APPROACHES FOR SUSTAINABLE AGRICULTURAL PRODUCTION SYSTEMS

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BOGOR, 26 NOVEMBER 2014

What is...

- AGRICULTURE
  - ORIGIN AND EVOLUTION OF AGRICULTURE
    - EVOLUTIONARY PROCESS SINCE STONE AGE UP TO NOW
    - Subsistence vs. Commercial Agric.
    - WHERE DO WE GO?
  - AGRICULTURE IN ARCHIPELAGO AND IN MASSIVE CONTINENT
    - ARCHIPELAGO
      - TROPICAL ARCHIPELAGO
      - TEMPERATE CLIMATE ARCHIPELAGO
      - CONTINENTAL STRUCTURE OF AGRICULTURE
- SUSTAINABILITY
  - STRONG SUSTAINABILITY
  - WEAK SUSTAINABILITY
- SUSTAINABLE
  - GROWTH
  - DEVELOPMENT
  - EQUALITY
- SUSTAINABLE DEVELOPMENT
  - NORMATIVE POINT OF VIEW
  - EVOLUTIONARY POINT OF VIEW
- ENTROPY

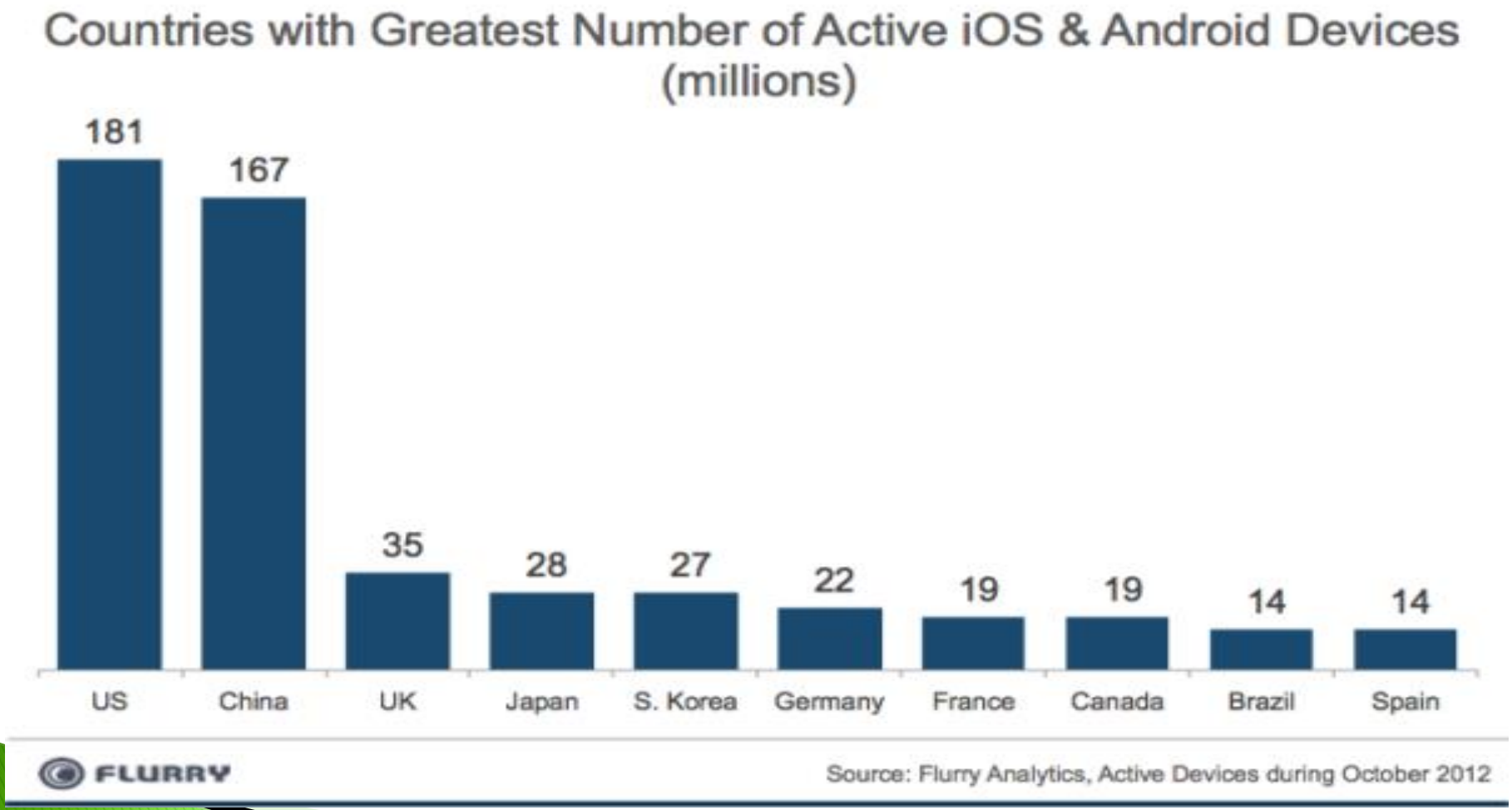
LESSONS FROM THE PAST: TWO DIFFERENT THEORETICAL PERSPECTIVES

Characteristic features	Rational choice	Evolutionary
Perspective (time horizon)	Short-term	Long-term
Focus of explanation	Decisions, equilibrium	Institutions, transitions
Choice process	Rational maximization	Trial and error search and selection
Ends-means schema	Given constraints and preferences, choice of means	Both constraints and preferences are variable

KONDRATIEF LONG TERM CYCLE

About	**K-waves** (global leading sectors)	**Long cycles** (**world powers** after 1500)
930	K1 Printing and paper	LC1 Northern Sung
990	K2 National market	
1060	K3 Fiscal framework	LC2 Southern Sung
1120	K4 Maritime trade	
1190	K5 Champagne Fair	LC3 Genoa
1250	K6 Black Sea trade	
1300	K7 Galley fleets	LC4 Venice
1360	K8 Pepper	
1430	K9 Guinea gold	LC5 **Portugal**
1492	K10 Indian spices	
1540	K11 Atlantic, Baltic	LC6 **Dutch Republic**
1580	K12 Asian trade (VOC)	
1640	K13 Amerasian trade	LC8 **Britain I**
1688	K14 Amerasian trade	
1740	K15 Cotton, iron	LC9 **Britain II**
1792	K16 Steam, rail	
1850	K17 Electrics, chemicals, steel	LC10 **United States**
1914	K18 Autos, air, electronics	
1972	K19 Information industries	

TECHNOLOGY EVOLUTION

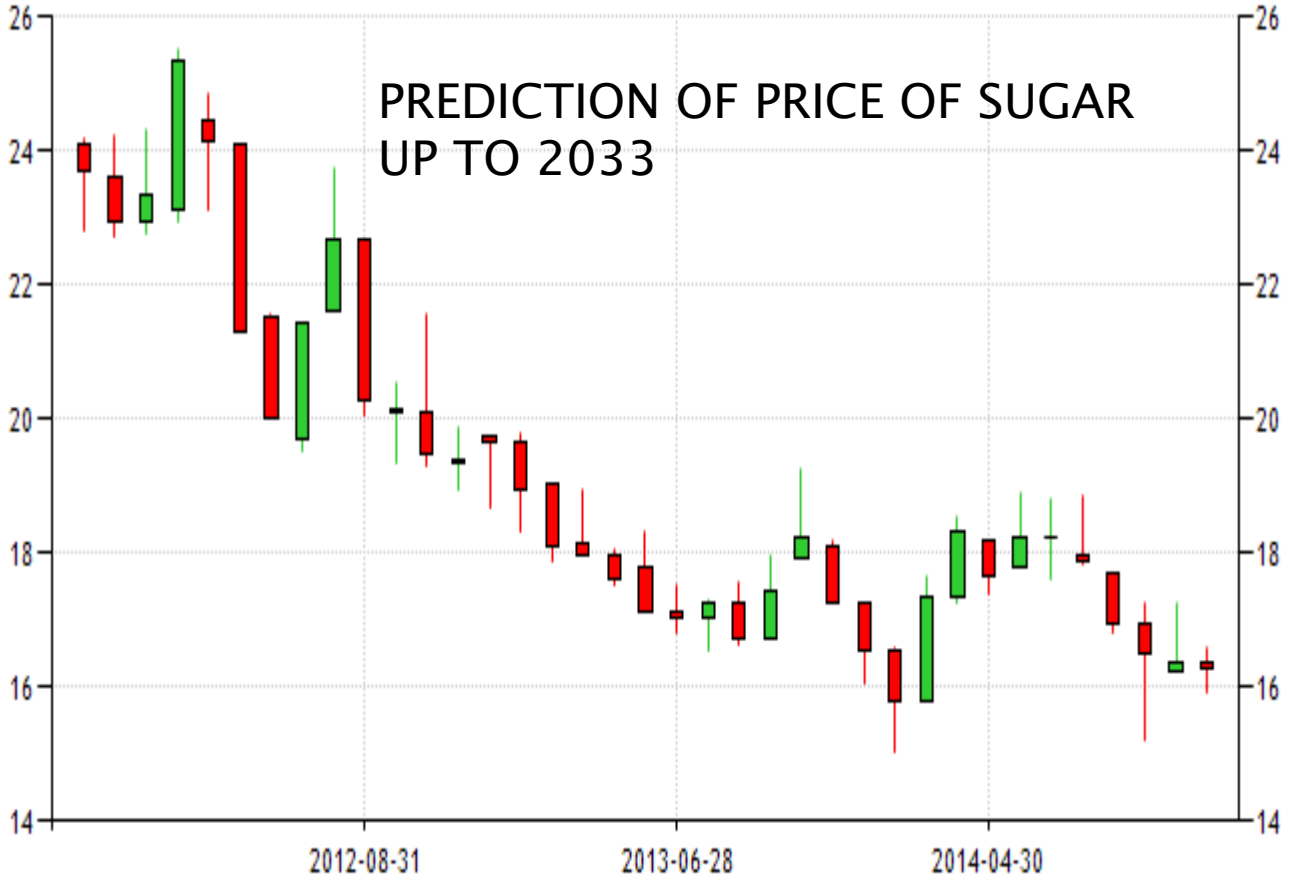


SUGAR WORLD PRICE: AS AN EXAMPLE OF WHAT WRONG WITH OUR POLICIES

Actual	Previous	Highest	Lowest	Dates	Unit	Frequency
16.27	16.33	65.20	1.25	1912 – 2014	Cents/lb	Daily

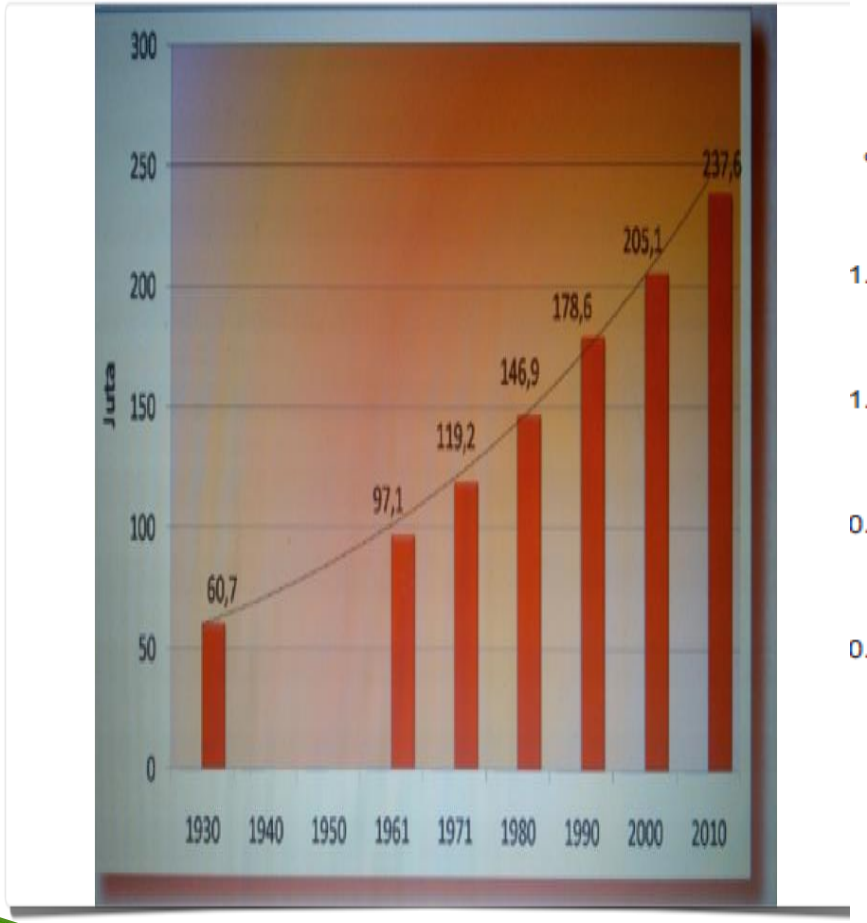
http://www.tradingeconomics.com/commodity/sugar

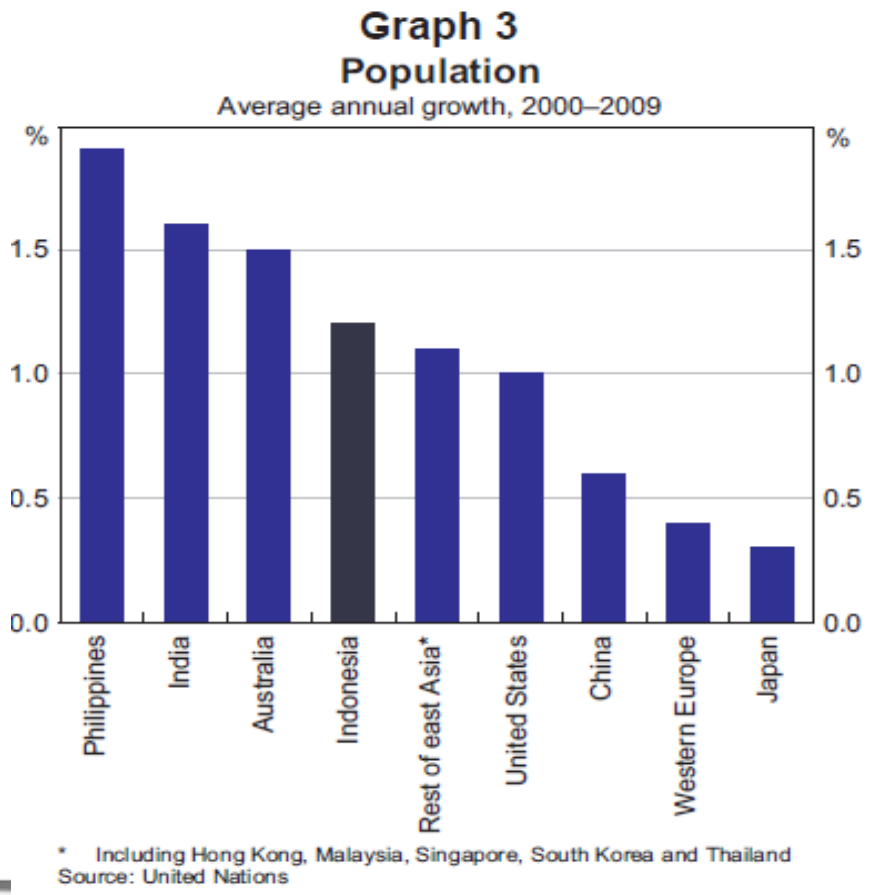
WILL WE HAVE SUSTAINABLE AGRICULTURE WITH DECLINING PRICE?

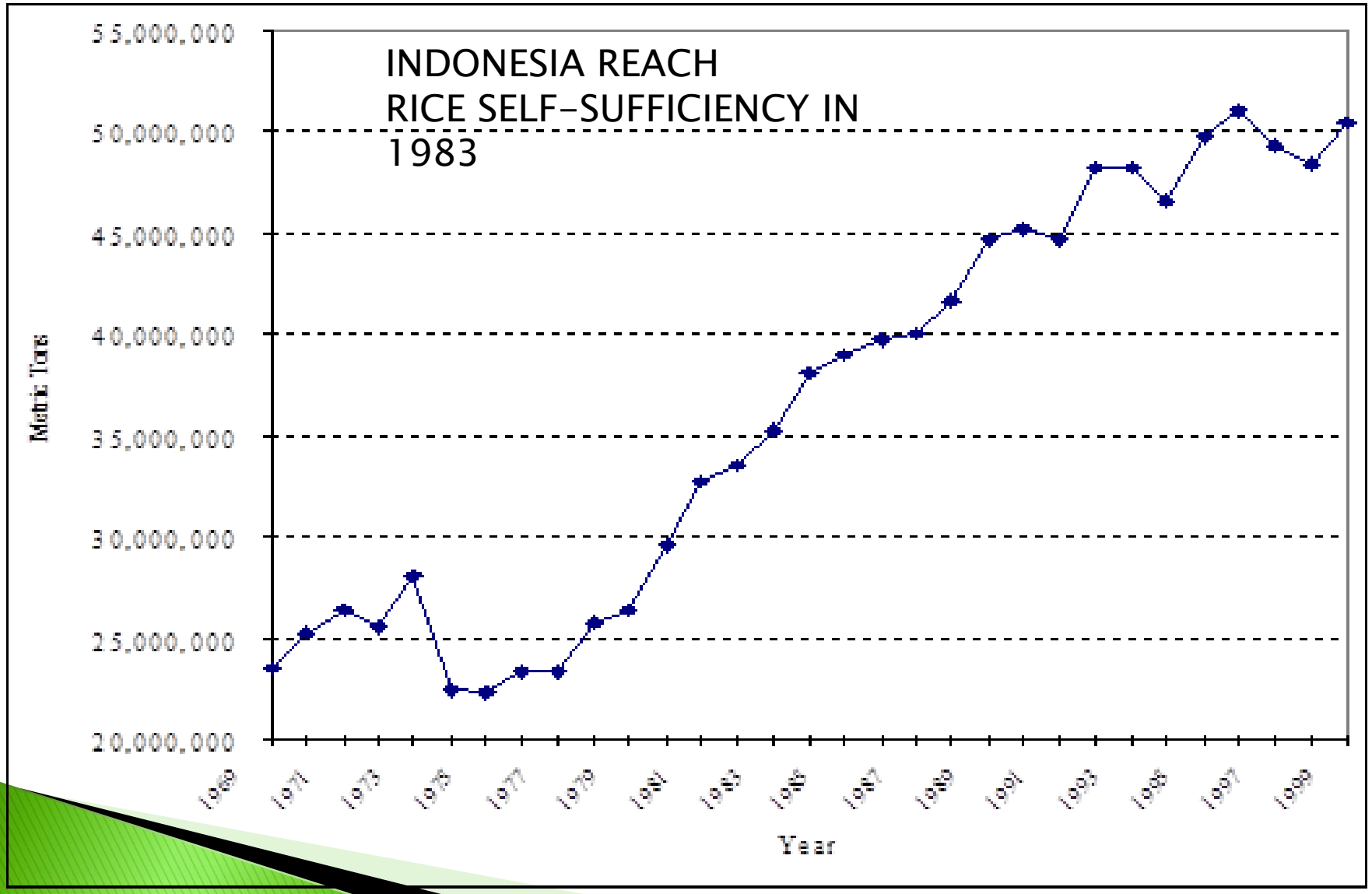


http://www.tradingeconomics.com/commodity/sugar

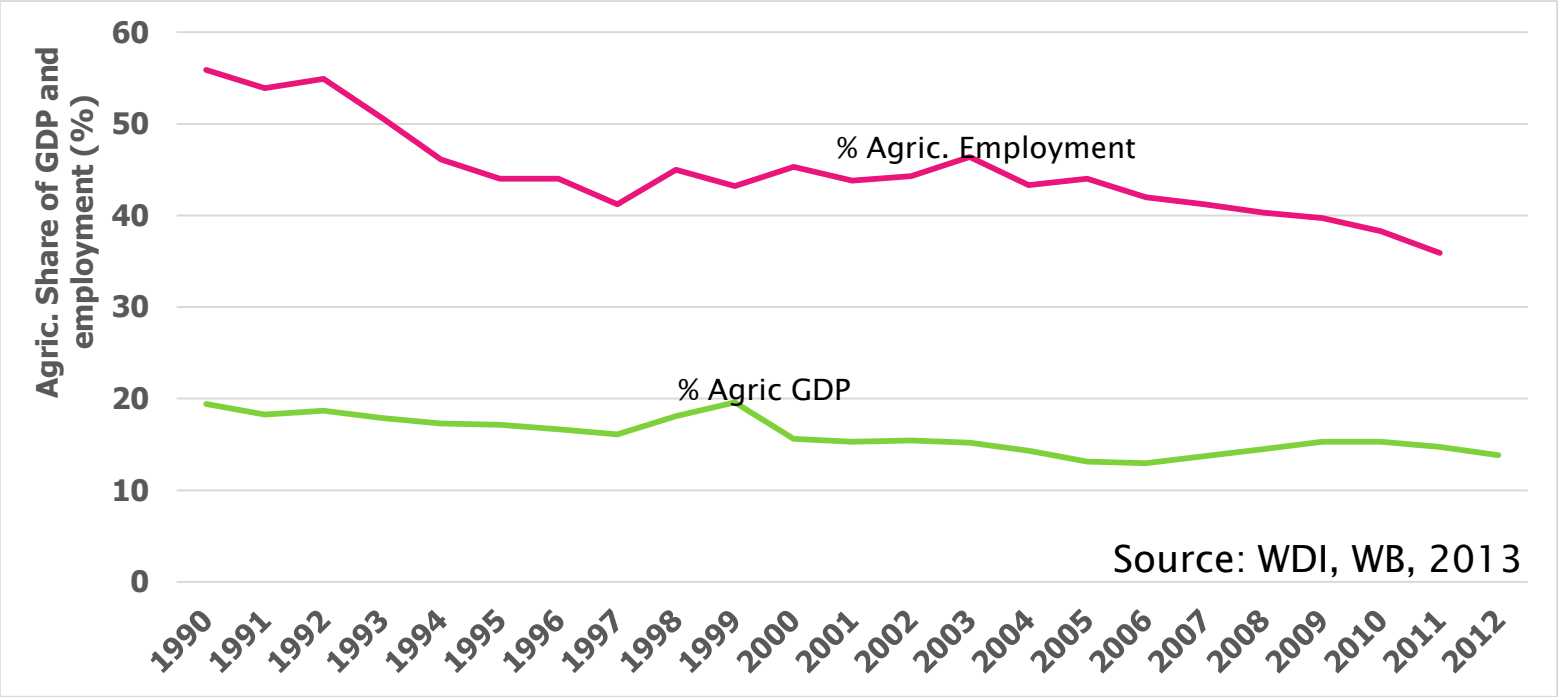
INDONESIAN POPULATION GROWTH






INDONESIA REACH
RICE SELF-SUFFICIENCY IN
1983
55,000,000
50,000,000
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
Metric Tons
Year

ECONOMIC STRUCTURE TRANSFORMATION 1990-2012



INDONESIA'S RICE SELF SUFFICIENCY IN 1984, AFTER ABOUT 15 YEARS OF DEVELOPMENT

MACROECONOMIC ENVIRONMENT: International Balance of Payments

(MILLION US$)

Year	Current Account					Capital Account		
	Trade Account			Service Account Balance	Total	Private Sector	Public Sector	Total
	Export (X)	Import (M)	X-M (Trade account balance)					
1971	1307	1225	81	-511	-430	156	285	441
1980	22609	13456	9153	-6399	2754	-630	2204	1574
1990	26807	21455	5352	-8592	-3240	4113	633	4746
2000	65408	40367	25041	-17043	7998	-9992	3217	-6775

Rate of Economic Structural Change in Indonesia, Thailand, Malaysia and South Korea 1957-2002

Change 1957-2002	Indonesia	Thailand	Malaysia	South Korea
(1) % of Agric. Labor	17	32	37	58
(2) % of Agr. GDP	39	29	36	37
Rate of change of (1): (2)	0.43	1.1	1.02	1.56

INCOME PER CAPITA OF SELECTED ASIAN COUNTRIES

Country	1820	1870	1930	1950	1970	2000
Burma	504	504	902	396	646	1353
Cina	600	530	567	439	783	3425
Indonesia	**612**	**654**	**1164**	**840**	**1194**	**3203**
Jepang	669	737	1850	1921	9714	21069
Korea	600	604	1020	770	1954	14243
Malaysia	605	663	1636	1559	2079	7872
Filipina	704	776	1476	1070	1764	2385
Singapura	615	682	1279	2219	4439	22207
Taiwan	**499**	**550**	**1099**	**924**	**2980**	**16642**
Thailand	646	712	793	817	1694	6336
Vietnam	527	505	724	658	735	1790

HOW IMPORTANT OF AGRICULTURE IS REFLECTED BY ITS ARDI

Table 1 Changes in ARDI in 40 countries from 1980 to 2004

Year	1980	1990	2000	2003	2004
USA	0.3725	0.4517	0.6582	0.7203	0.7606
France	0.3437	0.4628	0.7456	0.7778	0.9107
UK	0.4383	0.5405	0.5122	0.5159	0.6655
Australia	0.5660	0.6283	0.7418	0.9188	0.9338
New Zealand	0.6313	0.8394	0.9468	0.9973	1.0265
Japan	0.2864	0.3140	0.3545	0.4016	0.4265
South Korea	0.3684	0.4103	0.4990	0.4725	0.5451
Spain	0.2141	0.3252	0.4452	0.4783	0.5657
Norway	0.2782	0.3139	0.3764	0.3756	0.4885
Sweden	0.3108	0.4306	0.4867	0.5418	0.5816
Israel	0.4543	0.6771	1.0378	1.1772	1.2246

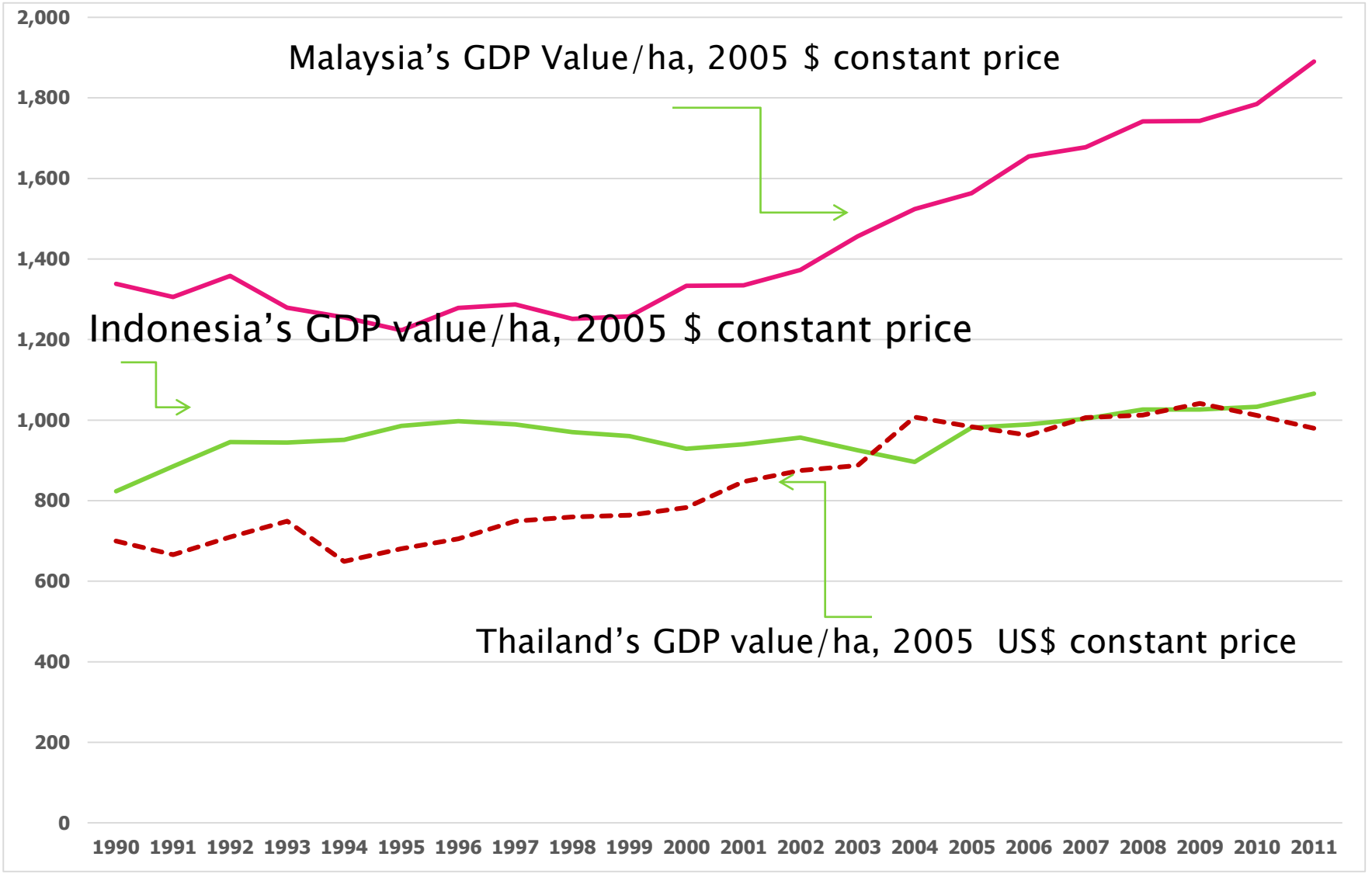
ARDI = AGRICULTURAL RELATIVE DEVELOPMENT INDEX

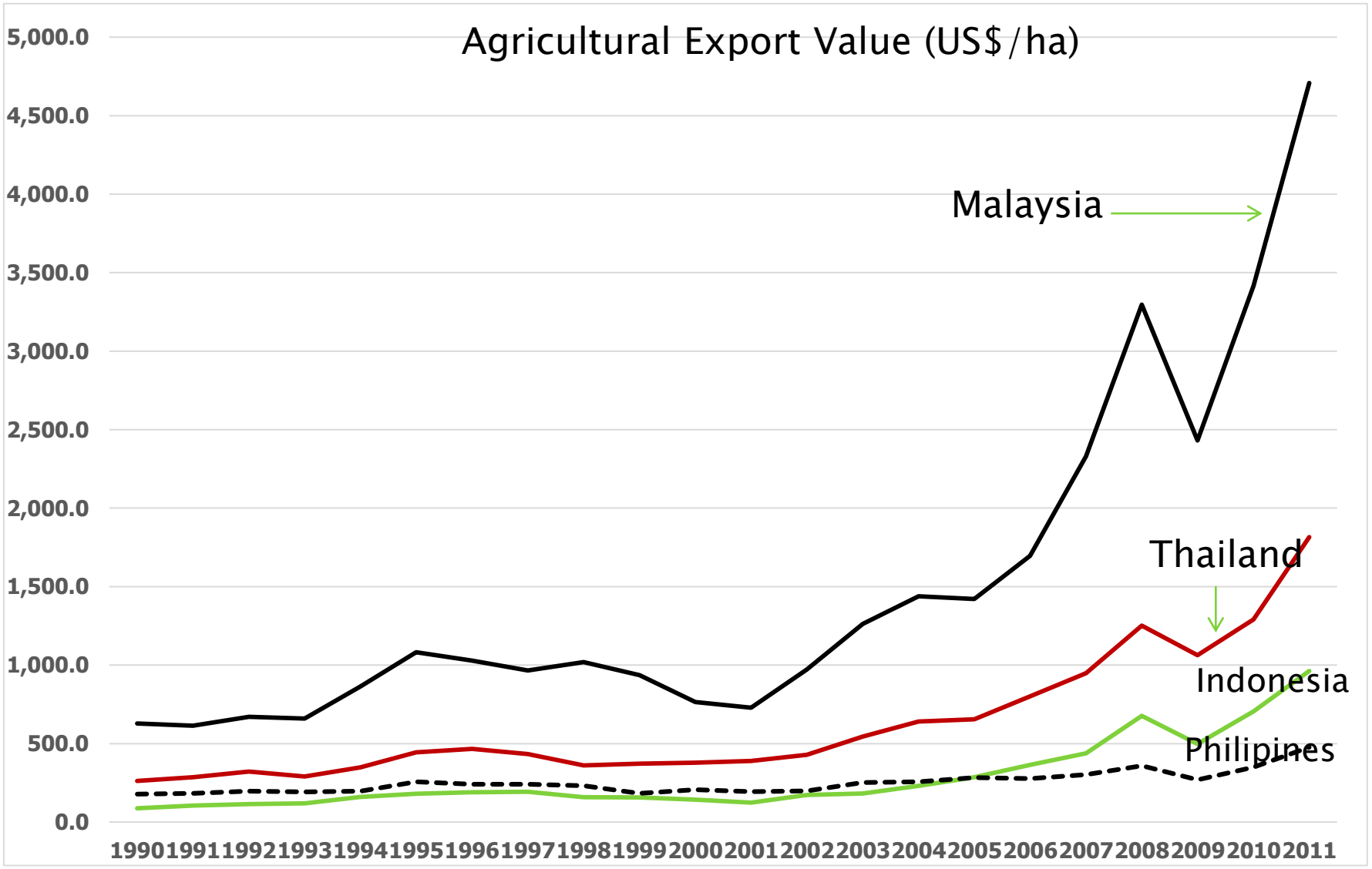
..... ARDI

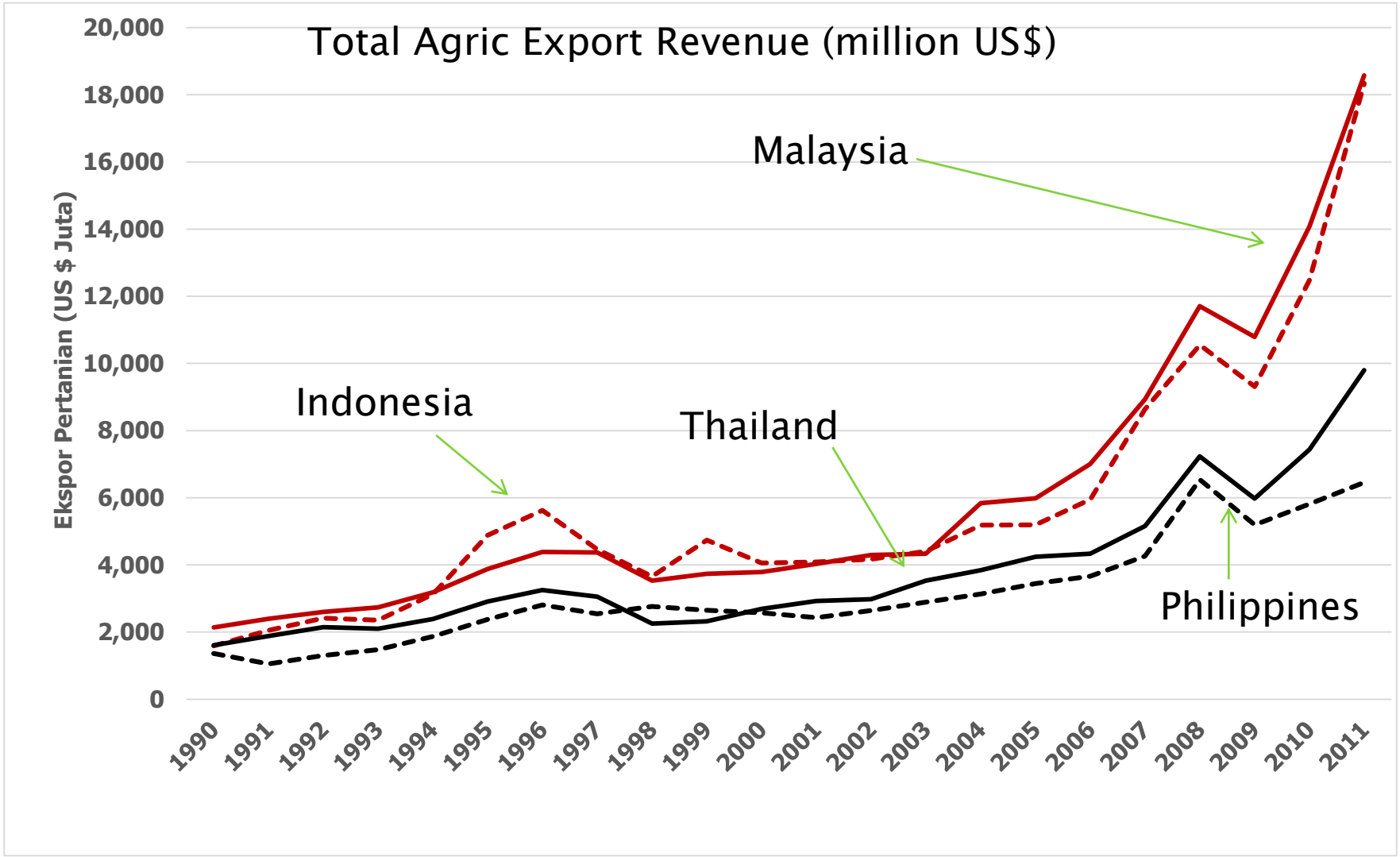
Indonesia	0.4634	0.3777	0.3574	0.3654	0.3675
Ghana	0.7789	0.6889	0.6424	0.6436	0.6389
India	0.5709	0.5094	0.4251	0.3912	0.3732
Pakistan	0.4326	0.4168	0.4689	0.4554	0.4421
Vietnamese	0.5464	0.4718	0.3620	0.3345	0.3181
Laos	0.7789	0.6889	0.6424	0.6436	0.6389
Yemen	0.3667	0.2342	0.2797	0.3102	0.3233
Rwanda	0.3997	0.3514	0.4547	0.4675	0.4494
Nepal	0.5398	0.5172	0.4127	0.4210	0.4095

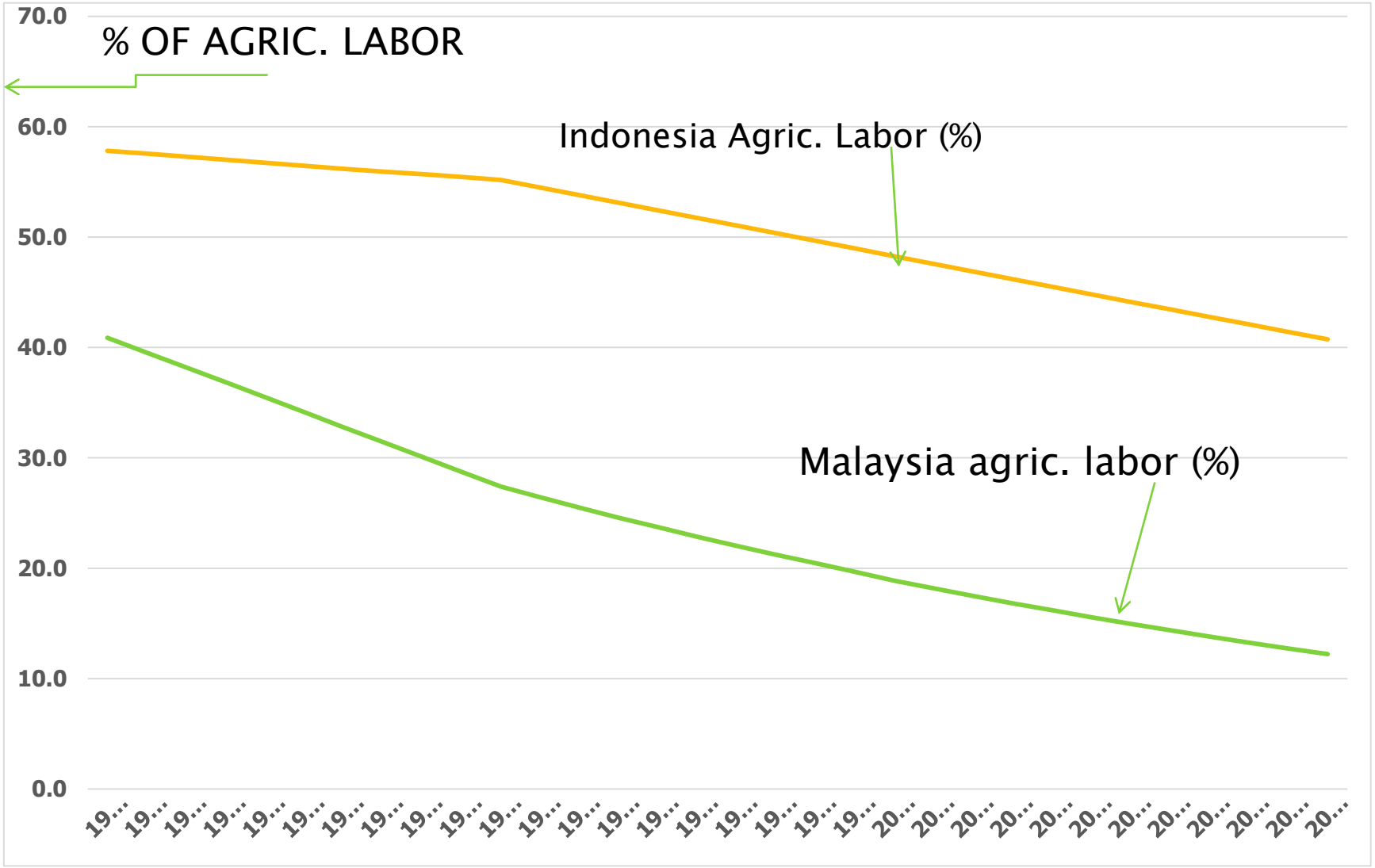
$$R = \frac{G_1 / L_1}{G_2 / L_2}$$

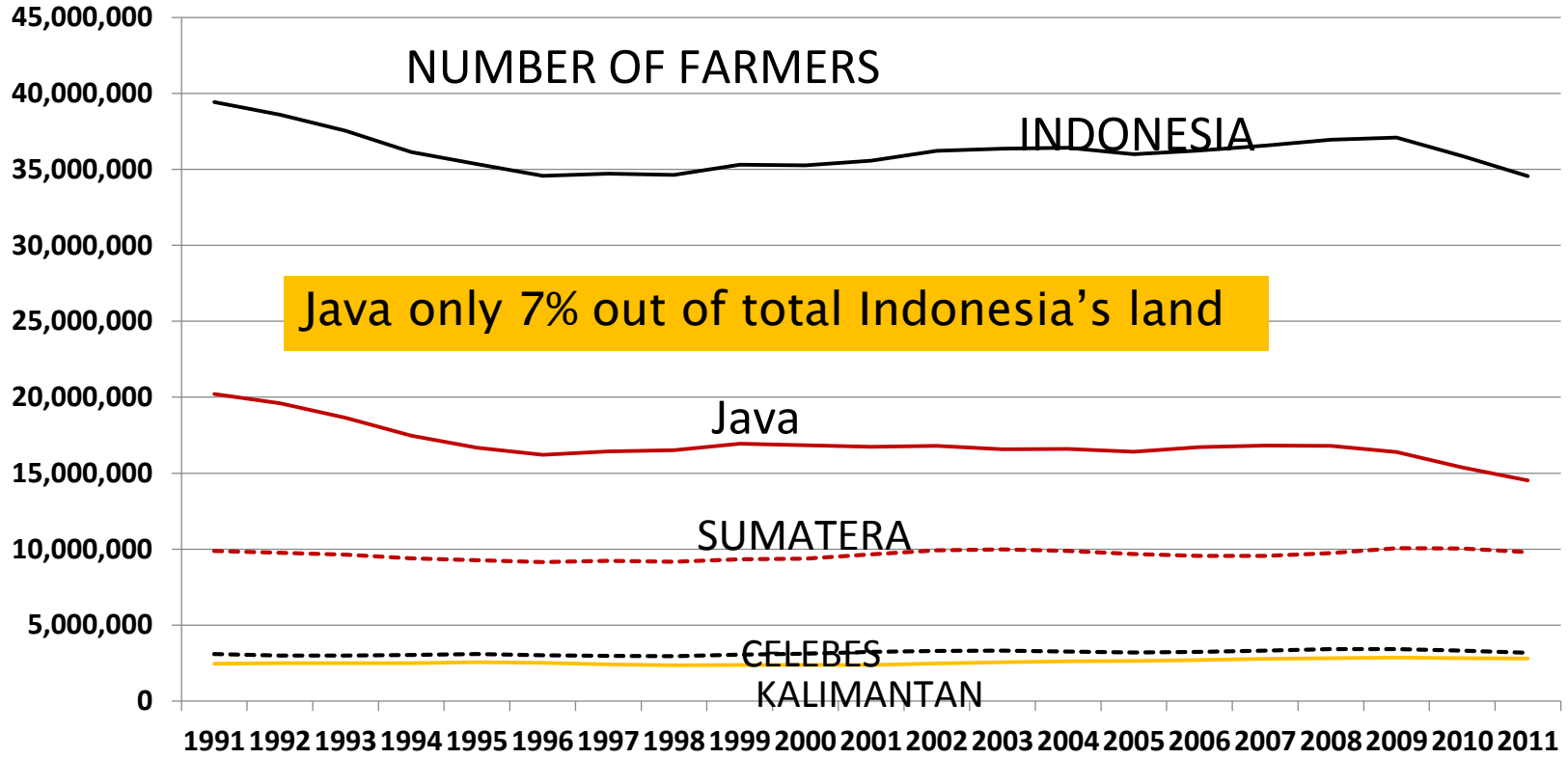
R= ARDI
G is gross domestic product
1 refers for agriculture
2 refers for national economy


Malaysia's GDP Value/ha, 2005 $ constant price
Indonesia's GDP value/ha, 2005 $ constant price
Thailand's GDP value/ha, 2005 US$ constant price
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011


Agricultural Export Value (US$/ha)
5,000.0
4,500.0
4,000.0
3,500.0
3,000.0
2,500.0
2,000.0
1,500.0
1,000.0
500.0
0.0
Malaysia
Thailand
Indonesia
Philipines
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011


Total Agric Export Revenue (million US$)
Ekspor Pertanian (US $ Juta)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Malaysia
Indonesia
Thailand
Philippines


% OF AGRIC. LABOR
Indonesia Agric. Labor (%)
Malaysia agric. labor (%)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0


NUMBER OF FARMERS
INDONESIA
Java only 7% out of total Indonesia's land
Java
SUMATERA
CELEBES
KALIMANTAN
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

GLOBAL HUNGER INDEX(GHI), 10 LOWEST GHI DEVELOPING COUNTRIES INDEX

Rank	Country	1990	1995	2000	2005	2013
1	Albania	9.2	6.0	7.8	6.1	5.2
1	Mauritius	8.5	7.6	6.5	5.9	5.2
3	Uzbekistan	–	8.3	9.3	6.6	5.3
4	Panama	11.6	10.8	11.4	9.0	5.4
4	South Africa	7.2	6.5	7.4	7.7	5.4
6	China	13.0	10.4	8.4	6.7	5.5
6	Malaysia	9.5	7.1	6.9	5.8	5.5
6	Peru	16.3	12.3	10.5	9.9	5.5
9	Thailand	21.3	17.1	10.2	6.6	5.8
10	Colombia	10.4	8.0	6.8	6.9	5.9

Source: International Food Policy Research Institute (IFPRI, 2013)

Position of Indonesia's GHI

		1990	1996	2000	2005	2013
20	Moldova	–	7.7	8.8	7.3	9.2
21	Georgia –	16.6	9.2	11.3	9.3	
22	Nicaragua	24.1	19.9	15.4	11.5	9.5
23	Indonesia	19.7	16.9	15.5	14.6	10.1
23	Paraguay	9.3	7.5	6.5	6.3	10.1
25	Mongolia	19.7	23.6	18.5	14.1	10.8
26	Bolivia	18.8	16.9	14.2	13.8	11.2
27	Lesotho	13.2	14.6	14.6	14.9	12.9
28	Mauritania	22.7	16.2	17.2	14.6	13.2
28	Philippines	19.9	17.4	17.7	14.0	13.2
30	Benin	22.5	20.5	17.3	15.2	13.3

Source: International Food Policy Research Institute (IFPRI, 2013)

Food security

Rankings by income classification

(Income groups are World Bank classifications, as of July 1st 2013)

High income (US$12,616 per capita or more)

Rank		Score/100
1	United States	89.3
2	Austria	85.5
=3	Netherlands	84.4
=3	Norway	84.4
5	Singapore	84.3

Lower middle income (US$1,036-4,085 per capita)

Rank		Score/100
1	Ukraine	56.4
2	Paraguay	53.1
3	Sri Lanka	51.7
4	Bolivia	50.6
=5	Honduras	50.1
=5	Morocco	50.1
7	Philippines	49.4
8	Egypt	49.3
9	Vietnam	49.1
10	El Salvador	48.8
11	India	48.3
12	Guatemala	46.9
13	Indonesia	46.5

Low income (US$1,035 per capita or less)

Rank		Score/100
1	Uganda	45.6
2	Kenya	40.1
3	Tajikistan	38.7
4	Benin	38.4
5	Nepal	37.7
6	Myanmar	37.6
7	Bangladesh	36.3

CORE LESSONS FROM OUR PAST

- GREEN REVOLUTION TECHNOLOGY HAD BEEN ADOPTED VERY FAST. BUT THE LAW OF DIMINISHING RETURN FROM OLD AGRIC. TECHNOLOGY ARRIVED VERY SOON

- WIDENING GAP BETWEEN DEVELOPED AND DEVELOPING COUNTRIES IN FOOD SECURITY

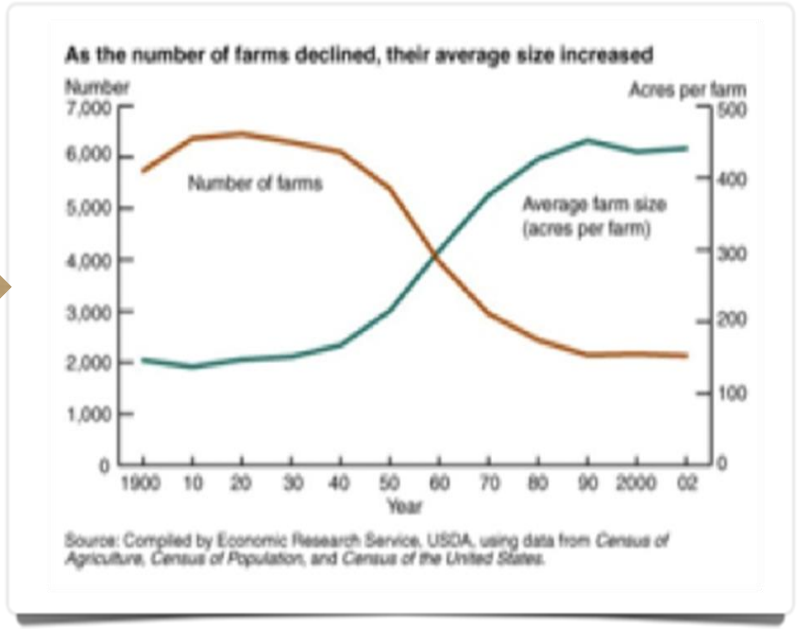
- ENVIRONMENTAL THREATS AND INCREASING NATURAL RESOURCES SCARCITIES ESPECIALLY WATER
- SUCCESSFUL INNOVATION IS A KEY FOR SUSTAINABILITY

Mankind is passing from the *primacy* of the *past* to the *primacy of expectations of vast future changes.*
Harold D. Lasswell

SUSTAINABILITY?

SUSTAINABILITY IS: HOW CAN WE SUCCESSFULLY ORGANIZE ECONOMIC TRANSFORMATION?

INDONESIA



USA, JAPAN, KOREA & ALL

AGRICULTURAL INVOLUTION

AGRICULTURAL SIZE EXPANSION /EVOLUTION

UN CONFERENCE ON ENVIRONMENT AND DEVELOPMENT (AGENDA 21)

- UN Conference on Environment and Development –
  - 20 years after the 1972 UN Conference on the Human Environment (Stockholm)
  - Rio de Janeiro, 1992, after several years of preparatory meetings.
    - Resulting in **Agenda 21** and the **Rio Declaration**

Agenda 21 (1992)

- Ch.1: Preamble:
  - Humanity is confronted with a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems.
  - Causes:
    - Population growth
    - Changing consumption patterns
    - Global warming and sea level rise
    - Etc.

Agenda 21 (1992)

Section I. Social and economic dimensions

Ch. 2. Sustainable development in developing countries
Ch. 3. Combating poverty
Ch. 4. Changing consumption patterns
Ch. 5. Demographic dynamics and sustainability
Ch. 6. Human health conditions
Ch. 7. Sustainable human settlement development
Ch. 8. Integrating environment and development

Agenda 21 (1992)

Section II. Conservation and management of resources.

Ch. 9. Protection of the atmosphere
Ch. 10. Management of land resources
Ch. 11. Combating deforestation
Ch. 12. Combating desertification and drought
Ch. 13. Sustainable mountain development
Ch. 14. Sustainable agriculture and rural development
Ch. 15. Conservation of biological diversity
Ch. 16. Environmentally sound management of biotechnology

Ch. 16: Env. Sound Management of Biotechnology

Preamble: **Modern biotechnology is a set of techniques for bringing about specific changes in DNA in organisms**.

By itself, biotechnology cannot resolve all the fundamental problems of environment and development, but it promises to make a significant contribution in enabling the development of, for example, better health care, enhanced food security through sustainable agricultural practices, improved supplies of potable water, more efficient industrial development processes for transforming raw materials, support for sustainable methods of afforestation and reforestation, and detoxification of hazardous wastes.

Ch. 16: Env. sound management of biotechnology

Objective: Promote the development of sustainable applications of biotechnology and to establish appropriate enabling mechanisms, especially within developing countries, through three program areas:

a. Increasing the availability of food, feed and renewable
b. Improving human health;
c. Enhancing protection of the environment
d. Developing international mechanisms for cooperation

Estimated total annual cost (1993-2000): 5 billion USD.

Explaining What Lesson from 1992 to 2014 w/ Regard to Biotech Utilization

Table 1. Global Area of Biotech Crops in 2013: by Country (Million Hectares)**

Rank	Country	Area (million hectares)	Biotech Crops
1	USA*	70.1	Maize, soybean, cotton, canola, sugar beet, alfalfa, papaya, squash
2	Brazil*	40.3	Soybean, maize, cotton
3	Argentina*	24.4	Soybean, maize, cotton
4	India*	11.0	Cotton
5	Canada*	10.8	Canola, maize, soybean, sugar beet
6	China*	4.2	Cotton, papaya, poplar, tomato, sweet pepper
7	Paraguay*	3.6	Soybean, maize, cotton
8	South Africa*	2.9	Maize, soybean, cotton
9	Pakistan*	2.8	Cotton
10	Uruguay*	1.5	Soybean, maize
11	Bolivia*	1.0	Soybean
12	Philippines*	0.8	Maize
13	Australia*	0.6	Cotton, canola
14	Burkina Faso*	0.5	Cotton
15	Myanmar*	0.3	Cotton
16	Spain*	0.1	Maize
17	Mexico*	0.1	Cotton, soybean
18	Colombia*	0.1	Cotton, maize
19	Sudan*	0.1	Cotton
20	Chile	<0.1	Maize, soybean, canola
21	Honduras	<0.1	Maize
22	Portugal	<0.1	Maize
23	Cuba	<0.1	Maize
24	Czech Republic	<0.1	Maize
25	Costa Rica	<0.1	Cotton, soybean
26	Romania	<0.1	Maize
27	Slovakia	<0.1	Maize
	Total	175.2	

* 19 biotech mega-countries growing 50,000 hectares, or more, of biotech crops
** Rounded off to the nearest hundred thousand

Source: Clive James, 2013.

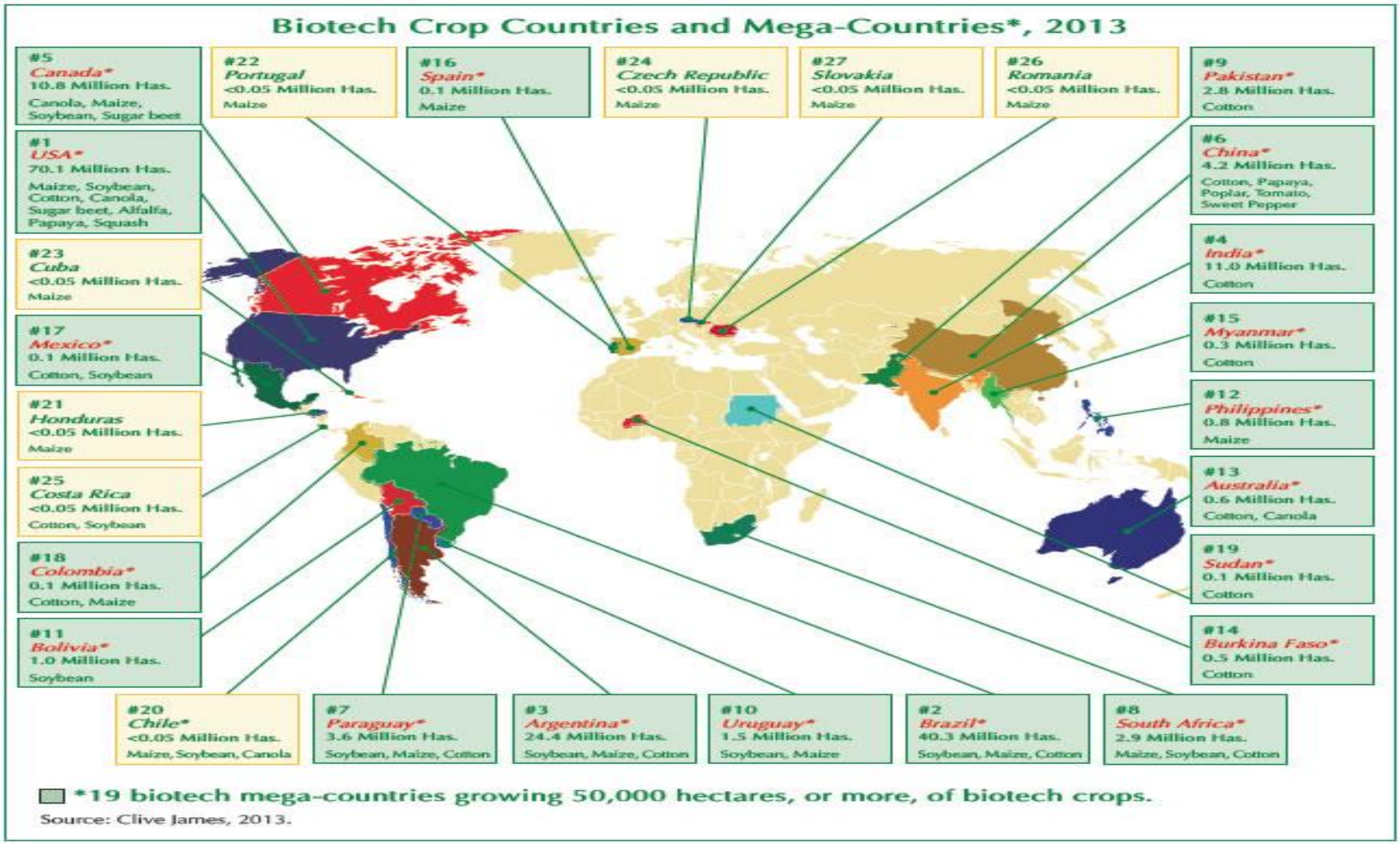
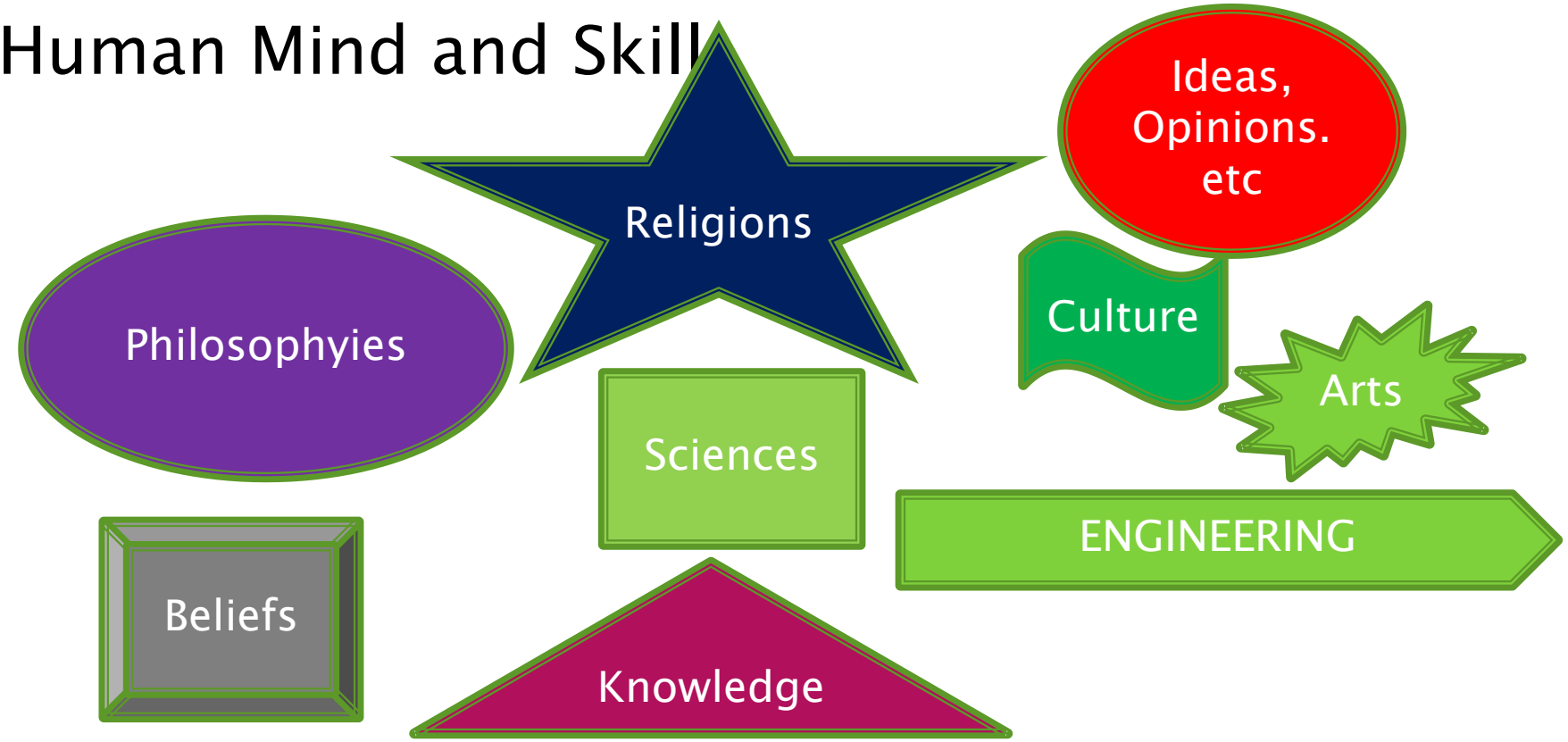


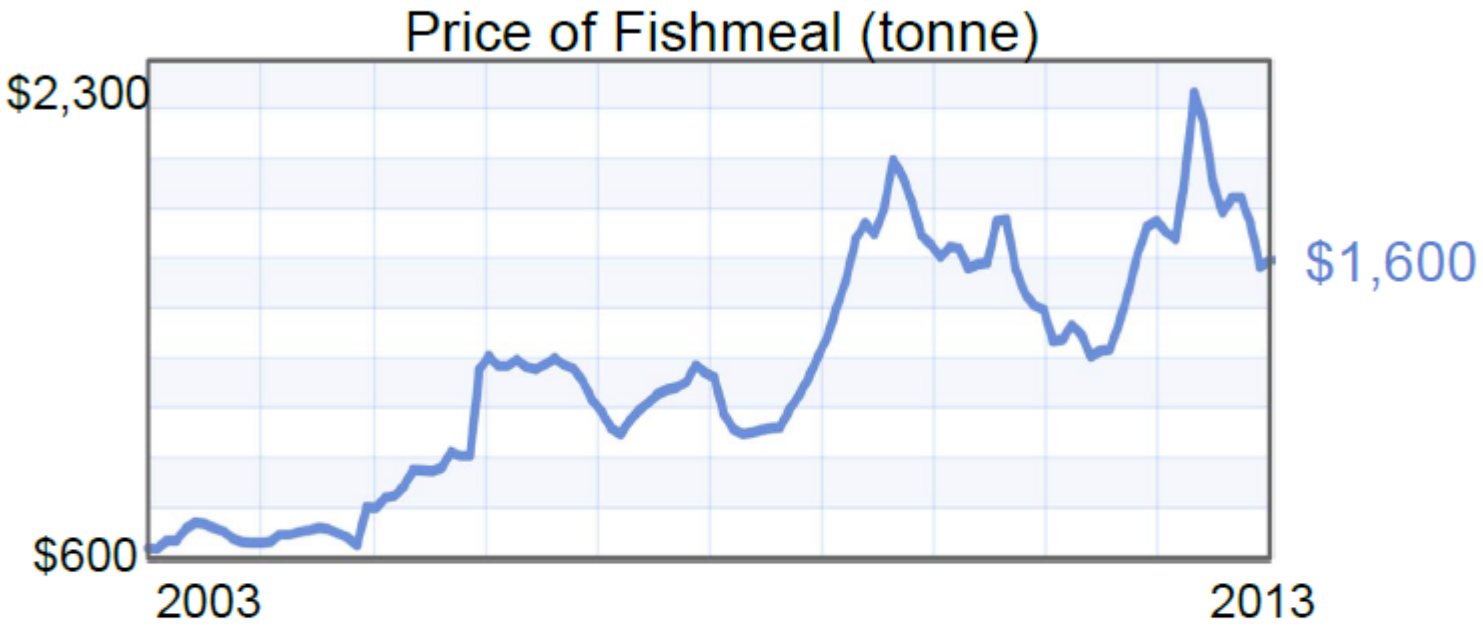
Figure 1. Global Map of Biotech Crop Countries and Mega-Countries in 2013

REAL WORLD? WHAT WILL FUTURE BE?

Human Mind and Skill

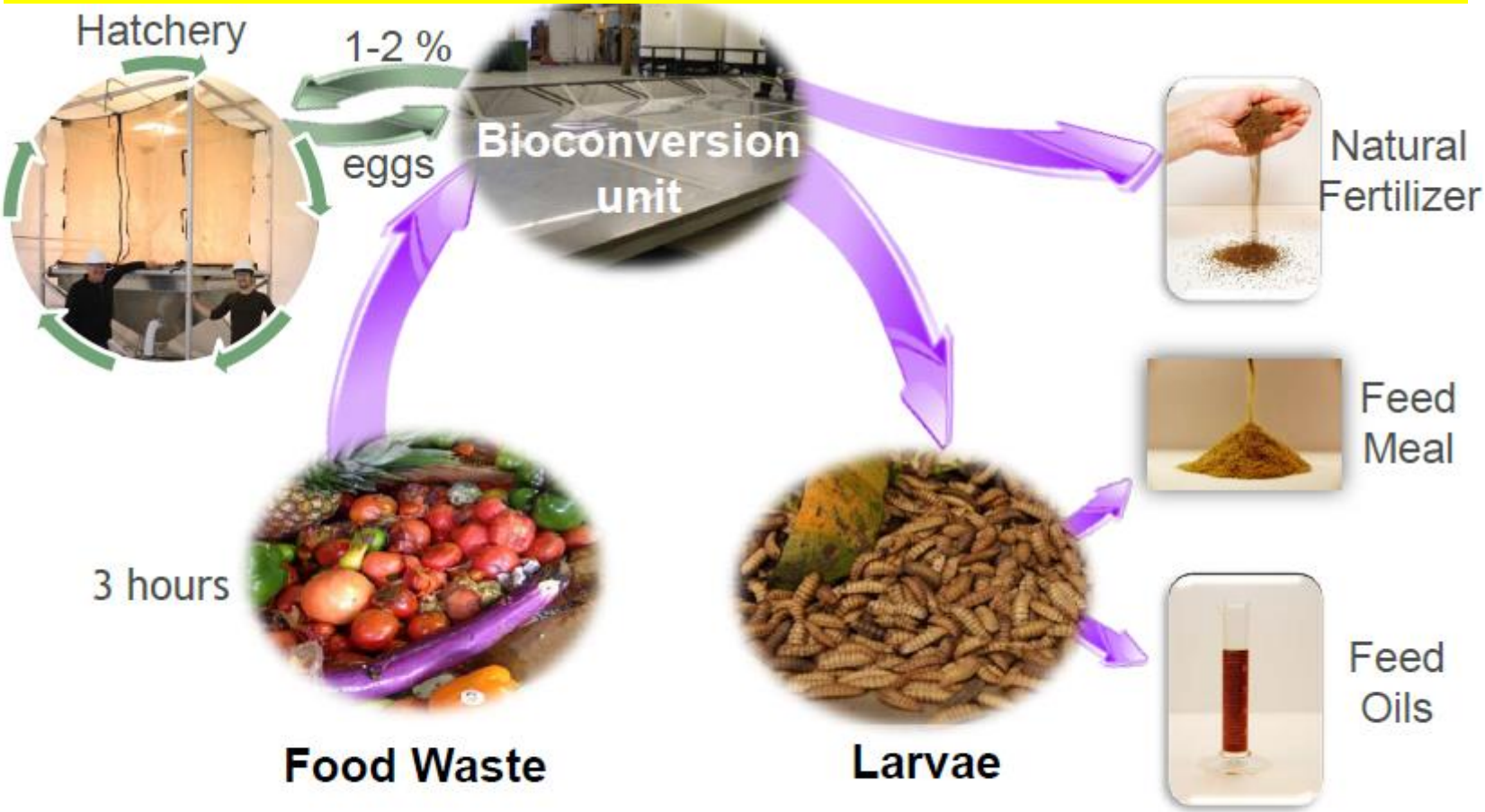


Food Production



Too much.

CIRCULAR WAY OF THINKING IN MANAGING AND UTILIZING ENVIRONMENT A NATURAL RESOURCES



Tables SF.4 through SF.7: Nutrient and Amino Acid Content of Black Soldier Fly Larvae

Table SF.4. Amino Acid Content of Dried Soldier Fly Larvae, Dry Matter Basis (Sheppard, Newton)

Amino Acid	Percent	Amino Acid	Percent
* Methionine	0.9 %	Tyrosine	2.5 %
* Lysine	3.4 %	Aspartic acid	4.6 %
* Leucine	3.5 %	Serine	0.1 %
* Isoleucine	2.0 %	Glutamic acid	3.8 %
* Histidine	1.9 %	Glycine	2.9 %
* Phenylalanine	2.2 %	Alanine	3.7 %
* Valine	3.4 %	Proline	3.3 %
* Arginine	2.2 %	Cystine	0.1 %
* Threonine	0.6 %	Ammonia +	
* Tryptophan	0.2 %	unidentified	1.3 %

* Essential

Table SF.5. Concentrations of Some Fatty Acids Present in Soldier Fly Prepupae Oil, Dry Matter Basis (Sheppard, Newton)

Fatty Acid	Percent
Capric	1.6 %
Lauric	53.2 %
Myristic	6.6 %
Palmitic	8.4 %
Stearic	1.7 %
Oleic	12.4 %
Linoleic	8.8 %

Table SF.6. Mineral Content and Proximate Analysis of Dried Soldier Fly Larvae, Dry Matter Basis (Sheppard, Newton)

Mineral Content		Proximate Analysis	
P	1.51 %	Crude Protein	42.1 %
K	0.69 %	Ether Extract	34.8 %
Ca	5.00 %	Crude Fiber	7.0 %
Mg	0.39 %	Ash	14.6 %
Mn	246 PPM	NFE	1.4 %
Fe	1370 PPM	Moisture	7.0 %
B	0 PPM		
Cu	6 PPM		
Zn	108 PPM		
Al	97 PPM		
Sr	53 PPM		
Ba	33 PPM		
Na	1325 PPM		

CONVERTING ORGANIC WASTES INTO HIGHER PRODUCT VALUES AND BETTER LIVING ENVIRONMENT

CAN WE IDENTIFY APPROACHES IN AGRICULTURAL DEVELOPMENT?

- DEVELOPED COUNTRIES MODEL
  - SUCCESFUL INDUSTRIALIZATION INDUCING AGRICULTURAL DEVELOPMENT/EXPANSION AND INCREASING FARMERS' WELFARE
  - ENERGY SURPLUS
  - MORE ROOMS/CAPACITIES FOR NATURAL AND ENVIRONMENTAL PROTECTIONS
  - INNOVATION IS A KEY FOR SUCCESSFUL ADAPTATION SUCH AS INDICATED BY HIGH FOOD SECURITY, LOW HUNGER INDEX AND ENLARGEMENT OF LAND HOLDING SIZE
  - UTILIZATION OF BIOTECHNOLOGY IS BELIEVED BY THE US AND OTHER USER COUNTRIES

.....CONTINUED

- DEVELOPING COUNTRIES MODEL
  - AGRICULTURE DEVELOPMENT HAS BEEN BOUNDED BY LACK OF SUCCESS IN INDUSTRIALIZATION
  - AGRICULTURAL INVOLUTION AND DECLINING SIZE OF LAND HOLDING
  - ENVIRONMENTAL AND NATURAL RESOURCES DETERIORATION
  - UNCONTROL POPULATION GROWTH
  - LACK OF R&D CAPACITY
  - FOOD INSECURITY
  - HUNGER

SOME THOUGHTS

- DO WE BELIEVE INDUSTRIALIZATION AS A KEY FOR PROGRESS?
- WHAT WAS THE FIRST REQUIREMENT FOR SUCCESSFUL INDUSTRIALIZATION-K FACTOR
- WHAT WAYS FOR DEVELOPING COUNTRIES TO CREATE SUSTAINABLE AGRICULTURAL SYSTEMS
  - NEW INDUSTRIALIZATION VISION AND STRATEGY--START FROM THE END (WASTES)-RECREATION PRINCIPLE IN A CIRCULAR MODEL—MINIMIZING ENTROPY
  - BROADENING CONSUMER TASTES AND AGRICULTURAL DIVERSIFICATION
  - MAKING CONSERVATION AS AN INVESTMENT
  - BETTER UNDERSTANDING THE MARKETS

CLOSING LECTURE

- SUSTAINABILITY OR SUSTAINABLE DEVELOPMENT AGRICULTURAL SYSTEMS IS VERY COMPLEX
- SUCCESSFUL ADAPTATION IS APPROXIMATION OF SUSTAINABILITY
- JUST LIKE THE EVOLUTION OF ANIMALS OR PLANTS, THE MIND OF PEOPLE MUST ALSO EVOLVE TO SEEK THE BEST WAYS TO ADAPT WITH ALL KIND OF CHANGES
- THANK YOU