



Food and Agriculture Organization  
of the United Nations

# **Cost of Production : Objectives, analytical framework and data dissemination**

Short Training Course on  
Agricultural Cost of Production  
Statistics

# 1- Current status of CoP Statistics

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- CoP surveys are often conducted on an **“ad hoc” basis**
- **Different methods** are used by different countries
- **Different methods** are used by **different institutions** within a country
- **Limited policy relevance** of the available data; **poor timeliness;**  
**limited data access**
- **Limited funding** for agricultural statistics in general (and CoP in particular)
- **Lack of human resources** ( with limited technical capacity in data collection & analysis )

## 2- General objectives 1/3

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- **Provide decision makers with reliable CoP information** (policymakers, bankers and traders ...)
- Allow policymakers to make **evidence based policies:** determination of taxes and taxes and subsidies, targeting policies.
- Identify candidates for **reducing costs**
- Improve **food security**

## 2- General objectives 2/3

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- Learn how to base **marketing objectives** on production costs
- Improve **whole-farm cash flow budgeting** and marketing plans.
- Determine which enterprises are more profitable than others
- Make **pricing strategy** and **management**
- Make **profitable marketing** and maintain a economically sustainable holding.

### 3- General objectives 3/3

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- **Enable more precise price determination for** inputs and outputs.
- **Better understand commodity supply and price situation** to prepare for implementing policies to ensure a stable and sufficient supply of food.
- **Set food import and export levels;** and better inform trade policy and assist negotiators participating in liberalizing import and export markets.
- **Determine income measures and distributions** and support anti-poverty policies and analysis.
- **Provide insight into agriculture sector contribution** to the whole economy

## 4- Specific objectives

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- Improve the measurement of **Agriculture value-added**
- **Understand underlying processes that influence output and productivity of Agriculture sector, identify best practices in farming,** such as input use and support training and outreach programs of extension workers
- **Allow a better understanding of farm practices and where and how good practices exist,** across regions, geographies, topographies, farm outputs/crops, the relative importance of outputs and inputs.
- **Simulate the effects of different policy alternatives,** such as different trade regimes or public support policies, and impact of technology and technology adoption, and returns to new capital investment.

## 5- Dissemination : general considerations (1/4)

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- Dissemination enhances **accessibility** of statistical information
- Dissemination, communication and outreach activities contribute to the statistical production process by **building relationships with data users and suppliers**.
- In return, the statistical organization benefits from the **feedback obtained from users**.

## 5- Dissemination : general considerations (2/4)

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- Release calendar (published in advance)
- Timely (within the survey cycle)
- Respondent confidentiality
- Accessibility
- Objectivity
- Meta data
- Quality Assessment



## 5- Dissemination : general considerations (3/4)

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- **Main instruments:**
  - Hard copy publications
  - Electronic reporting via websites or WebPages
  - Press (media) release
  - Micro or aggregated data bases (website, files, CD-ROMS, DVD)
  - Special tabulations
  
- **What should be considered when preparing a release?**
  - User guide(s)
  - Analysis
  - Variable selection
  - Tables
  - Geography
  - Charts and graphs
  - Meta Data

## 5 – Dissemination : general considerations (4/4)

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- **Interpretability and usability of indicators is bounded by:**
  - The quality (accuracy, precision) of the data meeting the needs of the users;
  - The representativeness of the dataset with respect to geographical areas, farm and activity types, etc
  - Indicators should be compiled for sufficiently homogenous groups of observations (farm type, region, etc.)
  - Identification of possible biases (known factors leading to consistent over or under-estimation)

## 5– Dissemination : possible reports for publishing

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- Main survey report (including the methods, main findings and statistical tabulations);
- Data analysis report;
- Quality evaluation report;
- Survey methodology report;
- Other reports (Specialized reports on data processing procedures, data collection, methodological studies, etc...)

## 6– Quality Assessment (multidimensional frameworks)

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- All official statistical outputs should provide a quality assessment of the data produced.
- Unlike in the 1980's, when data quality was synonymous with making known measures of sampling and non-sampling survey errors, **today it is generally accepted that quality can and should be described using multiple dimensions.**

## 6 – Quality Assessment (multidimensional frameworks) : an example

**Table A4.1. Data Dimensions of the GDDS**

Quality Dimensions	Elements	Indicators
0. Prerequisites of quality	<p>0.1 Legal and institutional environment—<i>The environment is supportive of statistics.</i></p> <p>0.2 Resources—<i>Resources are commensurate with needs of statistical programs.</i></p> <p>0.3 Relevance—<i>Statistics cover relevant information on the subject field.</i></p> <p>0.4 Other quality management—<i>Quality is a cornerstone of statistical work.</i></p>	<p>0.1.1 The responsibility for collecting, processing, and disseminating the statistics is clearly specified.</p> <p>0.1.2 Data sharing and coordination among data-producing agencies are adequate.</p> <p>0.1.3 Individual reporters' data are to be kept confidential and used for statistical purposes only.</p> <p>0.1.4 Statistical reporting is ensured through legal mandate and/or measures to encourage response.</p> <p>0.2.1 Staff, facilities, computing resources, and financing are commensurate with statistical programs.</p> <p>0.2.2 Measures to ensure efficient use of resources are implemented.</p> <p>0.3.1 The relevance and practical utility of existing statistics in meeting users' needs are monitored.</p> <p>0.4.1 Processes are in place to focus on quality.</p> <p>0.4.2 Processes are in place to monitor the quality of the statistical program.</p>

## 6– Quality Assessment : quality dimensions (1/2)

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- **Relevance:** The extent to which the compiled statistics **meet the demands** of data users, analysts and policy makers. In this context, relevance depends upon both the coverage of the required topics and the use of appropriate concepts.
- **Accuracy:** The extent to which the compiled statistics **measure the desired or true value**. Measures of accuracy would include estimates of under coverage and sampling errors. There is no definitive or single measure that can adequately describe the accuracy of an estimate.
- **Credibility:** The extent to which the compiled statistics **resonate and instill confidence** with the user(s).

## 6– Quality Assessment : quality dimensions (2/2)

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- **Timeliness:** The distance measured in time units, that **the data are released following the reference period**. All other things being equal the shorter the time distance, the higher the quality.
- **Accessibility:** Closely related to dissemination, the accessibility dimension describes **the availability for users to access the data** in formats that are useable by the user.
- **Interpretability:** Is a dimension of quality that attempts to gauge **how easy it is for users to understand** the official statistics and the extent to which there is support for the data user. It extends to include the availability of meta data.
- **Coherence:** The extent that the released **numbers conform or are supported by similar indicators** in the statistical domain, in other words the data are consistent within survey vehicle and are consistent across similar measures.

## 7- Analytical Framework : background and objectives (1/2)

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- Analytical Framework provides:
  - Key principles for the **interpretation of indicators** and evaluation of their qualities, to give credibility, trust and respect to analysis;
  - **Choice of the unit** (or normalization factor) in which the different measures of costs and returns are to be expressed;
  - **The dimensions of the production costs** to be included.
  
- Analysis of the cost of production data:
  - Difference between **historical and projected** estimates;
  - Estimates at the **individual farm compared to aggregated estimates**.
  - Compare data from **representative surveys** to the one from **non-representative surveys**;



## 7- Analytical Framework : background and objectives (2/2)

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- Analytical framework and indicators should :
  - Allow to properly **measure and describe the phenomenon** to be analyzed and **the users to which they are intended**;
  - Be carefully reviewed to ensure **relevance and accuracy**;
  - Be disseminated with the **sources** and the corresponding **methodologies**;
  - Be reproducible using the **same sources** and the **same methods**;
  - Be **standardized for units**;
  - Be adjusted to **the inflation** and to the **reference period**;

It is recommended that **the unit of observation should be consistent with other surveys** to ensure data crossing and comparisons.

## 7- Analytical Framework : choice of the disaggregation level

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The level of disaggregation depends on:

- **Representativeness** of the data (sector or geographical) ;
- **The type of indicator** and its relevance;
  
- **Sectorial disaggregation level:**
  - At the **farm level**: for example total cost, etc.
  - At the **output level**: eg average cost per hectare for a specific crop/product
  - At the **crop or the livestock sector**
  - At the **agricultural sector**
  
- **Geographical disaggregation levels:**
  - Local, regional, or national

## 7- Analytical Framework : Useful aggregates and constructs

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- Gross Margins
- Net Margins
- Cash Flow
- Cost/area
- Cost/unit of production
- USDA “Supply Curve”

## 7- Analytical Framework : efficiency indicators

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- **Total Costs per ha** = [Cash-costs + Non-cash costs + Land costs + Capital costs (replacement and opportunity cost of capital) + farm overhead expenses] / Total land area in ha.
- **Net Returns per MT of output** = [Value of output – Total Costs] / MT of Output.
- **Breakeven price per unit of output** = Total Costs / Total output.

## 7- Analytical Framework : environmental indicators

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- **Energy Use per ha** = [Fuel & lubricants use + electricity use] / Land area.
- **Fertilizer Use per ha** = [Fertilizer use] / Land area.
- **Pesticide Use per ha** = [Pesticide use] / Land area.
- **Environmental Pressure Index** = [Input use x Emission Factor] / Land area.

## 7- Analytical Framework : productivity indicators

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- **Input productivity** = Output / Input. Can be expressed in physical or monetary units.
- **Total Factor Productivity Growth** = [Change in the value of output – Change in the value of inputs].
- **Effect of technology** can be examined by comparing productivity of units with and without the technology. This analysis can also be done to compare new farming methods, input intensity and many other analyses

# 7- Analytical Framework: Commonly Produced CoP Indicators 1/2

Name	Definition	Comments	Unit of measure	Useful for...
Gross Returns	Value of Output – Variable Costs	Returns over Cash Costs	Per total land area, cattle head, etc.	Income/Price support
Net Returns	Gross Returns – Fixed Costs	Returns over Cash and Non- Cash Costs		Income/Price support
Breakeven price	Total Costs / Value of Output	Cash or non-cash costs		Income/Price support
Productivity of Inputs	Value of Output / Input Use	Labour, chemical inputs, etc.	Per quantity or value of input used	Productivity analysis
Technical coefficients	Cost for Input i / Value of Output		%	EEA and I-O tables

# 7- Analytical Framework: Commonly Produced CoP Indicators 2/2

Name	Definition	Comments	Unit of measure	Useful for...
Input Intensity	Input Use (Qty)	Fuel, fertilizers, pesticides, land area, etc.	Per total land area, cattle head, output, etc.	Sustainability analysis
Environmental Pressure Indexes (EPI)	Input Intensity x EF	EF= Emission of pollutants (air, water, etc.) per unit of input.		Sustainability analysis, SEEA
Abatement Cost Index	Input Productivity / EPI	Using value of output as normalization variable		Pollution abatement costs



**Corn production costs and returns per planted acre, excluding Government payments, 2013-2014, United States**

<b>Item</b>	<b>2013</b>	<b>2014</b>
<b>Gross value of production</b>		
Primary product: Corn grain	719.16	601.80
Secondary product: Corn silage	1.35	1.38
<b>Total, gross value of production</b>	<b>720.51</b>	<b>603.18</b>
<b>Operating costs:</b>		
Seed	97.59	101.04
Fertilizer	153.33	149.23
Chemicals	28.57	29.20
Etc.	...	...
<b>Total, operating costs</b>	<b>355.60</b>	<b>356.92</b>
<b>Allocated overhead:</b>		
Opportunity cost of unpaid labor	24.40	24.75
Capital recovery of machinery and equipment	96.86	100.15
Opportunity cost of land (rental rate)	167.74	175.60
Etc.	...	...
<b>Total, allocated overhead</b>	<b>320.85</b>	<b>332.88</b>
<b>Total, costs listed</b>	<b>676.45</b>	<b>689.80</b>
<b>Value of production less total costs listed</b>	<b>44.06</b>	<b>-86.62</b>
<b>Value of production less operating costs</b>	<b>364.91</b>	<b>246.26</b>

**Value of Production and Cost of Production per Hectare per Planting Season of Wetland Paddy,  
Dryland Paddy, Maize, and Soybean, 2014**

Description	Wetland Paddy		Dryland Paddy	
	Value (Million Rupiahs)	%	Value (Million Rupiahs)	%
<b>A. Value of Production</b>	<b>17.2</b>		<b>10.3</b>	
<b>B. Cost of Production</b>	<b>12.7</b>	<b>100</b>	<b>7.8</b>	<b>100</b>
<b>1. Seed</b>	<b>0.4</b>	<b>3.2</b>	<b>0.3</b>	<b>3.6</b>
<b>2. Fertilizer</b>	<b>1.3</b>	<b>10.4</b>	<b>0.6</b>	<b>7.8</b>
<b>3. Pesticides</b>	<b>0.2</b>	<b>1.9</b>	<b>0.1</b>	<b>1.7</b>
<b>4. Wage</b>	<b>4.5</b>	<b>35.9</b>	<b>4.6</b>	<b>58.8</b>
a. Land Processing	1.0	7.6	1.3	17.0
b. Planting	0.9	7.5	1.0	12.2
c. Maintenance	0.8	6.2	0.7	8.7
d. Fertilization	0.3	2.3	0.2	2.2
e. Pest Controlling	0.3	2.3	0.1	1.8
f. Harvesting, Thresing, and Yields Transportation	1.3	10.1	1.3	16.9
5. Agricultural Services	1.6	12.4	0.3	3.50
<b>6. Rent of Land</b>	<b>3.8</b>	<b>29.9</b>	<b>1.4</b>	<b>17.7</b>
<b>7. Rent of Agricultural Equipments</b>	<b>0.3</b>	<b>2.6</b>	<b>0.2</b>	<b>2.2</b>
<b>8. Fuel</b>	<b>0.1</b>	<b>0.7</b>	<b>0.1</b>	<b>0.9</b>
<b>9. Others</b>	<b>0.4</b>	<b>3.2</b>	<b>0.3</b>	<b>3.7</b>

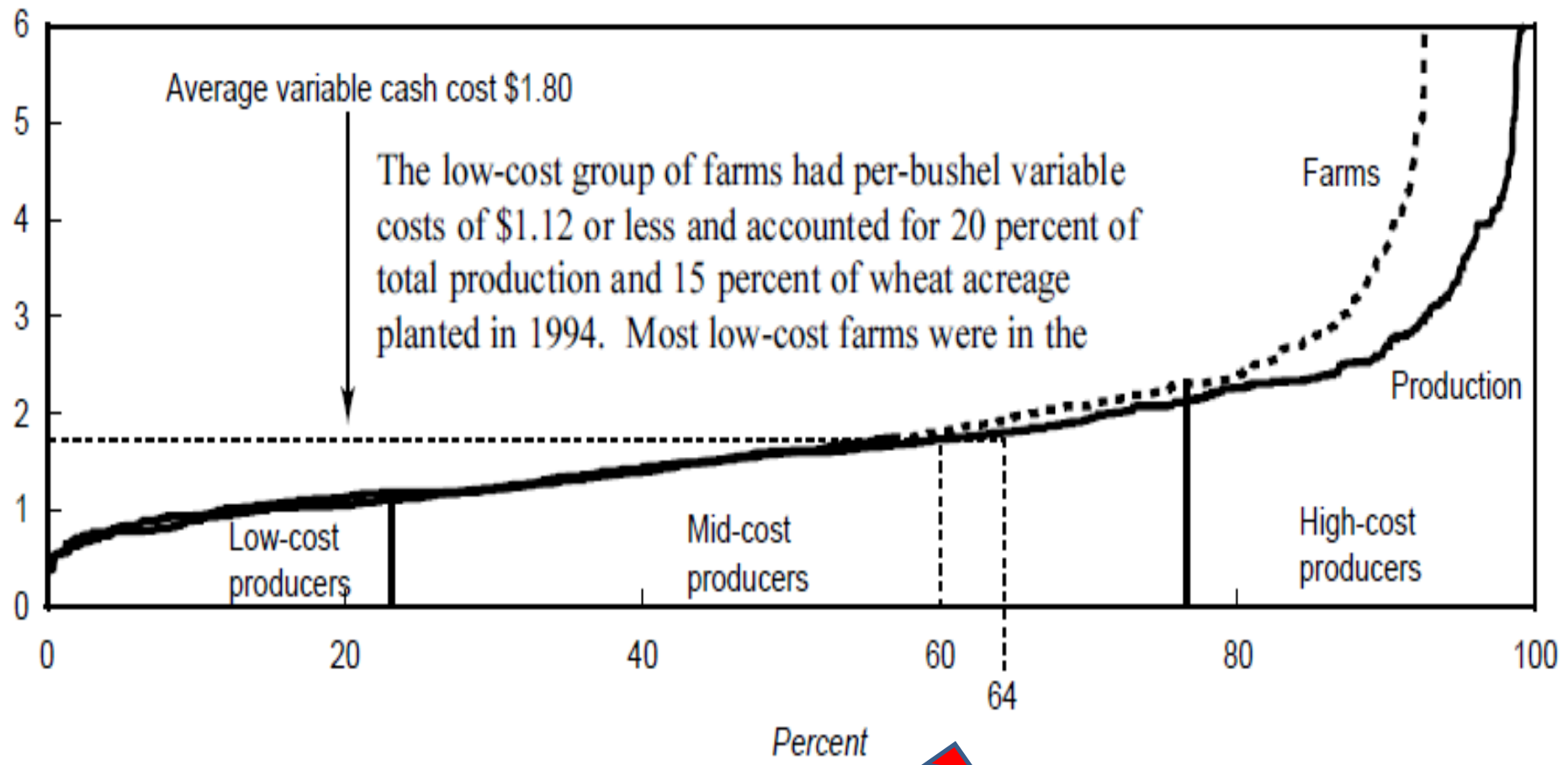
**Table 8a—Wheat production cash costs and returns per planted acre, by variable cost group, 1994**

Item	Low-cost farms	Mid-cost farms	High-cost farms	All FCRS farms
	<i>Dollars per planted acre</i>			
Gross value of production:				
Wheat grain	135.65	120.10	69.17	105.64
Wheat straw/grazing	9.04	3.31	4.49	4.55
Total, gross value of production	144.68	123.41	73.66	110.19
Cash expenses:				
Seed	6.64	7.41	7.90	7.46
Fertilizer	10.99	18.33	16.69	16.70
Chemicals	2.36	5.51	7.47	5.69
Custom operations	3.01	5.62	7.02	5.70
Fuel, lube, and electricity	5.84	7.11	12.05	8.55
Repairs	10.17	11.88	12.07	11.69
Hired labor	1.17	3.59	5.41	3.83
Purchased water and baling	0.26	0.46	0.26	0.36
Total, variable cash expenses	40.44	59.92	68.88	59.99
General farm overhead	6.63	5.86	4.00	5.36
Taxes and insurance	9.86	9.75	8.30	9.29
Interest	8.54	8.96	5.75	7.84
Total, fixed cash expenses	25.03	24.57	18.05	22.49
Total, cash expenses	65.48	84.49	86.93	82.48
Gross value of production less cash expenses	79.21	38.93	-13.27	27.71
	<i>Dollars per bushel</i>			
Harvest-period price	3.09	3.17	3.21	3.16
	<i>Bushels per planted acre</i>			
Yield	43.93	37.88	21.55	33.40

# Cumulative distribution of wheat variable cash costs, 1994

About 60 percent of Farm Costs and Returns Survey wheat farms, representing 64 percent of wheat production had variable cost at or below the average cost of \$1.80 per bushel.

Dollars per bushel



Source: U.S. Department of Agriculture's 1994 Farm Costs and Returns Survey.



# References

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- **Global Strategy to Improve Agricultural and Rural Statistics (2016),** Handbook on Agricultural Cost of Production Statistics, Handbook and Guidelines, pp. 50-55. FAO: Rome.
- **Literature Review on Cost of Production Methodologies** , Technical Report Series GO-04-2014