AFREEN SIDDIQI

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PROFESSIONAL INTERESTS

Sustainability, remote sensing, systems analysis, systems engineering, infrastructure systems, natural resource policy, aerospace systems, mechanical engineering

EDUCATION

2003-2006	Ph.D. Aerospace Systems	Massachusetts Institute of Technology (MIT)
1999-2001	S.M. Aeronautics and Astronautics	Massachusetts Institute of Technology (MIT)
1995-1999	S.B. Mechanical Engineering	Massachusetts Institute of Technology (MIT)

PROFESSIONAL EXPERIENCE

2019-	Research Scientist III, Department of Aeronautics and Astronautics, MIT
2018-2023	Adjunct Lecturer, Harvard Kennedy School (HKS)
2015-2018	Research Scientist, Institute for Data, Systems, and Society, MIT
2011-2017	Visiting Scholar, Belfer Center for Science & International Affairs, HKS
2009-2015	Research Scientist, Engineering Systems Division, MIT
2006-2009	Postdoctoral Research Associate, MIT
2002-2003	Software Engineer, National Instruments
2001-2002	Applications Engineer, National Instruments

SELECTED PROFESSIONAL ENGAGEMENTS

- Contributing Author, IPCC sixth assessment report (AR6) Working Group II. 2021 [url]
- Consultant for Working Group on Climate Change Action and Sustainability of Natural Resources, in the United National Committee of Experts on Public Administration (UN-CEPA), 2021 [url]
- Invited Expert, Indus River basin technical experts and policy knowledge forum (2018, 2019) [url]
- Invited for dialogue on *Science Needs for SDG implementation*, German Committee FutureEarth (2016)
- Invited roundtable panelist and speaker –Georgetown University-Qatar, Doha (2018)

Full details in Annex - V

RESEARCH PUBLICATIONS

Over 120 technical publications (with > 3580 citations) including refereed journal articles, refereed conference papers, book chapters, encyclopedia articles, technical reports, and briefs.

Full list in Annex-I (page 6)

SELECTED PAPERS IN REFEREED JOURNALS (inverse chronological order)

Siddiqi, A., Wescoat Jr, J.L. and Selin, N.E., 2024. Evolution of system connectivity to support food production in the Indus Basin in Pakistan. ***Proceedings of the National Academy of Sciences (PNAS)***, *121*(18), p.e2215682121. (2024). [url]

Giang, A., Edwards, M.R., Fletcher, S.M., Gardner-Frolick, R., Gryba, R., Mathias, J.D., Venier-Cambron, C., Anderies, J.M., Berglund, E., Carley, S. and Erickson, J.S., Grubert, E., Hadjimichael, A., Hill, J., Mayfield, E.,

Nock, D., Pikok, K., Saari, R. K., Lezcano, M. S., **Siddiqi, A.,** Skerker, J. B., Tessum, C. W., 2024. Equity and modeling in sustainability science: Examples and opportunities throughout the process. ***Proceedings of the National Academy of Sciences (PNAS),*** *121*(13), p.e2215688121. (2024) [url]

Lombardo, S., Kinney, J., Blake, D., Chase, S., Stovall, A., **Siddiqi, A.,** Arquilla, K., Israel, S., Wood, D., de Weck, O.L., "Accessible Satellite Data Decision Support Systems for Yoruk Time Forest Management", **Acta Astronautica**, Vol. 213, pp 777-791 (2023). [url]

Stern, J., **Siddiqi, A.,** and Grogan, P., 2023. Effects of individual strategies for resource access on collaboratively maintained irrigation infrastructure, DOI: 10.1002/sys.21701. ***Systems Engineering*** [url]

Vinca, A., Parkinson, S., Riahi, K., Byers, E., **Siddiqi, A**., Muhammad, A., Ilyas, A., Yogeswaran, N., Willaarts, B., Magnuszewski, P. and Awais, M., 2021. Transboundary cooperation a potential route to sustainable development in the Indus basin. ***Nature Sustainability***, *4*(4), pp.331-339. [url]

Siddiqi, A., Rebentisch, E., Dorchuck, S., Imanishi, Y. and Tanimichi, T., (2020). Optimizing Architecture Transitions Using Decision Networks. ***Journal of Mechanical Design***, *142*(12), p.121702. [url]

Siddiqi, A., Haraguchi, M. and Narayanamurti, V., 2020. Urban waste to energy recovery assessment simulations for developing countries. ***World Development***, *131*, p.104949. [url]

Siddiqi, A., Wescoat, J., and Muhammad, A., (2018) "Conjoint quantitative analysis of equity and reliability for socio-hydrological assessment of water security in surface irrigation sys.",***Water Security,***4-5:44-55[url]

SELECTED REFEREED CONFERENCE PROCEEDINGS AND BOOK CHAPTERS

Siddiqi, A., Milton, J., Khan, N., and de Weck, O.L., "Application of Markowitz Portfolio Theory for Space Technologies", 74th International Astronautical Congress (IAC) 2023. [url]

Siddiqi, A., Milton, J., Cabrera, M., and De Weck, O., (2023). Earth Observation Technologies for Climate Change Adaptation and Monitoring: Future Projection from Decadal Trends. In *IAF Global Space Conference on Climate Change (GLOC 2023)* – Oslo, Norway, 23-25 May. GLOC-2023-T.6A.1.x75338. [url]

Siddiqi, A., (2021) Building strong institutions for addressing climate change and for the sustainable management of natural resources, Background Paper, Prepared or United Nations Committee of Experts on Public Administration. [url]

Siddiqi, A., Baber, S. and De Weck, O., (2021), July. Valuing Radiometric Quality of Remote Sensing Data for Decisions. In *2021 IEEE International Geoscience and Remote Sensing Symp. IGARSS* (pp. 5724-5727). [url]

Full publications list is provided in Annex-I.

SELECTED BROADCAST MEDIA AND EDUCATION

- Energy Switch, *The Energy-Water Nexus*, Season 2, Episode. 11, Public Broadcasting Station (PBS). Spring 2023. [url]
- Podcast Globus, SDSN USA, Season 1, Episode 4. December 2021. [url]
- Water Diplomacy, Hollings Center. October 2023. [url]

SELECTED RESEARCH PROJECTS AND GRANTS

Over 27 research projects with roles of PI and Co-PI (in 10 projects) and senior researcher (in 12 projects).

2024-2025	NASA Office of Technology, Policy and Strategy (OTPS), PI
2023-2024	MIT Leventhal Center for Advanced Urbanism ($150,000), Sr. Researcher
2022-2024	MIT Energy Initiative ($150,000), Co-PI
2021-2023	NASA Space Technology Mission Dir. ($625,000), Sr. Researcher
2021-2022	MIT JWAFS Seed Grant ($25,000), Co-PI
2020-2021	Labsphere Inc. ($80,000), Co-PI
2017-2019	Hitachi Automotive Ltd. ($570,000), Technical Research Lead.
2017-2019	NASA Goddard Space Flight Center ($227,000), PI
2017-2018	NASA Emerging Space Office ($100,000), Co-PI / PI
2015-2017	Kuwait Program at Harvard Kennedy School, Senior Researcher.
2011-2013	MIT Energy Initiative ($200,000), Co-PI
2010-2012	Linden Trust, Co-PI

Full list of research projects is in Annex-II.

AWARDS AND HONORS

Fall Semester Dean's Teaching Award -– Harvard Kennedy School	2022
Spring Semester Dean's Teaching Award – Harvard Kennedy School	2021
Fall Semester Dean's Teaching Award – Harvard Kennedy School	2021
Water Resources Research Top downloaded research paper	2019
Editor's Choice award, *J. Water Res. Planning and Management*	2017
MERIT Visiting Scholar, University of Melbourne, Australia	2016
Visiting Fellow, Institute of Advanced Studies, Graz, Austria	2014
Editor's Choice paper selection, *Water International*	2013
Rene Miller Prize in Systems Engineering* (MIT)	2006
*Doctoral Dissertation Award	
Richard D. Dupont Graduate Fellowship (MIT)	2003
Marketing Leadership Program (National Instruments)	2002
Amelia Earhart Fellowship (MIT)	2000
Tau Beta Pi Honor Society (MIT)	1998
Pi Tau Sigma Honor Society (MIT)	1997

TEACHING

Developed and taught 6 different courses at undergraduate, graduate, and executive/professional levels:

1. **Fundamentals of Systems Engineering** (Fall 2023), Department of Aeronautics and Astronautics, MIT. Graduate course. [url]

2. **People and the Planet: Environmental Governance and Science**. Department of Earth, Atmospheric and Planetary Sciences, MIT. Undergraduate course (Fall 2023) [url]

3. **API-502: Policy Design and Delivery (MPP Core subject),** Harvard Kennedy School
   Core Course, Master in Public Policy Degree Program, Spring 2022

4. **IGA-565: Analytical Methods for Complex Adaptive Systems,** Harvard Kennedy School, Elective, Offered Spring 2019, Fall 2019, Spring 2021, Fall 2021, Fall 2022

5. **ESD.00: Introduction to Engineering Systems**, Massachusetts Institute of Technology Undergraduate course, Taught in 2011 and 2012. [url]

Executive Education Courses:

6. **Circular Economy: Transition for Future Sustainability**, MIT Professional Education Program – Digital Plus. (8-week course), inaugurated October 2022. [url]

7. **Sustainable Infrastructure Systems: Planning and Operations**, MIT Professional Education Program – Digital Plus. (8-week course), inaugurated February 2022. [url]

8. **Project Management Principles**, Humanitarian Logistics Program, Universita della Svizzera italiana, Lugano, Switzerland (Executive Master's short course) [url]

Invited lectures in Executive Education Courses at Harvard Kennedy School: **IFC Senior Training on Public-Private Partnerships and Project Finance** (2021, 2022, 2023), **Infrastructure in a Market Economy** (2022, 2023), **Senior Managers in Government** (2022, 2023), **Sustainability in Polarizing World Economy** (2022), **Policy Making in the 21st Century** (2023)

Invited guest lectures for classroom instruction at Harvard College; Harvard Business School, Harvard Medical School; Harvard Extension School, Department of Aeronautics and Astronautics - MIT, Department of Earth and Planetary Sciences – MIT, Media Lab – MIT, System Design and Management- MIT.

Full details of teaching experience are provided in Annex –III

RESEARCH SUPERVISION

Supervised and co-supervised **14 graduate** (doctoral and master's) research theses, and over **16 undergraduate** research projects at MIT. Co-supervised and collaborated with over **10 post-doctoral fellows** at the Belfer Center for Science and International Affairs, Harvard Kennedy School. Doctoral research **external examiner for 4 candidates** at University of Sannio-Italy (2023) Paris-Saclay (2020); University of Queensland, Australia (2019), and University of Calgary, Canada (2016).

Full details are provided in Annex – IV.

SELECTED LECTURES, SEMINARS, INVITED PRESENTATIONS (from last five years)

Full list is in Annex VI

May 21, 2024, invited seminar, "Studying nature-society interactions with network models: A case of food production system evolution in the Indus Basin in Pakistan", Environmental Change Institute, **University of Oxford,** UK.

April 16, 2024, invited speaker, "Goal-seeking structures for adaptation in socio-technical-environmental systems", Mindful Actions for Climate Change Symposium, **Harvard T. C. Chan School of Public Health** [url]

March 29, 2024, invited speaker, Exploring the Circular Economy through Waste Reduction, Climate Leadership Summit 2024, **Harvard Kennedy School**. [url]

December 4, 2023, keynote speaker, "An adaptive systems framework for leveraging the WEFE nexus in Pakistan", webinar, **Pakistan Water Week 2023**

July 2023, invited speaker, "Quantifying Earth Observation Technology Trends", **UK Space Agency,** 2023.

May 2023, invited speaker, "Earth Observation Technical Performance Trajectories for Technology Roadmapping and Investments", **Geoscience and Remote Sensing Society (GRSS) Instrumentation and Future Technologies Technical Committee** (IFT-TC) Webinar Series. [url]

April 2023, invited speaker, "Sustainable use of natural resources: concepts and lessons from living on Earth for forging futures on Moon and Mars", workshop on '**Artemis and Ethics** ', **NASA Head Quarters, Washington D.C.**

June 2022, Keynote, "Water-Energy-Food Ecosystems Nexus in River Basins and Landscapes", **International Center for Integrated Mountain Development** and Karakoram International University, Pakistan.

October 2021, invited seminar, "Leveraging the Water-Energy-Food Nexus: Applying a Complex Adaptive Systems Approach", ***Best of Water Systems Research - Seminar Series 2021*, Lahore University of Management Sciences,** Pakistan

July 2020, invited seminar, "Leveraging Systems Analysis for Development", **ETH Zurich, Switzerland**.

November 2020, invited seminar, "Adaptability of Sociotechnical Systems in Uncertain Environments", **Yale University,** New Haven, CT, US.

October 2019, invited presentation, **Pardee Center for Longer Range Futures, Boston University**.

August 2019, invited presentation, "Socio-hydrological Assessment of Canal Irrigation Systems", 4th Indus Basin Knowledge Forum, **Internal Center for Integrated Mountain Development (ICIMOD), Kathmandu,** Nepal, August, 2019.

May-June 2018, invited expert, "Managing Systems Under Stress: Science for Solutions in the Indus Basin", 3rd Indus Basin Knowledge Forum, **International Institute for Applied Systems Analysis**, **Vienna**, Austria, 31 May – 2 June, 2018.

October 2017, invited presentation, "Formulating Expectations for Future Water Availability in Arid Regions", Decadal Survey of Social and Behavioral Sciences for Applications to National Security: Emerging Trends and Methods in International Security, October 11, 2017, ***The National Academies***, ***Keck Center, Washington, D.C.*** [url]

MISC

Nationality: US and Pakistan (dual citizen)
Languages: English, Urdu (native fluency in speaking, reading, writing)

(Continued on next page)

ANNEX I - FULL PUBLICATIONS LIST

1. Book

Afreen Siddiqi and Laura Diaz Anadon, Editors, *Science and Technology Development in the Gulf States: Economic Diversification Through Regional Collaboration*, 2017, Gerlach Press, Berlin, Germany [url]

2. Papers in Refereed Journals (reverse chronological order)

Systems Analysis

1. [2024] **Siddiqi, A**., Wescoat Jr, J.L. and Selin, N.E., 2024. Evolution of system connectivity to support food production in the Indus Basin in Pakistan. *Proceedings of the National Academy of Sciences*, *121*(18), p.e2215682121. [url]

2. [2024] Giang, A., Edwards, M.R., Fletcher, S.M., Gardner-Frolick, R., Gryba, R., Mathias, J.D., Venier-Cambron, C., Anderies, J.M., Berglund, E., Carley, S. and Erickson, J.S., Grubert, E., Hadjimichael, A., Hill, J., Mayfield, E., Nock, D., Pikok, K., Saari, R. K., Lezcano, M. S., **Siddiqi, A.,** Skerker, J. B., Tessum, C. W., 2024. Equity and modeling in sustainability science: Examples and opportunities throughout the process. *Proceedings of the National Academy of Sciences*, *121*(13), p.e2215688121. [url]

3. [2023] Lombardo, S., Kinney, J., Blake, D., Chase, S., Stovall, A., **Siddiqi, A.,** Arquilla, K., Israel, S., Wood, D., de Weck, O.L., "Accessible Satellite Data Decision Support Systems for Yoruk Time Forest Management", Acta Astronautica, 213: 777-791 (2023). [url]

4. [2023] Stern, J., **Siddiqi, A.,** and Grogan, P., "Effects of individual strategies for resource access on collaboratively maintained irrigation infrastructure", *Systems Engineering*. DOI: 10.1002/sys.21701

5. [2022] Ilyas, A., Parkinson, S. Vinca, A., Byers, E., Manzoor, T., Riahi, K., Willaarts, B., **Siddiqi, A.,** and Muhammad, A., "Balancing smart irrigation & hydropower investments for sustainable water conservation in the Indus Basin", *Environmental Science and Policy*.

6. [2022] Birge, D., Fletcher, S., **Siddiqi, A.,** Al Sumaiti, A., Wescoat, J., "Multicriteria, Multiresolution Modeling of Suburban Residential Landscape Alternatives: Water-Efficient Villas in the Arid Middle East." *Journal of Urban Planning and Development* 148, no. 2 (2022): 04022010.

7. [2021] Usmani, S., **Siddiqi, A**. and Wescoat Jr, J.L., 2021. Energy generation in the canal irrigation network in India: Integrated spatial planning framework on the Upper Ganga Canal corridor. *Renewable and Sustainable Energy Reviews*, *152*, p.111692.

8. [2021] Vinca, A., Parkinson, S., Riahi, K., Byers, E., **Siddiqi, A**., Muhammad, A., Ilyas, A., Yogeswaran, N., Willaarts, B., Magnuszewski, P. and Awais, M., 2021. Transboundary cooperation a potential route to sustainable development in the Indus basin. *Nature Sustainability*, *4*(4), pp.331-339.

9. [2020] **Siddiqi, A**., Haraguchi, M. and Narayanamurti, V., 2020. Urban waste to energy recovery assessment simulations for developing countries. *World Development*, *131*, p.104949.

*****Featured in *Energy Matters, American Energy Society***

10. [2019] Yoshihide Wada, Adriano Vinca, Simon Parkinson, Barbara A Willaarts, Piotr Magnuszewski, Junko Mochizuki, Beatriz Mayor, Yaoping Wang, Peter Burek, Edward Byers, Keywan Riahi, Volker Krey, Simon Langan, Michiel van Dijk, David Grey, Astrid Hillers, Robert Novak, Abhijit Mukherjee, Anindya Bhattacharya, Saurabh Bhardwaj, Shakil Ahmad Romshoo, Simi Thambi, Abubakr Muhammad, Ansir Ilyas, Asif Khan, Bakhshal Khan Lashari, Rasool Bux Mahar, Rasul Ghulam, **Afreen Siddiqi**, James Wescoat, Nithiyanandam Yogeswara, Ather Ashraf, Balwinder Singh Sidhu, Jiang Tong, ISWEL Indus Basin Team, "Co-designing Indus Water-Energy-Land Futures", *One Earth,* 1 (2): 185-194

11. [2019] Jordaan, S. M., **Siddiqi, A**., Kakenmaster, B., and Hill, A.C., "The Climate Vulnerability of Global Nuclear Power". *Global Environmental Politics,* 19 (4): 3-13.

12. [2019] Haraguchi, M., **Siddiqi, A**., and Narayanamurti, V, "Stochastic Cost-Benefit Analysis of Urban Waste-to-Energy Systems", *Journal of Cleaner Production*. 224: 751-765

13. [2018] **Siddiqi, A.,** Wescoat, J., and Muhammad, A., "Socio-hydrological assessment of water security in canal irrigation systems: A conjoint quantitative analysis of equity and reliability", *Water Security,* 4-5: 44-55.

14. [2018] Wescoat, J., **Siddiqi, A.,** Muhammad, A., "Socio-Hydrology of Channel Flow in Complex River Basins: Rivers, Canals, and Distributary Channels in Punjab, Pakistan", *Water Resources Research*. 54. doi.org/10.1002/2017WR021486

*****Most Downloaded Research Paper, WRR in 2019**

15. [2018] Zhenyu, L., **Siddiqi, A**., Diaz, L. A., and Narayanamurti, V., "Towards sustainability in water-energy nexus: Ocean energy for seawater desalination", *Renewable and Sustainable Energy Reviews.* 82: 3833-3847.

16. [2017] Fletcher, S., Miotti, M., Swaminathan, J., Klemun, M., Strzepek, K., and **Siddiqi, A**., "Water Supply Infrastructure Planning: Decision Making Framework to Classify Multiple Uncertainties and Evaluate Flexible Design", *Journal of Water Resources Planning and Management*, 143 (10), 04017061. *****Editor's Choice Article**

17. [2017] **Siddiqi, A.,** and Collins, R., "Complex Socio-Technical Systems and Sustainability: Current and Future Perspectives for Inclusive Development", (invited contribution) *Current Opinion in Environmental Sustainability, 24:7-13.*

18. [2016] Bhaduri, A., Bogardi, J., **Siddiqi, A**., Voigt H., Wolf L., Vorosmarty, C., Pahl-Wostl, C., Bunn, S., Shrivastava, P., Lawford, R., Foster R., Harwig, K., Renaud, F., Bruns, A., and Osuna, V., "Achieving Sustainable Development Goals from a Water Perspective", *Frontiers in Environmental Science*. 4:64. doi: 10.3389/fenvs.2016.00064

19. [2016] **Siddiqi, A**., Ereiqat, F., and Anadon, L. D., "Formulating expectations for future water availability through infrastructure development decisions in arid regions", *Systems Engineering,* DOI 10.1002/sys.21337.

20. [2016] Mekonnen, D., **Siddiqi, A.,** and Ringler, C., "Drivers of groundwater use and technical efficiency of groundwater, canal water, and conjunctive use in Pakistan's Indus Basin Irrigation System", *International Journal of Water Resources Development*. DOI: 10.1080/07900627.2015.1133402

21. [2015] Grindle, A. K., **Siddiqi, A**., and Anadon, L. D., "Food security amidst water scarcity: Insights on sustainable food production from Saudi Arabia", *Sustainable Production and Consumption*, Vol. 2, pp 67-78

22. [2015] **Siddiqi, A.,** and Fletcher, S., "Energy Intensity of Water End Uses", *Current Sustainable/Renewable Energy Reports*. February, pp 1-7, 2015

23. [2013] **Siddiqi, A.,** de Weck, O. L., "Quantifying End-Use Energy Intensity in the Urban Water Cycle", ASCE *Journal of Infrastructure Systems*, 19, pp 474-485.

24. [2013] **Siddiqi, A.,** Wescoat, J. L., "Energy use in large-scale irrigated agriculture in the Punjab province of Pakistan**"**, *Water International*, 38 (5), pp 571-586.

*****Editor's Choice Article**

25. [2013] **Siddiqi, A.,** Kajenthira, A., Anadon, L. D., "Bridging Decision Networks for Integrated Water and Energy Planning", *Energy Strategy Reviews*, 2, pp. 46-58.

26. [2012] **Siddiqi, A.,** Wescoat, J. L. Jr., Humair, S., and Afridi, K. K, "An Empirical Analysis of the Hydropower Portfolio in Pakistan", *Energy Policy*, 50, pp 228-241.

27. [2012] Kajenthira, A., **Siddiqi, A**., and Anadon, L. D., "A new case for promoting wastewater reuse in Saudi Arabia: Bringing energy into the water equation", *Journal of Environmental Management*, 102, pp 184-192.

28. [2011] **Siddiqi, A**. and Anadon, L., "The Water-Energy Nexus in Middle East and North Africa", *Energy Policy*, 39, pp 4529-4540.

Technology and Engineering

29. [2020] **Siddiqi, A**., Rebentisch, E., Dorchuck, S., Imanishi, Y. and Tanimichi, T., 2020. "Optimizing Architecture Transitions Using Decision Networks". *Journal of Mechanical Design*, *142*(12), p.121702.

30. [2020] Cardenes, I., **Siddiqi, A**., Naeini, M.M. and Hall, J.W., 2020. "Multi-objective optimization of energy and greenhouse gas emissions in water pumping and treatment". *Water Science and Technology*, *82*(12), pp.2745-2760.

31. [2020] Collin, A., **Siddiqi, A.**, Imanishi, Y., Tanimichi, T., Rebentisch, E., and de Weck, O., "Autonomous driving systems hardware and software architecture exploration: optimizing latency and cost under safety constraints". *Systems Engineering*, *23*(3), pp.327-337.

32. [2019] Reis, A., Siddiqi, A. and de Weck, O., 2019. "Evolution stages of aircraft manufacturing firms". *Systems Engineering*, *22*(3), pp.255-270.

33. [2019] Doufene, A., **Siddiqi, A,** and de Weck, O. L., "Dynamics of Technological Change: The Case of Nuclear Energy and Electric Vehicle Innovation in France", *International Journal of Innovation and Sustainable Development,* 13(2):154-180.

34. [2011] **Siddiqi, A**., Bounova, G., de Weck, O., Keller. R, Robinson, B., "A posteriori Design Change Analysis for Complex Engineering Projects", *ASME Journal of Mechanical Design,* 133 (10) pp 101005-1 -11.

35. [2011] Grogan, P., **Siddiqi, A**., de Weck O., "Matrix Methods for Optimal Manifesting of Multi-Node Space Exploration Systems", *AIAA Journal of Spacecraft and Rockets,* 48 (4) pp 679-690.

36. [2010] Alfaris, A., **Siddiqi, A**., Rizk, C., de Weck, O., Svetinovic, D., "Hierarchical Decomposition and Multi-Domain Formulation for the Design of Complex Sustainable Systems", *Journal of Mechanical Design*, 132.

37. [2009] **Siddiqi, A**., de Weck O., Lee G., and Shull S., "Matrix Modeling Methods for Spaceflight Campaign Logistics Analysis", *Journal of Spacecraft and Rockets*, 46 (5) pp 1037-1048.

38. [2009] **Siddiqi, A**., and de Weck O., "Reconfigurability in Planetary Surface Vehicles", *Acta Astronautica*, 64 (5-6).

39. [2008] de Weck, O.L., Scialom, U. and **Siddiqi A**., "Optimal Reconfiguration of Satellite Constellations with the Auction Algorithm", *Acta Astronautica*, 62 (2-3), pp 112-130.

40. [2008] **Siddiqi, A**., and de Weck, O., "Modeling Methods and Conceptual Design Principles for Reconfigurable Systems", *ASME Journal of Mechanical Design*, Vol. 130.

41. [2007] **Siddiqi A.,** and de Weck O., "Spare Parts Requirements for Space Missions with Reconfigurability and Commonality", *Journal of Spacecraft and Rockets*, 44 (1).

42. [2006] **Siddiqi, A.,** de Weck O., and Iagnemma K., (2006), "Reconfigurability in Planetary Surface Vehicles: Modeling Approaches and Case Study", *Journal of the British Interplanetary Society*, 59 (1).

Science Policy and Higher Education

43. [2016] **Siddiqi, A.,** Stoppani, J., Anadon, L.D., and Narayanamurti, V., "Scientific Wealth in Middle East and North Africa: Productivity, Indigeneity, and Specialty in 1981 - 2013". *PLoS ONE 11(11): e0164500. doi:10.1371/journal.pone.0164500*

44. [2014] Hajjar, D. P., Moran, G. W., **Siddiqi, A**., Richardson, J., Anadon, L. D., and Narayanamurti, V., "Prospects for Policy Advances in Science and Technology in the Gulf Arab States: The Role for International Partnerships", *International Journal on Higher Education*, Vol. 3, No. 3. pp 45-57

3. Refereed Conferences Proceedings

45. [Presented] **Siddiqi, A.,** "Value analytics for earth observing systems", 2024 IEEE International Geoscience and Remote Sensing Symposium IGARSS. Athens, Greece. July 7-12, 2024

46. [2023] **Siddiqi, A.,** Milton, J., Khan, N., and de Weck, O.L., "Application of Markowitz Portfolio Theory for Space Technologies", 74th International Astronautical Congress (IAC) 2023. [url]

47. [2023] **Siddiqi, A.,** Ravishankar, R., Lombardo, and de Weck, O.L., "A Canonical Approach for Quantifying Value of Remote Sensing: Implications for Investments for Monitoring SDGs", 2023 IEEE International Geoscience and Remote Sensing Symposium IGARSS. Pasadena, CA, USA. July 16-21, 2023 [url]

48. [2023] **Siddiqi, A.,** Milton, J., and de Weck, O.L., "Performance Trajectories of Earth Observation Technologies: Parameterized Formulations and Estimation", 2023 IEEE International Geoscience and Remote Sensing Symposium IGARSS. Pasadena, CA, USA. July 16-21, 2023 [url]

49. [2023] **Siddiqi, A.,** Milton, J., Cabrera, M., and de Weck, O.L., "Earth observation technologies for climate change adaptation and monitoring: Future projections from decadal trends" International Astronautical Federation (IAF) Global Space Conference on Climate Change (GLOC 2023), Norway, May 23-25, 2023. Paper ID: 75338 [url]

50. [2022] **Siddiqi, A.,** Milton, J., Lordos, G., and de Weck, O.L., "Trends and Technology Roadmapping in Earth Observation Missions", 2022 IEEE International Geoscience and Remote Sensing Symposium IGARSS. July 2022. [url]

51. [2021] Stern, J., **Siddiqi, A.,** and Grogan, P., "Independent Adaptation Measures Enhancing Strategic Robustness in Cooperatively Maintained Irrigation Systems", Council of Engineering Systems Universities (CESUN) Meeting, October 2021.

52. [2021] **Siddiqi, A.,** Baber, S. and De Weck, O., 2021, July. Valuing Radiometric Quality of Remote Sensing Data for Decisions. In 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS (pp. 5724-5727). [url]

53. [2020] M. Moraguez, A. Trujillo, O. de Weck, and **A. Siddiqi**, "Convolutional Neural Network for Detection of Residential Photovoltalc Systems in Satellite Imagery," in *IGARSS 2020 - 2020 IEEE International Geoscience and Remote Sensing Symposium*, 2020, pp. 1600–1603. [url]

54. [2020] **Siddiqi, A**., Baber, S., and de Weck, O., Durell, C., Russell, B., and Holt, J. (2020). Integrating Globally Dispersed Calibration in Small Satellites Mission Value. Small Sat Conference, Utah. SSC20-WKIV-07 [url]

55. [2020] **Siddiqi, A**., Baber, S., de Weck, O. and Durell, C., 2020. Error and Uncertainty in Earth Observation Value Chains. In IGARSS 2020-2020 IEEE International Geoscience and Remote Sensing Symposium (pp. 3158-3161). IEEE. [url]

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113. Identification of the Harmonic Transfer Functions of a Helicopter Rotor, S.M. Thesis, Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, 2001.

114. Performance Evaluation of an FT-IR Spectrometer Used for Non-Invasive Blood Glucose Analysis, S.B. Thesis, Department of Mechanical Engineering, Massachusetts Institute of Technology, 1999.

7. Other Publications

115. "Facing Future Floods Safely", Opinion Editorial, The Express Tribune (with the International New York Times), November 1, 2022. [url]

116. "Accelerating Adaptation and Enhancing Sustainability with the Water-Energy-Food Nexus", Afreen Siddiqi, *ENSUS Magazine*, (invited article in inaugural issue) May 2022

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119. "Enabling Implementation through Roadmaps of Actions and Incentives Innovation" *Sustainable Development Goals- A Water Perspective/Voices on the SDGs,* (Article), August 2015.

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2. [In revision] **Siddiqi, A.,** Ravishankar, R., and de Weck, O. L., Decision Analytics of Remote Sensing Value for Sustainable Development.

3. [Submitted] **Siddiqi, A.,** Muhammad, A., and Wescoat, J., "Legacy supply-driven control architectures in water management", in *Encyclopedia of Systems and Control*, Eds. John Baillieul and Tariq Samad, Springer.

4. [In preparation] Iychettira, K., and **Siddiqi, A**., "Mapping governance of power: system dynamic models from case studies of power sector reform in developing countries". (invited for special issue in *Proceedings of the National Academy of Sciences (PNAS))*

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2. [2024] Siddiqi, A., "Quantitative value driven methods for earth observing systems architecture design and data use", Accelerating Informatics for Earth Science (AIFES 2024), NASA Science Mission Directorate, Washington D.C. June 13, 2024

3. [2022] (Invited) **Siddiqi, A.,** and de Weck, O.L. "Integrating portfolios for managing water-energy-food nexus", H45Q-1596. AGU Fall Meeting, Chicago. December 12-16, 2022.

4. [2022] Lombardo, S., Helmi, M**., Siddiqi, A**., Israel, S., de Weck, O.L. "Collaborative Development and Evaluation of Remote Sensing Analyses to Support Decision Making Regarding Coastal Resilience in Pekalongan, Indonesia. SY52C-0216. AGU Fall Meeting, Chicago. December 12-16, 2022.

5. [2021] Phillip Schmedeman, Cristian Junge, Karthik Rajasekaran, Chunhern Tan, **Afreen Siddiqi**, Olivier L de Weck, Janaina Camile Pasqual Lofhagen and Felipe Souza Marques, "Designing a regional biogas system: an optimization model for sustainable waste-to-energy networks with case studies from Brazil". GC35H-0772. AGU Fall Meeting, New Orleans. December 13-17, 2021.

6. [2020] **Siddiqi, A.,** Baber, S., de Weck, O. L., Durell, C., Rusell, B., and Holt, J., "Valuation of Calibration for Satellite Constellations". CalCON, Utah State University, 2020.

7. [2020] Baber, S., **Siddiqi, A.,** and de Weck, O. L., "A Quantitative Assessment of Radiometric Calibration Errors on Crop Cover Classifications", AGU Fall Meeting 2020.

8. [2020] **Siddiqi, A.,** Selin, N. E., and Clark, W. C., "Modeling Adaptive Capacity for Co-Evolving Water and Agriculture Systems", AGU Fall Meeting 2020.

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13. [2018] Foreman, V., **Siddiqi, A.**, and de Weck, O., "Advantages and limitations of small satellies in low earth orbit constellations: A prospective review". Small Satellite Conference, Utah State University.

14. [2017] Jacqueline LeMoigne, Philip Dabney, Veronica Foreman, Paul Grogan, Sigfried Hache, Matthew P Holland, Steven P Hughes, Sreeja Nag, **Afreen Siddiqi**. "End-to-End Tradespace analysis for Designing Constellation Missions". AGU Fall Meeting Abstracts 2017. IN13B-0071.

15. [2017] **Siddiqi, A**., Muhammad, A., and Wescoat, J.L., "A Quantitative Socio-Hydrological Characterization of Water Security in Large-Scale Irrigation Systems", AGU Fall Meeting Abstracts 2017. H13S-04.

16. [2017] **Siddiqi, A.,** "Systems Analysis and Planning for Inclusive Development", Oklahoma University Water Conference, Norman, Oklahoma, September 18-21, 2017.

17. [2017] **Siddiqi, A.,** Kennedy, S., and Weitershausen, I., "Investigating the Convening and Engagement Roles of Science and Technology-Oriented Universities: Case Studies from Emerging Economies". Atlanta Conference on Science and Innovation Policy, October 10, 2017.

ANNEX II – FULL PROJECTS AND RESEARCH LIST

PI and Co-PI

Year	Sponsor/Title	Role
2024-2025	NASA Office of Technology, Policy and Strategy, "Synthesizing Frameworks of Sustainability for Futures on the Moon", [~$138,000]	PI
2022-2024	MITEI, "Energy and multi-sector project portfolios optimization for investment decisions", [$ 150,000]	Co-PI
2021-2022	Jameel Abdul Latif Water and Food Security (JWAFS) Seed Grant, "Systems Analytics for Small Farms Waste to Energy Recovery", MIT [$25,000]	Co-PI

2020-2021	Labsphere, “Calibration Value Integration Analysis for Multi-Platform Earth Observation Systems”, MIT [~$ 80,000]	Co-PI
2017-2019	NASA Goddard Space Flight Center, “Cost and Risk Modeling of Distributed Missions: Applications for Trade-space Analysis Tool for Constellations”, MIT [~$ 227,000]	PI
2017-2018	NASA Emerging Space Office, “Development of a Commercial Space Technology Roadmap”, MIT [$ 100,000]	PI/Co-PI
2017-2019	Hitachi Automotive, “Autonomous Driving Systems Architecture Tradeoff Analysis”, SSRC, MIT [$ 550,000]	Technical Lead
2016-2018	Tata Center, “Evaluating Off-Grid Hydro Energy Systems in Irregular Channel Flow for Intensive Agriculture in Developing Countries”, MIT [$ 48,000]	Co-PI
2017-2018	MIT-Masdar Program, “The Role of Research University in Socio-Economic Development”, MIT [$ 38,000]	Co-PI
2011-2013	MITEI, “Coupling Water Use Efficiency and Energy Intensity Under Uncertainty in Large-Scale Irrigation Systems”, ESD MIT [$ 200,000]	Co-PI
2010-2012	MITEI and Linden Trust, “Environmental Impacts of Hydropower Projects & Energy Alternatives in a Complex River Basin”, ESD MIT [$ 40,000]	Co-PI

Senior Researcher

2023-2024	Leventhal Center for Advanced Urbanism, “Redesigning Vallejo-i: A metabolic approach to the decarbonization of the industrial sector in Mexico City”, MIT [$150,000]	Senior Researcher

2021-2023	NASA Space Technology Mission Dir. "Advanced Space Technology Roadmapping Architecture" (ASTRA), MIT [$625,000]	Senior Researcher
2018-2021	Japan Railways- East, "Oriented Rapid GAthering for Town Systems Design Platform", MIT [$940,000]	Senior Researcher
2017-2018	Emirates Leadership Program, "The Water-Energy Food Nexus: Harnessing Synergies for Urban Sustainability", Harvard University	Senior Researcher
2015-2017	Kuwait Program at Harvard Kennedy School, "Assessing and Strengthening University-Industry Collaborations: A Comparative Analysis of Gulf Countries", Harvard University	Senior Researcher
2015-2016	Emirates Leadership Program, "Emerging Solar Desalination Technologies: Understanding Local Adoption Drivers for Cost-Effective Decision Making", Harvard University	Senior Researcher
2013-2015	BP, "Water Access in the MENA Region: Exploring Future Water Allocation Decisions", Harvard University	Senior Researcher
2013-2015	Kuwait Foundation for Advancement of Science, "The Science, Technology, and Innovation Gap in the Gulf: Revamping University Education and Innovation in Sustainable Technologies", Harvard University	Senior Researcher
2010-2011	Harvard Dubai Initiative, "Water & Energy Nexus in Middle East and North Africa Region", Harvard University	Senior Researcher
2009-2011	Harvard Dubai Initiative, "Water & Energy Nexus in Middle East and North Africa Region", Harvard University	Senior Researcher
2009-2011	Masdar Initiative, Requirements Engineering for Sustainable Systems", ESD MIT	Senior Researcher
2010-2011	DARPA / Orbital Sciences Inc., "F6 Value-Centric Design Methodology", ESD MIT	Senior Researcher
2009-2011	BP, "Management of Change (MOC) in Complex Oil and Gas Projects", ESD MIT	Senior Researcher

Post-Doctoral Researcher

2008	Jet Propulsion Lab – NASA, "System Modeling of In-Situ Resource Utilization", Aero/Astro MIT	Post-doc Researcher
2007 – 2008	NASA Constellation University Institutes Program, "Lunar Campaign Logistics Analysis", MIT	Post-doc Researcher

Graduate Research Assistant

2005 – 2007	NASA Exploration Systems Mission Directorate, "Interplanetary Supply Chain Management and Logistics Architectures", Aero/Astro MIT	Research Assistant
2004-2005	Charles Stark Draper Laboratory, Inc. "NASA Space Exploration – Concept Evaluation & Refinement Study", Aero/Astro MIT	Research Assistant

ANNEX – III: TEACHING ACTIVITIES

UNDERGRADUATE-LEVEL TEACHING

Terms	Course Title	Role	Location
Fall 2023	**12.387 – People and the Planet: Environmental Governance and Science**	Primary Instructor	MIT
Spring 2011 Spring 2012	**ESD.00 - Introduction to Engineering Systems***	Co-Lecturer	MIT

* Developed new undergraduate course

Developed course materials for ESD.00, Introduction to Engineering Systems.

i) Created lecture materials for teaching systems dynamics, graph theory, and complex socio-technical systems analysis

ii) Developed problem sets, problem set solutions, and teaching notes

iij) Created materials for tutorials and simulation models

Undergraduate Course Development

Subject Number	Title
EPD.201	**Introduction to Engineering Product Design and Project Engineering**
ESD.101	**Introduction to Engineering Systems**

Descriptions

Developed full course materials with Professor Olivier de Weck for EPD.201, *Introduction to Engineering Product Design and Project Engineering*, to be offered at Singapore University of Technology and Design (SUTD)

i) Compiled lecture materials on engineering product design and engineering project management

ii) Created lecture materials on product Design for Changeability, and Design of Electro-Mechanical Systems

Developed full course materials with Professor Joseph Sussman for ESD.101, *Introduction to Engineering Systems*, to be offered at Singapore University of Technology and Design (SUTD)

i) Created lecture materials for teaching Systems analysis, Multi-Criteria Decision Analysis (MCDA), Decision Trees, and Net Present Value Analysis (NPV)
ii) Developed models in excel for teaching NPV and MCDA methods

GRADUATE AND PROFESSIONAL TEACHING

Year	Course Title	Role	Location
2023	Fundamentals of Systems Engineering	Lecturer	MIT
2022	Policy Design and Delivery -II	Lecturer	Harvard Kennedy School
2019-2022	Analytical Methods for Complex Adaptive Systems	Lecturer	Harvard Kennedy School
2010-2019	Project Management Principles	Lecturer	Universita della Svizzera italiana, Lugano, Switzerland
2017	Systems Dynamics	Lecturer	Lahore University of Management Sciences, Pakistan (Summer School)
2016	Systems Analysis and Applications	Lecturer	Lahore University of Management Sciences, Pakistan (Spring School)

Course Descriptions

Fundamentals of Systems Engineering

This course introduces key principles, methods, and tools for systems engineering. The course provides an overview of stakeholders analysis, requirements generation, concept formulation, trade space analysis, and architecture development.

People and the Planet: Environmental Governance and Science

This course introduces governance and science aspects of complex environmental problems and approaches to solutions. It introduces quantitative analyses and methodological tools to analyze environmental issues that have human and natural components, and it demonstrates concepts through a series of in-depth case studies of environmental governance and science problems. Students engage in experiential activities, such as modeling and policy exercises.

Analytical Methods for Complex Adaptive Systems

The course introduces complex adaptive systems theory for understanding and analyzing modern systems that embody technological and social elements and operate within changing environments such as water, energy, transportation, and communication systems. Key concepts of time lags in cause and effect, feedbacks, interactions and adaptive behavior will be introduced and implications for policy and planning are discussed. A variety of international cases drawn from different domains including water, energy, transportation, and space systems are analyzed.

Policy Design and Delivery-II

This course will be taught for the first time in Spring 2022 at Harvard Kennedy School. It includes topics on project management, including people and stakeholder management, financial management, performance monitoring, and organizational change management. This is a required (core) course for students in Master's in Public Policy (MPP) Program at HKS.

Project Management Principles

Taught annually (since 2010) in the Executive Master's Program for Humanitarian Logistics at Universita della Svizzera italiana, Lugano, Switzerland. The lectures are given over three full days, student teams submit written project reports after one month, and a final exam is administered after three months.

Course topics include Critical Path Method, Dependency Structure Analysis, Earned Value Management, and Risk Management.

Systems Analysis and Applications

Taught *Systems Analysis and Applications* in the "Water Systems, Science, and Practice – Spring School" at the Lahore University of Management Sciences, Lahore, Pakistan. March 14-18, 2016. This short course focused on water systems modeling and survey of quantitative methods for analyzing issues related to the water-energy-food nexus.

Systems Dynamics

Taught *Systems Dynamics* in the "Water Informatics: Science and Systems – Summer School" at the Lahore University of Management Sciences, Lahore, Pakistan. May 21-23, 2017.

Data Acquisition and Measurements

Taught courses on Data Acquisition, LabVIEW ™ Basic, LabVIEW ™ Advanced, to professional engineers, 2001-2003.

i) Presented lectures on data acquisition, instrumentation, and test and measurement in industrial applications

ii) Conducted in-class exercises on G-programming, LabVIEW applications for creating virtual PC-based instruments

ANNEX – IV: RESEARCH SUPERVISION

Doctoral Committee Member/Supervisor

1. Kristen Ammons, MIT Department of Aeronautics and Astronautics, 2023 – ongoing.
2. Seamus Lombardo, "*Remote Sensing and Integrated Systems Frameworks for Decision Support in Sustainable Development*", MIT Department of Aeronautics and Astronautics, 2021-2023
3. Anne Collin, "A Systems Architecture Framework towards Hardware Selection for Autonomous Navigation", MIT Department of Aeronautics and Astronautics, 2019
4. Sarah Fletcher, "Learning and Flexibility for Water Supply Infrastructure Planning under Diverse Uncertainties", MIT Institute of Data, Systems, and Society, 2018

External Examiner for Doctoral Thesis

1. Alessandro Sebastianelli, Satellite Remote Sensing through Machine Learning and Quantum Computing Techniques.
(University of Sannio, Benevento, Italy, 2023)

2. Lara Qasim, "System Reconfiguration: A Model Based Approach – From an Ontology to the Methodology Bridging Engineering and Operations",
(Universite Paris-Saclay, France, 2020)

3. Julijana Bors, "An Integrated Approach to Modelling Residential Water and Water-Related Energy",
(University of Queensland, Australia, 2019)

4. Maha Al-Zubi, "Water-Energy-Food-Climate Change Nexus in the Arab Cities: The Case of Amman City, Jordan", (University of Calgary, Canada, 2016)

Doctoral Theses Reader

1. Mark Chodas, "Addressing Deep Uncertainty in Space System Development through Model-based Adaptive Design", June 2019

2. Julien Lamamy, “Methods and Tools for the Formulation, Evaluation and Optimization of Rover Mission Concepts”, Aeronautics & Astronautics, supervised by Prof. David Miller, June 2007

3. Jennifer Underwood, “First-Order Interactions between System and Network Architectures in Distributed Satellite Communication System Design”, Dept. of Aeronautics & Astronautics, co-supervised with Dr. Dorothy Poppe, Charles Stark Draper Lab June, 2005.

Post-Doctoral and Pre-Doctoral Fellows Co-Supervisor

1. Inez Weitershausen, “Assessing Socio-Economic Impacts of Science and Technology Oriented Universities”, MIT, 2017-2018

2. Masahiko Haraguchi, “Water-Energy-Food Nexus: Harnessing Synergies for Urban Sustainability”, Harvard Kennedy School, 2017-2019

3. Rebecca Stern, “University-Industry Linkages in Kuwait and the UAE”
Harvard Kennedy School, 2015-2016
4. Fahad Javed, “Smart Grids Innovation”
South Asia Institute, Harvard University, 2016

Policy Analysis Project Supervision

1. Michael Sanchez, Policy Analysis, Master’s in Public Policy, Harvard Kennedy School - 2022

2. Siew Sanz Ng, Senior Year Policy Analysis, Master’s in Public Administration-International Development (MPA-ID), Harvard Kennedy School - 2022

Masters Thesis Supervisor/ Co-Supervisor

1. Aparajithan Sampath, “Satellite Remote Sensing of Natural Capital: Requirements assessment for wetlands monitoring and valuation”, MIT Systems Design and Management (2025)
2. Noemie Midrez, “System Approach to Investigate Environmental Footprint and Cost Tradeoffs in Additive Manufacturing”, MIT Systems Design and Management (2024)
3. Yu Miyashita, “Multi-Criteria Design Analysis of Sensor Systems for Railway Level Crossings”, MIT Systems Design and Management, (2020)
4. Eric Magliarditi, “Tradespace Analysis for Earth Observation Constellations: A Value Driven Approach“, Department of Aeronautics and Astronautics, MIT (2020)
5. Andrew L. Tsang, “Decentralized Sanitation Systems Design and Operation for Densely Populated Areas”, MIT System Design and Management (2019)
6. Veronica Foreman, “Emergence of Second-Generation Low Earth Orbit Satellite Constellations: A Prospective Technical, Economic, and Policy Analysis”, MIT Department of Aeronautics and Astronautics and Institute for Data, Science and Society (2018)
7. Alejandro Trujillo, “Survivability in Mars Transit Architectures: Analysis Framework for Failure Contingency Strategies”, MIT Department of Aeronautics and Astronautics, (2018)

8. Mathew Moraguez, “Technology Development Targets for Commercial In-Space Manufacturing”, MIT Department of Aeronautics and Astronautics, (2018)
9. Sabah Usmani, “Energy Generation in the Canal Irrigation Network in India: A Case for Integrated Spatial Planning”, MIT Department of Urban Studies and Planning, (2018)
10. Lisa Yang, “Application of High-Resolution Remote Sensing and GIS Techniques for Evaluating Urban Infrastructure”, MIT Department of Aeronautics and Astronautics, (2018)
11. Ayesha Shahid, “Reimagining Planning of Irrigated Agriculture in the Indus River Basin, Punjab, Pakistan”, MIT Department of Urban Studies and Planning, (2017)
12. John K. Graham, “A Payload-centric Approach Towards Resilient and Robust Electric-Propulsion Enabled Constellation Mission Design”, MIT Department of Aeronautics and Astronautics, (2017)
13. Tanja Nemetzade, “Dimensional Analysis for the Design of Satellites in LEO”, Technische Universitat Munchen. 2010.

Masters Theses Reader

1. Marianna Novellino, “Analysis of Water Supply Systems for Rural Communities Using Hierarchical Decomposition Methods”, MIT System Design and Management Program, supervisor Professor James L. Wescoat, (2015)

2. Bilhuda Rasheed, “Impact Assessment of Hydroclimatic Change on Water Stress in the Indus Basin”, Master of Science in Technology and Policy, Engineering Systems Division, supervised by Dr. C. Adam Schlosser, September 2013

MIT Undergraduate Research (UROP) Supervision

1. Lukas Hanson-Puffer, ‘Decarbonization of transportation in Vallejo in Mexico City’, Feb 2024- May 2024
2. Katie Kempff, ‘Geothermal energy potential for industrial decarbonization in Mexico City’, Jan 2024
3. Mary Foxen, ‘Simulating pathways of industrial decarbonization in Mexico City’, Sept – Dec 2023.
4. Jehan Ahmed, ‘integrated energy, water, agriculture, and environment project portfolios analysis for investment decisions’, Jan 2023- May 2023
5. Roderick Huang, ‘Earth Observation Technology Trend Analytics and Expert Elicitation’, Sep 2022-present
6. Maria Cabrera, ‘Earth Observation Technology Trend Analytics and Expert Elicitation’, Sep 2022
7. Naylah Canty, September 2021 – December 2021
8. Johan Soto, “Stochastic Simulation of Lagoon Digesters”, June 2021 – May 2021
9. Sheila Baber, “Integrating Vicarious Calibration in Multi-Node Earth Imaging Systems”, June 2020 – May 2021
10. Maria Barbosa, “Analysis of Buildings and Roads Networks from Satellite Imagery”, June 2020 – August 2020
11. Sam Dorchuck, “Autonomous Driving Systems: Forecasting Demand and Technology Costs”, May 2019 – January 2020
12. Jenny Choi, Sept 2018- May 2019
13. Mehak Sarang, 2017-2018
14. Jordan Isler, Department of Aeronautics and Astronautics, Sept 2016 – Jan 2017

15. Alex Latham, Department of Electrical Engineering and Computer and Science, Feb 2017-Sept 2017
16. Jimmy Tran, “Modeling the Dynamics of Energy Use in the Indus Basin”, Jan 2018 – Dec 2018.
17. Emma Broderick, “Geo-Spatial Mapping of Agricultural Production, Water Use, and Energy Consumption in the Indus Basin”, Sep 2012 – May 2014
18. Lina Karain, “Statistical Analysis of Crop Production in the Indus Basin of Pakistan”, Department of Architecture, January 2013 – May, 2013.

ANNEX – V: PROFESSIONAL SERVICE

Professional Organization Memberships:

- American Institute of Aeronautics and Astronautics (AIAA)
- Institute of Electrical and Electronics Engineers (IEEE)
- American Geophysical Union (AGU)

Activity	**Beginning**	**Ending**
Scientific Committee member, IGARSS 2024	2024	2024
Session Chair, IGARSS 2023, CA	2023	2023
Scientific Committee member, IGARSS 2023	2023	2023
Reviewer for visiting fellowship, Alexander von Humboldt Center of International Excellence, University of Bayreuth, Germany	2023	2023
Program Committee Member, KDD Workshop On Humanitarian Mapping,	2020	2020
Session chair, IGARSS 2022, Kuala Lumpur	2022	2022
Session chair, ‘Adaptation pathways through leveraging the water-energy-land nexus in developing countries’, GC35A. AGU 2021 Fall Meeting.	2021	2021
Steering committee member, GLOBAL FOOD+ 2021 conference, Weatherhead Center for International Affairs, Harvard University.	2020	2021
Member of the International Scientific Evaluation Panel for Partnership for Research and Innovation	2020	2020

in the Mediterranean Area (PRIMA) for Nexus 1A proposals 2020. [Reviewed grants worth $3 Million]		
Session organizer and co-chair, 2018 IEEE International Geoscience and Remote Sensing Symposium, Valencia, Spain	2018	2018
Program Committee Member, Complex Systems Design & Management – Asia 2018, Singapore	2018	2018
Workshop co-organizer, Science and Technology in the GCC: Building Research Capacity and Vital linkages, Kuwait.	2017	2017
Netherlands Organization for Scientific Research Grant Reviewer	2017	2017
Seed Grants Review – Center for Water Informatics Lahore University of Management Sciences, Pakistan	2016	2017
Session Chair, 1st International Conference and Expo on Biomass Gasification Technologies, National University of Science and Technology, Islamabad, Pakistan	2016	2016
Juror, $25,000 OU International Water Prize Committee, University of Oklahoma	2016	2017
Judging Panel Member, Seed for Change $40,000 Grand Prize Competition, South Asia Institute, Harvard University	2016	
Advisory Group Founding Member, Center for Water Informatics and Technology, Syed Babar Ali School of Science and Engineering, Lahore University of Management Sciences, Pakistan	2016	2018
Program Committee Member, Complex Systems Design & Management – Asia 2016, Singapore	2015	
Workshop Director, “Science and Technology Education, Research, and Innovation in the GCC”, Gulf Research Meeting, Univ. of Cambridge, UK	2014	
Research Grant Reviewer, Masdar Institute of Technology, Abu Dhabi, UAE	2013	

Research & Education Awards Program, South Carolina	2012	2013
Member, 'Water for Energy Framework – Assessing Human Impacts on Water' initiative	2012	
NASA Space Resources Technical Committee	2006	
Reviewer/Editor	Beginning	
Journal of Spacecrafts and Rockets	2005	
Acta Astronautica	2006	
Journal of Mechanical Design	2005	
Journal of Humanitarian Logistics & Supply Chains	2010	
Energy Policy	2012	
Proceedings of the National Academy of Sciences	2013	
Environmental Science and Technology	2015	
Systems Engineering	2016	
WIRES – Climate Change	2017	
Nature – Energy	2017	
Associate Editor - Frontiers in Sustainable Cities	2020	

INDUSTRY EXPERIENCE/CONSULTING

	Position	Beginning	Ending
United Nations Committee Of Experts on Public Administration (CEPA)	Consultant	Nov 2021	Dec 2021
International Food Policy Research Institute (IFPRI)	Consultant	March 2014	May 2014
Aurora Flight Systems	Consultant	Mar 2008	Oct 2008
National Instruments	Applications Engineer	Mar 2001	Sep 2002
National Instruments	Software Engineer	Oct 2002	Aug 2003
Schlumberger	Summer Intern	Jun 1997	Aug 1999

ANNEX – VI: SEMINARS, PRESENTATIONS, GUEST LECTURES

1. May 21, 2024, invited seminar, "Studying nature-society interactions with network models: A case of food production system evolution in the Indus Basin in Pakistan", Environmental Change Institute, **University of Oxford,** UK.

2. April 16, 2024, invited speaker, "Goal-seeking structures for adaptation in socio-technical-environmental systems", Mindful Actions for Climate Change Symposium, **Harvard T. C. Chan School of Public Health** [url]

3. March 29, 2024, invited speaker, Exploring the Circular Economy through Waste Reduction, Climate Leadership Summit 2024, **Harvard Kennedy School**. [url]

4. December 4, 2023, keynote speaker, "An adaptive systems framework for leveraging the WEFE nexus in Pakistan", webinar, **Pakistan Water Week 2023**

5. October 19, 2023, invited seminar, "Systems Analytics for Advancing Water, Energy, and Food Security", **Dalhousie University, Halifax, Canada**

6. October 16, 2023, invited panelist and speaker, "Waste Interrupted: A Working Session to Reinvent Systems to Stop Wasted Food", **Harvard Food Systems Initiative (HFSI).**

7. August 1, 2023, invited webinar, "A canonical approach for quantifying value of remote sensing", **Decision Analysis and Research Team (DART), NASA Langley Research Center.**

8. July 13, 2023, invited speaker, "Quantifying Earth Observation Technology Trends", Webinar, **UK Space Agency.**

9. May 4, 2023, invited speaker, Earth Observation Technical Performance Trajectories for Technology Roadmapping and Investments, **Geoscience and Remote Sensing Society (GRSS) Instrumentation and Future Technologies Technical Committee (IFT-TC), Webinar Series**. [url]

10. April 12, 2023, invited speaker, "Sustainable use of natural resources: concepts and lessons from living on Earth for forging futures on Moon and Mars", workshop on '**Artemis and Ethics** ', **NASA Head Quarters, Washington D.C.**

11. March 17, 2023, webinar, "Modeling system evolution in complex adaptive systems: Applications in waste-to-energy and food production systems", **Multi-Sector Dynamics webinar series, MIT** [url]

12. February 8, 2023, Invited presentation in panel: Scraps: The Environmental & Societal Implications of Reducing Food Waste, **Harvard Food Systems Initiative (HFSI)** [url]

13. September 29, 2022, Invited speaker, Pakistan floods and climate change, **Harvard Law School**

14. June 2022, Keynote, "Water-Energy-Food Ecosystems Nexus in River Basins and Landscapes", **International Center for Integrated Mountain Development** and Karakoram International University, Pakistan.

15. October 2021, invited seminar, "Leveraging the Water-Energy-Food Nexus: Applying a Complex Adaptive Systems Approach", ***Best of Water Systems Research - Seminar Series 2021*, Lahore University of Management Sciences,** Pakistan [url]

16. April 2021, invited, "A Water View of MENA: Implications for Policy", **HKS ELI Spring Institute**

17. March 2021, invited seminar, "Systems Thinking: Applications for Sociotechnical systems", **Technology and Public Purpose Project (**TAPP)**,** Harvard Kennedy School.

18. December 2020, Invited, "Waste to Energy Systems for Developing Countries", Webinar, **World Bank Water Resources Group.**

19. November 2020, invited seminar, "Adaptability of Sociotechnical Systems in Uncertain Environments", **Yale University,** New Haven, CT, US.

20. July 2020, invited seminar, "Leveraging Systems Analysis for Development", ***ETH Zurich***, July 7, 2020.

21. March 2020, invited web seminar, "Towards inclusivity and equity in complex sociotechnical systems", **University of Engineering and Technology (UET), Peshawer**, Pakistan

22. November 2019, seminar, "Engineering and Equity in Complex Sociotechnical Systems ", **Universidad de los Andes**, Bogota, **Colombia**

23. October 2019, invited presentation, "Informality and Sustainability in Sociotechnical Systems", Pardee Center for Longer Range Futures, **Boston University**.

24. August 2019, invited presentation, "Socio-hydrological Assessment of Canal Irrigation Systems", 4th Indus Basin Knowledge Forum, **Internal Center for Integrated Mountain Development (ICIMOD), Kathmandu,** Nepal, August, 2019.

25. July 2019, invited, "The Water- Energy Nexus in Pakistan", Webinar, ***Women Engineers, Pakistan.***

26. March 2019, invited, "Water, Energy and Food Nexus: Uncovering Systems Theoretic Solutions for a New Paradigm", *Visiting Delegation* ***Mitsubishi Ltd.*** *MIT.*

27. December 2018, invited presentation, "Dynamics of allocations and deliveries in irrigation systems: investigating human-water interactions", Fall **American Geophysical Union (AGU) Meeting**, Washington D.C., December 2018.

28. July 2018, invited, "Shifting from Water Scarcity to Surplus in Pakistan", ***British High Commission,*** *Islamabad, Pakistan.*

29. July 2018, invited, "Water, Energy and Food Security in Pakistan: Systems Analysis for Policy and *Planning, Asian Development Bank, Islamabad, Pakistan.*

30. July 2018, invited, "Shifting from Water Scarcity to Surplus in Pakistan"*, **LEAD,** Islamabad, Pakistan.*

31. June 2018, invited presenter, "Evaluating new urban waste-to-energy systems through the nexus of waste management, energy and environmental policies in developing countries", Conference Green Transformation and Competitive Advantage: Evidence from developing countries, **German Development Institute, Bonn**, June 18-19, 2018

32. May-June 2018, invited participant, "Managing Systems Under Stress: Science for Solutions in the Indus Basin", 3rd Indus Basin Knowledge Forum, **International Institute for Applied Systems Analysis**, **Vienna**, Austria, 31 May – 2 June, 2018.

33. May 2018, invited panelist, "Designing water infrastructure for an uncertain future", **Blue Cities Conference**, **Toronto,** Canada, May 2, 2018.

34. April 2018, invited seminar, "Bringing Equity and Inclusivity in the Objective Function: New Methods for Planning and Management of Energy and Water Systems", **Energy for Human Development (E4Dev) Seminar, MIT Energy Initiative**.

35. April 2018, invited guest lecture, "History, Hydrology, Hydro-economy and Hydro-politics of the Indus", ***Harvard Kennedy School***, April 24, 2018, Cambridge, MA.

36. February 2018, invited round table panelist, "Scientific production and indigeneity in the Middle East", **Georgetown University – Doha**, Qatar, February 22, 2018.

37. October 2017, invited panel presentation, "Formulating Expectations for Future Water Availability in Arid Regions", Decadal Survey of Social and Behavioral Sciences for Applications to National Security: Emerging Trends and Methods in International Security, October 11, 2017, ***The National Academies***, ***Keck Center, Washington, D.C.***

38. September 2017, invited seminar, "Systems Analysis and Planning for Inclusive Development", September 19, 2017 ***Oklahoma University WaTER Center*** Conference, Norman, Oklahoma.

39. August 2017, seminar, "Emerging Paradigms for Analysis of Complex Engineered Systems", ***Technical University of Denmark***, Department of Management Engineering, Lyngby, Denmark, August 14, 2017

40. April 2017, Seminar, "The Water-Energy-Food Nexus: Implications for Infrastructure Planning and Inclusive Development", ***Universidade Federal dos Vales do Jequitinhonha e Mucuri*** (UFVJM), **Diamantina, *Brazil.***

41. April 2017, Invited, "Water Infrastructure Planning: Incorporating Uncertainty and Inclusivity", ***MIT Water Club – Lunch and Learn Seminar Series, MIT***

42. April 2017, Invited, "Scientific Wealth of Nations: Emerging Trends in the Middle East", ***Spring Seminar – Industrial Performance Center, MIT***

43. March 2017, Seminar, "Science and Technology in the Middle East: Emerging Trends in the Research Enterprise", ***Masdar Institute***, Abu Dhabi, **UAE**

44. March 2017, Presentation, "Scientific Wealth in the GCC: Trends in Domestic Capacity and International Collaborations", ***Kuwait Foundation for Advancement of Sciences***, **Kuwait**

45. December 2016, invited panelist, "Advancing on the Research Frontier: A Systems Perspective", ***6th Annual Smart Grids Conference***, Jeddah, **Saudi Arabia**

46. November 2016, Seminar, "Systems Analysis for Planning Under Uncertainty and Scarcity", **Department of Mechanical Engineering, University of Massachusetts – Lowell**, USA

47. November 2016, Invited Lecture, "Water, Food, and Energy Systems in the Anthropocene", **STEM Talk Series, Sharon**, MA.

48. November 2016, Invited Talk, "The Water-Energy-Food Nexus in the Middle East: Implications for Policy and Technology", ***Hollings Center for International Dialogue, Washington, D.C***.

49. September 2016, Invited Panel Discussion, "Water-Energy-Food Nexus", WaTER Center, **University of Oklahoma**, Norman, Oklahoma

50. August 2016, Invited lecture, "Infrastructure Planning and Management Under Uncertainty and Scarcity", Department of Infrastructure Engineering, ***University of Melbourne, Australia***.

51. July 2016, Invited presentation, "Empirical Analysis of the Hydropower Portfolio of the Indus Basin of Pakistan", ***Planning Commission, Islamabad, Pakistan***.

52. June 2016, Invited, "Complex Systems Architecture and Planning and Uncertainty", **Visiting Delegation of Nissan Corporation, MIT**

53. June 2016, Invited, "Complex Systems Architecture and Planning and Uncertainty", **Visiting Delegation of Hitachi Ltd., MIT**

54. May 2016, Invited, "The Water Energy Food Nexus: An Integrated Approach to the Middle Water Challenge", organized by **Hollings Center for International Dialogue**, Abu Dhabi, **UAE**

55. April 2016, "Scientific Research in the Middle East and North Africa: Trends in Productivity, Specialty, and Affinity", **Science and Technology Policy Program, Harvard Kennedy School**

56. April 2016, Invited, "Science needs in the context of tough choices in implementing the new SDG framework', ***German Committee Future Earth, Loveno di Menaggio, Italy***

57. November 2015, invited panelist, Igniting Innovation Summit 2015, ***Harvard University***

58. October 2015, invited lunch seminar, "Water-Energy-Food Nexus: Interconnected Challenges and Convergent Opportunities for Planning Under Scarcity", **MIT Portugal Program**- **Institute for Data, systems, and Society, MIT**

59. September 2015, Keynote lecture, "Water-Energy-Food Nexus: Interconnected Challenges and Convergent Opportunities", 2015 **Oklahoma University WaTER Center Conference**, Norman, Oklahoma

60. August 2015, "Systemic Challenges in Building Science and Engineering Capacity in the Gulf Cooperation Council Countries", **Fifth Annual Gulf Research Meeting**, ***University of Cambridge, UK***

61. August 2015, "Systems-Theoretic Methods for Infrastructure Analysis & Planning Under Scarcity and Uncertainty", Environmental Change Institute, School of Geography, ***Oxford University, UK***

62. August 2015, plenary presentation, **Global Water Systems Project Conference**, Bonn, **Germany**

63. December 2014, invited lecture, "Systems Engineering: An Introduction and Applications", **National University of Science and Technology**, Islamabad, **Pakistan**

64. August 2014, "Science and Technology Collaboration Networks in the GCC States", Fourth Annual Gulf Research Meeting, University of Cambridge, **UK**

65. June 2014, invited seminar, "Quantifying WEF Interdependences for Mitigating Resource Uncertainties in Developing Countries", Technology, Management and Policy Symposium, **Instituto Superior Tecnico, Lisbon**, **Portugal**

66. June 2014, "WEF Nexus in the Indus Basin of Pakistan: Role of Technology Transitions, Organizational Change, and Policy Reform", **Institute for Advanced Studies – Science, Technology, and Society, Graz**, **Austria**

67. April 2014, invited presentation, "Challenges in Provincial Water Security in Pakistan", South Asia Institute, Annual Conference 2014, **Harvard University**

68. April 2014, invited panelist, "Energy and Water Security Nexus in Pakistan", **Harvard College Pakistan Conference,** Harvard University

69. April 2014, The Orangi Pilot Project and Legacy of Architect Perween Rehman Conference, Aga Khan Program for Islamic Architecture, **School of Architecture and Planning, MIT**

70. January 2014, invited webinar, "Water Energy Food Nexus in Developing Countries: Cases Studies from Pakistan and Jordan", **United States Agency for International Development (USAID**).

71. December 2013, "Integrated Planning and Data-Driven Decision Making for Complex Systems", Planning Commission, **Ministry of Planning, Development & Reform,** Islamabad, **Pakistan**

72. December 2013, “Energy Use in Large-Scale Irrigated Agriculture in Punjab”, Water International Special Seminar, Islamabad, Pakistan

73. November 2013, “Reformation and Revitalization of Science & Technology Education in the Middle East”, Istanbul, **Turkey**

74. September 2013, invited seminar, School of Engineering, Univ. of Western Sydney, **Australia**

75. September 2013, invited talk, “Energy Resources in Pakistan”, Pakathon, Cambridge, MA, US

76. August 2013, “Systems Analysis of Water-Energy Interdependencies in Developing Countries”, Department seminar, Department of Infrastructure Engineering, **University of Melbourne,** Australia

77. August 2013, “Science & Technology and Innovation in the Middle East: Shifting Sands of Change”, invited lecture, Peace Islands Institute, Boston, US

78. July 2013, Keynote lecture, “Science & Technology Education and Research in the Middle East: A Comparative Institutional Analysis”, International Conference on Engineering Education and Research, Marrakech, **Morocco**

79. May 2013, Board of Kuwait Foundation Advancement of Science, Harvard Kennedy School

80. October 2012, “Energy Intensity and Water Use Efficiency in Large-Scale Irrigation Systems”, **MIT Energy Initiative Fall Conference,** MIT

81. February 2012, “Modeling and Analysis of Water and Energy Systems Interdependencies”, department seminar, **Engineering Systems Division, MIT**

82. May 2011, “The Water and Energy Nexus in Middle East and North Africa”, **General Electric Visiting Committee**, John F. Kennedy School, Harvard University

83. November 2010, department seminar, **Masdar Institute of Science & Technology**, Abu Dhabi, UAE

84. June 2010, “Uncovering Inter-System Linkages for Sustainable Designs and Decisions”, Department seminar, Advanced Water Management Center, **University of Queensland, Australia**

85. May 2010, “Understanding Inter-System Relationships for Holistic Sustainability”, department seminar, Faculty of Engineering**, Brunei Institute of Technology, Brunei**

86. May 2010, invited presentation, Workshop on Climate Adaptation in the MENA: Challenges and Opportunities, **Harvard Kennedy School**

87. November 2008, “System Design Under Uncertainty”, **National Instruments, Austin**, Texas

88. July 2008, "Design for Reconfigurability", Engineering Design Center Seminar, Department of Engineering, **University of Cambridge**, **U.K**

89. July 2008, "Reconfigurability in Space Systems", invited seminar, Lahore University of Management Sciences, Lahore, **Pakistan**

Invited Guest Lectures (for Classroom instruction) – reverse chronological order:

90. May 14, 2024, Infrastructure in a Market Economy, Lecture Title: "Sustainable Infrastructure Systems", **Executive Education – Harvard Kennedy School**

91. May 13, 2024, Infrastructure in a Market Economy, Lecture Title: "Planning and Investment Under Uncertainty and Scarcity: Case of Melbourne Water System", **Executive Education – Harvard Kennedy School**

92. March 2024, Course: EM.413 Foundations of System Design and Management, Lecture Title: "Optimization in Complex Systems: Theory and Applications", **MIT System Design and Management (SDM)** Program

93. January 2024, MIT Technology Leadership Program (TLP**),** Lecture Title: Autonomous Vehicles in Cities, **MIT Professional Education**

94. June 26, 2023, Leverage the Water-Energy-Food Nexus, Course: Policy Making in the 21st Century, Executive Education, **Harvard Kennedy School**

95. June 22, 2023, IFC Training on Public-Private Partnerships in Infrastructure, Lecture Title: "Emerging Trends: Waste to Energy Systems", **Executive Education – Harvard Kennedy School**

96. May 15, 2023, Infrastructure in a Market Economy, Lecture Title: "Waste-to-Energy Systems", - **Executive Education – Harvard Kennedy School**

97. April 2023, MIT Technology Leadership Program (TLP**),** Lecture Title: Promise and Perils of Remote Sensing, **MIT Professional Education**

98. March 2023, Course: EM.413 Foundations of System Design and Management, Lecture Title: "Optimization in Complex Systems: Theory and Applications", **MIT System Design and Management (SDM)** Program

99. January 2023, MIT Technology Leadership Program (TLP**),** Lecture Title: Sustainable Infrastructure for the 21st Century: Applying a Systems Approach for Thinking and Design, **MIT Professional Education**

100. December 2022, Course: 12.387 *People and the Planet: Environmental Governance and Science*, Lecture Title: "Sustaining Irrigation and Agriculture in the Indus River Basin of Pakistan", **Department of Earth and Planetary Sciences, Massachusetts Institute of Technology**

101. November 2022, Sustainability in a Polarizing World Economy, Lecture Title: "Leveraging the nexus of water, energy, and food security in sustainable development". **Executive Education – Harvard Kennedy School.**

102. October 2022, Senior Managers in Government, Lecture Title: "Concepts for Systems Thinking: Managing Complexity and Dynamics of Sociotechnical Systems". **Executive Education – Harvard Kennedy School.**

103. October 2022, Senior Managers in Government, Lecture Title: "Leveraging the nexus of water, energy, and food security: a systems thinking approach for meeting human needs". **Executive Education – Harvard Kennedy School.**

104. June 2022, IFC Training on Public-Private Partnerships in Infrastructure, Lecture Title: "Emerging Trends: Waste to Energy Systems", **Executive Education – Harvard Kennedy School**

105. May 2022, Infrastructure in a Market Economy, Lecture Title: "Waste-to-Energy Systems", - **Executive Education – Harvard Kennedy School**

106. March 2022, invited lecture, "The water-energy-food nexus: A case of irrigation-based agriculture", *EC.711- Introduction of Energy in Global Development*, **D-Lab, Massachusetts Institute of Technology,** USA

107. November 2021, Course: 12.387: *People and the Planet: Environmental Governance and Science*, Lecture Title: "Sustaining Irrigation and Agriculture in the Indus River Basin of Pakistan", **Department of Earth and Planetary Sciences, Massachusetts Institute of Technology**

108. September 2021, Course: *16.851-Introduction to Satellite Engineering*, Lecture Title: "Remote Sensing", **Department of Aeronautics and Astronautics, Massachusetts Institute of Technology**

109. June 2021, IFC Training on Public-Private Partnerships in Infrastructure, Lecture Title: "Emerging Trends: Waste to Energy Systems", **Executive Education – Harvard Kennedy School**

110. March 2021, Course: MAS.859 Space Technology for the Development Leader, Lecture Title: "Remote Sensing Systems for Sustainability", **MIT Media Lab**

111. February 2021, Course: *API-504: Solving Problems in the Global Arena: Policy Analysis for Transnational Affairs*, Lecture Title: "Dynamics of Complex Systems", **Harvard Kennedy School**

112. February 2021, Course: *16.89-Space Systems Engineering*, Lecture Title: "Remote Sensing for Earth Observation", **Department of Aeronautics and Astronautics, Massachusetts Institute of Technology**

113. March 2020, Course: *ESPP-11-Sustainable Development*, Lecture Title: "Modeling Complexity: How to Use Simple Models to Capture the Essential Dynamics of Complex Adaptive Systems", Environmental Science and Public Policy/GSAS, **Harvard College**

114. November 2020, Course: *12.387-People and the Planet: Environmental Governance and Science*, Lecture Title: "Sustaining Irrigation and Agriculture in the Indus River Basin of Pakistan", **Department of Earth and Planetary Sciences, Massachusetts Institute of Technology**

115. March 2020, Course: *ESPP-11-Sustainable Development*, Lecture Title: "Analyzing the dynamics of the anthropocene system VI: Modeling Complexity", Environmental Science and Public Policy/GSAS, **Harvard College**

116. April 2019, Course: MAS.S64 Space Technology for the Development Leader, Lecture Title: "Towards inclusivity and equity in sociotechnical systems", **MIT Media Lab**

117. April 2018, "History, Hydrology, Hydro-economy and Hydro-politics of the Indus", ***Harvard Kennedy School***

118. November 2017, "Systems Thinking and Modeling: Theory and Applications", ***Harvard Business School***.

119. July 2017, *Harvard Extension School* - *Summer School- ENVR S-129B*, "Food-Water-Energy Nexus: Paradigms and Perspectives for Middle East and North Africa", ***Harvard Extension School***

120. April 2012, Course: *16.888-Multidisciplinary System Design Optimization*, Lecture Title: "Multiobjective Optimization", **Department of Aeronautics and Astronautics, Massachusetts Institute of Technology**

121. September 2011, *Course: IN-601: Medicine and Management*, Lecture Title: "Systems Thinking and Modeling", **Harvard Medical School**

122. March 2006, Course: *16.89-Space Systems Engineering*, Lecture Title: "Planetary Surface Vehicle Design", **Department of Aeronautics and Astronautics, Massachusetts Institute of Technology**

123. February 2006, Course: *16.89-Space Systems Engineering*, Lecture Title: "Reconfigurability: Perspectives from System Architecture", **Department of Aeronautics and Astronautics, Massachusetts Institute of Technology**