Different types of capital goods in agriculture and the estimation of capital costs

Short Training Course on
Agricultural Cost of Production Statistics
• Capital goods = capital assets = capital inputs

• **Def:** **input not entirely used up during one production period:** it generates services for a period that goes beyond the cropping or annual production cycle

• Typical capital goods:
  - **Farm buildings and infrastructures** where production takes place
  - **Machinery and equipment** used in the production process
  - **Animals** used in farm operations (tilling, harvesting, etc.)
  - **Animals breed and used to obtain livestock products** (milk, wool, meat, skin, etc.)
  - **Permanent crops** such as orchards, coffee, cacao, olives, etc.
  - **Tree plantations**
1 - Capital assets: definitions (2/2)

• **Residual capital:** inputs other than traditional capital assets that can yield benefits beyond the current production period

• Examples: some types of **fertilizers**

• The **carry-over effect** may be amplified by specific cropping practices, such as crop rotations

• **it is not recommended to treat these inputs as capital assets**, because:
  
  o It is difficult to separate those inputs that have a carry-over from those that do not
  
  o The identification of the nature and extent of these carry-over effects is too complex: they depend on cropping practices, type of fertilizer used, etc.
2 - Capital costs: definitions

• All costs associated with the ownership of capital:
  
  o **Economic depreciation** (or consumption of fixed capital): it represents the reduction in the useful service life of capital (due to obsolescence and age)

  o **Opportunity cost of capital**: the return on capital had it been invested in the next best alternative

  o **Other costs** associated with capital ownership or use, such as property taxes, insurance expenses, licenses, fees, etc. These should not be subject to depreciation and grouped into a different item

• Capital depreciation has to be allocated over the service life of the capital asset

• **Costs associated with rented capital** are generally grouped in a specific cost item (ex: rental services), often with other non-capital rental services (labor, etc.)
3 – Measuring depreciation costs: first best approach

• Depreciation of owned capital goods \( \approx \) change in the market price of the capital:

\[
\text{Depreciation costs } (t) = P(t) - P(t-1)
\]

Where \( P(t) \) is the current market price of the asset

• If current market prices are available only for a similar asset (pivot asset) but not the asset itself:

\[
\text{Depreciation costs } (t) = \Delta P(t) \cdot P(0)
\]

Where \( \Delta P(t) \) is the percentage change in the market value of the pivot asset and \( P(0) \) the purchase price of the asset
In the absence of reliable market prices for capital assets, assumptions on the asset’s service life and the depreciation rate have to be made:

- **Linear depreciation schedule** (or “straight-line depreciation”):

  \[
  \text{Depreciation costs (t)} = \frac{[ P(0) - P(T) ]}{T}
  \]

  Where \( T \) is the useful service life of the asset and \( P(T) \) its price at the end of its service life (salvage value)

  - **Advantages**: easy to implement, easily understandable by analysts
  - **Drawbacks**: the asset is depreciated at each period of a fixed amount, which is unrealistic => under-estimation of depreciation at the beginning of the period, over-estimation at the end
• Non-Linear depreciation schedule

  => Depreciation costs \( (t) = P(0) \cdot f(t) \)

Where \( f(.) \) is a non-linear function of time and \( \sum f(t) = 1 \) to ensure full depreciation

  - Advantages: more realistic depreciation schedule, reduced data requirements (only the purchase price of the asset is required)
  - Drawbacks: how to determine the depreciation schedule / choose \( f(.) \)?
• Declining balance approach: a fixed rate is applied to the current value of the depreciated asset

\[
\text{Depreciation costs } (t) = \alpha \cdot P(t)
\]

Where \( P(t) = P(t-1) \cdot (1 - \alpha) = \ldots = P(0) \cdot (1 - \alpha)^T \)

- Advantages: more realistic depreciation schedule, reduced data requirements (only the purchase price of the asset is required)

- Drawbacks: the asset never depreciates to zero; method best limited to those capital assets with a long service life
Declining balance approach: example

- Depreciation rate = 5%
- Depreciation rate = 10%
- Depreciation rate = 20%

Value of the asset vs. nb years after the purchase of the asset
• Methods determining **capital costs as the amount that needs to be provisioned each year** by the farmer: Annuity, Cost recovery approach, etc.
  
  o These methods are described in the presentation on pre-production costs
  
  o Advantages: consistent from an economic point of view
  
  o Drawbacks: complexity

• Methods based on the **cost of purchasing a capital service**:
  
  o Assumes that the price of the service provider covers the cost of using his own capital
  
  o Assumes that such rental costs are available and representative
• Fully depreciated assets that keep being used
  
  o Systematic ≠ between the effective and theoretical service life of an asset should lead to a revision of the parameters

  o The effective service life is often prolonged, mostly in developing countries, through repair work -> if these are substantial, they should be accounted for as an investment and a new asset created (e.g. engine change)

• Lack of reliability / availability of market values

• Farm and household use of capital have to be distinguished:
  
  o Small/medium farms which use assets such as vehicles or buildings for their farming activity as well as for private purposes

  o Only the share relative to farm use has to be accounted for as depreciation costs for the farm
• Opportunity Cost of Capital (OCC) = expected return on the capital invested in the farm operation if it had been invested in the next best alternative

• OCC provides a measure of the profitability of farm investments relative to other sectors: it is relevant for analytical and policy purposes, less so for the farmers themselves

• The purchase of capital assets is an investment. Improvement works that lead to an increase in the service capacity and/or service life of the asset, such as land terracing, wells, engine change, etc. are also an investment

• Interest payments associated with the purchase of capital assets should be accounted for as a financial cost for the farm in a separate cost category
6 – The opportunity cost of capital: measurement

• **First Best Approach:**

\[ \text{OCC}(t) = \text{Market value of the assets}(t) \times (1+r) \]

Where \( r \) is the rate of return on capital in the next best alternative

- In theory, \( r \) should depend on the investment possibilities in the region, the size of the investment, etc.

- In practice, \( r \) is difficult to determine: it varies across region/localities, time and... preferences! Its determination is highly subjective and therefore prone to criticisms

• **Alternative Approach:** if region/area specific rate of return are absent, long-term government bond rates are generally used
• **Widespread practice in developing countries** because of the difficulty to finance the purchase of capital assets

• **Rental price often includes services associated with the capital asset** (machine operator, fuel, inputs, etc.): this leads to allocation questions

• **The renting of capital services may not necessarily involve a monetary transaction:**
  
  o Exchange of other services -> value at the opportunity cost
  
  o Share of the harvest/production -> value at the producer price for the commodity
7 – Rented capital (2/2): accounting options

• **Grouping rental costs under a specific item**, such as “rented services” or “custom services”:
  - Simplest option, but leads to underestimation of capital costs for farmers who rent
  - Comparability is affected when comparing cost items between those who rent vs. those who do not
  - But the comparison of total costs informs on the relative profitability of each option (renting vs. owning), all things equal
  - Recommended approach from national accounts perspective: appropriately measures transactions between branches

• **Allocate rental costs to each cost item**:  
  - Ensures comparability
  - Complexity: how to separate labor, inputs, etc. from the cost of the asset?
  - Double counting: implicit capital costs included in the rental price => a given asset can be depreciated twice (in then rental company’s accounts as well as in the farmer’s accounts) => over-estimation of capital costs at the aggregate level