MEASURING THE SOCIOECONOMIC IMPACT OF USING ROBOTIC SYSTEMS IN RECYCLING: THE CASE OF GREECE AND CYPRUS

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Introduction

Organisations in all economic sectors are expected to contribute towards the achievement of the 17 Sustainable Development Goals (Antonaras, 2018). Recycling is a crucial aspect of sustainable living, as it plays a key role in protecting the environment, conserving resources, and reducing waste. Recycling is one of the key components of the European Green Deal which aims to promote circular economy principles including the reuse and recycling of materials and to reduce the environmental impact of the targeted increase of production and consumption. The recovery of materials can be significantly enhanced by robots equipped with sensors and artificial intelligence to adapt to different types of materials and improve sorting accuracy.

This is also the target of the project "Fast sorting robotic system for promoting interregional recycling activities of Greece and Cyprus" (InterRecycle) which is implemented within the framework of the Cooperation Programme INTERREG V-A "Greece-Cyprus 2014-2020". The project promotes the use of smart robotic systems which automate the recyscling waste material sorting/classification process so that the productivity of material retrieval in the two sorting facilities in Greece (Association of Solid Waste Management of Crete - ESDAK) and Cyprus (Green-Dot), which until now mainly rely on manual sorting, can be amplified.

InterRecycle focuses on improving waste sorting robots (e.g., Koskinopoulou et al., 2020; Raptopoulos et al., 2020), which use a combination of machine learning algorithms and computer vision, to provide a composite autonomous system that successfully identify, localize, and categorize recyclables in a challenging and demanding industrial environment (Koskinopoulou et al., 2020). The purpose of the current study is to measure the socioeconomic impact of the use of the robotic systems in the two sorting facilities in Greece and Cyprus. Robots and automation have the potential to greatly impact the socioeconomic landscape in various ways. Through our analysis, we tried to understand whether the robotic systems are making a difference in solving societal issues and whether they create economic value (Costa and Pesci, 2016) as it is supported that robots can work faster and more efficiently than humans, which can then lead to increased productivity and lower costs for businesses (Ballestar et al., 2020). Regarding the societal benefits, the stakeholder approach was utilised to measure the social impact of the project. Such an approach, like SROI, is often used by organizations and investors who are looking to understand the full impact of their activities beyond just financial returns. It can help them to make more informed decisions

about where to allocate their resources and how to maximize their impact (e.g., Lingane and Olsen, 2014; Rotheroe and Richards, 2007).

Methodology

The methodology for measuring the socioeconomic impact of the InterRecycle project includes quantitative research and a comparative analysis using performance metrics. The quantitative research involved measuring [a] the perceptions of employees working at the sorting facilities in Cyprus and Greece, and [b] collecting and analysing citizens' perceptions relevant to the use of robotic systems in the two recycling systems. Both surveys were contacted prior and after the implementation of the robotic systems in the two sorting facilities in order to capture any changes and determine any perception changes. The fast-sorting robotic systems were installed in the two facilities in early 2023. The initial perception surveys were conducted in November 2022, while the final surveys were planned for June 2023. Finally, a comparative analysis was used to assess the impact of the use of robotic systems by collecting performance and productivity metrics and indicators of the two sorting systems prior and after the pilot implementation in the two facilities in Greece and Cyprus. Specific indicators capturing the performance and productivity of the recyclable materials were considered and collected from the two facilities proving insights of the performance of the systems before using the robots. The same indicators were collected after the pilot use of the robots, to allow a comparison of the two time points within each country.

Preliminary results

At the point of writing this abstract the project is still in progress and consequently, only some preliminary results are currently available regarding the socioeconomic impact of the project. The initial employee perception surveys indicated a high level of job satisfaction in both facilities. However, it was observed that there was more variance in respondents' answers considering the questions that had to do with the efficiency of the existing sorting system, such as the speed of the belt. Furthermore, the public opinion surveys indicate that citizens in both countries are positively inclined towards recycling and have a positive view regarding the installation of robotic systems for the sorting of recyclable materials.

The performance and productivity indicators collected before the installation of the robotic systems in the two facilities reveal a significant potential for increasing the quantities of recyclable materials. Current results indicate that relatively significant quantities of quality recyclable material cannot be collected with the manual sorting process and are lost as waste. Our hypothesis supports that the productivity rate will increase with the use of the robots and

thus expect the performance and productivity indicators to be collected in June 2023 will show significantly reduced quantities of quality recyclable materials.

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