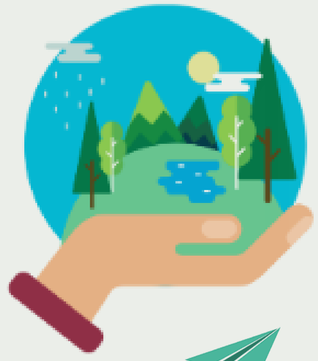
LET'S CULTIVATE THE FUTURE:
SYNERGY BETWEEN AGRICULTURE AND SUSTAINABILITY

Introduction and goals

Topic **-** The 7th General Census of Agriculture, the last one with a decade interval, provides an informational overview of the agricultural enterprises at a national and regional level and shows how political and social events have influenced the agricultural world.

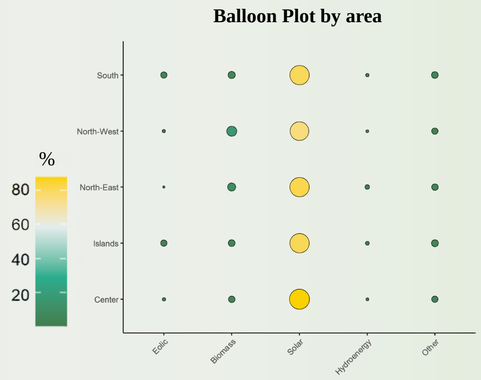
Goals **-** Analysis of national agricultural production with a particular reference to the production of renewable energy.

Data and Tools **-** The data have been extracted from the statistical tables available on ISTAT official website (www.istat.it). Statistical software, such as Microsoft Excel and R, have been used for the creation of datasets and analysis.



In the Italian scenario, especially in agriculture, the theme of renewable energy is widely addressed starting from the issuance of Legislative Decree of 3 March 2011, implementation of Directive 2009/28/CE about the promotion of the use of energy from renewable sources. It introduces simplification and rationalization measures of administrative procedures for the construction of renewable energy facilities.

How is renewable energy production divided among the parts of Italy?



A **Balloon Plot** is used to analyze how renewable energy production is divided among the five parts of Italy.

Four main types of renewable energy production are considered: *Wind energy, Biomass, Solar, Hydroenergy*, and energy produced from *other sources*.

The largest number of enterprises in each area produce **Solar** energy with a slightly higher value in the Center, which exceeds 80%. **Hydroenergy** is overall less produced by agricultural enterprises in Italy.

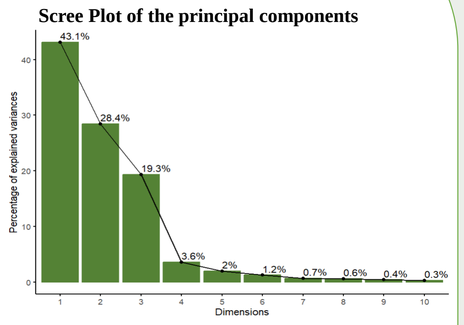
The part of Italy with the highest production of renewable energy is the **North-East**, followed by North-West, Center, South and Islands. This result could be influenced by the fact that there are more enterprises in the North.

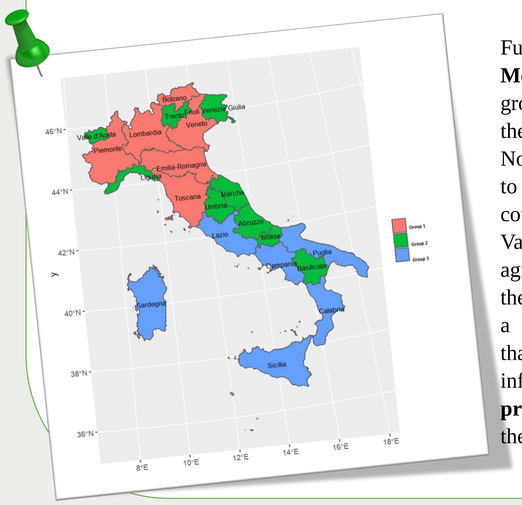
AREA	TOTAL [%]
Center	17.1
Islands	6.4
North-East	40.1
North-West	26.2
South	10.2

"Plant" the basis...

The regions have been grouped to identify which ones have a similar agricultural profile, based on information regarding business leaders, crops, title of lands ownership and their use, labor and activities related to agricultural production.

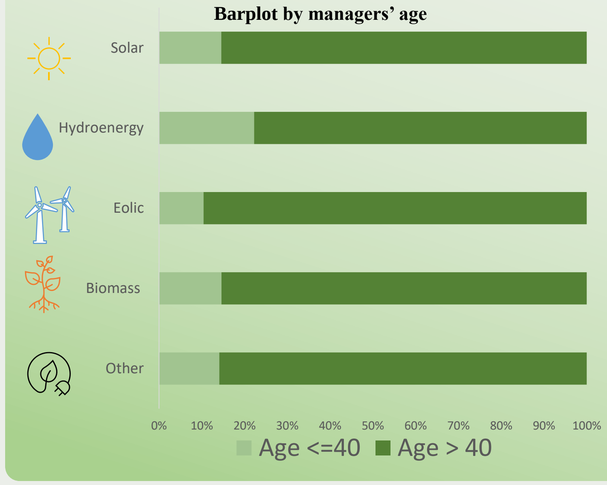
The number of variables has been reduced using **Principal Components** to facilitate the analysis. Observing the **Scree Plot**, the first three Principal Components have been selected because they add together about 90% of the total variability.



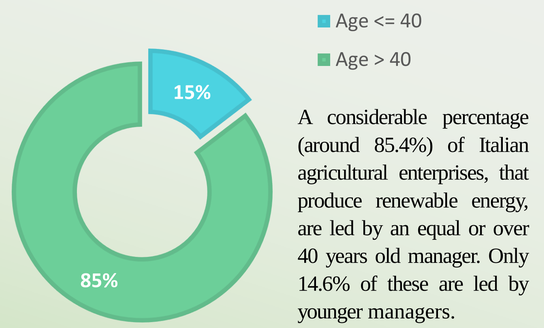


Furthermore, a clustering method (**K-Medoid**) has been used to identify three groups of regions. The result shows that the geographical distinction among North, Central and South does not apply to the agricultural structure of the country. In fact, regions as Basilicata and Valle d'Aosta are similar in terms of agricultural organization, even though they are geographically distant. Through a more in-depth analysis it is evident that, among the original variables, information regarding **renewable energy production** has the greatest impact on the grouping.

What about the relationship with the managers' age?



The bar plot shows the relationship between the percentage of Italian agricultural enterprises which produce renewable energy and the type of produced energy depending on the managers' age. Most of the enterprises producing renewable energy, for each type, have an **over 40 years old** manager, with a percentage that always exceeds 85%, except for **Hydroenergy.** Approximately 25% of Hydroenergy is produced by enterprises with an **under or equal 40 years old** manager and the remaining 75% by enterprises with an older one.



A considerable percentage (around 85.4%) of Italian agricultural enterprises, that produce renewable energy, are led by an equal or over 40 years old manager. Only 14.6% of these are led by younger managers.

SCAN THE QR CODE!!

In the shared drive you can find the datasets used for the analysis and the additional graphics.*

*R Codes are available on request.

...“pick up” the results

- The regions' division into groups is interesting in order to have a general overview of the Italian agricultural landscape: it has been shown that geographical location does not necessarily condition the grouping. However, it is greatly influenced by the production of renewable energy.
- Among the different parts of Italy, Solar is the most produced type of energy and the North-East is the area with the highest number of enterprises producing renewable energy.
- Conditioning on the managers' age, production is strongly skewed between the two considered groups: almost all of the enterprises are led by an over 40 years old manager.
- We have tried to understand the reasons that encourage or discourage agricultural enterprises to produce a certain type of renewable energy. There could be both environmental and economic reasons behind the greater production of Solar energy. It is, in fact, a self-produced energy, derived from an inexhaustible source and it is a good investment. At the same time, Hydroenergy is the least produced: the main causes could reside in the damage to the environment and its total dependence on climate change.