A MULTIFUNCTIONAL ANSWER TO MULTIPLE QUESTIONS

EPILOGUE

When the MIFD project took off in 2012, its general goal was to gain a deeper understanding of multifunctional flood defenses, in order to provide a solid foundation for their design, assessment and management. As a point of departure, it assumed that a new generation of explicitly multifunctional flood defenses was the product of an effort to accommodate competing spatial claims, and perhaps, contribute financial savings by combining functions. Piloting projects like the Scherwerking Boulevard and Hatfijk’s hybrid parking garage complemented an older generation of multifunctional flood defenses, the traditional example being dikes with sheep grazing or arable land atop. The contemporary multifunctional flood defense was viewed as a complex but desirable phenomenon: the answer to multiple needs, and therefore best studied from a multidisciplinary perspective.

What are the lessons learned regarding the design, assessment, and management of multifunctional flood defenses in 2019? Based on this multidisciplinary research? And to what extent does the MIFD program help us to disentangle the various processes associated with such interdisciplinary research efforts? Interdisciplinary research in all forms (ranging from non-committal knowledge-sharing to mandatory integration of parallel research trajectories) is known for its challenges; in particular, paradigmatic confusion between the natural and the social sciences, and the lack of possibilities for academic publication and prestige (Dorier et al., 2018). On the other hand, benefits are found in terms of innovation, greater applicability and societal acclaim.

With its ambitious point of departure—a multidisciplinary approach to a complex subject with a broad scope—the MIFD program started as an academic experiment. It was designed in such a way that disciplinary insights could be integrated into shared case studies that addressed the practical needs of users (this model is known as ‘spatial integration’). The program’s findings were grouped in three sections for this book, each relating to one of the program’s original goals: risk assessment, (risk) assessment and safety knowledge, design and planning, and governance & knowledge transfer.

In the first section, steps were taken towards a risk assessment of multifunctional flood defenses, compared to other multifunctional countermeasures. Chen studied the influence of wave on the safety of buildings and coastal flood defenses, based on experimental studies (shallow-water lab), while Vossen developed a generic method to evaluate the reliability of multi-functional flood defenses (both provide stepping-stones towards reliability analysis). Rosso also investigated the reliability of flood defenses by applying Bayesian network techniques, which have the advantage of clearly visualizing and communicating with users.

Vossenrodt also demonstrated that an integral design of a parking garage and a flood defense is in fact cheaper than two separate designs; however, the true bottleneck is that an integral design also requires integrated maintenance. Aguilar Lopez showed that embedded structures have a significant effect on safety during storm events, both positive and negative. Mächer focused on risks associated with wind turbines on dikes. Results investigated the multiple lines of defense strategy from an economic point of view, and developed new methods to optimize the combination of defense and functions. Nonetheless, an overall perspective on the safety of multifunctional flood defenses remains beyond the scope of this book. In practice, multifunctionality has been realized in an infinite number of combinations, and is therefore hard to model. This should, however, not be considered as an impediment to the implementation of multifunctional flood defenses.

In the planning & design section, virtually all contributions focus on the decision-making process in which all flood risk reduction strategies take shape. How different aspects of this process shape the outcome, like boundary conditions, tools and knowledge regarding future outcomes. Researchers from different academic backgrounds reflected different understandings of planning and design. For example, Vossenrodt emphasized the technical components of design, while Rosso focused on the visual. Both stress the collective action of design work, at least during the exploratory phases of the decision-making process. Design calculations should be conducted by a specialist, although it should not be stated that everything is different from just doing calculations and making a design in a design, all perspectives need to be integrated. Additionally, Van Loon made a plea to take soft mechanisms along the coast in the design of flood risk reduction alternatives. Contributions dealing with planning also reflect different conceptualizations of the same term (Brand considered spatial planning as a driver for multifunctional flood defenses, using the adaptive planning approach). Van Veelen and Van den Berg, on the other hand, addressed temporal aspects of planning, using simulations to study the long-term workings of alternatives, to reduce the probability of possible future look-arounds.

The section on governance & knowledge transfer emphasizes the many obstacles different actors face when trying to collaborate, as well as the importance of perceptions (frames) and awareness of these, as a way to smooth decision making regarding multifunctional flood defenses. Hermans, Matos Cabral, Hogendoorn and Matos Calado argue that MIFD’s are a means to address diverse interests, and as a way to overcome constraints in the decision making process regarding flood safety. Tronk provides links to Brand and Van Veelen’s contributions in the previous section, addressing the issue of coupling flood risk.

Figure 1 (below). Dike along Western Schelde at Elswout-dijk, with green forest, a nature reserve, and recreational functions (image courtesy Rijkswaterstaat, Beeldbank, Jopie van Hoof.)

Figure 2 (page 186). Multifunctional dike—boulevard at Scherwerking under construction in 2014 (image courtesy Rijkswaterstaat, Beeldbank, Harry van Reden.)

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management, and spatial planning, and the opportunities this offers for synchronizing spatial development or interventions for flood risk reduction. Studying knowledge transfer at the Texas, Holland, and Venice exemplifies the importance of trust between actors. Institutions have a direct effect on building and sharing of knowledge (Hoppendorf, 2018).

In addition to a variety of single case studies, the program included two program cases: Rotterdam Roofpark (Dakpark) and a future flood defense strategy for the Houston Galveston Bay Region (Texas). Rotterdam Roofpark had the advantage of being a local, completed project, where the design and decision-making process could be reconstructed and analyzed. The Texas case dealt with international knowledge transfer on a regional scale project, which is still in the planning stages. The advantage of this was that the decision-making and design process for multifunctional flood defenses could be studied as it evolved. The Roofpark is a construction where flood safety, recreation (park) and shopping mall are combined in the same site. The site was designed using visual urban design, structural and frames analysis. This confirmed the role of some independent actors which result in a combination where the shopping mall and the flood defense were ultimately structurally separated for management reasons.

For the Houston Galveston Bay Region, contributions analyzed the role of political values in decision-making, constrained stakeholders inclusive design and governance and planning of flood defenses and spatial adaptation, and investigated how wetlands can contribute in the design of a future strategy. Duport is made a simple analysis of the complex region flood risks issues; the other author analyzed the boundary conditions for the design of a future strategy. Strikingly, while Van Loon concludes that a strategy based on spatial planning could be rewarding given the large amount of pristine wetlands, Brand concludes that the region lacks the proper tools and the political support for such an approach. The Texas case demonstrates not only how challenging the design of a flood defense strategy is, but also how conflicting interests and lack of instruments can obstruct solutions that would otherwise be feasible.

The experience of the MEPPO project, as a multidisciplinary program, confirms some of the obstacles and benefits associated with multidisciplinary research. For example, it was a challenge to find a shared definition for multifunctional flood defense as a concept, as Klothius demonstrated in her contribution on knowledge transfer. On the other hand, Van Loon, Vooren, and Van der Zwaal managed to create a shared classification of multifunctional flood defenses, based on the degree to which functions are integrated. The example of the Rotterdam Roofpark was classified at the lowest level of ‘shared use’ in a separate contribution using a simple structural perspective. Vooren even concludes that it would have been desirable to actually integrate the shopping mall with the flood defense. Management needs to know the separation of functions; it did not benefit the structure’s integrity, nor did it offer the most efficient design in terms of materials and resources. Another result of multidisciplinary research is when different approaches confirm the same findings. For example, the co-play between stakeholders in the design of the Roofpark was confirmed by Rapheal’s visual rhetoric analysis.

Still, the number of multidisciplinary peer-reviewed studies published in 2017 to 2018 supports a trend which demonstrates the challenging nature of multidisciplinary research as Klothius discusses in connection to the Program Cases. For future research efforts, we recommend an independent management budget, cross-discipline, and multi-time frame for experience more researchers to integrate their findings at the end of the programs. PhD candidates can also broaden their perspective by working with users and exchanging ideas about their individual project on a voluntary basis with other researchers. Multidisciplinary programs demand more in terms of management than their single-discipline counterparts, in the first case, just cost analysis is not between parts from different backgrounds. Therefore, key to successful multidisciplinary research is that researchers be allocated independent time budgets to organize and integrate their work.

To conclude, the MEPPO program yielded practical recommendations for the design of multifunctional flood defenses and strategies from a variety of disciplines. Van Loon suggests starting with an early collective design round, after which a specialist can make detailed calculations. Additionally, it is recommended that water authorities should share their long-term spatial plans in order to allow other interested parties to synchronize their plans. This will make it easier for others to function with long-term flood safety plans. Van Loon also warns that, if there is partial implementation or even complete implementation in various cities, it is limited for example, moving from incremental adaptation of existing non-functional areas to strict adaptation to the flood defense. Once a path of investment has been chosen, it is not easy to switch to another.

As the complex nature of multifunctional flood defenses, many questions remain to be studied. Is the multifunctional flood defense a ‘new’ approach in other contexts? Are there long-term management risks that need to be considered? What is the best way to organize management and maintenance, and should a central management approach (as used in apartment buildings) be an efficient solution? Can implementing multifunctional flood defenses contribute to overcoming decision-making obstacles? For example, by reducing real estate towards flood defense area, leading to a long-standing flood safety tradition, and by building alliances that can construct and manage the flood defense itself? And, who is best equipped to communicate with policymakers about multifunctional flood defenses? For example, hydraulic experts who focus on the structure itself or specialists in public administration who focus on the policy?

One thing, however, seems certain: multifunctional flood defenses serve a new demand, both in the Netherlands and abroad. We have clearly seen this in Texas, where the matrix of multifunctionality and co-benefits has entered the popular debate. With the anticipated rise in sea levels and the increased concentration of population in flood-prone cities, we expect to see many more multifunctional flood defenses in the future.