

# LIMITS AND BARRIERS TO PRODUCT LIFE CYCLE MONITORING FOR CHEMICALS – A CASE STUDY



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## Introduction

Monitoring the product life cycle and the introduction of the eco-design principle is a prerequisite for the effective implementation and enforcement of the circular economy concept. The presented paper focuses on the issue of the possibility of monitoring the life cycle of chemicals with emphasis on the ability to monitor chemicals in the value chain. The possibilities of life cycle monitoring of a selected chemical substance – basic inorganic acids – were researched and the limitations and limits of life cycle monitoring of chemical substances for the needs of the circular economy were identified.

## Research methodology

**Aims:** The main goal of the primary research was to monitor the life cycle of a selected chemical substances (nitric acid and sulfuric acid) along its life cycle. The importance of product life cycle monitoring is essential for assessing economic and environmental impacts and is also a prerequisite for assessing and improving producer responsibility for its products. A key research question was whether companies could track their products "from cradle to grave":

**Methodology:** To achieve this goal, qualitative research was performed on the manufacturer of this basic inorganic acid. Selected chemicals - nitric acid and sulfuric acid are considered to be basic inorganic compounds with a wide range of uses for both direct consumption and further processing. Primary sources at the manufacturer (safety data sheets, business information, etc.) were selected as a source of information, and customers of this chemical were also interviewed through peer-to-peer interviews.

## Business case: Nitric acid – HNO<sub>3</sub>

Nitric acid is produced in the company concentrated and diluted (concentration 53 %). Up to 80,000 tons is produced annually, of which about 20,000 tons remains for internal use.

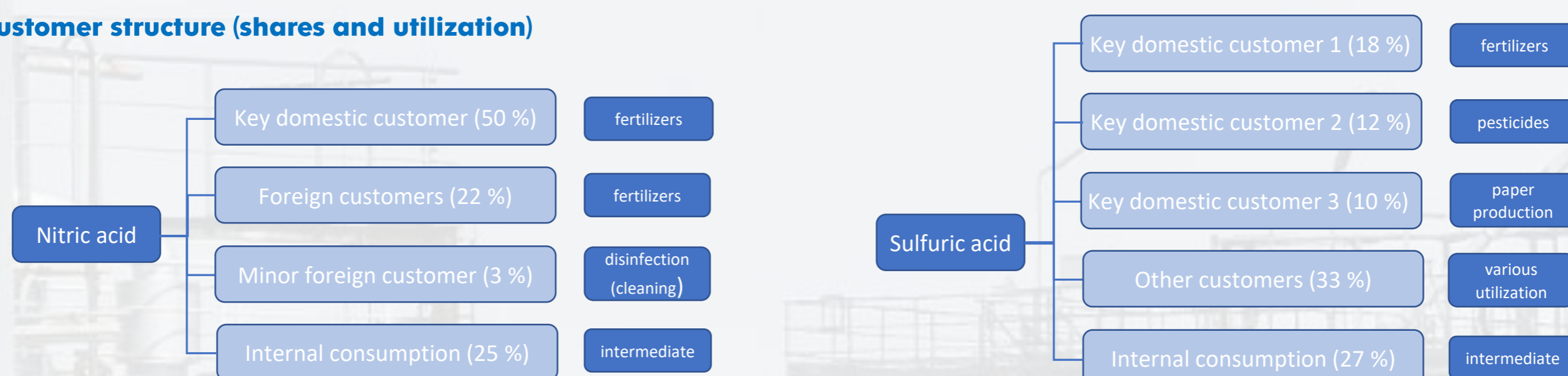
## Business case: Sulfuric acid – H<sub>2</sub>SO<sub>4</sub>

Sulfuric acid is produced in the company mainly as technical acid with a concentration of 94-98 %. Up to 55,000 tons are produced annually, of which about 15,000 tons are for internal use.

## Life cycle monitoring

The ratio of foreign and domestic customers, of which there are thirty to forty, is roughly the same for both acids. Customers are mostly regular, without significant requirements for product diversification. For up to 80% of the production volume, the company can monitor where the product is used and can derive from about 60% what is probably created from the product. However, these products (acids) are further processed - they are only intermediates for further production and therefore the company's management views the life cycle of its products as very short. They consider the monitoring of chemicals to be very difficult and, given the usefulness of this information, inefficient in relation to the cost of obtaining this information.

## Estimated customer structure (shares and utilization)



## Limits and barriers identified

When monitoring the life cycle of chemicals, there are a number of objective (but also subjective) limits and barriers. One of the most important barriers is the widespread use of these substances for subsequent production. In subsequent productions, the chemical composition of substances usually changes - only a very small proportion of production is directly consumed by the customer. Manufacturing companies also do not have a complete overview of the end use of chemicals, which can be resold. Last but not least, the prevailing opinion among management representatives is that it is possible to identify only low benefits from life cycle monitoring compared to the cost of obtaining this information.

## Conclusion

During the qualitative research, the complexity and even impossibility of monitoring chemicals along the life cycle was confirmed. Unlike mechanically produced products, chemical products change their composition and structure and it is difficult to define the life cycle on its own. Although the management of chemical companies knows its customers and the intended use of its products, it cannot follow the life cycle beyond the gateway of the customer's plant.

Despite their simplicity in terms of use and application, selected chemicals can be monitored with high difficulty, which does not balance the benefits of the information thus obtained. By forming various salts, oxides, mixtures or more complex complexes from acids, it is almost impossible to say when the monitored product ceases to be the acid - its own product, and thus when its life cycle ends.

A simplistic view is acceptable to the company's management that the acid ends its life cycle when it enters the customer's plant, although in reality it may continue to occur in its chemical nature and be subsequently resold. However, due to chemical processes, new compounds are formed from acids. The life cycle of the original substance thus ends in terms of its original chemical structure.

## Resources

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