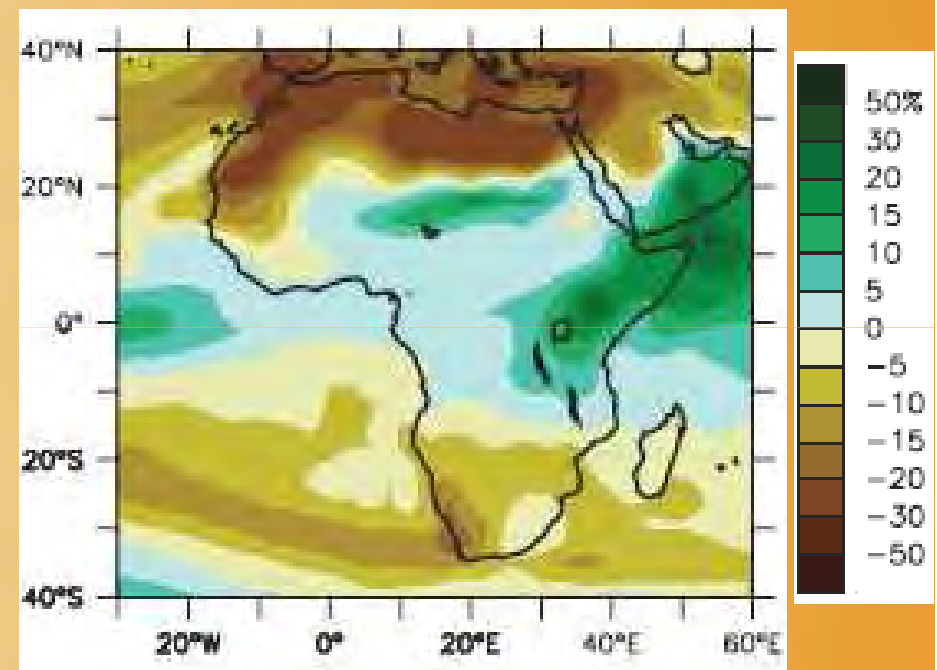
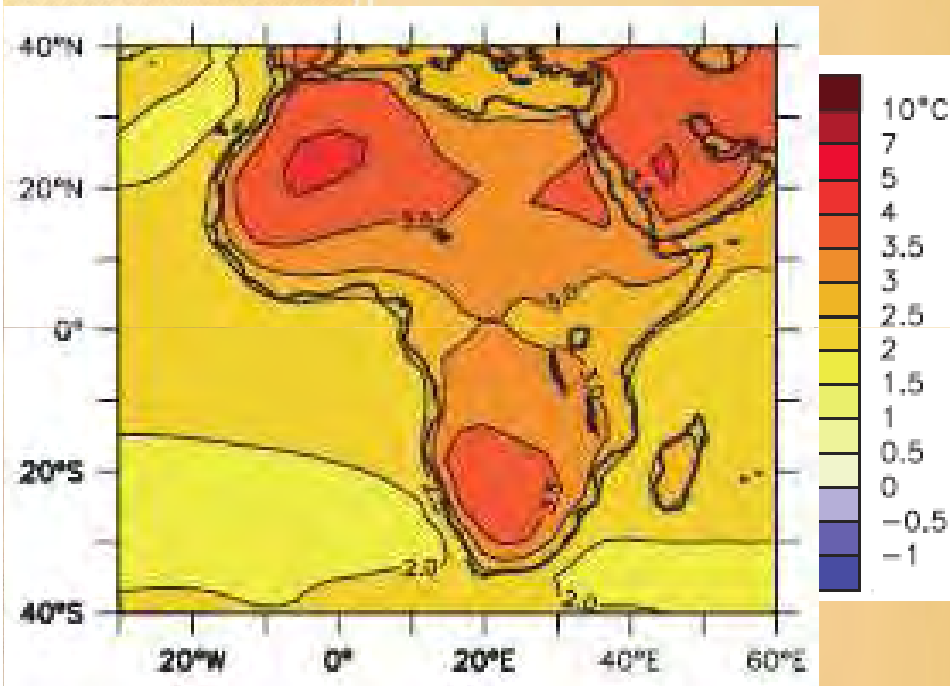




Challenges for biotechnology adoption in sub-Saharan Africa in an era of climate change

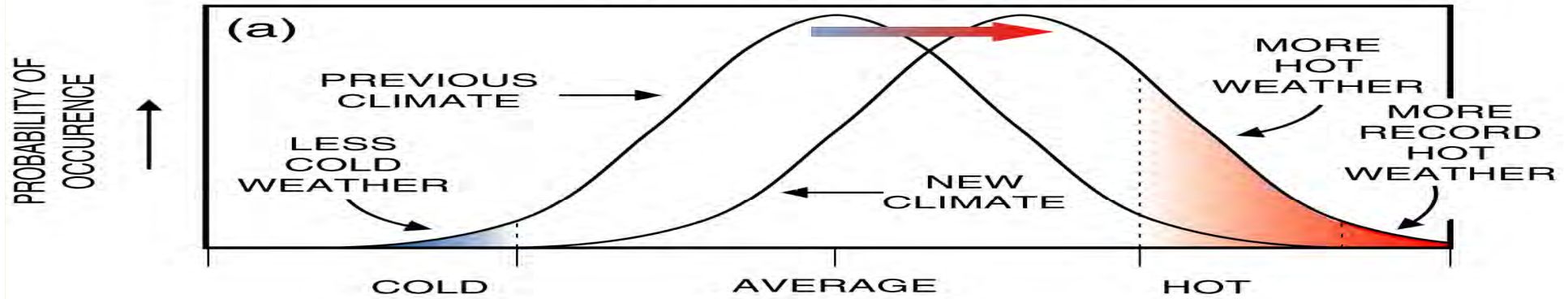
E Jane Morris

Predicted African temperature and rainfall changes

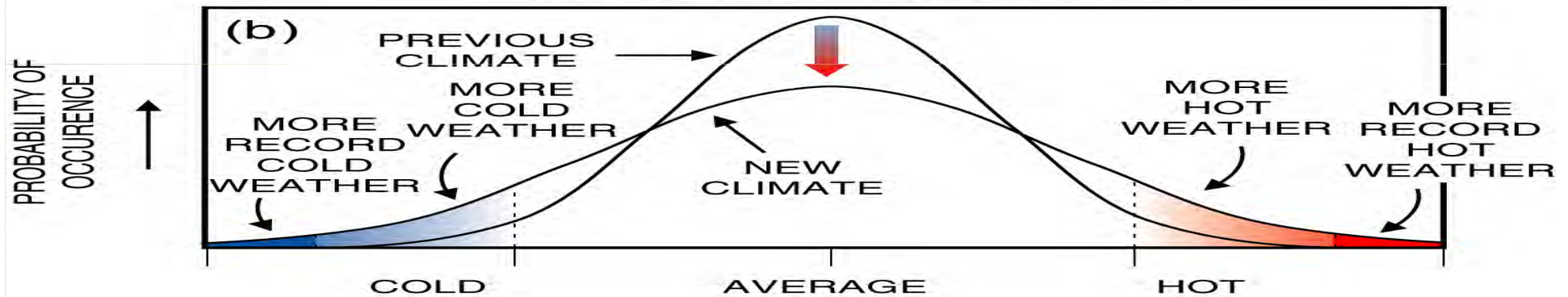


Climate extremes

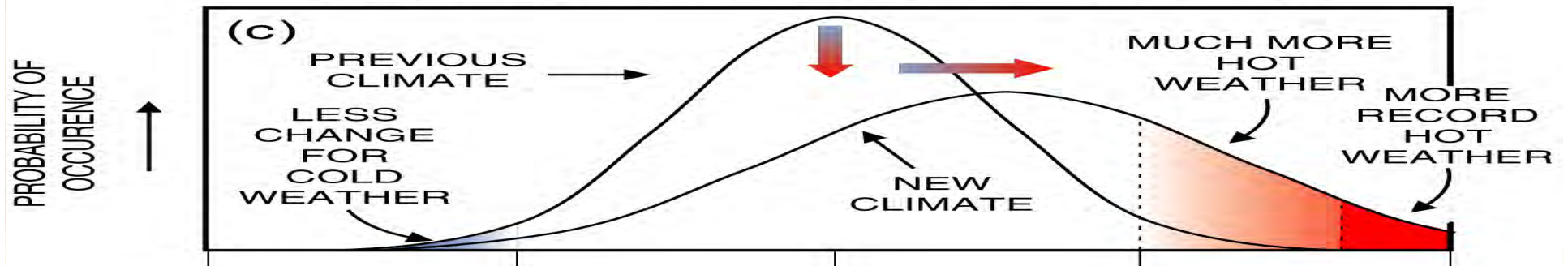
INCREASE IN MEAN



INCREASE IN VARIANCE

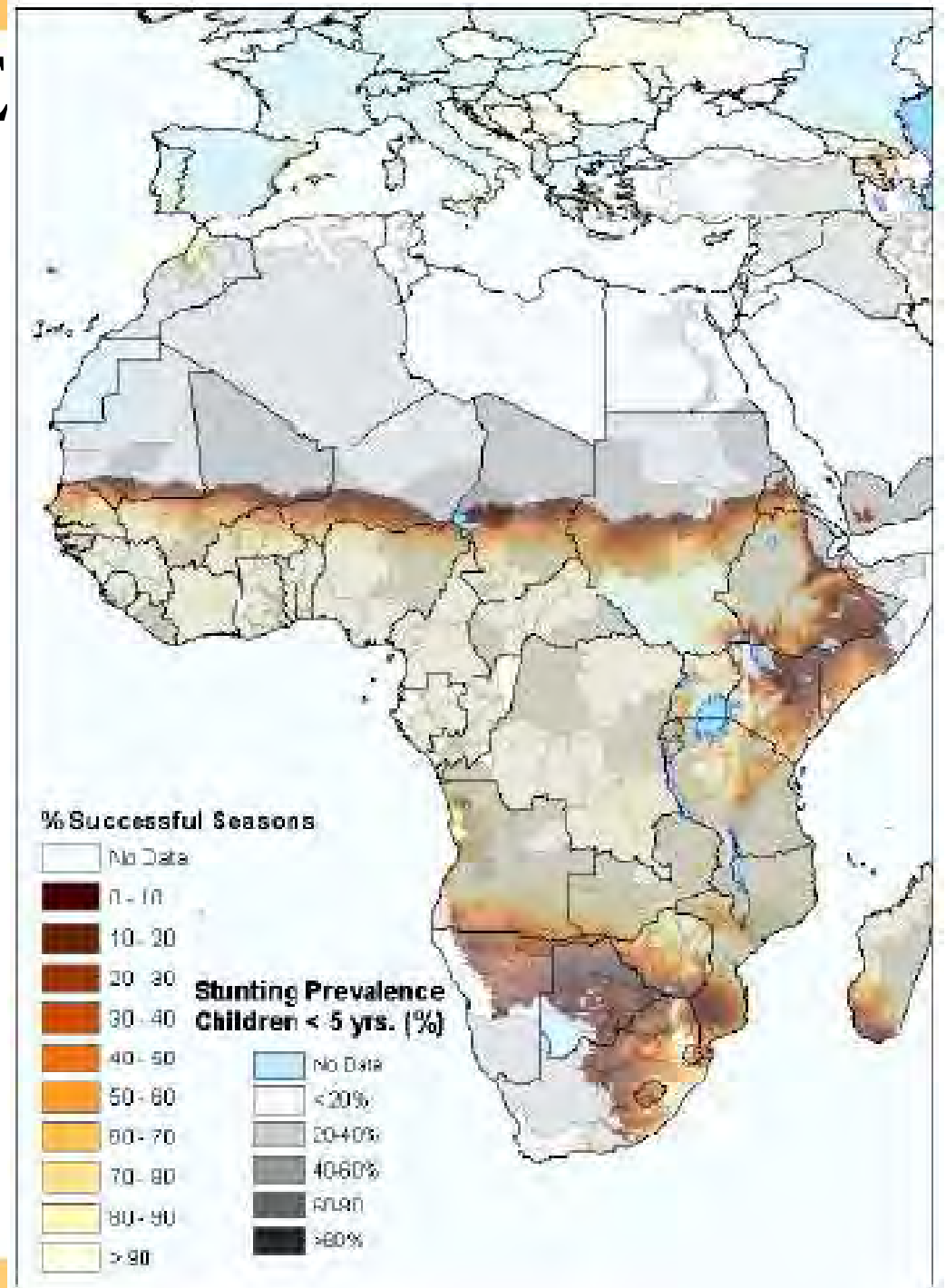


INCREASE IN MEAN AND VARIANCE



THE CHALLENGE

USE BIOTECHNOLOGY
TO INCREASE FOOD
PRODUCTION
AND IMPROVE
NUTRITION,
HEALTH AND THE
ENVIRONMENT
IN AFRICA.



Crops – we need to improve:

- **Abiotic stress tolerance**
 - Drought
 - Salt
 - Heat/cold
 - Aluminium etc
- **Biotic stress**
 - Fungal diseases
 - Viral diseases
 - Bacterial diseases etc
- **Nutritional characteristics**
 - Vitamin A
 - Amino acid profile
 - Iron content etc
- **Agronomic characteristics**
 - Dwarfing
 - Yield etc



In response to climate change:

- **New crops**
 - Breeding initiatives for African orphan crops
 - Preservation/utilization of African biodiversity
- **Crop improvement**
 - Shorter growing season
 - Heat stress
 - Resilience to variability



Biotechnology techniques and adoption challenges:

Technique	Adoption challenges
Tissue culture	Vegetatively propagated crops. Disease free, not disease resistant
Soil inoculants	Not universally applicable. Production difficult (eg mycorrhizae)
Biological control agents	Limited application, cost
Marker assisted breeding	Marker identification, lack of breeders with molecular know-how and equipment
Sequencing assisted breeding	Sophisticated equipment, data management challenges, expensive
Animal vaccine development	Expensive development. Production facilities needed.
Animal/plant diagnostics	Regulatory, production, marketing
Aquaculture	Fish breeding, fish feeds, market acceptance

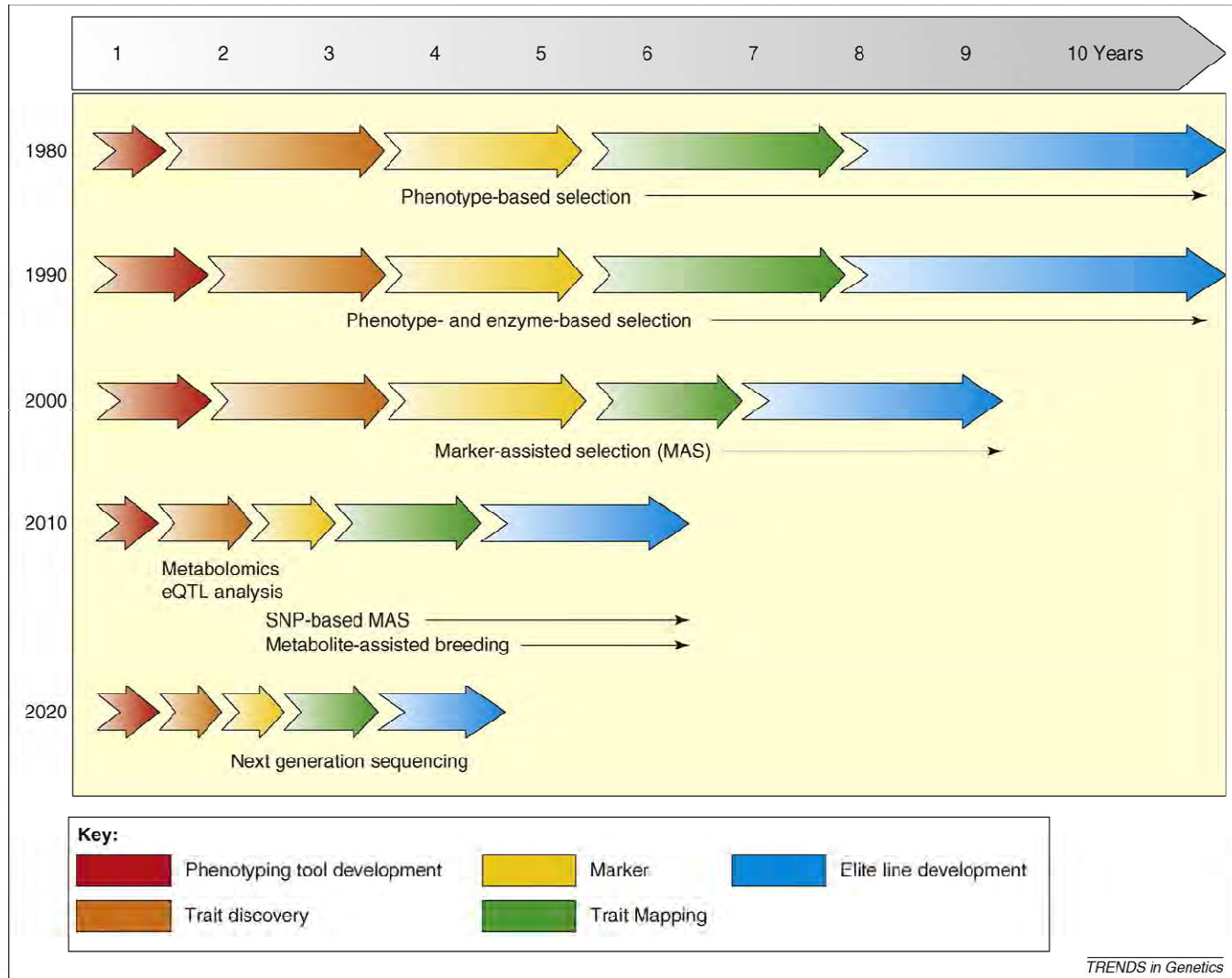


Biotechnology techniques and adoption challenges:

Technique	Adoption challenges
Inoculants for fermented foods	Inoculant production, stabilization
Food processing enzymes	Production and stabilization, cost, economy of scale
Medicinal plants	Efficacy and safety, mechanism of action, regulatory requirements, production and processing
Production of food and feed additives (amino acids, vitamins, flavourings etc)	Process development, production, economy of scale
Forestry – improved trees	Long time frames for development and proof of concept
GMOs	Cost of development and testing, regulatory hurdles, public acceptance



Impact of new technologies on plant breeding



Some broader challenges

- **R&D funding**
 - Donor funding relatively short term
 - Agendas set by donors, not always demand-driven
 - African public investment is lacking
 - Lack of linkage between researchers and farmers
- **Access to finance**
 - Farmers
 - Entrepreneurs
 - Food processors
 - Seed companies etc



Some broader challenges

- **Political will**
 - Lack of biotechnology policies
 - Lack of linkage between researchers, farmers, entrepreneurs and policy makers
 - Lack of commitment to R&D funding
 - Lack of investment incentives
 - Lack of enabling regulatory environment
 - Regional harmonization efforts scattered
- **Market access**
 - Lack of market knowledge
 - Distance to market, cost of transport
 - Market size uncertain, consumers lack buying power (economy of scale)



Improving the policy environment

- Intellectual property laws weak or non-existent
- No laws on Plant breeder's rights in some countries
- Seed production and distribution systems inadequate
- Systems lacking to protect/reward indigenous knowledge
- Systems lacking to support inter-institutional & inter-country collaboration, exchange of materials & know-how
- Approach to biosafety designed to keep out multi-nationals rather than to stimulate home-grown innovation
- No systems in place to promote tech transfer and inward licensing of technologies

Need for much stronger engagement between scientists, entrepreneurs, farmers, holders of indigenous knowledge and government!

Scientists can take the lead to kick-start this process!



Capacity development

- **Scientists face:**
 - **Lack of critical mass**
 - **Lack of retention incentives**
 - **Limited experience in modern molecular techniques**
 - **Need access to modern equipment and facilities**
 - **Need increased understanding of the business development process and value chain to stimulate translational research**
 - **Need improved knowledge of regulatory requirements**
 - **Lack of experience in bioprocess engineering and manufacture**



Improving capacity

- Put in place mechanisms for sharing know-how and facilities within the continent
- Networked training opportunities – postgraduate training programmes with supervisors from more than one African country
- Provide training in IPR, entrepreneurship, project management, knowledge management, financial management, regulatory issues.....
- Key issue – skills retention!!



Biotech development - Africa in the modern world

- **The world is increasingly internationalized and competitive**
- **The cost of developing new biotech products is high – resulting in a focus on products with a global rather than local market potential**
- **The needs of the poor have to be addressed in the context of global trends**
- **Major social, environmental, and economic challenges in Africa will require radical innovation rather than incremental innovation**



TOWARDS THE FUTURE

- **Learn by doing – adopt/adapt technologies developed elsewhere in the world**
- **Focus on real identified needs in areas where there is a competitive advantage**
- **Form partnerships with others who have complementary experience and know-how**
- **Build a strong business case – encourage PPPs**
- **Build new ways of innovating that suit Africa better – use social relationships and networks to stimulate knowledge innovation**