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## Circularity in the food processing industry – valorization of various waste streams originating from wine production

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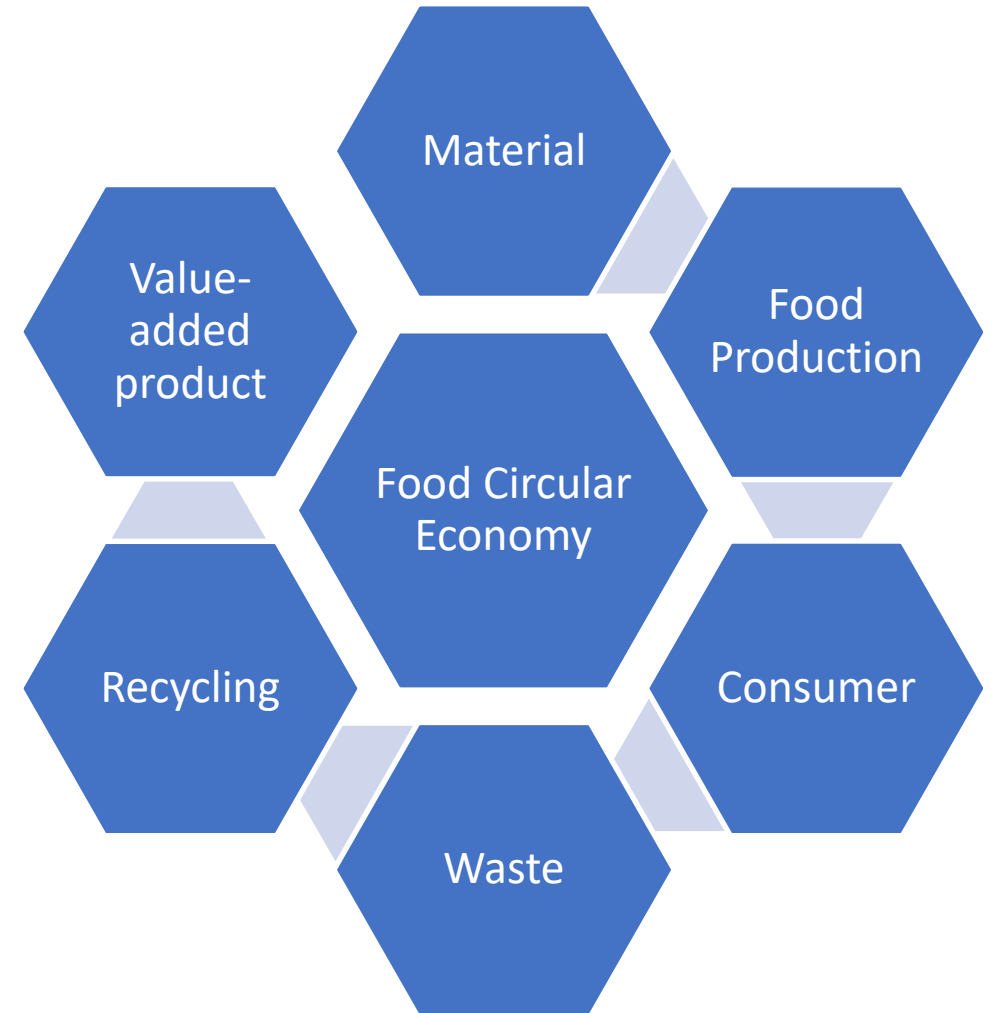
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Faculty of Technology and Metallurgy

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## FOOD CIRCULAR ECONOMY

- The "linear" process of producing food today depletes finite resources, pollutes the environment, and destroys natural systems.
- A system where materials and products are reused and recycled instead of ending up in waste streams is known as the "circular economy."
- A circular economy emits fewer greenhouse gases; the soil, air and water remain vital.
- There are three challenges of the circular economy to achieving the Sustainable Development Goals: city economies, human health, and the environment.





## WINE PRODUCTION AND WASTE BY-PRODUCTS

- Grapes are one of the oldest fruits which is used for wine production from the ancient period. It is rich in sugars, organic acids, vitamins, bioactive compounds (phenols and antioxidants) and minerals.
- Significant amounts of these compounds are found in the grape peels and seeds which are considered as waste by-product from the process of wine production.
- Every year food industry in North Macedonia generated huge amount of seasonal waste. Over 100,000 tons per year of organic waste from the wine industry ends up in one of the local landfills. Until now it has not been adequately used.

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# VINEYARDS AND WINE PRODUCTION



Wine grape



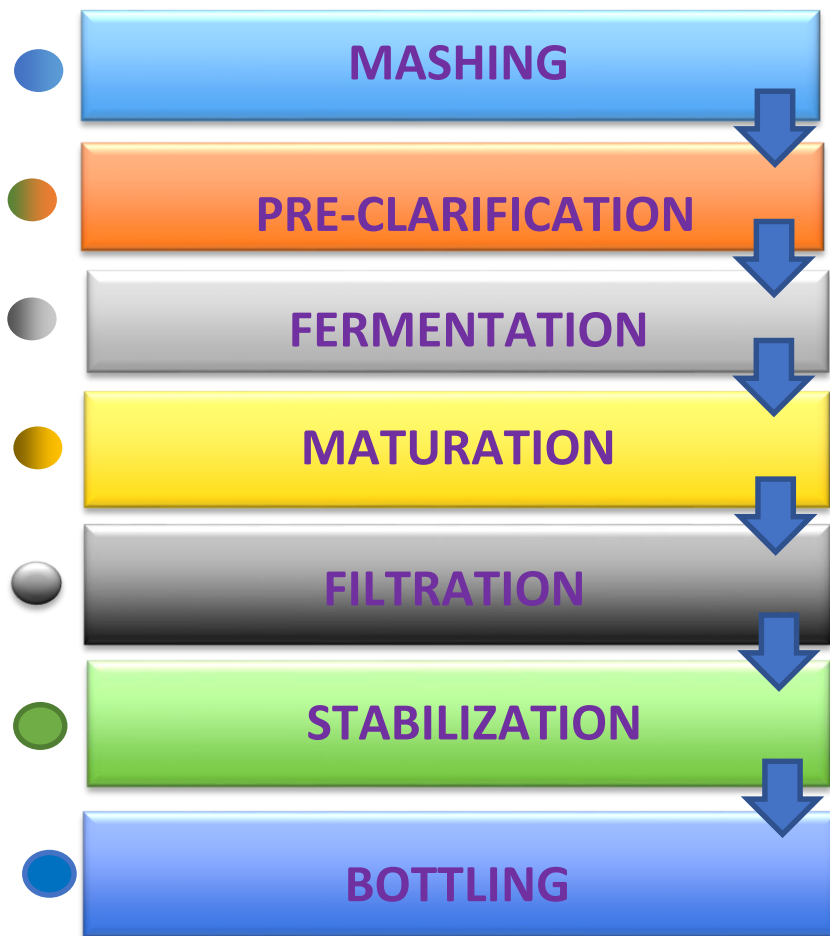
Wine



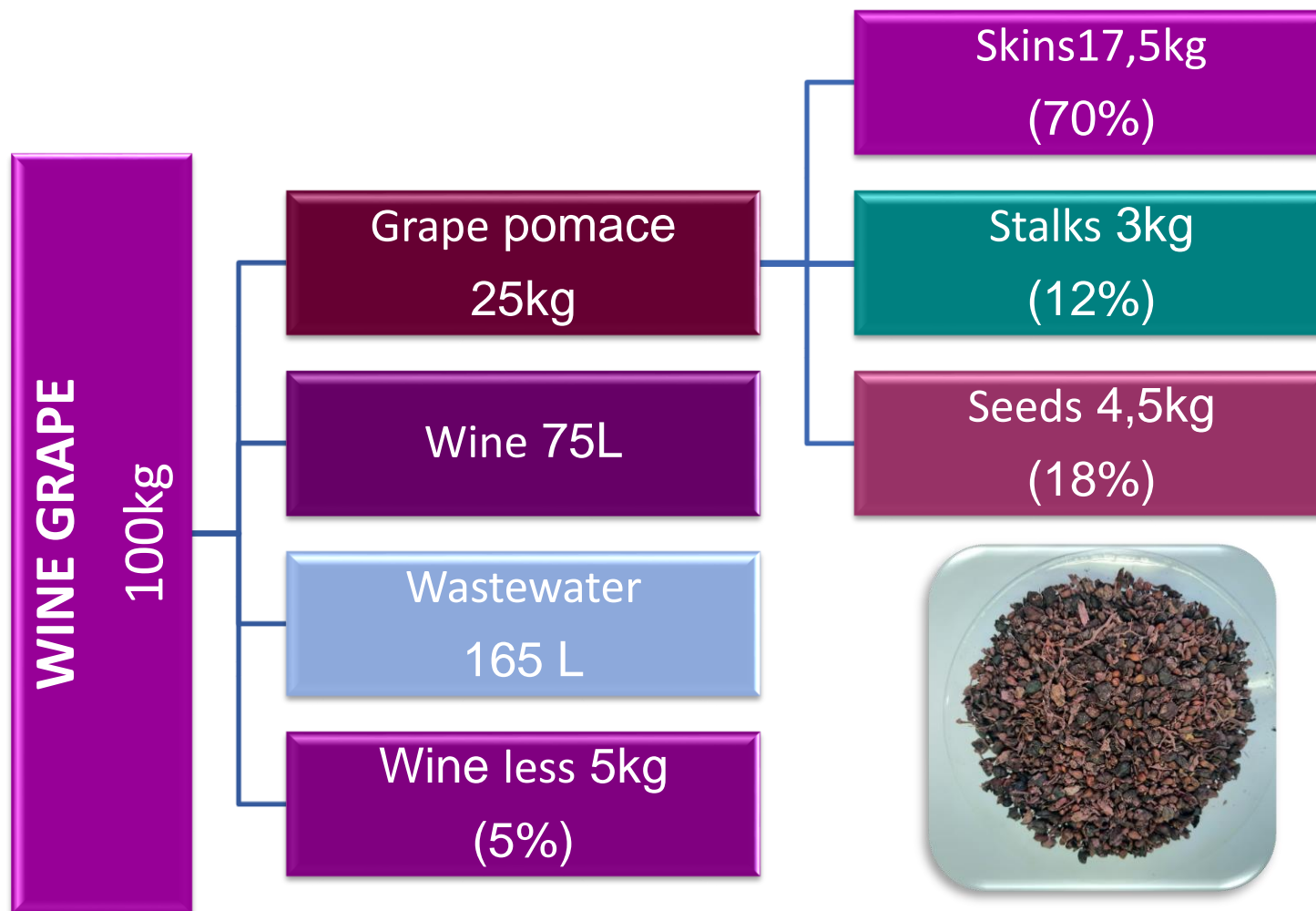
Winery wastes



# TEHNOLOGY OF RED WINE PRODUCTION



## RED WINE PRODUCT AND WASTES





# GRAPE POMACE CIRCULARITY MATERIALS

**Grapeseed  
(oil, polyphenols)**

**Grape skins  
(antioxidants)**

**Grape stalks (cellulose,  
hemicellulose and lignin)**

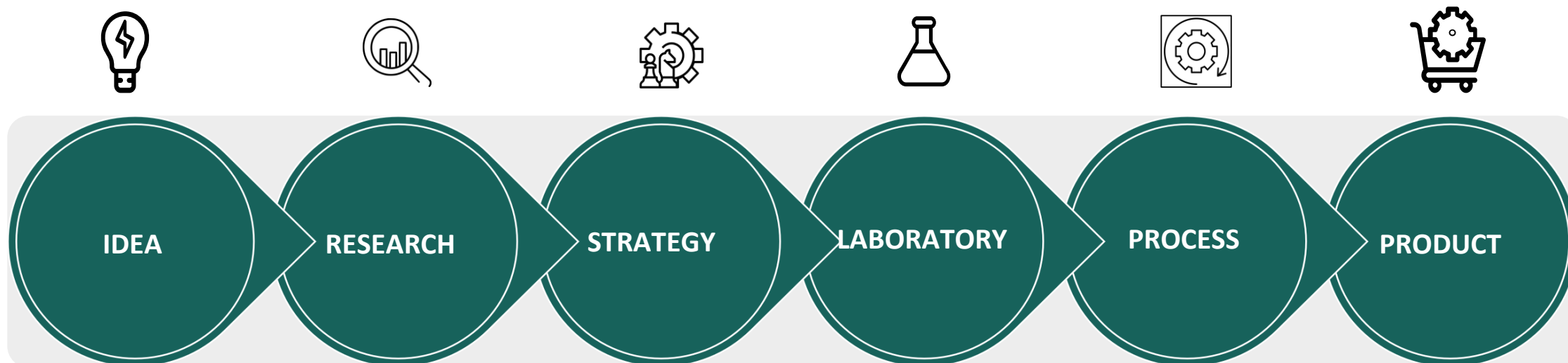




## ACHIEVING CIRCULARITY BY WINE WASTE VALORIZATION

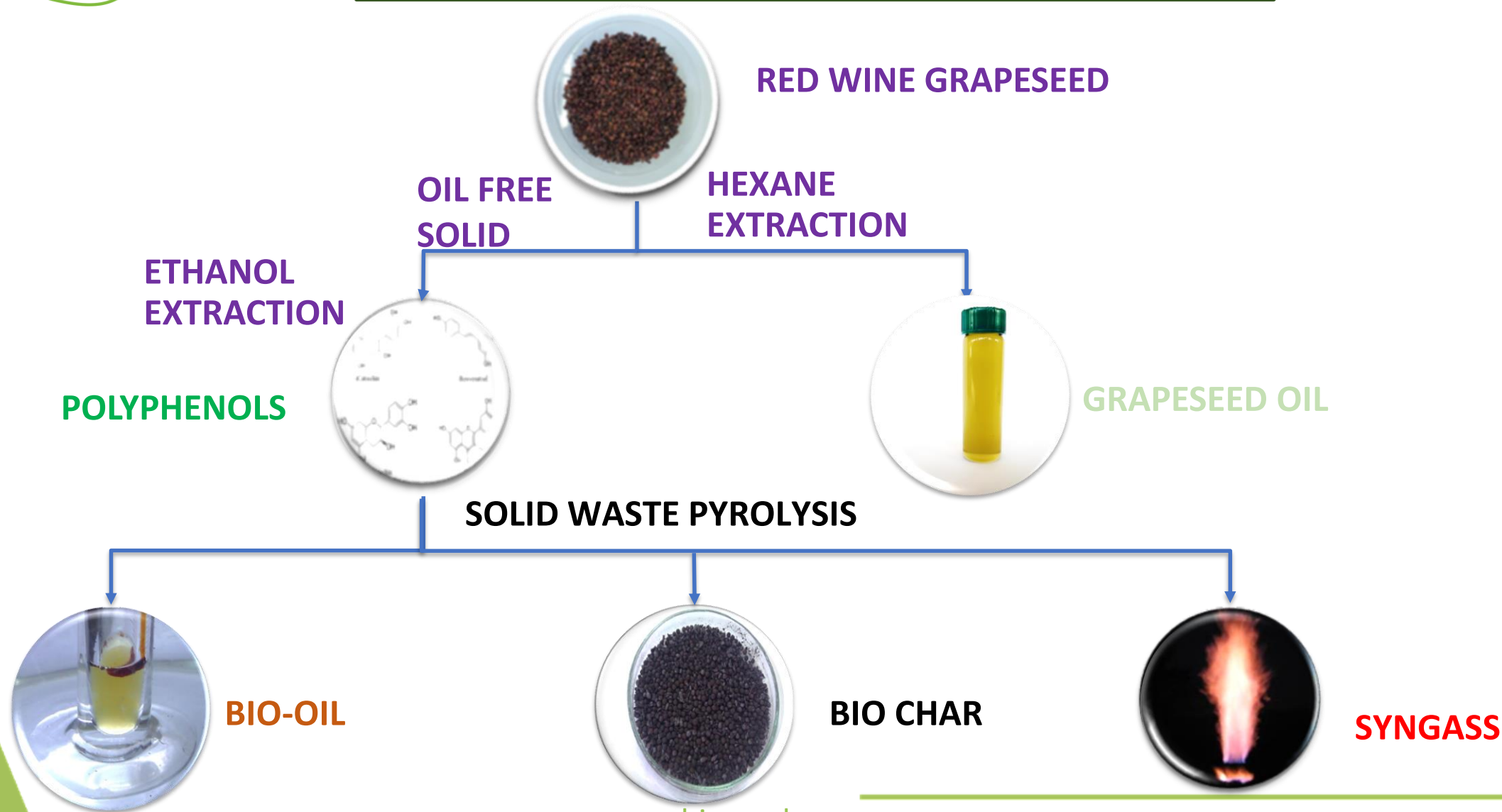
- New technologies can help wineries with adding value to the process of wine production, waste management and transformation to a more circular process of production.
- Examples of these technologies can be oil extraction from grape seeds, extraction of cellulose and other hydrocarbons, extraction of phenols and natural colours, bioethanol production, bio fertilizer production, bio char production etc.
- Adoption of these technologies can have huge socio-economic and environmental benefits.

## DRIVING PROCESS FOR WASTE VALORIZATION



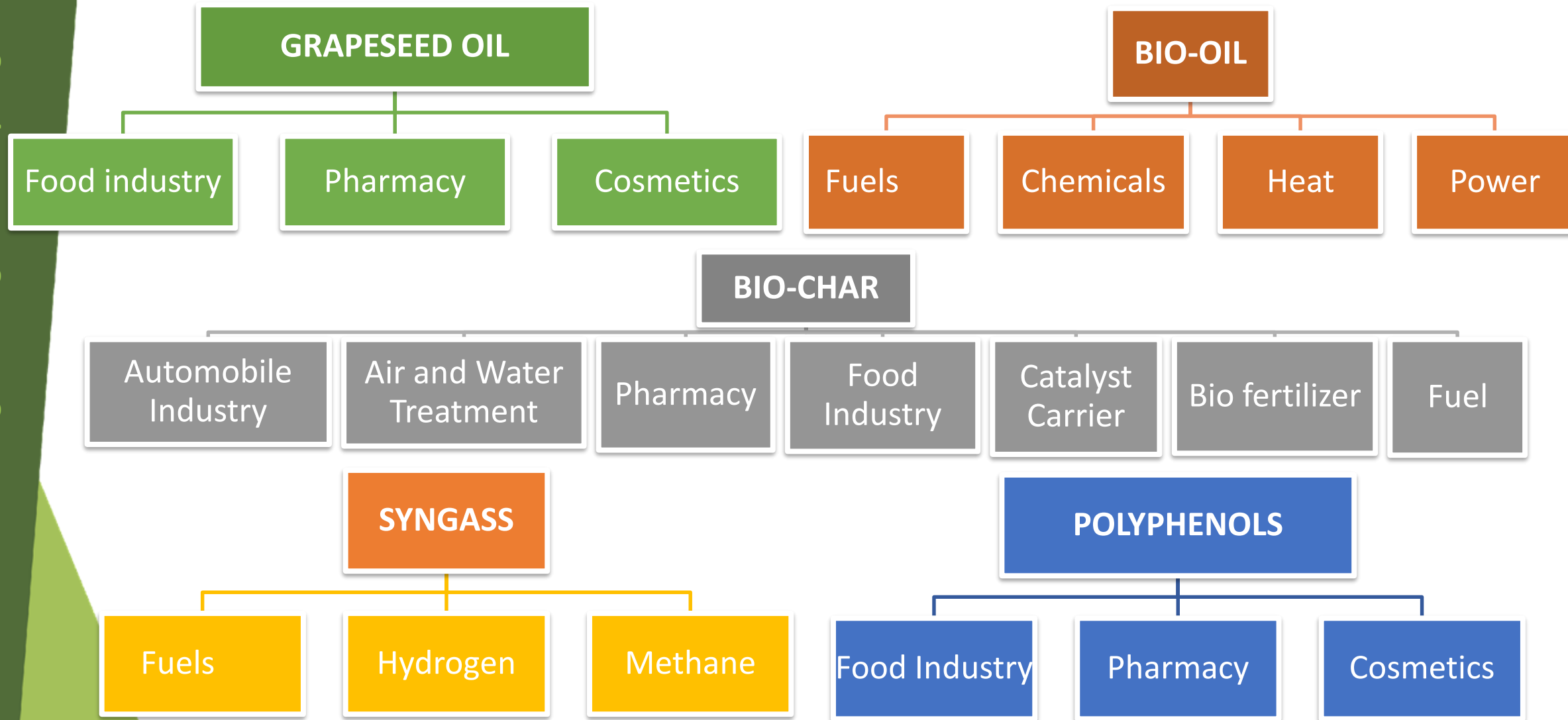


## GRAPESEED BIOREFINERY PROCESS





# VALUE-ADDED PRODUCTS FROM AN INTEGRATED BIOREFINERY PROCESS AND THEIR APPLICATION



# ECONOMY OF THE WINE INDUSTRY

Linear economy

Reuse economy

Circular economy



**GRAPE**  
(Raw materials)

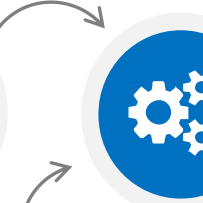
**WINEMAKING**  
(Production)

**WINE**  
(Use)

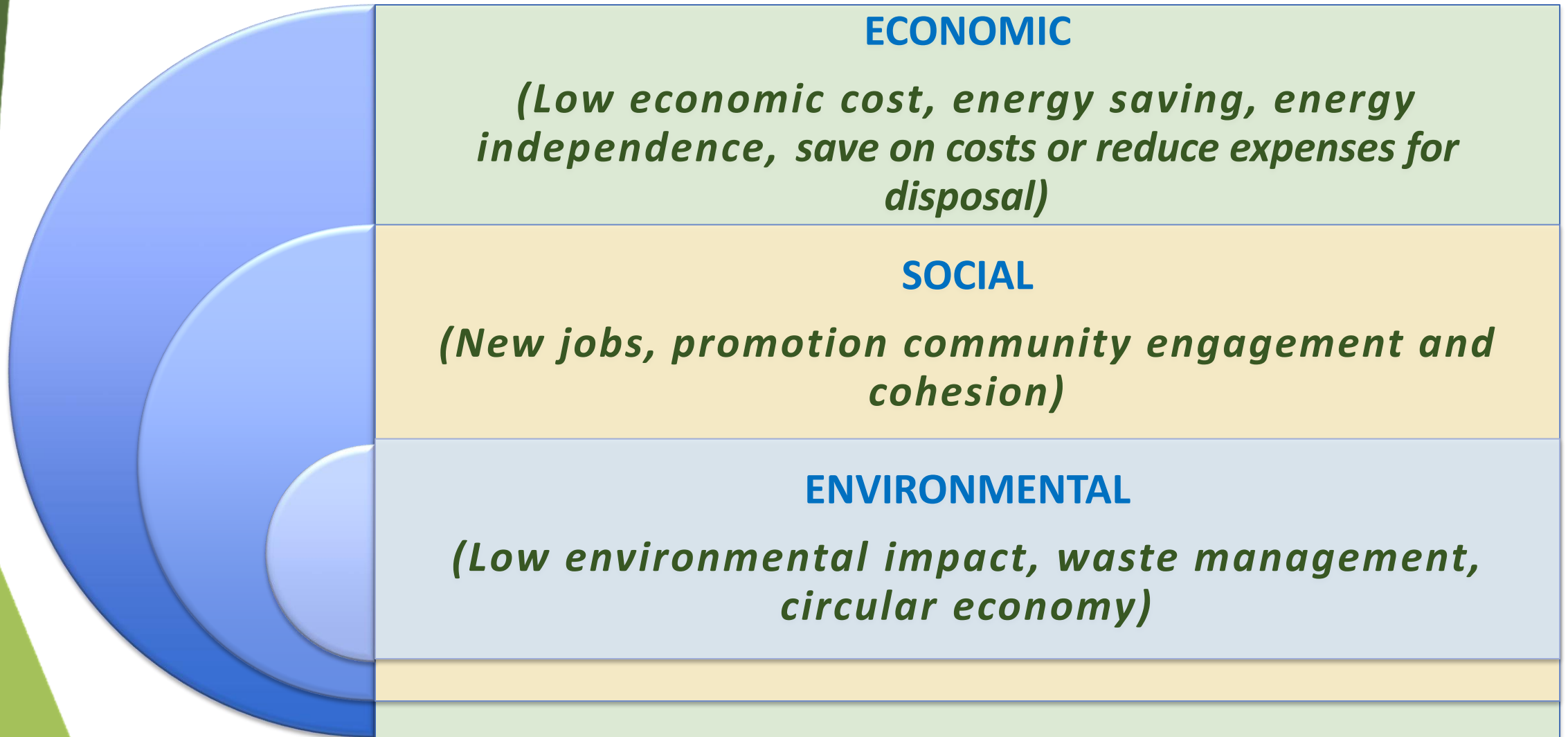
**GRAPESEED, SKINS,  
STALKS**  
(Non-recyclable Waste)



Recycling



## SUSTAINABLE DEVELOPMENT





## CONCLUSION

1. Cost effective treatment of wine wastes as second-generation feedstock.
2. Sustainable production achieving with integration of social, economic and environmental changes.
3. Promotion a circular economy model and perspective.
4. Buying environmentally friendly products, extending product lifetimes, reducing waste, and increasing recycling rates are the ways for moving forward.
5. Stimulating companies to invest in and implement in Technologies with renewable energy.
6. This integrated bio-refinery course of wine production waste management and circular economy could be apply in North Macedonia and the whole Mediterranean region.





# Thank You!



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