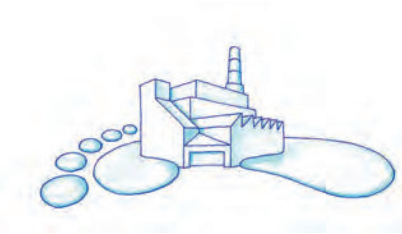

**WELLE: Water footprints in companies: Organizational Water Footprint – Local measures in global value chains**

# WELLE: Organizational water footprint – local measures in global value chains

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## ABSTRACT

The WELLE research project aims to develop methodological and practical solutions for determining the overall water scarcity footprint of companies. Besides considering direct water consumption at production sites, WELLE's approach also takes account of the local effects of indirect water use in upstream energy and material chains. The method development is performed by i) reviewing and evaluating existing methods for assessing water-related environmental impacts of organizations and ii) combining the existing product-related water footprint approach and the organizational life cycle assessment method. To make the method applicable in practice, guidelines for companies are developed. The applicability is ensured through a water inventory database, developed to satisfy the industry partners' needs for regionalized water consumption data depicting their supply chain. An online tool for calculating a company's water footprint according to the organizational water footprint method developed in the project will be made available. These products are tested in four case studies. Deutsches Kupferinstitut assesses the water footprint of the European copper cathode production; Evonik compares two amino acids production lines for methionine and lysine located in facilities in Belgium and the U.S.; Neoperl analyses the organizational water footprint of the entire company (Neoperl GmbH, Germany); Volkswagen assesses the production facility in Uitenhage, South Africa. Based on assessments of water risks, WELLE will identify local hotspots in global supply chains in which water stewardship measures will be initiated.

## INTRODUCTION

In current industry practice, water is managed at the production sites only, e.g. within the framework of environmental management systems. However, production activities are supported by complex upstream supply chains, which deliver energy and raw materials, and followed by possibly water intensive use phases. Recent research has shown that, in different sectors, the main impacts on water scarcity have their roots in such upstream activities, often located in different regions than the main production site. For example, the first published water footprint study of a complex industrial product carried out for three Volkswagen car models (Berger et al. 2012), identifies the largest share of water consumption in the upstream value chain, mainly in precious metals and natural rubber production, while only 5% takes place at production sites. Though delivering relevant information on water consumption and water-related impacts throughout specific life cycles, the mentioned studies are limited to single products and do not depict the impacts of an entire company or facility. To allow companies addressing their water-related impacts in an effective and targeted manner, a holistic approach taking into account all company-related activities is required.

Before this backdrop, WELLE aims at providing companies with applicable solutions to:

1. Recognize the possible sources of water consumption at production sites and throughout a company's supply chain in a systematic manner;

2. Identify the location of water consuming activity throughout supply chains;

3. Carry out a comprehensive water footprint study via an online tool.

By means of a company's water footprint, hotspots along the company's supply chain can be identified which are target areas for local mitigation measures. In addition to the physical water risk calculated by the WELLE tool, also regulatory and reputational risk factors are taken into account. The information gained will be used to:

4. Identify the most relevant geographical hotspots along the supply chains;

5. Initiate water stewardship dialogues with local stakeholders.

The entire WELLE approach targets at companies' and other organizations' willingness to explore their supply-chain impacts on water scarcity and initiate multi-stakeholder dialogues to put into place mitigation measures.

## METHODS

### Organizational water footprint method

The method was developed in a two-step approach. In a first publication, available tools to track the water-related environmental performance of companies were analysed via a multi-criteria approach evaluating e.g. their scientific soundness, environmental relevance, organizational system boundaries, and broadness of application (Forin et al. 2018a). As a result, the product related water footprint method was chosen as a starting point to develop the organizational water footprint approach, in combination with organizational Life Cycle Assessment (LCA). A submitted publication (Forin et al. 2018b) discussed how both methods, based on ISO standards, can be hybridized. Moreover, application guidelines e.g. to prioritize data collection, are delivered.

### Regionalized water inventory database

While most companies can monitor their internal activities comparatively easy, they rely on external data about the water consumption of their indirect upstream activities (material and energy supply chain). Thinkstep's life cycle inventory database GaBi 8 is used as foundation for the case studies carried out in this project. As a first step, relevant datasets are identified by the participating companies. These datasets are investigated comprehensively and modified to better meet the demand for detailedness expressed in the case studies. Important modifications include the allocation of generic processes to their typical location, and the disaggregation of datasets, allowing the selection of country specific energy and material mixes or market mixes based on several countries.

### WELLE tool

To facilitate the use of the provided inventory data, a web-based tool is created. The tool guides the user through the different compartments of the organizational water footprint. Starting with direct water use, the user can enter water use data of production sites in high geographical resolution. In terms of indirect upstream and downstream activities, users can enter purchased goods and materials as well as water consumption during product's use phase. In combination with the water inventory database described above, the tool allows to assess the water consumption of an entire organization and weights the results by water scarcity in its respective locations, using recent impact assessment methods (Pfister et al. 2009; Boulay et al. 2017).

## INTERIM RESULTS AND DISCUSSION

### Organizational water footprint method

Based on the two scientific publications mentioned above (Forin et al. 2018a, 2018b), practical guidelines for conducting the organizational water footprint have been developed and are currently tested by the industry partners.

### WELLE database and tools

According to the methodology described above, water use data is provided for a set of 100 relevant material and energy datasets in a country-specific resolution, which allows for identifying local hotspots in a company's supply chain. This database is fed into the water footprint tool, which enables users to determine the water footprint of organizations. A prototype of the tool in an existing LCA software application (GaBi Envision), is currently transferred into a WebTool and tested by industry partners.

## Case studies

Four industry partners tested the organizational water footprint method, the regionalized water scarcity database and the WELLE tool. The scope and preliminary results of the case studies are described in the following.

The **Evonik Nutrition & Care GmbH** participates in the WELLE project with two case studies which are conducted by the Life Cycle Management team which is part of the Evonik Technology and Infrastructure GmbH. Water scarcity footprints are assessed for two amino acids at different production sites: lysine in Blair (USA) and methionine in Antwerp (Belgium). Further, the use phases of those two amino acids will be modelled since these products significantly help to reduce water consumption of farmed animals.

The case study of the lysine production has shown that in this case the major share of the water consumption accrues upstream. Water required to irrigate the raw material corn is the most decisive factor regarding the water scarcity footprint whereas the water required for the fermentation process itself only plays a minor role. As Blair is situated in an area of medium to high water scarcity and the corn cultivation takes place roughly in a 150 km radius around the production site, the impact of the water withdraw in this region is stressed.

Motivated by the above mentioned insights, first steps were taken to improve the exchange with relevant suppliers in order to gain a deeper understanding of the upstream supply chain. This resulted in a more precise estimation of the water scarcity factor for the procured corn based on the actual region of cultivation. Further action will be taken within the context of the planned water stewardship measures.

Also in the case of methionine, raw materials are highly relevant when it comes to hotspots in a water scarcity footprint. A detailed review of the supply chain of selected raw materials illustrated that it is crucial to be precise when it comes to locating the origin of raw materials as deviations up to a factor of 100 were detected for local water scarcity. Whenever possible, an in depth analysis of the supply chain is important in order to draw a clearer picture in terms of water scarcity.

**Neoperl GmbH** is a medium-sized company that offers innovative solutions regarding drinking water for the plumbing industry. Within the WELLE project, Neoperl carries out the organizational water footprint of its main facility located in Müllheim, Germany, and aims at gaining insights in the facility's impact on water scarcity worldwide. The analysis includes, besides the water scarcity impacts of water consumed in the facility itself, also the upstream supply chain (purchased goods, materials and fuels), and the company's main supporting activities. Within an intensive data collection process, Neoperl tracked the country of origin of most of their purchased materials, which allows identifying regional water scarcity hotspots based on available country-specific characterization factors. In addition, Neoperl's supporting activities were analyzed with regard to water consumption and impacts on water scarcity. This implied a detailed data collection on on-site energy generation, company-owned vehicles, buildings and machinery (including component materials), work place equipment and the facility's canteen. Preliminary water footprint results show that purchased goods and materials contribute to a significant share of Neoperl's water consumption and water scarcity impacts. The prevalent product category is represented by purchased metals, especially stainless steel and brass. The region-specific data collection allows identifying in which countries the most water intense materials are produced. On this basis, the supply chain of selected materials will be analyzed more in depth based on suppliers' information and the WELLE database. This knowledge will inform management purchase decisions and increase awareness on Neoperl's impacts on freshwater scarcity.

Copper is a material needed to secure our modern life. With regard to the demand for e-mobility and green energy the demand for copper is assumed to be growing. As a result, resource demand, e.g. for water, might increase as well. Before this backdrop, **Deutsches Kupferinstitut Berufsverband e.V.** contributes to the WELLE project by assessing the water footprint of the European copper cathode production and identifies local hotspots with a granularity going down to local water management, e.g. intake, consumption and/or sewage. Since more than half of the copper processed and used in Europe is imported from different places of the world, it is worth to know the bottleneck to ensure production and supply risk are best monitored. In previous studies on the European copper supply chain we found out that in water rich regions, e.g. northern Europe, water is extremely abundant and groundwater is rather transformed in surface water, while in dry regions, e.g. Arizona in North America, water can be a limiting factor to deal with. A preliminary assessment of the European cathode production shows that the copper extraction taking place outside of Europe is dominant for the blue water consumption. Further steps in the granularity will help to identify and localize the hotspot of this upstream and help to best address the water management, taking into account production and supply risk perspective.

**Volkswagen** analyzed the organizational water footprint of its production site in Uitenhage, South Africa, which is part of Volkswagen South Africa. With its ca. 4,000 employees, it is the largest automobile production site in Africa and manufactures the Polo as well as engines. Apart from the direct water consumption at the site (Scope 1), the water consumption caused by the energy supply (Scope 2) and by the material and upstream product manufacturing (Scope 3) was analyzed. In addition to the water volume consumed, hotspots within the supply chain were identified. An initial regionalization at the country level was conducted. A more in-depth regionalization on the water basin level is in preparation.

Initial findings of the water footprint analysis for the production site Uitenhage: The predominant portion of the water consumption lies in the product supply chain (particularly in the raw material extraction/fabrication) and in the use phase of the products (particularly in the fuel supply), respectively. On the other hand, Scope 1 (direct on-site water consumption) and Scope 2 (energy supply) contribute less than five per cent to the overall water consumption. In the supply chain, steels, platinum-group metals and elastomers were identified as hotspots. To what extent these water consumption hotspots contribute to the generation of water stress is currently part of an in-depth analysis.

## CONCLUSIONS & OUTLOOK

Based on the case study results, the identified physical hotspots will be further analyzed and prioritized according to the local physical, regulative and reputative risk assessment. In a further step, meeting with suppliers and local stakeholders at hotspot locations will be organized in order to initiate water stewardship measures.

The WELLE approach will be made available to the general public through a methodological guidance and an online WELLE tool. These deliverables will allow other companies to scope their case study, model their organization and screen the water consumption and water scarcity hotspots along their supply chain.

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