Statistical Capacity Building (StatCaB) Programme

FOOD SECURITY

Measurements and Analysis

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OUTLINE

1. DEFINING FOOD SECURITY
2. MEASUREMENT OF FOOD SECURITY IN INDONESIA

BACKGROUND

Why food security?

- **Food insecurity is a serious issue:** Food security adversely impacts the physical, mental, and social health of adults and children (Sumsion et al, 2023).
  - Impact on adults: overweight or obese, micronutrient deficiencies, diabetes or chronic heart disease, etc.
  - Impact on children: higher rates of behavioral problem, stunted, poor health, etc.

- **Food insecurity is a global challenge in achieving Goal 2 (zero hunger) of the SDGs:** 2.3 billion people in the world were affected by food insecurity and an estimated more than 800 million people suffered from hunger in 2021 (FAO, 2022).

FOOD SECURITY

Defining food security (1)

- The concepts have **evolved over the years.**
- Initially, food security referred mainly to *countries*' ability to guarantee adequate *food supplies* (World Food Summit, 1974).
- FAO, 1983: "Ensuring that all people at all times have both *physical and economic access* to the *basic food* that they need"
- World Bank report "Poverty and Hunger", 1986: "Access of all people at all times to enough food for an active, healthy life"
- By mid 1990s: spanning a spectrum from the individual to the global level.
- UNDP Human Development Report, 1994: promoted the construct of human security, including a number of component aspects, of which security was only one.

FOOD SECURITY

Defining food security (2)

"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". (World Food Summit, 1996; refined in The State of Food Insecurity 2001)

From this definition, **four main dimensions** of food security can be identified:

- **AVAILABILITY**
- **ACCESS**
- **UTILIZATION**
- **STABILITY**

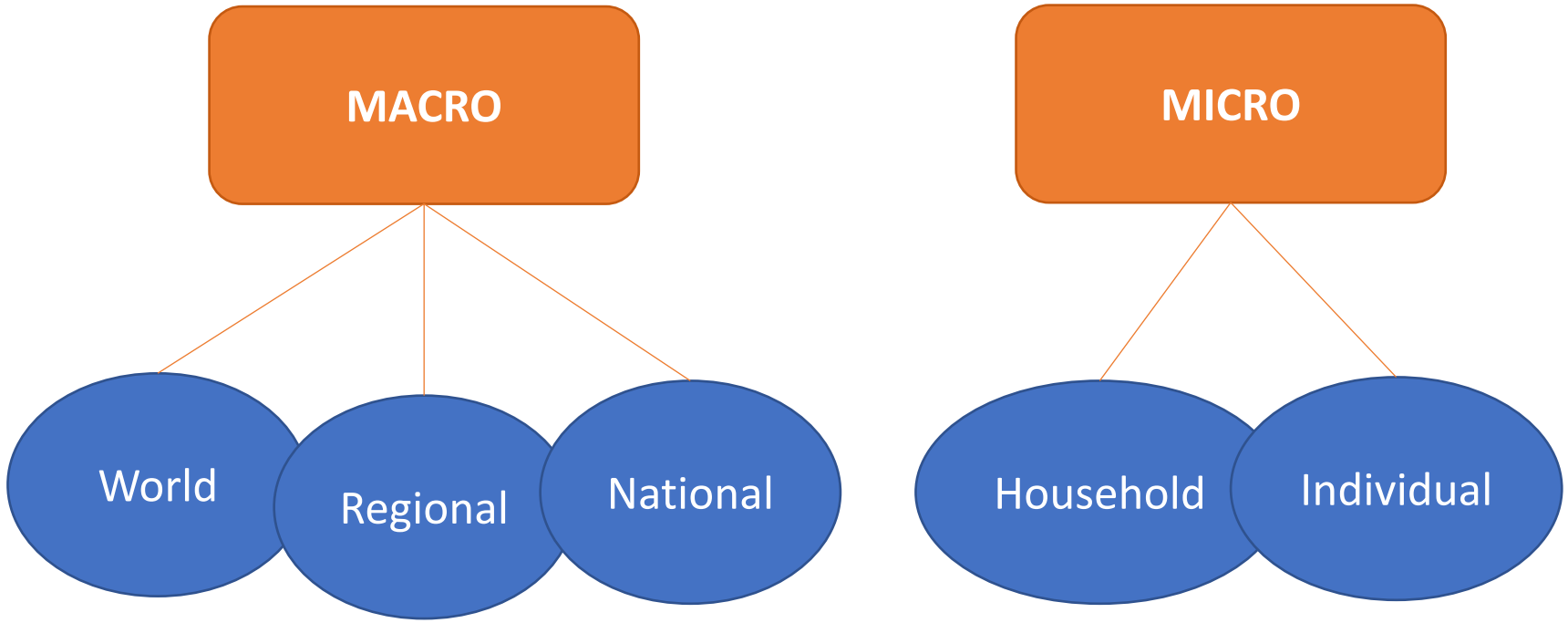
FOOD SECURITY

Defining food security (3)

AVAILABILITY	Food availability addresses the “supply side” of food security.
ACCESS	Access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet
UTILIZATION	Utilization of food through adequate diet, clean water, sanitation, and health care to reach a state of nutritional well-being where all physiological needs are met.
STABILITY	To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks or cyclical events.

Source: FAO.

FOOD SECURITY LEVEL OF ANALYSIS



KEY PRINCIPLE:

There are a number of proxy indicators to measure food security > NOT ONLY one single indicator.

MEASUREMENT OF FOOD SECURITY

(Some) common measures of food insecurity: Indonesia's Case

Global

✓ Global Food Security Index (GFSI)

(Developed by Economist Impact and supported by Corteva Agriscience)

Regional

✓ Regional food security index

(The Agency of Food Security, MoA)

Household/individual

✓ Percentage of household total expenditure on food

✓ The prevalence of undernourishment (PoU)

✓ The food insecurity of experience scale (FIES)

Indicators 2.1.1 and 2.1.2 for 2030 Agenda for Sustainable Development

(BPS-Statistics Indonesia)

GLOBAL FOOD SECURITY INDEX (GFSI)

Broad concept

Measurement aspect of Global Food Security Index

Affordability


Availability


Quality and Safety


Natural Resources and Resilience

- **Data provider:** The Economist Impact
- **Data acquisition:** qualitative scoring calculated from 28 individual indicators (from many sources), produced annually, now cover 113 countries
- **Level of indicator:** global or national level
- **Advantages:**
  - ✓ Progress of countries over time
  - ✓ Summarize complex, multidimensional realities
- **Weakness:**
  - ✓ May invite simplistic policy conclusions
  - ✓ May disguise serious failings in some dimensions
  - ✓ Indicators focus on the determinant, not the outcomes

GLOBAL FOOD SECURITY INDEX (GFSI)

Broad concept: indicators included

The categories and indicators included in the 2020 index are:

1)	**AFFORDABILITY**
1.1)	**Change in average food costs**
1.2)	**Proportion of population under global poverty line**
1.3)	**Inequality-adjusted income index**
1.4)	**Agricultural import tariffs**
1.5)	**Food safety-net programmes**
1.5.1)	Presence of food safety-net programmes
1.5.2)	Funding for food safety-net programmes
1.5.3)	Coverage of food safety-net programmes
1.5.4)	Operation of food safety-net programmes
1.6)	**Market access and agricultural financial services**
1.6.1)	Access to finance and financial products for farmers
1.6.2)	Access to diversified financial products
1.6.3)	Access to market data and mobile banking

2)	**AVAILABILITY**
2.1)	**Sufficiency of supply**
2.1.1)	Food supply adequacy
2.1.2)	Dependency on chronic food aid
2.2)	**Agricultural research and development**
2.2.1)	Public expenditure on agricultural research and development
2.2.2)	Access to agricultural technology, education and resources
2.3)	**Agricultural infrastructure**
2.3.1)	Crop storage facilities
2.3.2)	Road infrastructure
2.3.3)	Air, port and rail infrastructure
2.3.4)	Irrigation infrastructure
2.4)	**Volatility of agricultural production**
2.5)	**Political and social barriers to access**
2.5.1)	Armed conflict
2.5.2)	Political stability risk
2.5.3)	Corruption
2.5.4)	Gender inequality
2.6)	**Food loss**
2.7)	**Food security and access policy commitments**
2.7.1)	Food security strategy
2.7.2)	Food security agency

3)	**QUALITY AND SAFETY**
3.1)	**Dietary diversity**
3.2)	**Nutritional standards**
3.2.1)	National dietary guidelines
3.2.2)	National nutrition plan or strategy
3.2.3)	Nutrition labelling
3.2.4)	Nutrition monitoring and surveillance
3.3)	**Micronutrient availability**
3.3.1)	Dietary availability of vitamin A
3.3.2)	Dietary availability of iron
3.3.3)	Dietary availability of zinc
3.4)	**Protein quality**
3.5)	**Food safety**
3.5.1)	Food safety mechanisms
3.5.2)	Access to drinking water
3.5.3)	Ability to store food safely

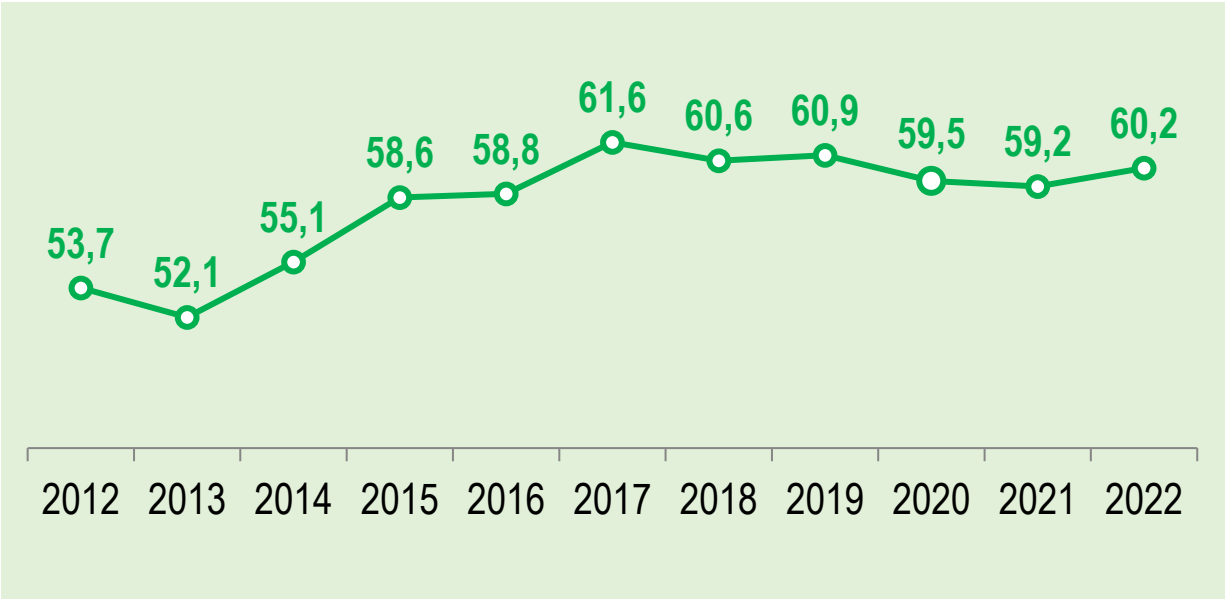
4)	**NATURAL RESOURCES & RESILIENCE**
4.1)	**Exposure**
4.1.1)	Temperature rise
4.1.2)	Drought
4.1.3)	Flooding
4.1.4)	Storm severity (annual average loss)
4.1.5)	Sea level rise
4.2)	**Water**
4.2.1)	Agricultural water risk—quantity
4.2.2)	Agricultural water risk—quality
4.3)	**Land**
4.3.1)	Land degradation
4.3.2)	Grassland
4.3.3)	Forest change
4.4)	**Oceans, rivers and lakes**
4.4.1)	Eutrophication
4.4.2)	Marine biodiversity
4.5)	**Sensitivity**
4.5.1)	Food import dependency
4.5.2)	Dependence on natural capital
4.6)	**Political commitment to adaptation**
4.6.1)	Early-warning measures/climate-smart agriculture
4.6.2)	Commitment to managing exposure
4.6.3)	National agricultural adaptation policy
4.6.4)	Disaster risk management
4.7)	**Demographic stress**
4.7.1)	Projected population growth
4.7.2)	Urban absorption capacity

GLOBAL FOOD SECURITY INDEX (GFSI)

How to analyze: Indonesia's case

Ranking
63

*Global Food Security Index Indonesia in 2022 ranked **63 of 113 countries** with index score **60.2***



Source: Global Food Security Index 2022 by The Economist Intelligence Unit (EIU) and supported by Corteva Agriscience

Global Food Security Index of ASEAN countries, 2022

Country	GFSI Score	Ranking
Singapore	73.1	28
Malaysia	69.9	41
Vietnam	67.9	46
Indonesia	**60.2**	**63**
Thailand	60.1	64
Myanmar	57.6	72
Phillippines	59.3	67
Cambodia	55.7	78
Laos	53.1	81

Regional Food Security Index

Broad concept

Measurement aspect of Regional Food Security Index

Affordability


Availability


Utilization

- **Data provider:** The Agency of Food Insecurity, Ministry of Agriculture
- **Data acquisition:** A composite indicators constructed from 9 indicators sourced from BPS, Ministry of Agriculture, and Ministry of Health
- **Level of indicator:** Regional
- **Advantages:**
  - ✓ Allow sub-national comparison
  - ✓ Policy relevant
- **Weakness:**
  - ✓ Simplification policy conclusion
  - ✓ May disguise serious failings in some dimensions

Regional Food Security Index

Broad concept: Weighting on 9 Indicators at District and provincial level

4 Considerations:

1) review on GFSI;
2) sensitivity level;
3) 3 pillar of food security;
4) data availability

No	Indicators	Weight
FOOD AVAILABILITY DIMENSION		
1.	The ratio of normative consumption per capita per day to net production	0.30
	Sub Total	**0.30**
FOOD ACCESS DIMENSION		
2.	Percentage of population below the poverty line	0.15
3.	Percentage of households with a proportion of expenditure on food is more than 65% of the total expenditure	0.075
4.	Percentage of households with no access to electricity	0.075
	Sub Total	**0.30**
FOOD UTILIZATION DIMENSION		
5.	Average length of schooling for females above 15 years old	0.05
6.	Percentage of the household with no access to clean water	0.15
7.	Ratio of population per health worker to population density	0.05
8.	Prevalence of stunting toddlers	0.05
9.	Life expectancy at birth	0.10
	Sub Total	**0.40**

Source: *BKP, Kementerian Pertanian, 2021*

Regional Food Security Index

Broad concept: Weighting on 8 Indicators at Municipality Level

4 Considerations:

1) review on GFSI;
2) sensitivity level;
3) 3 pillar of food security;
4) data availability

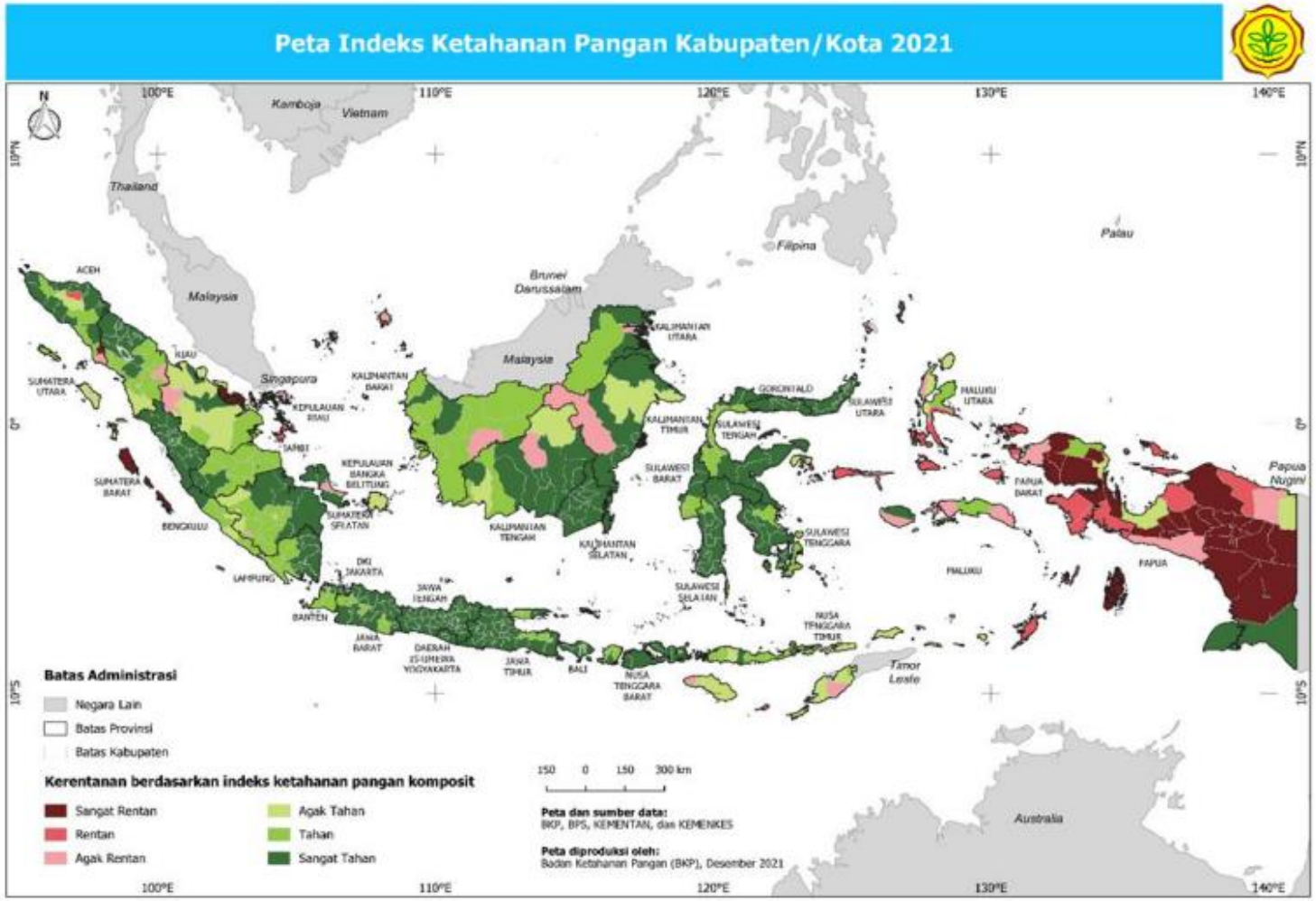
No	Indicators	Weight
FOOD AVAILABILITY DIMENSION		
1.	The ratio of normative consumption per capita per day to net production	-
	Sub Total	**-**
FOOD ACCESS DIMENSION		
2.	Percentage of population below the poverty line	0.20
3.	Percentage of households with a proportion of expenditure on food is more than 65% of the total expenditure	0.125
4.	Percentage of households with no access to electricity	0.125
	Sub Total	**0.45**
FOOD UTILIZATION DIMENSION		
5.	Average length of schooling for females above 15 years old	0.08
6.	Percentage of the household with no access to clean water	0.18
7.	Ratio of population per health worker to population density	0.08
8.	Prevalence of stunting toddlers	0.08
9.	Life expectancy at birth	0.13
	Sub Total	**0.55**

Source: *BKP, Kementerian Pertanian, 2021*

Regional Food Security Index

How to analyze: Indonesia's case 2021

Maps of Food Security Index by District/Municipalities, 2021



Source: *BKP, Kementerian Pertanian, 2021*

Provincial Food Security
Ranking and Index (IKP) 2021

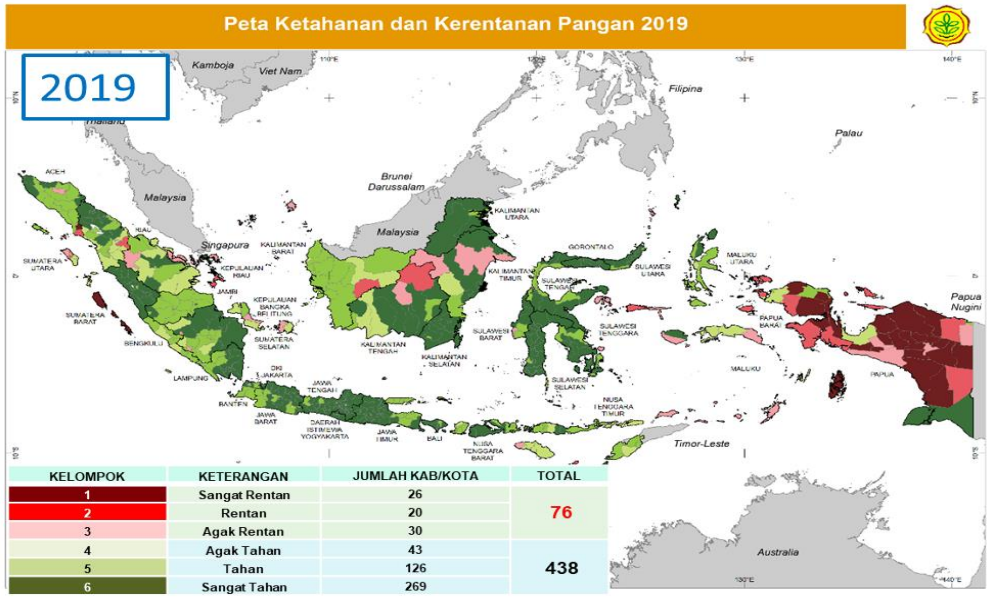
Peringkat	Provinsi	IKP
1	Bali	83,82
2	Jawa Tengah	82,73
3	DI Yogyakarta	81,43
4	Sulawesi Selatan	80,82
5	Gorontalo	80,52
6	Kalimantan Selatan	80,29
7	Jawa Timur	79,70
8	Sumatera Barat	79,55
9	Sulawesi Utara	78,30
10	DKI Jakarta	78,01
11	Lampung	77,96
12	Jawa Barat	77,79
13	Kalimantan Timur	77,46
14	Sulawesi Tenggara	76,64
15	Sulawesi Tengah	75,73
16	Nusa Tenggara Barat	75,67
17	Sulawesi Barat	75,49

Peringkat	Provinsi	IKP
18	Banten	74,38
19	Jambi	74,18
20	Kalimantan Tengah	73,68
21	Kep. Bangka Belitung	73,22
22	Kalimantan Utara	73,02
23	Sumatera Utara	72,25
24	Aceh	71,63
25	Kalimantan Barat	71,32
26	Bengkulu	70,32
27	Sumatera Selatan	69,55
28	Nusa Tenggara Timur	67,35
29	Riau	66,84
30	Kepulauan Riau	63,26
31	Maluku Utara	59,58
32	Maluku	58,70
33	Papua Barat	46,05
34	Papua	35,48

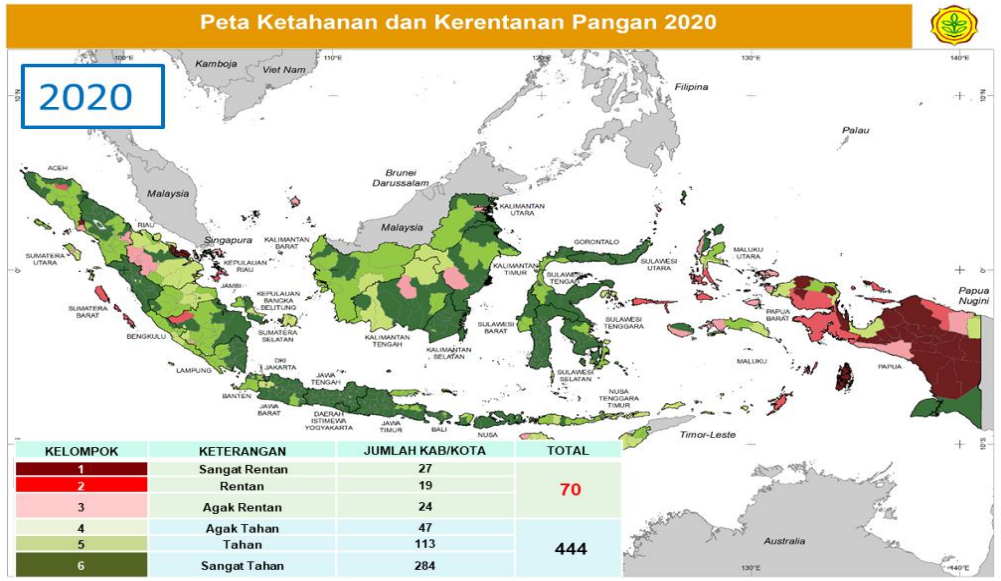
Higher score of the index >> more food secure

Regional Food Security Index

How to analyze: Indonesia's case comparison between

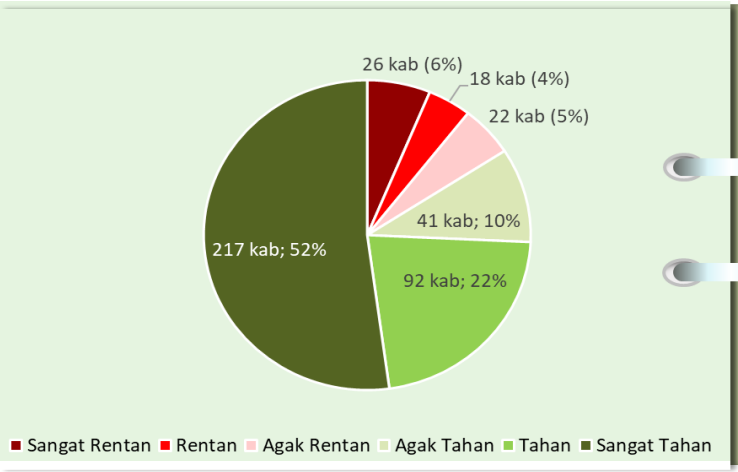


KELOMPOK	KETERANGAN	JUMLAH KAB/KOTA	TOTAL
1	Sangat Rentan	26	76
2	Rentan	20	
3	Agak Rentan	30	
4	Agak Tahan	43	438
5	Tahan	126	
6	Sangat Tahan	269	



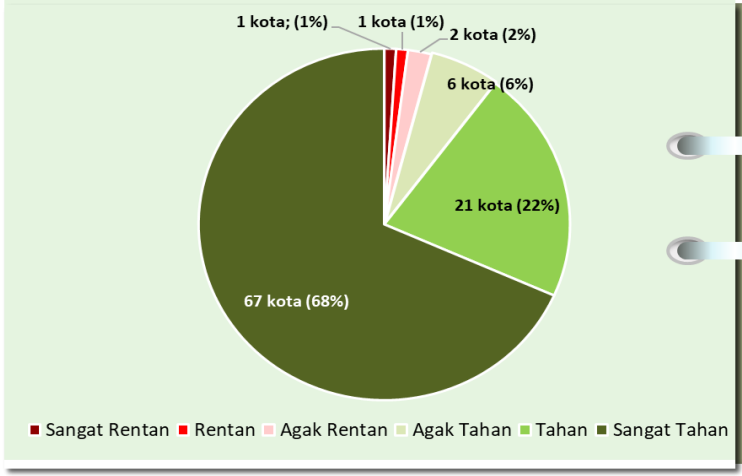
KELOMPOK	KETERANGAN	JUMLAH KAB/KOTA	TOTAL
1	Sangat Rentan	27	70
2	Rentan	19	
3	Agak Rentan	24	
4	Agak Tahan	47	444
5	Tahan	113	
6	Sangat Tahan	284	

- Comparison between two period of time
- The most contributed indicators on the regional food insecurity



INDIKATOR PENYEBAB UTAMA KABUPATEN RENTAN PANGAN

1. Rasio konsumsi normatif terhadap ketersediaan bersih
2. Presentase penduduk dibawah garis kemiskinan
3. Rasio penduduk per tenaga Kesehatan terhadap kepadatan penduduk



INDIKATOR PENYEBAB KOTA RENTAN PANGAN

1. Presentase Balita stunting
2. Presentase penduduk dibawah garis kemiskinan
3. Angka harapan hidup
4. Presentase rumah tangga tanpa akses air bersih

Source: bkp.pertanian.go.id

Percentage of household's total expenditure on food

Broad concept

- **Data provider:** BPS-Statistics Indonesia
- **Data acquisition:** collected from the National Socio-Economic Survey (*Susenas*); > 70% expenditure on food – very vulnerable to food insecurity (WFP)
- **Advantages:**
  - ✓ Policy relevant
  - ✓ Multilevel measure
- **Weakness:**
  - ✓ Data collection and computation costs high
  - ✓ Cannot determine inequalities within a household
  - ✓ Often fails to determine the accurate account of food eaten outside home
  - ✓ Household may change after the interview

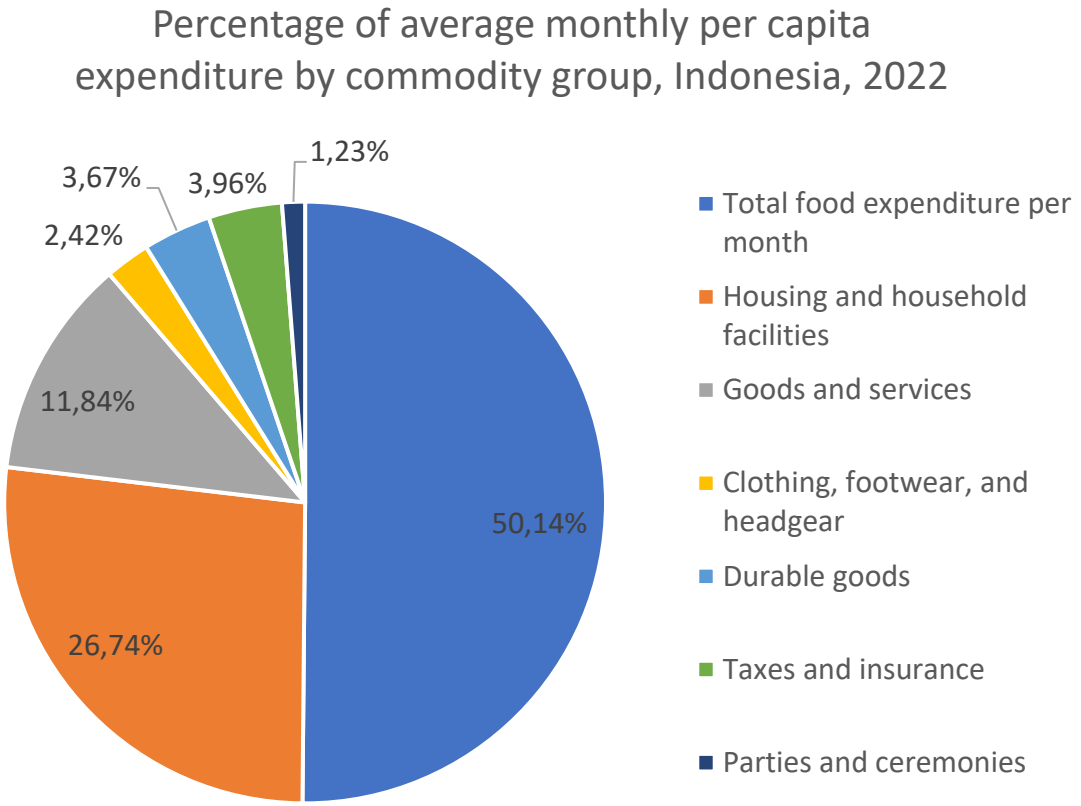
Percentage of household's total expenditure on food

How to analyze: Indonesia's case

Share of expenditure on food

- 75+: very high (very vulnerable to food insecurity)
- 65–75: high
- 50–65: medium
- <50: low

Source: WFP training material on food security indicators



MEASUREMENT OF FOOD SECURITY

for 2023 Agenda of Sustainable Development

Target 2.1: By 2023, **end hunger and ensure access by all people,** in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round

- **The prevalence of undernourishment** (indicator 2.1.1)
- **The prevalence of food insecurity at moderate and severe levels** (indicator 2.1.2)

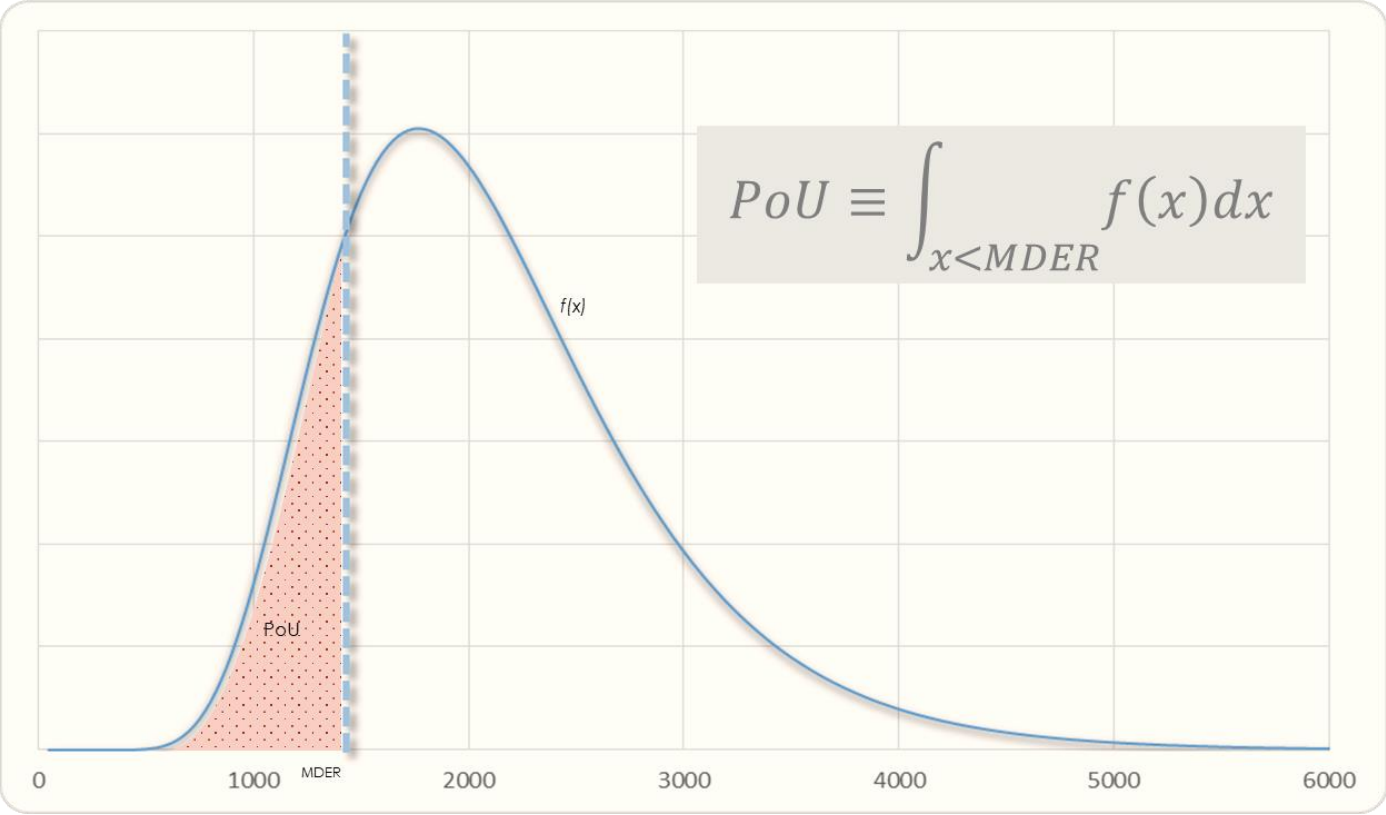
PREVALENCE OF UNDERNOURISHMENT (PoU)

Broad concept

- **The Prevalence of Undernourishment (PoU):** estimate the proportion of a given population with insufficient caloric intake relative to the minimum calorie requirement of an average individual in the population.
- **Data acquisition:** the National Socio-Economic Survey (BPS) & Basic Health Research (Ministry of Health)

Prevalence of Undernourishment (PoU)

Estimating PoU (2)



- Estimate the PoU as

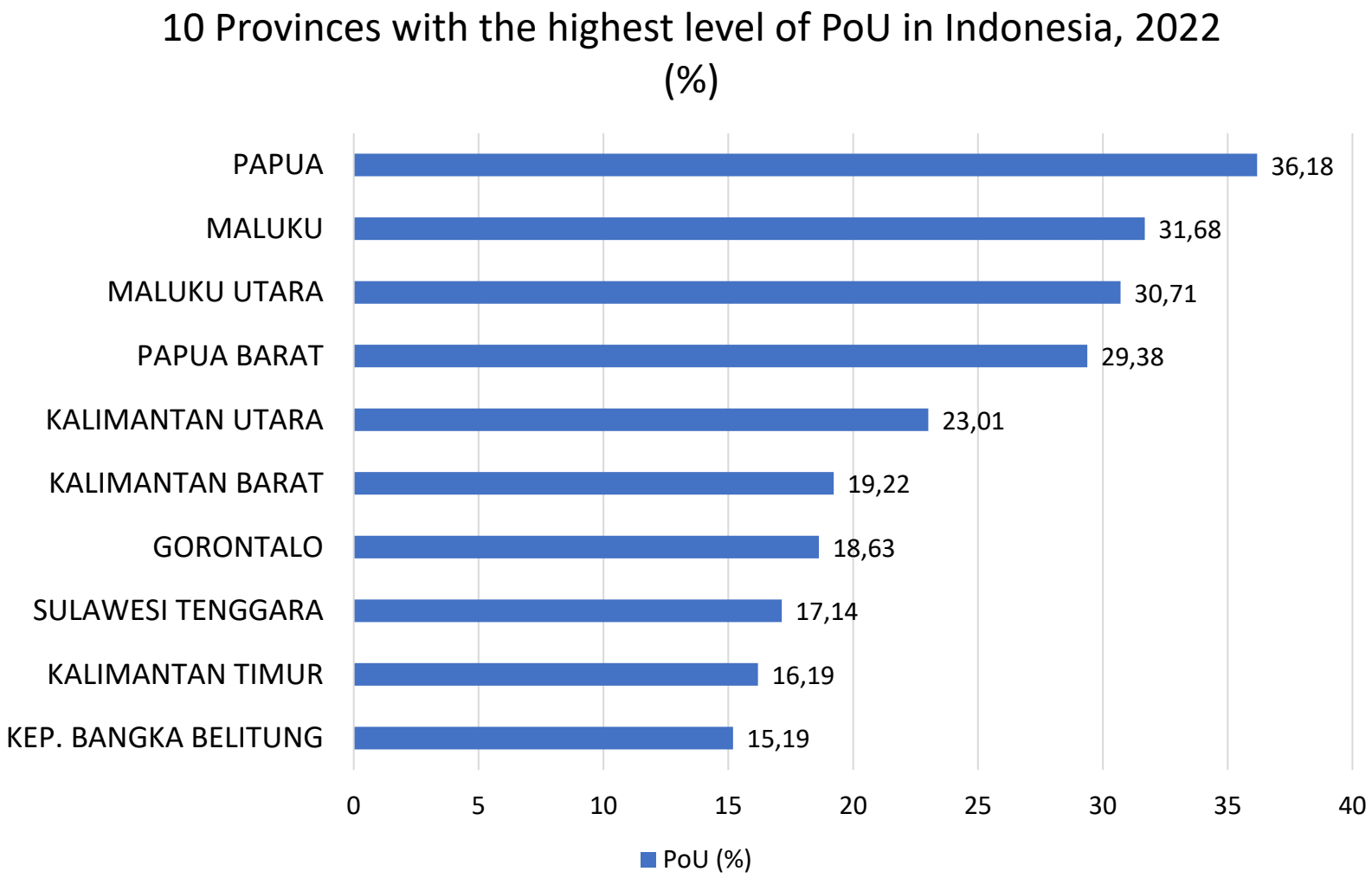
$$PoU = \int_{x<MDER} f(x)d(x)$$

- It can be applied to any population for which there are sufficient data on the distribution of food consumption and on relevant characteristics of the population (sex, age, height and occupation)

PoU is NOT based on a headcount of households who report food consumption below a certain threshold

Prevalence of Undernourishment (PoU)

How to analyze: monitoring levels



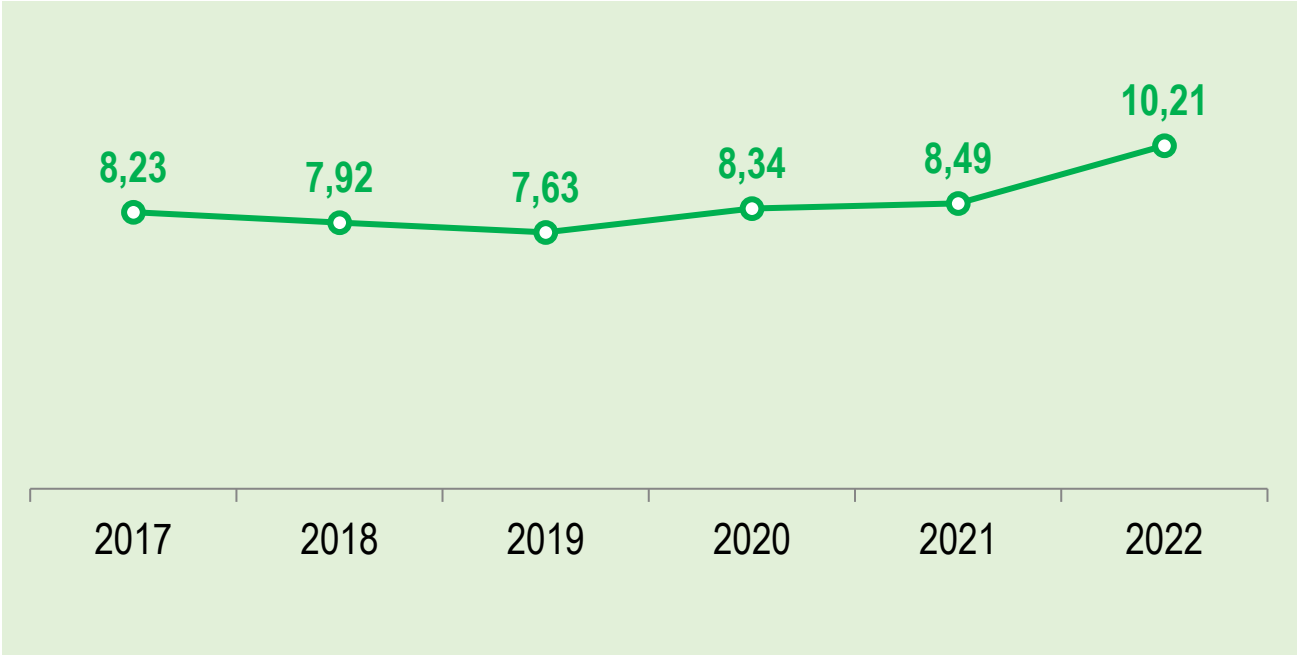
The PoU in Papua is the highest compared to the PoU in other provinces, reaching to around 36.18%.

Source: BPS, 2022

Prevalence of Undernourishment (PoU)

How to analyze: monitoring trends

PoU trends in Indonesia, 2017-2022 (%)



- The figure shows the share of population who are undernourished in Indonesia from 2017-2022.
- In 2022, around 10.21 percent of the population was undernourished in Indonesia, experiencing an increase compared to the year before.

Source: BPS, 2022

FOOD INSECURITY EXPERIENCE SCALE (FIES)

Broad concept

- Food Insecurity Experience Scale (FIES) is **an experience-based measure** of household or individual food security developed by the FAO through the Voices of the Hungry (VoH) project.
- Facilitating the estimation of the prevalence of food insecurity **(SDG indicator 2.1.2).**
- **Consists of eight questions** regarding people's access to adequate food, and can be easily integrated into various types of population surveys.
- Experiences can be ranked in terms of severity **from the least severe to the most severe.**

FOOD INSECURITY EXPERIENCE SCALE (FIES)

Questions in FIES

Now I would like to ask you some questions about food. During the last 12 MONTHS, was there a time when... :	
1	... you were worried you would **not have enough food** to eat because of a lack of money or other resources?
2	... you were **unable to eat healthy and nutritious food** because of a lack of money or other resources?
3	... you ate only **a few kinds of foods** because of a lack of money or other resources?
4	... you had to **skip a meal** because there was not enough money or other resources to get food?
5	... you ate **less than you thought you should** because of a lack of money or other re- sources?
6	... your household **ran out of food** because of a lack of money or other resources?
7	... you were **hungry but did not eat** because there was not enough money or other resources for food?
8	... you went without eating **for a whole day** because of a lack of money or other re- sources?

FOOD INSECURITY EXPERIENCE SCALE (FIES)

Estimating FIES: The Rasch Model

$$Prob(X_{i,j} = 1) = \frac{\exp(\theta_i - \beta_j)}{1 - \exp(\theta_i - \beta_j)}$$

- $X_{i,j}$ is the answer that the *i*-th respondent gives to the *j*-th question, coded as 1 for "yes"
- The model imposes that the probability to report a food insecurity experience identified by a severity level β_j is a logistic function of the distance between the respondent's severity condition and that of the item
- The model provide the basis for
  - ✓ **Estimating the severity parameters** associated both with items (i.e., the various experiences mentioned in the questions) and with respondents
  - ✓ Conducting statistical tests of the strength of association of the responses to the latent trait, and of goodness of fit

FOOD INSECURITY EXPERIENCE SCALE (FIES)

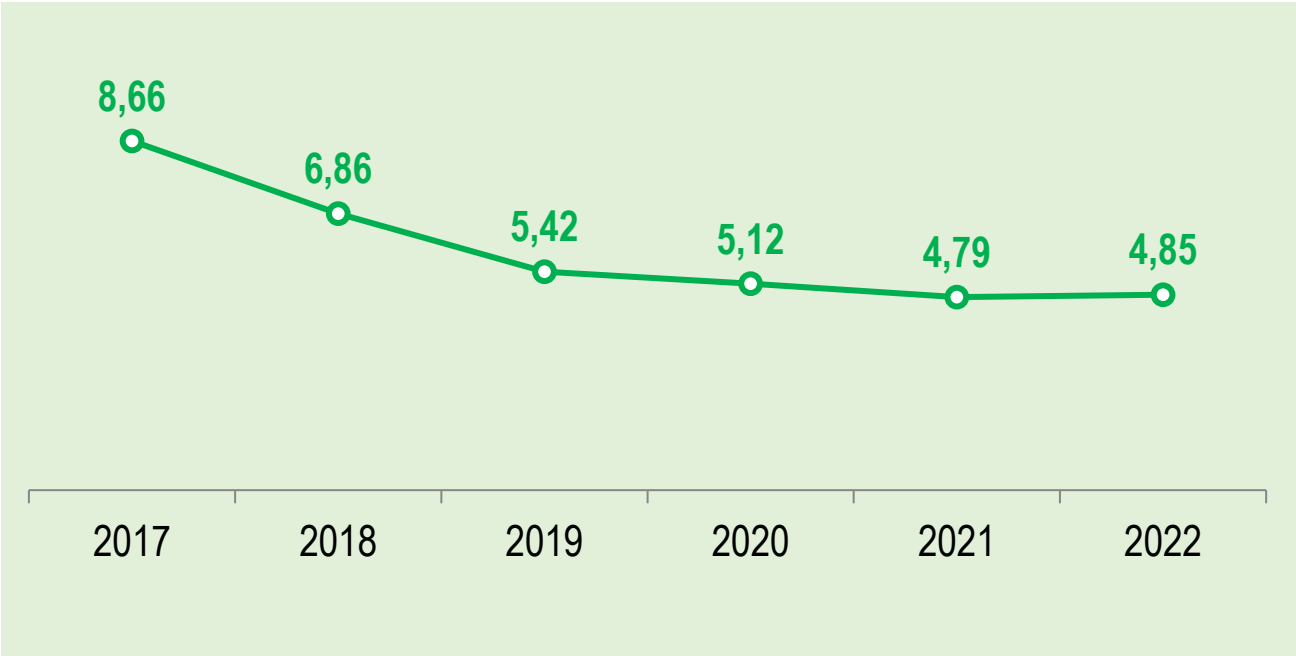
Advantages and Weaknesses

- **Advantages:**
  - ✓Easily applied at low cost within any individual or HH survey.
  - ✓Comparable across countries/sub-populations
  - ✓Software program and learning materials for computing FIES are provided by FAO (*elarning.fao.org*)
- **Weakness:**
  - ✓Challenging for non-specialists to analyze data
  - ✓Does not quantify the actual diet quality, food consumption, or expenditures
  - ✓Does not measure child food security

FOOD INSECURITY EXPERIENCE SCALE (FIES)

How to analyze: Indonesia's case

Prevalence of experiencing food security at moderate to severe level, 2017-2022 (%)



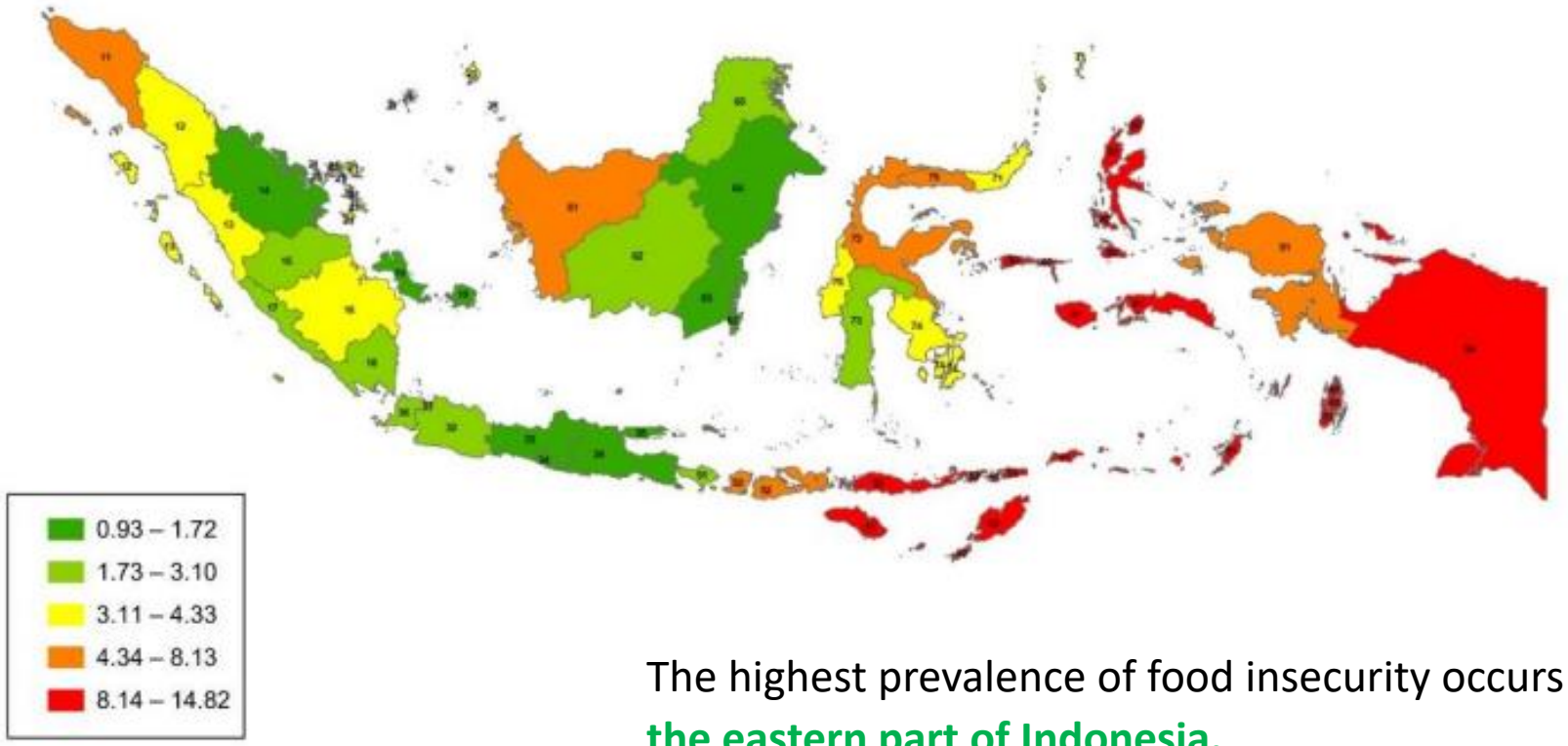
- The figure shows the share of population who experienced food security at moderate to severe level based on FIES in Indonesia from 2017-2022.
- Trend tends to decrease.

Data sources: Social Economic Household Survey (Susenas)

FOOD INSECURITY EXPERIENCE SCALE (FIES)

How to analyze: Indonesia's case

Percentage of agricultural households experiencing food insecurity at moderate to severe levels by province, 2021



The highest prevalence of food insecurity occurs in provinces in **the eastern part of Indonesia.**

Data sources: Agricultural Integrated Household Survey (AGRIS/SITASI)

CONCLUSION

- There are **a number of indicators often used** to get an understanding of the food security issue.
- In the context of Indonesia, there are five common indicators that could be used to assess the food security state.
- Two indicators are used **to monitor Target 2 of SDGs:** PoU and FIES.
- Utilization of the **combination of several indicators of food insecurity** can be useful to give a comprehensive view of food insecurity causes and consequences, leading to **more effective decision-making.**

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THANK YOU

TERIMA KASIH