SWOT analysis for the development of circular economy in existing industrial areas: A case study from Cyprus

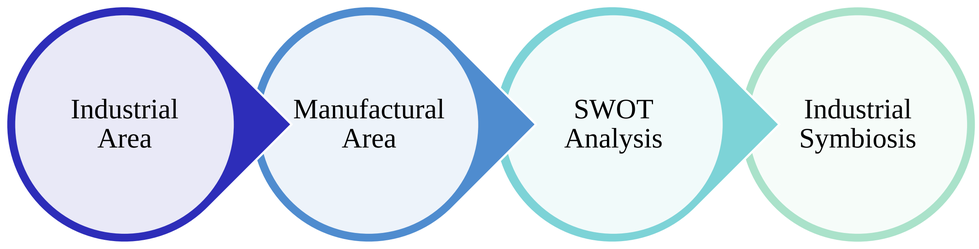
Marinos Stylianou*, Panagiotis Shiakallis, Iliana Papamichael, Irene Voukkali, Antonis Zorpas

Laboratory of Chemical Engineering and Engineering Sustainability, Faculty of Pure and Applied Sciences, Open University of Cyprus, Giannou Kranidioti 89, Nicosia 2231, Cyprus

*Corresponding authors: e-mail address: marinos.stylianou@ouc.ac.cy

Research Scope and Methodology:

- In the present era, the significant advancement of the manufacturing industry has led to the generation of substantial amounts of waste, the depletion of natural resources, and a surge in CO_2 emissions.
- These factors have diverse impacts on both the environment and human beings.
- However, it is crucial to acknowledge that the growth of the industrial sector plays a vital role in the long-term economic progress of a nation.
- Thus, it becomes imperative to seek solutions that can effectively minimize the environmental impact associated with these industries.



- In this regard, the implementation of industrial symbiosis and circular economy models emerges as catalysts for promoting sustainable development while ensuring the viability of all participating units simultaneously
- In the present study, an industrial and a craft industrial area were investigated in relation to (i) the number and type of units operating in the areas, (ii) raw materials needs, (iii) and also the type and volumes of waste produced.
- The results were obtained through a questionnaire survey

Methodology - Results

- SWOT analysis was applied in order to identify internal factors (strengths and weaknesses) and external factors (opportunities and threats) that might affect the application of circular economy and industrial symbiosis practices.

Table 1. SWOT analysis applied in the craft industrial area

INTERNAL FACTORS	
Strengths	**Weaknesses**
1) High interest from facilities to be informed and participate in an industrial symbiosis program 2) No mixed waste is produced 3) A large volume of tires as waste is produced (14.6 t/month) 4) A large number of units are operating in the area. 5) High connectivity between processes 6) A wide range of raw materials is used	1) Mostly very small businesses are active 2) Small number of personnel in a large number of facilities 3) Small energy and water needs are present 4) A large percentage of facilities participate in existing waste management systems (94.4%) 5) Very low percentage of units implementing circular economy policies, as well as waste reduction practices 6) Insufficient knowledge of the production of gaseous pollutants, resulting in non-application of measures
EXTERNAL FACTORS	
Opportunities	**Threats**
1) Saving financial resources from waste management 2) Utilization of financial opportunities from National and European circular economy programs. 3) Prospects for the development of ecological and environmental consciousness 4) Perspective of cooperation with the scientific community and experts in the subject, with the ultimate goal of implementing synergies with other industries	1) Possibility of non-participation of facilities in the area 2) Failure to implement a symbiotic network can jeopardize plant viability 3) Lack of funds to promote industrial symbiosis practices 4) High cost of equipment to put in practice for industrial symbiosis needs

Table 2. SWOT analysis applied in the Industrial Area

INTERNAL FACTORS	
Strengths	**Weaknesses**
1) Coexistence of very large facilities with small ones 2) A large number of personnel in a small number of facilities 3) The activities of both the agricultural and livestock sector and the food industry results in a large volume of organic waste produced (68 t/month) 4) Large volume of waste produced by the facilities in the area	1) Small number of units operating in the area 2) High inconsistency between processes 3) The largest percentage of the total raw materials is occupied by specific raw materials 4) Production of individual waste which cannot be used 5) The category of dairy industries produces the highest amount of liquid waste (99.9%)
EXTERNAL FACTORS	
Opportunities	**Threats**
1) Saving financial resources from waste management 2) Utilization of financial opportunities from National and European programs 3) Perspective of cooperation with the scientific community and experts 4) Possible utilization of solid, liquid and gaseous waste to save raw materials, energy, water and financial resources. 5) Future expansion of symbiosis outside the industrial area with the livestock sector 6) Possibility of producing new products through synergies	1) Possibility of non-participation of facilities in the area 2) Lack of funds to promote symbiosis practices 3) Lack of policies that could encourage facilities to implement Industrial Symbiosis 4) High cost of equipment to put in practice for industrial symbiosis needs

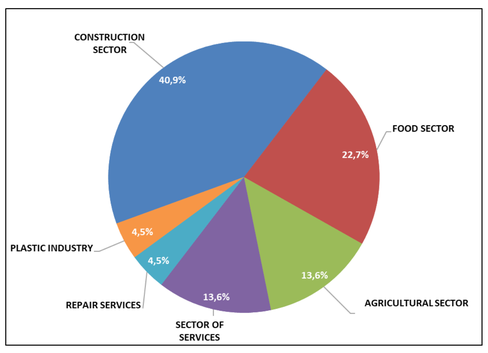


Figure 1. Sectors of activities in the Industrial Area

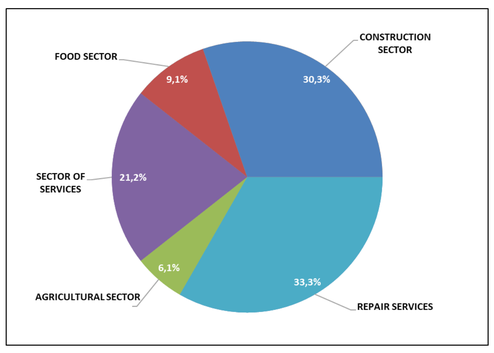


Figure 2. Sectors of activities in the craft industrial area

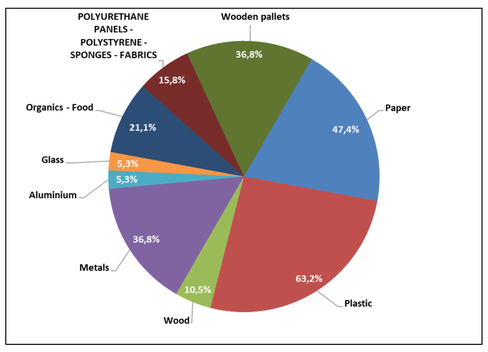


Figure 3. Solid waste produced in the Industrial Area

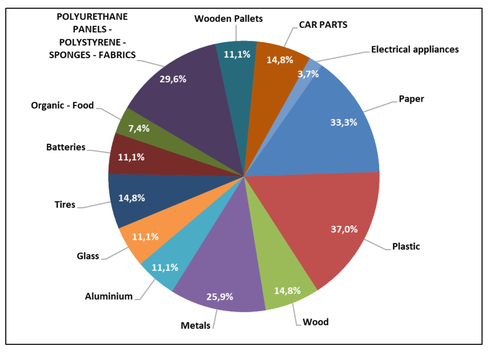


Figure 4. Solid waste produced in the craft industrial area

Figure 5. Number of facilities in each area

Conclusions

- Finally, possible future synergies for the implementation of industrial symbiosis were planned and calculated for the two areas

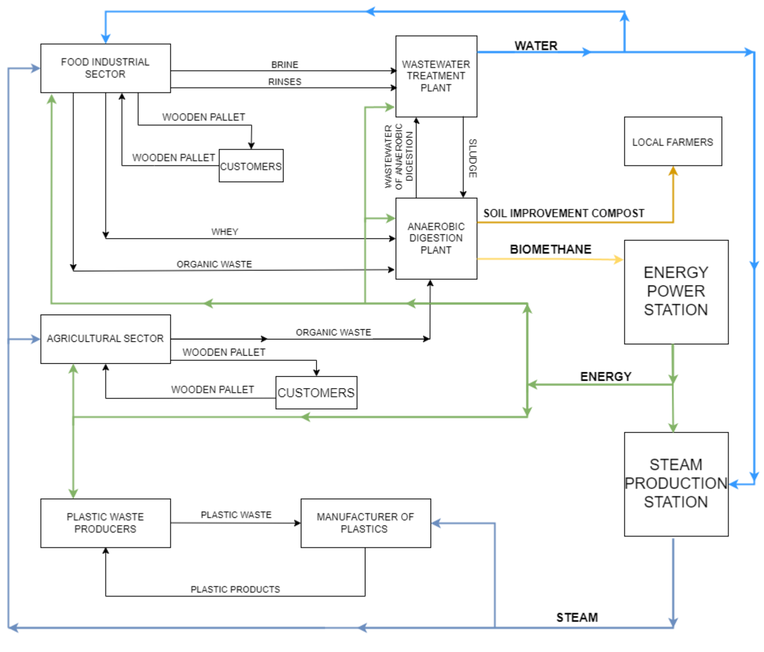


Figure 6. Possible industrial symbiosis synergies in the Industrial Area

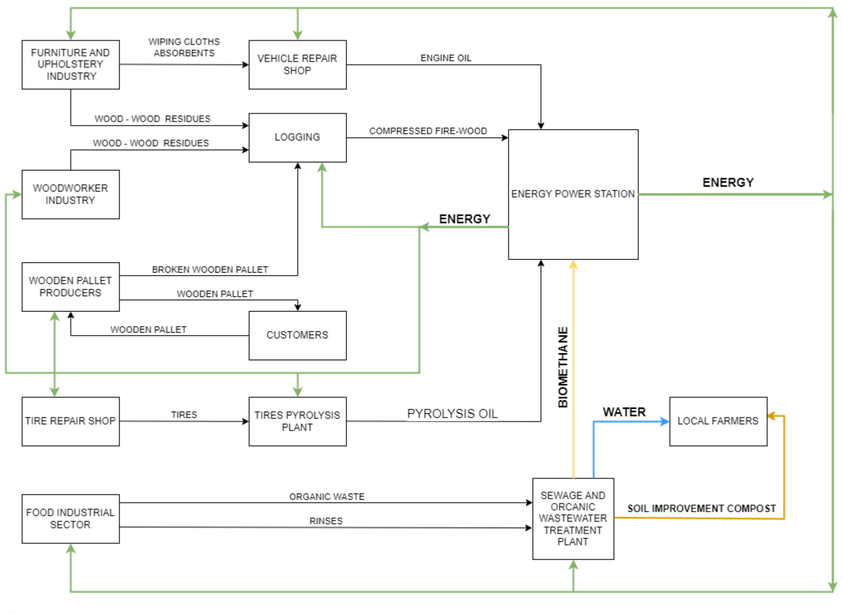


Figure 7. Possible industrial symbiosis synergies in the craft industrial area