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Review papers

Conceptualizations of water security in the agricultural sector: Perceptions, practices, and paradigms

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ABSTRACT

Conceptions of agricultural water security are conditioned by larger understandings of being and reality. It is still unclear what such understandings mean for perspectives on water security in general and on causes and solutions related to perceived water security risks and problems in agricultural sector in particular. Based on a systematic literature review, three conceptualizations of water security, related to different paradigms, are presented. Also the consequences of such conceptualizations for determining research objectives, research activities, and research outcomes on agricultural water security are discussed. The results showed that agricultural water security from a positivist paradigm referred to tangible and measurable water-related hazards and threats, such as floods and droughts, pollution, and so forth. A constructivist approach to agricultural water security, constituted by a process of interaction and negotiation, pointed at perceptions of water security of farmers and other stakeholders involved in agricultural sector. A critical approach to agricultural water security focused on the processes of securing vulnerable farmers and others from wider political, social, and natural impediments to sufficient water supplies. The conclusions of the study suggest that paradigms, underlying approaches should be expressed, clarified, and related to one another in order to find optimal and complementary ways to study water security issues in agricultural sector.

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1. Introduction

Water wars are coming! (Harrington, 2013). The issue of water security has attracted increasing attention over the past years. Growing water scarcity is increasingly constraining food production, causing adverse impacts on the goals of food security and human well-being (Rosegrant et al., 2009). Several groups, including UNESCO's Institute for Water Education and the Asia-Pacific Water Forum, have made water security a central research theme (UNESCO-IHE, 2009). In the past decade, the issue of water security has also come to the fore in several water management agendas, particularly associated with bioterrorism concerns (Jansky et al., 2008). The growing attention for water security has resulted in a significant increase in the employment of 'water security' scholars within the academic community. Accordingly, the number of scientific papers on water security has significantly increased in the last 25 years (Cook and Bakker, 2012).

Clearly, water security is of utmost importance, especially in the agricultural sector: agriculture uses approximately 70% of renewable water resources worldwide (Taylor, 2015) and will continue to be the largest user of freshwater resources through 2050 for all regions (Rosegrant et al., 2009). Furthermore, in water scarce countries, irrigation is vital to enhance crop production (Jhorar et al., 2009). However, the growing water scarcity is putting pressure on irrigation systems (Forouzani et al., 2012), yield, and quality. Moreover, water insecurity has irreparable effects on raw materials production, rural employment opportunities, rural development, etc. Consequently, any discussion about agriculture is incomplete without consideration of water availability (Taylor, 2015).

Different studies have been found to present a comprehensive review of the concept of water security in academic debates. Cook and Bakker (2012), for instance, analyzed differences in approaches to water security across academic disciplines such as natural, social, applied, and medical science. Liu et al. (2007) discussed definitions of water security, water resources security, and water environment security. They concluded that natural attributes, socioeconomic attributes, and cultural attributes were recurring elements of the agricultural water resources security concept. In addition, agricultural water resources security includes food security, agro environmental security, agro economic security, rural society security, etc. Based on a multi-criteria evaluation model to assess water security, Wang et al. (2014) used catastrophe theory to consider different management strategies with the aim of recommending the best water management strategy to achieve water security. Furthermore, Qiang et al. (2008) applied a water poverty index (WPI) including five key indices, namely resources, access, capacity, utilization, and environment, to evaluate regional water security. Liu et al. (2012) reviewed both international and domestic conceptualizations of water security using the DPSIR model – exploring Driving forces, Pressures, States, Impacts, and Responses as relevant factors of water security.

Not only researchers, but also societal actors put different accents when assessing water security. International organizations, such as the Global Water Partnership and the World Economic Forum, have, for instance, presented different definitions of water security. However, it is not clear where these definitions come from and how they are, or are not, related. This is important, because definitions are selections that include those aspects that are considered to be important and thus play a role in deciding upon problems and solutions related to water security issues.

Although several studies have been carried out with the aim to assess water security, a systematic overview of assessing water security from different paradigms is still lacking. Neither had we found any study that systematically reflected the consequences of the possible different conceptualizations of agricultural water security for doing research in this field. For agricultural production, water security denotes that water should be available at a sustainable, stable rate and at a reasonable cost (Liu et al., 2007). However, acceptable, sustainable, stable rate and reasonable cost are not fixed concepts. From the perspective of different paradigms, questions such as, *What does acceptable mean for quality and quantity of water in agriculture?, Who can determine the acceptability of water in the agricultural sector?, How should one determine an acceptable quantity and quality of water?*, may lead to different answers.

Therefore, this paper aimed to present, compare, and analyze main approaches of agricultural water security, based on different paradigms, including how each conceptualization affected research objectives, methods and outcomes. The results can help researchers to become aware of implicit selections and choices that are being made, including the consequences for research questions, objectives and methods, leading to specific outcomes and recommendations for dealing with water security in agricultural sector. Besides, its outcome could be useful and assist policy makers to adjust their plans base on relevant concept of agricultural water security.

After a brief explanation of the methodology we continued to discuss a positivist, constructivist, and critical perspective on security in general, followed by a discussion on different conceptualizations of water security and water security in the agricultural sector. Finally the consequences of the conceptualizations for doing research in the domain of water security in the agricultural sector were explored.

2. Materials and methods

The literature review for this study was conducted on four fields: paradigms, security, water security, agricultural water security. In total, 30 keywords[1] were applied over 15 search queries on Scopus and Google Scholar to find results for each field and for combinations of fields. The frame of research is presented in Fig. 1.

On the basis of this systematic literature review, we first selected three main paradigms (positivism, constructivism, and critical theory) representing core differences, that also go for their ontology, epistemology, and methodology. The differences were presented in Table 1.

Subsequently, various studies of security were selected and related to the different paradigms which resulted in different conceptualizations of security in general. These conceptualizations

[1] The keywords were positivism, constructivism, critical theory, paradigm, security, water security, ontology, epistemology, methodology, water, agriculture, agricultural water security, research, conceptualization, definition, participatory, perception, behavior, reality, Index, concept, action, practice, availability, accessibility, quantity, quality, consequence.