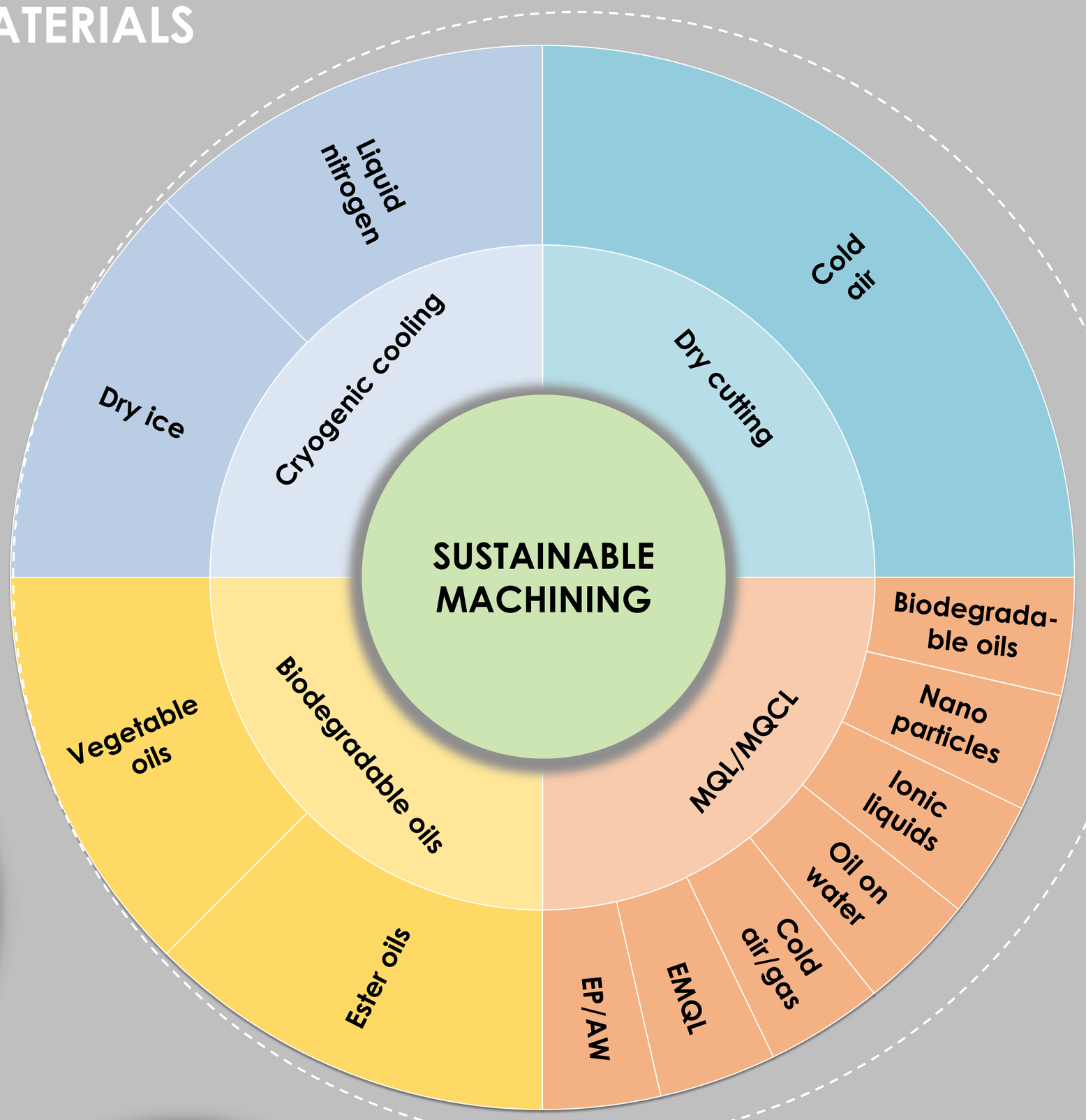
INVESTIGATION OF ALTERNATIVE COOLING-LUBRICATION TECHNIQUES FOR SUSTAINABLE MACHINING OF DIFFICULT-TO-CUT MATERIALS

RESEARCH

- **Martensitic stainless steels**
  - difficult-to-cut materials, large amounts of chromium, which makes the material harder
  - cooling, flushing and lubricating liquids or shorter cutting liquids are regularly used in their machining since reducing the heat generated in the cutting zone has a positive effect on increasing the productivity, the tool life and the quality of the finished product

PROBLEM

- **Storage and disposal of used cutting liquids**
  - opens many issues related to environmental protection and workers since they represent one of the most complex and most dangerous types of waste in nature
  - during machining of difficult-to-cut materials, procurement costs, application and disposal of cutting liquids can reach up to twenty to thirty percent of total production costs



HYPOTHESIS

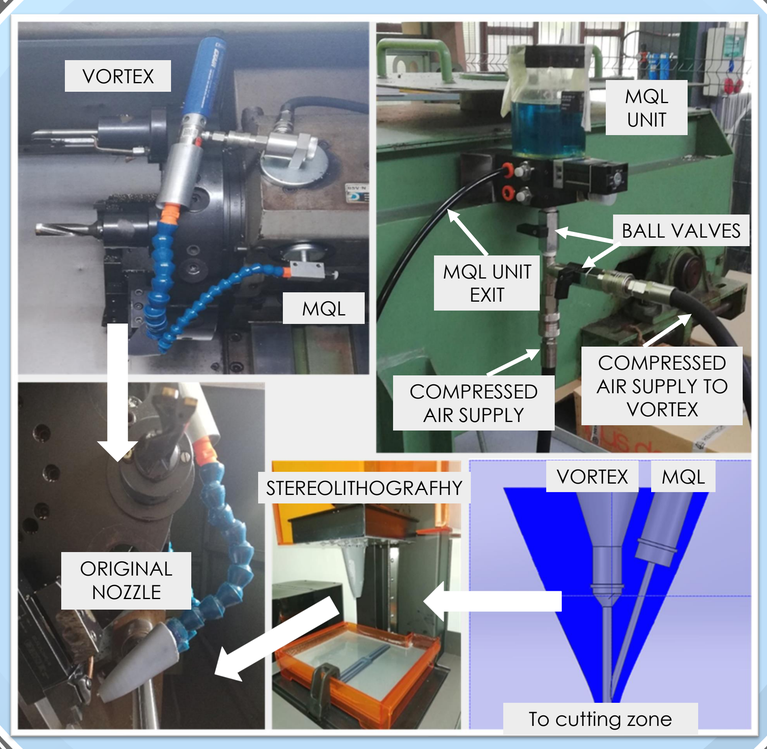
- **The negative impact of conventional cutting liquids on the sustainability of machining leads to the need for development of alternative cooling, flushing and lubricating techniques**
  - sustainable machining based on alternative techniques strives for a balanced system between ecological and sociological acceptability and economic efficiency

- since there is still no study on the introduction of a combination of alternative techniques of the cold compressed air and the minimum quantity lubrication in the machining of martensitic stainless steel by turning, the proposed research is the **first** of its kind

- cold compressed air-cooling technique can replace two of the three basic functions of conventional cutting liquid: cooling of tool, workpiece and chip, and removal of chip from the cutting zone, while the main drawback is the inability to lubricate in the cutting zone

EXPERIMENT

- **A combination of vortex cold compressed air and minimum quantity lubrication MQL with original printed nozzle**
  - a new solution on the road to "green production,,, which is an important scientific contribution



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