

# **SUPPLEMENTARY MATERIAL For Optimization Models for Long-Term Planning of Municipal Solid Waste Management Systems: A Review with An Emphasis on Mass Balances**

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**Table S1.** The List of Journal Considered in the Specific Surveillance

| JOURNALS                                              | NUMBERS OF ARTICLE |
|-------------------------------------------------------|--------------------|
| Waste Management                                      | 57                 |
| Waste Management and Research                         | 37                 |
| Resources, Conservation and Recycling                 | 32                 |
| Journal of Cleaner Production                         | 28                 |
| Journal of Environmental Management                   | 20                 |
| European Journal of Operational Research              | 18                 |
| Journal of the Air and Waste Management Association   | 17                 |
| Environmental Engineering Science                     | 14                 |
| Engineering Optimization                              | 13                 |
| Computers and Chemical Engineering                    | 8                  |
| Environmental Modeling and Assessment                 | 8                  |
| Journal of Environmental Engineering                  | 8                  |
| Journal of Environmental Informatics                  | 8                  |
| Water Science and Technology                          | 8                  |
| Sustainability Switzerland                            | 7                  |
| Environmental Management                              | 6                  |
| Environmental Modelling and Software                  | 6                  |
| Environmental Science and Technology                  | 6                  |
| Journal of Environmental Engineering United States    | 6                  |
| Journal of Hazardous Materials                        | 6                  |
| Applied Mathematical Modelling                        | 5                  |
| Civil Engineering and Environmental Systems           | 5                  |
| International Journal of Production Economics         | 5                  |
| Journal of Solid Waste Technology and Management      | 5                  |
| Science of the Total Environment                      | 5                  |
| Stochastic Environmental Research and Risk Assessment | 5                  |

**Table S2.** The Results for the Programming Components of the Literature Evaluation Scheme

| OBJECTIVE<br>FUNCTIONS | CONSTRAINTS | VARIABLES  | PARAMETERS                | ECHELON<br>TYPES <sup>1</sup> | INTEGRATED<br>MASS<br>BALANCE<br>POSSIBILITY | WASTE<br>TRANSFORMATION | REFERENCES                          |
|------------------------|-------------|------------|---------------------------|-------------------------------|----------------------------------------------|-------------------------|-------------------------------------|
| Linear                 | Linear      | Mixed      | Deterministic             | TS/TP                         | -                                            | Cumulative              | Galante et al., 2010                |
| Linear                 | Linear      | Mixed      | Fuzzy/Interval            | TP/LP                         | No P. S.                                     | Cumulative              | Li and Huang, 2010a                 |
| Linear                 | Linear      | Mixed      | Stochastic/Interval       | BP/TP/LP                      | No P. S.                                     | Cumulative              | Li and Huang, 2010b                 |
| Linear                 | Linear      | Mixed      | Stochastic/Interval       | TP/LP                         | No P. S.                                     | Cumulative              | Xu et al., 2010                     |
| Linear                 | Linear      | Continuous | Fuzzy/Stochastic/Interval | TP/LP                         | No P. S.                                     | Cumulative              | Tan et al., 2010a                   |
| Quadratic              | Linear      | Continuous | Stochastic/Interval       | BP/TP/LP                      | No P. S.                                     | Cumulative              | Sun et al., 2010                    |
| Linear                 | Linear      | Continuous | Fuzzy /Interval           | TP/LP                         | No P. S.                                     | Cumulative              | Zhang and Huang, 2010               |
| Linear                 | Linear      | Mixed      | Fuzzy/Interval            | BP/TP/LP                      | No P. S.                                     | Cumulative              | Guo and Huang, 2010                 |
| Linear                 | Linear      | Mixed      | Stochastic/Interval       | BP/TP/LP                      | No P. S.                                     | Cumulative              | Su et al., 2010                     |
| Linear                 | Linear      | Continuous | Fuzzy /Interval           | TP/LP                         | No P. S.                                     | Cumulative              | Zhang et al., 2010                  |
| Linear                 | Linear      | Continuous | Radial Interval           | TP/LP                         | No P. S.                                     | Cumulative              | Tan et al., 2010b                   |
| Linear                 | Linear      | Mixed      | Fuzzy/Interval            | TP/LP                         | No P. S.                                     | Cumulative              | Tan et al., 2010c                   |
| Linear                 | Linear      | Mixed      | Random/Intervals          | TS/BP/LP                      | No P. S.                                     | Cumulative              | Cui et al., 2011                    |
| Linear                 | Linear      | Continuous | Fuzzy/Stochastic/Interval | BP/LP                         | No P. S.                                     | Cumulative              | Li and Chen, 2011                   |
| Quadratic              | Linear      | Mixed      | Fuzzy /Interval           | MP/BP/TP/LP                   | No P. S.                                     | Cumulative              | Guo and Huang, 2011                 |
| Linear                 | Linear      | Mixed      | Fuzzy /Interval           | TS/TP/LP                      | No P. S.                                     | Cumulative              | Li and Huang, 2011                  |
| Fractional             | Linear      | Continuous | Stochastic                | MP/BP/LP                      | No P. S.                                     | Cumulative              | Zhu and Huang, 2011                 |
| Linear                 | Linear      | Mixed      | Interval                  | TS/BP/TP/LP                   | No P. S.                                     | Cumulative              | Dai et al., 2011                    |
| Linear                 | Linear      | Continuous | Interval                  | TP/LP                         | No P. S.                                     | Cumulative              | Zhang et al., 2011                  |
| Linear                 | Linear      | Mixed      | Fuzzy                     | TS/BP/TP/LP                   | Yes                                          | Cumulative              | Srivastava and Nema, 2011           |
| Non-linear             | Linear      | Integer    | Deterministic             | TS/LP                         | -                                            | Cumulative              | Chatzouridis and Komilis, 2012      |
| Linear                 | Linear      | Continuous | Deterministic             | MP/BP/TP/LP                   | No P. S.                                     | Cumulative              | Chang et al., 2012                  |
| Linear                 | Linear      | Continuous | Fuzzy /Interval           | TP/LP                         | No P. S.                                     | Cumulative              | Tan et al., 2012                    |
| Linear                 | Linear      | Mixed      | Fuzzy/Stochastic/Interval | BP/TP/LP                      | No P. S.                                     | Cumulative              | Wang et al., 2012                   |
| Linear                 | Linear      | Continuous | Interval                  | MP/BP/LP                      | No P. S.                                     | Cumulative              | Dai et al., 2012                    |
| Linear                 | Linear      | Continuous | Fuzzy /Interval           | TP/LP                         | No P. S.                                     | Cumulative              | Sun et al., 2012                    |
| Linear                 | Linear      | Mixed      | Deterministic             | MP/BP/TP/LP                   | Yes                                          | Component-based         | Levis et al., 2013                  |
| Linear                 | Linear      | Mixed      | Deterministic             | TS/MP/BP/TP/LP                | Yes                                          | Component-based         | Mavrotas et al., 2013               |
| Linear                 | Linear      | Continuous | Deterministic             | TP/LP                         | No P. S.                                     | Cumulative              | Chang and Lin, 2013a                |
| Linear                 | Linear      | Mixed      | Fuzzy/Stochastic          | TP/LP                         | No P. S.                                     | Cumulative              | Zhang and Huang, 2013               |
| Non-linear             | Linear      | Continuous | Deterministic             | TS/MP/BP/TP/LP                | No P. S.                                     | Component-based         | Minoglou and Komilis, 2013          |
| Linear                 | Linear      | Continuous | Deterministic             | MP/BP/TP/LP                   | No P. S.                                     | Cumulative              | Chang and Lin, 2013b                |
| Linear                 | Linear      | Mixed      | Deterministic             | MP/TP                         | -                                            | Component-based         | Santibanez-Aguilar et al., 2013     |
| Linear                 | Linear      | Continuous | Stochastic/Interval       | TS/TP/LP                      | No P. S.                                     | Cumulative              | Chen et al., 2014                   |
| Linear                 | Linear      | Mixed      | Stochastic/Interval       | MP/BP/LP                      | No P. S.                                     | Cumulative              | Dai et al., 2014                    |
| Linear                 | Linear      | Mixed      | Fuzzy                     | TP/LP                         | No P. S.                                     | Cumulative              | Zhang and Huang, 2014               |
| Linear                 | Linear      | Continuous | Fuzzy                     | TP/LP                         | No P. S.                                     | Cumulative              | Fan et al., 2014                    |
| Linear                 | Linear      | Mixed      | Deterministic             | TS/LP                         | -                                            | Cumulative              | Eiselt and Marianov, 2014           |
| Linear                 | Linear      | Continuous | Stochastic                | TP/LP                         | No P. S.                                     | Cumulative              | Zhang et al., 2014                  |
| Linear                 | Linear      | Continuous | Fuzzy                     | TP/LP                         | No P. S.                                     | Cumulative              | Xu et al., 2014a                    |
| Linear                 | Linear      | Mixed      | Fuzzy                     | BP/TP/LP                      | No P. S.                                     | Cumulative              | Xu et al., 2014b                    |
| Linear                 | Linear      | Mixed      | Deterministic             | MP/BP/TP/LP                   | -                                            | Cumulative              | Tan et al., 2014                    |
| Linear                 | Linear      | Mixed      | Deterministic             | BP/TP                         | -                                            | Cumulative              | Münster et al., 2015                |
| Linear                 | Linear      | Mixed      | Deterministic             | BP/TP/LP                      | -                                            | Cumulative              | ThiKimOanh et al., 2015             |
| Linear                 | Linear      | Mixed      | Stochastic                | MP/BP/LP                      | No P. S.                                     | Cumulative              | Chen et al., 2016a                  |
| Quadratic              | Linear      | Continuous | Interval                  | TP/LP                         | No P. S.                                     | Cumulative              | Kong et al., 2016                   |
| Linear                 | Linear      | Continuous | Interval                  | TP/LP                         | No P. S.                                     | Cumulative              | Zhai et al., 2016                   |
| Linear                 | Linear      | Mixed      | Deterministic             | TP/LP                         | -                                            | Cumulative              | Lee et al., 2016                    |
| Linear                 | Linear      | Mixed      | Fuzzy/Stochastic/Interval | TS/MP/BP/TP/LP                | No P. S.                                     | Cumulative              | Chen et al., 2016b                  |
| Fractional             | Linear      | Mixed      | Stochastic                | MP/BP/LP                      | No P. S.                                     | Cumulative              | Zhou et al., 2016                   |
| Linear                 | Linear      | Continuous | Interval                  | BP/TP                         | No P. S.                                     | Cumulative              | Zhu et al., 2016                    |
| Non-linear             | Linear      | Continuous | Deterministic             | TS/MP/BP/TP/LP                | No P. S.                                     | Component-based         | Asnoue et al., 2016                 |
| Linear                 | Linear      | Mixed      | Fuzzy                     | TS/BP/TP/LP                   | -                                            | Cumulative              | Xu et al., 2016                     |
| Linear                 | Linear      | Continuous | Deterministic             | TS/MP/BP/TP/LP                | No P. S.                                     | Component-based         | Tascione et al., 2016               |
| Linear                 | Non-linear  | Mixed      | Interval                  | TS/BP/LP                      | -                                            | Component-based         | Yadav et al., 2017                  |
| Linear                 | Linear      | Mixed      | Stochastic                | TS/MP/BP/LP                   | -                                            | Cumulative              | Habibi et al., 2017                 |
| Linear                 | Linear      | Continuous | Interval                  | BP/TP/LP                      | No P. S.                                     | Cumulative              | Zhu and Huang, 2017                 |
| Linear                 | Linear      | Mixed      | Deterministic             | TS/MP/BP/TP/LP                | -                                            | Component-based         | Harijani et al., 2017               |
| Linear                 | Linear      | Mixed      | Fuzzy                     | BP/TP/LP                      | -                                            | Cumulative              | Ma et al., 2017                     |
| Linear                 | Linear      | Mixed      | Deterministic             | TS/MP/BP/TP/LP                | No P. S.                                     | Cumulative              | Asefi and Lim, 2017                 |
| Linear                 | Linear      | Mixed      | Deterministic             | MP/TP/LP                      | No P. S.                                     | Component-based         | Santibanez-Aguilaret al., 2017      |
| Linear                 | Non-linear  | Mixed      | Deterministic             | MP/BP/LP                      | -                                            | Cumulative              | Li et al., 2017                     |
| Linear                 | Linear      | Continuous | Stochastic/Interval       | TP/LP                         | No P. S.                                     | Cumulative              | Wu et al., 2018                     |
| Linear                 | Linear      | Mixed      | Stochastic                | MP/TP/LP                      | -                                            | Component-based         | Diaz-Barriga-Fernandez et al., 2018 |
| Linear                 | Non-linear  | Mixed      | Deterministic             | MP/BP/TP/LP                   | -                                            | Cumulative              | Sharif et al., 2018                 |
| Non-linear             | Non-linear  | Mixed      | Deterministic             | MP/BP/TP/LP                   | Yes                                          | Component-based         | Rizwan et al., 2018                 |
| Linear                 | Linear      | Mixed      | Deterministic             | TS/MP/BP/TP/LP                | -                                            | Cumulative              | Rathore and Sarmah, 2019            |
| Linear                 | Linear      | Mixed      | Deterministic             | MP/BP/TP                      | Yes                                          | Component-based         | Mohammadi et al., 2019              |
| Linear                 | Linear      | Mixed      | Stochastic                | TS                            | -                                            | Cumulative              | Kudela et al., 2019                 |
| Linear                 | Linear      | Mixed      | Stochastic/Interval       | TS/TP/LP                      | No P. S.                                     | Cumulative              | Li et al., 2019                     |
| Linear                 | Linear      | Mixed      | Stochastic                | TS/PP/TP                      | No P. S.                                     | Cumulative              | Gambella et al., 2019               |
| Linear                 | Linear      | Mixed      | Deterministic             | TS/MP/BP/TP/LP                | Yes                                          | Cumulative              | Yousefloo and Babazadeh, 2020       |

<sup>1</sup>: Process alternatives that may be used in waste management: Transfer station (TS), mechanical process (MP), biological process (BP), thermal process (TP), landfills (LP).

No P. S.: The study doesn't consider the process selection question.

**Table S3.** The Results for the Decision Components of the Literature Evaluation Scheme

| COLLECTION ZONING | WASTE ALLOCATION | CAPACITY ASSESSMENT | PROCESS SELECTION <sup>1</sup> | TECHNOLOGY ALTERNATIVES | SITE SELECTION | REFERENCES                          |
|-------------------|------------------|---------------------|--------------------------------|-------------------------|----------------|-------------------------------------|
| Yes               | Yes              | Yes                 | TS                             | Yes                     | Yes            | Galante et al., 2010                |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Li and Huang, 2010a                 |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Li and Huang, 2010b                 |
| Yes               | Yes              | Yes                 | -                              | -                       | Yes            | Xu et al., 2010                     |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Tan et al., 2010a                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Sun et al., 2010                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhang and Huang, 2010               |
| -                 | Yes              | Yes                 | -                              | -                       | -              | Guo and Huang, 2010                 |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Su et al., 2010                     |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhang et al., 2010                  |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Tan et al., 2010b                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Tan et al., 2010c                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Cui et al., 2011                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Li and Chen, 2011                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Guo and Huang, 2011                 |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Li and Huang, 2011                  |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhu and Huang, 2011                 |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Dai et al., 2011                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhang et al., 2011                  |
| Yes               | Yes              | Yes                 | LP                             | -                       | Yes            | Srivastava and Nema, 2011           |
| Yes               | -                | Yes                 | TS                             | -                       | Yes            | Chatzouridis and Komilis, 2012      |
| Yes               | Yes              | -                   | -                              | -                       | -              | Chang et al., 2012                  |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Tan et al., 2012                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Wang et al., 2012                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Dai et al., 2012                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Sun et al., 2012                    |
| -                 | Yes              | Yes                 | MP/BP/TP/LP                    | -                       | -              | Levis et al., 2013                  |
| Yes               | Yes              | Yes                 | TS/MP/BP/TP/LP                 | Yes                     | -              | Mavrotas et al., 2013               |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Chang and Lin, 2013a                |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhang and Huang, 2013               |
| Yes               | Yes              | -                   | -                              | Yes                     | -              | Minoglou and Komilis, 2013          |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Chang and Lin, 2013b                |
| Yes               | Yes              | Yes                 | MP/TP                          | Yes                     | Yes            | Santibanez-Aguilar et al., 2013     |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Chen et al., 2014                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Dai et al., 2014                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhang and Huang, 2014               |
| Yes               | Yes              | -                   | -                              | -                       | -              | Fan et al., 2014                    |
| Yes               | Yes              | Yes                 | TS/LP                          | -                       | Yes            | Eiselt and Marianov, 2014           |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhang et al., 2014                  |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Xu et al., 2014a                    |
| -                 | Yes              | Yes                 | -                              | -                       | -              | Xu et al., 2014b                    |
| Yes               | Yes              | Yes                 | MP/BP/TP/LP                    | -                       | -              | Tan et al., 2014                    |
| -                 | Yes              | Yes                 | BP/TP                          | Yes                     | -              | Münster et al., 2015                |
| Yes               | Yes              | Yes                 | BP/TP                          | Yes                     | Yes            | ThiKimOanh et al., 2015             |
| Yes               | -                | Yes                 | -                              | -                       | -              | Chen et al., 2016a                  |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Kong et al., 2016                   |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhai et al., 2016                   |
| Yes               | Yes              | Yes                 | TP/LP                          | -                       | Yes            | Lee et al., 2016                    |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Chen et al., 2016b                  |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhou et al., 2016                   |
| Yes               | Yes              | -                   | -                              | -                       | -              | Zhu et al., 2016                    |
| -                 | Yes              | -                   | -                              | -                       | -              | Asnoune et al., 2016                |
| Yes               | Yes              | Yes                 | BP/TP/LP                       | -                       | -              | Xu et al., 2016                     |
| Yes               | Yes              | Yes                 | -                              | Yes                     | -              | Tascione et al., 2016               |
| -                 | Yes              | Yes                 | TP                             | -                       | Yes            | Yadav et al., 2017                  |
| Yes               | Yes              | Yes                 | TS/MP/LP                       | Yes                     | Yes            | Habibi et al., 2017                 |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Zhu and Huang, 2017                 |
| Yes               | Yes              | Yes                 | MP/BP/TP/LP                    | Yes                     | Yes            | Harijani et al., 2017               |
| Yes               | Yes              | Yes                 | BP/LP                          | -                       | -              | Ma et al., 2017                     |
| Yes               | Yes              | Yes                 | -                              | -                       | Yes            | Asefi and Lim, 2017                 |
| Yes               | Yes              | -                   | -                              | -                       | -              | Santibanez-Aguilaret et al., 2017   |
| Yes               | Yes              | Yes                 | LP                             | -                       | -              | Li et al., 2017                     |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Wu et al., 2018                     |
| Yes               | Yes              | -                   | MP/TP                          | Yes                     | Yes            | Diaz-Barriga-Fernandez et al., 2018 |
| Yes               | Yes              | Yes                 | MP/BP/TP/LP                    | -                       | Yes            | Sharif et al., 2018                 |
| Yes               | Yes              | Yes                 | MP/BP/TP/LP                    | Yes                     | -              | Rizwan et al., 2018                 |
| Yes               | Yes              | Yes                 | TS                             | -                       | Yes            | Rathore and Sarmah, 2019            |
| Yes               | Yes              | Yes                 | MP/BP/TP/LP                    | Yes                     | -              | Mohammadi et al., 2019              |
| Yes               | Yes              | Yes                 | TS                             | -                       | Yes            | Kudela et al., 2019                 |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Li et al., 2019                     |
| Yes               | Yes              | Yes                 | -                              | -                       | -              | Gambella et al., 2019               |
| Yes               | Yes              | Yes                 | TS/MP/BP/TP/LP                 | Yes                     | Yes            | Yousefloo and Babazadeh, 2020       |

<sup>1</sup>: Process alternatives that may be used in waste management: Transfer station (TS), mechanical process (MP), biological process (BP), thermal process (TP), landfills (LP).

**Table S4.** The Results for the Managerial Components of the Literature Evaluation Scheme

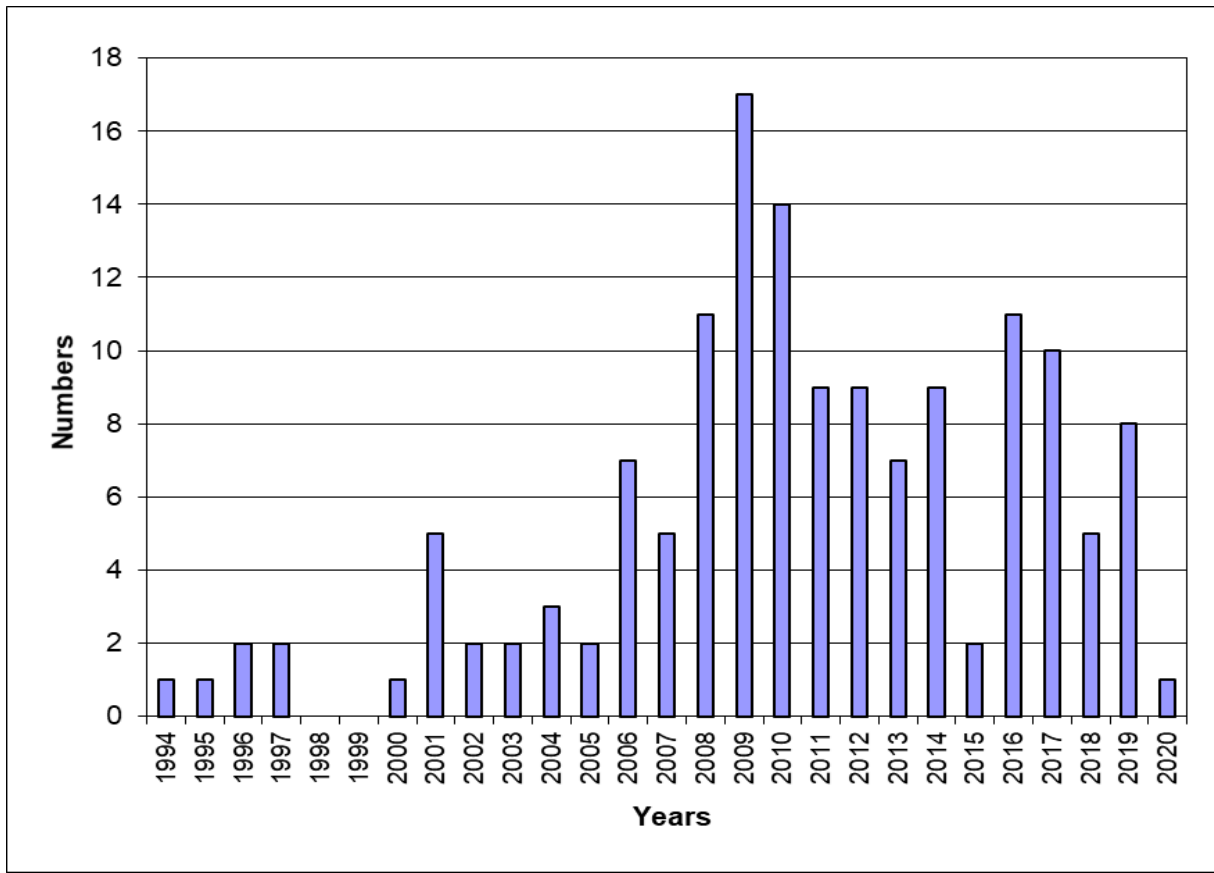
| COLLECTION TYPE | GEOGRAPHIC FOCUS | DISTANCES | COST AND BENEFIT COMPONENTS OF OBJECTIVE FUNCTION <sup>1</sup> | OTHER COMPONENTS OF OBJECTIVE FUNCTION <sup>2</sup> | PLANNING PERIOD (YEARS) | REFERENCES                          |
|-----------------|------------------|-----------|----------------------------------------------------------------|-----------------------------------------------------|-------------------------|-------------------------------------|
| Mix             | Italy            | Yes       | CC/OC/TC                                                       | AP                                                  | 30                      | Galante et al., 2010                |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Li and Huang, 2010a                 |
| Mix             | Canada           | -         | OC/TC/RV                                                       | -                                                   | 15                      | Li and Huang, 2010b                 |
| Mix             | Hypothetical     | -         | OC/TC                                                          | -                                                   | 15                      | Xu et al., 2010                     |
| Mix             | Hypothetical     | -         | OC/TC                                                          | -                                                   | 15                      | Tan et al., 2010a                   |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Sun et al., 2010                    |
| Mix             | Hypothetical     | -         | OC/TC                                                          | -                                                   | 15                      | Zhang and Huang, 2010               |
| Mix             | Canada           | -         | OC/TC/RV                                                       | -                                                   | 21                      | Guo and Huang, 2010                 |
| Mix             | China            | Yes       | OC/TC/RV                                                       | -                                                   | 15                      | Su et al., 2010                     |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Zhang et al., 2010                  |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Tan et al., 2010b                   |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Tan et al., 2010c                   |
| Mix             | China            | -         | OC/TC/RV                                                       | -                                                   | 15                      | Cui et al., 2011                    |
| Mix             | China            | Yes       | OC/TC/RV                                                       | -                                                   | 5                       | Li and Chen, 2011                   |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Guo and Huang, 2011                 |
| Mix             | China            | -         | OC/TC/RV                                                       | -                                                   | 15                      | Li and Huang, 2011                  |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Zhu and Huang, 2011                 |
| Mix             | China            | Yes       | OC/TC/RV                                                       | -                                                   | 15                      | Dai et al., 2011                    |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | -                       | Zhang et al., 2011                  |
| Mix             | India            | Yes       | CC/OC/TC/RV                                                    | -                                                   | 17                      | Srivastava and Nema, 2011           |
| Mix             | Greece           | Yes       | CC/OC/TC                                                       | -                                                   | -                       | Chatzouridis and Komilis, 2012      |
| Separate        | Taiwan           | Yes       | OC/TC/RV                                                       | AP                                                  | -                       | Chang et al., 2012                  |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Tan et al., 2012                    |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Wang et al., 2012                   |
| Mix             | Canada           | -         | OC/TC/RV                                                       | -                                                   | 15                      | Dai et al., 2012                    |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Sun et al., 2012                    |
| Separate        | Hypothetical     | Yes       | CC/OC/RV                                                       | GHG                                                 | 10                      | Levis et al., 2013                  |
| Separate        | Macedonia        | Yes       | CC/OC/RV                                                       | GHG                                                 | 20                      | Mavrotas et al., 2013               |
| Mix             | Taiwan           | Yes       | OC/TC/RV                                                       | -                                                   | 5                       | Chang and Lin, 2013a                |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | GHG                                                 | 15                      | Zhang and Huang, 2013               |
| Separate        | Macedonia        | Yes       | CC/OC/TC/RV                                                    | CO <sub>2</sub> equivalents                         | 15                      | Minoglou and Komilis, 2013          |
| Separate        | Taiwan           | -         | OC/TC/RV                                                       | Emissions                                           | -                       | Chang and Lin, 2013b                |
| Separate        | Mexico           | Yes       | CC/OC/TC/RV                                                    | -                                                   | -                       | Santibanez-Aguilar et al., 2013     |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Chen et al., 2014                   |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Dai et al., 2014                    |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | GHG                                                 | 15                      | Zhang and Huang, 2014               |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Fan et al., 2014                    |
| Mix             | Chile            | Yes       | CC/OC/TC/RV                                                    | Pollution                                           | -                       | Eiselt and Marianov, 2014           |
| Mix             | Hypothetical     | -         | OC/TC                                                          | -                                                   | -                       | Zhang et al., 2014                  |
| Mix             | Hypothetical     | -         | OC/TC                                                          | -                                                   | 15                      | Xu et al., 2014a                    |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Xu et al., 2014b                    |
| Separate        | Malaysia         | -         | CC/OC/TC/RV                                                    | GHG                                                 | 13                      | Tan et al., 2014                    |
| Mix             | Denmark          | -         | OC                                                             | GHG                                                 | -                       | Münster et al., 2015                |
| Mix             | Vietnam          | Yes       | CC/OC/TC/RV                                                    | -                                                   | 20                      | ThiKimOanh et al., 2015             |
| Mix             | Canada           | Yes       | OC/TC/RV                                                       | -                                                   | 25                      | Chen et al., 2016a                  |
| Mix             | China            | -         | OC/TC/RV                                                       | -                                                   | 15                      | Kong et al., 2016                   |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Zhai et al., 2016                   |
| Mix             | Hong Kong        | Yes       | CC/OC/TC/RV                                                    | -                                                   | -                       | Lee et al., 2016                    |
| Mix             | China            | -         | OC/TC/RV                                                       | -                                                   | 15                      | Chen et al., 2016b                  |
| Mix             | Hypothetical     | -         | OC/TC/RV                                                       | -                                                   | 15                      | Zhou et al., 2016                   |
| Separate        | Canada           | -         | OC/TC/RV                                                       | -                                                   | 24                      | Zhu et al., 2016                    |
| Separate        | Algeria          | -         | CC/OC/RV                                                       | -                                                   | 5                       | Asnoue et al., 2016                 |
| Mix             | China            | Yes       | CC/OC/TC/RV                                                    | -                                                   | 15                      | Xu et al., 2016                     |
| Separate        | Italy            | Yes       | -                                                              | Life Cycle Impacts                                  | -                       | Tascione et al., 2016               |
| Mix             | Hypothetical     | Yes       | CC/OC/TC/RV                                                    | -                                                   | 20                      | Yadav et al., 2017                  |
| Separate        | Iran             | Yes       | CC/OC/TC/RV                                                    | GHG/Visual/ Pollution                               | -                       | Habibi et al., 2017                 |
| Mix             | Canada           | -         | OC/TC/RV                                                       | -                                                   | 21                      | Zhu and Huang, 2017                 |
| Separate        | Iran             | Yes       | CC/OC/TC/RV                                                    | AP/SCB/Sustainability                               | 5                       | Harijani et al., 2017               |
| Mix             | China            | Yes       | CC/OC/TC/RV                                                    | -                                                   | -                       | Ma et al., 2017                     |
| Mix             | Iran             | Yes       | CC/TC                                                          | Suitability                                         | -                       | Asefi and Lim, 2017                 |
| Separate        | Mexico           | Yes       | OC/TC/RV                                                       | -                                                   | -                       | Santibanez-Aguilaret et al., 2017   |
| Mix             | Canada           | -         | CC/OC/TC/RV                                                    | GHG                                                 | 30                      | Li et al., 2017                     |
| Mix             | China            | -         | OC/TC/RV                                                       | -                                                   | -                       | Wu et al., 2018                     |
| Separate        | Mexico           | Yes       | CC/OC/TC/RV                                                    | -                                                   | -                       | Diaz-Barriga-Fernandez et al., 2018 |
| Separate        | Iran             | -         | CC/OC/RV                                                       | -                                                   | -                       | Sharif et al., 2018                 |
| Mix             | U. A. Emirates   | -         | CC/OC/RV                                                       | -                                                   | 20                      | Rizwan et al., 2018                 |
| Separate        | India            | Yes       | CC/OC/TC/RV                                                    | -                                                   | 5                       | Rathore and Sarmah, 2019            |
| Separate        | Mexico           | Yes       | CC/OC/TC/RV                                                    | -                                                   | -                       | Mohammadi et al., 2019              |
| Mix             | Czechia          | Yes       | CC/OC/TC                                                       | -                                                   | -                       | Kudela et al., 2019                 |
| Mix             | China            | -         | OC/TC/RV                                                       | -                                                   | 15                      | Li et al., 2019                     |
| Mix             | Italy            | -         | OC/TC/RV                                                       | -                                                   | 3                       | Gambella et al., 2019               |
| Separate        | Iran             | Yes       | CC/OC/TC/RV                                                    | Health Risk                                         | -                       | Yousefloo and Babazadeh, 2020       |

<sup>1</sup>: It refers to the parameters used in the objective function: Construction costs (CC), operation-maintenance costs (OC), transportation costs (TC), and revenues (RV).<sup>2</sup>: It refers to the social and environmental components of objective functions: Air pollution (AP), greenhouse gases (GHG), social costs and benefits (SCB).

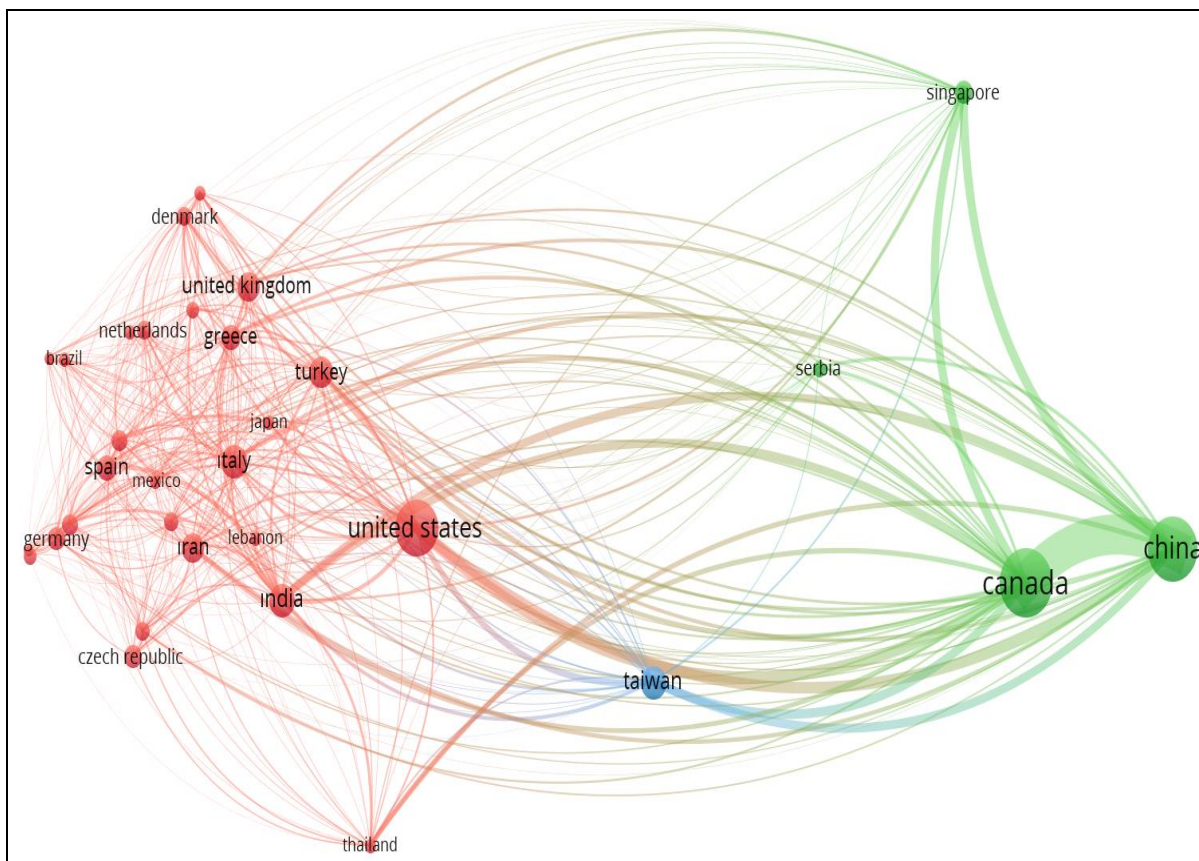
**Table S5.** The Findings for 74 Articles Examined in the Last Assessment Stage

| MODEL<br>PARAMETERS | GEOGRAPHIC<br>FOCUS | OBJECTIVE<br>FUNCTION | CONSTRAINTS | VARIABLES  | INTEGRATED<br>MASS<br>BALANCE<br>POSSIBILITY | REFERENCES                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------|---------------------|-----------------------|-------------|------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Non-deterministic   | Hypothetical        | Linear                | Linear      | Mixed      | No. P. S.                                    | Huang et al., 1994; Huang et al., 1995; Zou et al., 2000; Huang et al., 2002; Li et al., 2006a; Li et al., 2006b; Guo et al., 2008a; He et al., 2008b; Lu et al., 2008; Guo et al., 2009; He et al., 2009a; He et al., 2009b; He et al., 2009c; Li and Huang, 2009a; Li et al., 2009a; Liu et al., 2009; Lu et al., 2009; Nie et al., 2009; Lu et al., 2012; Fan et al., 2012; Yu and Solvang, 2017 |
|                     | Hypothetical        | Linear                | Linear      | Continuous | No. P. S.                                    | Maqsood and Huang, 2003; Maqsood et al., 2004; Li and Huang, 2006b; Li et al., 2007; Nie et al., 2007; Guo et al., 2008b; He and Huang, 2008; He et al., 2008a; Li et al., 2008c; Cai et al., 2009; Cheng et al., 2009; Fan et al., 2009; Li and Huang, 2009c; Sun et al., 2011; Wang et al., 2019                                                                                                  |
|                     | Hypothetical        | Quadratic             | Linear      | Mixed      | No. P. S.                                    | Li and Huang, 2007                                                                                                                                                                                                                                                                                                                                                                                  |
|                     | Hypothetical        | Quadratic             | Linear      | Continuous | No. P. S.                                    | Chen and Huang, 2001                                                                                                                                                                                                                                                                                                                                                                                |
|                     | China               | Linear                | Linear      | Mixed      | No. P. S.                                    | Jing et al., 2009; Xi et al., 2010; Chen et al., 2016c; Zhou et al., 2017                                                                                                                                                                                                                                                                                                                           |
|                     | China               | Linear                | Linear      | Continuous | No. P. S.                                    | Su et al., 2008                                                                                                                                                                                                                                                                                                                                                                                     |
|                     | Canada              | Linear                | Linear      | Mixed      | No. P. S.                                    | Li et al., 2008b                                                                                                                                                                                                                                                                                                                                                                                    |
|                     | Canada              | Non-linear            | Linear      | Continuous | No. P. S.                                    | Wu et al., 2006                                                                                                                                                                                                                                                                                                                                                                                     |
|                     | Canada              | Linear                | Linear      | Continuous | No. P. S.                                    | Yeomans, 2007                                                                                                                                                                                                                                                                                                                                                                                       |
|                     | Hypothetical        | Linear                | Linear      | Mixed      | -                                            | Huang et al., 2001a                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | U. S. A.            | Linear                | Linear      | Mixed      | -                                            | Davila and Chang, 2005; Chang and Davilla, 2006; Chang and Davilla, 2007                                                                                                                                                                                                                                                                                                                            |
|                     | Czechia             | Non-linear            | Non-linear  | Mixed      | -                                            | Hrabec et al., 2019                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | Canada              | Linear                | Linear      | Mixed      | -                                            | Huang et al., 2001b; Li and Huang, 2006a; Li et al., 2008a; Guo and Huang, 2009; Li et al., 2009b; Li and Huang, 2010c                                                                                                                                                                                                                                                                              |
|                     | India               | Linear                | Linear      | Mixed      | -                                            | Srivastava and Nema, 2012                                                                                                                                                                                                                                                                                                                                                                           |
|                     | Hypothetical        | Linear                | Linear      | Mixed      | Yes                                          | Li and Huang, 2009b                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | Taiwan              | Linear                | Non-linear  | Continuous | Yes                                          | Chang and Wang, 1996                                                                                                                                                                                                                                                                                                                                                                                |
|                     | Taiwan              | Linear                | Linear      | Mixed      | Yes                                          | Chang and Wang, 1997                                                                                                                                                                                                                                                                                                                                                                                |
|                     | Hypothetical        | Linear                | Linear      | Mixed      | No. P. S.                                    | Solano et al., 2002a                                                                                                                                                                                                                                                                                                                                                                                |
| Deterministic       | Hypothetical        | Non- Linear           | Non- Linear | Continuous | No. P. S.                                    | Muneeb et al., 2018                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | Italy               | Linear                | Linear      | Mixed      | No. P. S.                                    | Fabbricino, 2001                                                                                                                                                                                                                                                                                                                                                                                    |
|                     | Italy               | Non-linear            | Linear      | Continuous | No. P. S.                                    | Minciardi et al., 2008                                                                                                                                                                                                                                                                                                                                                                              |
|                     | Lebanon             | Linear                | Linear      | Continuous | No. P. S.                                    | Najm and El-Fadel, 2004                                                                                                                                                                                                                                                                                                                                                                             |
|                     | Hypothetical        | Linear                | Linear      | Continuous | -                                            | Harrison et al., 2001                                                                                                                                                                                                                                                                                                                                                                               |
|                     | U. S. A.            | Linear                | Non-linear  | Mixed      | -                                            | Chang et al., 2005                                                                                                                                                                                                                                                                                                                                                                                  |
|                     | Egypt               | Linear                | Linear      | Mixed      | -                                            | Badran and El-Haggar, 2006                                                                                                                                                                                                                                                                                                                                                                          |
|                     | Iran                | Linear                | Linear      | Mixed      | -                                            | Heidari et al., 2019                                                                                                                                                                                                                                                                                                                                                                                |
|                     | Taiwan              | Linear                | Linear      | Mixed      | Yes                                          | Chang et al., 1996; Chang and Lu, 1997                                                                                                                                                                                                                                                                                                                                                              |
|                     | Italy               | Linear                | Non-linear  | Mixed      | Yes                                          | Fiorucci et al., 2003; Costi et al., 2004                                                                                                                                                                                                                                                                                                                                                           |

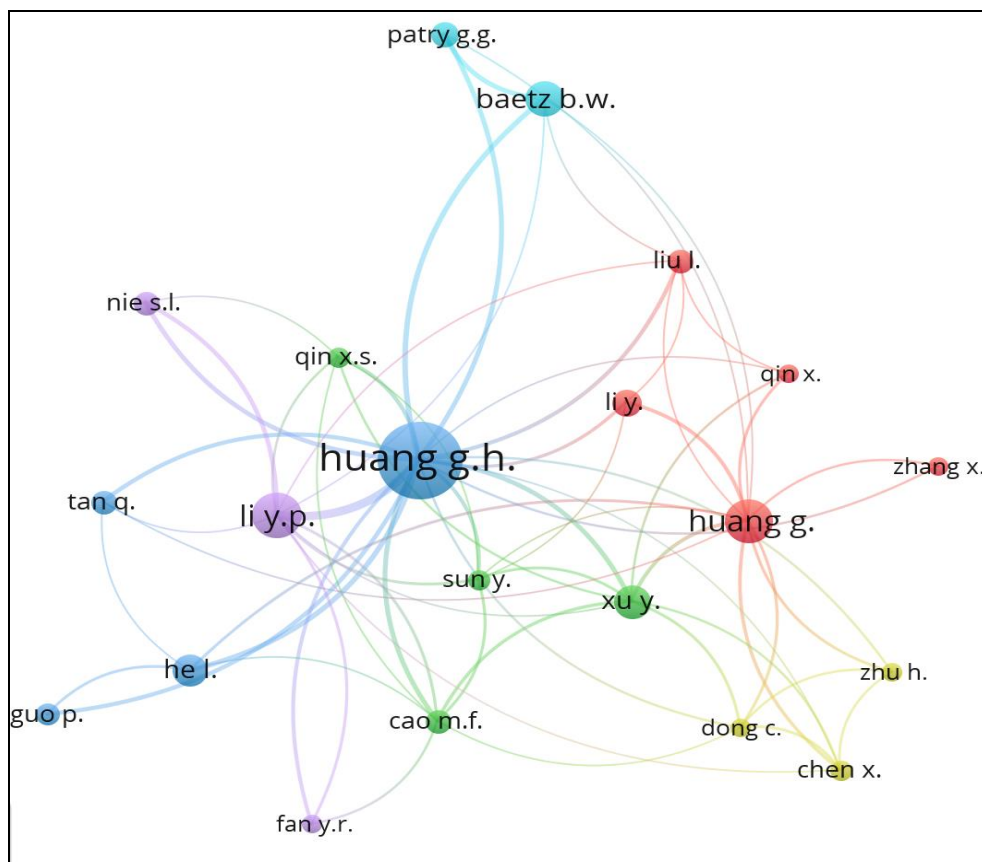
No P. S.: The study doesn't consider the process selection question.



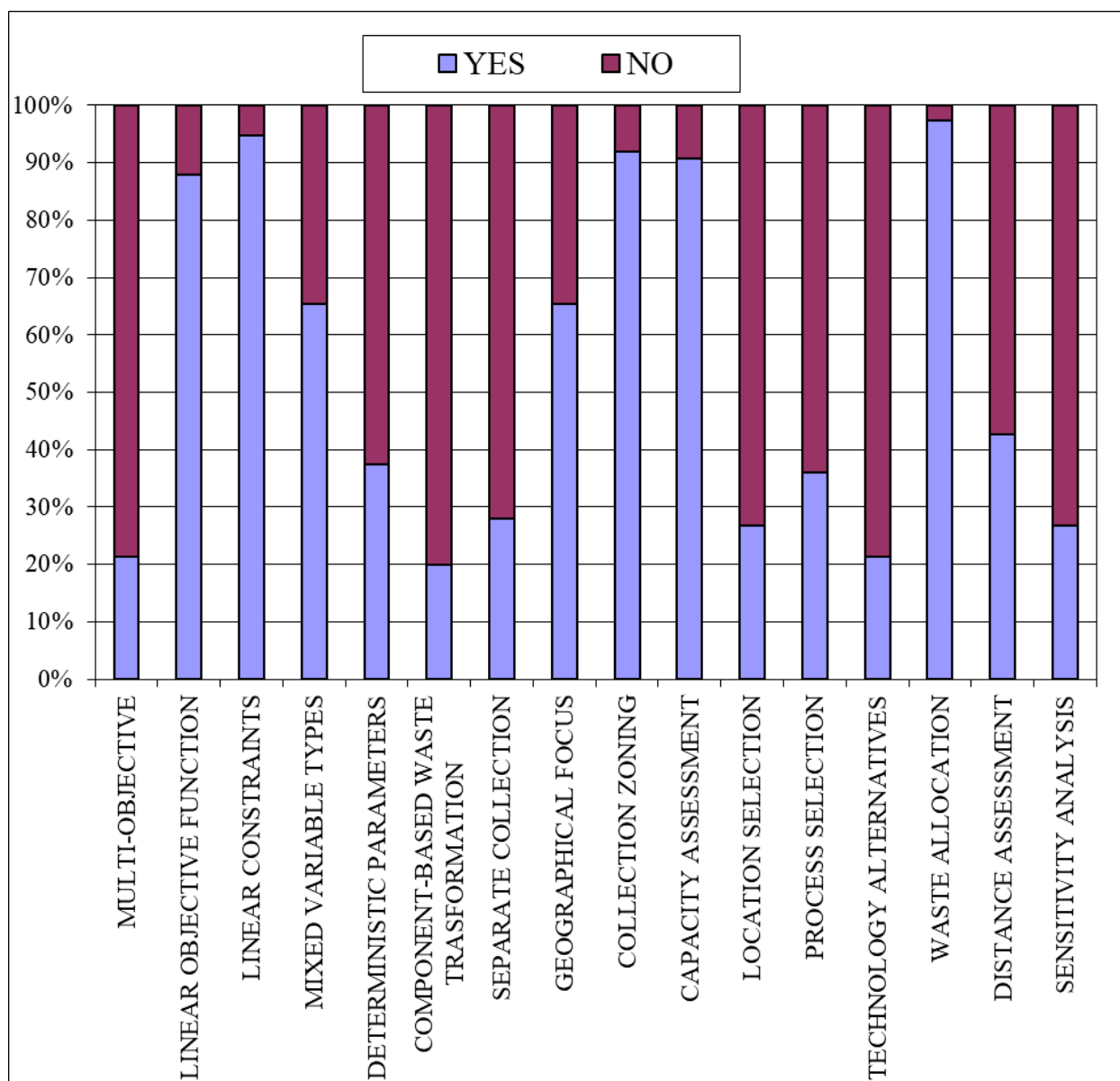
**Figure S1.** The temporal distribution of 146 articles examined in the first assessment and the last assessment stages.



**Figure S2.** The bibliographic coupling of countries in publications.



**Figure S3.** The co-authorship of authors in publications.



**Figure S4.** A summary of the findings obtained in the first assessment stage.