

## **Application of the Analytic Hierarchy Process for Solving Social “Wicked Problems”: Keynote and Plenary Sessions from the 2022 International Symposium of the AHP**

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It is my pleasure to be guest editor for the special topics section of the International Symposium of the Analytic Hierarchy Process (ISAHP2022). Peer-reviewed papers from this symposium will be published in *IJAHP* in the special topics section of this issue and following issues as they become accepted for publication. In listening to the speakers at the 2022 International Symposium of the Analytic Hierarchy Process, it became clear how many of society’s problems are “wicked” and in need of a rigorous process whereby they can be disaggregated and discussed without involving stakeholders’ emotions. Many of the social challenges that the world faces today are “wicked problems” as defined by Camillus (2016). The term "wicked problem" was coined by Rittel and Webber (1973). It refers to complex and ill-structured problems that are difficult to define, have multiple interrelated causes and effects, and often lack a clear solution. Understanding wicked problems is crucial, as they often involve issues related to sustainability, environmental, social and governance (ESG) concerns, and conflict resolution. Wicked problems are characterized by several key attributes that make them particularly challenging to solve. These attributes are as follows:

**Complexity:** Wicked problems are inherently complex, often involving numerous interconnected factors and variables. These factors can be social, economic, political, environmental, etc. The complexity arises from the dynamic relationships between these elements.

**No Clear Solution:** Unlike "tame" problems that have well-defined and straightforward solutions, wicked problems lack clear solutions. Multiple perspectives and potential solutions may coexist, making it difficult to identify a single correct answer.

**No End Point:** Wicked problems often do not have a clear endpoint or resolution. They persist over time, and solutions may need to evolve as circumstances change.

**Symptoms vs. Causes:** Identifying the root causes of a wicked problem can be challenging because the problem's symptoms may be more visible and immediate. Addressing symptoms without addressing underlying causes can lead to ineffective solutions.

**Stakeholder Diversity:** Wicked problems typically involve a wide range of stakeholders with diverse interests, values, and viewpoints. Managing these stakeholders and reconciling their conflicting perspectives can be a significant challenge.

**Uncertainty and Ambiguity:** Wicked problems are characterized by a high degree of uncertainty and ambiguity. Information may be incomplete, and the future consequences of potential solutions are often unclear.

**Continuous Learning:** Solving wicked problems often requires a process of continuous learning and adaptation. Solutions must be flexible and responsive to changing circumstances and feedback from stakeholders.

**Unique Context:** Each wicked problem is unique and influenced by its specific context and history, what works in one situation may not apply directly to another.

**Ethical Considerations:** Ethical considerations often play a central role in wicked problems, as decisions can have significant ethical implications. Balancing competing ethical principles can be complex.

**Policy Resistance:** Efforts to address wicked problems can sometimes face resistance from existing policies, structures, or vested interests that perpetuate the problem.

These characteristics make wicked problems particularly challenging to tackle, and require approaches that are adaptive, inclusive of diverse perspectives, and capable of dealing with ongoing uncertainty and complexity. Understanding these characteristics is crucial when addressing complex issues related to conflict resolution, risk, prioritization in highly sensitive situations, and planning. While the organizing team of the 2022 International Symposium of the Analytic Hierarchy Process (ISAHP) may not have been thinking in terms of wicked problems, it is clear to me that the keynote and plenary speakers have demonstrated how the Analytic Hierarchy Process (AHP) and its generalized approach, the Analytic Network Process (ANP), can be used to address many social “wicked problems”.

The keynote speech and three plenary session summaries that follow address different aspects of decision making and problem solving in the context of social “wicked problems”. These are complex, multi-dimensional problems that are difficult to define and solve, and require a collaborative and interdisciplinary approach.

The keynote featured Dr. Amos Guiora who presented his work on trying to solve the Israeli- Palestinian conflict. Given the recent increase in aggression and tension between the two parties, this is a particularly important topic. Dr. Guiora’s work using the AHP in the context of the peace process provides insights into how the AHP can be used to address wicked problems. The AHP provides a structured approach to decision-making that can help break complex problems down into smaller, more manageable parts. This can be particularly useful in the context of conflicts, which are often multi-dimensional and involve multiple stakeholders with conflicting interests and values. By breaking down complex problems into smaller parts, the AHP can help identify areas of agreement and disagreement, which can help move negotiations forward (Saaty, Zoffer, Vargas, & Guiora, 2022). Additionally, the AHP process can help build trust and understanding between parties, which is critical in the context of wicked problems where there may be deep-seated cultural or religious differences. Overall, Dr. Guiora’s work using the AHP provides a valuable example of how structured decision-making processes can be used to address wicked problems and move towards mutually beneficial solutions.

The plenary sessions featured the role of data and analytics in addressing social problems in a variety of contexts which, taken together, provide valuable insights into the

challenges and opportunities of decision making and problem solving in the context of social "wicked problems". They highlight the importance of a values-based approach, effective communication and stakeholder engagement, interdisciplinary collaboration, and the use of data and analytics to inform decision making. By bringing these different perspectives together, they provide a comprehensive and nuanced understanding of the complex issues involved in addressing social problems, and offer valuable guidance for researchers and practitioners working in this field.

**Keynote: Conflict resolution**

Dr. Amos Guiora, the keynote speaker at the 2022 International Symposium of the Analytic Hierarchy Process, shared his extensive experience in the implementation of the Oslo peace process and how, in subsequent years, the AHP was used to facilitate the negotiations. The AHP is a decision-making tool that helps individuals and groups make complex decisions by breaking them down into smaller, more manageable parts. Dr. Guiora discussed how the AHP was used to prioritize the concessions that each party was willing to make, which helped move the negotiations forward. He emphasized the importance of having people who know what they are talking about and how social interactions between parties can help build trust and understanding.

The application of the AHP is not limited to the context of conflict resolution in the Middle East. The AHP has been used in a variety of contexts, including environmental management, healthcare, and transportation planning. In environmental management, the AHP has been used to calculate the perception of the willingness to pay of areas of high ecological value (e.g. Wattage & Mardle, 2008). In healthcare, the AHP has been used to prioritize patient needs and allocate resources (Büyükožkan, Çifçi, & Güleriyüz, 2011). In transportation planning, AHP has been used to prioritize infrastructure projects and identify areas of high traffic congestion (Raza et al., 2022).

The use of the AHP in the context of conflict resolution has the potential to improve the negotiation process by providing a structured approach to decision-making. By breaking complex decisions down into smaller, more manageable parts, the AHP can help parties identify areas of agreement and disagreement, which can help to move negotiations forward. Additionally, the AHP can help ensure that all parties have a voice in the decision-making process, which can build trust and understanding.

Based on the discussion by Dr. Guiora, several opportunities and challenges with using the AHP in conflict resolution were highlighted. One opportunity is that the AHP provides a structured approach to decision-making, which can help parties identify areas of agreement and disagreement. By breaking down complex decisions into smaller, more manageable parts, the AHP can help parties prioritize their goals and identify potential trade-offs. Another opportunity is that the AHP can help build trust and understanding between parties. By providing a transparent and objective decision-making process, the AHP can help reduce the perception of bias and ensure that all parties are heard. Additionally, the social aspect of the AHP process can help build relationships between parties, which can help to improve communication and reduce tensions. However, there

are also several challenges with using the AHP in conflict resolution. One challenge is that the process can be time-consuming and resource-intensive. Negotiations can take years to complete, and the AHP process requires significant time and effort from all parties involved. Additionally, the AHP process requires a high level of expertise, which may not be available in all conflict resolution contexts. Another challenge is that the AHP process may not be suitable for all types of conflicts. The AHP is best suited for conflicts where there are clear goals and objectives and willingness to compromise. In conflicts with a high level of emotion or where deep-seated cultural or religious differences exist, the AHP process may not be effective. Overall, while there are opportunities and challenges that exist with using the AHP in conflict resolution, it has the potential to provide a structured and transparent approach to decision-making that can help parties reach mutually beneficial agreements.

### **Plenary 1: Transplant patient selection**

Dr. James Alcorn's talk focused on the use of the AHP for transplant patient selection and the process of developing the models. He explained that the AHP was used to develop a new organ allocation policy that prioritizes patient outcomes and access to transplantation (e.g. Stewart, Wood, Alcorn, Lease, Hayes, Hauber, & Goff, 2021; Gragert, Kadatz, Alcorn, Stewart, Chang, Gill, Liwski, Gebel, Gill, & Lan, 2022). The AHP was used to identify criteria for patient selection, including wait-list mortality (the likelihood of dying while waiting), post-transplant outcomes, access, and efficiency. The AHP was also used to develop a scoring system that assigns weights to each criterion, which is used to rank patients on the waiting list.

Dr. Alcorn emphasized the importance of transparency in the development of public policy and how the AHP helped achieve this. He explained that the team working on the project held a "traveling roadshow" to teach people about the AHP and transplantation, as well as offered online courses and virtual town halls. They needed to get buy-in from the community on the methodology, which was new to many clinicians. By involving the community in the development of the policy, they were able to build trust and ensure that the policy was fair and equitable.

Dr. Alcorn's speech highlighted the importance of using the AHP in developing organ allocation policies that prioritize patient outcomes and access to transplantation, and the importance of transparency in the development of public policy. His talk suggested that the AHP has potential applications in other risk assessment contexts beyond organ allocation, and that its ability to prioritize multiple criteria and involve stakeholders in the decision-making process makes it a valuable tool for developing policies that are transparent, equitable, and effective.

### **Plenary 2: Disaster management**

Dr. Madhury (Didi) Ray discussed the use of the AHP in risk assessment in New York City. She explained that disaster risk is a new concept in the field of disaster management and that the measurement of disaster risk is still undefined. Dr. Ray also mentioned that the AHP method was used by the World Health Organization for their emerging

infectious disease blueprint. She went on to describe how the AHP was used in New York City's risk assessment and the unique features that resulted from this approach (Ray, Tornello, Pickart, Stripling, Ali, & Vargas, 2023).

One of the key takeaways from Dr. Ray's presentation is the importance of risk perception in the AHP approach. Unlike other risk assessment methods that rely heavily on quantitative and geographic elements, the AHP approach places a strong emphasis on community expertise and perception. This allows for a more nuanced understanding of risk and can help identify potential blind spots in traditional risk assessment methods. The AHP approach used in New York City's risk assessment can also be applied in other risk assessment contexts. For example, it could be used to assess the risk of natural disasters in other cities or to evaluate the risk of emerging infectious diseases in different regions. The AHP approach may also be used to assess the risk of other types of disasters, such as cyber-attacks or terrorist attacks. By incorporating community expertise and perception into the risk assessment process, the AHP approach can help identify potential risks that may be overlooked by traditional risk assessment methods.

Overall, Dr. Ray's presentation highlighted the importance of the AHP approach in the field of emergency management and the potential applications in other risk assessment contexts. By incorporating community expertise and perception into the risk assessment process, the AHP approach can help identify potential risks and improve disaster preparedness and response. Additionally, the AHP approach can help identify potential risks that may be overlooked by traditional risk assessment methods, which can improve disaster preparedness and response.

### **Plenary 3: Strategic planning and decision making in higher education**

The final plenary session at the 2022 International Symposium of the Analytic Hierarchy Process featured Dr. Nina Begicevic Redjep, who discussed the use of the AHP and the ANP for strategic planning and decision making in higher education. Dr. Redjep explained how the AHP and ANP can be used to bring rationality to academic and teaching programs, and how these techniques can be applied to other areas of risk assessment. She discussed the challenges of implementing these techniques in decision making and shared her experience implementing the AHP and ANP at various universities and institutions. The AHP and ANP are powerful decision-making tools that can be applied to a wide range of contexts, including risk assessment in higher education (Lacković, Redjep, & Sprčić, 2023). By breaking down complex decisions into smaller, more manageable parts, the AHP and ANP can help decision makers identify the most important factors and make more informed decisions. In the context of risk assessment, the AHP and ANP can be used to identify and prioritize risks, evaluate the effectiveness of risk mitigation strategies, and allocate resources to minimize risk.

Dr. Redjep emphasized the importance of crisis leadership and crisis management in the context of the COVID-19 pandemic and highlighted the need for higher education institutions to perform digital transformation in a decisive way. She discussed the challenges of implementing the AHP and ANP in decision making, and shared her

experience using these techniques to bring rationality to decision making in higher education. Dr. Redjep also discussed the importance of a supportive organizational culture in higher education institutions and the need for decision making and strategic planning to be based on well-known and proven methodologies. She highlighted the role of learning analytics, artificial intelligence, and machine learning in analyzing student learning and customizing learning approaches for students.

Finally, Dr. Redjep provided valuable insights into the challenges and opportunities of strategic planning and decision making in the context of the COVID-19 pandemic and the need for digital transformation in higher education. The talk highlighted the importance of crisis leadership, supportive organizational culture, and the use of well-known and proven methodologies in decision making and strategic planning. The transcript of this talk is a useful resource for researchers and practitioners in the field of higher education, as well as for those working in other contexts where digital transformation and strategic planning are critical.

### **Conclusions**

The four speakers at the 2022 International Symposium of the Analytic Hierarchy Process addressed different aspects of decision making and problem solving in the context of social “wicked problems”. These are complex, multi-dimensional problems that are difficult to define and solve, and require a collaborative and interdisciplinary approach. The keynote highlighted the importance of ethical decision making in the context of national security. All of the speakers stressed the need for a values-based approach to decision making and highlighted the importance of transparency, accountability, and collaboration in addressing complex social problems. They discussed the challenges and benefits of using the AHP and ANP to bring rationality to decision making, and highlighted the importance of effective communication and stakeholder engagement in the implementation of these techniques.

Taken together, these four speakers provide valuable insights into the challenges and opportunities of decision making and problem solving in the context of social “wicked problems”. They emphasized the importance of a values-based approach, effective communication and stakeholder engagement, interdisciplinary collaboration, and the use of data and analytics to inform decision making. These different perspectives provide a comprehensive and nuanced understanding of the complex issues involved in addressing social problems and offer valuable guidance for researchers and practitioners when faced with complex decisions.

I hope that you find the ISAHP2022 articles published in the special topics section of this issue and in following issues useful and good references to show how the AHP can not only handle theoretical and methodological issues but more importantly, address social “wicked problems” in an ever changing world.

## REFERENCES

Büyüközkan, G., Çifçi, G., & Güteryüz, S. (2011). Strategic analysis of healthcare service quality using fuzzy AHP methodology. *Expert Systems with Applications*, 38(8), 9407-9424. Doi: <http://dx.doi.org/10.1016/j.eswa.2011.01.103>

Camillus, J. C. (2016). *Wicked strategies: How companies conquer complexity and confound competitors*. Toronto: University of Toronto Press. Doi: <http://dx.doi.org/10.3138/9781442624054>

Gragert, L., Kadatz, M., Alcorn, J., Stewart, D., Chang, D., Gill, J., Liwski, R., Gebel, H.M., Gill, J., & Lan, J. H. (2022). ABO-adjusted calculated panel reactive antibody (cPRA): A unified metric for immunologic compatibility in kidney transplantation. *American Journal of Transplantation*, 22(12), 3093-3100. Doi: <http://dx.doi.org/10.1111/ajt.17175>

Lacković, I. D., Ređep, N. B., & Sprčić, D. M. (2023). Strategic risk management in higher education institutions: Integrated risk analysis and the AHP approach. In *EDULEARN23 Proceedings* (pp. 665-670). IATED. Doi: <http://dx.doi.org/10.21125/edulearn.2023.0270>

Ray, M., Tornello, A. R., Pickart, F., Stripling, M., Ali, M., & Vargas, L. G. (2023). A jurisdictional risk assessment for the whole community: A new, systematic approach to participatory decision-making in public health emergency preparedness using the analytic hierarchy process. *Journal of Multi-Criteria Decision Analysis* (2023), 1-33. Doi: <https://doi.org/10.1002/mcda.1820>

Raza, A., Ali, M. U., Ullah, U., Fayaz, M., Alvi, M. J., Kallu, K. D., ... & Nengroo, S. H. (2022). Evaluation of a sustainable urban transportation system in terms of traffic congestion—A case study in Taxila, Pakistan. *Sustainability*, 14(19), 12325. Doi: <http://dx.doi.org/10.3390/su141912325>

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155-169. Doi: <http://dx.doi.org/10.1007/bf01405730>

Saaty, T. L., Zoffer, H. J., Vargas, L. G., & Guiora, A. (2022). *Overcoming the retributive nature of the Israeli-Palestinian conflict*. Springer International Publishing. Doi: <http://dx.doi.org/10.1007/978-3-030-83958-1>

Stewart, D. E., Wood, D. W., Alcorn, J. B., Lease, E. D., Hayes, M., Hauber, B., & Goff, R. E. (2021). A revealed preference analysis to develop composite scores approximating lung allocation policy in the US. *BMC Medical Informatics and Decision Making*, 21(1), 1-11. Doi: <http://dx.doi.org/10.1186/s12911-020-01377-7>

Wattage, P., & Mardle, S. (2008). Total economic value of wetland conservation in Sri Lanka identifying use and non-use values. *Wetlands Ecology and Management*, 16, 359-369. Doi: <http://dx.doi.org/10.1007/s11273-007-9073-3>