Course: Global Pennovation

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Global and Local Water Resources the Link to Food Security

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Wystan H. Auden, British poet (1907 – 1973):

"Thousands have lived without love, not one without water"



No such a thing as an average water/rainfall

- ✓ Uneven and uncertain
- ✓ Worshiped and feared
- ✓ High value low price
- ✓ Has no substitute you cannot drink oil



Water availability, stress and exploitation





The seven fat and the seven lean years (Zimbabwe, 1910 – 2000; 1970 - 1993)





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Extremes – socio-economic & environmental hazards



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Demography, GDP and Water – Past & Future

Previous century: accelerated trends

- Population increase: 1.65 6 billion; about 360 %
- GDP increased: 1,900% (IMF)
- Water demand/withdrawals increase: 700 to 3,900 km³; about 600 700%

2010 - 2050: 'An inconvenient truth'

- Population increase: 7 to 9.2 billion, 20 25%
- GDP increase, estimated 350 % to 480% (current annual growth rate 3,25 4,0%; IFM)
- Water demand increase, mainly domestic & urban/industrial: about 40% (IWMI, OECD)





Another 2 - 3 billion in a generation

- with dreams

- with the right to sense development
- considerable increase in purchasing power; e.g. increased food demand





Water and Food

Significant volumes of water required to produce food

- we drink a few litres while we "eat" tons of water every day

More water required:

- with shifts in dietary preferences
- global warming

Production in open landscape, seasonally

- consumptive water use
- three to four months critical





Food Security ...

"...exists when all people, at all times, have physical and economic access to *sufficient*, safe and nutritious food to meet their dietary needs and food *preferences* for an active and healthy life" Rome Declaration (FAO, 1996, Italics added)

- How much is s*ufficient*: 2,000 2,200 kcal/person, day on average
- What to do when *preferences* deviate from *sufficient* (i.e. healthy diets)?
- Estimated 870^{'''} undernourished; compare: **1,600^{'''} overweight**





Changes in food supply, 1961 – 2005



Searching under the street lamp?



"It is distressing to note that so much time is being devoted to the culture of the plant, so much money spent on irrigation, fertilization and crop protection measures, only to be wasted about a week after harvest" (FAO, 1981)

Production, supply Sustainability, green growth, sound progress, human wellbeing, etc. hinge on linking the two sides



Beware of terminology

- Food production: The amount in the field
- Food supply: The amount available on the market; production minus losses before market, conversion
- Food demand: The amount bought/'procured' by households, public institutions and other social entities
- Food intake: the amount of food eaten;
 'beneficial consumption'
- Food absorption: the uptake of energy & nutrients in human body



Post-harvest losses, conversions and waste along the food supply/value chain



Losses & waste at a high cost

Water - all food produced consumes water;

a rough estimate (50% losses & waste): 1,350 km³ of irrigation water

Energy

about 32% of total global end-use of energy in food systems

Monetary

global: US\$ 750 billion

US – estimated US \$100 billion annually (WEF)

Green house gas emission

from production throughout the supply chain, incl disposal; food systems about 22%

Labor and money: income and security

L&W incur costs – no gains for nobody

Investments & efforts to reduce L&W

harvesting, storage, transport, marketing, consumer attitudes/habits - cf. with above



Recent trends in China: 1961 - 2005



Source: Liu and Savenije, 2008



Magnitude of food losses and waste in China Water and land implications



19 % grains lost and wasted in supply chain from field to fork

135 billion

m³ of water used to produce food not eaten

43 bill m³ +/- of irrigation water = planned South – North transfer 26 million hectares of cropland used in vain

Cf: harvested acreage of corn in the US about: 33 mill ha

Source: Source: Liu et al. 2013





Distinction between food production, supply and (recommended) intake





Human behavior, value and price of food

A dollar could buy

- -1,200 kcal of potato chips
- 875 kcal of soda
- 250 kcal of vegetables
- 170 kcal of fresh fruit

More expensive to choose a healthy diet



Another perception and policy a generation or two ago



Limited empirical evidence, but indications that post-harvest losses and waste 'from field to fork' account for 30 – 50% reductions

What company with an ambition to stay in business would accept 30 – 50% losses and waste?





Food production > supply > intake requirement *Huge* losses & waste = multiple cost Food chain efficiency very different from production efficiency Most worthwhile use of water & other resources – a social issue

Where is

the road ahead?

Thank you!

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