Environmental and economic assessment of MEMs inspection system: CITCOM Project

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INTRODUCTION & OBJECTIVES

Micro- and nano-manufacturing used in modern electronic devices (e.g. smartphones, healthcare applications), are driven by **micro-electro-mechanical systems (MEMS)**.

- A major task in micro-manufacturing is the **quality inspection** with respect to specific defect classes.
- These micro components are susceptible to surface and internal damage, **not visible to the un-aided eye, leading to a defective final product after integration.**

Need for more reliable and efficient system to reduce rate of rejection of high value parts in micro/MEMs-manufacturing: CITCOM system.

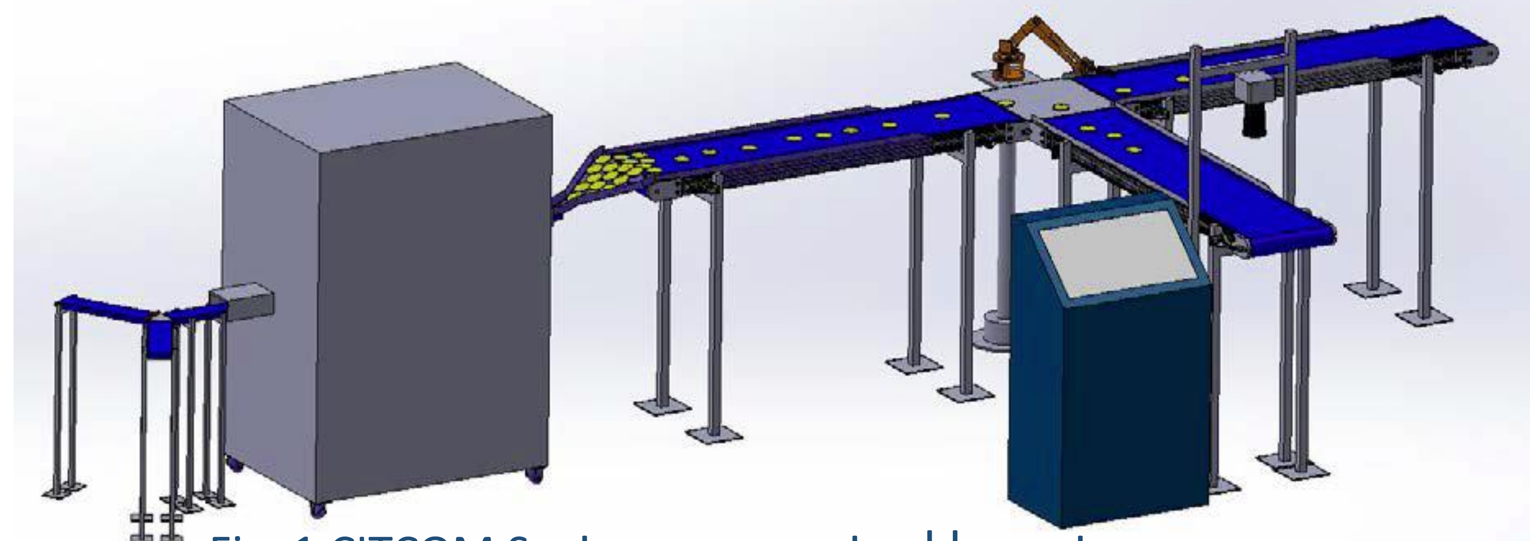


Fig. 1 CITCOM System conceptual layout

The objective of this study is to assess the potential environmental and economic impacts and benefits of the CITCOM system compared to the current system (high magnification microscope).

MATERIAL & METHODS

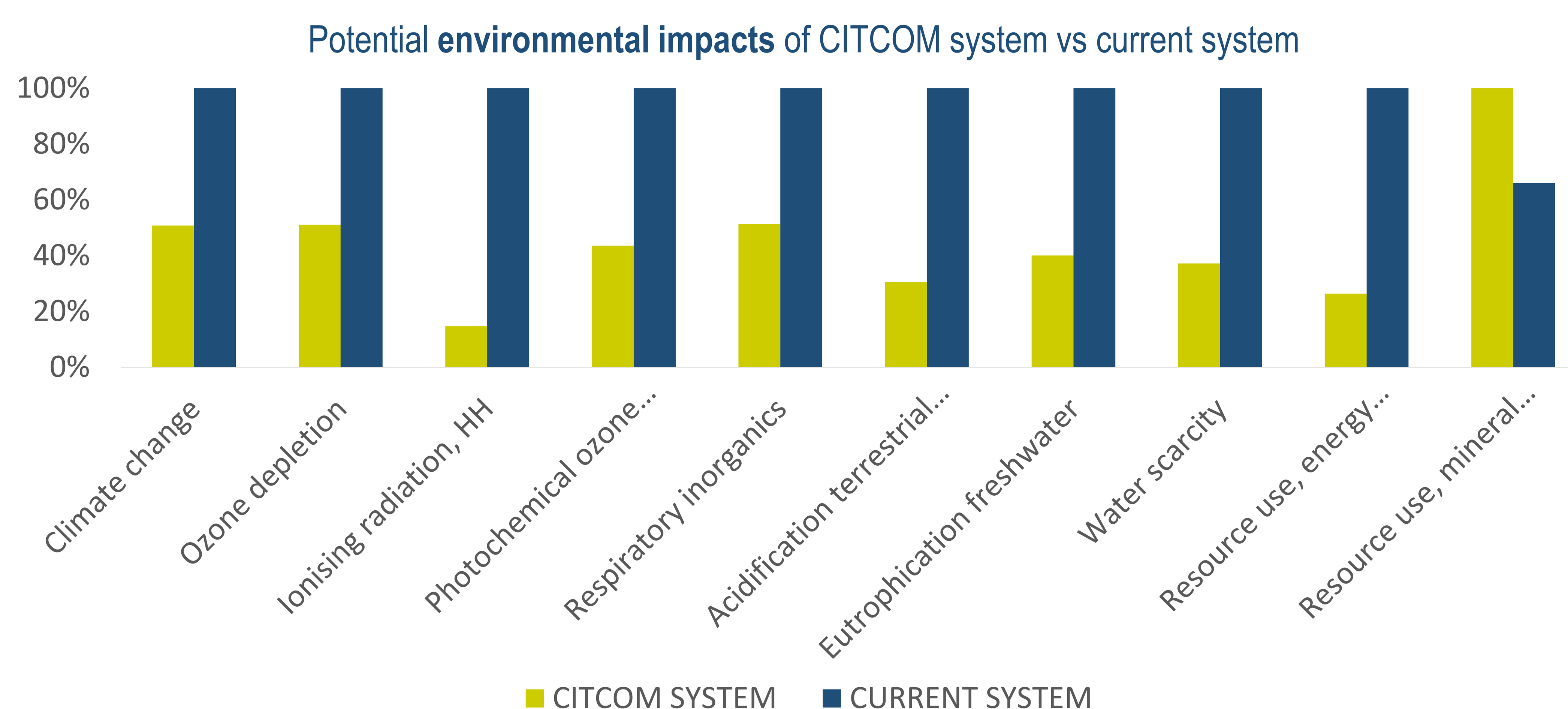
The following methodologies have been applied:

- Environmental assessment: **Life Cycle Assessment (LCA)**
- Economic assessment: **Life Cycle Costing (LCC)**

Functional Unit: Detection rate of defective MEMs during 24 hours of inspection period
System boundaries: From "cradle to grave"
LCIA: EF Method (adapted) V1.00
LCA software/database: SimaPro V8.1/ecoinvent v3.6

PRELIMINARY RESULTS & DISCUSSION

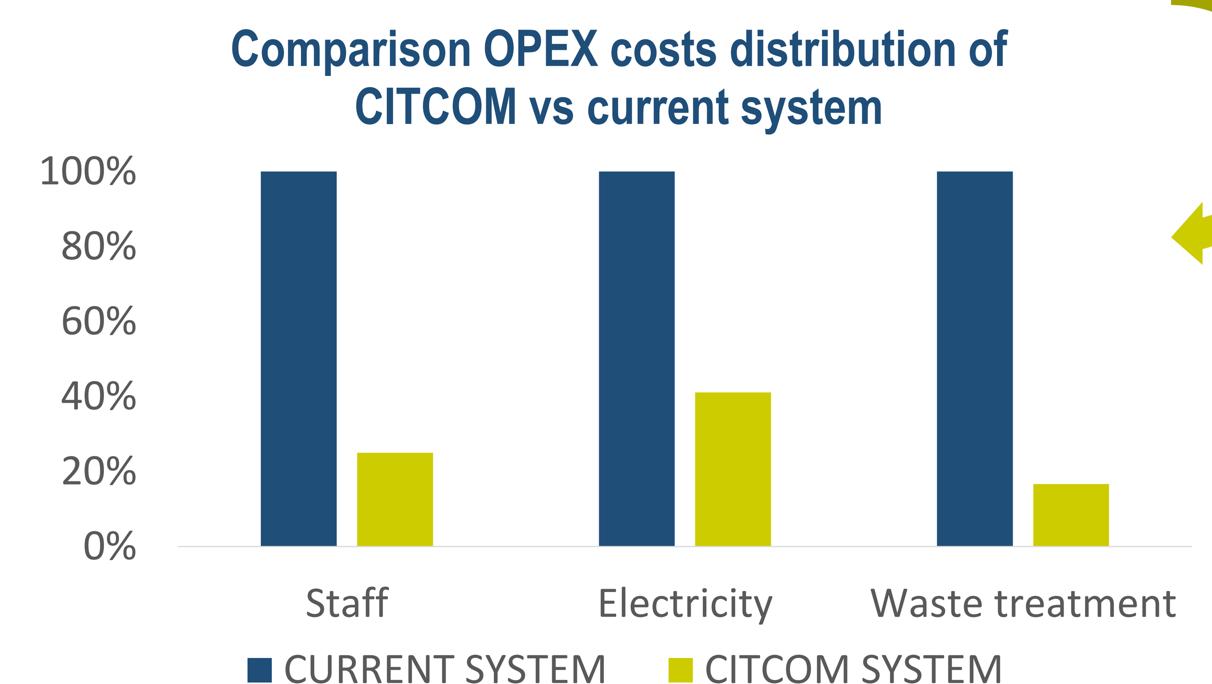
Potential **environmental impacts** of CITCOM system vs current system



Costs reduction with CITCOM:

- **CAPEX (Capital investment)**: **-29%**
- **OPEX (Operation & Maintenance)** : **-76%**

Comparison OPEX costs distribution of CITCOM vs current system



- **Reduction of OPEX costs with CITCOM** due to the decrease on staff, electricity and waste treatment.
- **Reduction in environmental impacts for CITCOM** compared to current system for all impact categories with exception of resource, mineral & metal use due to the higher use of lead, silver, steel and aluminum.

Take home message

CITCOM system, an efficient technology that detects defect MEMs more effectively than a microscope, and provides significant environmental and economic benefits

The CITCOM consortium consists of 12 partners from 7 different European Countries: VTT, TWI, Raytrix, Philipps, Polytec, Microsemi, InnoTecUK, Exillum, CSEM, Brunel, aixACCT, LEITAT. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 768883. This publication reflects only the author's views and the European Union is not liable for any use that may be made of the information contained therein.