Life Cycle Approach in Food Safety Assurance

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OUTLINE

1. Current changes of food system
2. Risks along the food life cycle
3. A Need for new strategy

Current Changes of Food System

Swift transformation of food system

DRIVERS

~ Internal factors (materials & technology)
~ External factors
- change of human life style
- change of ecosystem quality

CO-EVOLUTION of 3 highly interacting systems
*) food system *) human society *) ecosystem

Declining ecosystem quality:

Increasing pollution of xenobiotics & pathogenic microorganisms

Climate change (flood & other nat disasters)

Revolutionary change of human lifestyle

eating style toward more **convenient and ready to eat foods**

SETS A PERFECT VENUE FOR CONTAMINANTS TO SPREAD THEIR RISKS

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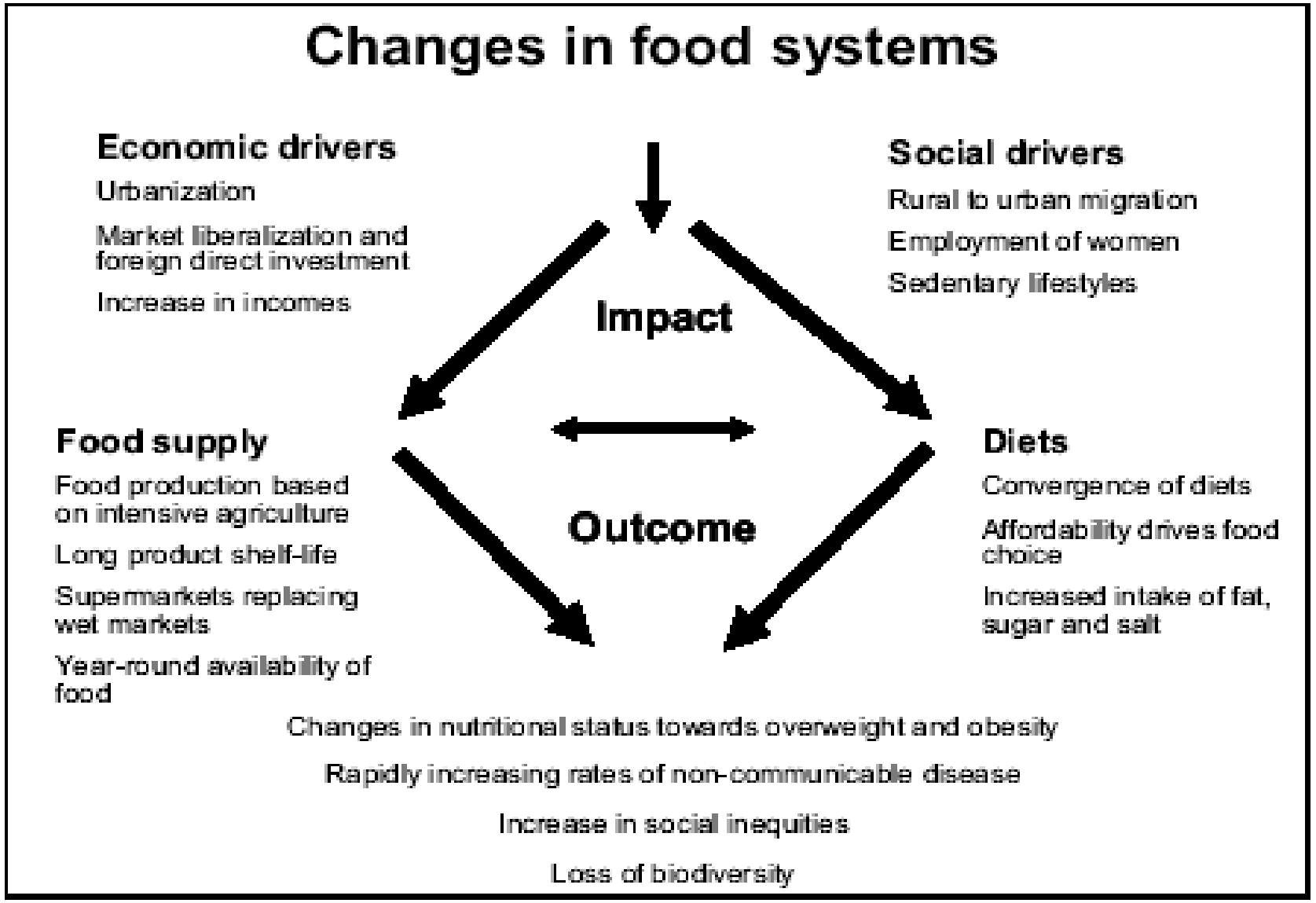
FIGURE 1
Changes in food systems



Source: Kennedy *et al.*, 2004

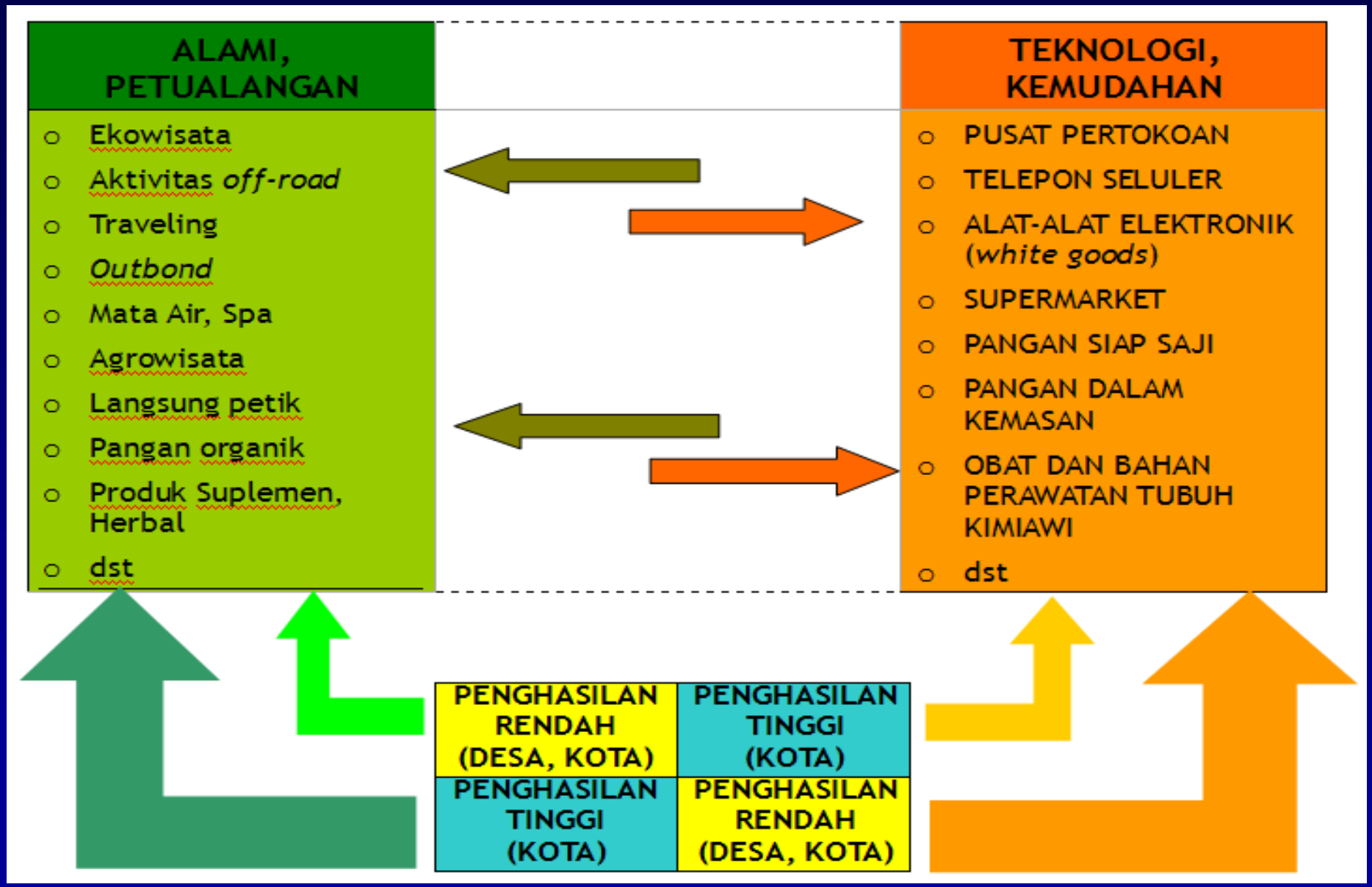
GLOBALISASI PANGAN – adaptasi diet

Perubahan gaya hidup dan adaptasi pola konsumsi ➡ pangan instan dan siap saji

- *Street foods*
- *Supermarkets, Hypermarkets*
- *Fast food industry*
- Peran iklan
- Perubahan perilaku

The appeal "to be modern"

RESPON TERHADAP GLOBALISASI: ASPIRASI WARGA YANG TERBELAH



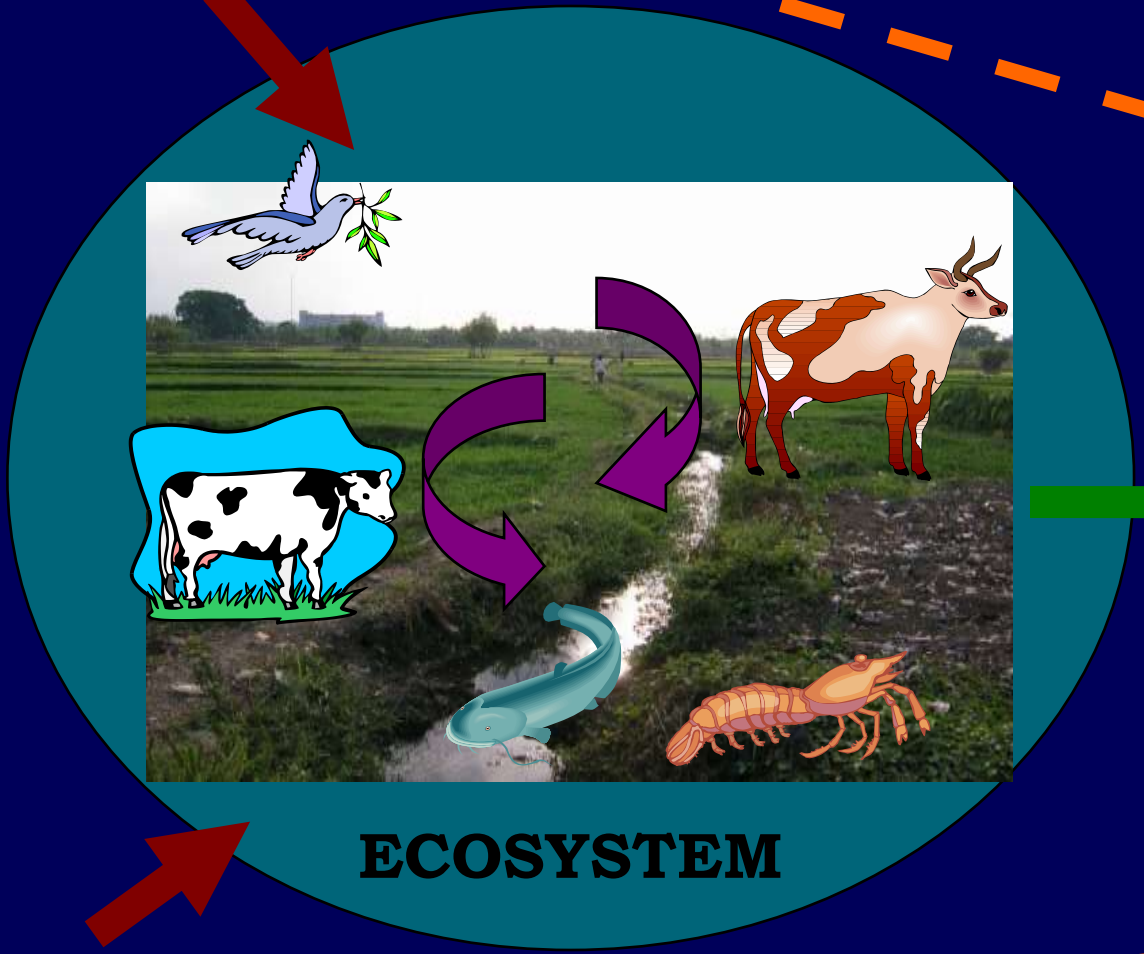
Risks along the Lifecycle

POLLUTION :
Flow of Xenobiotics into Food System

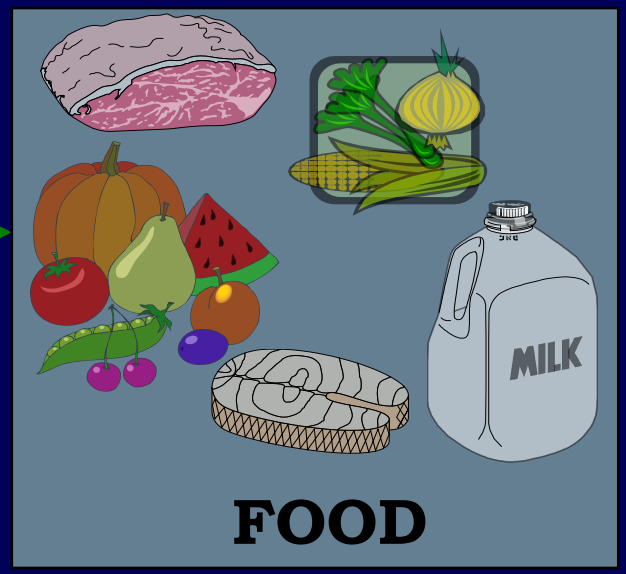
A WORLD WIDE CONCERN !

POLLUTION

QUALITY



ECOSYSTEM



FOOD

SAFETY

POLLUTION

LIVESTOCKS FARMING ON THE GARBAGE'S DISPOSAL SITE

Table 2. Metal content (ppm, dw) in meat and viscera of cattle cultivated in the final waste disposal site of Semarang

Tissue	Cr	Cd	Co	Fe	Zn	Pb
Meat	0.383	1.165	0.163	119.72	155.76	10.64
Liver	0.855	1.741	0.287	531.623	144.743	–
Rumen, Abomasum	3.120	1.705	0.291	616.955	119.941	–
Jejunum	0.034	–	0.186	1965.53	317.43	–
MRL (URI)	0.02-0.56	0.01-0.09	1.94	34	330	–

Source: Purwandari (2003) & Widowo (2003) cited in Widianarko *et al.* (2003)
(MRL = the maximum residue limit)

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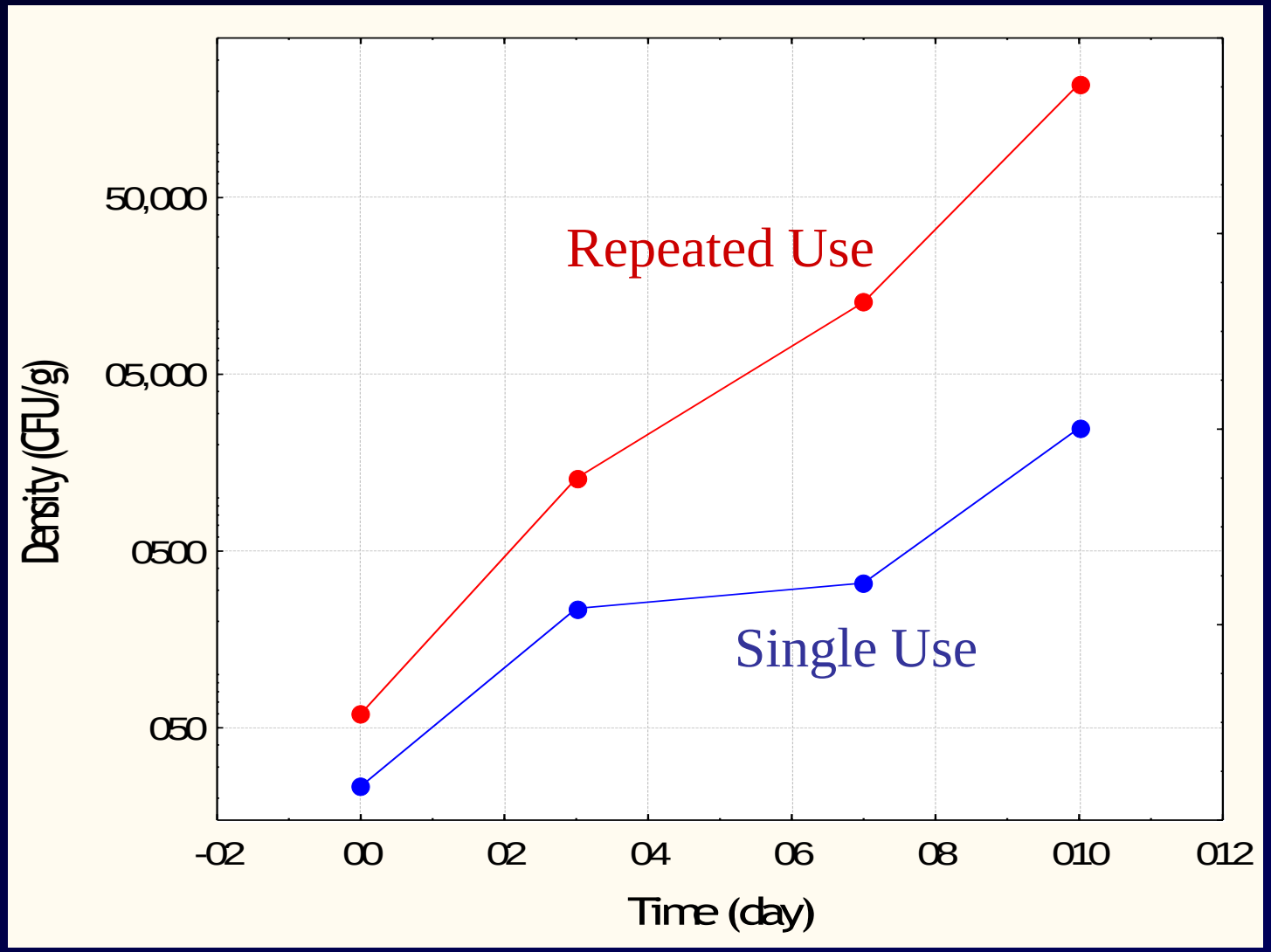
Metals in foodstuffs (μg/g dw)

Foodstuff	Cadmium	Copper	Zinc
Cow's liver[1] (local)	0.15 - 0.18	93.8 – 156.6	172.5 – 177.2
Cow's liver[1] (imported)	0.16 – 0.19	100.1-163.0	191.5 – 199.0
Chicken Liver[2] (local strain)	0.4 – 0.7	8.2 - 12.0	89.8 – 116.2
Chicken Liver[2] (broiler strain)	0.2 - 0.3	7.4 – 11.3	74.0 – 95.7

Sources: [1]Putra (2004); [2]Untoro (2005),

SPECIAL FEATURES OF MICROBIAL HAZARDS

- Dynamic of growth
- Inactivation of MOs throughout the food chain
- Diversity of MOs and of human immune response to MOs
- The phenomenon of resistance toward antibiotics, sanitizers, pasteurization
- Role of the consumer in altering the potential risk outcome through food handling and preparation

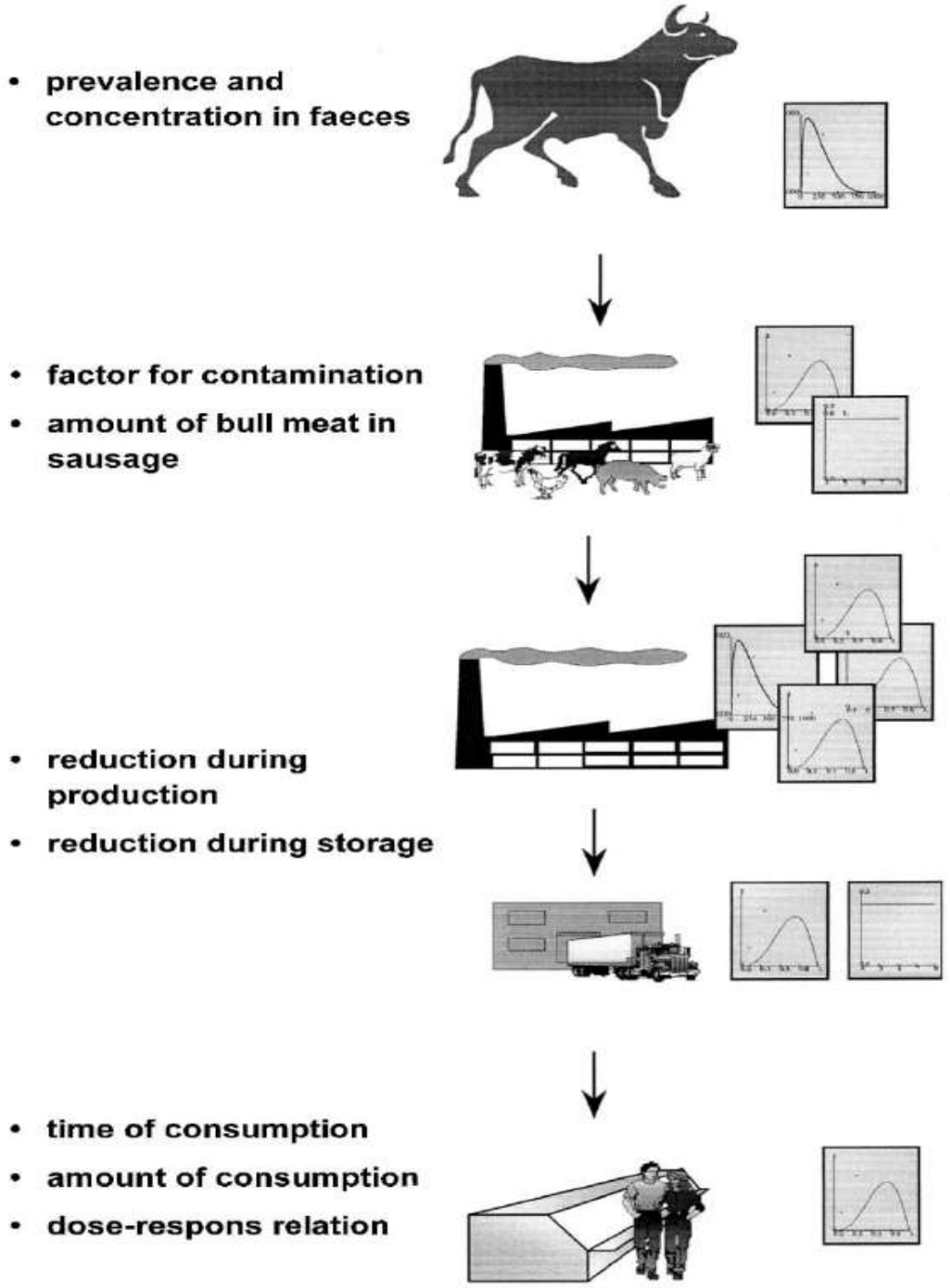


Growth of bacteria in corned beef during storage in the refrigerator

Sources: Mayasari (2004)

Risk factors in the lifecycle of fermented sausages

Sources: Hoornstra & Notermans (2001)



A Need for New Strategy

EU's import conditions are harmonized

- Controls made at the EU border, with free circulation inside
- Free trade may be restricted only in exceptional cases (e.g. public health, environment or consumer protection risks)
- EU rules are transparent and aligned with World Trade Organization's rules and international standards (IPPC, OIE & CODEX)
- EU plays an active role in international bodies on food safety and assists trading partners in reaching EU standards

The EU integrated approach to Food Safety

- Farm to fork concept since 1992, which aims to ensure:
  1. High level of food safety, animal health, animal welfare and plant health
  2. Effective control systems and compliance with EU standards
  3. Science-based risk management

"A World-class Food Safety System from the Farm to the Fork"

Tabel 1. Unsur-unsur Utama Konsep Keamanan Pangan "*Farm to Fork*"

No	UNSUR UTAMA
1	Berlandaskan evaluasi risiko terus menerus
2	Mencakup keseluruhan rantai pasokan pangan, mulai dari lahan/peternakan (termasuk pakan)
3	Tanggung jawab utama keamanan pangan dipikul oleh industri, produsen dan pemasok (pengawas mandiri)
4	Transparansi melalui pengawasan rantai produksi hulu dan hilir
5	Keterlacakan (*traceability*) mencakup keseluruhan rantai pangan (dan pakan)
+	Tindakan khusus perlindungan konsumen (a.l. pestisida, suplemen pangan, pewarna, antibiotika atau hormon)
++	Aturan untuk produk yang bersentuhan dengan bahan pangan
+++	Aturan pelabelan untuk identitas bahan dan klaim produk

Sumber: Piekkari (2010)

Ensuring the safety of food is now becoming an enormously complex task

Hazard can arise **at every stage** of the food supply chain:

* Farm
* Processing facility
* Transportation
* Storage
* Food service
*Retail establishment
*Household

During each of these steps along the way, measures must be taken to prevent or minimize hazards

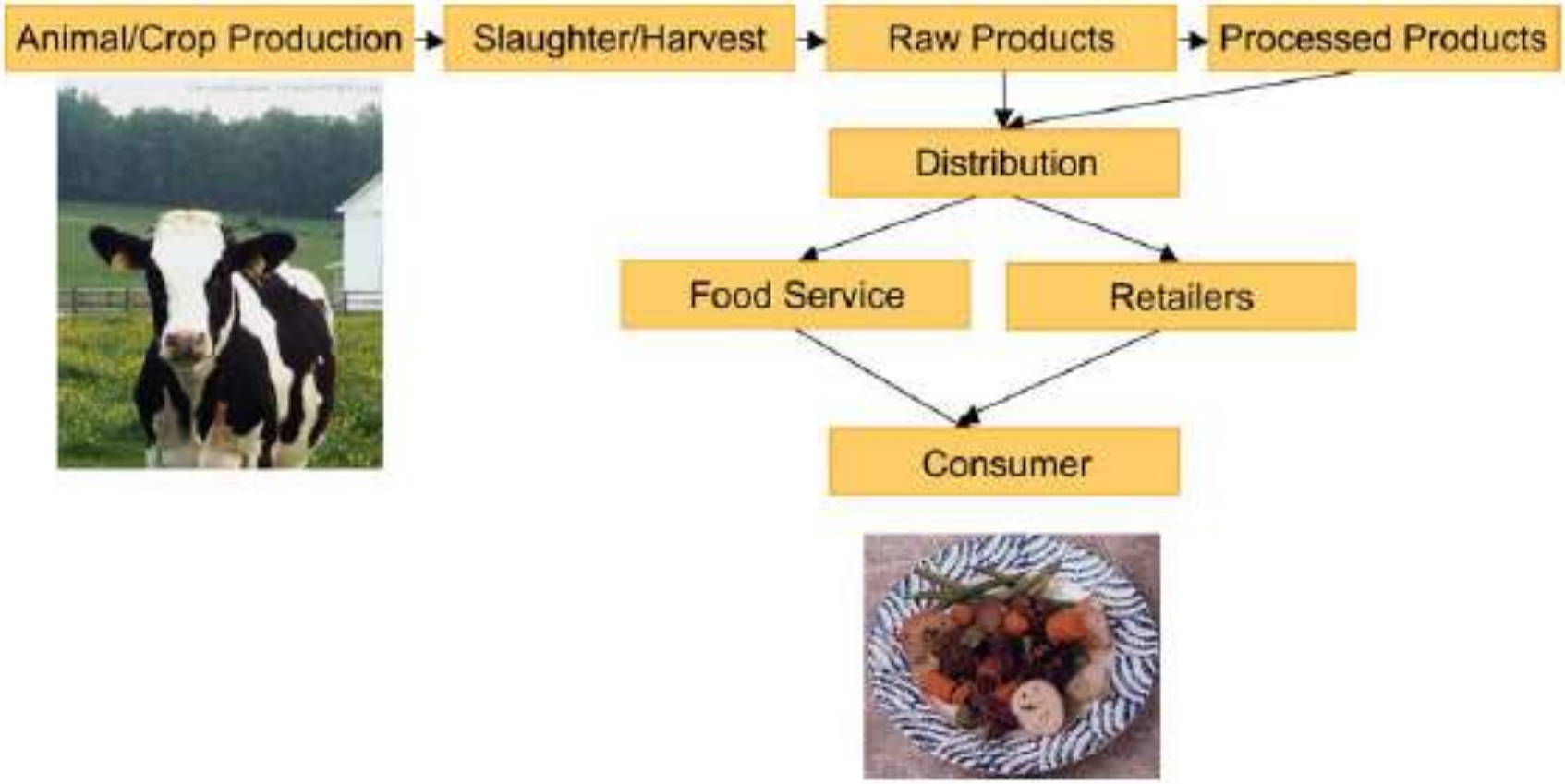
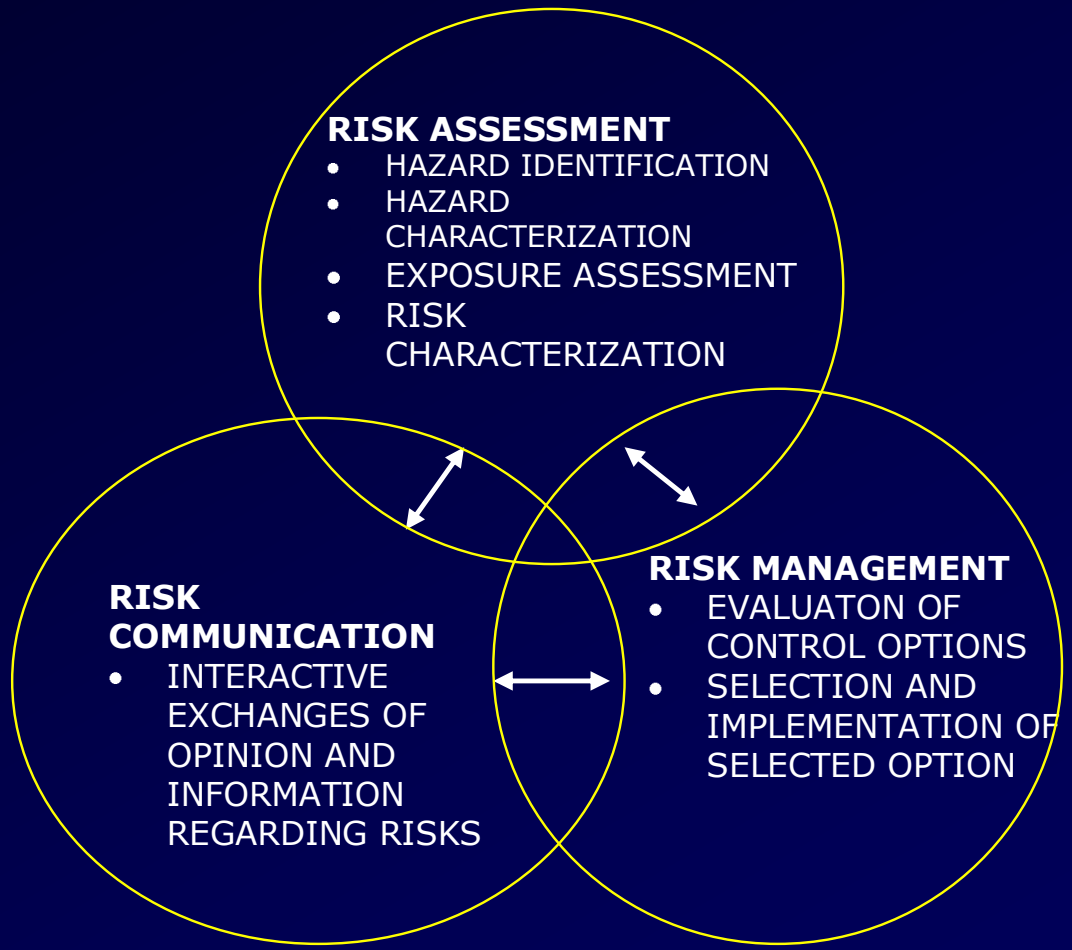


Fig. 3. Farm to Table food safety.

Sources: Sperber (2005)

HACCP is only one part of the risk analysis process
HACCP is a risk management tool not a risk assessment tool



RISK ANALYSIS FRAMEWORK
(Adapted from Benford, 2001)

HACCP CAN NOT BE EFFECTIVELY APPLIED
from farm to table

Farm to table HACCP => A FALSE EXPECTATION

Food safety is not synonymous with HACCP

FOOD SAFETY = HACCP *plus* PREREQUISITE PROGRAMS

All supply chain steps must pay attention and apply the appropriate prerequisite programs

Sources: Sperber (2005)

PREREQUISITES PROGRAMS COMMONLY USED IN FOOD PROCESSING INDUSTRY

- Cleaning and sanitation
- Purchasing requirements
- Pest control
- Labeling
- Rework
- Facility and equipment design
- Supplier approval
- Employee training
- Foreign material control

* Product retrieval
* Allergen control
* Chemical control
* Product specifications
* Product Storage Control
* Transportation
* Maintenance
* Personal hygiene
* Good agricultural practices

Sources: Sperber (2005)

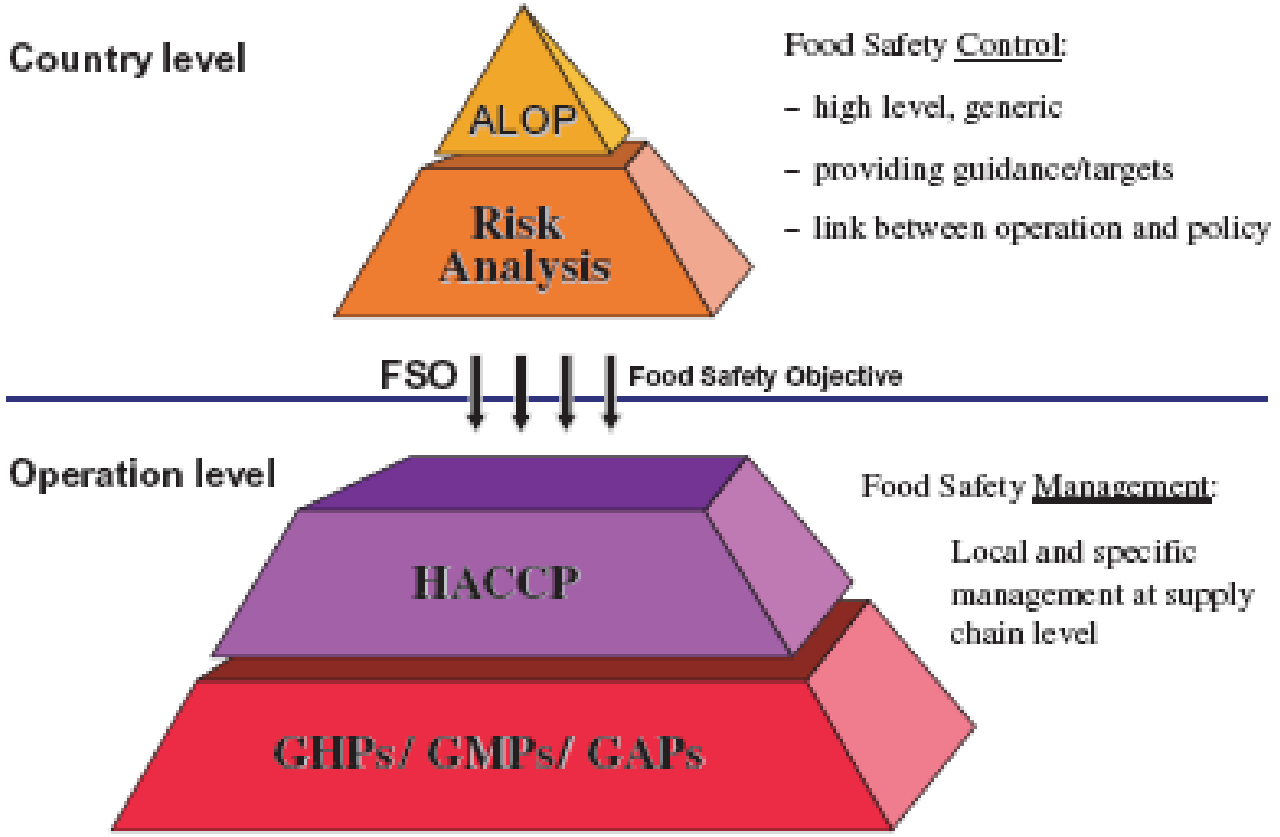
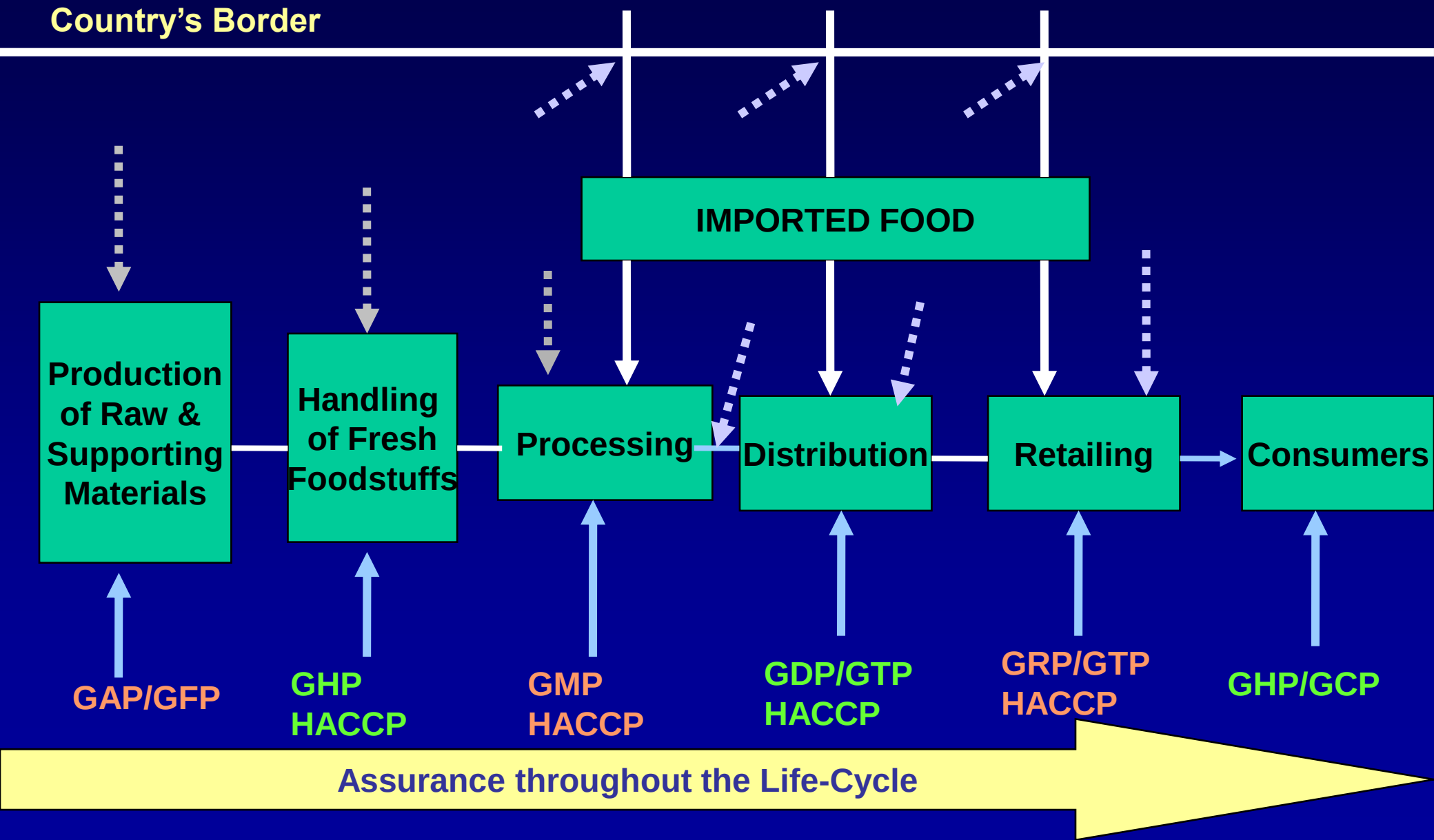


Fig. 2. Illustration of how Food safety control at a country level can link into Food Safety Management at the operational level through a Food Safety Objective set by a governmental competent authority on the basis of a public health goal (ALOP) established following the Risk Analysis framework.

Sources: Gorris (2005)

From Farm to Table- Food Safety Assurance

(Adapted from Drug and Food Control Agency, 2003)



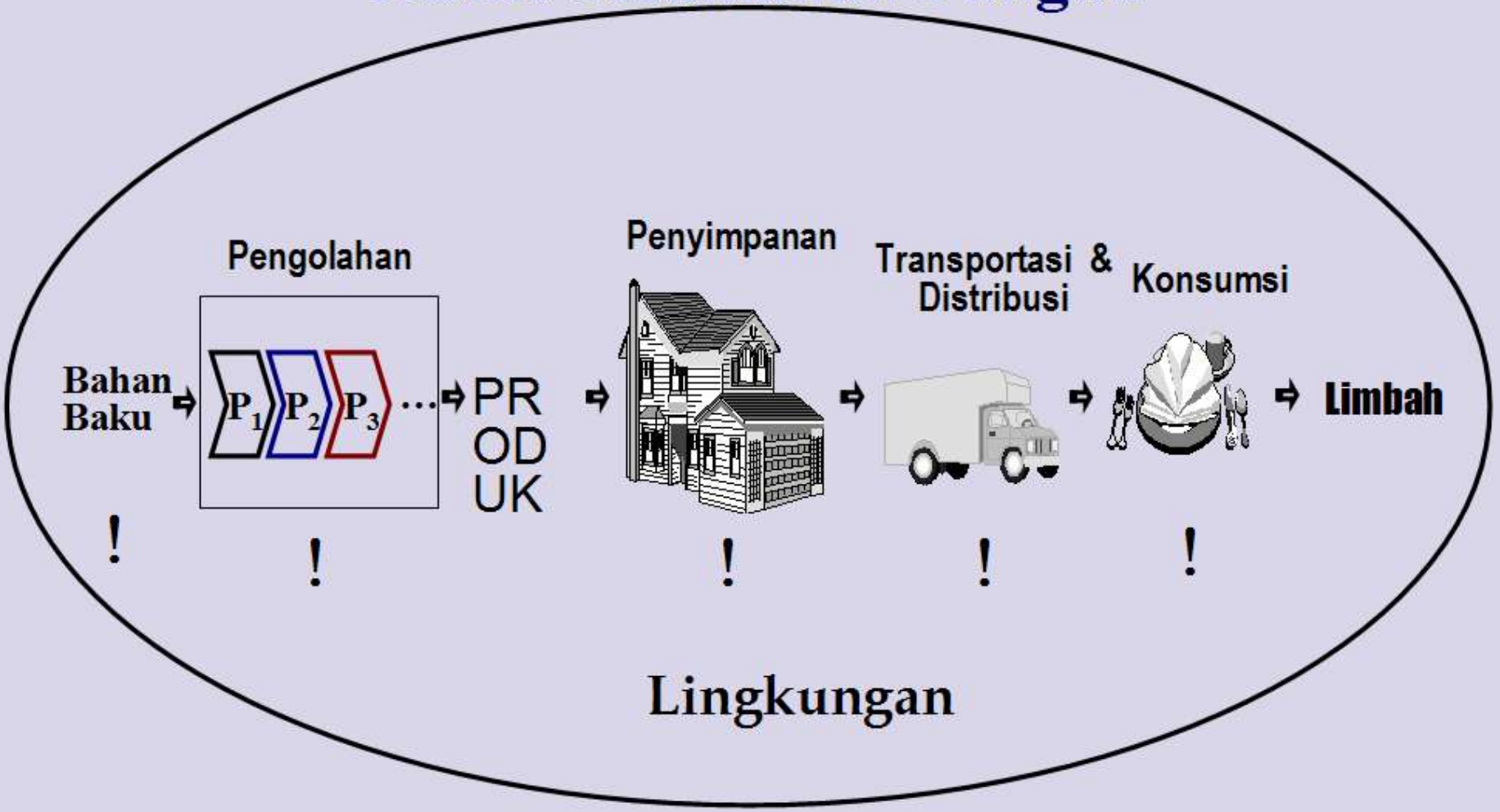
GOOD AGRICULTURAL PRACTICES FOR USE IN PRODUCTION AND HARVEST

- Water quality
- Land history and surrounding properties
- Soil amendments
- Field sanitation
- Pest control
- Agricultural chemicals
- Worker sanitation facilities

* Worker health and hygiene
* Containers and packaging materials
* Tools and equipment
* Transport
* Post-harvest cooling
* Storage
* Product traceability

Sources: Sperber (2005)

Risiko Keamanan Pangan



! = **Risiko**

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RISK ALONG THE PROCESS (1)

RISK ALONG THE PROCESS (2)

RISK ALONG THE PROCESS (3)

RISK ALONG THE PROCESS (4)

RISK ALONG THE PROCESS (5)

Food safety is not only HACCP

FOOD SAFETY = HACCP *plus*
PREREQUISITE PROGRAMS

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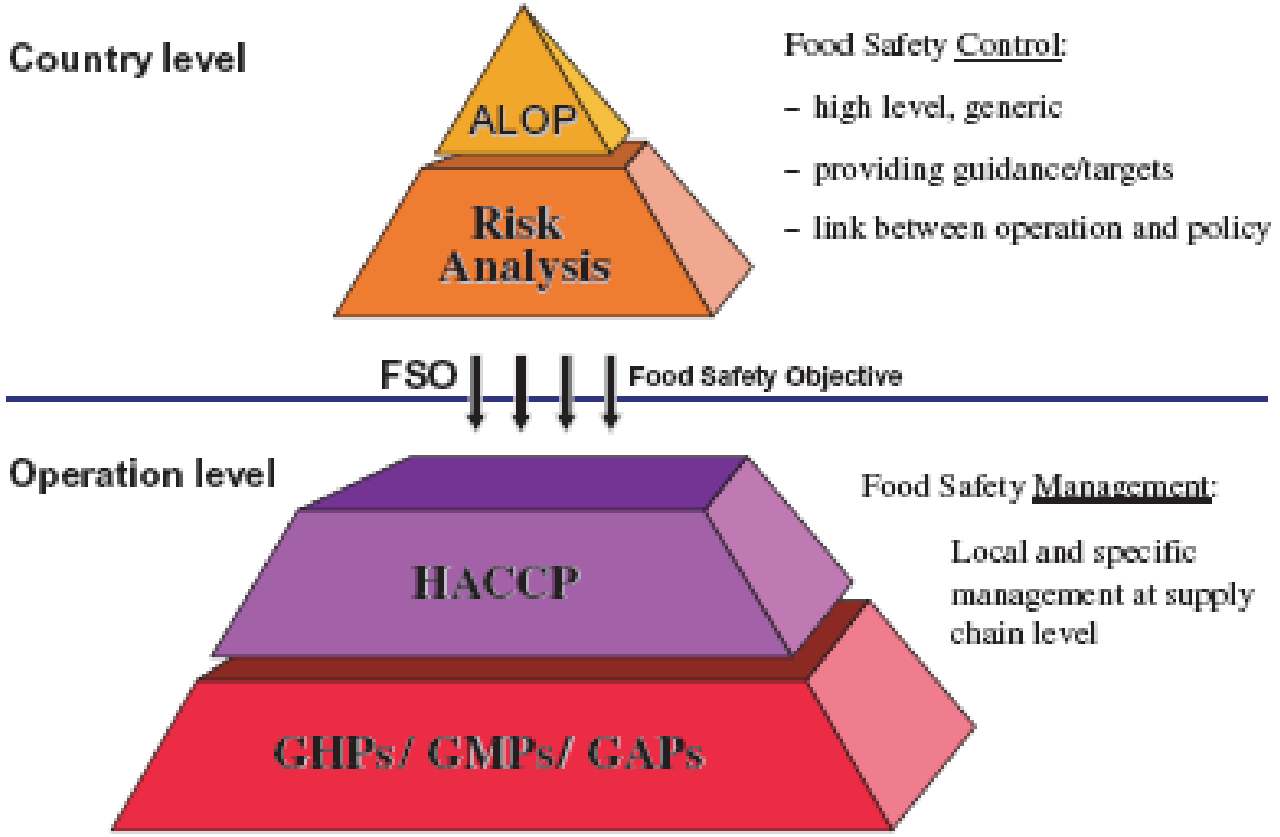

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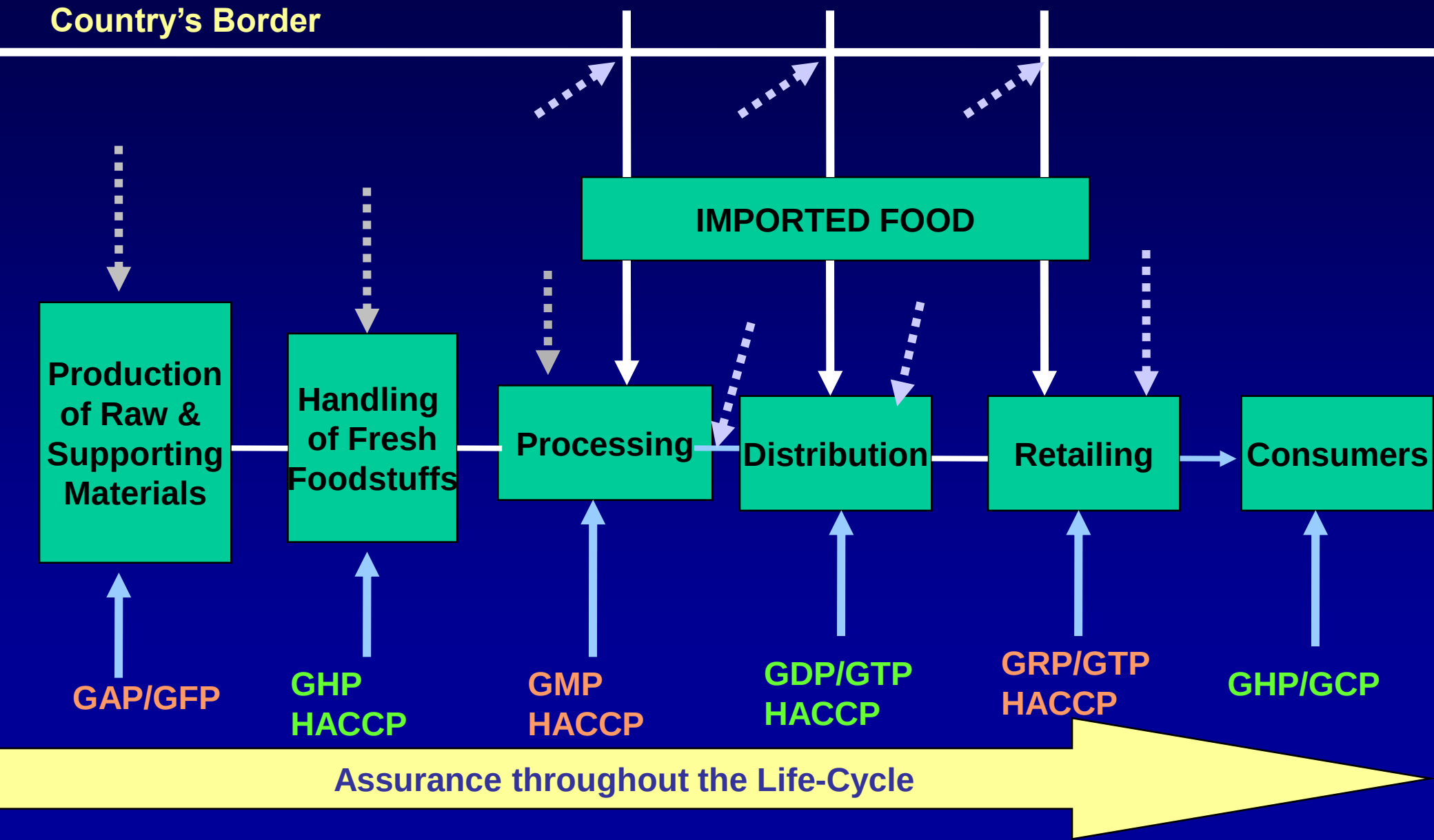

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- * Transport
- * Post-harvest cooling
- * Storage
- * Product traceability

Sources: Sperber (2005)

Farm to Table : Safety Aspects for Milk

Stages	Factors Affecting Quality	Attributes	Possible Contaminants
• Animals	• Fodder • Medicinal treatment • Sanitation of animal • Barn hygiene	• Taste • Flavour • Fat	• Fertilizers, Pesticides • Antibiotics, veterinary drugs • Physical contaminants • Bacteria
• Collection of Milk	• Hygiene of milkman • Equipment and utensils	• Flavour • Appearance	• Microbial contamination • Physical contaminants
• Transportation	• Distance • Time • Heat • Light • Violent movement	• Taste • Appearance • Flavour • Rancidity	• Bacteria

Farm to Table : Safety Aspects for Milk

Stages	Factors Affecting Quality	Attributes	Possible Contaminants
• Storage	• Hygiene • Temperature	• Rancidity • Appearance • Shelf life	• Micro organism • Bacteria
• Packaging	• Type • Sterility • Hygiene	• Taste • Flavour • Shelf life	• Chemicals • Mirco organisms • Bacteria • Extraneous matter

CONSUMER

⇨ **Possibilities of contamination exist at each step of processing**

⇨ **For safe food (milk) careful monitoring is a must !**

HAZARD = a biological, chemical or physical agent with the potential to cause an adverse health effect (e.g. Salmonella could be in food and it could make someone ill) .....CODEX definition

RISK = the likelihood of an adverse event (e.g. a consumer gets food-borne illness) and the severity of that event

RISK ≠ HAZARD

FOOD SAFETY EQUATION

$$(H_0 - \Sigma R + \Sigma I) \leq PO \text{ (or FSO)}$$

H0 = The Initial Contamination Level
∑R = The Sum of Reductions of Contaminant along the process (*from farm to fork*)
∑I = The Sum of Increases of Contaminant along the process (*from farm to fork*)
PO = Performance Objective
FSO = Food Safety Objective

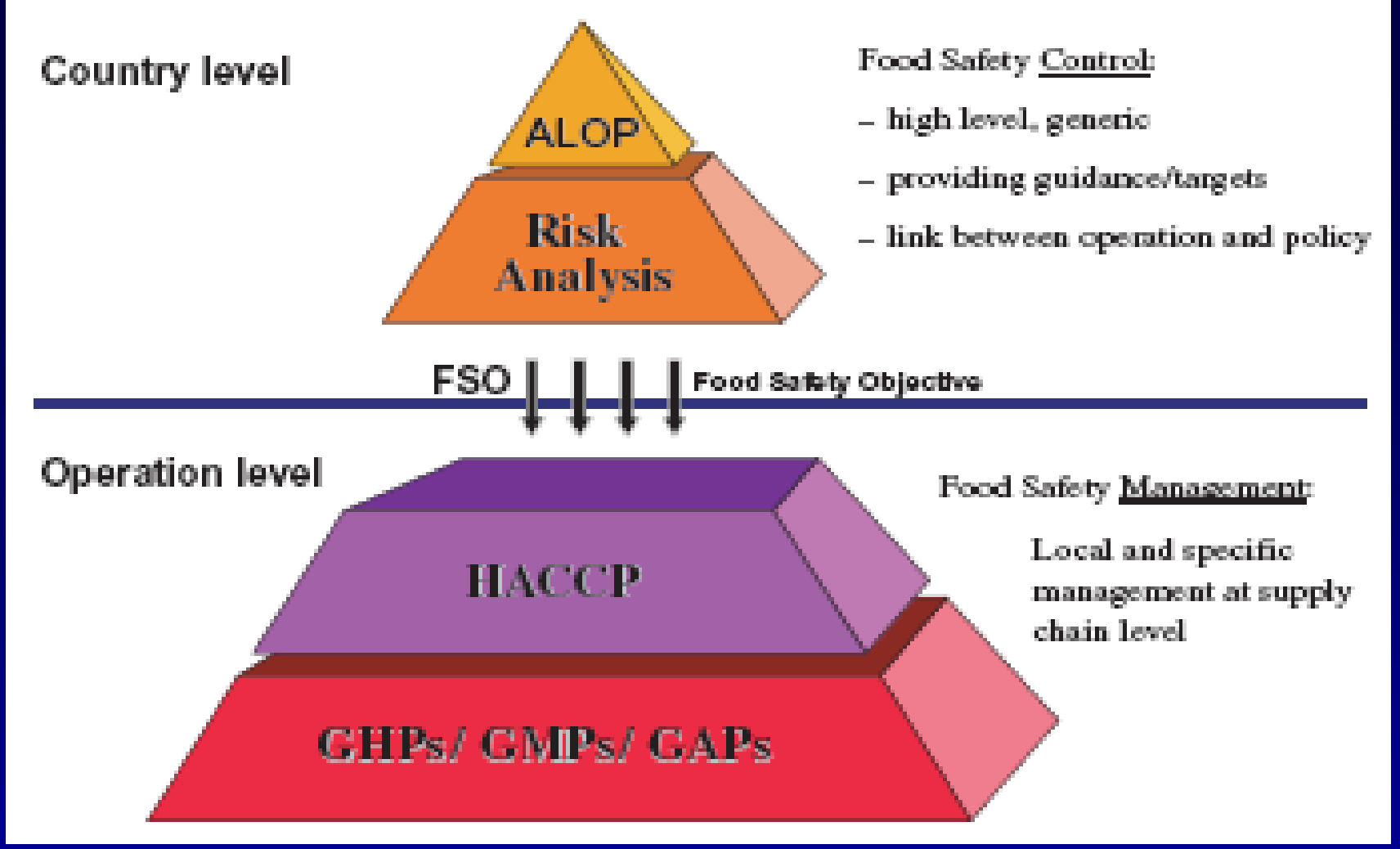

Illustration of how Food safety control at a country level can link into Food Safety Management at the operational level through a Food Safety Objective set by a governmental competent authority on the basis of a public health goal (ALOP) established following the Risk Analysis framework.

- **ALOP = appropriate level of protection**
  (tingkat perlindungan yang sesuai)

- **FSO = food safety objectives**
  (baku keamanan pangan)

HACCP = hazard analysis critical control point

CONCLUDING REMARKs

Snapshot approach in food safety control is no longer recommended

All parties involved in the production, transportation, retail sale, and final preparation of food products *[from farmer to consumer]* must share the responsibility for food safety

Education plays a critical role in food safety awareness campaign to individuals involved in food supply chain