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# Identification of Corporate Sustainability System (CSS) Performance Indicators in the Casting Industry: An Exploratory Action Research Study

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**Abstract**
When academic studies on the casting industry in Türkiye are examined, it is observed that the majority of research focuses on alloy development and the improvement of production techniques. In recent years, studies addressing the environmental impacts of the sector have also become more visible. However, considering the economic, social, and environmental significance and impacts of the sector, it is evident that academic and practical studies encompassing all dimensions of sustainability remain limited. To address this gap, this study aims to identify Corporate Sustainability System (CSS) performance indicators within the context of the casting industry.
In the study, the action research method was employed. Within the scope of the research, the requirements of international sustainability standards were first identified. Subsequently, an indicator pool was established through the analysis of sustainability reports published by companies operating in the casting industry, as well as leading companies from different sectors (cement, automotive, and metal industries), supported by a comprehensive literature review.
Following this stage, document analysis, meetings, observations, interviews, and record-keeping activities were conducted in order to analyze the company's practices and existing key performance indicators. During the meetings held with sustainability teams, consensus was achieved among all relevant experts of the organization, and measurable and traceable performance indicators that complied with standard requirements and comprehensively reflected the company's activities were identified together with their measurement methodologies.
As a result of the three-month study, a total of 112 CSS performance indicators were identified for MESA Makine. The findings of the study are expected to contribute to the literature while also serving as a reference framework for practitioners in the sector.
**Keywords:** Sustainability, CSS performance indicators, casting industry, sustainability metrics.

## Introduction

The implementation of sustainability, defined as the continuous fulfillment of human needs, at the organizational level is referred to as corporate sustainability [1]. A Corporate Sustainability System (CSS) is a system that provides the information required for the management, control, planning, and performance monitoring of an organization's economic, environmental, and social activities in both the short and long term [2]. Naturally, performance indicators are needed to measure the effectiveness and efficiency of any system. CSS performance indicators constitute a set of tools that measure the extent to which an organization integrates economic, environmental, social, and governance factors into its activities, as well as their ultimate impacts on both the organization and society [3].
A successful CSS performance measurement system enables organizations to manage the system effectively [4], while also helping them overcome corporate sustainability challenges by accurately analyzing the gap between the current state and the desired future state [2]. In addition, CSS performance indicators disclosed in sustainability reports are highly important for stakeholders such as investors, customers, employees, governments, and non-governmental organizations, as they reflect the organization's business practices, values, and corporate culture [5].
The casting industry, one of the oldest manufacturing industries [6], is among the sectors of fundamental importance to the global economy and society. However, it is also responsible for the generation of many potentially hazardous and polluting substances [7, 8]. Considering that many products used in daily life consist of components manufactured in foundries and that these products are of vital importance, ensuring the sustainability of the sector, rather than limiting its growth due to environmental impacts, has become a significant necessity [6, 7]. But despite its critical importance for many other industries, studies on sustainability in the casting sector remain insufficient [9].

## Experimental procedure

Within the scope of the research, action research, one of the qualitative research methods, was employed in order to identify CSS performance indicators. Action research is process-oriented and is based on the integration of research and practice [10]. The realistic and rational definition of the problem, together with the use of creative methods for data collection, is of critical importance in action research [11]. Within the scope of the study, MESA Makina, which is in the process of establishing a CSS and where the researcher also served as a mentor during this process, constitutes the single-case sample of the research.

Established in 1979, MESA Makina is an innovative medium-sized enterprise operating in the automotive, railway systems, and defense industries, with R&D, casting, and machining processes. As of 2025, CSS establishment activities were initiated within the company, and sustainability teams were formed in order to review and redesign all organizational processes within this framework. At the end of the approximately three-month study, measurable performance indicators that fully reflect the activities of the enterprise were determined, accompanied by standard requirements, good practice examples and literature research findings.

## Results and discussion

The findings, obtained after a long and intensive research process, including meetings, observations, interviews, and documentation, were reviewed and evaluated together with company representatives and team leaders. In the final form, 32 environmental sustainability indicators, 22 social sustainability indicators, 32 economic and operational sustainability indicators, and finally 26 governance performance indicators were identified. Some examples of these indicators are below:

- Electricity consumption per unit product (kWh/kg)
- Total carbon emissions (ton $CO_2e$)
- Particulate matter (PM) emissions (ton)
- Recycled or reused water volume ($m^3$)
- Employee satisfaction score (%)
- Lost workforce rate / total workforce) (%)
- Training hours for employee qualification and career development (hours)
- Average cost of quality (€)
- Supplier retention rate (%)
- Total investment in innovative product / process / method development (€)
- Total investment in sustainability projects (€)
- Ratio of process performance parameters achieving targets (%)
- Employee participation rate in decision-making processes (%)

## Conclusion

Naturally, it is not claimed that these indicators can be generalized to all casting companies. Although standards, sustainability reports of different companies, literature review findings, and organizational objectives were comprehensively analyzed and the findings were supported through expert evaluations, the selection of a single company as the sample constitutes the main limitation of this study. For future studies, it is recommended that similar research be conducted with companies of different sizes and structures from different regions in order to develop a sector-specific indicator set for the casting industry.

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