Allocating pre-production costs in multi-year enterprises

Regional Training Course on Agricultural Cost of Production Statistics
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1 – What are pre-production costs ?

- **Pre-production costs are incurred at least one year in advance of the time period when the commodity is actually produced** and can be sold on the market

- They are also called **establishment or installation costs**

- **AEAA Handbook definition**: "The pre-productive period begins with the first expense associated with establishing the crop enterprise and ends in the crop year just before the crop yields a substantial percent of its expected mature yield (usually 70-80%)"

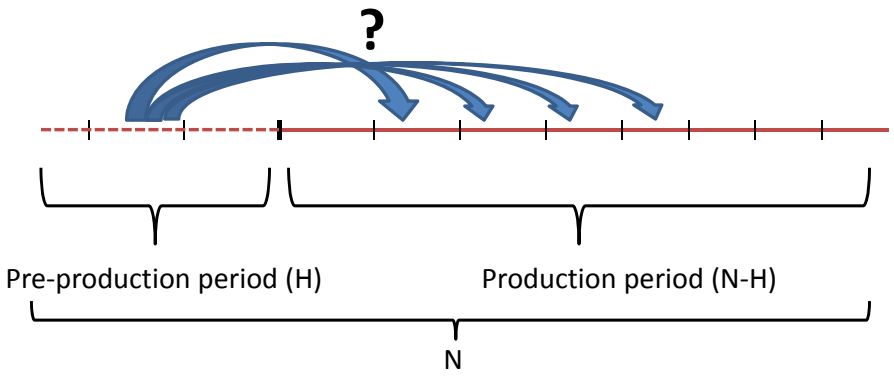
- Examples:
  - Establishment of a new coffee plantation: preparation of the soil, buying and planting the coffee trees, expenses related to tree nursery, etc.
  - Establishment of a new orchard for the production of flowers, etc.

2 - Why pre-production costs should be allocated?

• **To obtain relevant and comparable cost and revenue estimates**, pre-production expenses need to be allocated to the year or years in which production takes place

• **For production which are entirely harvested in a single-year** (ex: annual crops), all the pre-production costs are allocated to this production year

• **When production is distributed over several years** (ex: plantations, orchards, perennial crops), the question becomes more complex



3 - Concepts and definitions (1/2)

- **What costs should be allocated ?**
  - o **All cost items** (direct, indirect, labour, land, capital)
  - o They should be estimated using the same methodologies as those described in this training (and in the Manual)

• **Secondary products**: the revenues and costs associated with the selling of secondary products during the pre-productive years (ex: banana production on cacao plantations) should be added/deducted to/from preproduction costs

• **The production of the commodity before it reaches its mature yield** should also be accounted for and valued

3 – Concepts and definitions (2/2)

• When there is a substantial lag between the moment costs are incurred and production effectively takes place:

=> it is important **adjust nominal costs for inflation**

• **Pre-production costs = the net returns during the pre-productive years** adjusted to the end of the pre-productive period:

$$PPC = \sum_{t=1}^{H} (1+i)^{H-t} R_t$$

- R_t is the difference between revenues and costs in year t (= net returns, usually negative during the preproduction period)
- H is the length in years of the pre-productive period
- i is the annual inflation rate

4 – The traditional budgeting method (1/2)

• Accumulated costs (capital and non-capital) are allocated to the productive years using a **linear depreciation schedule**:

$$D = \frac{PPC - SV}{N - H}$$

•D is the portion of the establishment costs that will be charged against each productive year

• N-H is the length in years of the productive period (N is the total life span of the enterprise)

• SV is the value of the enterprise, excluding land, at the end of its productive cycle (salvage value)

4 – The traditional budgeting method (2/2)

- **Time adjustments**:
  - o PPC and SV should be expressed in the prices referring to the last pre-productive year
  - o The amounts charged to each production year should be expressed in current prices:

$$D_t = D(1+i)^t$$

- **Advantages**:
  - o Easy to implement and understandable
  - o Similar to what is usually done to estimate capital depreciation
- **Drawbacks**:
  - o Is the linear depreciation schedule a realistic/appropriate one ?
  - o The determination of SV is not easy

5 – The cost recovery (or annuity) approach (1/3)

- **The accumulated total is amortized over the production period using an annuity formula**

- The annual amount to be charged against each production year (A) is such that:

$$\underbrace{PPC - \frac{SV}{(1+r)^{N-H}}}_{\text{Net PPC at end of the pre-production period prices (“present”)}} = \underbrace{\sum_{t=H+1}^{N} A/(1+r)^t}_{\text{Present value of the amount to be charged}}$$

- It follows that: $$A = \frac{r}{1-(1+r)^{H-N}} NetPPC$$

5 – The cost recovery (or annuity) approach (2/3)

- **Time adjustments**: the amounts A charged to each production year need to be adjusted for inflation only if r is a real interest rate (i.e. excluding inflation)

- **Advantages**:
  - It is consistent with business accounting practices
  - It is economically founded

- **Limitations**:
  - Determining SV (an option could be 0)
  - Sensitivity to the choice of the interest rate r

5 – The cost recovery (or annuity) approach (3/3)

Example: installation costs of a new coffee plantation in Colombia

- **Assumptions**
  - H = 3 (marginal production starts at year 2, neglected here)
  - N-H = 7 (variable depending on production type)
  - r (nominal interest rate) = 15%
  - SV = 0 (excluding the value of land, the remaining is biomass)
  - PPC = 9.000.000 COL per hectare

- **Results:**
  - **Net PPC** = 9.000.000 per hectare (SV is 0)
  - **A =** 2.163.243 per hectare (~ 720 USD)

  -> This amount is charged against the revenues of each production year

6 – The current cost approach (1/2)

• **Adapted to situations where the farm is at the production equilibrium** or steady-state, i.e. having reached the maximum of its potential yield

• Allocated PPCs are determined **as a share of current costs** (CC)

• **This share is closely related to the steady-state replacement rate of the assets**, for examples:

- 5% of a herd may need to be replaced annually to maintain stable the number of heads
- 10% of a plantation may have to be renewed each year to maintain a stable average plantation age (and therefore yield)

6 – The current cost approach (2/2)

The calculation are done in 4 steps:

• Step 1: **determine the ratio r = PPC/CC** (assumed to be fixed for a given time period under the assumption of fixed technology)

- CC = change in asset value + operating costs associated with these assets
- **This operation has to be done with data spanning a sufficiently large time period** (e.g. average of 3 years) to reduce the risk that outlier observations might distort the ratio

• Step 2: **apply r to the estimated annual current costs** CC(t)

• Step 3**:** r.CC(t) **is charged against production for the year t**

7 – Market value approach

- Similar to the CC method, with the **PPC estimated using opportunity costs (market values)** instead of actual costs:
  - PPC are estimated as the foregone revenues from the selling of the assets (livestock, trees, etc.) instead of holding them
  - For example, market prices for replacement animals are used to estimate PPC for a livestock farm, as opposed to building up the actual costs associated with livestock breeding herd

- **Advantage**: ease of implementation; particularly adapted for livestock pre-production expenses

- **Drawbacks**:
  - Markets might not exist or may be too thin, in which case the current cost method may be used
  - Market valuations might be biased towards future earnings and not historical costs

8 – Yield or production-based allocation (1/3)

- It is an allocation rule based on a **non-linear depreciation schedule**

- PPC calculation:
  - Establishment expenses comprise capital as well as variable costs
  - Production occurring during the pre-production period for the main commodity are not deducted from PPC

- The amount to charge against each production year is proportional to the share of current production in the total expected production for the productive years:

$$D(t) = PPC \cdot \left[\frac{Q(t)}{\sum_{t=H+1}^{N} Q(t)} \right]$$

8 – Yield or production-based allocation (2/3)

- **Example**: N=10, H=3, PPC=500

	Years	Production shares (%)	Allocated PPC (D)
Pre-production years	1	0	0
	2	0	0
	3	0	0
Production years	4	10	**50**
	5	10	**50**
	6	20	**100**
	7	30	**150**
	8	20	**100**
	9	5	**25**
	10	5	**25**

8 – Yield or production-based allocation (3/3)

- **Advantages**:
  - Easy to implement and intuitive
  - Assumes a non-linear depreciation schedule, reflective of the farm's production cycle
- **Drawbacks**:
  - It is dependent on the schedule assumed for yields, which varies necessarily across varieties, regions, etc.
  - It has to be refined to include revenues and costs associated with secondary commodities

9 – References

• **AAEA Task Force on Commodity Costs and Returns** (2000). *Commodity Costs and Returns Estimation Handbook*. United States Department of Agriculture: Ames, Iowa, USA.

• **Global Strategy to Improve Agricultural and Rural Statistics** (2016), Handbook on Agricultural Cost of Production Statistics, Handbook and Guidelines, pp. 80-84. FAO: Rome.