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Graduate School of Environmental Studies
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EDUCATION

- Ph.D. Tohoku University**, Environmental Science March 2020
Dissertation: “Dynamic Material Flow Analysis of Metals Derived from End-of-Life Vehicles: Focusing on reuse”
Advisor: Prof. Kazuyo Matsubae
Graduated as an outstanding Ph.D. student
- M.S. Tohoku University**, International Politics and Economics March 2013
Thesis: “Characteristics and Issues of Vehicle Diffusion During the Period of High Economic Growth: A Case Study in Ordos, Inner Mongolia”
Advisor: Prof. Yu Jeongsoo
- B.S. University of Science and Technology Beijing** July 2010
Japanese Language and Literature

SELECTED RESEARCH EXPERIENCE

- Assistant Professor, Tohoku University**, Sendai, Japan April 2020-present
Environmental and Economics Lab
- Evaluated the impacts of innovative aluminium recycling technologies on global aluminium cycles by material flow analysis in collaboration with Prof. Tetsuya Nagasaka, Prof. Hongming Zhu, et al. at Tohoku University. (Publication in *Nature*, funded by the Promotion of Science (JSPS), etc.)
 - Identified multi-regional land disturbances induced by the production of vehicles in Japan by using total material requirement in collaboration with Prof. Eiji Yamasue, Assoc. Prof. Shoki Kosai, et al. at Ritsumeikan University. (Publication in *Resources, Conservation and Recycling*; Funded by the JSPS, etc.)
 - Studied the potential of applying vertical farming to supplement traditional agriculture in Kuwait on alleviating the food insecurity in collaboration with Dr. Meshal Abdullah from Kuwait Environment Public Authority. (Publication in *Sustainability* and another manuscript in preparation; Funded by the JSPS.)
 - Studied the energy consumption, CO₂ emissions and benefits of reclamation in one coal mining site in Indonesia, using cost-benefit analysis in collaboration with a PhD student in my lab. (Publication in *Resources* and was funded by the Japanese Ministry of Education, Culture, Sports, Science, and Technology.)

- Received 6 grants from Japan as a principal investigator or co-investigator
- Collaborating with experts from top universities in Japan (The University of Tokyo, Ritsumeikan University, Kyoto University, Research Institute for Humanity and Nature, National Institute for Environmental Studies), and Tsinghua University and University of Science and Technology Beijing in China.

PhD Candidate, Tohoku University, Sendai, Japan

April 2017-March 2020

Advisor: Prof. Kazuyo Matsubae

- Developed a dynamic material flow analysis model and indicators for analysing steel cycles and the effectiveness of recycling, reuse, and remanufacturing through vehicle engine's life cycles. (Publications in *Resource, Conservation and Recycling*, *Matériaux & Techniques*; Funded by the JSPS.)

TEACHING EXPERIENCE

Research advisor, Tohoku University, Sendai, Japan

2021-present

Environmental and Energy Economics laboratory

- Assisting in managing the laboratory contains 15 graduate students from diverse countries and backgrounds.
- Organizing seminars, weekly meetings, practices, and discussions with students.
- Providing one-on-one tutorials for conducting research, writing and reviewing proposals/papers, forming research plans, extracting information, using analysis tools, and fixing research difficulties.
- Evaluated by students for stimulating independent thinking, developing skills in writing and publishing research papers, and logically presenting research findings and thesis defenses.

Doctoral students under advising

2021-present

- Tomoya Sugiyama, "Supply chain risk analysis of mineral resources: Focusing on disaster risks at mining site"
- Binze Wang, "Quantifying global environmental impacts of aluminium recycling"
- Junbin Xiao, "Environmental impacts of copper mining"
- Chuan Zhao, "Analysis of local food demand and agriculture production in China"

Masters' students under advising

2022-present

- Takuro Inoue, "Industrial nitrogen and phosphorus flows in Japan",
- Soh Takemoto, "Life cycle assessment of tungsten hexafluoride (WF₆) gas in Japan's semiconductor industry", 2022-present

Guest lecturer, Tsinghua University, Beijing, China

May 9, 2022

Course: *Material Flow Analysis*

- Developed and delivered one 90-minute online lecture on "The evolution of material flow analysis" to graduate students.

The 580th Environmental Academic Salon

September 23, 2021

- Developed and delivered 90-minute online lecture on "Is Japan's high recycling rate good enough" to students and young professionals from diverse backgrounds.

Guest lecturer, University of Technology and Science Beijing

September 27, 2021

Seminar on Resource Use and Climate Change

- Developed and delivered 90-minute lecture on “Carbon footprint: Concept and calculation method” with clicker questions.

Lecturer, Tohoku Gakuin University, Sendai, Japan

2021-2022

Course: Information Literacy Course

- Developed and delivered two weekly 90-minute lectures to 60 freshmen in Japanese for two semesters, covering contents of information ethics, internet security, information collection/analysis/transmission, economic statistical analysis, and group presentations.
- Developed course materials, group work, quizzes, and assignments.
- Graded weekly assignments, provided individual feedback, and awarded credits.
- Freshers gained knowledge and abilities to extract information, and use Microsoft office to analyse data, write reports, and make presentation materials.

Co-Lecturer, Tohoku University, Sendai, Japan

Spring 2021

Course: Seminar on Environmental Studies

- Co-designed course topics: resource depletion, energy transition, climate change, water security, overpopulation, biodiversity reduction.
- Co-developed lecture contents, tests, and evaluation criteria.
- Coordinated grading with 2 lecturers.

Teaching assistant, Tohoku University, Sendai, Japan

Fall 2018

Course: Chinese Language

- Assisted in preparing lecture materials and grading exams.
- Supported students with communication and writing.

INDUSTRY EXPERIENCE

SEINAN Cooperation, Hirosaki, Japan

April 2013-March 2017

Department of Market Planning

- Assisted in improving existing recycling businesses and planning on new recycling projects, involving vehicles, scrap metals, waste electrical and electronic equipment, and other industrial wastes.
- Evaluated potential cost benefits of steel scrap recycling business in Mongolia.
- Led industry-academia collaboration in recycling.
- Obtained the national license for recycling small waste electrical and electronic equipment issued by the Ministry of the Environment Government of Japan.
- Launched a project on dismantling waste computers in 2 facilities for handicapped in Hirosaki-city.
- Designed an unmanned waste recycling station project that has been set up 6 stations in Japan.
- Promoted recycling of car interior plastics into car dashboards. Recycled dashboards have been adopted in new cars by a Japanese car manufacturer.

RESEARCH GRANTS

- 2021-2025 **Accelerating the promotion of zero emission vehicles and abolition of gasoline vehicles: Comparative analysis of strategies in Japan, China, and Korea**
Principal Investigator: Assoc. Prof. Gregory Trencher,
Kyoto University, Kyoto,
Japan Society for the Promotion of Science, 16,770,000 JPY
Role: Co-investigator. My work on the material flow analysis of vehicle batteries and policy analysis of zero emission vehicle market and phase-out of gasoline vehicles in China. I wrote progress reports for Tohoku University.
- 2021-2024 **Development of high-purity aluminum alloy refining technology from aluminum alloy scrap by solid electrolysis using molten salt**
Principal Investigator: Prof. Tetsuya Nagasaka
Tohoku University, Sendai,
New Energy and Industrial Technology Development Organization, Japan,
198,550,000 JPY
Role: Co-investigator. My work on an optimization analysis of aluminium supply-demand balance through the application of innovative aluminium recycling technology at regional and global level. I wrote progress reports and answered related queries.
- 2021-2024 **Dynamic material flow analysis of automotive lightweight materials and effects of remanufacturing strategy**
Principal Investigator: Assist. Prof. Zhengyang Zhang
Tohoku University, Sendai,
Japan Society for the Promotion of Science, 2,730,000 JPY
- 2021-2023 **Accurate assessment of the resource potential and urban metabolism mechanism of end-of-life vehicles in China and Japan**
Principal Investigators: Prof. Kazuyo Matsubae; Prof. Xianlai Zeng
Tohoku University, Sendai; Tsinghua University, Beijing,
FY2021 Tohoku University–Tsinghua University Joint Research Fund,
2,500,000 JPY
Role: Co-investigator. My work on the analysis of the latest development of Japan's vehicle recycling policies/ technologies and vehicle-derived resources circulation.
- 2021-2023 **Establishment of resource logistics analysis system for minimizing supply chain risks of mineral resources**
Principal Investigators: Prof. Kazuyo Matsubae
Tohoku University, Sendai,
Japan Science and Technology Agency, 35,000,000 JPY
Role: Co-investigator. My work on the mitigation of supply chain risks of food and mineral resources. I assisted in supervising the overall progress of the project and writing progress reports with other required materials.
- 2021-2028 **Towards Sustainable Nitrogen Use Connecting Human Society and Nature**
Principal Investigators: Prof. Kentaro Hayashi

National Agriculture and Food Research Organization, Tsukuba,
Research Institute for Humanity and Nature, 30,000,000 JPY
*Role: Co-investigator. My work on the estimation of nitrogen utilization
associated with the changes in materials and technologies used in vehicles.*

AWARDS AND HONOURS

- Professional Director for Sustainable Environment**, Tohoku University 2020
Only one awarded from all doctoral graduates in the graduate school. Awarded for the sense of internationalism, practical know-how, management capability, and the leadership and group-minded orientations in strategic planning in environmental science.
- Certificate of Merit for University House Advisor**, Tohoku University 2020
Awarded the active promotion of cross-cultural understanding, encouragement of resident interaction, and exemplary behaviour as a dormitory advisor.
- Best Poster Award**, The 1st Academic Forum on Environmental Studies 2019
Tohoku University
One of the three awarded from eighty submissions.
- Best Student Oral Presentation**, Sino-Japan Symposium for Industrial Ecology 2018
Xiamen, China
- Award of Excellent Presentation** 2018
The 13th International Conference on Waste Management and Technology, Beijing, China
- Japanese Scholarship Award**, Tatsunoko Foundation of Japan 2018
One of the nine awarded on a national basis.

PUBLICATIONS

Peer-reviewed publications

1. Lu, X., **Zhang, Z.**, Hiraki, T., Takeda, O., Zhu*, H., Matsubae, K., & Nagasaka, T.* (2022). A solid-state electrolysis process for upcycling aluminium scrap. *Nature*. <https://doi.org/10.1038/s41586-022-04748-4> (IF: 69.504)
2. Kosai, S.*, Hanqing, L., **Zhang, Z.**, Matsubae, K., & Yamasue, E. (2022). Multi-regional land disturbances induced by mineral use in a product-based approach: A case study of gasoline, hybrid, battery electric and fuel cell vehicle production in Japan. *Resources, Conservation and Recycling*, 178, 106093. <https://doi.org/10.1016/j.resconrec.2021.106093> (IF: 13.716)
3. **Zhang, Z.***, Matsubae, K., & Nakajima, K. (2021). Impact of remanufacturing on the reduction of metal losses through the life cycles of vehicle engines. *Resources, Conservation and Recycling*, 170, 105614. <https://doi.org/10.1016/j.resconrec.2021.105614> (IF: 13.716)

4. Abdullah, M. J.*, **Zhang, Z.**, & Matsubae, K. (2021). Potential for Food Self-Sufficiency Improvements through Indoor and Vertical Farming in the Gulf Cooperation Council: Challenges and Opportunities from the Case of Kuwait. *Sustainability*, 13(22), 12553. <https://doi.org/10.3390/su132212553> (IF: 3.889)
5. Setiawan, I. E.*, **Zhang, Z.**, Corder, G., & Matsubae, K. (2021). Evaluation of Environmental and Economic Benefits of Land Reclamation in the Indonesian Coal Mining Industry. *Resources*, 10(6), 60. <https://doi.org/10.3390/resources10060060>
6. Hu, W.*, Tian, K., **Zhang, Z.**, Guo, J., Liu, X., Yu, H., & Wang, H. (2021). Flotation and Tailing Discarding of Copper Cobalt Sulfide Ores Based on the Process Mineralogy Characteristics. *Minerals*, 11(10), 1078. <https://doi.org/10.3390/min11101078> (IF: 2.818)
7. Numfor, S. A.*, Omosa, G. B., **Zhang, Z.**, & Matsubae, K. (2021). A Review of Challenges and Opportunities for End-of-Life Vehicle Recycling in Developing Countries and Emerging Economies: A SWOT Analysis. *Sustainability*, 13(9), 4918. <https://doi.org/10.3390/su13094918> (IF: 3.889)
8. **Zhang, Z.***, Takeyama, K., Ohno, H., Matsubae, K., Nakajima, K., & Nagasaka, T. (2019). An estimation of the amount of dissipated alloy elements in special steel from automobile recycling. *Matériaux & Techniques*, 107(1), 105. <https://doi.org/10.1051/mattech/2019007>

Journal papers in review

9. Wang, B.*, **Zhang, Z.**, Zeng, X., & Matsubae, K. Hu, W.* (2022). Material flow analysis of secondary aluminium: Focusing on electric vehicles in China. Submit to: *Resources, Conservation and Recycling* (IF: 13.716).
10. Xiong, X., **Zhang, Z.**, Pell, R., Hu, Z., Matsubae, K., & Zeng X.* (2022). From wonderland to wasteland: recycling potential of typical high-end equipment and its implications. *Communications Engineering*.
11. **Zhang, Z.***, Abdullah, M.J., Xu, G., Matsubae, K., Zeng, X.* (2022). Impact of the Conflict in Ukraine on Global Food Security. *Scientific Reports* (IF: 4.996)

Manuscripts in preparation

12. Hu, W., Xiao, F., Wang, D., Yang F., **Zhang, Z.**, Zhu, H.* An electrolysis and heating crystallization operation for recovery of REEs and Fe from waste NdFeB management.
13. Sugiyama, T.*, **Zhang, Z.**, Nakajima, K., & Matsubae, K. Development of IO-based model for supply chain risk analysis: A case of tailings dam failures. Submit to: *Journal of Industrial Ecology*.
14. Xu, G., **Zhang, Z.**, Liu, F., Li, J., Matsubae, K., & Zeng, X.* Sustainable materials management of end-of-life vehicles in China and Japan. Submit to: *Nature Review Earth and Environment*.

15. Abdullah, M.J., **Zhang, Z.***, & Matsubae, K. Greenhouse emissions associated with food imports in Kuwait. Submit to: *Environmental Research Letters*.

Industry reports and others

(In Japanese)

16. **Zhang, Z.*** (2018). Report on the 12th society and materials international conference (SAM12). *Journal of Life Cycle Assessment, Japan* 14(3), 234-235.
<https://doi.org/10.3370/lca.14.234>
17. **Zhang, Z.***, Matsubae, K. (2018). Introduction to Matsubae laboratory in Tohoku University. *Journal of Life Cycle Assessment, Japan* 14(2), 186-187.
<https://doi.org/10.3370/lca.14.186>
18. **Zhang, Z.** (2016). Documents for national license for recycling business plan for waste electrical and electronic equipment. *Ministry of the Environment Government of Japan*.
19. **Zhang, Z.** (2016). Report on commercial area analysis and site selection of unmanned resource recycling station project. *SEINAN Corporation, Japan*.
20. **Zhang, Z.** (2016). Disassembly and management manuals for waste electrical and electronic equipment for handicapped workers. *SEINAN Corporation, Japan*.
21. **Zhang, Z.** (2016). Presentation materials for the long-term experience with gasification of shredder residues at SEINAN, Japan. *16th International Automobile Recycling Congress (IARC)*. Berlin, Germany. March 17, 2016.
22. **Zhang, Z.** (2015). Recruitment documents for the SEINAN Scholarship Program. *SEINAN Corporation, Japan*.
23. **Zhang, Z.** (2015). Post-event report on the post-disaster reconstruction project: Memorial rebirth in Kesenuma, Japan. *SEINAN Corporation, Japan*.
24. **Zhang, Z.** (2014). Report on the recovery of interior plastics derived from end-of-life vehicles. *SEINAN Corporation, Japan*.
25. **Zhang, Z.** (2014). Report on the recovery of neodymium magnet derived from end-of-life hybrid vehicles. *SEINAN Corporation, Japan*.

PRESENTATIONS

Oral presentations

1. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Development of the MaTrace model for evaluating the effect of automotive product remanufacturing. *The 10th International Conference of the International Society for Industrial Ecology*. Beijing, China. July 8, 2019.

2. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Modelling the flow of engine-derived steel in successive rounds of reuse and recycling. *The 177th Spring Meeting of the Iron and Steel Institute of Japan*. Tokyo, Japan. March 20, 2019.
3. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Transition and losses of steel alloy elements used in internal combustion engines throughout multiple life cycles. *Sino-Japan Symposium for Industrial Ecology 2018*. Xiamen, China. November 29, 2018.
4. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. A comparative study of the potential for material losses reduction between auto parts reuse and recycling strategies. *The 13th Biennial International Conference on EcoBalance*. Tokyo, Japan. October 12, 2018.
5. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Estimating the amount of steel alloy elements dissipated in recycling of end-of-life vehicles. *The 12th Society and Materials International Conference*. Metz, France. May 22, 2018.
6. **Zhang, Z.**, Takeyama, K., Matsubae, K. Analysis of material recovery potentials of introducing reuse strategies into recycling of end-of-life vehicles in Japan. *The 13th International Conference on Waste Management and Technology*. Beijing, China. March 24, 2018.
7. **Zhang, Z.**, Matsubae, K. Cost-benefit analysis of recycling of end-of-life gasoline and hybrid electric vehicles in Japan. *The 175th Spring Meeting of the Iron and Steel Institute of Japan*. Chiba, Japan. March 21, 2018.
8. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Development of the MaTrace model for steel cycles: Focusing on auto parts reuse. *The 13th Meeting of the Institute of Life Cycle Assessment, Japan*. March 7, 2018.
9. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Effects of auto parts reuse on avoiding material losses and losses in value in nickel and chromium cycles. *Study Group on Visualization of Social Value of Steel by Innovative Life Cycle Assessment Approach*. Tokyo, Japan. December 12, 2017.
10. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Dynamic material flow analysis of alloyed steel used in vehicle engines. *The 4th International Conference on Final Sinks*. Kyoto, Japan. October 25, 2017.
11. **Zhang, Z.** Challenges and issues of recycling end-of-life vehicles in Japan. *Tohoku University–Ritsumeikan University Joint Seminar*. Sendai, Japan. September 9, 2017.

Poster presentations

1. **Zhang, Z.**, Abdullah, M. J., Matsubae, K. Potentials for Food Self-sufficiency Improvement through Indoor Vertical Farming in Kuwait. The 14th ISIE Socio-Economic Metabolism section conference. Vienna, Austria. September 19-21, 2022.
2. **Zhang, Z.**, Takeyama, K., Nakajima, K., Matsubae, K. Dynamic material flow analysis of engine-derived steel scrap and associated elements—nickel and chromium—in Japan.

The 1st Academic Forum on Environmental Studies, Tohoku University. Sendai, Japan.
June 28, 2019.

3. **Zhang, Z.**, Yu, J., Che, J. Trends in the diffusion of vehicles in China and Mongolia. *The 5th Asian Automotive Environmental Forum.* Gold Coast, Australia. December 1, 2012.
4. **Zhang, Z.**, Yu, J., Che, J. Analysis of the status of the rapid motorization and recycling of end-of-life vehicles in Inner Mongolia, China. *The 4th Asian Automotive Environmental Forum.* Kuala Lumpur, Malaysia. November 10, 2012.

PROFESSIONAL TRAINING

Practical English Course

Tohoku University, Sendai, September to November 2017

Description: An extracurricular training specializing in English presentation skills.

EcoLead Premium Summer School 2017

Environmental Human Resources Consortium (EcoLead), Tokyo, September 11-15, 2017

Description: Trained diverse concepts and methodologies on knowing/recognizing the limits and future of the planet along with the evaluation of sustainability at national and regional level from nine most influential environmental scientists from Japan.

PROFESSIONAL AFFILIATIONS

Environmental Economics and Policy Studies, Japan, 2020-present

International Society for Industrial Ecology, 2018-present

The Iron and Steel Institute of Japan, 2018-present

The Institute of Life Cycle Assessment of Japan, 2017-present

PROFESSIONAL SERVICE

Host member

Tohoku University alumni “Shuyukai” – The Chinese Chapter, 2022-present

Supporting the mutual understanding and academic exchange activities between Tohoku University and Faculties from various Chinese universities and/or institutions.

President

The Student Chapter of International Society for Industrial Ecology, 2019-2020

Elected on a board-wide basis to serve on a student-led Board to promote the development of the Chapter. Duties involved organizing the ISIE conference for students and monthly board meetings, establishing peer-groups and communication platforms, networking events for students, running elections, and enhancing diversity and equality of membership.

Asian Representative

The Student Chapter of International Society for Industrial Ecology, 2018-2019

Elected on an organization-wide basis. Duties involved supporting within the Chapter, coordinating student-centered factory tours, and poster presentations, and answering to student needs during the ISIE conference in Beijing,

Peer-reviewed articles for:

- Resources, Conservation & Recycling (IF: 10.204), 2022-present
- Frontiers of Environmental Science & Engineering (IF: 4.375), 2022-present
- Journal of Industrial Ecology (IF: 6.946), 2021-present

LANGUAGES

Japanese: Native-level speaker, Advanced teaching, reading, and writing

English: Advanced communicating, listening, reading, and writing

Chinese: Native language

COMPUTER SKILLS

Software proficiency:

- programming with Matlab,
- MiLCA (a Japanese software for Life Cycle Assessment)
- ArcGIS (a geographic information analysing and visualizing software)
- Sankey Diagram (a data visualizing software)
- OriginPro (a data analysis and graphing software)

OTHER

Press Releases

1. “Recycling of high-purity aluminum from scrap, avoiding deterioration of quality and saving energy, developed by Tohoku University.” *The Mainichi Newspapers*, May 12, 2022. <https://mainichi.jp/articles/20220512/k00/00m/040/073000c>
2. “Tohoku University’s aluminum scrap recycling technology saves energy to less than half of that to produce primary aluminum ingots.” *MIT Technology Review*, April 27, 2022. <https://www.technologyreview.jp/n/2022/04/27/274592/>
3. “Recycling of high-purity aluminum from scrap, Tohoku University's new technology.” *Nihon Keizai Shimbun*, April 26, 2022. <https://www.nikkei.com/article/DGXZQOCC266XU0W2A420C2000000/>
4. “Development of a new sustainable recycling technology for aluminum: Aiming to overcome the aluminum crisis.” *Tohoku University*, April 26, 2022. <https://www.tohoku.ac.jp/japanese/2022/04/press20220426-05-aluminium.html>

REFERENCES

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