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Hein, Carola

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Toward a Value Case Approach for Designing Sustainable Water Systems

Carola Hein

Abstract
Designing water systems – interconnected networks of water-related structures and practices – is not only a matter of technology and economics, but also of history, institutions and culture. Understanding these multiple, overlapping and interconnected spaces and practices requires a holistic approach that contextualizes current projects and helps identify challenges and opportunities. The article introduces a value case approach, including tools and methods that can be used to connect spatial, social and cultural conditions and their change over time. Such comprehensive understanding can potentially be used to facilitate societal change and guide political decision-making. The article first explores the rationale and setup of a value-case approach in the context of the PortCityFutures Center and the work of the UNESCO Chair Water, Ports and Historic Cities. It concludes by introducing key elements and methodological tools.

Policy Recommendations

- Politicians and policy makers should take a contextual approach to water-related interventions, considering space, society and culture and their transformation over time. The value case approach has been designed to make such abstract aspects tangible and can help balance the dominance of technological and economic perspectives.

KEYWORDS

PortCityFutures
Port city territories
Adaptive strategies
Water systems design
Value case approach

WATER ICONS

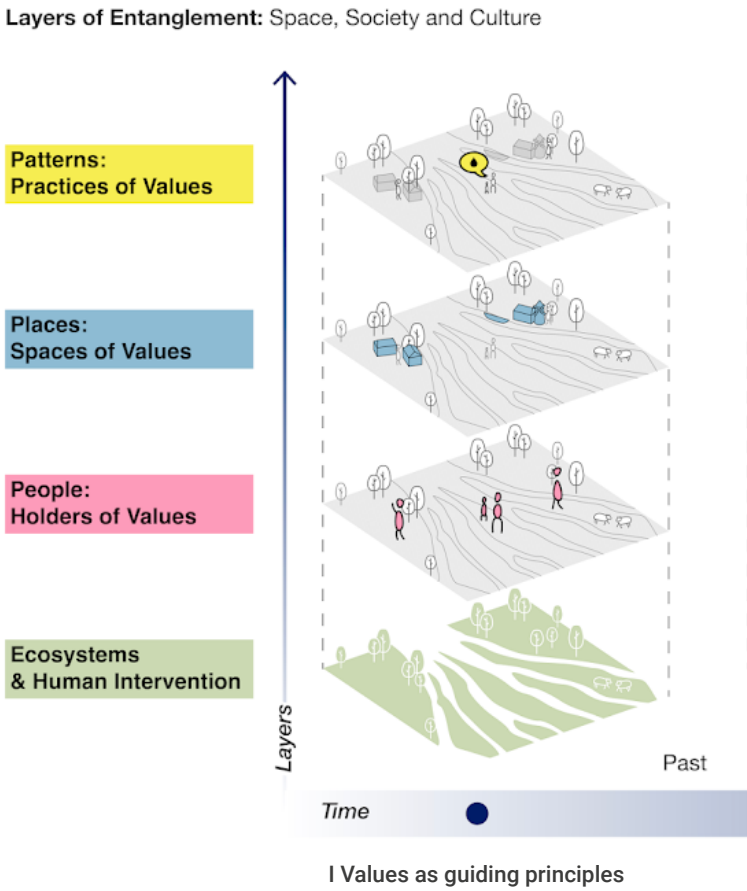


< Fig. 1 Aerial view of Venice (Source: Carola Hein, 2023).

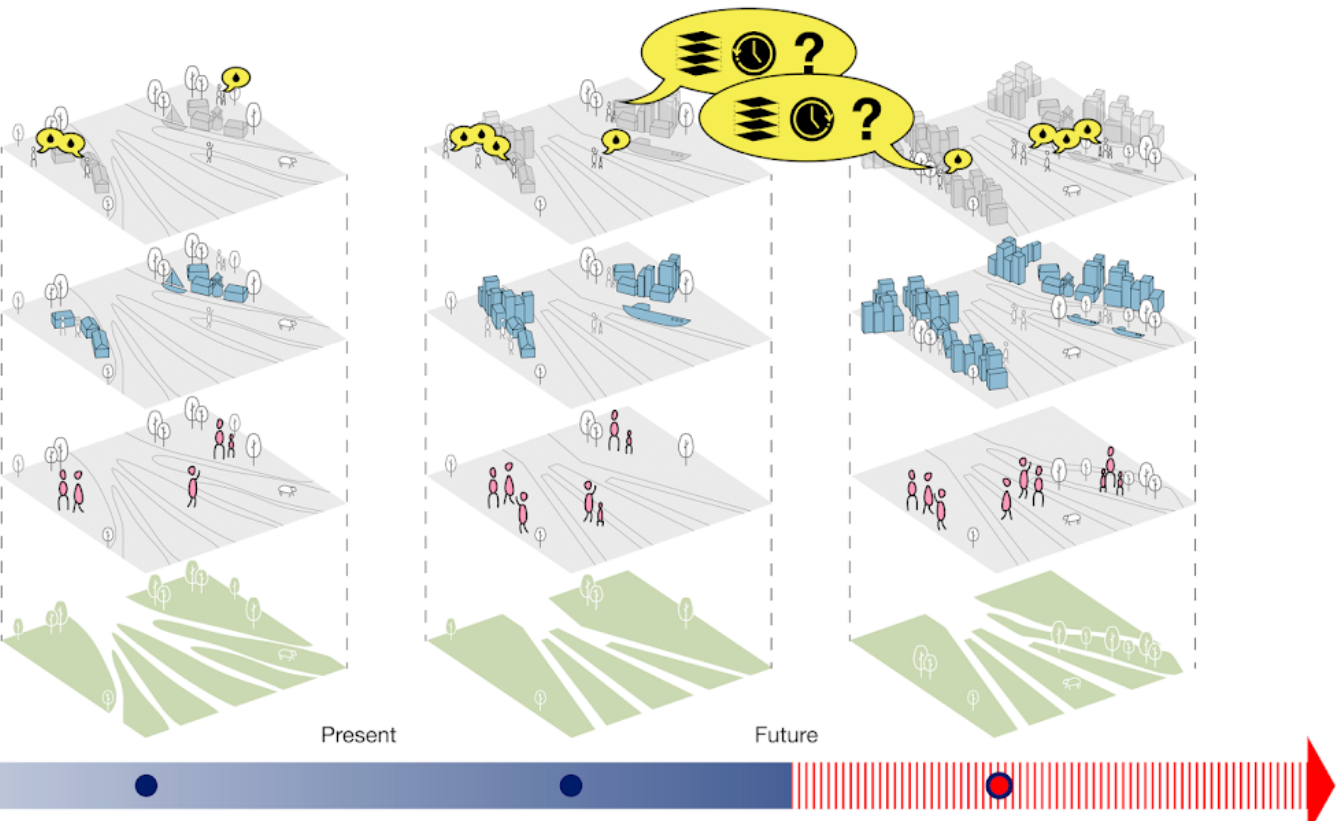
Introduction

Humans have shaped their built environments, institutions and practices to serve needs and values – understood here as socially and historically contingent beliefs that inform action. Across diverse and sometimes extreme climate conditions, people have developed varied spatial arrangements and ways of life. Decisions made in specific ecological, political and cultural contexts have generated spatial, economic, material and symbolic practices, some of which continue to influence contemporary projects. At the heart of many human interventions has been the availability or absence of water, leading people to transform a natural water cycle into a sociocultural one (Hein 2022).

Making the most of local conditions, people have controlled water flows through infrastructures, institutions and policies. How we manage drinking water, irrigation and sewage systems and defend against floods reflects the values of decision makers – who may opt for systems that benefit corporations or the public good, for extractive or nature-positive solutions. These decisions may not reflect the values of the entire population. To identify and potentially address points of contention, values can serve as a guide. At a time of climate change, uncertainty and risk, there are many reasons to question the tendency to place technological prowess and economic gain above all else. To solve complex problems, such as those that characterize water systems, we need an approach that elevates discussions to the level of values. The potential of values as guides of decision-making, actions and shaping the future is not fully recognized and appropriate methodologies are only in development. Value-based methodologies can provide participatory tools and support political decision-making. With input from members of PortCityFutures and the UNESCO Chair Water, Ports and Historic Cities, I have therefore developed a value case approach to complement existing frameworks. This article introduces the approach, its development and inspiration, as well as the advantages of taking a multi-scalar, multi-stakeholder, culture-driven long-term perspective.



^ Fig. 2 The transformation of physical space – such as cities or landscapes – and the development of institutions and practices occurs over time. Such space-time entanglements reflect decisions based on values and bring them to the fore, creating a palimpsest (Source: Carola Hein; visualization by Lea Kayrouz, 2025).



Exploring Values in Space and Time as Context for Design

Activities leave their trace over time on the physical environment, which includes natural and human-made structures such as cities, buildings and landscapes, creating a feedback loop that influences the future. Figure 2 visualizes the multiple interactions involving people and space and the role of institutions and culture in the creation of a palimpsest that evolves over time. The illustration shows a natural ecosystem that is transformed over time. People adapt physical spaces to their own needs. They create places in which they can perform specific activities and establish policies, laws and institutions that guide later developments. Designs for the future are always embedded in these decisions and investments of the past, yet the impact of the past is often underestimated. These developments need to be seen as interconnected in space and time.

As illustrated in figure 2, this analysis puts space and its multiple layers of engagement with tangible and intangible practices at the center of investigation. It proposes that the physical environment is where values become tangible. To give just a few examples:

Health and safety have long been key values influencing human interventions in the built environment. Well-to-do people around the world have been able to build in healthier locations – in Tokyo, for example, on higher ground, leaving floodable areas to workers. Edward Seidensticker (1991) describes this well for Edo (now Tokyo); similar examples can be found in Hamburg, Jakarta and many other cities. Health and the prevention of disease has been a key theme for the construction and location of workers' housing since the industrial revolution, when planners began arguing that access to fresh air and sunlight was key to improving health for the working class, leading to the construction of multi-story blocks and high-rise apartments in green surroundings and to policies that promoted high-rise housing in greenery. The built environment is also where value dynamics over time become evident. Blocks and towers built for health reasons in the 1920s, for example, are no longer considered as embedding health values. Situated on the outskirts of cities, new towns have often become the model of car-reliant areas without spaces for walking, which has contributed to health deficiencies.

Multiple authors have recognized the importance of values in shaping spatial and social practices and guiding our decision-making. They have discussed the multiple characteristics of values – diverse, multiple, dynamic, embedded, local – and the need for value literacy (D'Agostino and Hein 2024; Hein et al. 2021; Hofstede 2001; Steinert 2023; Stephenson 2008). Some experts have proposed a paradigm shift: building on the notion, often used in the fields of business and project management, of "business case" – that is, as the Cambridge English Dictionary defines it, "an explanation or set of reasons describing how a business decision will improve a business, product, etc., and how it will affect costs and profits" – to develop a "value case" (Dittrich and Dijk 2013; Tulder and Mil 2023; Beutell 2018). Activating values for better design, also called value-sensitive design (Friedman and Hendry, 2019), has been proposed by several initiatives (Ritvala and Salmi 2010), including Delft Design for Values.[1]

Given the longevity of buildings, cities and human-made landscapes, values of the past inscribed in the built environment form a palimpsest that affects the future. Economic flows, governance, or literature can be seen as disconnected, yet, their objects of study can all relate to the same physical location, collectively providing a more complex understanding of a site and its development. Physical space thus forms a meeting point for a variety of investigations that develop in the natural sciences, social sciences and humanities. Placing space at the center of analysis is in line with Henri Lefebvre's understanding of space as socially produced and then appropriated (Lefebvre 1974), thus combining the spatial dimension with the representation of space, and with the spaces of representation. The construction of spaces over time adds another facet to Lefebvre's argument. I have argued elsewhere that spaces, their representation and their lived experience create a feedback loop and that space, society and culture effectively reinforce each other (Hein 2018, 2019a).

Such a spatialization of values does not need to be continuous physically. Inspired by Arjun Appadurai's (1990) use of the suffix *-scape* to represent the "new global cultural economy as a complex, overlapping, disjunctive," collaps-

1. Delft Design for Values, "Values to Design For," https://www.delftdesignforvalues.nl/values-to-design-for/.

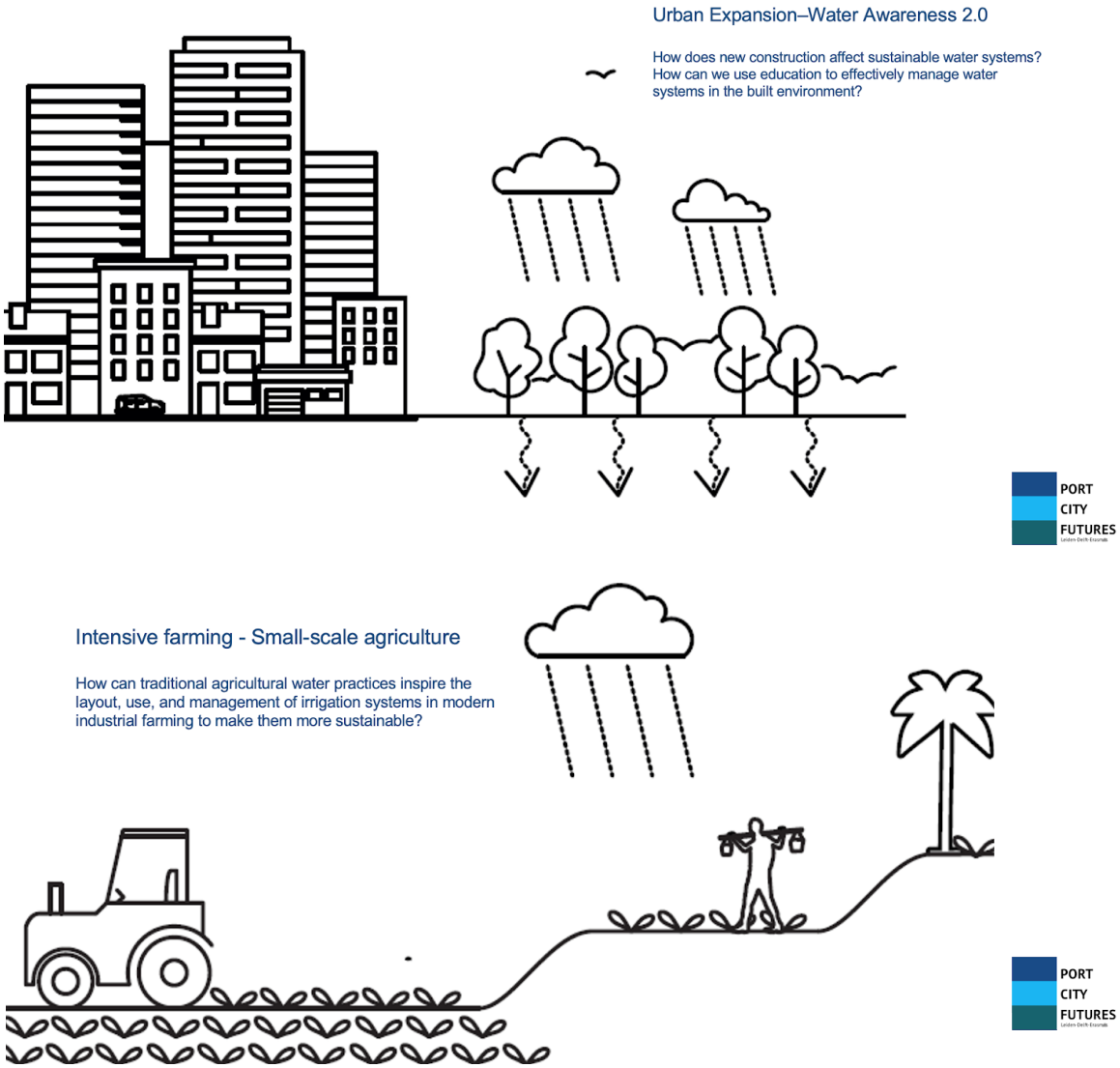
ing distinctions between city and periphery, I have found it helpful to use *petroleumscape* and *portcityscape* to describe the impact of a single commodity and the impact of port flows on disconnected spaces. This approach can be connected to the theory of affordance, that is, the ways in which the qualities of an object communicate certain behaviors (Gibson 1979). Exploring the impact of decisions that reflect values and their impact on spatial development over time and at different scales, as stakeholders and their views change, can provide a more complex understanding of a specific situation and help develop a broader framework for decision-making and future design.

A Value Case Approach for Water: Concepts and Tools

Water systems – complex systems of spatial, social and cultural practices involving water – are an example of space-time entanglement across scales, involving multiple stakeholders. Water is always moving or transforming, and water systems form interconnected spaces that cross the border of water bodies and land, linking diverse water uses – from drinking water to shipping, energy generation to irrigation. The values associated with water systems depend on specific types of and forms of engagement with water – clean or polluted, fresh or salty. Historically, where water was scarce, people built water distribution systems that were publicly accessible and beautiful. The value placed on community access to drinking water can be seen in public fountains in the squares of Marrakech and the pumps in medieval European cities. Such water distribution sites were closely connected to public spaces; they served as gathering places and were depicted in paintings, literature and music. The protection of drinking water often requires interventions in other aspects of water systems. Sewage, for example, has often posed a great threat to healthy drinking water, and people have developed extensive systems of separating fresh and polluted water, involving distinctive water-related spaces and practices. Public toilets are excellent examples, even if typically they are less remarkable than the "designer toilets" of Tokyo celebrated in Wim Wenders' 2023 film *Perfect Days*.

Values related to water develop in specific contexts and change over time. When there are competing uses of water, people need to negotiate preferences in line with values. For example, rivers have long been the source of drinking water. The use of river water for industrial production and the use of rivers as sewage canals or for shipping can conflict with demands for high quality fresh water. Such conflicts have repeatedly arisen over time along with compromises. Historically in villages, practices such as fetching drinking water, bathing, and washing clothes were carried out in a sequential progression from clean water to dirty. Another example involves the introduction of petroleum refineries in the mid-nineteenth century. Some of the early refineries were built above the water intake of cities such as Rotterdam, Hamburg and Philadelphia. Eventually, to maintain drinking water quality, the refineries were relocated downstream. If such competing interests are not addressed, conflicts can easily arise. How different interests are balanced is influenced by cultural practices and societal values. There are also practical considerations, such as the availability of tools and energy.

Values pertaining to water change over time for example as people have demanded safe drinking water and fought polluters, creating

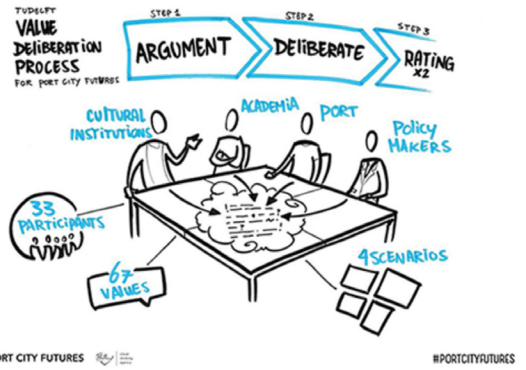


^ Fig. 3 Water dualities (Source: PortCityFutures, 2022).

new challenges. Industrialization facilitated the emergence of public "modern water" systems that improved health for large parts of the population (Linton 2013); yet in general, people lost much awareness of water and the system of which it is a part. Figure 3 illustrates some of the conflicts that can arise between different water uses and how uses may change over time. For example, many historic cities were built to accommodate traditional needs related to drinking water, sewage and transport. Industrialization has increased pollution and water consumption and cities have expanded in ways that fail to align with the watershed, leading to water conflicts, social injustice and health challenges. A new balance for the water system must be found that doesn't deplete water sources or pollutes but improves water quality.

Understanding the specific role of water in each natural and cultural context, its representation and interrelation is an important precondition to designing sustainable future water systems. Such understanding is particularly important at a time of climate-related water systems change and its impact on human and non-human actors and serves as a foundation for identifying opportunities and challenges for future design. The absence of widespread understanding of water has gone hand in hand with the decay of many natural water bodies, including lakes, rivers and oceans. Today, we are seeing signs of renewed awareness of water, as places that were used for shipping become sites for swimming or other leisure activities. The current climate-related transformation of water systems, changes in the frequency and intensity of floods and droughts, shortages of drinking water, and pollution challenge current water systems and require a new holistic approach to water system design, one that recognizes and acknowledges different values and their transformation over time.

In 2018, as part of a Delft Design for Values kick-off grant, we developed a Value Deliberation Methodology concerning the future of port city territories (Hein 2019b). Using a visualization of four different scenarios of port-city interaction, we invited stakeholders from academia and practice to identify relevant values – such as sustainability, safety, efficiency, cooperation or continuity – and discuss the scenarios based on values. Participants were asked to think beyond a specific technological choice and instead discuss underlying values, as figure 4 shows. These discussions aimed at opening up a wider perspective on the topic; the discussions remained academic, but they did help start the work of PortCItyFutures. While productive, this value deliberation did not include the dimension of change over time.



^ Fig. 4 Value deliberation methodology (Source: PortCity-Futures, 2022).

Developing a Value Case Approach for Water Spaces and Practices: Icons, Mapping and SDGs

The value case approach aims to bring together diverse interests and generate shared benefits. Exploring the role of water in society is also a way to test the ecosystemic approach underlying the UN Sustainable Development Goals (SDGs). As figure 5 proposes, if we put water at the center of analysis and explore its climate and energy context, we can classify the SDGs in terms of individual survival and community structures; more broadly, we can explore the values that drive the solutions that have emerged over time and that continue to influence contemporary decision-making (Hein 2022a). As we aim for socially just and sustainable development, we need to identify and address side effects, stimulating potential positive impact and avoiding negative repercussions. Understanding the multiple impacts and side effects of a project beyond its main goal and group of stakeholders can encourage new alliances of stakeholders, including those that are otherwise under represented.

The SDGs provide a framework for reflecting on direct and indirect consequences of water management for various sectors of society and aspects of the environment and the economy.

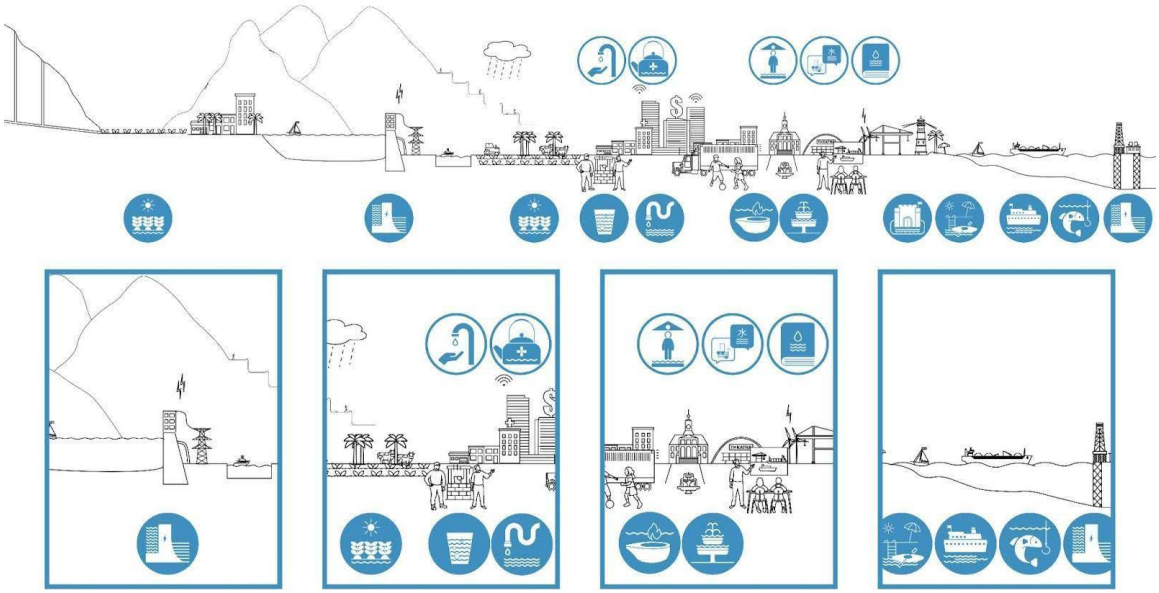


^ Fig. 5 Visualization of the SDGs as an ecosystem through time, with a focus on water. Originally published in figure 4 in *Blue Papers* 2022 (Vol. 1, No. 1), pp. 12–23 (Source: Carola Hein, 2022).

Each of these approaches to water – captured here through the visualization of the SDGs in time – has its own spaces, institutions and practices. For example, for people to use a water body for drinking or swimming, it needs to be accessible – think of beaches, stairs and pontoons. By contrast, a sewage canal can be hidden in underground canals or behind walls. Different uses of water also elicit different types of narratives, education and literature. This separation can be advantageous for decision-makers. Planning a port for large ships is easiest when there are no other water-related needs – no citizens who would like to swim, need to be able to get across the port or who complain about noise or pollution. Depending on how we see and value water, we will include different structures and institutions than if we see it as a partner and part of an ecosystem (Hein 2016).

To facilitate engagement around values pertaining to water and the diverse functions that are related to it, it is important to provide a shared language and set of imaginaries. Together with other researchers in the UNESCO Chair Water, Ports, and Historic Cities (Matteo D'Agostino, Lea Kayrouz, Zuzanna Sliwinska and others) we have developed and tested a set of icons that reflect different types of intangible water practices and tangible spatial patterns of water (Hein et al. 2022). First introduced in 2022, after experimenting in different cultural contexts, we have further refined and detailed the icons (Hein et al. 2025). Visualizing various water functions in space can encourage conversations in line with the value deliberation presented earlier, leading to a better understanding of potentially conflicting water practices in a certain location.

To gain a better understanding of how water uses exist in space, figure 6 shows a section of an abstract landscape with its multitude of natural and cultural conditions and their connection to water. It uses icons that relate to



^ Fig. 6 Visualizing the spatial, social and cultural conditions of water in its tangible and intangible form as a water grammar provides insight regarding water systems' conflicts and opportunities as related to natural landscapes, cultural developments and tangible and intangible practices (Source: Carola Hein; visualization by Lea Kayrouz, 2025).[2]

different uses of water and their location in the landscape to identify potential conflicts and opportunities in water use as well as how these are imagined, including their intersection upstream and downstream. Visualizing water practices through icons can facilitate conversations about conflicts and possible positive or negative externalities among stakeholders, in space or over time. For example, there may be conflicts involving water quality (e.g., drinking water vs. sewage water) or agriculture (e.g., irrigation vs. drinking water), or water flows (e.g., water retention vs. shipping). Whether or not specific activities can reinforce or impede one another changes over time and across space. Comprehensive discussions based on icons can help visualize value conflicts and their transformation over time.

The vignettes on value grammar presented in figure 6 illustrate the proximity and interconnectedness of water in all its forms and visualize interactions and possible conflicts between different ways of using water. For example, the provision of drinking water in a well, the use of water for irrigation, the storage of water in a retention basin or the use of water for energy generation can take place in proximity; they can even reinforce each other. Analyzing both existing and missing connections among various uses and the stakeholders that engage with them forms a basis for developing long-term solutions designed to address multiple problems and fit the intervention context. In several pilot workshops (about 10) with stakeholders from public institutions, NGOs, as well as with private citizens, these value coins have served to facilitate communication and help promote conversations on how we value and think about water systems, including how we value and protect historic systems and heritage. For the first workshops we used icons only

2. This section can be redrawn and further developed in green or red, depending on perceptions by different actors.

to indicate specific functions; more recently, we have used different colors to show that a value has been compromised (red), or has been promoted (green). A structured and consistent assessment of the impact of the workshop remains to be accomplished.

Conclusion

Understanding, analyzing and connecting existing conditions and the opportunities for co-creation and trade-offs through shared values lies at the heart of the value case approach. The method aims at a comprehensive understanding of the development of natural and cultural landscapes and of tangible and intangible practices through time, which in turn helps inform the formulation of long-term strategies in line with an action-oriented, overarching vision and mission. The value case approach in itself is not political, but it aims to equip policymakers with tools for identifying shared values and establishing processes. The aim is to create solutions that connect societal principles with local interests and values, using long-term thinking and context-sensitive planning. This requires a deep understanding of the historical processes that have shaped the current situation, of the relevant constellation of actors, networks and values and of the surrounding ecosystem.

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Carola Hein is Professor History of Architecture and Urban Planning at Delft University of Technology, Professor at Leiden and Erasmus University and UNESCO Chair Water, Ports and Historic Cities. She has published and lectured widely on topics in contemporary and historical architectural, urban and planning history and has tied historical analysis to contemporary development. Among other major grants, she received a Guggenheim and an Alexander von Humboldt fellowship. Her recent books include *Port City Atlas* (2023), *Oil Spaces* (2021), *Urbanisation of the Sea* (2020), *Adaptive Strategies for Water Heritage* (2020), *The Routledge Planning History Handbook* (2018), *Port Cities: Dynamic Landscapes and Global Networks* (2011). Carola is also the leader of the PortCityFutures research group.

Contact: c.m.hein@tudelft.nl