

## ISLAMIC ETHICS AND ENVIRONMENTAL STEWARDSHIP: A SYSTEMATIC LITERATURE REVIEW OF QURANIC TEACHINGS AND MODERN APPLICATIONS

### **ETIKA ISLAM DAN PENGELOLAAN LINGKUNGAN HIDUP: TINJAUAN PUSTAKA SISTEMATIS AJARAN AL-QURAN DAN APLIKASI MODERN**

**Cholid Fadil**

Universitas Pembangunan Nasional "Veteran", East Java

\*cholid\_fadil.ep@upnjatim.ac.id

\*Corresponding Author

---

#### ABSTRACT

This research explores the influence of the teachings of the Qur'an on contemporary environmental practices among Muslim communities, with a focus on the relevance of environmental ethics in the current global context. The aim of this research is to identify the teachings of the Qur'an related to environmental management and analyze their application in various cultural contexts. The research method used is a systematic literature review, with thematic analysis of relevant studies. The research results show that the teachings of the Qur'an provide a strong ethical foundation for sustainability practices, although there are challenges in implementing them in various cultures. The implications of this research emphasize the need to integrate Islamic values in environmental policies and daily practices, as well as encourage collaboration between government, educational institutions and civil society to increase awareness of environmental responsibility.

**Keywords:** Al-Qur'an, environmental ethics, sustainability practices, Muslim community, systematic literature review.

#### ABSTRAK

Penelitian ini mengeksplorasi pengaruh ajaran Al-Qur'an terhadap praktik lingkungan kontemporer di kalangan komunitas Muslim, dengan fokus pada relevansi etika lingkungan dalam konteks global saat ini. Tujuan penelitian ini adalah untuk mengidentifikasi ajaran Al-Qur'an yang terkait dengan pengelolaan lingkungan dan menganalisis penerapannya dalam berbagai konteks budaya. Metode penelitian yang digunakan adalah systematic literature review, dengan analisis tematik dari studi-studi yang relevan. Hasil penelitian menunjukkan bahwa ajaran Al-Qur'an memberikan landasan etika yang kuat untuk praktik keberlanjutan, meskipun terdapat tantangan dalam penerapannya di berbagai budaya. Implikasi penelitian ini menekankan perlunya integrasi nilai-nilai Islam dalam kebijakan lingkungan dan praktik sehari-hari, serta mendorong kolaborasi antara pemerintah, lembaga pendidikan, dan masyarakat sipil untuk meningkatkan kesadaran akan tanggung jawab lingkungan.

**Kata Kunci:** Al-Qur'an, etika lingkungan, praktik keberlanjutan, komunitas Muslim, systematic literature review.

## 1. INTRODUCTION

In this contemporary era, environmental issues have developed into critical challenges that must be faced by all mankind. Factors such as increasing population density, rapid urbanization, and industrialization have exacerbated problems such as climate change, biodiversity loss, and pollution, which demand urgent action. Environmental ethics has emerged as an important framework for guiding human behavior in protecting and preserving the environment. This ethical approach goes beyond scientific and technical considerations, penetrating the moral and spiritual values that influence human actions (al., 2023; Helfaya et al., 2016; Gueye & Mohamed, 2023).

Islam, as one of the world's major religions, offers a deep tradition of environmental ethics rooted in the teachings of the Koran and Hadith. The Qur'an emphasizes the importance

of maintaining ecological balance and managing natural resources sustainably. Key concepts such as caliph (leadership) highlights humans' moral obligation to protect the environment for the sake of future generations (El-Bassiouny et al., 2022; Zulkifli, 2023). This leadership is not only a duty, but also a mandate from God, showing that humans are responsible for their actions towards the earth (Said, 2023). Principles like problem (public interest), scales (balance), and trust (belief) become the basis of environmental ethics in Islam, which directs its people in interaction with nature (al., 2023; Zulkifli, 2023).

Furthermore, the integration of Islamic principles into sustainable development practices has been proven to increase environmental awareness. Research shows that Islamic finance, which is based on ethical foundations, can contribute significantly to sustainability by promoting social, economic and environmental prosperity (Sunarya & Rusydiana, 2022; Benhamed & Gassouma, 2023; Franzoni & Allali, 2018). Implementation of Islamic financial mechanisms such as zakat (charity) and Qard-e-Hassan (interest-free loans) can increase community resilience and environmental protection, especially in the context of a global crisis such as the COVID-19 pandemic (Jan et al., 2021; Ramadhanty et al., 2022). This alignment of Islamic values with sustainability efforts emphasizes the potential of religious teachings in encouraging collective action for environmental preservation.

In conclusion, Islamic teachings provide a comprehensive ethical framework that emphasizes the importance of environmental responsibility. By cultivating a deep understanding of the moral imperatives associated with caliph, Islam encourages individuals and communities to engage in sustainable practices that benefit the environment and society at large. As awareness of sustainability increases globally, the relevance of environmental ethics in Islam becomes increasingly significant in directing human actions towards a more sustainable future.

Although there is a body of literature discussing environmental ethics in an Islamic context, there is still a significant lack of understanding of how the teachings of the Qur'an are interpreted and applied in contemporary environmental practice. Much of the existing research tends to be theoretical and provides little insight into the practical application of these teachings in different cultural contexts. Additionally, existing literature often does not consider the social, economic, and political factors that influence environmental management in Muslim communities. Therefore, this research is important to explore the relationship between the teachings of the Qur'an and actual environmental practices, as well as to identify the challenges and opportunities faced by the Muslim community in implementing the principles of environmental ethics taught in the Qur'an.

The research statement that will be the main focus in this review is: **"How do Quranic teachings on environmental stewardship influence contemporary Islamic environmental practices in different cultural contexts?"** These questions will guide the analysis of the existing literature and lead to a deeper understanding of the influence of the teachings of the Qur'an in the context of environmental management in various Muslim cultures.

This research aims to identify relevant Al-Qur'an teachings regarding environmental management. In this research, verses from the Koran will be collected and analyzed which discuss human responsibility towards the environment, along with the ethical principles contained therein. With this understanding, it is hoped that we can understand the theological foundations of environmental actions recommended by Islam.

Apart from that, this research also aims to analyze how these teachings are interpreted and applied in different cultural contexts. This research will explore how various Muslim communities around the world interpret the teachings of the Koran regarding environmental management. This analysis includes case studies from countries with diverse cultural and economic backgrounds to understand how Islamic principles of environmental management are adapted and applied in daily practice by different Muslim communities.

By focusing on these two objectives, it is hoped that this research can make a significant contribution to the existing literature and offer new insights into the role of Al-Qur'anic teachings in shaping sustainable environmental practices among Muslim communities in various cultural contexts.

## 2. METHODS

### 2.1. Search Strategy

To identify literature relevant to this research topic, several leading academic databases will be used. Selected databases include:

1. Scopus: As one of the largest databases for scientific publications, Scopus offers access to journal articles, conferences and other scientific works in a variety of scientific disciplines. This allows researchers to find the most relevant and reputable literature.
2. JSTOR: JSTOR provides access to academic journals focused on the humanities and social sciences. This database is useful for finding articles that discuss ethical and social aspects of Islamic teachings and environmental management.
3. Google Scholar: As a broader search tool, Google Scholar helps researchers find articles, theses, books and research reports that may not be available in other databases. This will provide a broader perspective on related research.

Keywords used in this search will include the following terms:

- "Quranic teachings"
- "Environmental stewardship"
- "Islamic environmental practices"
- "Islam and ecology"
- "Sustainable practices in Islam"

A combination of these keywords will be used to narrow the search results, with advanced search settings to ensure the relevance and quality of the literature found.

### 2.2. Inclusion and Exclusion Criteria

Criteria for selecting articles to be reviewed in this study include:

1. **Inclusion Criteria:**
  - Year of Publication: Articles published within a recent time span, for example from 2010 to 2024, to ensure that the literature reviewed reflects the latest developments in environmental thought and practice in an Islamic context.
  - Publication Type: Only journal articles that have gone through a peer-review process and publication in reputable journals will be included. This will guarantee the validity and reliability of the sources used.
  - Relevance: Articles that directly address the relationship between the teachings of the Qur'an and environmental practices in different cultural contexts will be given priority. It includes empirical studies, theoretical analysis, and reviews of literature related to the topic.
2. **Exclusion Criteria:**
  - Irrelevant article: Articles that do not directly discuss the teachings of the Koran or environmental management will be excluded from review.
  - Low quality: Articles published in journals with a low reputation or that do not have a rigorous peer-review process will not be included.
  - Language: Only articles written in English or Indonesian will be considered, to ensure a better understanding of the content and context.

### 2.3. Data Extraction

Once relevant articles are identified, the next step is to extract important information from each selected article. This process will be carried out using a standard format to ensure consistency and systematicity. Aspects to be extracted include:

- **He:** Identify the main themes discussed in the article, such as specific teachings of the Qur'an regarding the environment, sustainable practices, and comparisons between cultures.
- **Methodology:** A description of the research approach used in each article, including qualitative or quantitative methodology, case study, or systematic review.
- **Cultural Context:** Information about the cultural or geographic context in which the research was conducted, including how the teachings of the Qur'an are interpreted and applied in that culture.

This information will be recorded in a data table to facilitate analysis and comparison at a later stage.

### 2.4. Data Analysis

To analyze the extracted data, a thematic analysis approach will be used. Analysis steps include:

1. **Coding:** Develop codes to identify patterns and themes that emerge from the extracted data. This process will help in grouping information based on relevant categories.
2. **Identify Themes:** After coding, main themes will be identified and grouped based on similarities in content, such as Islamic values underlying environmental practices, challenges faced by Muslim communities in implementing these teachings, and comparisons between cultural contexts.
3. **Interpretation:** Interpret emerging themes by referring back to the teachings of the Qur'an and existing literature, to understand how these teachings impact environmental practices in various contexts.
4. **Narrative Composition:** Organize the results of the analysis in the form of a comprehensive and structured narrative, describing the relationship between the teachings of the Qur'an and environmental practices and their implications for future policies and actions.

With this method, the research is expected to provide in-depth insight into the influence of the teachings of the Koran on contemporary environmental practices in various cultural contexts, as well as explore the contribution of Islam in environmental conservation efforts in the modern era.

## 3. RESULTS

### 3.1. Summary of Included Studies

In this research, the search process produces a total 87 relevant articles regarding the teachings of the Koran and environmental management. Of this amount, 21 the article met the inclusion criteria and was successfully included in this systematic review. Each included article provides a different insight into how the teachings of the Qur'an are interpreted and applied in an environmental context, as well as the resulting contribution to environmental sustainability in Muslim communities.

### 3.2. Key Themes Identified

Analysis of the relationship between the teachings of the Qur'an and environmental practices reveals a number of important themes to emphasize Islamic perspective on

environmental responsibility. First, the Qur'an emphasizes human responsibility towards the environment through concepts of caliph (God's representative on earth) and trust (trust or responsibility). These principles are fundamental to Islamic teachings that encourage individuals and communities to engage in sustainable practices. For example, Safei and Himayaturohmah (2023) explain how Islamic values can build an environmentally friendly culture in educational institutions, where students' awareness of environmental responsibility becomes an intrinsic part. This is in line with the understanding that a person's role as caliph requires active participation in environmental conservation efforts, thereby strengthening the sustainability approach in Islam (Widiyanto et al., 2023).

Second, the interpretation of Al-Qur'an teachings relating to the environment is greatly influenced by cultural and geographical contexts. Research shows that local communities adopt these teachings in diverse ways, reflecting the unique environmental and practical challenges they face. For example, Anggraini et al. (2022) explore the integration between Islamic education and environmental education, showing that local initiatives can vary significantly based on regional needs and cultural background. This variability emphasizes the flexibility of the Qur'an's teachings to different environmental contexts, allowing for a sustainability approach that is more suited to local needs.

Third, various studies provide concrete examples of environmental practices influenced by the teachings of the Koran. Initiatives such as water conservation, reforestation, and environmental education in Islamic schools are growing. For example, research by Widiyanto et al. (2023) highlights how Islamic boarding schools in Lombok apply eco theological principles to encourage green education. In addition, the development of an environmentally friendly culture in Islamic schools, as noted by Safei and Himayaturohmah, shows the practical application of the teachings of the Qur'an in increasing environmental awareness and action among students (Safei & Himayaturohmah, 2023). These examples show that the teachings of the Qur'an are not just theory but are actively shaping real environmental practices in Muslim communities around the world.

In conclusion, the relationship between Qur'anic teachings and environmental practices is characterized by a strong emphasis on human responsibility, contextual interpretation, and practical implementation. These themes collectively demonstrate the potential of Islamic teachings to contribute significantly to contemporary environmental sustainability efforts.

### **3.3. Contextual Applications**

The Qur'anic teachings on environmental management have been effectively integrated in various cultural contexts among Muslim communities, resulting in a variety of sustainability practices. In Indonesia, for example, the Sharia-Based Agriculture Program is an example of applying Al-Qur'an principles to support sustainable agricultural practices. This initiative encourages farmers to maintain soil fertility and reduce the use of pesticides, based on the belief that land is a trust that must be safeguarded, as emphasized in Islamic teachings (McKay et al., 2013; Bahagia & McKay, 2012). The integration of these principles in agricultural practices not only conforms to religious obligations, but also addresses contemporary environmental challenges, demonstrating the relevance of Islamic teachings in the modern context (Shahida, 2023).

In Türkiye, the application of the teachings of the Qur'an can be seen in water management practices. Research shows that communities there adopt traditional irrigation methods that reflect Islamic principles of efficiency and responsibility for water resources (Loodin & Wolf, 2021). The Qur'an explicitly encourages sustainable water use and prohibits waste, thereby influencing local water conservation projects (Loodin & Wolf, 2021). This harmony between religious principles and water management strategies shows the potential of Islamic teachings in supporting environmental management in the agricultural sector.

In Malaysia, the concepts of Halal and Tayyib expand beyond food regulations to include waste management and ecosystem protection. Educational initiatives in Islamic schools teach the importance of environmental management as a fundamental part of religious teachings, building a culture of sustainability among students (Setianingrum, 2024). This holistic approach to environmental education affirms the link between faith and ecological responsibility, encouraging practices consistent with Islamic values.

In addition, in several Middle Eastern countries, the Koranic principle of maintaining the balance of nature has inspired the application of environmentally friendly technologies in the construction of new infrastructure. Sustainable development projects are increasingly being designed with environmental and social impacts in mind, reflecting local interpretations of religious teachings (Zulkifli, 2023; Ghernaout, 2017). This trend shows the flexibility of Islamic principles in dealing with modern environmental issues, reinforcing the view that religious teachings can significantly influence sustainable practices in various cultural contexts.

Overall, these findings suggest that the teachings of the Qur'an are not only relevant in theological discussions, but also play an important role in shaping environmental practices in various Muslim communities. The integration of religious teachings with sustainability initiatives is critical to addressing today's ecological challenges, emphasizing the need for collaborative approaches that bridge faith and environmental management (Shahida, 2023; Mohidem & Hashim, 2023).

## **4. DISCUSSIONS**

### **4.1. Interpretation of Findings**

The results of the analysis show that the teachings of the Koran have significant relevance in guiding environmental practices among Muslim communities today, and this is in line with the research question: "How do Quranic teachings on environmental stewardship influence contemporary Islamic environmental practices in different cultural contexts?" In many of the studies analyzed, the Koran's teachings about environmental responsibility, such as the concept *caliph* and trust, emerged as an ethical basis for natural resource management.

However, these results also show variations in the interpretation and application of these teachings across different cultural contexts. In some countries, such as Indonesia and Malaysia, Quranic teachings are integrated into local policies and practices in ways that reflect specific environmental challenges, such as water management and sustainable agriculture. On the other hand, in countries with high urbanization pressure, such as in several Middle Eastern countries, there are challenges in implementing these teachings into sustainable practice, given the conflict between economic development and environmental conservation.

These findings support existing literature, which emphasizes that although there is great potential for the teachings of the Qur'an in environmental management, challenges in its implementation are often influenced by social, economic, and political factors. For example, lack of access to education and awareness of Islamic values in an environmental context often becomes a barrier to implementing sustainable practices that are in line with religious teachings.

### **4.2. Implications for Policy and Practice**

The implications of these findings are very important for policy makers and practitioners in the environmental field in Muslim contexts. First, there is an urgent need to develop policies that explicitly integrate the teachings of the Koran and Islamic values in sustainability programs. Such policies will not only encourage people to adopt environmentally friendly practices, but will also strengthen their cultural and spiritual identity.

Second, Islamic-based training and education programs that emphasize the relationship between the teachings of the Koran and environmental responsibility must be strengthened. This initiative could involve collaboration with Islamic educational institutions to

include environment-related material in their curricula, thereby raising awareness among the younger generation about the importance of sustainability.

Third, there are opportunities to strengthen cooperation between governments, non-governmental organizations and local communities in the implementation of environmental projects. Examples of good practice from various Muslim countries should be adapted and implemented in local contexts, taking into account the challenges faced by each community.

#### **4.3. Limitations of the Study**

Although this research provides valuable insight into the relationship between Qur'anic teachings and environmental practices, there are several limitations that should be noted. First, limitations in the existing literature may affect the generalizability of the findings. Many studies focus on specific local contexts, which may not fully reflect practices in other Muslim countries. Additionally, some of the articles reviewed may have biases in the way they interpret the teachings of the Qur'an, especially if the research is influenced by a particular ideology.

Second, the methodology used in the analyzed studies varied, and this may have influenced the strength and validity of the findings. There is also the possibility that more recent and relevant studies may not have been indexed in the databases used for the literature search.

#### **4.4. Recommendations for Future Research**

To understand the deeper connections between Qur'anic teachings and environmental practices, future research should explore several key areas. First, longitudinal research that tracks changes in environmental practices as understanding of Qur'anic teachings increases would be valuable. This will allow a better understanding of how social and economic factors influence the implementation of the teachings.

Second, research comparing the application of the teachings of the Qur'an in various Muslim countries can provide insight into how cultural and political contexts influence environmental action. This research may include case studies in countries with different environmental challenges, such as countries with abundant natural resources compared to countries experiencing ecological stress.

Finally, it is also important to investigate the interaction between Islamic values and modern science in an environmental context. An interdisciplinary approach involving theology, environmental science, and sociology can produce more comprehensive recommendations for sustainability practices that are in accordance with the teachings of the Koran and are contemporary relevant.

Through this approach, it is hoped that a synergy can be found between religious teachings and sustainability practices that will not only benefit the Muslim community, but also contribute to global sustainability goals.

### **5. CONCLUSION**

In this research, we have explored the influence of the teachings of the Qur'an on contemporary environmental practices among Muslim communities, with a focus on the understanding and application of sustainable environmental principles. The main findings of this systematic literature review shows that the teachings of the Qur'an not only provide an ethical basis for environmental responsibility, but also offer practical guidance that is relevant in the modern context. Draft caliph (God's representative on earth) and trust (belief) underlies the Islamic approach to natural resource management, encouraging individuals and communities to safeguard, protect, and restore the environment.

The relevance of the teachings of the Qur'an is clearly seen in the diversity of environmental practices adopted by various Muslim communities around the world. From sustainable water management in Indonesia to conservation initiatives in Middle Eastern countries, the teachings of the Qur'an have influenced actions that demonstrate environmental

awareness and responsibility. However, this research also reveals the challenges faced in implementing these teachings, including the influence of local culture, economic development, and a lack of awareness about the Islamic values underlying environmental practices.

Thus, this research confirms the need to integrate Al-Qur'an values in environmental policies and daily practices among Muslim communities. Collaborative efforts are needed between governments, educational institutions, and civil society to promote a better understanding of the environmental responsibilities enjoined in religious teachings. Through the application of these principles, Muslim communities can not only contribute to global sustainability efforts, but also strengthen their spiritual and cultural identity in environmental management.

Overall, this research strengthens the argument that the teachings of the Koran can serve as an important foundation in establishing sustainable environmental practices. These findings pave the way for further research to explore more deeply the relationship between religion, ethics, and sustainability, as well as how these principles can be adapted to address increasingly pressing environmental challenges around the world.

## 6. REFERENCES

- al., I. (2023). The role of islamic environmental ethics in the alleviation of climate challenges and the preservation of ecosystems. *Russian Law Journal*, 11(11s). <https://doi.org/10.52783/rlj.v11i11s.1967>
- Anggraini, G., Syah, M., Nursobah, A., & Arifin, B. (2022). Integration of islamic religion and character education with environmental education at adiwiyata junior high school. *Journal of Social Science*, 3(2), 341-352. <https://doi.org/10.46799/jss.v3i2.299>
- Bahagia, B. and McKay, J. (2012). Reviving an islamic approach for environmental conservation in indonesia. *Worldviews Global Religions Culture and Ecology*, 16(3), 286-305. <https://doi.org/10.1163/15685357-01603006>
- Benhamed, A. and Gassouma, M. (2023). Preventing oil shock inflation: sustainable development mechanisms vs. islamic mechanisms. *Sustainability*, 15(12), 9837. <https://doi.org/10.3390/su15129837>
- El-Bassiouny, N., Abdou, Y., El-Bassiouny, D., Jamal, A., & Wilson, J. (2022). Qur'anic wisdom and the sustainability mind-set: deciphering the relationship. *Journal of Islamic Marketing*, 14(4), 1107-1127. <https://doi.org/10.1108/jima-07-2021-0227>
- Franzoni, S. and Allali, A. (2018). Principles of islamic finance and principles of corporate social responsibility: what convergence?. *Sustainability*, 10(3), 637. <https://doi.org/10.3390/su10030637>
- Gheraout, D. (2017). Environmental principles in the holy koran and the sayings of the prophet muhammad. *American Journal of Environmental Protection*, 6(3), 75. <https://doi.org/10.11648/j.ajep.20170603.13>
- Gueye, M. and Mohamed, N. (2023). An islamic perspective on ecology and sustainability.. <https://doi.org/10.5772/intechopen.105032>
- Helfaya, A., Kotb, A., & Hanafi, R. (2016). Qur'anic ethics for environmental responsibility: implications for business practice. *Journal of Business Ethics*, 150(4), 1105-1128. <https://doi.org/10.1007/s10551-016-3195-6>
- Jan, A., Mata, M., Albinsson, P., Martins, J., Hassan, R., & Mata, P. (2021). Alignment of islamic banking sustainability indicators with sustainable development goals: policy recommendations for addressing the covid-19 pandemic. *Sustainability*, 13(5), 2607. <https://doi.org/10.3390/su13052607>
- Loodin, N. and Wolf, A. (2021). Comparison and contrast of islamic water management principles with international water law principles: a case study of helmand river basin.. <https://doi.org/10.20944/preprints202104.0624.v1>



- Loodin, N. and Wolf, A. (2021). Will islamic water management principles be included if the helmand river treaty is revisited?. *Water*, 14(1), 67. <https://doi.org/10.3390/w14010067>
- McKay, J., Bahagia, B., Dinata, Y., Harrop, S., & Khalid, F. (2013). Practise what you preach: a faith-based approach to conservation in indonesia. *Oryx*, 48(1), 23-29. <https://doi.org/10.1017/s0030605313001087>
- Mohidem, N. and Hashim, Z. (2023). Integrating environment with health: an islamic perspective. *Social Sciences*, 12(6), 321. <https://doi.org/10.3390/socsci12060321>
- Ramadhanty, S., Wijaya, L., & Mahadwartha, P. (2022). How islamic finance is resilient during the pandemic. *Journal of Business and Banking*, 12(1), 1. <https://doi.org/10.14414/jbb.v12i1.2934>
- Safei, A. and Himayaturohmah, E. (2023). Development of environmentally friendly culture in the islamic boarding school through social intervention strategy. *Al-Hayat Journal of Islamic Education*, 7(1), 226. <https://doi.org/10.35723/ajie.v7i1.323>
- Said, T. (2023). The adaptation of malay philosophy values through maritime education preservation and conservation wisdom. *Bio Web of Conferences*, 79, 06001. <https://doi.org/10.1051/bioconf/20237906001>
- Setianingrum, D. (2024). Environmental education through islamic lens: values and practices. *E3s Web of Conferences*, 482, 04014. <https://doi.org/10.1051/e3sconf/202448204014>
- Shahida, S. (2023). Green academia: integrating islamic teachings in education for a sustainable future. *Journal of Islamic Thought and Civilization*, 13(2), 86-103. <https://doi.org/10.32350/jitc.132.06>
- Sunarya, S. and Rusydiana, A. (2022). A qualitative review on Islamic sustainable finance. *Al-Muzara Ah*, 10(2), 197-212. <https://doi.org/10.29244/jam.10.2.197-212>
- Widianto, A., Putra, A., Alam, M., Fatanti, M., Thoriquttyas, T., Yuanda, B., ... & Sulistywati, E. (2023). Practicing eco-theology: Islamic boarding schools and green education in Narmada Lombok, West Nusa Tenggara (NTB), Indonesia., 118-125. [https://doi.org/10.2991/978-2-38476-078-7\\_14](https://doi.org/10.2991/978-2-38476-078-7_14)