

# REKAYASA PROSES UNTUK NILAI TAMBAH DAN KEAMANAN PANGAN menuju ketahanan pangan mandiri dan berdaulat

**Purwiyatno Hariyadi**

Departemen Ilmu dan Teknologi Pangan, Fakultas Teknologi Pertanian,  
Southeast Asian Food & Agricultural Science & Technology (SEAFast) Center, LPPM,  
**INSTITUT PERTANIAN BOGOR**

**Kuliah Inaugurasi**  
Sebagai Anggota AIPI - Komisi Ilmu Rekayasa  
Padjadjaran Suites Hotel & Conference ,  
Bogor, 27 April 2013

# REKAYASA PROSES UNTUK NILAI TAMBAH DAN KEAMANAN PANGAN menuju ketahanan pangan mandiri dan berdaulat

Kata –Kata Kunci /Pembahasan:

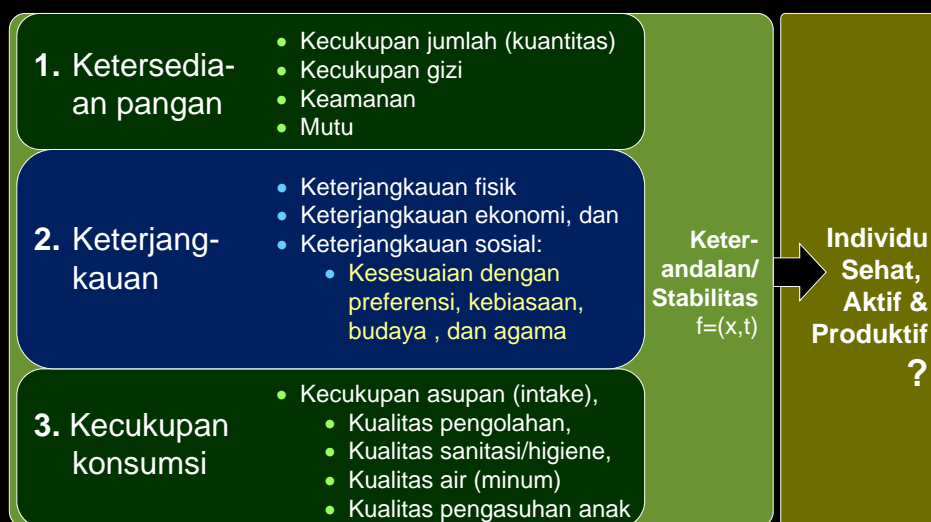
1. Ketahanan pangan?
2. Mandiri dan Berdaulat ?
3. Peranan Teknologi Pangan & Pertanian?
4. Perkembangan Teknologi Pangan?
5. Perkembangan Rekayasa Proses Pangan?
6. Beberapa contoh aplikasi potensial?
7. Penutup

# KETAHANAN PANGAN (Food Security)

## UU Pangan No 18, 2012

Ketahanan Pangan adalah kondisi terpenuhinya Pangan bagi negara sampai dengan perseorangan, yang tercermin dari tersedianya Pangan yang cukup, baik jumlah maupun mutunya, aman, beragam, bergizi, merata, dan terjangkau serta tidak bertentangan dengan agama, keyakinan, dan budaya masyarakat, untuk dapat hidup sehat, aktif, dan produktif secara berkelanjutan.

# KETAHANAN PANGAN (Food Security) → DIMENSI & INDIKATOR



## KETAHANAN PANGAN yang Mandiri dan Berdaulat? (UU No 18, 2012 tentang PANGAN)

**Kemandirian Pangan** adalah kemampuan negara dan bangsa dalam memproduksi pangan yang beraneka ragam dari dalam negeri yang dapat menjamin pemenuhan kebutuhan pangan yang cukup sampai di tingkat perseorangan dengan memanfaatkan potensi sumber daya alam, manusia, sosial, ekonomi, dan kearifan lokal secara bermartabat.

**Kedaulatan Pangan** adalah hak negara dan bangsa yang secara mandiri menentukan kebijakan pangan yang menjamin hak atas pangan bagi rakyat dan yang memberikan hak bagi masyarakat untuk menentukan sistem pangan yang sesuai dengan potensi sumber daya lokal.

### KETAHANAN? KEMANDIRIAN? KEDAULATAN PANGAN?

Dimensi <b>Ketersediaan</b>	<ul style="list-style-type: none"> <li>Jumlah</li> <li>Mutu</li> <li>Gizi</li> <li>Keamanan</li> </ul>	Katahanan Pangan	Kemandirian Pangan	Kedaulatan Pangan
Dimensi <b>Keterjangkaun</b>	<ul style="list-style-type: none"> <li>Keterjangkauan fisik, ekonomi, dan sosial,</li> <li>Kesukaan/kebiasaan</li> </ul>			
Dimensi <b>Konsumsi</b>	<ul style="list-style-type: none"> <li>Mutu pengolahan/penyiapan di RT,</li> <li>Jumlah asupan</li> <li>Mutu sanitasi/higiene,</li> <li>Mutu air minum</li> <li>Mutu pengasuhan anak</li> </ul>			
Dimensi <b>Kemandirian</b>	<ul style="list-style-type: none"> <li>Tingkat (%) impor bahan pangan</li> <li>Tingkat (%) impor ingriden &amp; sarana produksi, mesin, dll</li> <li>Penganekaragaman pangan (SDA lokal)</li> </ul>			
Dimensi <b>Kedaulatan</b>	<ul style="list-style-type: none"> <li>Keragaman industri pangan lokal</li> <li>Tingkat partisipasi masyarakat dalam sistem pangan</li> <li>Tingkat keragaman budaya pangan</li> <li>Kesejahteraan masyarakat, petani, nelayan, dll</li> </ul>			

KETAHANAN? KEMANDIRIAN? KEDAULATAN PANGAN?	
Dimensi Ketersediaan	<ul style="list-style-type: none"> <li>• Jumlah</li> <li>• Mutu</li> <li>• Gizi</li> <li>• Keamanan</li> </ul>
Dimensi Keterjangkaun	<ul style="list-style-type: none"> <li>• Keterjangkauan fisik, ekonomi, dan sosial,</li> <li>• Kesukaan/kebiasaan</li> </ul>
Dimensi Konsumsi	<ul style="list-style-type: none"> <li>• Mutu pengolahan/penyiapan di RT,</li> <li>• Jumlah asupan</li> <li>• Mutu sanitasi/higiene,</li> <li>• Mutu air minum</li> <li>• Mutu pengasuhan anak</li> </ul>
Dimensi Kemandirian	<ul style="list-style-type: none"> <li>• Tingkat (%) impor bahan pangan</li> <li>• Tingkat (%) impor ingriden &amp; sarana produksi, mesin, dll</li> <li>• Penganekaragaman pangan (SDA lokal)</li> </ul>
Dimensi Kedaulatan	<ul style="list-style-type: none"> <li>• Keragaman industri pangan lokal</li> <li>• Tingkat partisipasi masyarakat dalam sistem pangan</li> <li>• Tingkat keragaman budaya pangan</li> <li>• Kesejahteraan masyarakat, petani, nelayan, dll</li> </ul>

**Individu Sehat, Aktif & Produktif**

**AIPI** AKADEMI ILMU PENGETAHUAN INDONESIA  
INDONESIAN ACADEMY OF SCIENCES

Purwiyatno Hariyadi  
hariyadi@seafast.org

# TEKNOLOGI PANGAN DAN PERTANIAN?

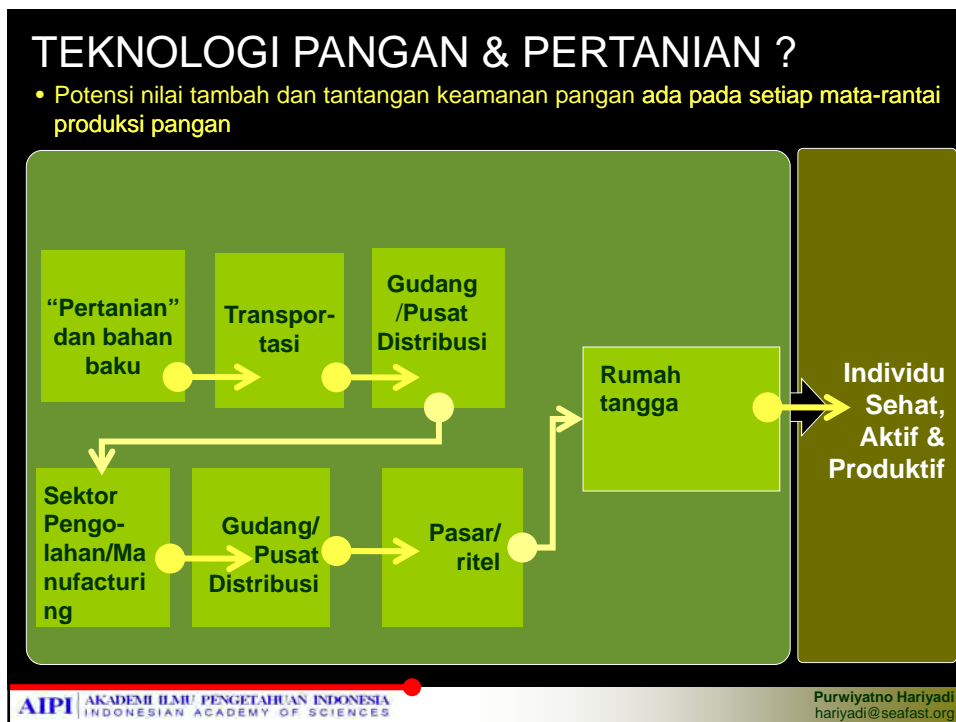
## menuju

# KETAHANAN PANGAN YANG MANDIRI DAN BERDAULAT

# ?

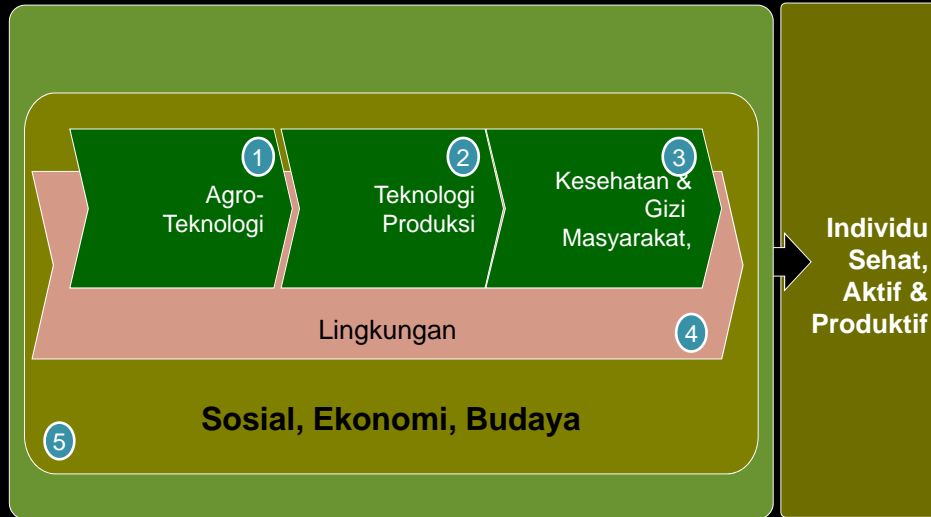
**AIPI** AKADEMI ILMU PENGETAHUAN INDONESIA  
INDONESIAN ACADEMY OF SCIENCES

Purwiyatno Hariyadi  
hariyadi@seafast.org



# TEKNOLOGI PANGAN & PERTANIAN ?

- Potensi nilai tambah dan tantangan keamanan pangan ada pada setiap mata-rantai produksi pangan

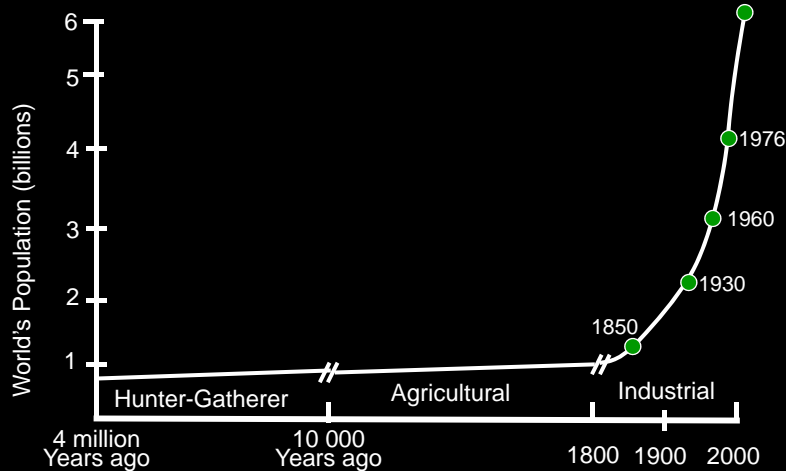


# TEKNOLOGI PANGAN ?

Ref.: Original C.J.K. Henry, Proc. Nutrition Soc 56:855-863, 1997;  
2011 IFIC Communication Summit – Dave Schmidt, "Alliance to Feed the Future, 24 May 2011



[www.ift.org](http://www.ift.org)

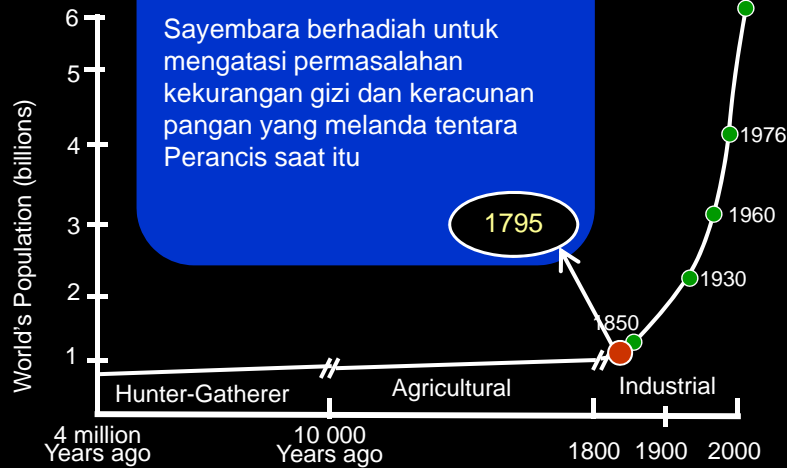


## TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman

### Napoleon Bonaparte:

Sayembara berhadiah untuk mengatasi permasalahan kekurangan gizi dan keracunan pangan yang melanda tentara Perancis saat itu



## TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman

### Nicholas Francois Appert

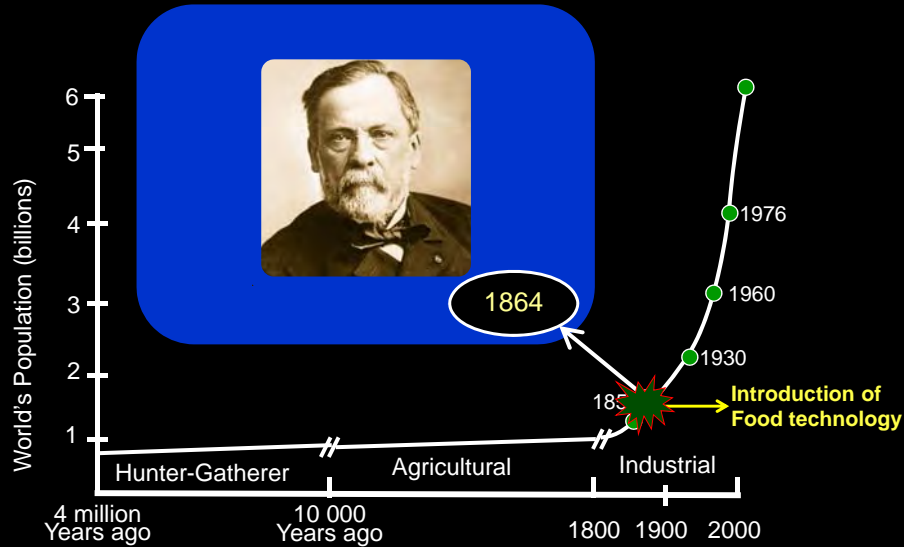
- (i) Botol gelas diisi makanan,
- (ii) Ditungkat rapat,
- (iii) Dipanaskan dalam air mendidih beberapa saat, lalu
- (iv) Didinginkan

→ Appertization



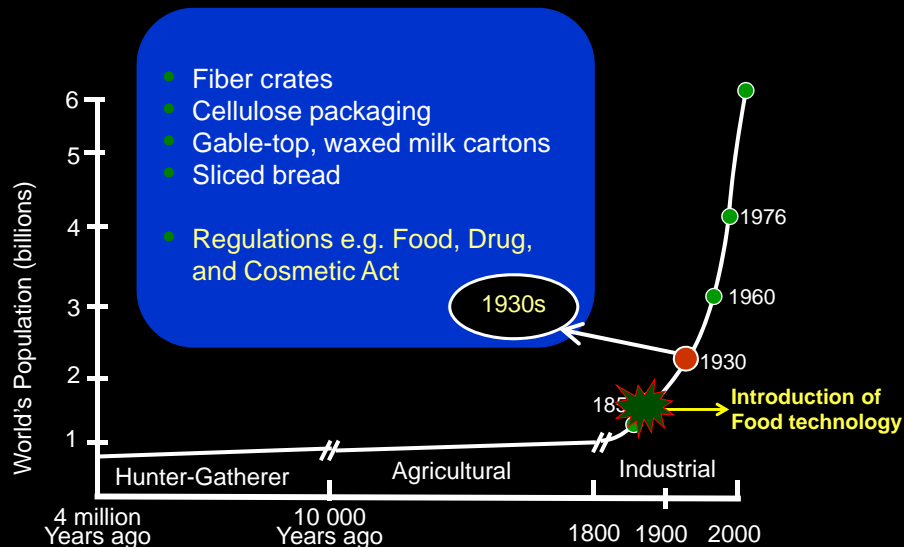
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



# TEKNOLOGIPANGAN ? –

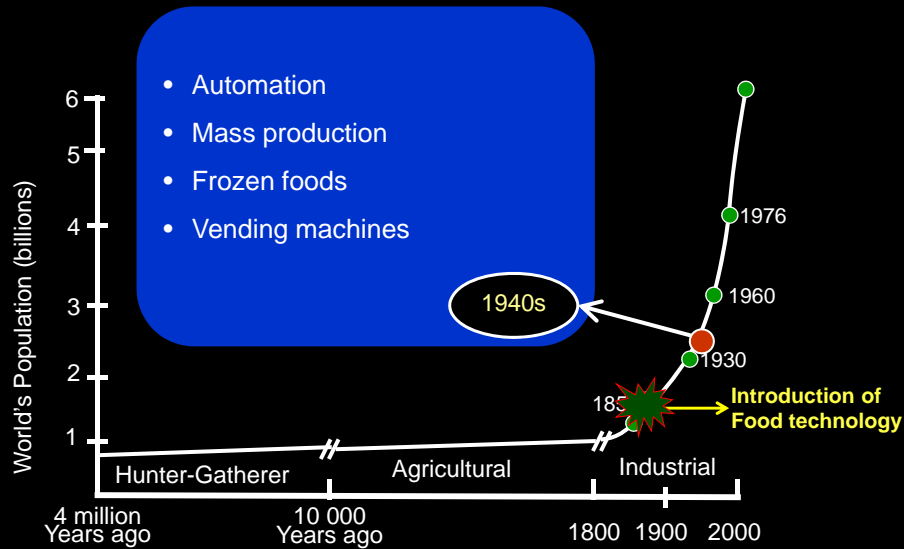
menjawab berbagai tantangan jaman





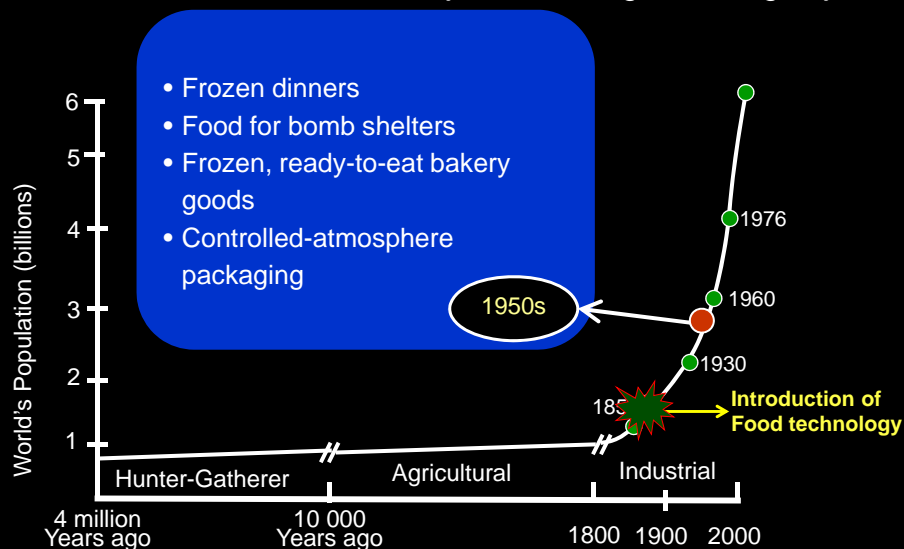
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



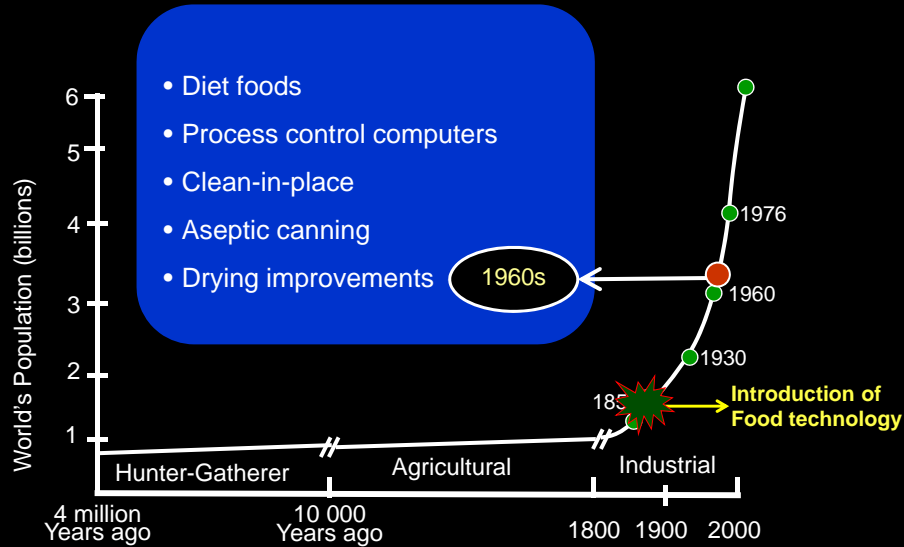
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



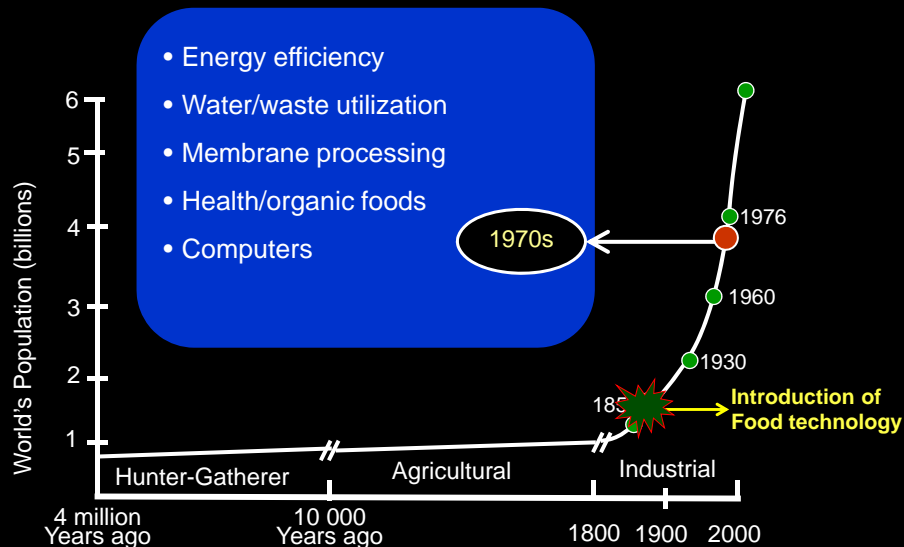
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



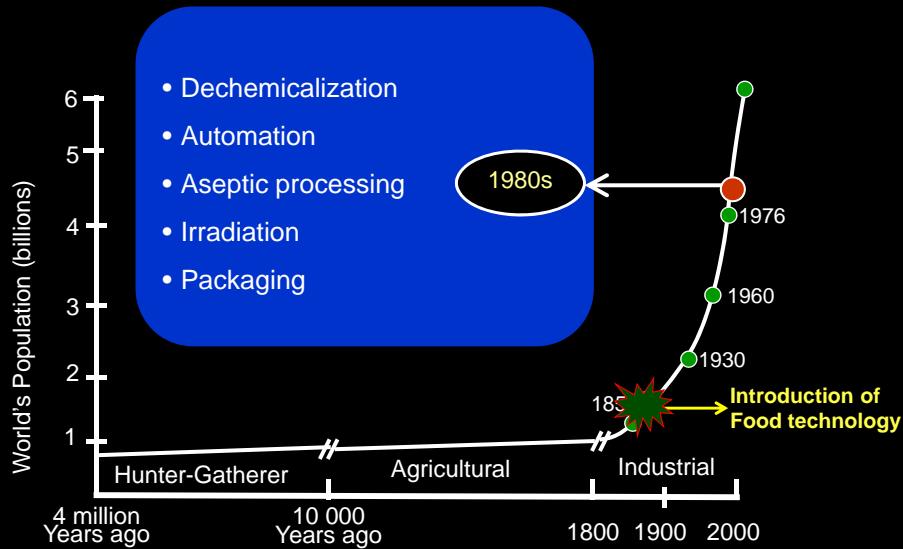
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



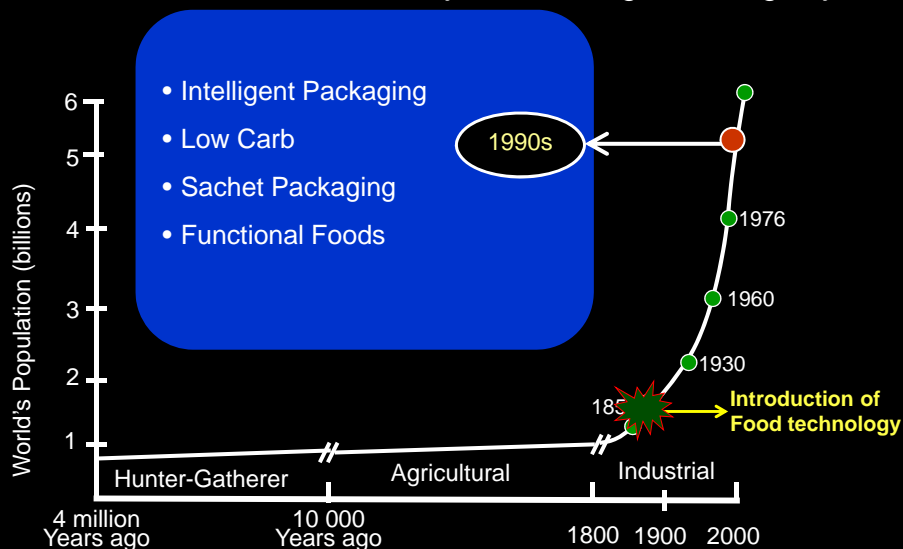
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



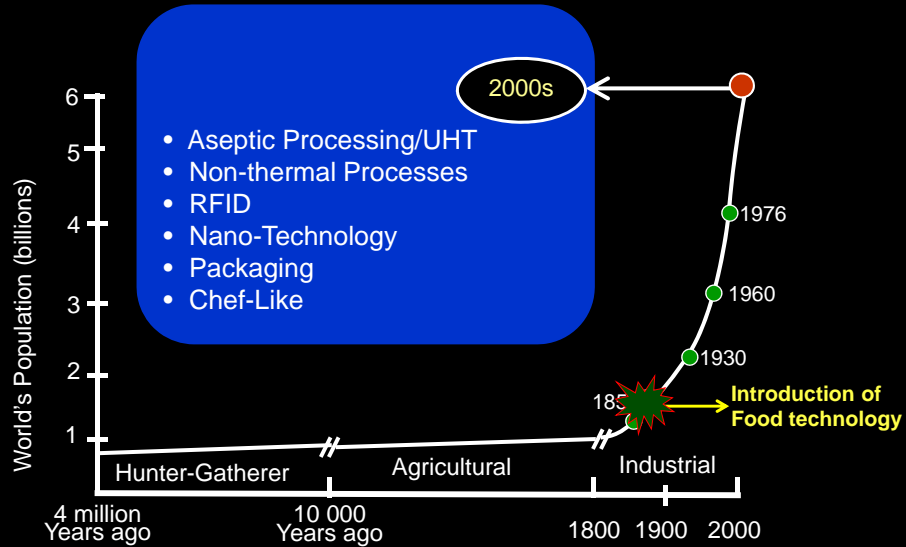
# TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



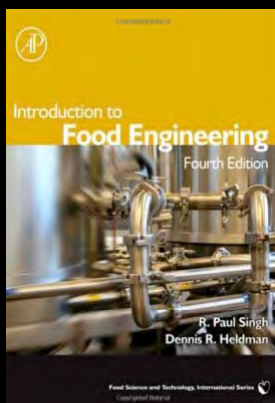
## TEKNOLOGIPANGAN ? –

menjawab berbagai tantangan jaman



## REKAYASA PROSES PANGAN ?

### *Food process engineering*

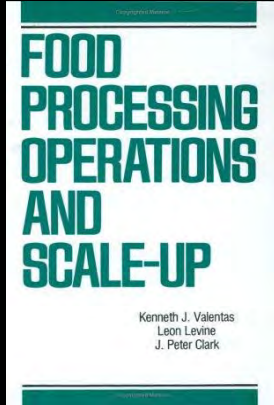


- is a broad field that is concerned with the application of engineering principles and concepts to the handling, manufacturing, processing and distribution of foods.

(R P Singh, R.P. And Heldman, D.R. 2008. Introduction to Food Engineering. Academic Press)

## REKAYASA PROSES PANGAN ?

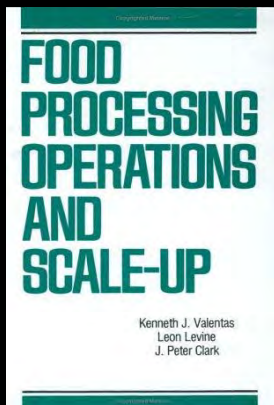
### *Food process engineering*



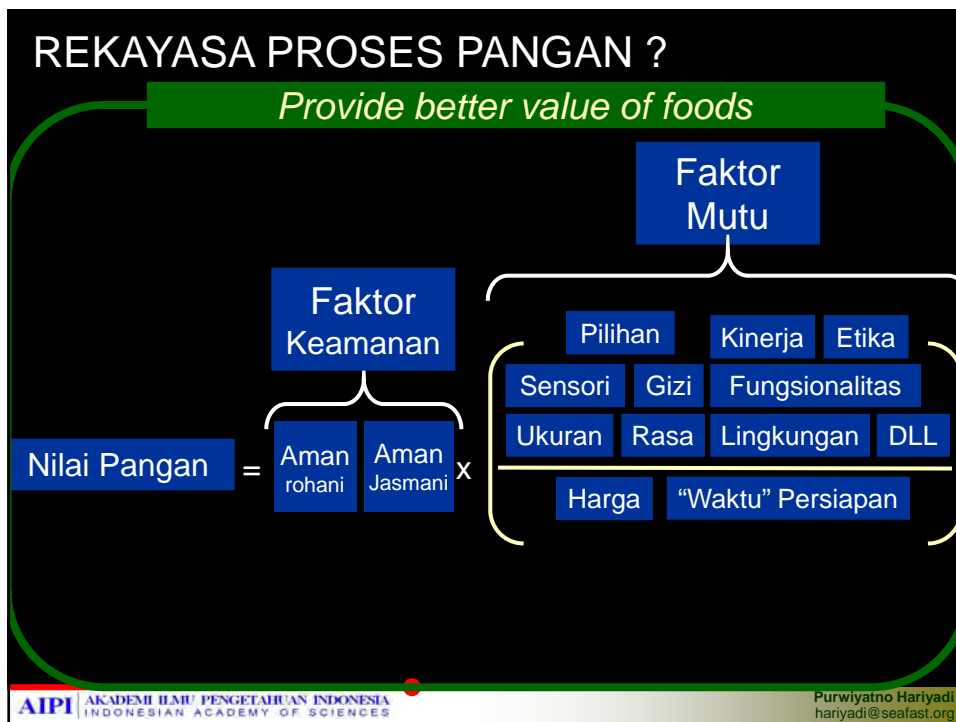
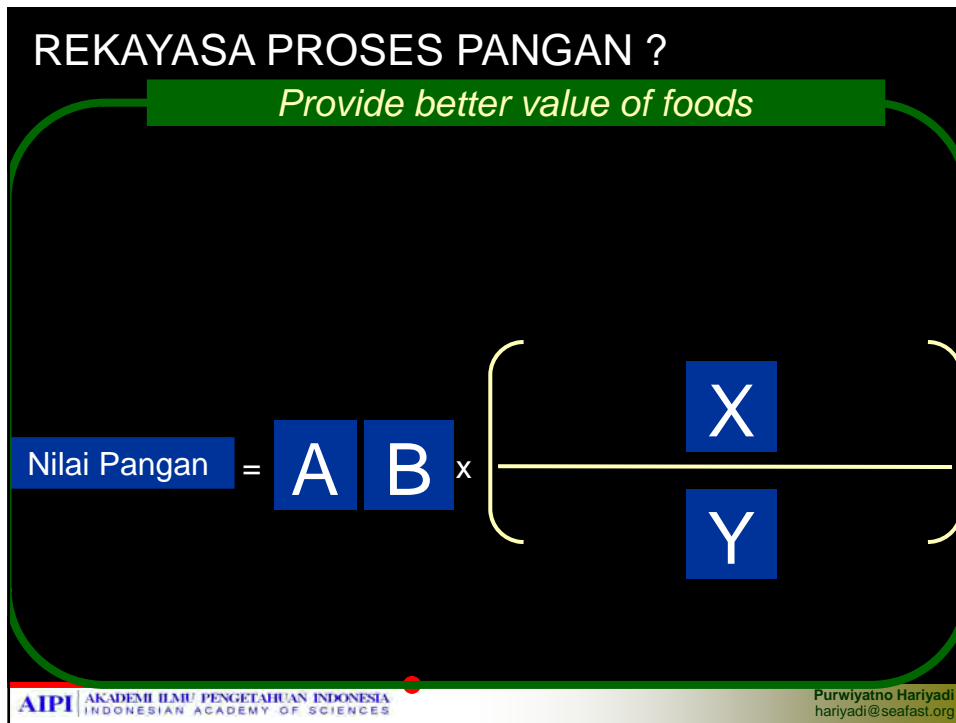
- is concerned with feasibility and practicality, that is, will something work and how much will it cost?
- Food engineers are educated to analyze, synthesize, design, and operate complex systems that manipulate mass, energy, and information to transform material and energy into **more useful form**

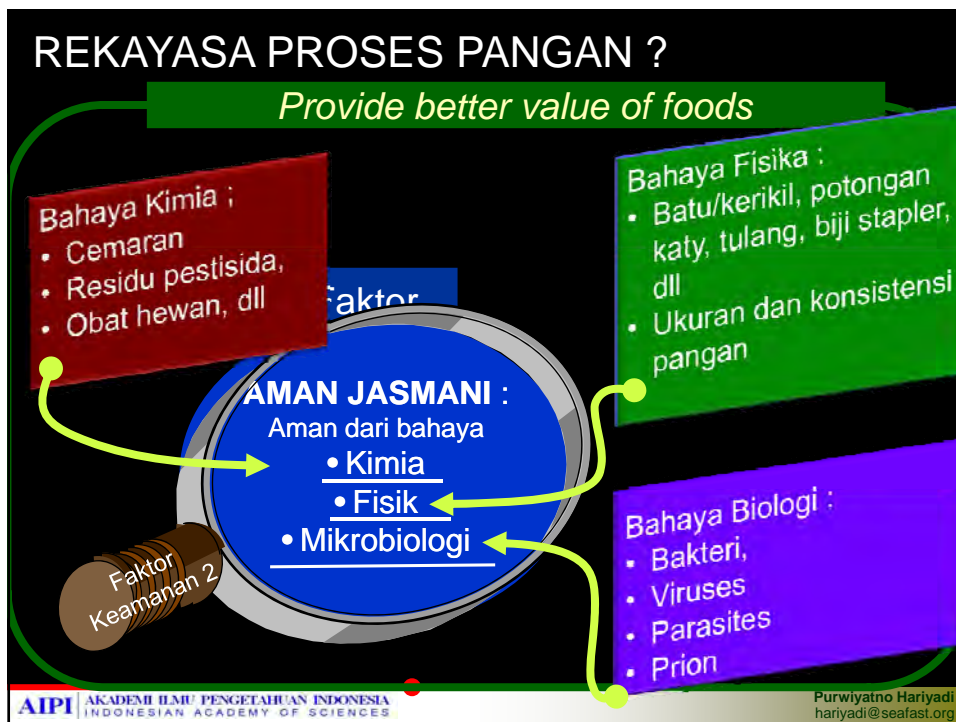
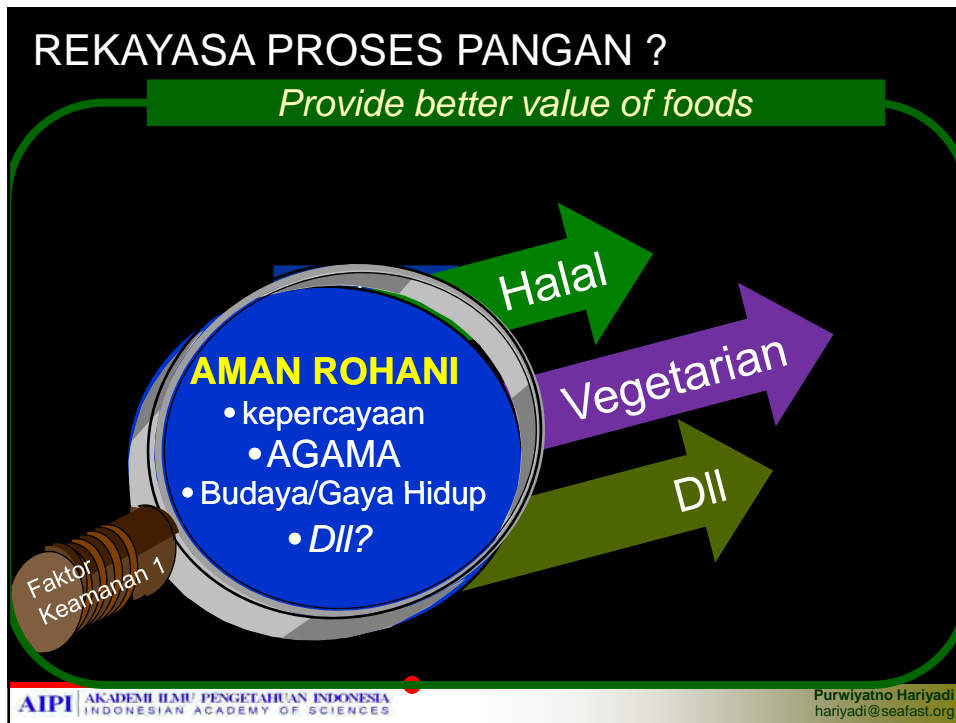
*Valentas, K.J., Levine, L and Clark, J.P. 1991. Food Processing Operation & Scale-up. Marcel Dekker Incorporated).*

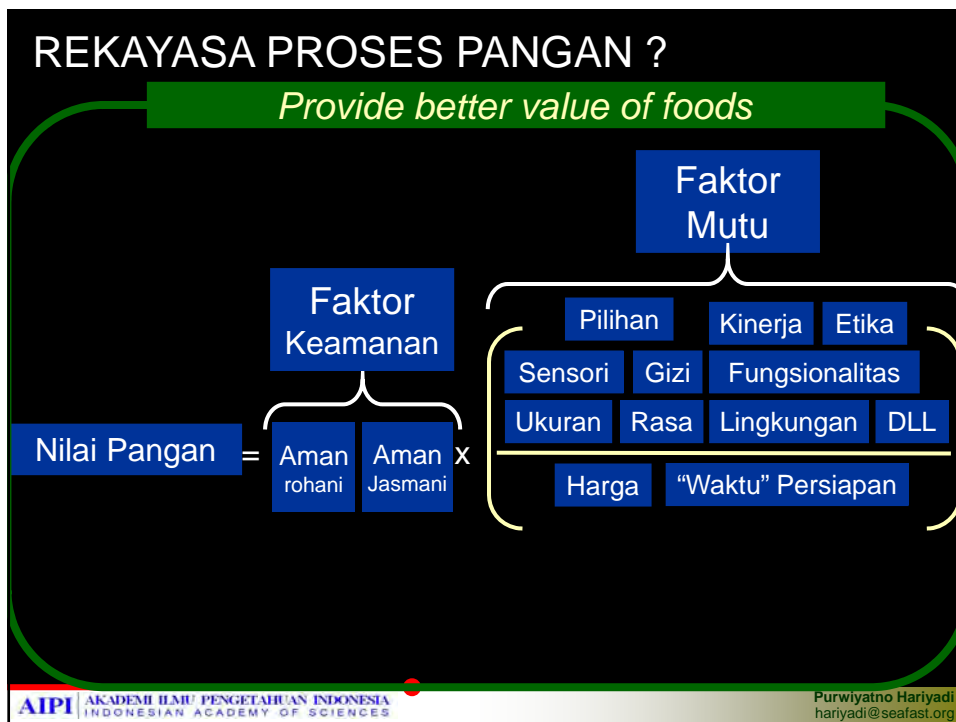
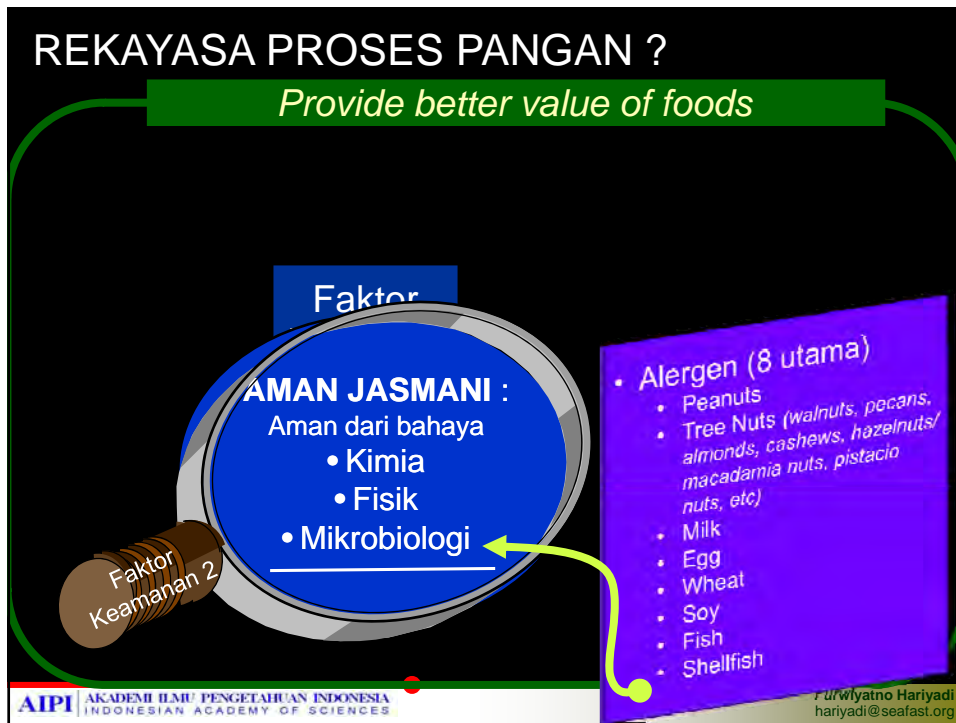
## REKAYASA PROSES PANGAN ?



more useful form



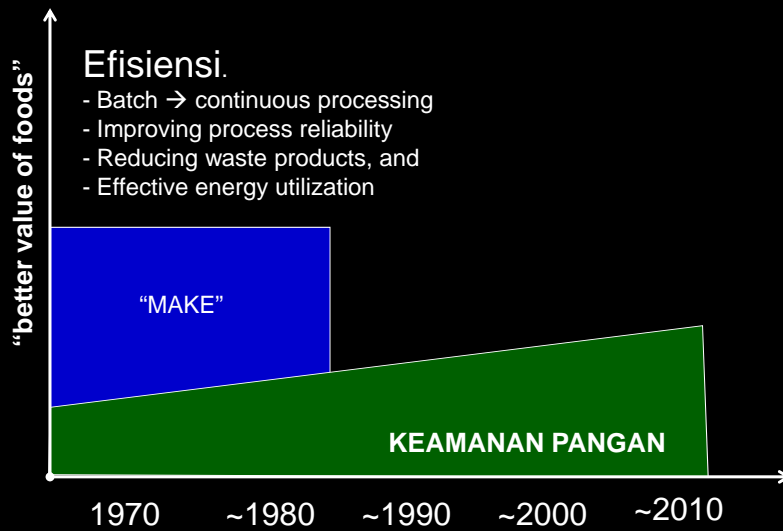






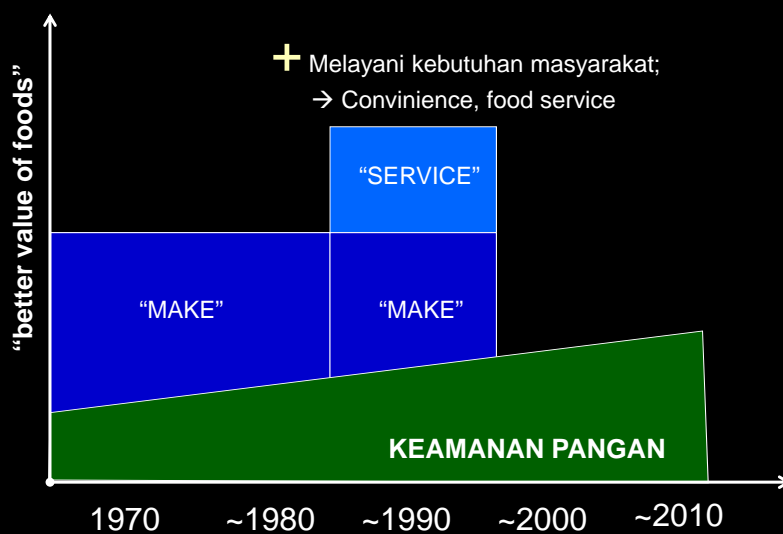
# REKAYASA PROSES PANGAN ? –

Perkembangan 25 tahun terakhir .....



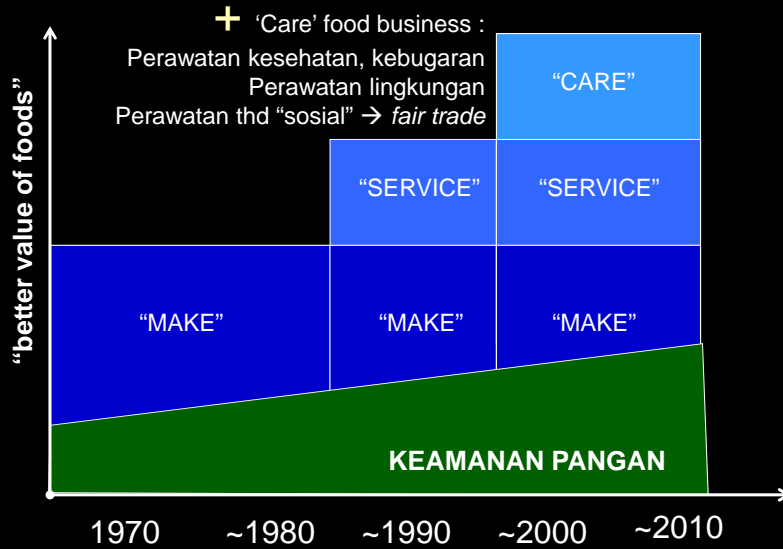
# REKAYASA PROSES PANGAN ? –

Perkembangan 25 tahun terakhir .....



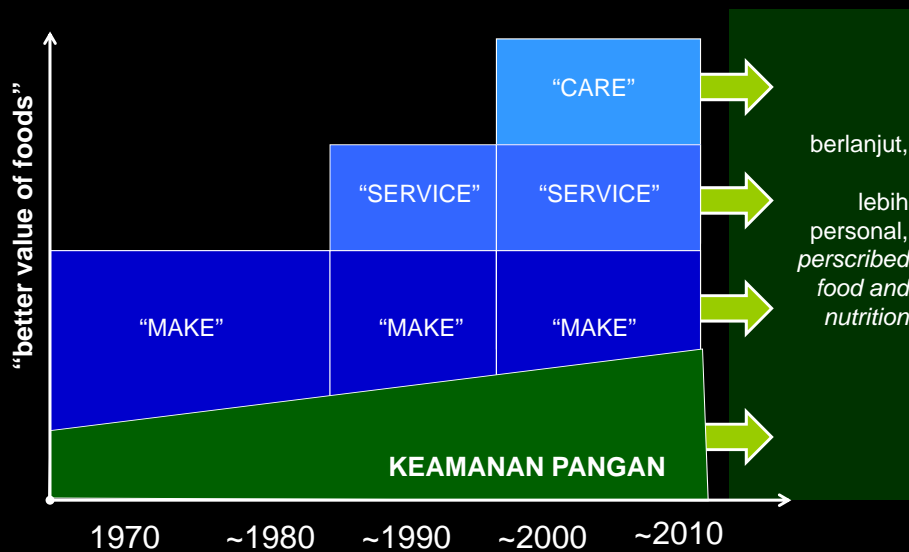
# REKAYASA PROSES PANGAN ? –

Perkembangan 25 tahun terakhir .....



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan **keamanan pangan** → Salah satu relevansi thd Indonesia



Penolakan  
Import  
produk  
Indonesia



berlanjut,  
lebih  
personal,  
prescribed  
food and  
nutrition

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan **keamanan pangan** → Salah satu relevansi thd Indonesia

Table 3. Number of EU rejections of food and feed products from Third Countries, 2002-2008

Country	Year							Total	Annual Average
	2002	2003	2004	2005	2006	2007	2008		
Iran	63	492	491	470	243	130	172	2,061	294.4
China	149	133	158	253	262	354	498	1,807	258.1
Turkey	141	200	180	198	250	294	302	1,565	223.6
India	60	119	110	137	86	111	157	780	111.4
United States	25	53	52	74	231	184	144	763	109.0
Thailand	143	85	45	117	85	92	103	670	95.7
Brazil	102	116	109	124	91	58	61	661	94.4
Vietnam	67	35	56	124	68	44	55	449	64.1
Argentina	11	42	16	57	75	17	58	336	48.0
Indonesia	39	36	70	58	43	25	14	285	40.7
Other	1	0	10	27	44	21	13	144	20.6
Egypt	9	40	33	74	30	35	48	219	31.3
Nigeria	1	7	15	30	28	40	25	155	22.1

berlanjut,  
lebih  
personal,  
prescribed  
food and  
nutrition

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan **keamanan pangan** → Salah satu relevansi thd Indonesia

Table 4. Number of US rejections of food products, 2002-2008

Country	Year							Total	Annual Average
	2002	2003	2004	2005	2006	2007	2008		
Mexico	1,804	1,503	1,581	1,235	1,477	1,270	1,066	11,926	1490.7
India	746	725	871	1,026	1,132	1,113	707	7,223	902.9
China	541	667	616	672	664	740	479	5,005	625.6
United Kingdom	377	288	325	245	369	430	1,262	3,767	470.9
Dominican Republic	263	266	535	415	663	512	77	3,121	390.1
Canada	414	543	551	284	246	238	361	3,014	376.7
Vietnam	428	332	478	350	300	378	306	2,939	367.4
Japan	722	311	363	112	285	103	300	2,114	264.3
<b>Indonesia</b>	<b>138</b>	<b>269</b>	<b>331</b>	<b>214</b>	<b>313</b>	<b>374</b>	<b>350</b>	<b>2,159</b>	<b>269.9</b>
Thailand	209	230	391	309	210	433	414	2,442	305.3
France	461	365	345	223	159	155	113	2,081	260.1
South Korea	297	344	285	205	112	166	287	1,938	242.3
Philippines	203	456	248	314	135	244	168	1,906	238.3

berlanjut,

lebih personal, prescribed food and nutrition

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan **keamanan pangan** → Salah satu relevansi thd Indonesia

Table 2. Value of EU rejections of fish and fishery products, 2004-2008 (US\$ million)

Country	2004	2005	2006	2007	2008	Total
<b>Indonesia</b>	<b>0.9</b>	<b>0.4</b>	<b>1.9</b>	<b>0.8</b>	<b>8.1</b>	<b>12.0</b>
Australia	0.0	0.7	10.7	0.3	0.0	11.7
Vietnam	1.0	3.3	1.8	0.6	0.6	7.3
China	0.4	0.9	0.9	1.9	1.3	5.3
India	0.6	1.1	1.1	0.8	1.4	5.1
Bangladesh	0.4	0.3	1.4	0.5	0.8	3.4
Russia	2.0	0.8	0.1	0.1	0.0	2.9
Greenland	0.0	0.0	0.1	0.0	2.0	2.1
Other	4.9	4.1	4.9	6.2	2.3	22.5
<b>Total</b>	<b>10.3</b>	<b>11.6</b>	<b>23.3</b>	<b>11.6</b>	<b>17.4</b>	<b>74.3</b>

berlanjut,

lebih personal, prescribed food and nutrition

## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan **keamanan pangan** → Salah satu relevansi thd Indonesia

Table 3. Value of US rejections of fish and fishery products, 2004-2008 (US\$ million)

Country	2004	2005	2006	2007	2008	Total
China	3.5	6.9	21.5	13.2	7.9	53.0
Vietnam	12.0	9.7	6.7	8.3	6.1	42.8
Indonesia	7.2	6.3	5.8	6.3	5.6	31.2
Bangladesh	6.3	3.8	1.0	0.8	1.9	13.8
India	3.5	3.8	2.0	1.8	0.5	11.6
Thailand	2.3	2.6	1.7	2.5	1.6	10.7
Honduras	0.0	7.9	0.2	0.0	0.1	8.2
Taiwan	1.9	1.3	0.9	1.6	2.0	7.7
Philippines	2.2	1.3	0.6	1.7	1.2	7.0

berlanjut,

lebih personal,  
*perscribed food and nutrition*

## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan **keamanan pangan** → Salah satu relevansi thd Indonesia

**2005:**  
Kerugian Indonesia karena masalah keamanan pangan = 6.7 Trilyun Rupiah

(Hariyadi, P. 2005. Ekonomi Keamanan Pangan: kerugian ekonomi karena masalah keamanan pangan. BPOM RI).

berlanjut,

lebih personal,  
*perscribed food and nutrition*

## REKAYASA PROSES PANGAN ? –

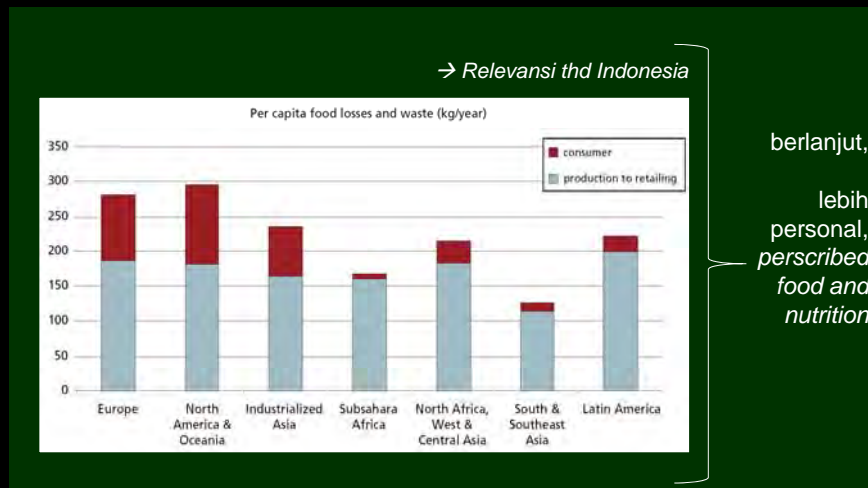
..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan keamanan pangan
  - Mempertahankan **kesegaran**
  - Mempertahankan/meningkatkan **kualitas sensori**
  - Mempertahankan/meningkatkan **kualitas gizi**
  - Mempertahankan/meningkatkan **masa simpan**
  - Meningkatkan **keramahan thd lingkungan**

berlanjut,  
lebih personal,  
*prescribed food and nutrition*

## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....



berlanjut,  
lebih personal,  
*prescribed food and nutrition*

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

→ Relevansi thd Indonesia

**The food canning industry in Indonesia: need for safety assurance regulation and quality optimisation**  
 Purwiyatno Hariyadi  
 Southeast Asian Food and Agricultural Science and Technology (SEAFST) Centre/Department of Food Science and Technology, Bogor Agricultural University, Bogor, Indonesia

**Abstract**  
 The food canning industry in Indonesia is one of the most important agro-based industries. Especially popular for processing and preserving fish, horticulture, fruit and horticultural products, the food canning industry has contributed significantly to Indonesia's national economy. To assess the safety aspects of commercial sterilization processing practices, we have evaluated the sterilizing value ( $F_0$ -value) for selected canned foods produced by the Indonesian food industry. The method for sterilization evaluation was adopted from the guidelines of the Institute for Thermal Processing Specialists. Our results indicated that not all scheduled processes have been evaluated properly. Based on the calculated  $F_0$ -value, most low-acid canned foods produced by the food canning industry in Indonesia are adequately heat processed or even tend to be over processed. Sterilisa-

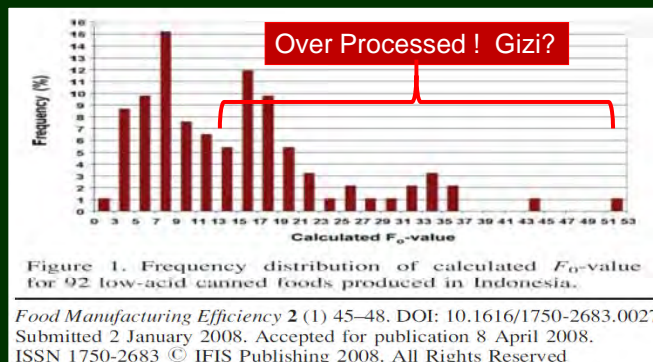
*Food Manufacturing Efficiency* 2 (1) 45–48. DOI: 10.1616/1750-2683.0027  
 Submitted 2 January 2008. Accepted for publication 8 April 2008.  
 ISSN 1750-2683 © IFIS Publishing 2008. All Rights Reserved

berlanjut,  
 lebih personal,  
 perscribed food and nutrition

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

→ Relevansi thd Indonesia



berlanjut,  
 lebih personal,  
 perscribed food and nutrition

## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan keamanan pangan
  - Mempertahankan kesegaran
  - Mempertahankan/meningkatkan kualitas sensori
  - Mempertahankan/meningkatkan kualitas gizi
  - Mempertahankan/meningkatkan masa simpan
  - Meningkatkan keramahan thd lingkungan
- Meningkatkan fungsionalitas
- Meningkatkan peran pangan → strategi “preventative health care”

berlanjut,  
lebih  
personal,  
*prescribed*  
*food and*  
*nutrition*

## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

- Pemastian : mempertahankan/meningkatkan keamanan pangan
  - Mempertahankan kesegaran
  - Mempertahankan/meningkatkan kualitas sensori
  - Mempertahankan/meningkatkan masa simpan
  - Meningkatkan keramahan thd lingkungan
  - Meningkatkan “fair trade”
- Meningkatkan fungsionalitas
- Meningkatkan peran pangan → strategi “preventative health care ”
- Meningkatkan efisiensi proses produksi/pengolahan

berlanjut,  
lebih  
personal,  
*prescribed*  
*food and*  
*nutrition*



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

<http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm>



- Thermal Processing :
  - Microwave and Radio Frequency
  - Ohmic and Inductive Heating
- Non-Thermal Processing:
  - High Pressure Processing
  - Pulsed Electric Field
  - High Voltage Arc Discharge
  - Pulsed Light
  - Ultraviolet Light
  - Ultrasound
  - X-Rays

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

<http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm>



- Thermal Processing :
  - Microwave and Radio Frequency
  - Ohmic and Inductive Heating
- Non-Thermal Processing:
  - High Pressure Processing
  - Pulsed Electric Field
  - High Voltage Arc Discharge
  - Pulsed Light
  - Ultraviolet Light
  - Ultrasound
  - X-Rays
  - Food Irradiation
  - Food Packaging
  - Biotechnology
  - Omic-Technologies: Nutrigenomic
  - Nano-Technology
  - ...

 [http://www.ifst.org/science\\_technology\\_resources/for\\_food\\_professionals/](http://www.ifst.org/science_technology_resources/for_food_professionals/)

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

<http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm>



- Thermal Processing :
  - Microwave and Radio Frequency
  - Ohmic and Inductive Heating
  
- Ekuivalen dengan pemanasan tradisional
- Lebih cepat → *High Temperature Short Time*

# REKAYASA PROSES PANGAN ? –

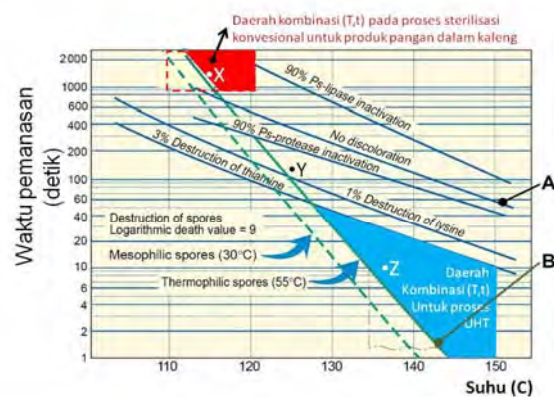
..... KEDEPAN ? .....

## Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

<http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm>



- Thermal Processing :



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

<http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm>



### • Non-Thermal Processing:

- High Pressure Processing
- Pulsed Electric Field
- High Voltage Arc Discharge
- Pulsed Light
- Ultraviolet Light
- Ultrasound
- X-Rays



[http://www.ifst.org/science\\_technology\\_resources/for\\_food\\_professionals/](http://www.ifst.org/science_technology_resources/for_food_professionals/)

- Food Irradiation
- Food Packaging
- Biotechnology
- Omic-Technologies: Nutrigenomic
- Nano-Technology
- ...

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

<http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm>



### • Non-Thermal Processing:

- High Pressure Processing
- Pulsed Electric Field
- High Voltage Arc Discharge
- Pulsed Light
- Ultraviolet Light
- Ultrasound
- X-Rays



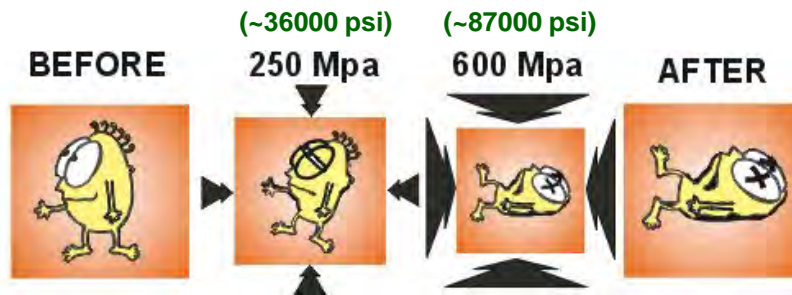
[http://www.ifst.org/science\\_technology\\_resources/for\\_food\\_professionals/](http://www.ifst.org/science_technology_resources/for_food_professionals/)

- Food Irradiation
- Food Packaging
- Biotechnology
- Omic-Technologies: Nutrigenomic
- Nano-Technology
- ...

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## High Hydrostatic Pressure Processing



High Pressure (>600 Mpa) can kill microorganisms by interrupting with their cellular function without the use of heat that can damage the taste, texture, and nutritional value of the food.

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## High Hydrostatic Pressure Processing

- Pathogens such as *salmonella* and *E.coli* 0157:H7 can be effectively destroyed without changing the fruit juice's fresh, natural characteristics.
- A pressure exposure of 80,000 psi for 30 seconds can achieve a 3-5 log reduction of all of the pathogens of concern in fresh juice



## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

### High Hydrostatic Pressure Processing

#### Pengolahan Oyster dengan HHP

- Destruction of *Vibrio* bacteria in raw oysters without destroying the raw feel and taste of the oyster.
- A pressure of 200 to 300 MPa for 5 to 15 minutes at 25°C inactivate :
  - *Vibrio parahaemolyticus* ATCC 17803,
  - *Vibrio vulnificus* ATCC 27562,
  - *Vibrio cholerae* ATCC 14035,
  - *Vibrio cholerae* non-O:1 ATCC 14547,
  - *Vibrio hollisae* ATCC 33564
  - *Vibrio mimicus* ATCC 33653



("D. Berlin, D. Herson, D. Hicks, and D. Hoover; Applied and Environmental Microbiology, June 1999")

## REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

### High Hydrostatic Pressure Processing

#### Pengolahan Oyster dengan HHP



*HHP memudahkan lepasnya daging dari cangkang:*

- *Menghemat tenaga kerja*
- *Meningkatkan mutu daging*

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## High Hydrostatic Pressure Processing

Contoh produk dari EU



ULTI / PAMPRYL (Groupe PERNOD-RICARD) - France freshly squeezed fruit juice Fresh pressed



Spain – sliced cooked ham

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## High Hydrostatic Pressure Processing

Contoh produk dari AS





# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## High Hydrostatic Pressure Processing

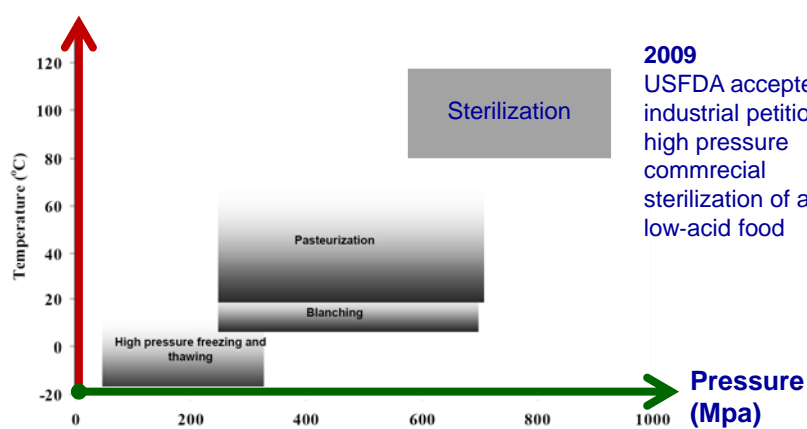
Contoh produk dari AS



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

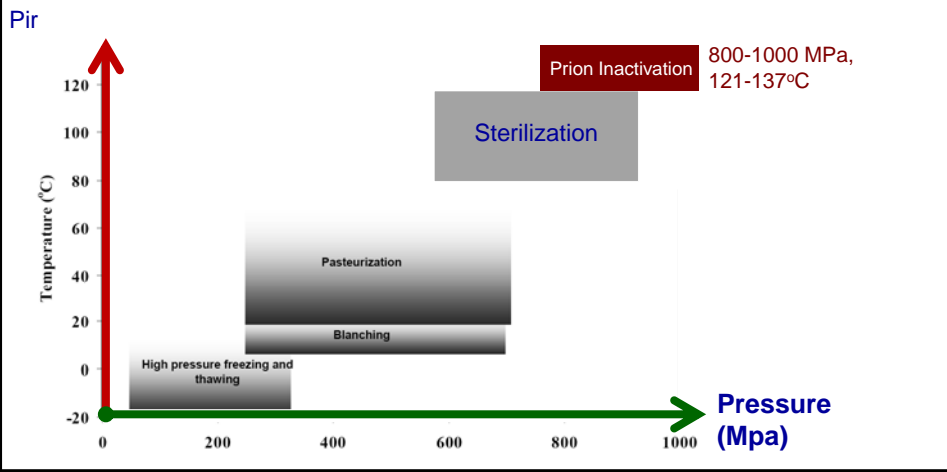
## Thermally-assisted High Hydrostatic Pressure Processing :



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Thermally-assisted High Hydrostatic Pressure Processing :



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Thermally-assisted High Hydrostatic Pressure Processing :

### Ultra-high-pressure inactivation of prion infectivity in processed meat: A practical method to prevent human infection

Paul Brown<sup>1\*</sup>, Richard Meyer<sup>2</sup>, Franco Cardone<sup>3</sup>, and Maurizio Pocchiari<sup>4</sup>

<sup>1</sup>National Institutes of Health, Bethesda, MD 20892; <sup>2</sup>Nadlington Farm, Tazewell, VA 98443; and <sup>3</sup>Nutrina Sperimentali S.p.A., 00101 Rome, Italy

Communicated by Ralph M. Garriga, State University of New York, Binghamton, NY, March 28, 2003 (received for review March 1, 2003)

**Bovine spongiform encephalopathy** contamination of the human food chain most likely resulted from nervous system tissue in mechanically recovered meat used in the manufacture of processed meats. We spiked hot dogs with 263K hamster-adapted scrapie brain (10% wt/wt) to produce an infectivity level of ~9 log<sub>10</sub> mean lethal doses (LD<sub>50</sub>) per g of paste homogenate. Aliquots were subjected to short pressure pulses of 690, 1,000, and 1,200 MPa at running temperatures of 121–137°C. Western blots of PrP<sup>Sc</sup> were found to be useful indicators of infectivity levels, which at all tested pressures were significantly reduced as compared with untreated controls: from ~10<sup>7</sup> LD<sub>50</sub> per g at 690 MPa to ~10<sup>6</sup> LD<sub>50</sub> per g at 1,200 MPa. The application of commercially practical conditions of temperature and pressure could assure the safety of processed meats from bovine spongiform encephalopathy contamination, and could also be used to study phase transitions of the prion protein from its normal to misfolded state.

food processing | scrapie | bovine spongiform encephalopathy | amyloidosis | Creutzfeldt-Jakob disease | prion disease

**Substrate Tissue.** Oscar Mayer brand hot dogs were purchased at a U.S. food store chain and brought to Europe at ambient temperature, where sample preparation was performed. Analysis showed 0.98 water activity (Aw), pH of 6.8, fat content of 30%, and salt level of 2.2%. Three hot-dogs were mechanically homogenized for 3 min.

**Sample Preparation.** Six grams of brain tissue were blended into 54 g of the hot dog paste with a further 3 mm of mechanical homogenization to achieve a final 10% (w/w) concentration of brain in the hot dog substrate. Approximately 2-g quantities of the “spiked” hot dog homogenate were distributed into 0.75 ml nylon/2.25 mil (1 mil = 25.4 μm) polyethylene pouches, heat-sealed, repacked in 100 mm × 125 mm pouches (12-μm polyester outer layer, 15 μm of nylon, 12.5 μm of aluminum foil, 102 μm of polypropylene inner layer), and heat sealed again. An undiluted aliquot of brain macerate used for the spikes was similarly packaged for testing.

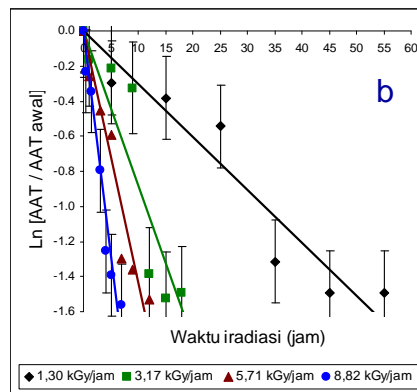
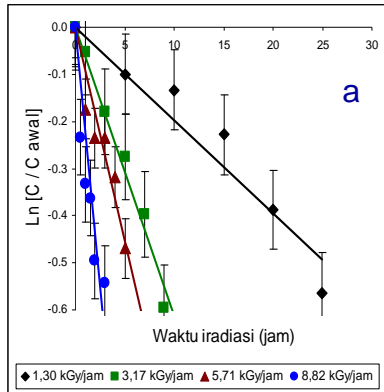
**Pressure Treatments.** The sealed samples were immersed in water...



# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Re-emerging Food Irradiation :

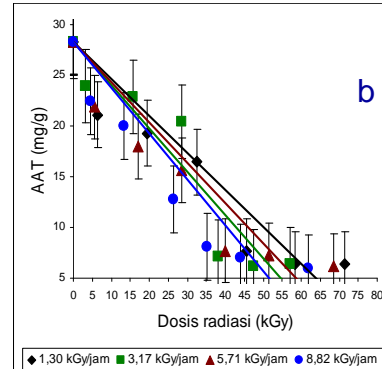
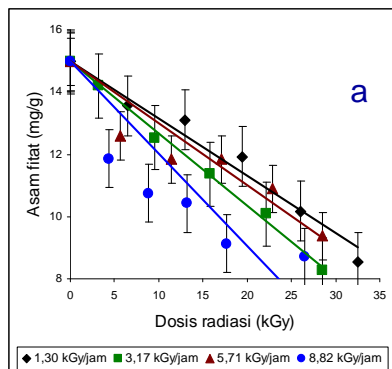


Degradasi (a) asam fitat dan (b) aktivitas antitripsin selama proses Irradiasi pada beberapa laju dosis yang berbeda .

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Re-emerging Food Irradiation :

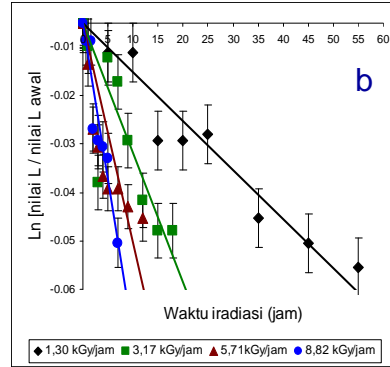
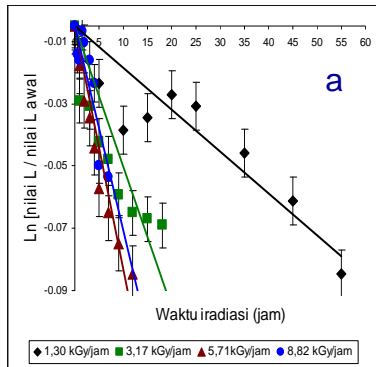


Degradasi (a) asam fitat dan (b) aktivitas antitripsin pada proses irradiasi sebagai fungsi dosis; dipengaruhi oleh laju dosis yang digunakan

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Re-emerging Food Irradiation :

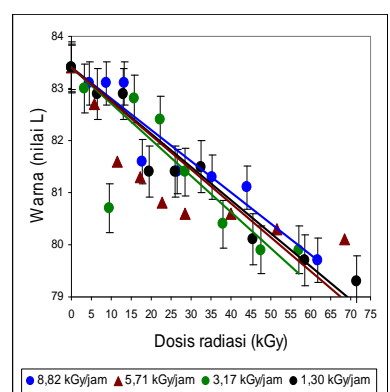
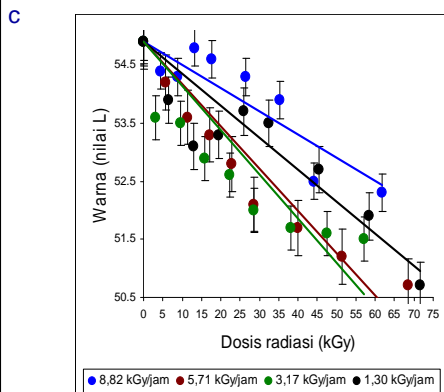


Perubahan kecerahan warna biji kedelai (a) selama proses iradiasi pada beberapa laju yang berbeda, dan warna tepung kedelai yang dihasilkan (b).

# REKAYASA PROSES PANGAN ? –

..... KEDEPAN ? .....

## Re-emerging Food Irradiation :



Degradasi kecerahan warna (a) biji kedelai dan (b) tepung kedelai sebagai fungsi dosis radiasi; dipengaruhi oleh laju dosis yang digunakan

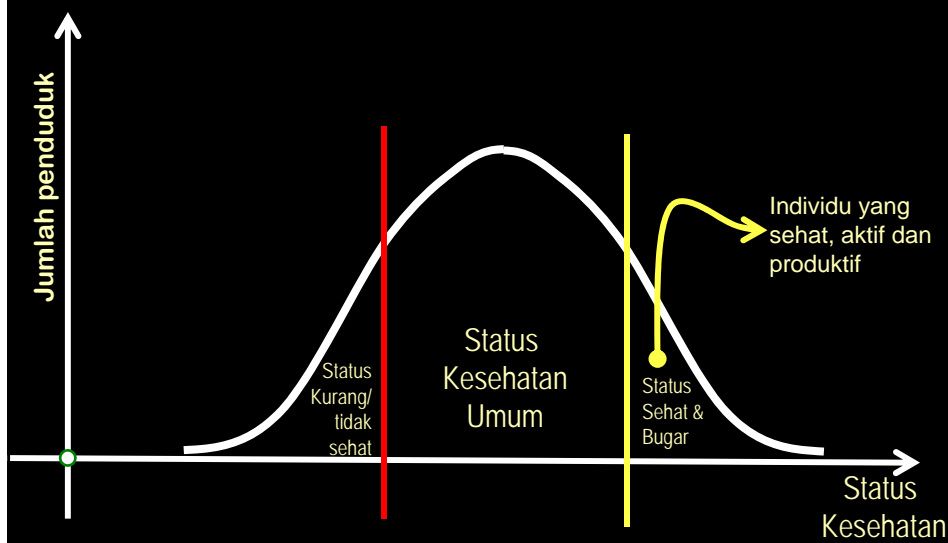
## PENUTUP

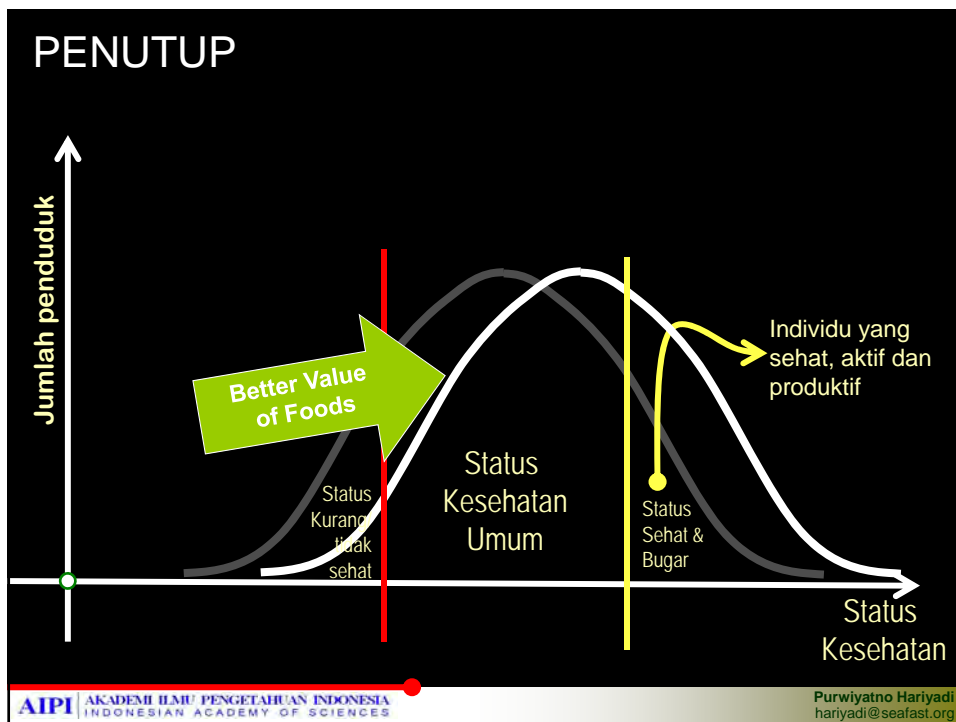
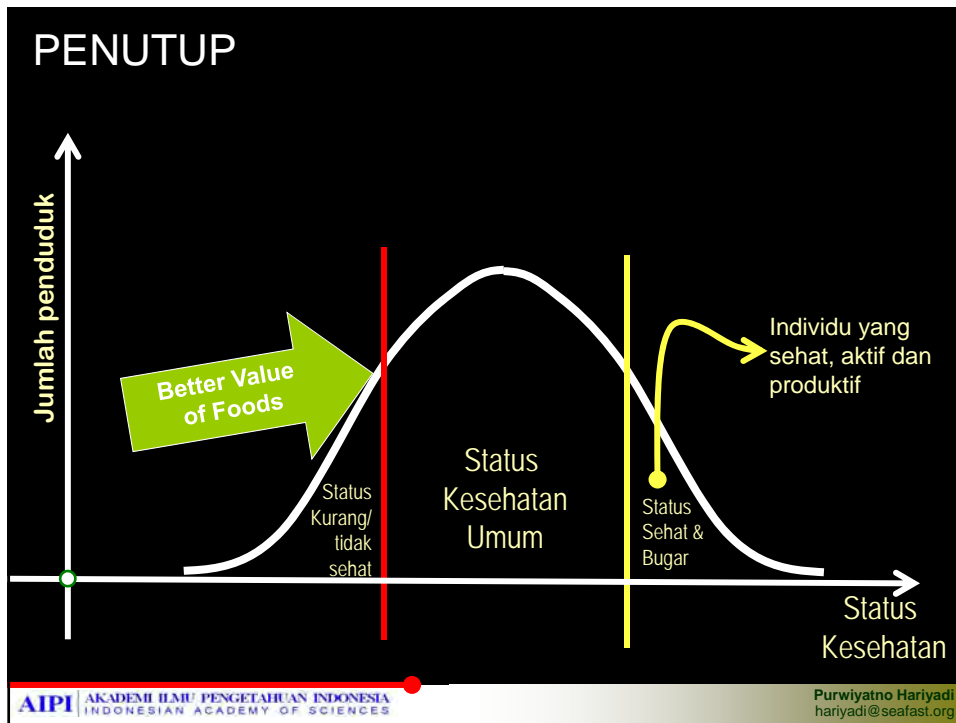
Rekayasa proses pangan mempunyai peranan penting:

→ Dengan memberikan *"better value of foods"*

→ Meningkatkan jumlah individu yang bisa hidup sehat, aktif dan produktif

## PENUTUP





## PENUTUP

### Untuk berkontribusi pada ketahanan pangan yang mandiri dan berdaulat,

#### Diperlukan:

- Peningkatan sistem R&D dan inovasi pangan nasional
- Peningkatan sistem kajian kesesuaian dan aplikasi teknologi :
  - Fokus pada peningkatan nilai pangan → *high value "local" product*
- Peningkatan sistem pendidikan rekayasa proses pangan.

## UCAPAN TERIMA KASIH



- Ibu, bapak hadirin sekalian
- Para mahasiswa
- Prof. Dr. Sangkot Marzuki, AM, Ketua Akademi Ilmu Pengetahuan Indonesia
- Prof. Dr. F.G. Winarno, Ketua Komisi Ilmu Rekayasa, Akademi Ilmu Pengetahuan Indonesia
- Seluruh anggota Akademi Ilmu Pengetahuan Indonesia
- Rektor Institut Pertanian Bogor
- Dekan Fakultas Teknologi Pertanian, IPB
- Ketua, staff pengajar dan pegawai Departemen Ilmu dan Teknologi Pangan, Fateta, IPB
- Staf dan kolega peneliti di SEAFast Center, IPB
- Panitia Pelaksana Inaugurasi AIPI
- Teman teman semua &
- Keluarga tercinta

TERIMAKASIH



Terimakasih

[hariyadi@seafast.org](mailto:hariyadi@seafast.org)



**AIPI** AKADEMI ILMU PENGETAHUAN INDONESIA  
INDONESIAN ACADEMY OF SCIENCES

Purwiyatno Hariyadi  
[hariyadi@seafast.org](mailto:hariyadi@seafast.org)