



A look into water usage data in the construction industry

Uma visão sobre dados de uso de água na indústria da construção

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ABSTRACT

The growth of the construction industry seen in recent decades has brought more infrastructure and development of human settlements. However, to ensure this expansion, there may be irrational use and exploitation of water in many cases. Thus, the construction industry may compete for water resources with the population it intends to serve. Therefore, considering the increasing difficulties related to potable water availability worldwide, there is a growing concern for best water management practices in this industry. Given this scenario, the research described in this article followed two approaches to investigate water usage: one through a literary review to answer the question “Where to collect data on water usage in the construction industry?” and the other through a tool for artificial intelligence to answer the question “How much water is used by the construction sector?”. Preliminary results revealed that few data are measured and published, making planning strategies for efficient water use in the construction industry challenging. It was concluded that future studies need to carry out case studies for data collection on water usage in the different sectors of the construction industry to provide benchmarks for best-informed decisions on water management in this industry.

KEYWORDS: construction industry; water intensity; water management; water usage.

RESUMO

O crescimento da indústria da construção verificado nas últimas décadas gerou aumento nas obras de infraestrutura e de edificações. Contudo, para garantir essa expansão, em muitos casos pode ocorrer exploração irracional dos recursos hídricos. Assim, a indústria da construção poderá competir pelos recursos hídricos com a população que pretende servir. Diante desse cenário, a investigação descrita neste artigo seguiu duas abordagens: a primeira através da pergunta de pesquisa “Onde coletar dados sobre o uso da água na indústria da construção?” e a outra através do uso de inteligência artificial para responder à pergunta “Qual o volume de água utilizado pelo setor da construção?”. Resultados preliminares revelaram que poucos dados são medidos e publicados, dificultando definições de estratégias para uso racional da água nesta indústria. Portanto, constatou-se que é necessário acesso a mais dados para comparar e analisar as estratégias adotadas em relação à gestão do uso da água na indústria da construção. Concluiu-se que esta pesquisa deve seguir com a realização de estudos de caso para coleta de dados em diferentes setores da indústria da construção, para então gerar uma base de dados e embasar o desenvolvimento de estratégias para gestão e uso racional água nesta indústria.

PALAVRAS-CHAVE: indústria da construção; intensidade da água; gestão de água; uso de água.

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INTRODUCTION

When combined with a lack of environmental awareness, the growth of the construction sector - by building infrastructures and human settlements - and the population rise may lead to increased water consumption. Moreover, water consumption and wastage translate into the generation of effluents, representing a potential loss of water quality worldwide. Thus, in the near future, the cost of potable water distribution is expected to increase globally. Furthermore, in a water scarcity scenario, the construction industry may compete with the population it intends to serve.

With this scenario of expansion of the construction industry, it is necessary to quantify water usage in this sector to propose best water management strategies to allow for water availability for the population. This research is a step towards a better understanding of water usage in the construction industry, and it aims at compiling existing data and producing new information to convert this knowledge into best water management strategies. With access to more data, it will be possible to benchmark water usage in the construction industry, thus allowing comparison of strategies adopted in each scenario and the proposition for respective best water management in various construction industry sectors. One approach toward that goal is to compile and analyze data to establish data sets of water usage per product unit, also known as water intensity (BEZERRA, 2014).

Given this situation, the research described in this article followed two approaches to investigate water usage: one through a literary review to answer the question “Where to collect data on water usage in the construction industry?” and the other through a tool for artificial intelligence to answer the question “How much water is used by the construction sector?”.

METHODOLOGY

The starting point for this research was reading and analyzing the doctoral dissertation “Enhancing Characterization of Water Use Practices in Cement Manufacturing and Related Construction Sectors” (BEZERRA, 2014). After that, a further literature review was performed to collect more data on water usage in the construction sector to update information from the time of that research, approximately ten years. The searches were carried out in the metabases of Google Scholar and Scopus from October 2022 to September 2023. The keywords and terms investigated were:

- a) water usage data in the construction sector;
- b) water intensity indicators; and,
- c) water management in the construction sector.

After the literary review, a tool of artificial intelligence was used to answer the question: “How much water is used by the construction sector?”. The selected tool was the GPT Chat, which is a model trained to follow instructions in a prompt and provide a detailed response (OpenAI, 2022). GPT stands for generative pre-trained transformer.

RESULTS AND DISCUSSIONS

Data compiled at the beginning of this research, coming from the doctoral dissertation by Bezerra (2014), provided that water intensity at the cement plants ranged from 147 to 3,500 litres per tonne of cement, indicating a wide range in water use patterns. In addition,



from that same dissertation, volumes of mixing water have been reported in the literature as ranging from 100 to 243 litres of water per cubic metre of concrete. The quantities of total water usage at ready-mixed concrete plants, for other uses beyond mixing water - such as preparing samples for laboratory work, washing concrete trucks, and workers' needs - have not been available in the literature. Another sector investigated by Bezerra (2014) was water usage for buildings under construction, resulting in 370 to 680 litres of water being used at construction sites per square metre of floor space built, with these data coming from case studies developed by that researcher and by Pessarello (2008).

The next stage of the research described in this article was a literature review to search for additional data and update the information provided by Bezerra (2014). Fifteen new articles were found using the keywords and terms indicated in the methodology. However, only one new article has brought new data on water usage in the construction sector, which described case studies at three construction sites in Maringá, Paraná State, Brazil (SILVA; VIOLIN, 2013). Their results for water intensity included a range of 200 to 250 litres of water being used at construction sites per square metre of floor space built, thus representing lower numbers than Bezerra (2014) and Pesarello (2008), which were 370 to 680 litres of water being used at construction sites per square metre of floor space built. A proper analysis of the causes for differences was not possible because of a lack of detailed information regarding data collection methods. However, it seems that Silva and Violin (2013) had not add all water uses at the construction site. These authors published that an average of 211 litres of water per cubic meter of concrete and 201 litres per cubic meter of mortar was used through their case studies, but they came prepared from plants outside the construction site. Moreover, water consumption by the workers at the construction sites was also investigated by Silva and Violin (2013), resulting in a range of 75 to 90 litres of water per worker per day.

It was noted that there needs to be more water usage data published, considering that out of the fifteen articles found, only one brought some new data regarding water usage in the construction sector. However, it is essential to reinforce the idea that reporting water usage data and their respective methods of investigation provide an overview of who is doing what and with how much water. This understanding empowers managers to identify and adopt the most suitable initiatives and better define tools for sustainable water management inside their industries.

Following the attempt to find new articles through a literature review, the use of AI, when asked - "How much water is used by the construction sector?" - provided the following response:

Concrete production is one of the most water-intensive activities in the civil construction sector. The exact water-to-cement ratio can vary depending on factors like the desired strength of the concrete, but it generally takes a significant amount of water to mix with cement to create the concrete mixture.

As of my last update in September 2021, I don't have access to specific global or region-specific statistics on the exact water usage in the civil construction sector beyond that point. Additionally, water usage trends and regulations can change over time due to advances in technology and a growing emphasis on sustainability.

For the most up-to-date and accurate information on water usage in the civil construction sector, I recommend consulting industry reports, research studies, and data from relevant government agencies or industry associations that focus on construction and water resource management.



This research indicated that the need for substantial new data on water intensity in different construction industry sectors is an ongoing challenge. However, enhanced knowledge of water usage in the construction industry is timely because this industry may be driven to invest more significantly in best water management practices soon, as good quality water availability is becoming scarce worldwide. To overcome this issue, the future steps of this research will be to form partnerships with construction companies to develop case studies and collect water usage data in situ.

CONCLUSIONS

This research work contributes to the field of water management by shedding light on the need for water usage data availability and reliability in the globally important sector of the construction industry, as well as raising awareness of the need for best water management practices in this field. Moreover, such knowledge has the potential to foster collaboration with stakeholders in the construction sector and policymakers to propose guidelines and regulations to attain economic, environmental, and social sustainability. Communities home to water-efficient industries will eventually gain more freshwater availability for potable uses, thus increasing their potential to meet drinking water requirements and improve their quality of life.

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Conflict of interest

There is no conflict of interest.

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