



## Sustainability practices applied in welding process: literature review and case study.

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### Abstract

Different methods and technologies for welding are known today, some already consolidated and others newer in the manufacturing industry, but there are common points about the social and environmental impact of the process that need attention. This article seeks to evaluate how companies have dealt with sustainability in the context of welding process, developing a literature review in order to raise the academic results of the topic, and to evaluate how the industry has received this information through a case study

### Key words:

*Sustainability, welding process, health.*

### Introduction

Since the mid-1940s, industrial manufacturing power has been expanded due to the Technical-Scientific Revolution, fostering the need of natural resources to obtain energy and produce manufactured goods. Considering the three pillars of sustainability (social, economic and environmental), sustainable development and standardization of work conditions are crucial to avoid compromising the needs of future generations and to guarantee a satisfactory quality of life. In this regard, the production processes involving welding techniques can have considerable consequences on energy consumption, particulate emission of heavy metals, as well as providing diverse sources of risks to the health of operators. The aim of this study is to identify the variables that influence the aspects of sustainability of the welding process and to verify its occurrence in a manufacturing plant. This work is part of a macro project on sustainability in manufacturing processes coordinated by professors Robert Cooper and Rosley Anholon.

### Results and Discussion

To reach the proposed objective, it was adopted as research methodology to begin with a literature review and with the information obtained conduct an interview with semi-open questions in a voluntary company, developing the case study in the industrial sector. The questionnaire was approved by the Research Ethics Committee of Unicamp under the CAAE's number: 02653618.8.0000.5404.

The answers collected in the case study were synthesized in such a way as to promote an internal analysis of its coherence as to the external equivalence with the information found in the scientific articles, thus providing a sample of the points for improvement, as well as those that stood out by its applicability observed in the field.

Through the literature review the variables that impact the pillars of sustainability in the welding process were identified, which were divided into 3 groups, as below:

**Social:** Operators health risks through exposure to heavy metal fumes, toxic gases, radiant energy, heat, electricity and noise.

**Economic:** Low productivity and higher production cost.

**Environmental:** Uncontrolled energy consumption and waste of material.

Evaluated practices that positively interfere with the reduction of the impacts described may be listed as follows: 1 - Life cycle assessment (LCA) and Social life

cycle assessment (S-LCA) methodologies; 2 – Use of welding wires that have a lower rate of fume generation; 3 – Automation of welding processes; 4 – Continuous study of the welding techniques for the most appropriate choosing; 5 – Control and minimization of energy consumption; 6 – Application of measures to protect the health of the operator.

During the case study carried out, the volunteer company showed concern to satisfy the standards of quality management, environmental management, safety and occupational health requirements. Although, it did not apply or know about the practices 1, 2 and 5, the company showed to follow the practices 3, 4 and 6.

The analysis of interview responses also demonstrates a focus on the economic aspects of sustainability with consequent improvements to the social-environmental pillar, but in a secondary way. Its clients conduct periodic audits to verify the quality of production and the fulfillment with the normative certification they have. Thus, this study can generally highlight an initial contribution to achieving the goals of the UN 2030 Agenda for Sustainable Development, as follows: Insert the text here. Use Arial 10.



Image 1. Sustainable Development Goals, UN<sup>1</sup>

### Conclusions

The proposed methodology allowed to identify the variables that can influence the sustainability of the welding process and its evidences in a company of the manufacturing sector. Future research may continue the literary review and apply the case study at a national level in order to obtain a more representative sample.

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<sup>1</sup>Sustainable Development Goals. Knowledge Platform. UN, 2015. Available in: <<https://sustainabledevelopment.un.org/>>. Accessed on June 10, 2019