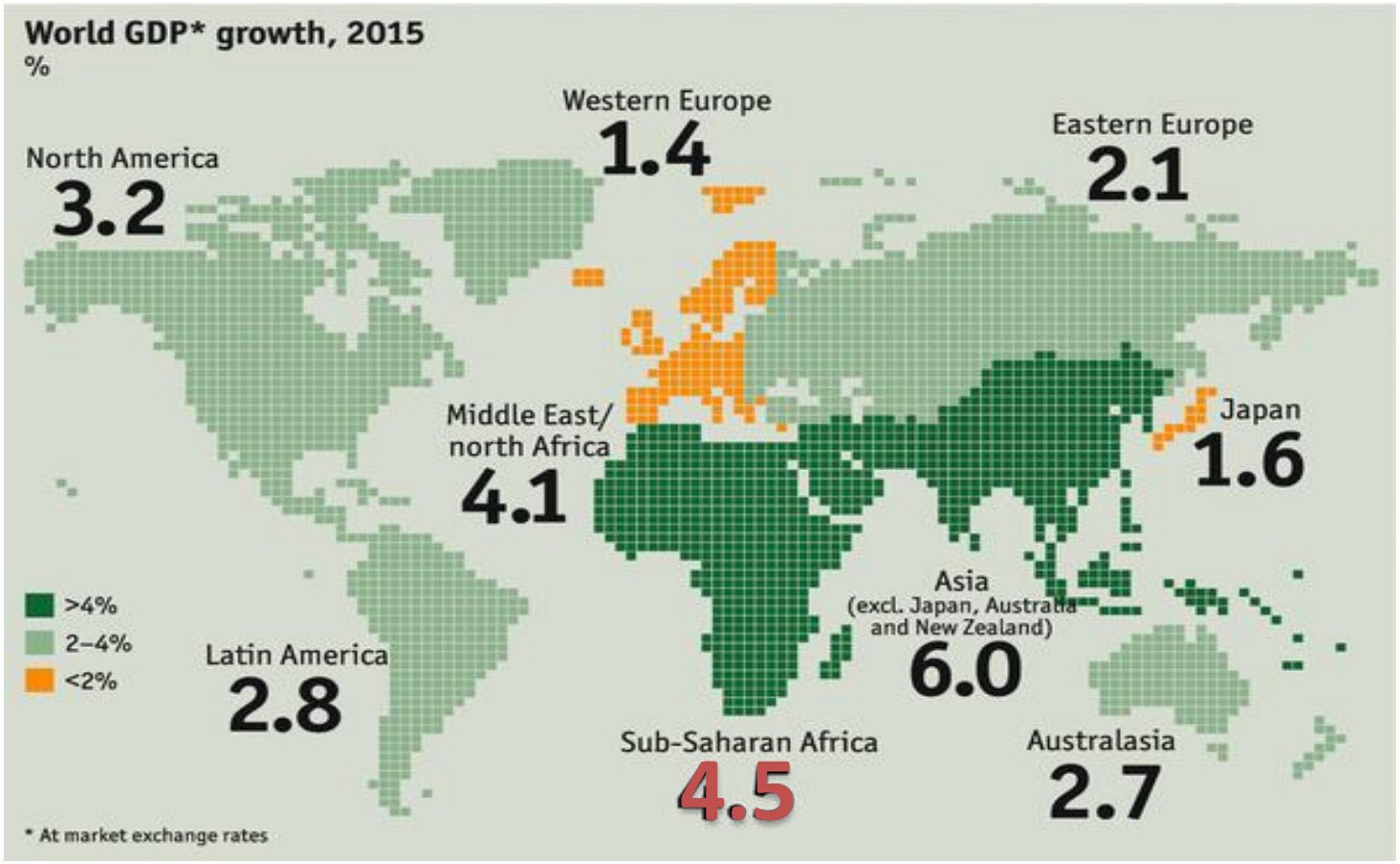
..And its possible for Africa to feed itself and generate income..



- **Uganda**: Growing apples, displacing imports
- **Zambia**: Increase of cotton production
- **Kenya**: Flower exports surpassed coffee exports
- **Ethiopia**: Beans and coffee from local cooperatives responding well to international markets
- **DRC**: Post conflict areas relying on cavies for nutrition and growth

Optimism in African Agriculture Exists..

GDP growth forecasts for 2015: Africa and Asia leading



Source: 'The World in 2015', The Economist

…through significant agricultural transformation

Strategies for Transforming African Agriculture

- Improving agricultural productivity
- Availability and widespread use of quality farm inputs and technologies, including crop biotechnologies
- Facilitating growth in agricultural markets and trade
- Investing in public infrastructure for agricultural growth
- Reducing rural vulnerability and insecurity
- Improving agricultural policy and institutions
- **Foresight and visioning to meet market/consumers' demands**

Global Seed Companies in Africa

	DuPont Pioneer	Monsanto	Vilmorin	Seed Co	Syngenta	Others
Southern						
South Africa	✓	✓	✓	✓	✓	
Zambia	✓	✓	✓	✓	✓	
Zimbabwe	✓	✓				
Malawi	✓	✓		✓		
Others	Lesotho, Botswana, Angola			Angola, Botswana, Swaziland		Angola/Baddar
Eastern						
Kenya	✓	✓	✓	✓	✓	
Tanzania	✓			✓		
Uganda	✓					
Ethiopia	✓			✓		
Mozambique	Setting up			✓		
Others				Rwanda		
North						
Morocco			✓			
Tunisia	✓					Baddar
Egypt	✓					
Algeria		✓				Baddar
Libya	✓					
West						
Nigeria	Setting up			✓		Baddar
Ghana	✓			✓		
Senegal						Baddar
Others		Burkina Faso		DRC		Baddar: Benin /BF /Cameroon/Chad/Cote D'Ivoire/ Guinea/Mali
# Countries	15	<10	NA	15	NA	Baddar: 15 Bayer: 8

Source: Commercial Seed Market in Africa, J L Shoham, Informa, 2014

African seed companies and crops portfolio

	Maize	Veget	Wheat	Rice	Cotton	Sorgh	Soyb.	Others
Agricol	✓							Sunflower
Afrisem		✓						
Agri-Seeds	✓							
AGPY						✓		
Arab Sudanese Seed Company					✓	✓		
Arda Seeds	✓						✓	Cowpeas; Millet; Groundnuts; Sunflower
Baddar		✓						
Capstone	✓							Pasture/forage
East African Seed Co		✓						
Ethiopian Seed Enteprise			✓					
Fica	✓	✓		✓		✓	✓	Millet; Groundnuts; Pasture
FreshCo	✓	✓						
Funwe Seeds	✓						✓	Pigeon peas; Cowpeas; Beans
Green Lakes Co		✓ (toms)						
Harvest Farm Seeds	✓	✓						
Hygrotech		✓						
Kenya Highland Seed Co		✓						
Kibo		✓						
Klein Karoo		✓						Pasture
KSC	✓	✓		✓		✓		Millet; Pasture; Sunflower

	Maize	Veg.	Wheat	Rice	Cotton	Sorgh	Soyb.	Others
Leldet								Groundnuts; Pigeon peas; Chickpeas
Link Seed	✓							
Maslaha Seeds	✓				✓	✓	✓	Cowpeas
Monsanto	✓				✓	✓	✓	
MRI	✓							
NASECO	✓							
Nectar Group	✓	✓				✓		
Otis Garden Seeds	✓					✓		Millet
Premier Seeds	✓			✓		✓	✓	Cowpeas; Groundnuts; Millet
Prime Seeds	✓					✓		Millet
Pristine Seeds	✓					✓		Cowpeas; Millet; Groundnuts
Reapers								Groundnuts
Sakata	✓							Flowers
Seed Co	✓		✓		✓	✓	✓	Cowpeas; Groundnuts
Sesako			✓					
Syngenta	✓	✓						Flowers
Technisem		✓						
Terratiga	✓			✓		✓		Cowpeas
Victoria Seeds	✓	✓		✓		✓		Beans, millet, cowpeas, groundnut
Vilmorin	✓	✓	✓				✓	
Western Seed Co	✓							
Zamseeds	✓	✓						

Source: Commercial Seed Market in Africa, J L Shoham, Informa, 2014

3. Visioning and foresight using STEEP analysis and scenario creation

3. Visioning and foresight using STEEP analysis and scenario creation

- How accurately can we predict the future?
  - Too many factors and interactions to consider?

- Focus on key drivers of change

- Construct a range of possible future scenarios
  - What actually happens is more likely a ‘hybrid’

- Test strategies for robustness against these scenarios

STEEP: Useful Framework for Identifying Drivers of Change

- Identify the drivers of change by type
  - **S**ocial
  - **T**echnological
  - **E**conomic
  - **E**nvironmental
  - **P**olitical/Policy

STEEP Analysis and Scenario Creation

STEP 1 – Identify key drivers of change and assess their predictability

STEP 2 – Access reliable information sources

STEP 3 – Scenario creation using unpredictable drivers (‘splitting factors’)

STEP 4 – Variety specification validation

Social Drivers

Driver	Impact	Predictability	Source
Population growth	Total demand	High	UN data
Urbanization	Dietary habits and tastes	High	UN data
GM accept-ability and regulation	Technical possibilities	Low	IFPRI, ISAAA, News media

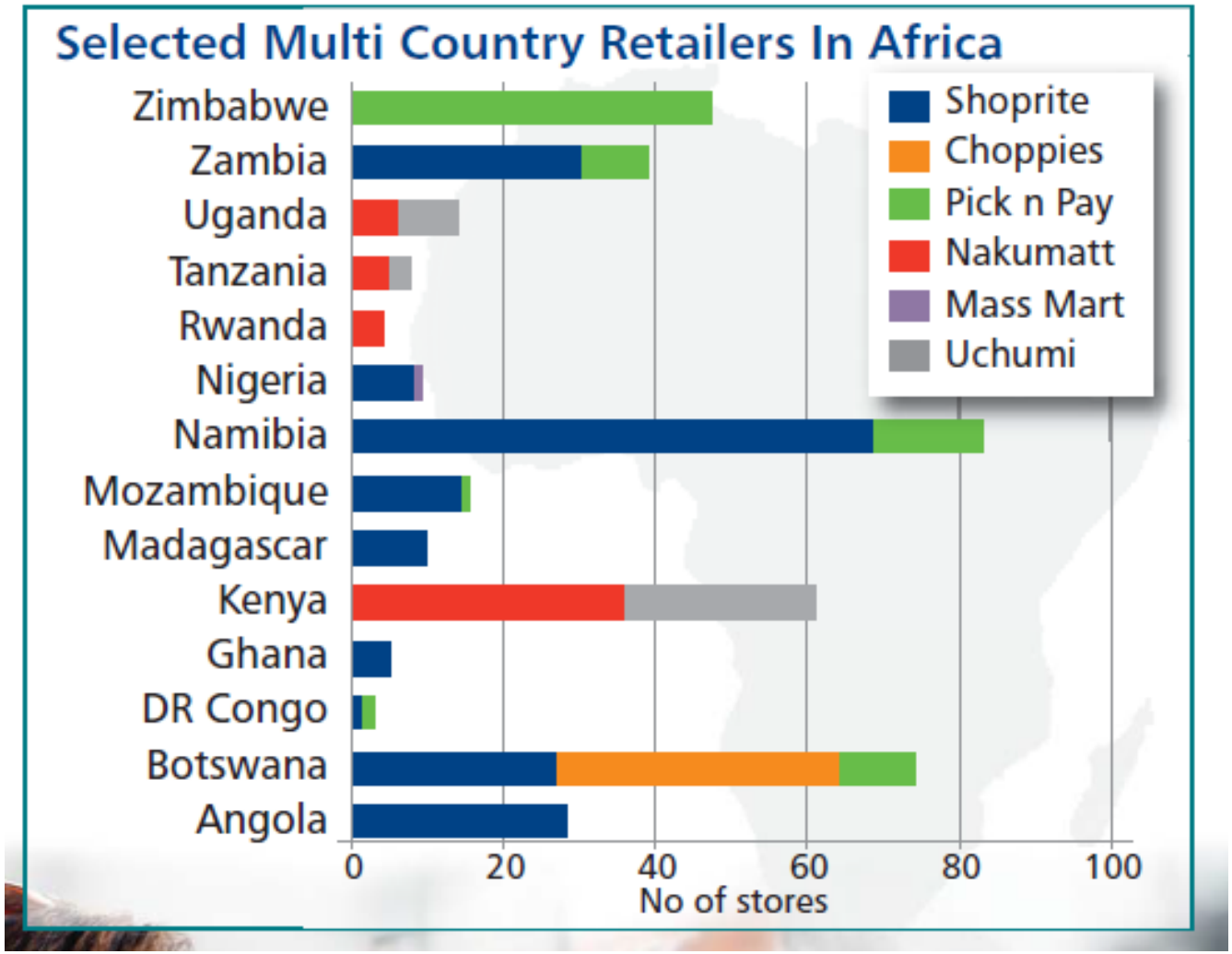
Technological drivers

Driver	Impact	Predict	Source
Biotechnology	Genetic variance, speed and cost	Low	
High throughput phenotyping	Selection intensity, number of years per breeding cycle	Low	
High throughput genotyping	Selection accuracy, breeding speed and cost	High	
Pre-Breeding	Breeding possibilities	Low	
Core Breeding	Breeding possibilities	Low	
Post Breeding	Breeding possibilities	Low	
Big Informatics data	Data management and analysis	Low	

Economic Drivers

Driver	Impact	Predict.	Source
GDP/capita	Food consumption patterns	High	World Bank FAO Food Balance Sheets
Food industry /retailer development	Demand for improved seeds, AMC's, Scope for PPP's	Medium	Reardon (2011)
Seed company developments	Seed improvement	Medium	Informa (2014)
Dealer network	Accessibility of seeds	Low	AGRA (2013)

Selected Multi-Country Retailers in Africa



Source: Promar, Insight, June 2014

Environmental Drivers

Driver	Impact	Predict.	Source/ Milestones
Climate change	Crop yields Agronomic traits Extreme events	Low	IPCC/Paris 2015
Certification schemes	Traceability Food safety Export market access	Medium	
Pest incidence	Crops yields and quality	Low	CABI Plantwise

Political Drivers

Driver	Impact	Predictability	Source
National seed laws	IP protection Private sector investments	Low	SeedQuest
Regional seed/variety harmonization schemes	Development costs, speed of variety release	Low	COMESA, ECA, ECOWAS SADC
Ag policies (CAADP)	Investment focus	Low	CAADP web site
Nutrition policies	Consumer traits	Medium	IFPRI

Seed Harmonization Schemes

Regional grouping	Status
SADC (Southern Africa)	MoU signed 2013 It is now for individual countries to join up
COMESA (Eastern and Southern Africa)	Draft COMESA Seed Trade Harmonization regulations adopted Sept 2013
EAC (East Africa)	2-year project started Oct 2013
ECOWAS (West Africa)	Seed Regulation adopted in 2008 but not yet implemented in most countries

Source: Commercial Seed Market in Africa, J L Shoham, Informa, 2014

Group Exercise

- What is your timeframe to create and release a new variety ?
- Identify drivers of change that could affect your variety designs on this timeframe
- Which drivers are unpredictable?
- What different agriculture scenarios could there be?
- How could the various scenarios affect the need for plant breeding and new variety designs?

4. Integrating Foresight into Variety Design

Integrating foresight into new variety design

- Foresight methods are used to review existing variety designs or as a starting point to create new designs.
- Every trait characteristic in each product profile should be analysed and a decision taken if the trait and benchmark is likely to remain relevant over time required for variety development.

Risk management

- Risk analysis and mitigation is essential for testing long-term viability of demand-led designs.
- Decision points are required in the stage plan and risk spreading considered
- e.g. benefits and costs of maintaining many biologically diverse germplasm lines

What Next?

Having analysed the drivers and identified the ‘splitting factors:

- Construct 2-4 scenarios around ‘splitting factors’
- Test your breeding strategies against these scenarios
- Identify signposts and put in place indicators
- Review and amend variety designs and plant breeding targets

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