Life Cycle Assessment of Mousetrapper Advance 2.0/2.0+

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LCA practitioner: Oline Haggren and Emilia Ingemarsdotter, Miljögiraff AB

Miljögiraff

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Ordered by: Trapper Data AB
Trapper Data AB designs, develops, and manufactures Mousetrapper in Sweden with a strong focus on high quality and responsibility throughout the entire product life cycle.

The company has expressed a vision of promoting good working conditions and responsible resource use. Trapper Data aims to combine product development with long-term sustainability, striving for positive impacts on both people and the environment. In support of this vision, the company has set targets to carry out manufacturing close to its core markets, to use only recycled or renewable materials, and to implement a science-based strategy for reducing its climate footprint. Fair working conditions across the supply chain are also emphasized.

Trapper Data was founded in 1994 by Swedish inventor Rolf Strömberg. The same year Mousetrapper was launched. Its success made it the market leader in Scandinavia, which led to an international launch. Through research by ergonomics experts and physiotherapists, it has been known that strain injuries caused by office jobs can be avoided. Trapper Data is located in Järfälla, north of Stockholm, where its development, production, and head office are all based.

Issued by: Miljögiraff AB
Miljögiraff is an environmental consultant specialising in product Life Cycle Assessment and Life Cycle Design. We believe that combining analysis and creativity is necessary to meet today's challenges. Therefore, we provide Life Cycle Assessment to evaluate environmental aspects and design methods to develop sustainable solutions.

We create measurability in environmental work based on a life cycle perspective on ecological aspects. The LCA methodology establishes the basis for modelling complex systems of aspects with a credible assessment of potential environmental effects.

Miljögiraff is part of a global network of experts in sustainability metrics piloted by PRé Sustainability.

Abbreviations and Expressions

Clarification of expressions and abbreviations used in the report

CO_2 eq – Carbon dioxide equivalents
EPD – Environmental Product Declaration
GWP – Global Warming Potential
ISO – International Organization for Standardisation
IPCC – Intergovernmental Panel on Climate Change
LCA – Life Cycle Assessment
LCI – Life Cycle Inventory Analysis
LCIA – Life Cycle Impact Assessment
PCR - Product Category Rules
RER – The European region
RoW – Rest of the world
GLO – Global
APOS – Allocation at the point of substitution (system model in ecoinvent)
Cut-off in ecoinvent – Allocation cut off by classification (system model in ecoinvent)
Cut-off in general – Environmental impact that contributes insignificantly to the overall results.

Environmental aspect - An activity that might contribute to an environmental effect, for example, “electricity usage”.

Environmental effect - An outcome that might influence the environment negatively (Environmental impact), for example, “Acidification”, “Eutrophication”, or “Climate change”.

Environmental impact - The damage to a safeguarding object (i.e., human health, ecosystems, health, and natural resources).

Life Cycle Inventory (LCI) data – Inventory of input and output flows for a product system

Abstract

Life cycle assessment (LCA) is a standardised method to quantify the potential environmental impact of a product or service from a holistic perspective.

This report presents the results of the environmental impact of Mousetrapper Advance 2.0/2.0+ produced by Trapper Data AB. The assessment is carried out according to a life cycle perspective using the ISO 14040 standard (ISO, 2006a), using the EF 3.1 impact assessment method.

The report includes the following sections: section 3 introduces the goal and scope of the study, section 4 specifies the life cycle inventory including the collected data and how different life cycle stages were modelled, section 5-6 present and interpret the impact assessment results, while section 7 states the conclusions and recommendations.

A declared unit of one (1) Mousetrapper Advanced 2.0/2.0+ is used as a basis for the calculations. For secondary data, the ecoinvent cut-off by classification database version 3.10 is used. The cut-off allocation method is used to allocate between lifecycles at end of life.

Based on a previous screening LCA study of the product, the circuit board was identified as a key driver of the environmental impact. In this study, care has thus been taken to model the circuit board in detail, selecting specific datasets for individual components.

The following main results were obtained from this study:
The total climate change impact of one Mousetrapper Advanced 2.0/2.0+ is 6.2 kg CO2 eq. The environmental impact of Mousetrapper Advanced 2.0/2.0+ from a cradle-to-grave perspective comes mainly from the production of upstream components. Electronic components have the highest contribution, followed by plastics and metal.

Important environmental impact categories are “Resource use, minerals and metals”, “Climate change potential” and “Resource use, fossil resources”.

Based on these results, the following key recommendation are made:

- Reduce scrap in production (printed circuit board).
- Reduce or eliminate air freight.
- Improve data quality for upstream production of components by collecting supplier-specific inventory data or using EPD’s published by suppliers.
- Work with mounting supplier to reduce impact from the solder material. This includes improving the data quality for this material.

1 Introduction

Life cycle assessment (LCA) is a standardised method to quantify the potential environmental impact of a product or service from a holistic perspective. With its holistic perspective, LCA avoids the so-called burden-shifting from one part of the lifecycle to another or across impact categories. LCA results provide an understanding of a product's life cycle burdens and hotspots and allow for identifying opportunities to mitigate adverse effects.

This report presents the results of the environmental impact of Mousetrapper Advance 2.0/2.0+ produced by Trapper Data AB. The assessment is carried out according to a life cycle perspective using the ISO 14040 standard (ISO, 2006a).

1.1 Reading Guide

The purpose of the report is to provide valuable insight to decision making and detailed information about how the study was made and the results. Readers can select sections of the report depending on their role and usage of it.

- 5 minutes – strategic planning
    - The summary explains the purpose and the conclusions in short.
- 20 minutes – product development
    - Section 7 and section 6. Section 7 present the conclusions of the study while section 6 gives the reader more nuance and depth as it includes the interpretation and sensitivity analysis that underpins the conclusions.
- >20 minutes - Understanding
    - Section 7, section 6 and section 5. Section 5 presents detailed results through flowcharts or diagrams for the different impact categories that support the conclusion and recommendations.
- >60 minutes – Review and reproducibility
    - For in-depth detail and transparent documentation on the modelling of each part of the life cycle, see section 4 ("Life Cycle Inventory")
    - For information about methodology, scope and functional unit, see sections 2 ("Life Cycle Assessment") and section 3 ("Goal and Scope").

1.2 General Description of the Product and its Context

The product assessed in this study is the Mousetrapper Advance 2.0/2.0+, an ergonomic computer mouse with a keyboard wrist rest. The device consists of steel, aluminium, and various plastic components. It is delivered with a product guide and packaging made of paper and corrugated cardboard. Versions 2.0 and 2.0+ differ on software level and on the number of buttons (6 or 8, respectively). The material content in the two is the same, and they are thus analysed as one product. Two images are added to Appendix 5 to exemplify the minor difference between key parts.

An image of the product is provided in Figure 1 below.

Figure 1: Picture of a Mousetrapper Advance 2.0

1.3 The Sustainability Challenge

Sustainability comprises meeting our own needs without compromising the ability of future generations to meet their own needs. Industrial and natural systems depend on a stable Earth system to function. A quantitative planetary boundary within which humanity can continue to develop and thrive for generations to come has been proposed (Richardson et al., 2023) . These researchers describe nine processes that determine the resilience and stability of the Earth system, such as climate change, water use, and land use. Crossing these boundaries increases the risk of abrupt and irreversible environmental change, while staying within the boundaries represents a safe operating space for a sustainable society, see Figure 2.

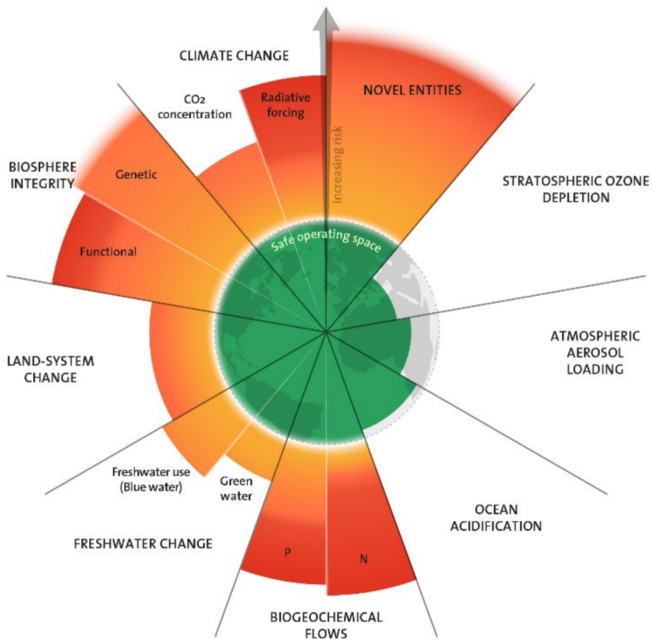

Figure 2: Shows the state of the planetary boundaries, where the green area represents a safe operating space. Credit: Azote for Stockholm Resilience Centre, based on analysis in (Richardson et al., 2023).

One critical environmental problem we face today is climate change. The report from the Intergovernmental Panel on Climate Change (IPCC), shows that only the most ambitious of five scenarios for greenhouse gas emissions would result in a temperature increase within 2°C (IPCC, 2021a), see Figure 3. Considering that limiting temperature rise below 1.5°C is the ambition of the Paris Agreement 2016, it is evident that the available space for mitigating radical climate change is ever-shrinking, necessitating decisive action in all parts of society. This is also evident in the latest report from IPCC (IPCC, 2022).

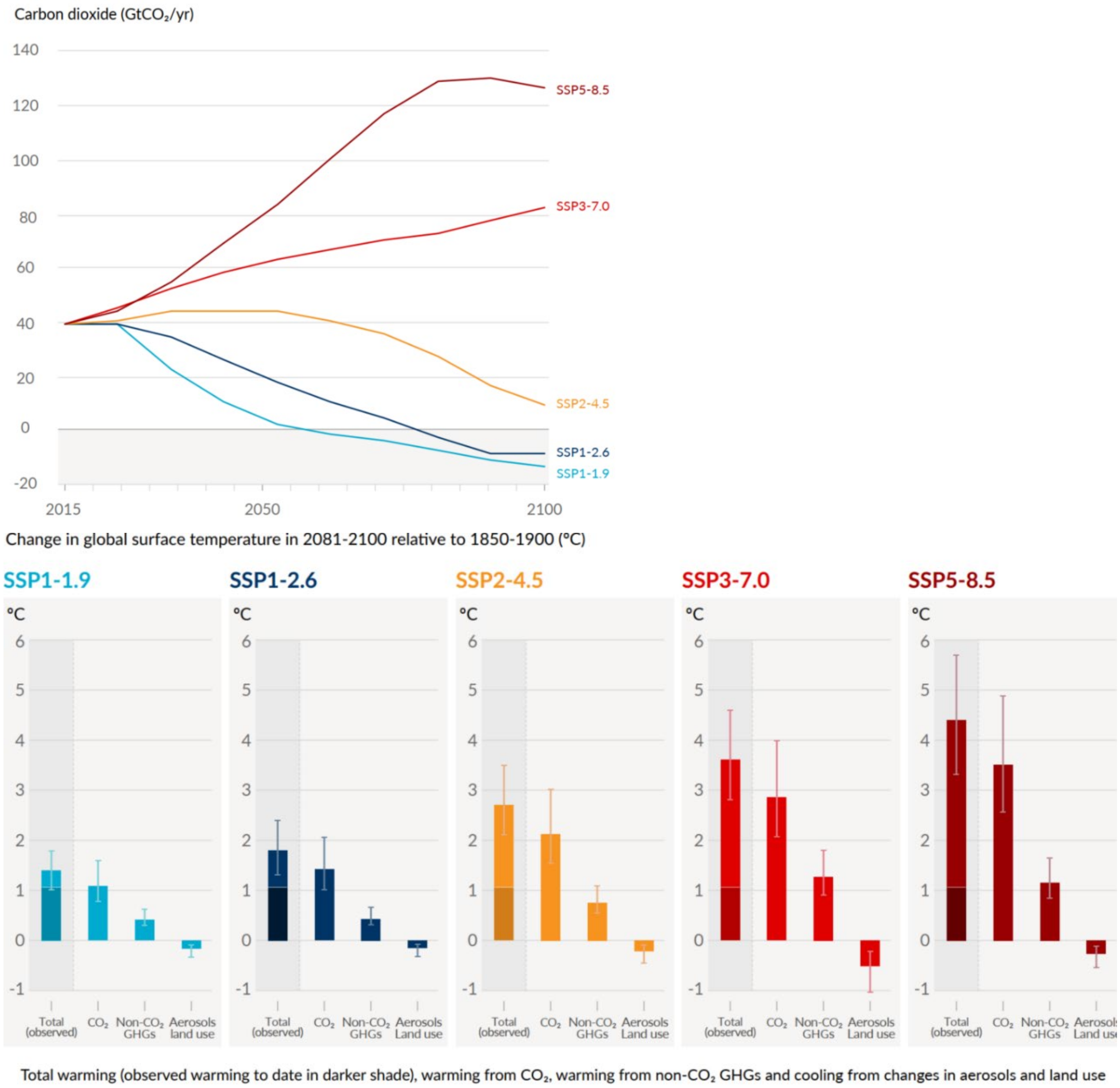

Figure 3: Future annual emissions of CO_2 (top) and contribution to global surface temperature increase from different emissions, with a dominant role of CO_2 emissions (bottom) across five illustrative scenarios. Image from IPCC (2021b).

2 Life Cycle Assessment (LCA)

2.1 LCA Methodology Background

Understanding the potential environmental impact in connection with the manufacture and use of products is increasingly important. LCA is an accepted standardised method that is applied to create this understanding. Being a quantitative tool, LCA can contribute to more sustainable development by identification of hotspots and by guiding actionable measures to reduce environmental impacts. A business can use the results of an LCA to develop strategy, management and communication of environmental issues related to products. By including environmentally relevant input and output flows through a product's entire supply chain, from raw material extraction to final disposal, LCA provides a comprehensive basis for the environmental impact of a product's supply chain (see Figure 3).

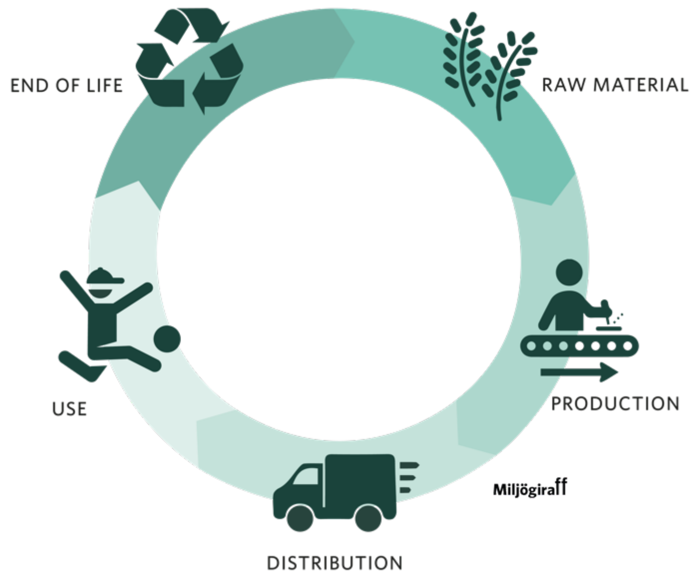

Figure 4: The Life Cycle concept, starting from raw material extraction, production, and distribution, followed by use and end-of-life.

Products' supply chains are complex and involve numerous connections. Therefore, in order to analyse a product's entire life cycle, LCA practitioners must simplify it into a model which involves limitations, as those as summarised by Guinée et al. (2002):

- Localised aspects are typically not addressed, and LCA is not a local risk assessment tool
- LCA is typically a steady-state approach rather than a dynamic approach
- LCA does not include market mechanisms or secondary effects on technological development
- Processes are considered linear, both in the economy and the environment, meaning that impact increases linearly with increased production.
- LCA involves several technical assumptions and value choices that are not purely science-based
- LCA focuses on environmental aspects and excludes social, economic, and other characteristics

The study presented in this report is a result of Miljögiraff's work which combines the confidence and objectiveness of the strong and accepted ISO standard with the scientific and reliable LCI data from ecoinvent and with the world-leading LCA software SimaPro for calculation and modelling (see Figure 5.)

Figure 5: ISO standard combined with reliable data from ecoinvent and the LCA software SimaPro.

Already in 1997, the European Committee for Standardisation published their first set of international guidelines for the performance of LCA. This ISO 14040 standard series has become widely accepted amongst the practitioners of LCA and is developing along with progressions within the field of LCA (Rebitzer et al., 2004). The guidelines for LCA are in two documents: ISO 14040, which contains the main principles and structure for performing an LCA, and ISO 14044, which includes detailed requirements and recommendations. Furthermore, a document containing the format for data documentation (ISO/TS 14048) and technical reports with guidelines for the different stages of an LCA are available in ISO/TR 14047 and ISO/TR 14049 (ISO, 2012b, 2012a).

The method used in the study is Life Cycle Assessment (LCA) as described in:

- ISO 14040: 2006 – Principles and framework (ISO, 2006a)
- ISO 14044: 2006 – Requirements and guidelines (ISO, 2006b)

2.2 Standards and Frameworks

The ISO 14040 and 14044 standards (ISO, 2006b, 2006c) guide this LCA. This study follows an attributional LCA approach (accounting) defined in the ISO 14040 standard.

The standards and frameworks guiding this LCA are in Table 1.

Table 1: Standards and framework conformance.

Standards conformance
ISO 14040 and 14044 (ISO, 2006a, 2006b)

2.3 LCA Software

The life cycle impact assessment (LCIA) was calculated using the LCA software SimaPro (PRé Sustainability, 2024) which includes regulary updated databases with libraries of LCI data (e.g. ecoinvent) and all relevant LCIA methods.

3 Goal and Scope

3.1 The goal of the Study

The goal of this study is to produce an LCA report that fulfils the requirements of ISO 14044. The results are intended to be used in external communication, as well as internally in Trapper Data's ongoing environmental work and strategic decision-making. This study does not include comparative assertions intended to be disclosed to the public.

3.2 Scope of the Study

3.2.1 Declared unit

In this study, a declared unit is used as the basis for the calculations. The declared unit is one (1) Mousetrapper Advanced 2.0/2.0+.

The function of the product is to allow the user to click, scroll and zoom in/out. The duration of active use of the product was estimated as described in section 4.6.

The product is estimated to be used for five (5) years. This is based on an approximation of IT equipment renewal rate at one of Trapper Data's customers.

3.2.2 System Boundary

This study includes all life cycle stage from cradle to grave, including raw material extraction and processing, component manufacturing, final product assembly, use, and end of life. A simplified schematic representation of a cradle-to-grave system under study is presented in Figure 6.

The method chosen for separating consecutive life cycles is the cut-off method which means for recycled material used as inputs to the product system the recycling process and transport from recycler to production is included in the system boundary. For materials that are sent to recycling, only the transport to the recycler is included. This approach to end-of-life allocation is described in ISO 14044 section 4.3.4.3.3 (ISO, 2006b). More details are given in section 3.2.4.

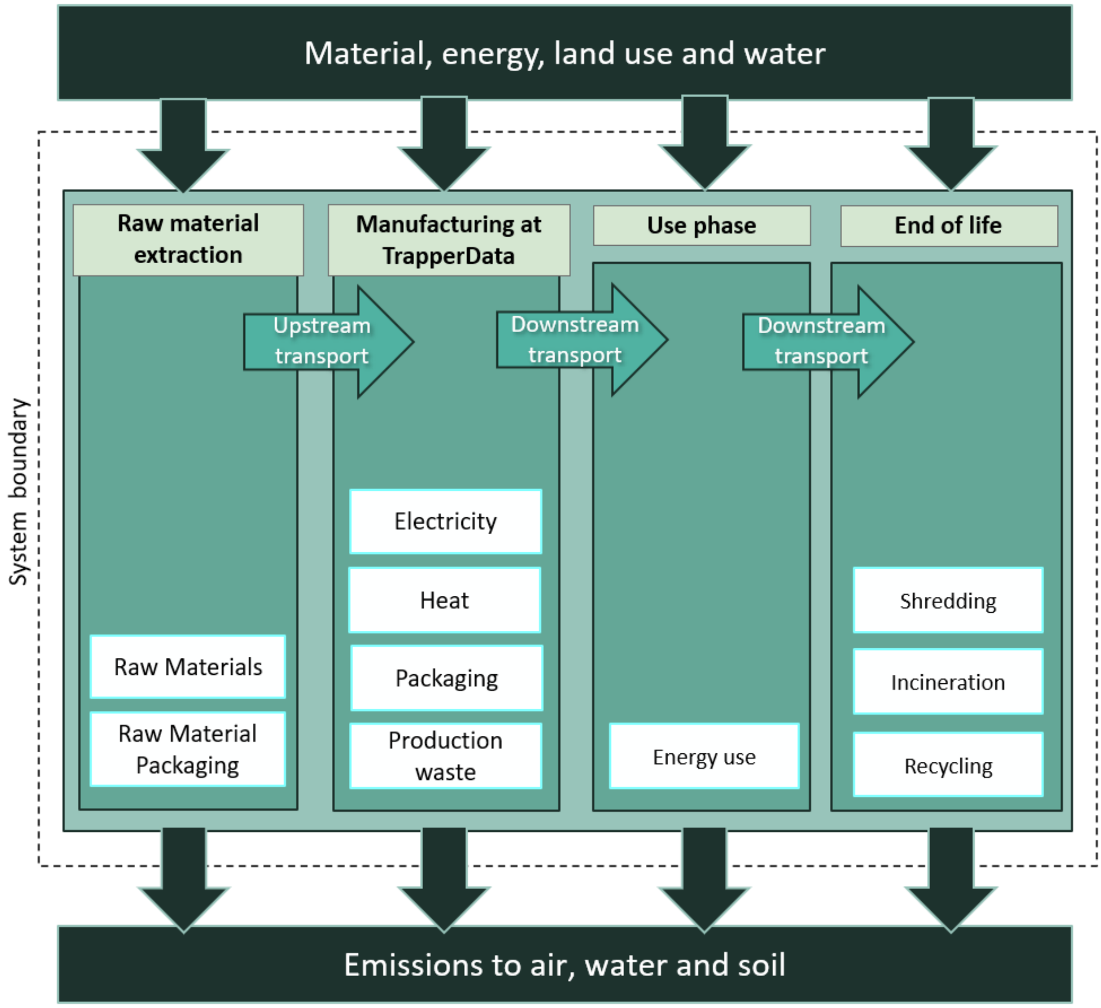

Figure 6: System boundaries for the model of the product system.

3.2.3 Cut-off Criteria

Life cycle assessment aims to include all relevant environmental flows related to a product's entire supply chain. Quantifying these impacts is done through a simplified model, as it is too time-consuming to obtain data and model every flow in practice. Specific cut-off criteria facilitate the comparison of LCA for different products.

To ensure that all relevant environmental impacts were represented in the study, a cut-off criterion was of maximum 5% overall environmental impact, following EN50693 (CEN, 2019).

In this study, no activities have been excluded, and any proxy data is reported in this section 4.

3.2.4 Allocation

When dealing with a multi-output process, in other words, if a process creates several products or one product along with by-products, this is referred to in LCA as an allocation problem. This is the case for materials like wool, for which production processes produce both meat and wool.

In this study, allocation was applied for the Trapper Data's manufacturing process. As there are other products produced at the same site, data from this process was allocated to Mousetrapper Advanced 2.0/2.0+ based on the number of products produced (per unit). This is also described in section 4.3.

With regard to allocation of waste, this study follows the polluter pays principle as described in EN15804 (CEN, 2021). This means that the generator of the waste carries the full environmental impact of waste processing, transport and treatment until the waste fulfils the end-of-waste criteria. In summary the end-of-waste criteria are reached when a waste has been recovered to a material that has an economic value and that can be used as an input to another product life cycle. This implies also that potential benefits of recycling are only accounted for in the life cycle of products that use recycled material as an input, not in the life cycle of products that generate material for recycling. In this LCA, material for recycling leaves the product system from the manufacturing process and at the product end-of-life. For these flows, only the transports to recyclers have been included in the LCA (no burdens nor benefits of recycling). The same procedure applies to the product packaging materials sent to recycling. The full burdens of waste sent to incineration with energy recovery and to landfill have been included in the LCA.

3.2.5 Assumptions

Assumptions that are general to the entire LCA are:

- Choice of energy model: (e.g., regional averages obtained from the Ecoinvent LCI database or according to specific conditions);
- Choice of transport model: (e.g., regional averages from Ecoinvent) or according to specific conditions calculated according to the Network for Transport and the Environment (NTM).
- Transport distances have been based on Google Maps for road transportation and a port routing tool (e.g., Sea Distances or Port World) for sea transport. Possible deviating routes have not been included in the calculations.
- Ecoinvent processes that contain market funds such as "Diesel burned in building machine {GLO} | market for | Cut-off, U" includes generic shipments from producer to end customer. Therefore, these data sets have no further transport.

Assumptions that are specific to this LCA are:

- Use phase energy consumption was estimated based on assumptions about mouse/mousepad use patterns in offices. A sensitivity analysis is included in which the energy consumption is doubled, in order to assess the effect of this assumption on the total results.

3.2.6 Limitations

The analysis in this study has following limitations:

- No dataset was found in the available databases for recycled ABS. Based on the cut-off approach to end-of-life allocation, the impact of a recycled material should be accounted as the impact of the recycling process only. Therefore, it was deemed reasonable to use a dataset for another recycled plastic (PE) as a proxy.
- Assumptions has been regarding the use phase energy consumption.
- The data used to model the TPE material is confidential. This data was shared with the LCA practitioner from the supplier of the material, but cannot be transparently reported in this report. A sensitivity analysis is included in which the material is modelled in a conservative way, based on generic datasets. This is to assess whether the modelling approach for this material has any significant effect on the total results.

3.2.7 Method of Life Cycle Impact Assessment (LCIA)

The results are derived using the impact assessment method EF3.1. The methods used to calculate the relevant environmental impact categories in this study are summarised in Table 2. For further details on the LCIA method, see Appendix 2-Appendix 3.

Table 2: Impact categories, indicators and methods used in the study (EF3.1 impact assessment method).

Impact category	Category indicator	Method
Climate Change	kg CO_2 equivalents	The baseline model of 100 years of the IPCC based on IPCC 2021
Climate Change-fossil	kg CO_2 equivalents	The baseline model of 100 years of the IPCC based on IPCC 2021
Climate Change-biogenic	kg CO_2 equivalents	The baseline model of 100 years of the IPCC based on IPCC 2021
Climate Change-land use and land use change	kg CO_2 equivalents	The baseline model of 100 years of the IPCC based on IPCC 2021
Ozone depletion	kg CFC 11-equivalents	Steady-state ODPs, WMO 2014
Acidification	mol H+ eq	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication, freshwater	kg P equivalents	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication, marine	kg N equivalents	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication, terrestrial	mol N equivalents	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical ozone formation	kg NMVOC eq.	LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe
Resource use, minerals and metals	kg Sb eq	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.
Resource use, fossils	MJ	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.
Water use	m3 world eq. deprived	Available WAter REmaining (AWARE) Boulay et al., 2018
Particulate Matter	kg CO2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2021
Ionising radiation, human health	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ecotoxicity, freshwater	kBq U235 eq.	Human health effect model as developed by Dreicer et al. 1995 and updated by Frischknecht et al., 2000
Human toxicity, cancer	CTUh	USEtox 2.1. model (Rosenbaum et al, 2008)
Human toxicity, non-cancer	CTUh	USEtox 2.1. model (Rosenbaum et al, 2008)
Land use	dimensionless	Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016)

3.2.8 Data quality requirements (DQR)

The following data was collected by Trapper Data AB:

- Bill of materials, including specific components on the circuit board
- Electricity use and amount of scrap material at the assembly site
- Electricity consumption by the product during use

With only one exception, background is collected from the ecoinvent database, version 3.10, using the cut-off by classification system model. For one material, the database Industry 2.0 was used, since this database contained a closer match with the specific material. Moreover, suppliers were contacted to ensure that renewable electricity was used for the circuit board mounting process (supplier in Sweden) and for the injection moulding of ABS parts (supplier in Estonia). Certificates of renewable energy are provided in Appendix 4. Finally, the supplier of the TPE material was contacted to ensure suitable modelling for their material.

Section 6.4 of this report presents an assessment of the data quality. The data quality requirements applied are listed below.

- Geographical coverage: The processes included in the data set are well representative of the geography stated in the "location" indicated in the metadata
- Technology representativeness: Data of core processes: The collected data is representative for the technology used. Data of upstream and downstream processes: Data is representative for the technology used (for example at suppliers) if possible. Otherwise, average technology in the relevant region.
- Time-related coverage: Data of core processes: The collected data is ideally representative for the last 12 months but not older than 5 years. Data of upstream and downstream processes: The collected data is as recent as possible but not older than 10 years.

3.2.9 Type of critical review, if any

A critical review means that the study is reviewed by a third party. According to the standard, this is necessary if the result is to be communicated externally or if the result is to be compared with results from other studies.

A critical review will be carried out according to the International Standards ISO 14040 and 14044 (ISO 2006 b,c), as well as ISO 14071. The LCA will be reviewed according to the following five aspects:

- the methods used to carry out the LCA are consistent with this International Standard.
- the methods used to carry out the LCA are scientifically and technically valid
- the data used are appropriate and reasonable in relation to the goal of the study
- the interpretations reflect the limitations identified and the goal of the study, and
- the study report is transparent and consistent.

As this is a study destined for external audiences, the LCA report is reviewed by a third party, Viktor Hakkarainen and Alexander Munge, from CHM Analytics. CHM Analytics is a well-known LCA expert consultancy with extensive experience.

The critical review statement is attached to this report in Appendix 6

4 Life Cycle Inventory (LCI)

In the life cycle inventory, the product system is defined and described. Firstly, the material flows and relevant processes required for the product system are identified. Secondly, relevant data (i.e., resource inputs, emissions and product outputs) for the system components are collected, and their amounts are related to the defined functional unit.

For data referring to processes beyond the control of the core production, the ecoinvent database 3.10 is use as well as Industry data 2.0. Ecoinvent is one of the world's leading databases with consistent, open, and updated Life Cycle Inventory Data (LCI). With several thousand LCI datasets in the fields of agriculture, energy supply, transport, biofuels and biomaterials, bulk and special chemicals, construction and packaging materials, basic and precious metals, IT and electronics and waste management, ecoinvent offers the most comprehensive international LCI database. Ecoinvent's high-quality LCI datasets are based on industrial data and have been compiled by internationally recognized research institutes and LCA consultants. Industry data 2.0 contains more than 300 datasets covering plastics, surfactants, detergents, and steel. The underlying data has been collected and provided by sectoral industry associations, including PlasticsEurope, ERASM, World Steel Association, the International Molybdenum Association, and the Alliance for Beverage Cartons and the Environment.

4.1 Input data references

Table 3 shows the supplier contacts that have supplied the sources for data input.

Table 3 Input data references

Data contact information	
Company	Trapper Data AB
Name	David Larsson
e-mail	david@trapperdata.se
Phone number	+46-(0)8-388036
Position in company	Production Manager

4.2 Raw materials

This section describes all the different raw materials needed for the manufacturing of Mousetrapper Advance 2.0/2.0+. The composition of the product can be seen in Table 4 below. The words in parentheses in the table below is the original Swedish word, which has been translated to English for clarity.

Table 4: Component composition of the Mousetrapper Advance 2.0/2.0+.

Component	Weight (g)
Pure plastics	
Housing (kåpa)	292
Battery case (batterilucka)	15
Rail (räls-plast)	9
Anti-skid	90
Loop Support	6
Light guide+Lens+Foil (Ljusledare+Lins+folie)	4
Composite plastics	
Wrist rest (Handlovstöd)	41
Mat (Matta)	8
PET circuit (PET-krets)	8
Glide tape (Glidtejp)	1
Metal	
Rail (räls-metall)	47
Rollers	1
Screw + spring (Skruv + fjäder)	3
Electronics	
PCBA (kretskort)	21
USB cable (USB kabel)	37

Total	583

4.2.1 Supplier raw material extraction and production

In this section, the modelling details of the different components can be seen.

4.2.1.1 Housing (Kåpa)

The housing is modelled according to the specifications in the table below. The origin of the plastic raw material is Austria, and the supplier is located in Estonia, where the processing takes place. The processing is carried out using renewable energy, based on the dataset "*Electricity, medium voltage {EE} | market for electricity, medium voltage | Cut-off*". This dataset represents the market mix in Estonia. However, all fossil-based energy in the mix has been removed and replaced with renewable energy. The renewable share has been scaled up accordingly to fully compensate for the excluded fossil-based portion. This adjusted electricity dataset was then used in the injection moulding process dataset presented in the table.

The housing is made from 100% recycled ABS, and this is represented by the dataset "*Polyethylene, high density, granulate {Europe without Switzerland} | polyethylene, high density, granulate, recycled to generic market for high density PE granulate | Cut-off, U*" as a proxy. This proxy was chosen because, based on the cut-off-approach to end-of-life allocation, only the impact of the recycling process itself should be accounted for when using recycled materials. The dataset for recycled PE does model the recycling process for PE, and this was estimated as a reasonable proxy also for the recycling of ABS. Moreover, Trapper Data has received Product Carbon Footprint report from the supplier (see Appendix 7), and the recycled PE dataset had an impact that was relatively close to this number. The climate change results from the supplier were not presented in the form of a full EPD but only as a CO_2-eq value. In the absence of an EPD, the recycled PE dataset was considered the most appropriate and transparent proxy available.

The component is transported a total of 2048 km by truck and 285 km by ship. The truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*", and the ship transport is represented by the dataset "*Transport, freight, sea, ferry {GLO}| transport, freight, sea, ferry | Cut-off, U*".

Table 5: Modelling details of the housing (kåpa).

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
Recycled ABS	292	Polyethylene, high density, granulate {Europe without Switzerland}| polyethylene, high density, granulate, recycled to generic market for high density PE granulate | Cut-off, U	Austria	Tartu, Estonia

		& Injection moulding {RER}| injection moulding | Cut-off, U		

4.2.1.2 Battery cover (Batterilucka)

The battery cover is modelled according to the specifications in the table below. The origin of the plastic raw material is Austria, and the supplier is located in Estonia, where the processing takes place. The processing is carried out using renewable energy, based on the dataset "*Electricity, medium voltage {EE} | market for electricity, medium voltage | Cut-off,*". This dataset represents the market mix in Estonia. However, all fossil-based energy in the mix has been removed and replaced with renewable energy. The renewable share has been scaled up accordingly to fully compensate for the excluded fossil-based portion.

The battery case is made from 100% recycled ABS, and this is represented by the dataset "*Polyethylene, high density, granulate {Europe without Switzerland} | polyethylene, high density, granulate, recycled to generic market for high density PE granulate | Cut-off, U*" as a proxy. The choice of dataset is based on the same reasoning as for the housing modelling.

The component is transported a total of 2048 km by truck and 285 km by ship. The truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*", and the ship transport is represented by the dataset "*Transport, freight, sea, ferry {GLO}| transport, freight, sea, ferry | Cut-off, U*".

Table 6: Modelling details of the battery case (batterilucka).

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
Recycled ABS	15	Polyethylene, high density, granulate {Europe without Switzerland}| polyethylene, high density, granulate, recycled to generic market for high density PE granulate | Cut-off, U & Injection moulding {RER}| injection moulding | Cut-off, U	Austria	Tartu, Estonia

4.2.1.3 Rail (Räls)

The rail is modelled according to the specifications in the table below. It follows the same structure as for the housing and the battery case. The origin of the plastic raw material is Austria, and the supplier is located in Estonia, where the processing takes place. The processing is carried out using renewable energy, based on the dataset "*Electricity, medium voltage {EE} | market for electricity, medium voltage | Cut-off,*". This dataset represents the market mix in Estonia. However, all fossil-based energy in the mix has been removed and replaced with renewable energy. The renewable share has been scaled up accordingly to fully compensate for the excluded fossil-based portion.

The rail is made from 100% recycled ABS, and it is represented by the dataset "*Polyethylene, high density, granulate {Europe without Switzerland} | polyethylene, high density, granulate, recycled to generic market for high density PE granulate | Cut-off, U*" as a proxy. The choice of dataset is based on the same reasoning as for the housing modelling.

The component is transported a total of 2048 km by truck and 285 km by ship. The truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*", and the ship transport is represented by the dataset "*Transport, freight, sea, ferry {GLO}| transport, freight, sea, ferry | Cut-off, U*".

Table 7: Modelling details of the Rail (Räls)

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
Recycled ABS	9	Polyethylene, high density, granulate {Europe without Switzerland}| polyethylene, high density, granulate, recycled to generic market for high density PE granulate | Cut-off, U & Injection moulding {RER}| injection moulding | Cut-off, U	Austria	Tartu, Estonia

4.2.1.4 Anti-skid

The "anti-skid" component is made of a Thermoplastic elastomer (TPE). The TPE is modelled based on information from the supplier about their specific raw material mix. The exact mix is strictly confidential, but mass ranges were provided for individual raw materials. The supplier also provided data for the energy consumption at their production site. This electricity use was included in the modelling of the raw material mix, using the Swedish electricity mix represented by the dataset "*Electricity, medium voltage {SE}| market for electricity, medium voltage | Cut-off, U*".

Injection moulding has been assumed for the processing of the material to a final component, using the dataset "*Injection moulding {RER}| injection moulding | Cut-off, U*".

The component is transported a total of 410 km by truck. The truck transport within Sweden is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO6 {RER}| transport, freight, lorry 16-32 metric ton, EURO6 | Cut-off, U*".

Table 8: Modelling details of the anti-skid.

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
TPE	90	Supplier-specific material mix and energy consumption & Injection moulding {RER}| injection moulding | Cut-off, U	Åmål, Sweden	Laxå, Sweden

4.2.1.5 Loop support

This component is modelled according to the specifications in the table below. It is made of polyoxymethylene (POM), and it is represented by the dataset "*Polyoxymethylene (POM)/EU-27*" from Industry data 2.0. Since this dataset does not include upstream transportation, transportation is included from the following ecoinvent market dataset: Polycarbonate {RER}| market for polycarbonate | Cut-off, U.
The manufacturing of the component occurs in Sweden and is represented by the dataset "*Injection moulding {RER}| injection moulding | Cut-off, U*".

The component is transported 400 km by truck from Hestra, Sweden to Järfälla. The truck transport within Sweden is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO6 {RER}| transport, freight, lorry 16-32 metric ton, EURO6 | Cut-off, U*".

Table 9: Modelling details of the loop support.

Material	Weight (g)	LCI database representation	Material origin	Manufacturing location
POM	4	Polyoxymethylene (POM)/EU-27 + upstream transport & Injection moulding {RER}| injection moulding | Cut-off, U	Unknown	Hestra, Sweden

4.2.1.6 Light guide+Lens+Foil (Ljusledare+Lins+folie)

These three small components are made of the same material and modelled in the same way according to the specifications in the table below. The raw material is polycarbonate (PC), represented by the dataset "*Polycarbonate {RoW}| market for polycarbonate | Cut-off, U*". The light guide is injection moulded in Estonia while the lens is injection moulded in Germany. The foil is sent from Sweden to Estonia where it is mounted onto the housing. Both in case of Germany and Estonia, the injection moulding process is represented by the dataset "*Injection moulding {RER}| injection* *moulding | Cut-off, U*”. Upstream transport for these components is conservatively modelled as 1500km truck transport, corresponding to the approximate distance from mid-Germany to Stockholm, Sweden. The truck transport is represented by the dataset “*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*”.

Table 10: Modelling details of the light guide+Lens+Foil (Ljusledare+Lins+folie)

Material	Weight (g)	LCI database representation	Material origin	Manufacturing location
PC	4	Polycarbonate {RoW}| market for polycarbonate | Cut-off, U & Injection moulding {RER}| injection moulding | Cut-off, U	Unknown	Estonia/Germany

4.2.1.7 Wrist rest (Handlovstöd)

The wrist rest has a total weight of 41 g and it consists of PVC, PU and polyester. The modelling details of this component is modelled can be seen in the table below.

The transport of each material can be seen in the table below and the finished component is then transported 550 km from Olofström, where the manufacturing occurs, to Järfälla. The truck transport is represented by the dataset “*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*”. It is also transported by ship, and it is represented by the dataset “*Transport, freight, sea, ferry {GLO}| transport, freight, sea, ferry | Cut-off, U*”. The default transport processes included in the ecoinvent dataset “*Polyurethane, flexible foam {RER}| market for polyurethane, flexible foam | Cut-off, U*” have been removed to avoid double counting.

Table 11: Modelling details of the light guide+Lens+Foil (Ljusledare+Lins+folie)

Material	Weight (g)	LCI database representation	Origin	Manufacturing location	Transport type and distance
PVC	36	Polyvinylidenchloride, granulate {RER}| polyvinylidenchloride production, granulate | Cut-off, U & Injection moulding {RER}| injection moulding | Cut-off, U	Järfälla, Sweden	Blekinge, Sweden	Truck, 550 km
PU	1	Polyurethane, flexible foam {RER}| market for polyurethane, flexible foam | Cut-off, U - without transport & Injection moulding {RER}| injection moulding | Cut-off, U	Germany	Blekinge, Sweden	Ship, 350 km Truck, 175 km

Polyester	4	Textile, nonwoven polyester {RoW}| textile production, nonwoven polyester, needle-punched | Cut-off, U	UK	Blekinge, Sweden	Ship, 1000 km Truck, 300 km

4.2.1.8 Mat (Matta)

The mat has a total weight of 8 g and it consists of silicon, epoxy and polyester textile. The modelling details of this component is modelled can be seen in the table below. 90% of the manufacturing occurs in Indonesia and 10% occurs in Sweden, however, it is modelled according to 100% manufacturing in Indonesia as a conservative assumption.

The transport of each material can be seen in the table below and the finished component is then transported 10500 km by flight from Indonesia to Sweden and 40 km by truck from Arlanda to Järfälla. The truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*". the flight transport is represented by the dataset "*Transport, freight, aircraft, unspecified {GLO}| transport, freight, aircraft, all distances to generic market for transport, freight, aircraft, unspecified | Cut-off, U*".

Table 12: Modelling details of the Mat (Matta).

Material	Weight (g)	LCI database representation	Origin	Manufacturing location	Transport type and distance
Silicon	4	Silicone product {RoW}| silicone product production | Cut-off, U & Injection moulding {RoW}| injection moulding | Cut-off, U	USA	Indonesia	Flight, 14000 km
Epoxy	3	Bisphenol A epoxy based vinyl ester resin {RoW}| bisphenol A epoxy based vinyl ester resin production | Cut-off, U & Injection moulding {RoW}| injection moulding | Cut-off, U	USA	Indonesia	Flight, 14000 km
Polyester	1	Textile, nonwoven polyester {RoW}| textile production, nonwoven polyester, needle-punched | Cut-off, U	Vietnam	Indonesia	Flight, 2000 km

4.2.1.9 PET- circuit (PET-krets)

The PET circuit has a total weight of 7,8 g, and it consists of silicon, PET, and a small amount of copper. The modelling details of this component can be seen in the table below.

The component is transported 8400 km from Taiwan to Stockholm by flight and it is then transported 40 km by truck from Arlanda to Järfälla. The truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*". The flight transport is represented by the dataset "*Transport, freight, aircraft, unspecified {GLO}| transport, freight, aircraft, all distances to generic market for transport, freight, aircraft, unspecified | Cut-off, U*".

Table 13: Modelling details of the PET circuit (PET-krets).

Material	Weight (g)	LCI database representation	Material origin	Manufacturing location
Silicon	5.3	Silicone product {RoW}| market for silicone product | Cut-off, U & Injection moulding {GLO}| market for injection moulding | Cut-off, U	Unknown	Taiwan
PET	2.6	Polyethylene terephthalate, granulate, amorphous {RoW}| polyethylene terephthalate production, granulate, amorphous | Cut-off, U & Injection moulding {GLO}| market for injection moulding | Cut-off, U	Unknown	Taiwan
Copper	0.001	Copper, cathode {GLO}| market for copper, cathode | Cut-off, U & Metal working, average for copper product manufacturing {RER}| metal working, average for copper product manufacturing | Cut-off, U	Unknown	Taiwan

4.2.1.10 Glide tape (Glidtape)

The glide tape has a total weight of 1 g, and it consists of polytetrafluoroethylene (PTFE) and adhesive. As a rough approximation, it is assumed that 95% of the tape's weight is PTFE and 5% is adhesive. The modelling details of this component is modelled can be seen in the table below. A proxy dataset has been used to represent the PTFE.

The component is transported 25 km from Stockholm to Järfälla by truck and it is represented by the dataset *"Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U".*

Table 14: Modelling details of the glide tape (Glidtejp).

Material	Weight (g)	LCI database representation	Origin	Manufacturing location

PTFE	0.95	Tetrafluoroethylene {GLO}| market for tetrafluoroethylene | Cut-off, U & Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	Unknown	Stockholm
Adhesive	0.05	Polyurethane adhesive {GLO}| market for polyurethane adhesive | Cut-off, U	Unknown	Stockholm

4.2.1.11 Rail (räls-metall)

The rail has a total weight of 47 g, and it consists of aluminium. The modelling details of this component is modelled can be seen in the table below.

The component is transported 11500 km from Brazil to Gothenburg by ship and it is then transported 500 km from Gothenburg to Järfälla by truck. The sea transport is represented by the dataset "*Transport, freight, sea, container ship {GLO}| transport, freight, sea, container ship | Cut-off, U*". The truck is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*".

Table 15: Modelling details of the rail (räls-metall).

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
Aluminium	47	Aluminium, wrought alloy {GLO}| market for aluminium, wrought alloy | Cut-off, U & Section bar extrusion, aluminium {RoW}| section bar extrusion, aluminium | Cut-off, U	Brazil	Sweden

4.2.1.12 Rollers

The rollers have a total weight of 1 g, and it consists of steel. The modelling details of this component is modelled can be seen in the table below.

The component is transported 400 km from Hestra to Järfälla by truck. The truck is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO6 {RER}| transport, freight, lorry 16-32 metric ton, EURO6 | Cut-off, U*".

Table 16: Modelling details of the rollers.

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
Steel	1	Steel, low-alloyed, hot rolled {RER}| steel production, low-alloyed, hot rolled | Cut-off, U & Metal working, average for steel product manufacturing {RER}| metal working, average for steel product manufacturing | Cut-off, U	Unknown	Hestra, Sweden

4.2.1.13 Screw + spring (Skruv + fjäder)

The screw + spring have a total weight of 3 g, and it consists of steel. The modelling details of this component is modelled can be seen in the table below. A market dataset has been used for the steel since the origin is unknown, however the processing occurs in Germany/Sweden and therefore it has been represented by a European (RER) dataset. In this modelling a conservative assumption has been made where it is assumed that 100% of the manufacturing occur in Germany.

The component is transported a total of 945 km from Germany to Järfälla by truck and 350 km by ship from Germany to Sweden. The truck is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*" and the ship is represented by the dataset "*Transport, freight, sea, ferry {GLO}| transport, freight, sea, ferry | Cut-off, U*".

Table 17: Modelling details of the screw + spring (Skriv + fjäder).

Material	Weight (g)	LCI database representation	Origin	Manufacturing location
Steel	3	Steel, low-alloyed, hot rolled {GLO}| market for steel, low-alloyed, hot rolled | Cut-off, U & Metal working, average for steel product manufacturing {RER}| metal working, average for steel product manufacturing | Cut-off, U	Unknown	Germany

4.2.1.14 Printed circuit board assembly, PCBA (kretskort)

The total weight of the PCBA (including components) is 20.9 g and it has an area of 49.77 cm2. The different components that are included in the printed circuit board assembly and the modelling details of them can be seen in the table below. Market datasets have been used in order to include estimated transports. The energy required for the mounting of the PCBA is modelled according to information from the supplier. The mounting of the PCBA is done at a supplier in Sweden and the certificate of the electricity used for that can be seen in Appendix 4.

The ecoinvent dataset "*Mounting, through-hole technology, Pb-free solder {GLO}| mounting, through-hole technology, Pb-free solder | Cut-off, U*" have been used to represent the mounting of the PCBA at the supplier and the energy in the dataset have been adapted. The energy originally used in this dataset has been replaced by a Swedish market mix, "*Electricity, medium voltage {SE}| market for electricity, medium voltage | Cut-off, U*", that have been adapted so it only consists of renewable energy and nuclear energy since that is the type of energy that the supplier has a certificate of. All fossil-based energy in the mix has been removed and replaced with renewable energy and nuclear energy. The renewable share (including nuclear energy) has been scaled up accordingly to fully compensate for the excluded fossil-based portion.

The printed circuit board also has an amount of spillage. However, the weight reported in the table below excludes this spillage. A description of the associated production waste is provided in Section 4.3.5.

Table 18: Modelling details of the composition of the printed circuit board assembly (PCBA).

Component	Weight (g)	LCI database representation	Origin
Printed circuit board, PCB (Mönsterkort)	16.33	Printed wiring board, for surface mounting, Pb free surface {GLO}| market for printed wiring board, for surface mounting, Pb free surface | Cut-off, U	CN
Capacitor (Kondensator)	0.142	Capacitor, for surface-mounting {GLO}| market for capacitor, for surface-mounting | Cut-off, U	PH & CN
Diode (light emitted)	0.137	Light emitting diode {GLO}| market for light emitting diode | Cut-off, U	PH, MY & TW
Diode	0.658	Diode, glass-, for through-hole mounting {GLO}| market for diode, glass-, for through-hole mounting | Cut-off, U	MY & CN
Resistor	0.719	Resistor, surface-mounted {GLO}| market for resistor, surface-mounted | Cut-off, U	CN & TW

USB connector (USB-kontakt)	1.5	Electric connector, peripheral type buss {GLO}| market for electric connector, peripheral type buss | Cut-off, U	TW
Flat cable connector (Flatkabelskontakt)	0.17	Electric connector, peripheral type buss {GLO}| market for electric connector, peripheral type buss | Cut-off, U	CN
MOSFET	0.006	Transistor, surface-mounted {GLO}| market for transistor, surface-mounted | Cut-off, U	CN
Microswitch	0.035	Switch, toggle type {GLO}| market for switch, toggle type | Cut-off, U	TW
Memory (Minne)	0.003	Integrated circuit, memory type {GLO}| market for integrated circuit, memory type | Cut-off, U	TW
Camera chip (Kamerakrets)	0.002	Electronic component, active, unspecified {GLO}| market for electronic component, active, unspecified | Cut-off, U	TH
Optointerrupter with Photodiode and Receiver (Läsgaffel, fotodiod och mottagare)	0.128	80% Acrylonitrile-butadiene-styrene copolymer {GLO}| market for acrylonitrile-butadiene-styrene copolymer | Cut-off, U Injection moulding {GLO}| market for injection moulding | Cut-off, U & 20% Diode, glass-, for through-hole mounting {GLO}| market for diode, glass-, for through-hole mounting | Cut-off, U	CN
Processor	0.0025	Integrated circuit, logic type {GLO}| market for integrated circuit, logic type | Cut-off, U	TW
Logic Circuit Containing Diodes (Logisk krets innehållande dioder)	0.006	Integrated circuit, logic type {GLO}| market for integrated circuit, logic type | Cut-off, U	CN
Amplifier	0.214	Transistor, surface-mounted {GLO}| market for transistor, surface-mounted | Cut-off, U	CN

Center Position sensor (Mittlägessensor)	0.66565	Diode, glass-, for surface-mounting {GLO}| market for diode, glass-, for surface-mounting | Cut-off, U	TH
Regulator	0.0063	Transformer, low voltage use {GLO}| market for transformer, low voltage use | Cut-off, U	MY
Oscillator (Kristall)	0.016	Transistor, surface-mounted {GLO}| market for transistor, surface-mounted | Cut-off, U	CN
Tin (Tenn)	0.16	Tin {GLO}| market for tin | Cut-off, U	Unknown

4.2.1.15 USB cable

The USB cable has been modelled based on the dataset "*Cable, connector for computer, without plugs {GLO}| cable production, connector for computer, without plugs | Cut-off, U*" which has been adapted. The dataset, originally based on a per-meter unit, was scaled to a mass-based functional unit using the actual copper content of the cable. According to information from Trapper Data, the cable weighs 36.8 g and contains 9.6 g of copper. This information was used to calculate a scaling factor, ensuring that the copper-to-cable ratio in the dataset reflects that of the actual product. Moreover, 3.6 grams of steel was added to the dataset to reflect the amount of steel reported by Trapper Data, using the dataset *Steel, low-alloyed {GLO}| market for steel, low-alloyed | Cut-off, U.*

The USB cable is manufactured in China and the origin is most probably China as well. The USB cable is assumed to be transported 8000 km by flight from China to Arlanda and 40 km by truck from Arlanda to Järfälla. The flight transport is represented by the dataset "*Transport, freight, aircraft, unspecified {GLO}| transport, freight, aircraft, all distances to generic market for transport, freight, aircraft, unspecified | Cut-off, U*" and the truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*".

4.2.2 **Upstream packaging/auxiliary material**

Table 19 presents the modelling of upstream production of material that is not part of the product itself but is sent to waste treatment from Trapper Data's factory. The amounts are based on waste data.

Table 19: Upstream production of packaging or auxiliary material that is sent to waste treatment from Trapper Data's factory [Source: Trapper Data 2025]. The data is based on waste numbers, see section 4.4.5.

Material as described in waste data from waste treatment partner	Weight (kg)	LCI database representation	Comment
Material sent to incineration	0.0118	Packaging film, low density polyethylene {GLO}| market for packaging film, low density polyethylene | Cut-off, U	Assumed to be low quality plastic that is not sorted nor sent for recycling.
LDPE	0.00327	Polyethylene, low density, granulate {GLO}| market for polyethylene, low density, granulate | Cut-off, U and Injection moulding {GLO}| market for injection moulding | Cut-off, U	
Paper	0.00127	Graphic paper, 100% recycled {RER}| graphic paper production, 100% recycled | Cut-off, U	
Cardboard	0.01345	Corrugated board box {RER}| market for corrugated board box | Cut-off, U	

4.3 Manufacturing

In this chapter, the activities carried out by Trapper Data are presented. All activities are presented per 1 unit of Mousetrapper Advanced 2.0/2.0+.

Data for heat and electricity was collected for the whole manufacturing site for the year 2024 and allocated to Mousetrapper Advanced 2.0/2.0+ based on the number of units produced. [redacted] units of Mousetrapper Advanced 2.0/2.0+ were produced in 2024, which made up approximately [redacted] % of the production volume in 2024.

4.3.1 Energy

Table 20: Energy use in production [Source: Trapper Data 2024]

Category	Description	LCI data representation	Amount	Comment
Electricity	Machines and lighting	MG Electricity, medium voltage {SE}| market for electricity, medium voltage | Cut-off, U - renewable electricity	1.1 kWh	Renewable electricity only. Data for Swedish average grid mix modified to only include renewable sources and (fossil source and imports set to zero, relative distribution between renewable source kept as in the dataset). Invoices from the electricity supplier are included in Appendix 4 as additional documentation. Trapper Data AB has inquired the electricity supplier for a green energy certificate for 2024 but since the original electricity supplier (Telge Energi) was acquired by another company (Fortum) on October 1st 2024, Fortum is not able to issue a certificate for 2024, and a certificate for 2025 can only be issued by December 2025. For this reason, Appendix 4 includes invoices for Jan-Sep 2024 from Telge Energi and an invoice from Fortum showing the consumption during Oct-Dec 2024. The supplier-specific electricity mix is stated on the invoices from Telge Energi, but Fortum only states the use of renewable energy. For this reason, a general Swedish renewable electricity mix was modelled (as described above), rather than a supplier-specific one.
Heat	Heating the facilities	Heat, district or industrial, other than natural gas {SE}| heat, from municipal waste incineration to generic market for heat district or industrial, other than natural gas | Cut-off, U	3.2 kWh	District heating from municipal waste incineration.

4.3.2 Direct emissions

No direct emissions have been reported for the assembly site.

4.3.3 Consumables

No consumables have been reported for the assembly site.

4.3.4 Packaging

The product is packaged into a cardboard box and loaded on a pallet. 420 products fit on a pallet. The pallet itself weighs 22 kg and is conservatively assumed to be used once (no reuse). Most of the cardboard boxes (70%) are supplied by a supplier in Poland. The remaining 30% comes from a mix of suppliers. To simplify, we assume all cardboard boxes are transported from Poland, with an estimated distance of 600 km by ferry and 100 by truck.

Table 21: Packaging used for product [Source: Trapper Data 2025]

Type of Packaging	Material	Amount (kg)	LCI data representation in ecoinvent	Transport type	Transport distance (km)	LCI data representation in ecoinvent, transport
Wooden pallet (420 units per pallet)	Wood	0.0524	EUR-flat pallet {RER}| market for EUR-flat pallet | Cut-off, U	Included in market dataset	Included in market dataset	Included in market dataset
Cardboard box	Cardboard	0.116	Corrugated board box {RER}| corrugated board box production | Cut-off, U	Ship from Poland and truck to and from port	600 km by ferry, 100 km by truck	Ship: Transport, freight, sea, ferry {GLO}| market for transport, freight, sea, ferry | Cut-off, U Truck: Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U

4.3.5 Production waste

Production waste data was collected for the factory as a whole, covering all waste streams except for waste related to the printed circuit board (PCB). Like for the electricity data, the waste data were allocated to the product in scope based on the number of units produced. [redacted] units of Mousetrapper Advanced 2.0/2.0+ were produced in 2024, which made up approximately [redacted]% of the production volume in 2024.

For the PCB, the spillage was calculated based on the area of the cut PCBs compared to the incoming PCBs. The PCB has a weight of 16.33g and an area of 49.77 cm2, excluding spillage. Including spillage, the total area is 65.205 cm2. Based on this, the weight of the cut-off material PCB has been calculated as 5.06g.

Table 22: Production waste types and treatment [Source: Trapper Data 2025]

Type	Quantity (kg)	Transport	Distance (km)	Treatment	Comment
PCB	0.00506 (approximately 31% of total PCB mass)	Truck	50 km	Waste electric and electronic equipment {GLO}| market for waste electric and electronic equipment | Cut-off, U	Scrap when cutting the printed circuit board. No mounted components are scrapped, only the PCB itself.

Mix waste, to incineration	0.0118	Truck	50 km	Waste plastic, mixture {GLO}| treatment of waste plastic, mixture, municipal incineration | Cut-off, U	Assumed to be plastic
LDPE, recycled	0.00327	Truck	50 km	Mixed plastics (waste treatment) {GLO}| recycling of mixed plastics | Cut-off, U	Empty process, due to cut-off approach to end-of-life allocation
Paper, recycled	0.00127	Truck	50 km	Paper (waste treatment) {GLO}| recycling of paper | Cut-off, U	Empty process, due to cut-off approach to end-of-life allocation
Cardboard, recycled	0.01345	Truck	50 km	Core board (waste treatment) {GLO}| recycling of core board | Cut-off, U	Empty process, due to cut-off approach to end-of-life allocation

4.4 Transport of finished product

The finished product and packaging (0.699 grams combined) are transported to customers in different countries. Sales shares between countries were used to calculate a weighted average transport distance, see Table 23. The truck transport is represented by the dataset "*Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U*" and the ship transport is represented by the dataset "*Transport, freight, sea, ferry {GLO}| transport, freight, sea, ferry | Cut-off, U*".

Table 23: Distribution of products [Source: Trapper Data 2025]

Country	Sales share	Transport type	Distance (km) - estimated	Comment
Sweden	[redacted]%	Truck	500	Based on the distance Stockholm-Gothenburg
Denmark	[redacted]%	Truck	700	Based on the distance Stockholm-Copenhagen
Norway	[redacted]%	Truck	500	Based on the distance Stockholm-Oslo
Finland	[redacted]%	Truck	100	Based on the distance Stockholm-Helsinki
		Ship	500	
Other EU	[redacted]%	Truck	1850	Based on the distance Stockholm-Zurich

4.5 Disposal of packaging

Treatment of packaging material at end of life was modelled with the predefined waste scenario for municipal solid waste in Sweden available in SimaPro. This assumes a 75% recycling rate for cardboard. Wood is not recycled, and instead assumed to be incinerated to 98.6% and landfilled to 1.4%. The transport from household/office to waste treatment plant was estimated to 20 km, see Table 24.

Table 24: Modelling details, packaging disposal

Material to be disposed	Quantity (kg)	Transport distance (km)	Waste scenario	Transportation dataset
Cardboard	0.116	20	Municipal solid waste (waste scenario) {SE}|	Municipal waste collection service by 21 metric ton lorry {RoW}| municipal waste

			Treatment of waste | Cut-off, U.	collection service by 21 metric ton lorry | Cut-off, U
Pallet	0.0524	20	Municipal solid waste (waste scenario) {SE}| Treatment of waste | Cut-off, U.	Municipal waste collection service by 21 metric ton lorry {RoW}| municipal waste collection service by 21 metric ton lorry | Cut-off, U

4.6 Usage

The electricity use during the use phase was estimated based on a usage scenario, see Table 25. During the use phase, the Mousetrapper Advance 2.0/2.0+ is assumed to remain continuously connected to a computer. The product consumes different amounts of electricity depending on whether it is in active use or in standby mode.

Active use is defined as periods when the user actively operates the touchpad or buttons. This is estimated to occur for a third of the workday, based on a study that reports an average of 2.3 hours mouse use time per day in 2015 (Lin, 2016). The remaining two thirds of the workday is assumed to be passive use. A workday is assumed to last 8 hours. The current drawn during active and passive use was measured by Trapper Data in their lab.

According to customer information provided by Trapper Data AB, the typical use time before replacement is approximately five years, corresponding to the general lifecycle of a computer in the workplace. The number of workdays per year is calculated as 365*5/7, i.e. not including weekends but including public holidays, since this differs in different countries.

Table 25: Energy consumed in the use phase

	Current (mA)	Voltage	Time (h)	Energy consumption per day	Energy consumption during product lifetime (5 years)	LCI data representation in ecoinvent
Active use	24	3.7V	2.66	0.237 Wh	309 Wh	Electricity, low voltage {RER}| market group for electricity, low voltage | Cut-off, U
Passive use	0.25	3.7V	5.33	5e-3 Wh	6.4 Wh	

4.7 End-of-Life

The treatment of the product at end of life was modelled as shredding (*“Waste electric and electronic equipment {GLO}| market for waste electric and electronic equipment | Cut-off, U”*) plus recycling, incineration or landfill based on the default values in Table G.4. in EN50693 (CEN, 2019). All material is assumed to be transport a household/office to a waste treatment plant with an estimated distance of 50 km, using the dataset “*Municipal waste collection service by 21 metric ton lorry {RoW}| municipal waste collection service by 21 metric ton lorry | Cut-off, U*”.

The percentages for recycling, incineration and landfill per material are listed in Table 26, as well as the dataset used for incineration and landfill. For recycled materials, only shredding and transport are included, following the cut-off approach to end-of-life allocation.

Table 26: End-of-Life modelling for Mousetrapper 2.0/2.0+, based on Table G.5. in EN50693.

Material to be disposed	Quantity (kg)	Share recycling	Share Incineration	Share landfill	Treatment process incineration	Treatment process landfill	Comment
Steel	0.0076	80%	0%	20%	N/A	Scrap steel {Europe without Switzerland}| treatment of scrap steel, inert material landfill | Cut-off, U	
Aluminium	0.047	70%	0%	30%	N/A		
Copper	0.0096	60%	0%	40%	N/A		
ABS	0.316	20%	40%	40%	Waste plastic, consumer electronics {GLO}| treatment of waste plastic, consumer electronics, municipal incineration | Cut-off,	Waste plastic, mixture {RoW}| treatment of waste plastic, mixture, sanitary landfill | Cut-off, U	
PU Foam	0.001	0%	50%	50%			
TPE	0.090	0%	50%	50%			Using percentages for Rubber from Table G.4.
Other plastics	0.0906	0%	50%	50%			
PCB (without components)	0.01633	0%	0%	100%	N/A		Using percentages for PCB (support) from Table G.4.
Mounted PCBA components	0.00457	50%	0%	50%	N/A	Scrap steel {Europe without Switzerland}| treatment of scrap steel, inert material landfill | Cut-off, U	Using percentages for PCB (metal) from Table G.4.

5 Result of Life cycle impact assessment (LCIA)

In this section, the results from the LCIA method Environmental footprint 3.1 are presented. This method is chosen since it is a method that is used within the European Union, and it provides a comprehensive and standardized framework with multiple environmental impact categories.

The results are presented in the following order:
1. Midpoint results per impact category using the EF 3.1 method
2. Single score results using the EF 3.1 method including normalisation and weighting factors
3. Impact on climate change
4. Impact on Resource use, minerals and metals
5. Impact from electronics

The reason why climate change and Resource use, minerals and metals are explored in more detail is that they are the two impact categories contributing most to the single score results.

The results are first presented as midpoint results per life cycle stage (section 5.1). The result is then presented as single score, which is calculated using the EF 3.1 normalisation and weighting factors (section 5.2). Weighting always implies a level of subjectivity, and it is thus recommended to only use single score results for internal communication. Section 5.3 presents the impact on Resource use, minerals and metals while section 5.4 presents impact on climate change. Section 5.5 includes a more detailed evaluation of the impact of electronic components.

Note that the LCIA results are relative expressions, which means that they do not predict impacts on category endpoints or the exceeding of thresholds, safety margins or risk. For further details on the LCIA method and impact categories, see Appendix 2 - Appendix 3.

Sankey diagrams are used to display the results as flow diagrams where the thickness of the arrows reflects the relative amount of that flow. All the nodes cannot be displayed simultaneously due to the vast amounts of background data. Therefore, a cut-off is used, and only processes that contribute more than this cut-off are displayed.

5.1 Environmental Footprint Midpoint

Table 27 shows the result per functional (or declared) unit according to the LCIA method Environmental footprint 3.1 midpoint level.

Table 27: Environmental footprint midpoint results per functional unit

	Unit	Total	Upstream production and transport - Electronics	Upstream production and transport - Other	Manufacturing	Downstream distribution	Use phase	End of Life
Climate Change-fossil	kg CO_2 eq	6.17E+00	2.08E+00	3.05E+00	4.85E-02	8.70E-02	1.03E-01	7.94E-01
Climate Change-biogenic	kg CO_2 eq	1.91E-02	2.47E-03	1.45E-02	9.07E-04	1.41E-05	2.29E-04	9.60E-04
Climate Change-land use and land use change	kg CO_2 eq	1.36E-02	2.43E-03	4.66E-03	6.15E-03	2.86E-05	3.14E-04	5.95E-05
Climate change	kg CO_2 eq	6.20E+00	2.09E+00	3.07E+00	5.56E-02	8.70E-02	1.04E-01	7.95E-01
Ozone depletion potential	kg CFC11 eq	3.57E-06	4.44E-08	3.52E-06	8.36E-10	1.72E-09	1.90E-09	1.16E-09
Acidification	mol H+ eq	4.02E-02	2.26E-02	1.59E-02	1.79E-04	3.06E-04	6.07E-04	6.01E-04
Eutrophication, freshwater	kg P eq	2.66E-03	1.75E-03	7.77E-04	8.07E-06	5.76E-06	9.60E-05	2.50E-05
Eutrophication, marine	kg N eq	7.67E-03	3.00E-03	3.69E-03	4.06E-05	1.00E-04	9.52E-05	7.44E-04
Eutrophication, terrestrial	mol N eq	7.68E-02	3.36E-02	3.82E-02	5.45E-04	1.09E-03	8.53E-04	2.46E-03
Photochemical ozone formation	kg NMVOC eq	2.71E-02	1.07E-02	1.48E-02	1.29E-04	4.49E-04	2.81E-04	7.89E-04
Resource use, minerals and metals	kg Sb eq	3.69E-04	3.30E-04	3.61E-05	6.68E-07	2.75E-07	1.39E-06	3.40E-07
Resource use, fossils	MJ	7.74E+01	2.77E+01	4.48E+01	1.88E-01	1.22E+00	2.40E+00	1.14E+00

Water use	m3 depriv.	2.00E+00	6.65E-01	1.29E+00	2.55E-02	4.97E-03	2.98E-02	-1.83E-02
Particulate Matter	disease inc.	3.53E-07	1.12E-07	2.21E-07	2.27E-09	6.77E-09	2.16E-09	8.34E-09
Ionising radiation, human health	kBq U-235 eq	4.68E-01	2.00E-01	1.95E-01	1.19E-03	1.55E-03	6.63E-02	4.32E-03
Ecotoxicity, freshwater	CTUe	5.67E+01	2.64E+01	2.01E+01	4.24E-01	3.26E-01	4.29E-01	9.06E+00
Human toxicity, cancer	CTUh	2.25E-08	6.87E-09	1.39E-08	4.54E-10	6.04E-10	2.42E-10	3.79E-10
Human toxicity, non-cancer	CTUh	1.75E-07	1.16E-07	3.64E-08	9.40E-10	7.54E-10	1.68E-09	1.97E-08
Land use	Pt	5.10E+01	1.05E+01	3.75E+01	1.44E+00	7.17E-01	5.34E-01	3.81E-01

5.2 Environmental Footprint Endpoint

Figure 7 shows the contribution of each environmental impact category to the total environmental impact based on EF 3.1 Single score. We can see that the most important impact categories for this product are Resource use, minerals and metals and Climate change. Figure 8 shows how different parts of the life cycle contribute to EF3.1 single score impacts. Upstream production is the main driver (~94%) followed by end of life (~3%). Components that contribute significantly to upstream impacts are, in order: PCBA (44.4%), USB cable (17.1%), Rail/Räls – metal (5.9%), Housing/Kåpa (5.2%), and Anti-skid (3.5%). The end-of-life impacts mainly come from incineration of plastics.

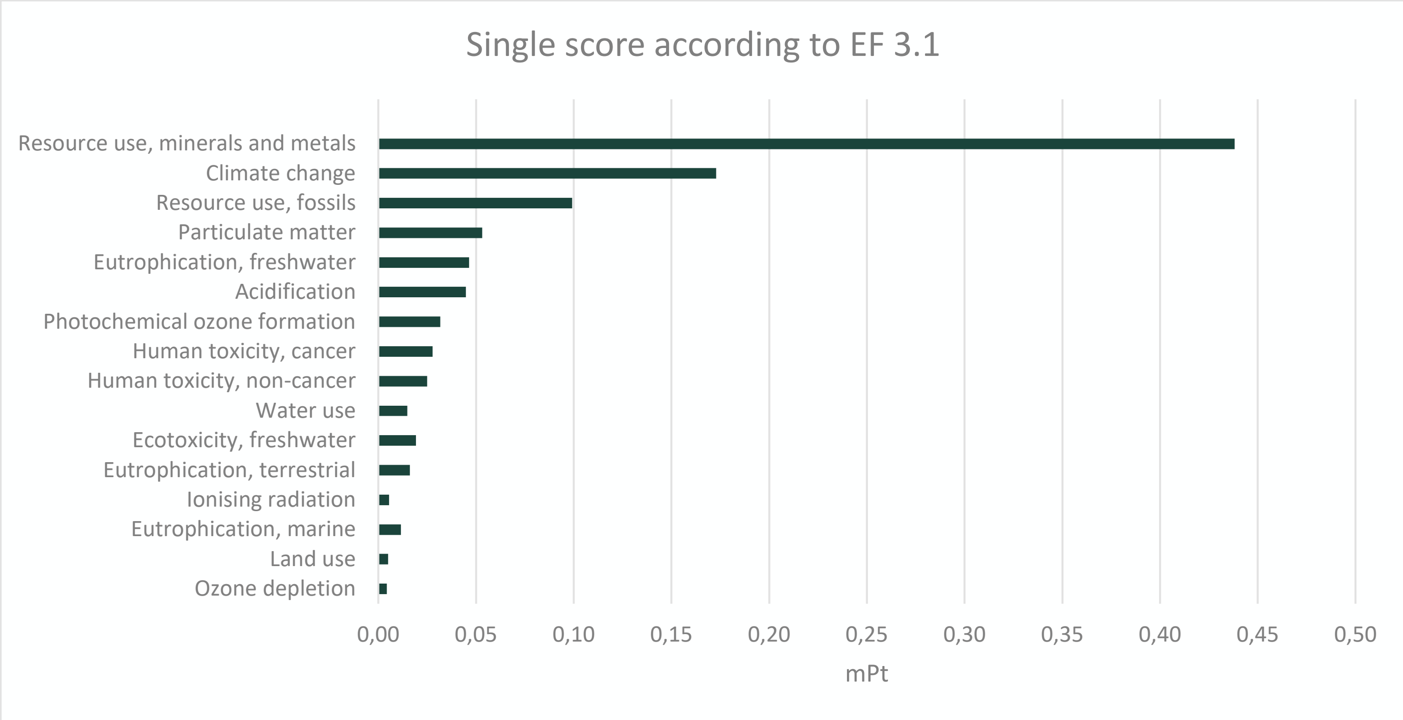

Figure 7: Contribution to EF 3.1 singe score results per impact category

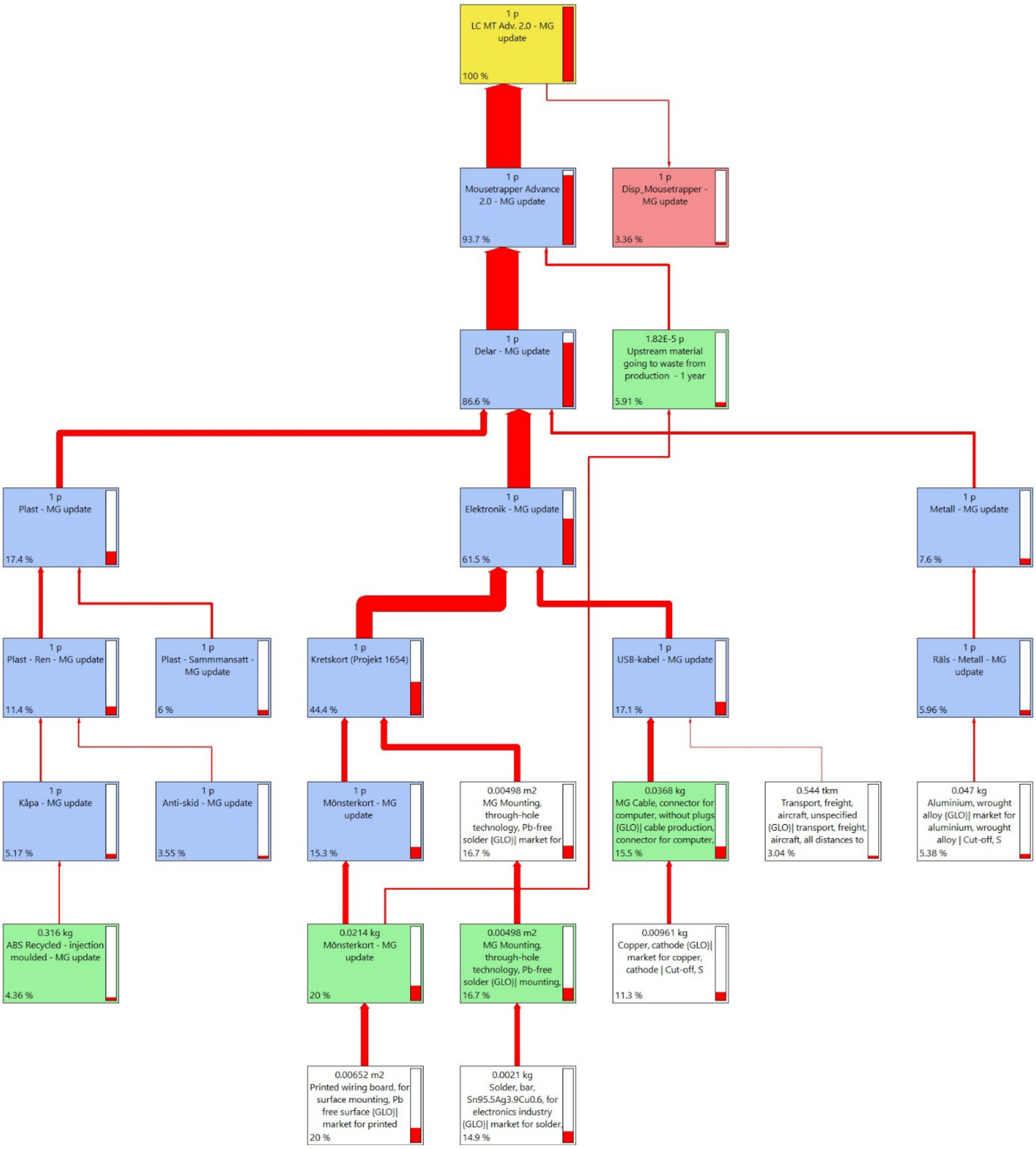

Figure 8: Sankey diagram over share of environmental impact contributions from different parts of the lifecycle, per unit Mousetrapper Advanced 2.0/2.0+ (EF3.1 single score, cut off 3%)

5.3 Impact on Resource use, minerals and metals

The total impact on Resource use, minerals and metals is calculated as 3.69E-04 kgSb-eq. per unit Mousetrapper 2.0/2.0+. The contribution from different life cycle stage can be seen in Figure 9. Upstream production of electronics dominates the impact (~90%). The PCBA along makes up about 70% of the total impact in this impact category and the cable also has a significant contribution (~20%). It is noteworthy that the soldering material used to mount the components to the PCB makes up about 30% of the impact on Resource use, minerals and metals.

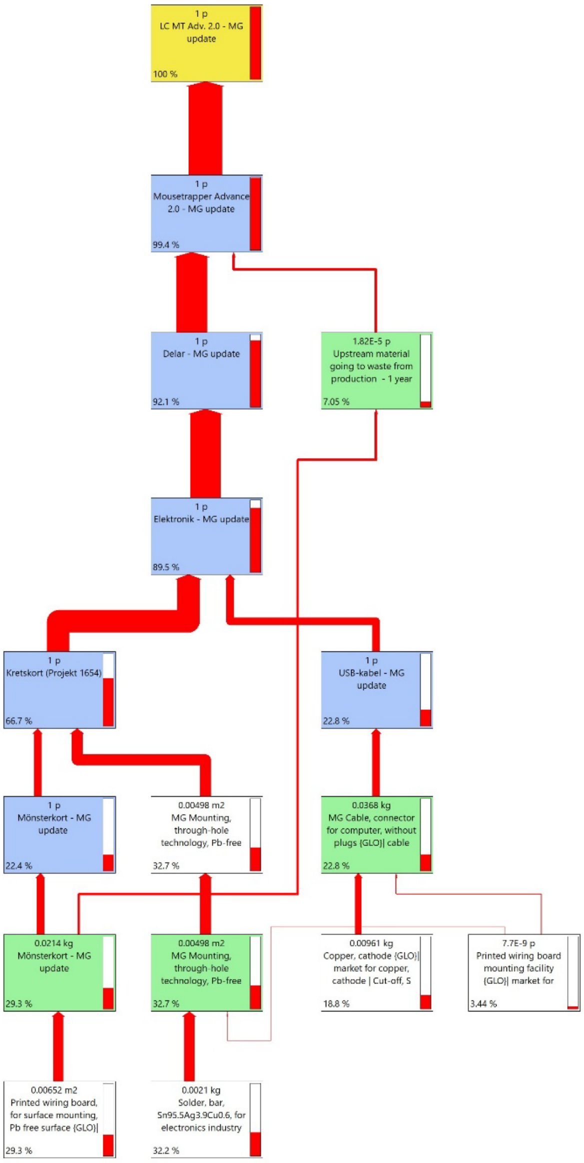

Figure 9: Sankey diagram showing the share of impact contributions to the impact category Resource use, minerals and metals from different parts of the lifecycle, per unit Mousetrapper Advanced 2.0/2.0+ (EF3.1 Resource use, minerals and metals, cut off 3%)

5.4 Impact on Climate Change

The total impact on climate change is calculated as 6.2 kgCO_2eq. per unit Mousetrapper 2.0/2.0+. The contribution from different life cycle stages can be seen in Figure 10 and Figure 11. It is clear that the impact is driven by the upstream production (~77%) and end of life (~12%). Components that contribute significantly to upstream impacts are, in order: PCBA (25.2%), Rail/Räls – metal (14.5%), USB cable (8.5%), Housing/Kåpa (7.8%), Anti-skid (5.6%), Wrist rest/Handlovsstöd (4.0%). The end-of-life impacts mainly come from incineration of fossil plastics.

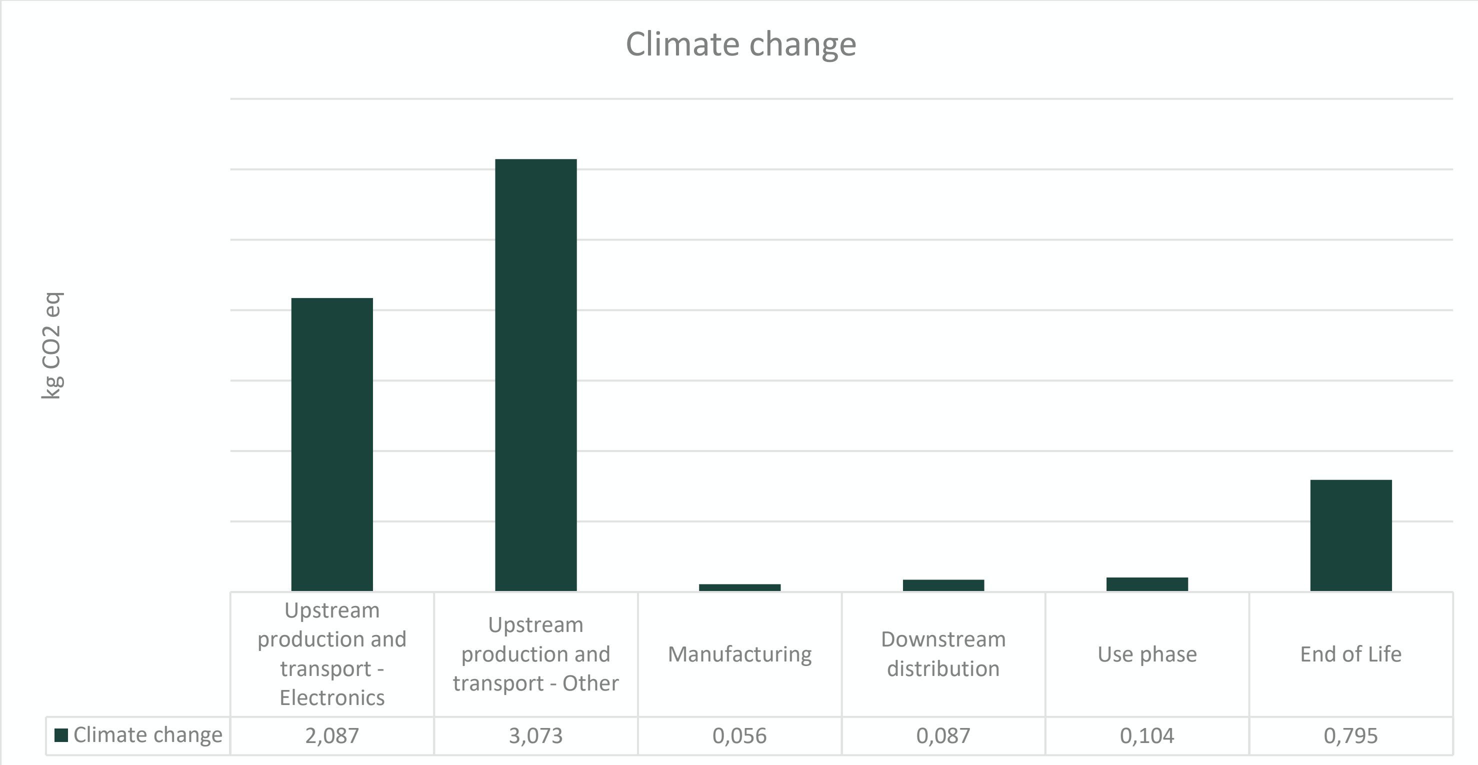

Figure 10: Climate impact per life cycle stage according to EF3.1, per unit Mousetrapper Advanced 2.0/2.0+ (kg CO2eq.).

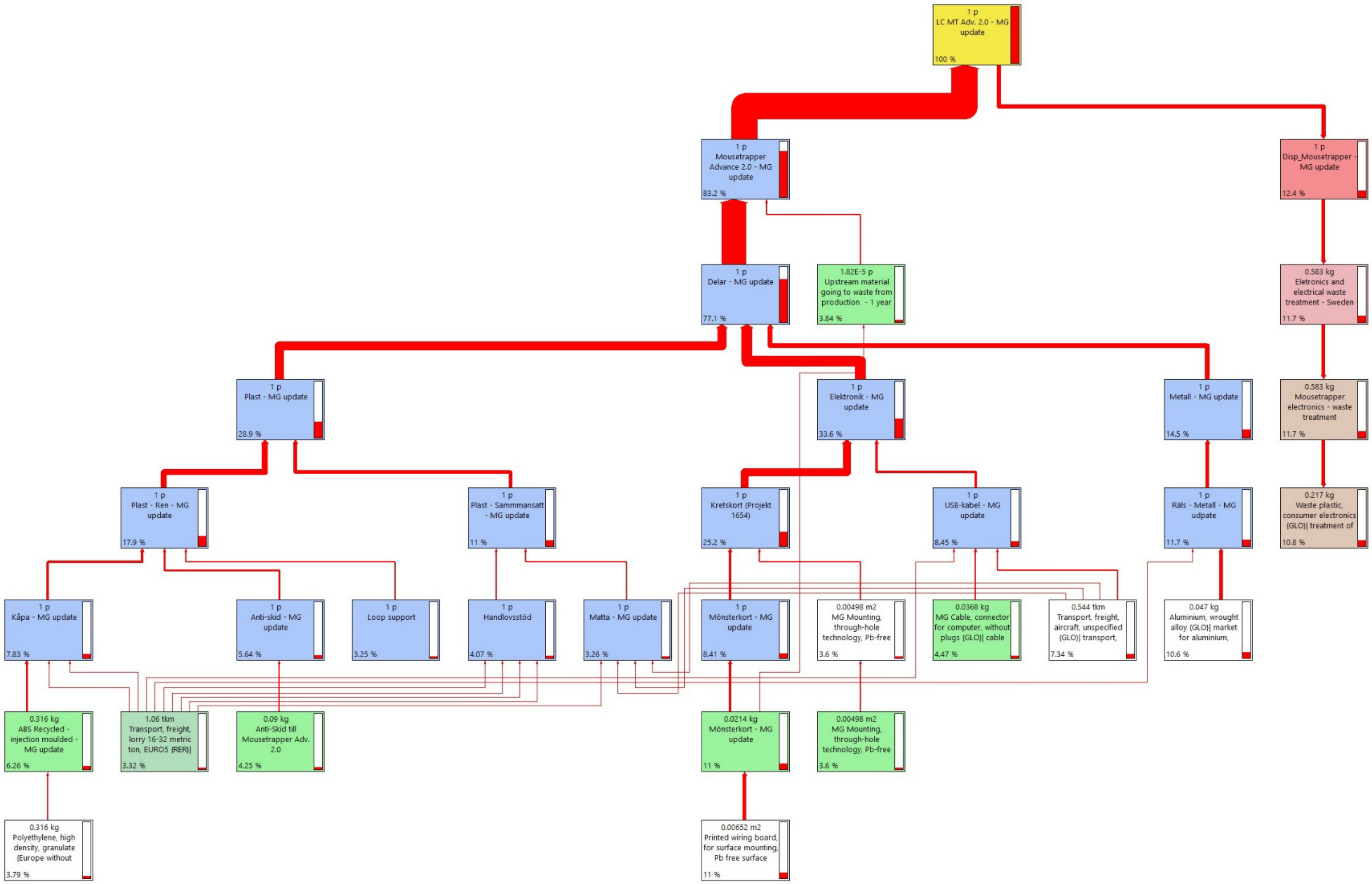

Figure 11: Sankey diagram showing the share of climate change impact contributions from different parts of the lifecycle, per unit Mousetrapper Advanced 2.0/2.0+ (EF3.1 climate change, cut off 3%)

5.5 Impacts from electronics – split by component

Electronics make up a large part of the impacts, for single score, resource use minerals and metals, and climate change. Therefore, Figure 12, Figure 13 and Figure 14 are included, which show the contribution per component relative to the total upstream impact of electronics. We can see that the unmounted PCB has a large relative impact (25% for single score, resource use minerals and metals, and climate change). Individual mounted PCBA components have relatively small impacts but combined they contribute significantly. Moreover, the solder material that is used in the mounting process contributes significantly to resource use, minerals and metals (36%) and also to single score (24%). Finally, the USB cable is also an important contributor, contributing 28% for single score, 26% to resource use minerals and metals and 25% for climate change.

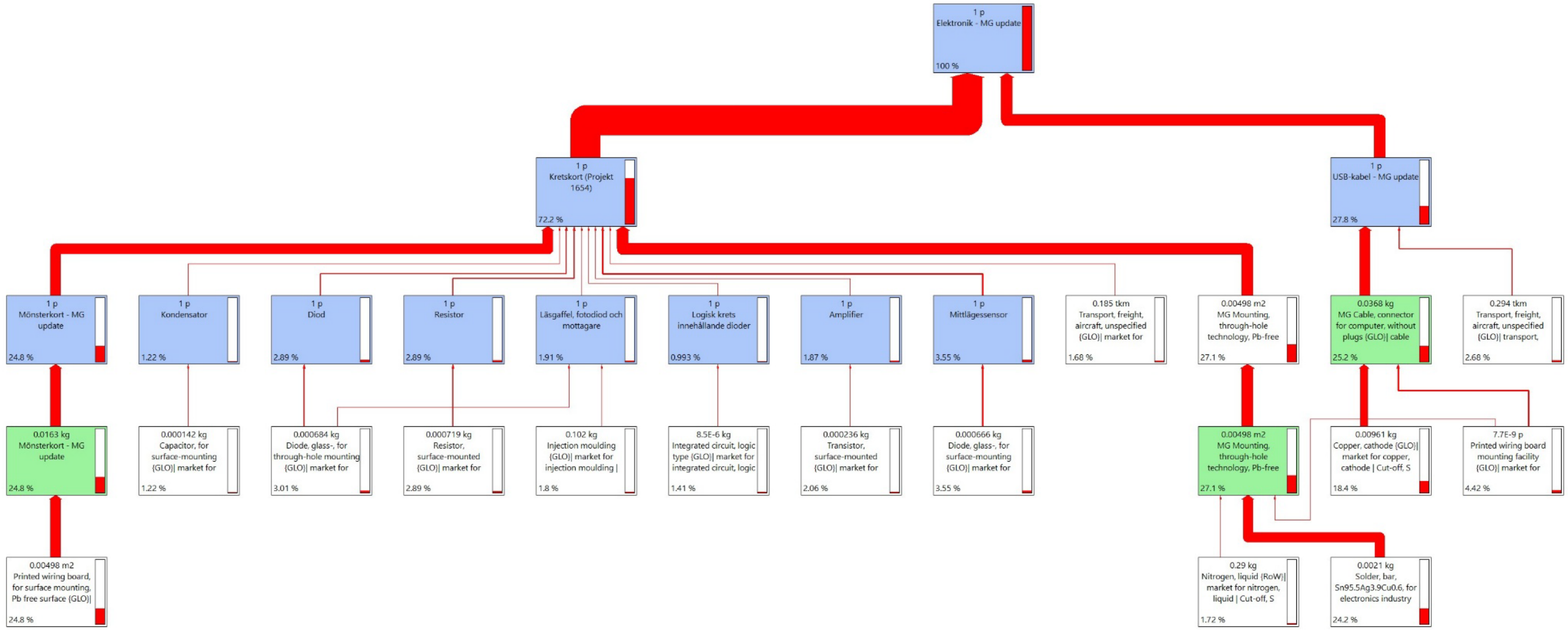

Figure 12: Breakdown of single score results from electronics - per component (cut-off 1%)

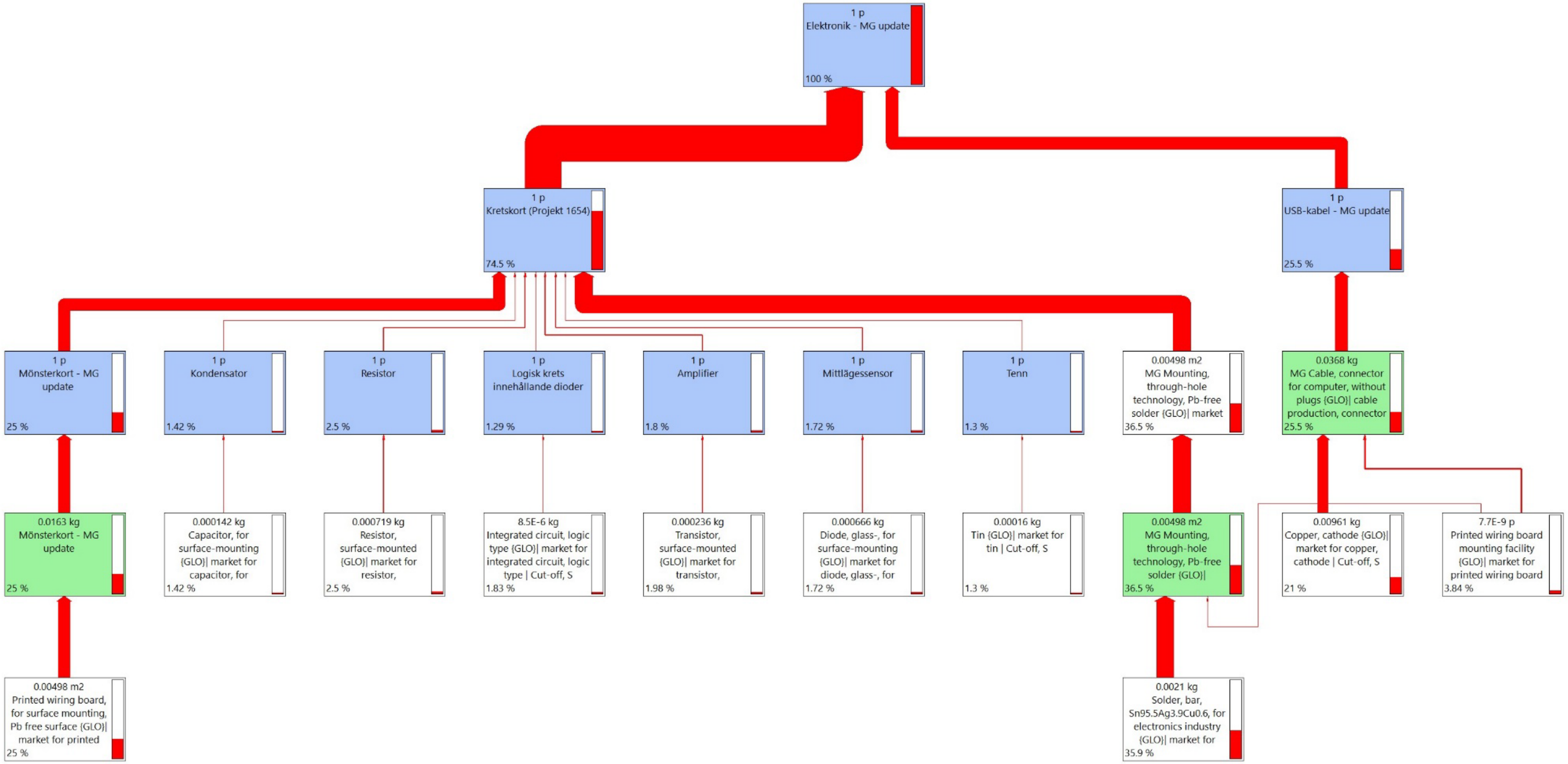

Figure 13: Breakdown of impacts on Resource use, minerals and metals from electronics - per component (cut-off 1%)

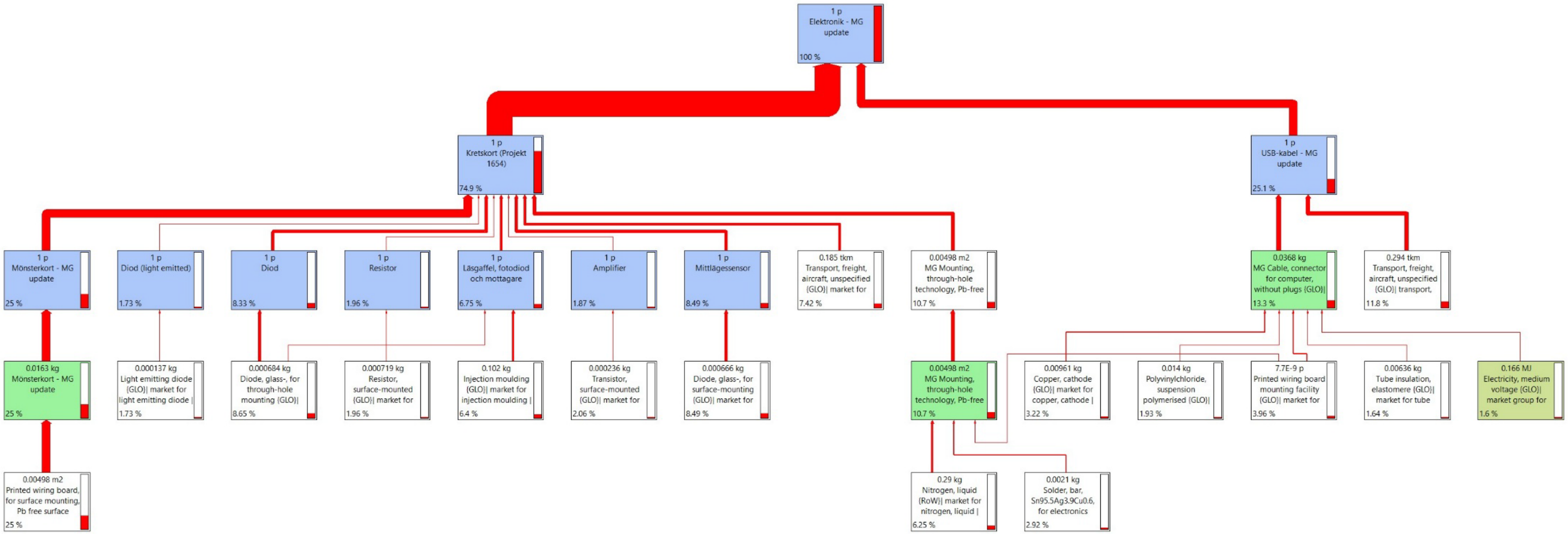

Figure 14: Breakdown of impacts on Resource use, minerals and metals from electronics - per component (cut-off 1%)

6 Interpretation

This section covers the key aspects of the results, scenario analyses and an evaluation of the model and underlying data.

The quantitative impact assessment results are interpreted to understand the possibilities of reducing environmental impact most efficiently.

6.1 Key aspects of results

Single score results as well as impacts on the two dominating impact categories (resource use, minerals and metals and climate change) show a large impact from upstream material. Most noteably, electronics (including PCBA and USB cable) are the main driver. For single score, upstream production impacts of electronics make up about 60% the total. For Resource use, minerals and metals, the corresponding value is 90%. For climate change, upstream production of electronics contributes about 30% to the total impact while plastics parts make up about 23% and metal parts about 13%.

End-of-life impacts are also important, especially when considering climate change, due to incineration of fossil plastics. If recycling could be achieved, this would reduce the impact end-of-life-impacts significantly.

It is noteworthy that the soldering material used to mount components on the PCB contributes about 15% to single score impacts and about 30% to Resource use, minerals and metals. Working with the supplier to reduce the impact of this material - and also to collect more specific data about it - is recommended for future studies.

On component level, we see that the production of (unmounted) printed wiring board makes up about 20% of single score impacts, 30% of impacts on resource use, minerals and metals and 8% of climate change impact. It could thus be effective to work with the supplier to reduce the impact of this component, and at the same time work to reduce the amount of scrap of printed wiring board in the production of Mousetrapper Advanced 2.0/2.0+ (tested in scenario analysis).

Transports of components (PET circuit, USB cable and mat) by aircraft contribute to about 7% of total life cycle impacts on climate change. It is thus recommended that air freight is replaced with transport options that have a lower carbon footprint (tested in scenario analysis).

It should be noted that an important aspect of the functionality of the Mousetrapper Advanced 2.0/2.0+, compared to traditional computer mice, is its ergonomical design. This is not captured in the analysis conducted in this study, which is based on a declared unit of one (1) Mousetrapper unit. This should be considered if the results from this study are compared to other similar products.

6.2 Sensitivity analysis

Sensitivity analysis is included here for two uncertain data points: the energy consumption in the use phase and for the TPE material. The data for the TPE is based on supplier-specific information but since this information cannot be transparently reported (for confidentiality reasons), it cannot be reviewed and must thus be considered uncertain.

6.2.1 Increased electricity consumption in the use phase

The electricity consumption in the use phase was calculated based on a user scenario in which the user actively used her mouse or mousepad for one third of the working day. To test the sensitivity of the result to this assumption, we also include a calculation in which the active use time is doubled.

Table 28 shows that the impact increase for climate change is 2%. For Resource use, minerals and metals, there is almost no difference in results, and the Single score increases by 1%. The conclusions of this study are thus not very sensitive to the assumption about the amount of active use time.

Table 28: Impact increase if the active use time is doubled.

Impact category	Unit	Baseline	Double active use time	Impact increase (%)
Acidification	mol H+ eq	4.02E-02	4.07E-02	1%
Climate change	kg CO2 eq	6.20E+00	6.30E+00	2%
Ecotoxicity, freshwater	CTUe	5.67E+01	5.71E+01	1%
Particulate matter	disease inc.	3.53E-07	3.55E-07	1%
Eutrophication, marine	kg N eq	7.67E-03	7.76E-03	1%
Eutrophication, freshwater	kg P eq	2.66E-03	2.76E-03	3%
Eutrophication, terrestrial	mol N eq	7.68E-02	7.76E-02	1%
Human toxicity, cancer	CTUh	2.25E-08	2.27E-08	1%
Human toxicity, non-cancer	CTUh	1.75E-07	1.77E-07	1%
Ionising radiation	kBq U-235 eq	4.68E-01	5.32E-01	14%
Land use	Pt	5.10E+01	5.15E+01	1%
Ozone depletion	kg CFC11 eq	3.57E-06	3.57E-06	0%
Photochemical ozone formation	kg NMVOC eq	2.71E-02	2.74E-02	1%
Resource use, fossils	MJ	7.74E+01	7.98E+01	3%
Resource use, minerals and metals	kg Sb eq	3.69E-04	3.71E-04	0%
Water use	m3 depriv.	2.00E+00	2.03E+00	1%
Single score	mPt	1.02E+00	1.03E+00	1%

6.2.2 Impact of TPE material (used in Anti-skid component)

The “anti-skid” component is made of a Thermoplastic elastomer (TPE). There is no good match in ecoinvent for this material. Therefore, supplier-specific information was used to model the specific moulding compound and its production process. However, the supplier information is strictly confidential and thus cannot be reported transparently nor reviewed by the third-party reviewers. Therefore, it must still be considered uncertain. In this sensitivity analysis, we double the amount of TPE, thereby doubling the impact of this material. This way, we test whether the overall results change significantly with a higher impact per kg TPE material.

Table 29 shows that that the impact on Climate change would be about 6% higher if the TPE material had a doubled impact per kg. The modelling of this material is thus significant. However, the single score results only increase 1% and the impacts on Resource use, minerals and metals, is close to unchanged.

For the future, if the supplier communicates official verified LCA results for their material, using these would improve the data quality of the Mousetrapper analysis.

Table 29: Impact increase if TPE impact is doubled.

Impact category	Unit	Baseline	Higher TPE impact	Impact increase (%)
Acidification	mol H+ eq	4.02E-02	4.14E-02	3%
Climate change	kg CO2 eq	6.20E+00	6.58E+00	6%
Ecotoxicity, freshwater	CTUe	5.67E+01	5.87E+01	3%
Particulate matter	disease inc.	3.53E-07	3.64E-07	3%
Eutrophication, marine	kg N eq	7.67E-03	7.94E-03	4%
Eutrophication, freshwater	kg P eq	2.66E-03	2.70E-03	1%
Eutrophication, terrestrial	mol N eq	7.68E-02	7.89E-02	3%
Human toxicity, cancer	CTUh	2.25E-08	2.31E-08	3%
Human toxicity, non-cancer	CTUh	1.75E-07	1.80E-07	2%
Ionising radiation	kBq U-235 eq	4.68E-01	4.98E-01	6%
Land use	Pt	5.10E+01	5.16E+01	1%
Ozone depletion	kg CFC11 eq	3.57E-06	3.58E-06	0%
Photochemical ozone formation	kg NMVOC eq	2.71E-02	2.95E-02	9%
Resource use, fossils	MJ	7.74E+01	8.54E+01	10%
Resource use, minerals and metals	kg Sb eq	3.69E-04	3.70E-04	0%
Water use	m3 depriv.	2.00E+00	2.08E+00	4%
Single score	mPt	1.02E+00	1.03E+00	1%

6.3 Scenario analysis

In this study, two scenarios have been evaluated. The first examines how the results would differ if there were no scrap from the PCB (mönsterkort), and the second assesses the impact of excluding air transport in the transportation of raw materials. These were selected based on the relatively large impact of the PCB and the air transport, and since both of the scenarios represent concrete improvements that Trapper Data AB could implement to improve the environmental performance of their product.

6.3.1 No scrap PCB (mönsterkort)

This scenario explores how the environmental impact of the Mousetrapper Advance would change if no PCB scrap were generated. The results are shown Table 30. For the climate change impact, the potential impact reduction is about 3%. For Resource use, minerals and metals, it is 7% and for Single score it is 5%. No impact categories show increased impacts.

Table 30: Potential impact reduction if there was no PCB scrap when producing the Mousetrapper.

Impact category	Unit	Baseline	No PCB scrap	Impact reduction (%)
Acidification	mol H+ eq	4.02E-02	3.87E-02	-4%
Climate change	kg CO2 eq	6.20E+00	6.04E+00	-3%
Ecotoxicity, freshwater	CTUe	5.67E+01	5.41E+01	-5%
Particulate matter	disease inc.	3.53E-07	3.45E-07	-2%
Eutrophication, marine	kg N eq	7.67E-03	7.47E-03	-3%
Eutrophication, freshwater	kg P eq	2.66E-03	2.49E-03	-6%
Eutrophication, terrestrial	mol N eq	7.68E-02	7.47E-02	-3%
Human toxicity, cancer	CTUh	2.25E-08	2.20E-08	-2%
Human toxicity, non-cancer	CTUh	1.75E-07	1.66E-07	-5%
Ionising radiation	kBq U-235 eq	4.68E-01	4.50E-01	-4%
Land use	Pt	5.10E+01	5.04E+01	-1%
Ozone depletion	kg CFC11 eq	3.57E-06	3.56E-06	0%
Photochemical ozone formation	kg NMVOC eq	2.71E-02	2.65E-02	-2%
Resource use, fossils	MJ	7.74E+01	7.54E+01	-3%
Resource use, minerals and metals	kg Sb eq	3.69E-04	3.44E-04	-7%
Water use	m3 depriv.	2.00E+00	1.96E+00	-2%
Single score	mPt	1.02E+00	9.67E-01	-5%

6.3.2 No air travel

In this scenario, all transportation of raw materials by aircraft has been removed and replaced with sea transport. The ecoinvent dataset "*Transport, freight, sea, container ship {GLO}| transport, freight, sea, container ship | Cut-off, U*" is used to represent the sea transport. The results are shown in Table 31.

For the climate change impact, the potential reduction is about 6%. For Resource use, minerals and metals, there is almost no difference and for Single score it is 5%. No impact categories show increased impacts.

Table 31: Potential impact reduction if there was no air freight of upstream Mousetrapper components.

Impact category	Unit	Baseline	No air freight	Impact reduction (%)
Acidification	mol H+ eq	4.02E-02	3.87E-02	-4%
Climate change	kg CO2 eq	6.20E+00	5.82E+00	-6%
Ecotoxicity, freshwater	CTUe	5.67E+01	5.64E+01	-1%
Particulate matter	disease inc.	3.53E-07	3.49E-07	-1%
Eutrophication, marine	kg N eq	7.67E-03	7.05E-03	-8%
Eutrophication, freshwater	kg P eq	2.66E-03	2.66E-03	0%
Eutrophication, terrestrial	mol N eq	7.68E-02	7.01E-02	-9%
Human toxicity, cancer	CTUh	2.25E-08	2.21E-08	-1%

Human toxicity, non-cancer	CTUh	1.75E-07	1.72E-07	-2%
Ionising radiation	kBq U-235 eq	4.68E-01	4.66E-01	0%
Land use	Pt	5.10E+01	5.07E+01	-1%
Ozone depletion	kg CFC11 eq	3.57E-06	3.56E-06	0%
Photochemical ozone formation	kg NMVOC eq	2.71E-02	2.50E-02	-8%
Resource use, fossils	MJ	7.74E+01	7.24E+01	-7%
Resource use, minerals and metals	kg Sb eq	3.69E-04	3.69E-04	0%
Water use	m3 depriv.	2.00E+00	1.99E+00	0%
Single score	mPt	1.02E+00	9.90E-01	-3%

6.4 Data quality assessment

The data is valid for production in Järfälla, Sweden. An evaluation of the model and underlying data is made by a data quality assessment which includes a completeness check, assessing the validity of data and a consistency check.

The data are assessed according to the data quality requirements in section 3.2.8. The data quality assessment is based on the requirements in the ISO 14044 standard. Specific data for this study is gathered 2025 and represents the year 2024/2025. All the data gathered, except for that from the TPE supplier, have been validated by Trapper Data AB. The generic data that have been used in the study is based on ecoinvent 3.10 or Industry data 2.0.

Table 32: Data quality assessment for the study.

Aspect	Notes
Geographical coverage	Upstream data: Good, generic datasets have been selected based on geographical region where suppliers are located. Manufacturing data: Very good (site-specific)
Technological representativeness	Upstream data: Good, generic data has been used. Manufacturing data: Very good (site-specific).
Time-related coverage	Upstream data: Good BoM: very good (current model) Manufacturing data: Very good (2024 data)
Validity	The technological and geographical coverage of the data chosen reflects the physical reality of the product system modelled.
Completeness	The data accounts for all known sub-processes. All upstream processes are modelled using generic data from the ecoinvent database, using country-specific datasets whenever available, otherwise using RER/RoW datasets.
Consistency, allocation method, etc.	Allocation follows the procedure described in section 4.
Completeness and treatment of missing data	No data is found missing.

6.4.1 Completeness check

The objective of the completeness check is to ensure that all relevant information and data needed for the interpretation are available and complete. If any relevant information is missing or incomplete, the necessity of such information for satisfying the goal and scope of the LCA shall be considered. This finding and its justification shall be recorded.

In reference to the goal and scope of the report, the report is complete.

6.4.2 Validation of data

The data collected is often linked to a specific context, a certain facility size, etc. This may mean that data needs to be adjusted to represent the system being studied. It is also common for data to be reported in units or quantities that require recalculations. All such adjustments are documented in the software used for LCA calculation, SimaPro and in this report. The data has been validated by double-checking with the providers of data at Trapper Data AB.

6.5 Limitations

Limitations are present mainly in the modelling of the electronics. In this study, care has been taken to weigh each component and to select the most suitable secondary datasets. However, the printed circuit board contains multiple components for which there is no exact dataset representation available in ecoinvent 3.10. In the future, this could be improved if suppliers conduct their own verified LCA studies, so that those result can be incorporated into Trapper Data's LCA model.

Moreover, the recycled ABS components were modelled using ecoinvent data for recycled PP, as this was considered the most suitable available dataset in ecoinvent (see section 4.2.1.1 for details). The supplier of the recycled ABS has a carbon footprint value communicated on their website, but no results for other impact categories. In the future, if complete and verified LCA results can be obtained for the material, this could be incorporated into Trapper Data's model, improving the data quality.

Another limitation lies in the assumptions made for the use phase. The product was also assumed to have a lifespan of approximately five years before being replaced. However, the sensitivity analysis showed that the results were not so sensitive to assumptions made about the use phase did.

Finally, the TPE material is modelled based on supplier information, but the details cannot be transparently reported for confidentiality reasons (the supplier does not allow it). The sensitivity analysis shows that the modelling of this material has a significant effect on climate change, but only a minor effect on single score results.

7 Conclusions and recommendations

The environmental impact of Mousetrapper Advanced 2.0/2.0+ from a cradle-to-grave perspective comes mainly from the production of upstream components. Electronic components (PCBA and USB cable) have the highest contribution to single score impacts, followed by plastics and metal.
The most relevant impact categories, based on contribution to single score, are “Resource use, minerals and metals”, “Climate change”. Upstream production of electronics completely dominates the impact on Resource use minerals and metals. For climate change, upstream production electronics and plastics have similar contributions, followed by metal components. For climate change, end-of-life impacts are also important due to incineration of fossil plastics.

Upstream activities should thus be in focus for Trapper Data's future efforts, both in terms of impact reduction and data quality improvements. Collaboration with suppliers will be important going forward.

7.1 Recommendations

This section presents recommendations for how to mitigate environmental hotspots as well as how to improve the data quality of the study. These efforts go hand in hand. With improved data quality, it will also be possible to improve the specificity and effectiveness of improvement actions.

- Work with component suppliers to reduce the upstream impact. The most important components are the PCBA, the USB cable, the metal rail, and the housing.
- Work with mounting supplier to reduce impact from the solder material and to improve the data quality for this material.
- Focus on improvements that can increase the recycling rate at the end of life of the product. This could be internal improvements in, for example, product design, but also collaborative supply-chain-level initiatives to increase recycling rates for electric and electronic equipment (EEE).
- Reduce scrap in production (printed circuit board).
- Reduce or eliminate air freight.
- Improve data quality for upstream production of components by collecting supplier-specific inventory data or using EPD's published by suppliers.

7.2 How to communicate the results

The study and report were carried out following the ISO standard for Life cycle assessments. According to ISO, LCA studies for external communication need to be summarised in a third party report (ISO, 14040):
"When results of the LCA are to be communicated to any third party (i.e. interested party other than the commissioner or the practitioner of the study), regardless of the form of communication, a third-party report shall be prepared. The third-party report can be based on study documentation that contains confidential information that may not be included in the third-party report. The third-party report constitutes a reference document, and shall be made available to any third party to whom the communication is made."

This LCA report can be used as a third-party report or as a basis for the development of such a report.

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