**Supplementary material**

**Social Sustainability of Raw Rubber Production: A Supply Chain Analysis under Sri Lankan Scenario**

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Table S1. Data related to Rubber cultivation (per field latex containing 1 tonne of dry rubber output). GTAP sector: Crops nec/LKA.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  Inputs  | Economic sector | Amount | Reference to the amount in the previous column | Unit price  | Country(s) sourced from (RRISL, the Observatory of Economic Complexity (OEC) (Datawheel, 2023) and Volza databases (Volza, 2020)) | Percentage of importation |
| Urea | CRP | 79.36 kg | RRISL | 1.35 USD/kg | China | 42% |
|  |  |  |  |  | Saudi Arabia | 19% |
|  |  |  |  |  | Indonesia | 12% |
|  |  |  |  |  | United Arab Emirates | 8% |
|  |  |  |  |  | Oman | 6% |
|  |  |  |  |  | Qatar | 6% |
|  |  |  |  |  | Egypt | 3% |
|  |  |  |  |  | India | 2% |
|  |  |  |  |  | Malaysia | 1% |
| Rock phosphate | CRP | 70.45 kg | RRISL | 0.07 USD/kg | Sri Lanka | 100 |
| MOP | CRP | 77.34 kg | RRISL | 1.35 USD/kg | Belarus | 52% |
|  |  |  |  |  | Lithuania | 18% |
|  |  |  |  |  | Russia | 10% |
|  |  |  |  |  | Jordan | 9% |
|  |  |  |  |  | Israel | 8% |
|  |  |  |  |  | Germany | 2% |
| Dolomite | CRP | 1.33 kg | RRISL | 0.03 USD/kg | Sri Lanka | 100% |
| KIE | CRP | 0.17 kg | RRISL | 1.35 USD/kg | China  | 100% |
| Diesel (and preparation) | OIL | 34.2 l | (Jawjit et al., 2021) | 1.13 USD/l | United Arab Emirates | 94% |
|  |  |  |  |  | Egypt | 6% |
| Sodium sulfite (in case of crepe rubber production) | CRP | 1.59 kg | RRISL | 0.48 USD/kg | China  | 100% |
| Ammonia (in case of concentrated latex) production) | CRP | 6.68 kg | (Birnbach et al., 2020) | 0.35 USD/kg | India  | 100% |
| Insecticides  | CRP | 0.34 kg | (Birnbach et al., 2020) | 6.00 USD/kg | India | 100% |
| Herbicides | CRP | 5.21 kg | (Birnbach et al., 2020) | 4.20 USD/kg | India | 100% |
| Fungicides | CRP | 1.23 kg | (Birnbach et al., 2020) | 7.92 USD/kg | India | 100% |

RRISL: Rubber Research Institute of Sri Lanka; MOP: muriate of potash; KIE: Kieserite; CRP: Chemical, rubber, plastic products; LUM: Wood products; ELY: electricity, OIL: Oil

Table S2. Data related to crepe rubber production (1 tonne of white-crepe rubber). GTAP sector: CRP/LKA.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  Inputs  | Economic sector | Amount | Reference to the amount in the previous column | Unit price  | Country(s) sourced from (RRISL, the Observatory of Economic Complexity (OEC) (Datawheel, 2023) and Volza databases (Volza, 2020)) | Percentage of importation |
| Diesel for transportation | OIL | 4.06 l | (Dunuwila et al., 2018c, 2018b) | 1.13 USD/l | See previous table | See previous table |
| Field latex | From rubber cultivation (crops nec) | 3540.28 kg | (Dunuwila et al., 2018c, 2018b) | Transported from own plantations | Sri Lanka | 100% |
| Sodium bisulfite | CRP | 5.22 kg | (Dunuwila et al., 2018c, 2018b) | 1.18 USD/kg | China | 100% |
| Formic acid | CRP | 5.11 kg | (Dunuwila et al., 2018c, 2018b) | 1.07 USD/kg | Hong Kong | 25% |
|  |  |  |  |  | Finland | 20% |
|  |  |  |  |  | Germany | 12% |
|  |  |  |  |  | India | 3% |
|  |  |  |  |  | South Korea | 1% |
| Bleaching agent  | CRP | 1.29 kg | (Dunuwila et al., 2018c, 2018b) | 14.27 USD/kg | India | 100% |
| Electricity  | ELY | 665.30 kwh | (Dunuwila et al., 2018c, 2018b) | 0.08 USD/kg | Sri Lanka | 100% |
| Firewood | LUM | 569.00 kg | (Dunuwila et al., 2018c, 2018b) | 0 (felled trees are used) | Sri Lanka | 100% |
| LDPE film  | CRP | 2.39 kg | (Dunuwila et al., 2018c, 2018b) | 0.004 USD/kg | Sri Lanka | 100% |
| Freshwater | WTR | 62354.95 kg | (Dunuwila et al., 2018c, 2018b) | 0 (freely abundant) | Sri Lanka | 100% |

RRISL: Rubber Research Institute of Sri Lanka; CRP: Chemical, rubber, plastic products; LUM: Wood products; ELY: electricity, OIL: Oil; WTR: Water; LDPE: Low-density polyethylene

Table S3. Data related to concentrated latex production (per 1 tonne of concentrated latex). GTAP sector: CRP/LKA.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Inputs  | Economic sector | Amount | Reference to the amount in the previous column | Unit price  | Country(s) sourced from (RRISL, the Observatory of Economic Complexity (OEC) (Datawheel, 2023) and Volza databases (Volza, 2020)) | Percentage of importation |
| Diesel for transportation | OIL | 11.41 l | (Dunuwila et al., 2020) | 1.13 USD/l | See table 1 | See table 1 |
| Field latex | rubber cultivation (crops nec) | 3648.15 kg | (Dunuwila et al., 2020) | Transported from own plantations | Sri Lanka | 100% |
| DAHP\* | CRP | 15.59 kg | (Dunuwila et al., 2020) | 1.98 USD/kg | India | 100% |
| TZ \* | CRP | 1.75 kg | (Dunuwila et al., 2020) | 2.1 USD/kg | India | 100% |
| Lauric Soap\* (at bulking) | CRP | 2.57 kg | (Dunuwila et al., 2020) | 1.78 USD/kg | India  | 68% |
|  |  |  |  |  | China | 32% |
| Ammonia \* | CRP | 6.26 kg | (Dunuwila et al., 2020) | 0.35 USD/kg | India | 100% |
| TMTD\* | CRP | 0.83 kg | (Dunuwila et al., 2020) | 2.1 USD/kg | India | 100% |
| Lauric Soap\* (at preservation) | CRP | 2.98 kg | (Dunuwila et al., 2020) | 1.78 USD/kg | India  | 68% |
|  |  |  |  |  | China | 32% |
| Sulfuric acid\* | CRP | 20.19 kg | (Dunuwila et al., 2020) | 0.24 USD/kg | India | 100% |
| Electricity | ELY | 128.71 kwh | (Dunuwila et al., 2020) | 0.08 USD/kwh | Sri Lanka | 100% |
| Freshwater  | WTR | 6981.96 kg | (Dunuwila et al., 2020) | 0 USD/l | Sri Lanka | 100% |

RRISL: Rubber Research Institute of Sri Lanka; DAHP: Di Ammonium Hydrogen Phosphate; TZ: mixture of Tetramethylthiuram Disulfide and Zinc oxide; TMTD: Tetramethylthiuram Disulfide; \*wet basis; CRP: Chemical, rubber, plastic products; ELY: electricity, OIL: oil; WTR: Water

Table S4. Data related to RSS production (per 1 tonne of RSS). GTAP sector: CRP/LKA.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Inputs  | GTAP sector | Amount | Reference to the amount in the previous column | Unit price (USD per kg) | Country(s) sourced from (RRISL, the Observatory of Economic Complexity (OEC) (Datawheel, 2023) and Volza databases (Volza, 2020)) | Percentage of importation |
| Field latex | rubber cultivation (crops nec) | 2763.86 kg | (Dunuwila et al., 2018a) | N/A | Manhandled from plantations | 100% |
| Fresh water | WTR | 4489.77 kg | (Dunuwila et al., 2018a) | 0 (freely abundant) | Sri Lanka | 100% |
| Formic acid\*  | CRP | 448.96 kg | (Dunuwila et al., 2018a) | 1.07 | Please see Table S2 | Please see Table S2 |
| Firewood  | LUM | 766.67 kg | (Dunuwila et al., 2018a) | 0 (felled trees are used) | Sri Lanka | 100% |

RRISL: Rubber Research Institute of Sri Lanka; \*wet basis; CRP: Chemical, rubber, plastic products; LUM: Wood products; WTR: Water



Fig.S1. Contribution of each subcategory to the impact category, Governance. (a: crepe rubber; b: concentrated latex; c: ribbed smoked sheets)



Fig. S2. Contribution of each subcategory to the impact category, Labor rights & decent work’. (a: crepe rubber; b: concentrated latex; c: ribbed smoked sheets)

**References**

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