The mica value chain from India to the world

A model for sustainability analysis

January 2023

RESPONSIBLE MICA INITIATIVE

BASIC

About RMI

The Responsible Mica Initiative (RMI) is a global Coalition for Action – putting policy into practice – comprised of multiple organizations committed to establishing fair, responsible and sustainable mica supply chains globally, that will eliminate unacceptable working conditions and eradicate child labour.
RMI uses a multi-stakeholder and holistic approach that engages companies, civil society organisations, industry associations and governments to develop and implement three integrated program pillars that will establish responsible workplace standards, empower local communities, and establish a legal framework for the mica sector.

http://www.responsible-mica-initiative.com

About BASIC

BASIC conducts social and economic analysis on value chains, on their governance and sustainability, with the objective of fuelling the public debate and supporting the social and environmental transition of actors and territories. The studies published by BASIC are designed to inform the public, through partnerships with civil society organisations and by helping decision-making processes of public and private actors. Since its establishment in 2013, BASIC has published studies on the value chains of banana, pineapple, cocoa, wine, grapes, coffee, milk, meat, and cereals, applying a unique methodology to estimate prices, costs, taxes, and margins along the value chain and enabling scenario-based modelling.

http://www.lebasic.com

Letter of endorsement

When the Responsible Mica Initiative approached us a few months ago with both the strong and undeniable belief that “paying adults-mica-pickers a living income would have a positive impact on reducing child labour,” as well as the innovative idea of demonstrating that paying this living income would be economically viable for the entire mica supply chain, we could not help but be willing to contribute. This demonstration had already great chances to remove barriers to change.

We are proud to have contributed to this long-running study throughout the last twelve months until its successful completion, by joining our complementary expertise (see list below), and to publish its results today. It was a unique exercise that brought together several industries that use mica across the value chain, and which also fed our current respective work. As a result, we are delighted to share this outstanding result: paying a living income to upstream mica adult-workers, allowing them to raise their standard of living, and support their families without relying on their children's work, will have an infinitesimal impact on the final cost of a lipstick, a paint, or a car!

We are conscious that the concrete implementation of this living income, within long and complex value chains, is a journey, but with the commitment of all, it is certainly achievable! Our deepest wish is that all the actors within or related to the mica supply chains take ownership of these findings and start actively looking for concrete and collective solutions, since it does make sense, both economically as well as in terms of child labor and poverty reduction!

Signatories

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Executive Summary

Mica, a naturally occurring mineral with outstanding electrical, heat and visual properties, is ubiquitous as an ingredient in certain industries, such as paints, cosmetics, and the automotive industry. Among others, mica comes in “sheet” form dug out from the ground, or in “scrap” form collected from mine shaft debris; in either case, mica is a valuable commodity on which hundreds of thousands of miners and pickers worldwide depend for their income. Child labour is a complex problem associated with low incomes that plagues the mica industry. The object of this study is to explore what would change along the value chain if mica pickers – people handling scrap mica in India – were paid a living income for their work, in a bid to eradicate child labour in this industry. The geographical perimeter is the world’s largest small-scale artisanal mica picking ecosystem: Bihar and Jharkhand states in India.

This study, conducted by BASIC for the Responsible Mica Initiative (RMI), explores the scrap mica value chain qualitatively and quantitatively, as a prelude to an analysis of scenarios for change. The value chain is analysed qualitatively in the sense that extensive interviews and bibliographical research were leveraged to build a model of the structure of the value chain for scrap mica: who does what, where, producing what intermediate and final products. The value chain is analysed quantitatively in the sense that prices, costs, taxes, and margins were assigned to each of the items in the structure of the value chain. These two processes, articulated jointly, made it possible for BASIC to construct an online model of the scrap value chain in Bihar and Jharkhand as it currently stands, to see where and by whom value is added to products all along the chain – from scrap mica picker to final consumer of paints, cosmetics, or cars (excluding electric components). The model is hosted on a platform on BASIC’s website (http://micavaluechain.lebasic.com/).

The current state of the value chain shows that there is considerable accrual of value downstream of India, in the middle and end of the chain. This can be illustrated by looking at the distribution of value for eight finished products that BASIC and RMI jointly decided to: DIY anti-corrosion paint, DIY architectural paint interior/exterior, OEM refinish paint, nail enamel, eyeshadow, lipstick, thermal car, and electric car. For each of these finished products, the India-based scrap mica segment of the chain represents negligible value addition: the stage from picking to export captures less than 1% of the price of final products in all cases.

Child labour is not the only problem facing the Indian scrap mica business. Mica pickers are paid far less than a living income, as are (to a lesser extent) workers in factories where scrap mica undergoes primary processing. Families live hand-to-mouth and many are indebted to loan sharks; their low caste/social status makes them especially vulnerable. Mica miners work in dangerous conditions, usually without Personal Protective Equipment (PPE), and are thereby fully exposed to the health hazards associated with their work. Most importantly perhaps, the scrap mica value chain has historically been mostly illegal (since implementation of the Forest Conservation Act of 1980). Mica workers and pickers are therefore in a precarious situation and generally have little leverage or bargaining power over dealers to whom they sell their wares, and dealers who purchase mica from pickers must lower their buying prices to prepare for unaccounted-for administrative costs. Illegality also means that the State has little control over who does what and where except through raids/inspections, and barely receives taxes on mica-related activities.

It is in light of the above considerations that RMI and BASIC built on the "status quo" model to study what would happen if mica pickers and factory workers in India were paid a living income. A series of scenarios were imagined, in increasing order of ambition in terms of social change:

- Scenario 1: Mica picking is legalised through auctions on *dhibra* dumps, and mica pickers and factory workers receive minimum wage or the equivalent income
- Scenario 2: Mica picking is legalised through auctions on *dhibra* dumps, and mica pickers and factory workers receive a living income/wage
- Scenario 3: Mica picking is legalised, and mica pickers organise into cooperatives of about 500 workers/10-12 villages each, and sell their mica to the Jharkhand State Mineral Development Corporation (JSMDC), which auctions it off. Mica pickers and factory workers receive a living income/wage

It is worth noting that Scenario 3 appears to be the one towards which the authorities in Jharkhand are orienting their efforts. Scenario 1 resembles more what has been done in the past: auctioning off specific sites of mica production through auctions, usually attracting bids from aggregators or processors (though extra provisions are made in our model of scenario 1 for PPE). Scenario 2 is a hypothetical "what if" of the same setup as Scenario 1 but with pickers and workers paid a living income.

Thanks to the qualitative/quantitative model built by BASIC on the basis of interviews and bibliographical research, it was possible to explore price transmission down the chain from the mine to final consumer. For each of the scenarios, the values in the model were adjusted to reflect each scenario's parameters: who does what, where, producing which finished or semi-finished products, at what price, with what costs, taxes, and margins. Price increases were transmitted down the chain with identical margins. The key finding of this exercise is that **when prices are modelled to reflect a minimum wage equivalent or a living income for mica pickers and workers, or a remodelling of the supply chain with formalisation under cooperatives, the impact on the price of intermediate products and finished retail products is negligible.** In relative terms, the additional cost at the retail stage is in most cases less than 0.1% of the per-kg price.

As for revenues to the State, we estimate that the State of Jharkhand stands to benefit from tax revenues thanks to legalisation. In a situation like scenario 3, where mica pickers organise into cooperatives and the JSMDC purchases and then auctions this mica at a living-income equivalent, total proceeds to the State from taxes on the scrap mica sector are estimated at 1,105,076,068.66 INR per annum, i.e., approximately 13.350 million USD.

The study concludes that although ending child labour in the mica value chain is a complex journey, providing a living income for mica pickers and factory workers is a first, necessary and achievable condition for reaching this goal that only requires a negligible but collective effort of all actors along the value chain. The scenarios explored in this study are improvements on the current situation because they ameliorate incomes and working conditions for mica pickers and factory workers. The model that is a companion to this report suggests that if they are accompanied with sufficient will from both political and economic actors, these scenarios could see the light of day, endowing the mica value chain with the sustainability and respect for human rights that its stakeholders wish to attain.

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Abbreviations

BGS	British Geological Survey
CINI	Child In Need Institute
DCC	District-level Collection Centre
DIY	Do It Yourself
EV	Electric Vehicle
FOB	Free On Board
IBM	Indian Bureau of Mines
JSMDC	Jharkhand State Mineral Development Corporation
OEM	Original Equipment Manufacturer
PPE	Personal Protective Equipment
RMI	Responsible Mica Initiative
TMR	Transparency Market Research
USGS	United States Geological Survey
VCC	Village-level Collection Centre

Glossary

Bihar Mica Belt/Mica Belt. The Bihar Mica Belt is the name given to a geological complex rich in mica, situated in forested and non- forested regions found in the north of the modern-day Indian state of Jharkhand and the south of the neighbouring state of Bihar.[1] The Bihar Mica Belt was so-named when Jharkhand and Bihar were a single state called Bihar, before Jharkhand split off from Bihar state in the year 2000. As a result, while the name "Bihar Mica Belt" continues to be used in academic publications, in common parlance it is common for people to refer to the "Mica Belt," without the word Bihar, given that substantial surfaces of the Belt stretch into Jharkhand.[2] The Bihar Mica Belt is where the vast majority of Indian mica is mined and picked.[3]

Block mica. Block mica is part of the sheet mica value chain. It refers to mica that is dressed from book-like blocks of mica, "with a minimum thickness of 7 mil (0.18 mm)" of relatively large size: at minimum 1 square inch (6.45 cm^2) but "up to 12" to 14" (30 to 35 cm) square."[4] Block mica is one of the bases for *Fabricated mica*.

Built-up mica. See *Micanite.*

Calcination. Calcination entails heating a raw material (here, mica) to very high temperatures, around 850 to 900°C. The impact of calcination is to remove the water content in mica, which is initially at around 4.5%.[5] The operation also gives the mica a golden lustre and may remove heavy metals and toxic substances, and improves yields.[6] Calcined mica is easier to delaminate (to separate the various sheets), and thus calcination is one of the first steps in the transformation of mica powder into a substrate for pearlescent pigments. After being rehydrated in the industrial process for making pigments, mica flakes may be calcined a second time to fix the pigment coatings such as titanium dioxide or iron oxides.[7] Calcined mica is also sought-after for its improved electrical properties. Not all mica is suitable for calcination; high temperature resistance is required.

Dhibra. *Dhibra* is the Hindi word for dumps of mica scrap. It is a neologism derived from the English word "debris."

Fabricated mica. Fabricated mica refers to sheet mica that has been mechanically transformed to make semi-finished mica products, such as washers, disks, furnace windows, strainers, condenser plates… This is achieved by "cutting, stamping and punching of natural sheet mica to specified size, shape, thickness and design."[8]

FOB (Free On Board). Free on Board (FOB) is "a shipment term that defines the point in the supply chain when a buyer or seller becomes liable for the goods being transported. It indicates when the

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[1] Hazarika, Pranjit, Dewashish Upadhyay, and Kamal Lochan Pruseth. "Episodic Tourmaline Growth and Re-Equilibration in Mica Pegmatite from the Bihar Mica Belt, India: Major- and Trace-Element Variations under Pegmatitic and Hydrothermal Conditions." Geological Magazine 154, no. 1 (January 2017): 68–86. https://doi.org/10.1017/S0016756815000916.

[2] BASIC Interview with mica sector expert, 18 November 2022

[3] BASIC Interview with mica sector expert, 1 April 2022

[4] Sitaram Group, "Processed Mica," 2020. https://www.sitaramgroup.co.in/processed-mica.html.

[5] CDMICA, "Calcined Mica Tape," 2018, http://cdmica.com/en/209/272.html

[6] BASIC Interview with mica sector experts, 9 February 2022 and 4 April 2022

[7] BASIC Interview with mica sector experts, 9 March 2022 and 2 May 2022

[8] MICAMAFCO. "Fabricated Mica," 2011. http://www.micaworld.in/fabricatedmica.html.

ownership of goods transfers from seller to buyer, and who is liable for goods damaged or destroyed during shipping."[9] A FOB dollar value, for instance in customs declarations, indicates the price paid by the buyer to the seller when the goods are loaded onto the means of transport (ship, for instance).

Mica board. Mica board is a semi-finished mica-based product made from mica paper impregnated with resins and pressed together at high temperatures. It has excellent electrical and thermal insulation properties and is sought out, among other uses, for electric vehicle batteries.

Mica films. Mica films are part of the sheet mica value chain: the term refers to sheets obtained from dressing mica books to a thickness of 0.0012 to 0.004 inches.[10] Mica films are typically used as a dielectric capacitor; the quality of the mica determines if the mica is used to make capacitors for calibration standards, transmitting capacitors, or receiving capacitors.[11]

Mica flakes. Mica flakes is "mica scrap grinded into sizes ranging from 2 mesh to 30 mesh. Natural mica flakes are prepared by a rotary hammer crushing machine."[12] Mica flakes are used as the primary ingredient in *Mica paper*, but they are also used as the basis for *Mica powder*.

Micanite. Micanite, or built-up mica, is the name given to sheet material which is made up of fine mica lamellae, called "splittings", bonded together by a variety of bonding agents in order to obtain particular characteristics for specific uses.[13] Micanite can be found in numerous forms, including sheets and tubes. Micanite/built-up mica is also the name given to materials made from mica paper pressed with resins at high temperatures, which have functional properties like those of micanite made from mica splittings. Micanite is sometimes made with a substrate such as glass fibre cloth, mat polyester, polyethylene, or ceramic felt.[14]

Mica paper. Mica paper is a semi-finished mica product that is part of the scrap mica value chain. It is made from crushed mica scrap or mica flakes, which are hydrolysed and then "deposited as a continuous mat which is then dried."[15] Inorganic or organic binders may be added. The result is a flexible material that resembles paper endowed with all of mica's desirable properties. Mica paper can be further processed to make *Micanite*.

Mica powder. Mica powder, part of the scrap mica value chain, is mica ground to any number of mesh sizes, ranging from ultra-coarse (10 mesh/1.68 mm) to ultra-fine (400 mesh/0.037 mm). There are different ways to grind mica powder from mica flakes or high-quality scrap: it is customary to distinguish between dry grinding, wet grinding, and micronisation, although the term "micronised mica" is sometimes applied to any mica sufficiently small (diameter less than 45 µm, i.e. 325 mesh and above) irrespective of how it is ground. Mica powder is the basis for an enormous part of the scrap mica value chain, with applications ranging including paints and pigments, plastics, automotive

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[9] Investopedia, "Free on Board (FOB) Explained: Who's Liable for What in Shipping?," September 14, 2022. https://www.investopedia.com/terms/f/fob.asp

[10] Kogel, Jessica, *Industrial minerals and rocks: Commodities, markets, and uses, 7th ed.,* Littleton, Colorado: Society for Mining, Metallurgy, and Exploration (U.S.), 2006

[11] United States Geological Survey, "Minerals yearbook: Mica," 2018

[12] Sitaram Group, "Mica Scrap," 2020. https://www.sitaramgroup.co.in/mica-flakes-powder.html

[13] MICAMAFCO, "Micanite," 2011, http://www.micaworld.in/micanite.html

[14] Continental Trade, "Micanite types," 2022, https://www.continentaltrade.com.pl/micanite-types

[15] Zlobik, Alvin B., and United States Bureau of Mines, "Mica," 1979

parts, rubber, oil drilling mud, welding electrodes, asphalt roofing, drywall, swimming pool floorings, aerospace, and acoustics, among others.[16]

Mica splittings. Mica splittings are part of the sheet mica value chain. They are the thinnest category of sheets obtained from block mica: splittings refers to laminae of block mica that are dressed to a maximum thickness of 0.0012 inches.[17] They can be sold in different forms: book mica, meaning individual books of mica from the same block or same thins, each block containing 4 to 10 sheets; wrapper mica splittings, which are book-form splittings that are split into a thickness between .00075" (0.019 mm) to .0015" (0.38 mm); and loose mica splittings, which are heterogeneous shapes of mica arranged in irregular order that are packed loosely in containers in bulk form.[18] Mica splittings are used as the basis for *Micanite*.

Mica thins. Mica thins are part of the sheet mica value chain: mica thins refers to sheets obtained from block mica and dressed to a thickness of 0.002 to 0.007 inches.[19] Mica "thins" are, paradoxically, the second-thickest form of sheets obtained from book of mica, after block mica.

Muscovite mica. Also known as potassium mica, muscovite mica is a variety of mica that is colourless to pale green in colour and presents interesting visual properties as well as insulation properties. It is the most frequently mined mica, and is the main type mined in the *Bihar Mica Belt* in India.[20]

Phlogopite mica. Also known as magnesium mica, phlogopite mica is a minor type of mica that is yellow to dark brown in colour and presents interesting heat resistance qualities. It is particularly mined in Madagascar.[21]

Scrap mica. Scrap mica is generally any mica of a quality and size not suitable for use as sheet mica. It frequently refers to what is left over from the mining of books of sheet mica. Per the Bihar Mica Act in India, scrap mica is defined as mica pieces under 6 sq. inches (38.7 cm^2). Scrap mica is found in dumps near mining shafts, where mica pickers go through the debris and pick out shiny flakes or scrap. The "scrap mica value chain" begins with these products and is used to make *Mica flakes, Mica powder,* and *Mica paper,* among others. Mica scrap itself, when it is of good quality, is crushed and then sold as "crushed mica scrap."

Sheet mica. Sheet mica refers to semi-finished mica products hand-cobbed with knives from thick, book-like blocks of mica. The term "sheets" is used because these products have a relatively large surface area (more than 6.5 cm^2) while being relatively thin – as against scrap mica, which is considered as having a smaller surface area.[22] The term "sheet mica value chain" refers to the products derived from mica books and their uses (*see Mica blocks, Mica films, Mica splittings, Mica thins*).

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[16] Kogel et al., *Industrial Minerals and Rocks*, 2006
[17] Kogel et al., *Industrial Minerals and Rocks*, 2006
[18] Sitaram Group, "Processed Mica," 2020. https://www.sitaramgroup.co.in/processed-mica.html
[19] Kogel et al., *Industrial Minerals and Rocks*, 2006
[20] Imerys, "Mica," 2022. https://www.imerys.com/fr/mineraux/mica and Kogel et al., *Industrial Minerals and Rocks*, 2006
[21] Kogel et al., *Industrial Minerals and Rocks*, 2006 and International Labour Organisation and Madagascar Ministry of Mines and Strategic Resources, "Rapport provisoire: Recensement des exploitants du mica," 22 June 2021
[22] Kogel et al., *Industrial Minerals and Rocks*, 2006

1. Introduction

Mica is a naturally occurring mineral with outstanding properties that make it sought-after in a number of industries.[23] This report, commissioned by the Responsible Mica Initiative,[24] explores the mica value chain in one country where small-scale artisanal mining of mica takes place: India. Fundamentally, this report is a companion to an online platform[25] that hosts a model of the mica value chain both in its current state, and under potential scenarios for the future in which mica workers' earnings increase towards a living income. The report presents the background information that was used to build the online model (Section 2) and the assumptions and consequences of three scenarios, each exploring the impact of legalising the mica trade as well as paying a minimum wage or a living wage for mica pickers and workers (Section 3). The report includes a glossary, bibliography, and two annexes – one detailing the general methodology used to build the model and another giving basic instructions for how to use the online tool.

Mica's insulation properties exceed that of all comparable materials due to its extremely high temperature resistance and low thermal expansion. This explains its wide use in the electrical and electronic sector, as well as heavy industry. Regarding visual properties, mica also makes it possible to make pearlescent pigments, but it also extends the shelf life of pigments, brightens their intensity and reinforces the resistance and flexibility of products it is mixed with, hence its large use in the paintings sector, but also in cosmetics products and even in the construction sector (plaster, cladding, joints…). As a result, it is also largely present in 2nd-tier sectors such as the automotive industry, where it can be found in many car components (paints, electrical and electronic parts, insulators, fenders and fascia, brake pads…).[26]

According to TMR (Transparency Market Research), the total market value of mica, including both the natural and synthetic forms, was over half a billion dollars (US$ 576.1 million) in 2020; in 2015, the market corresponded to a total volume of 951,129 tonnes (more recent data on the volumes figure was not available).[27] In 2015, natural mica represented roughly 90% of this market, both in value (US$

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[23] There are 37 different types of natural mica, among which only 2 are widely used by industries: muscovite (potassium mica) is the most frequently mined mica and presents interesting visual properties as well as insulation properties, while phlogopite (magnesium mica) is a minor type which provides interesting heat resistance properties.

[24] The Responsible Mica Initiative is a consortium of more than 80 members drawn from a cross section of industries that produce or use mica as well as industry associations and civil society and non-governmental organizations, working together for more sustainability and respect for human rights in the mica value chain.

[25] http://micavaluechain.lebasic.com/

[26] There also exists synthetic mica, which is made artificially by heating certain raw materials, but it is produced in far smaller quantities than natural mica. Its properties, partly similar to natural mica, are mainly interesting for cosmetics. In most cases the two products – natural and synthetic – are not substitutable (yet).

[27] More recent data on volumes/weight traded was not available in the open source, except for the UN COMTRADE database. However, the latter appears to significantly under-report mica exports: as an example, in 2021 only just over 500,000 tons were reported, when a more likely figure would be around 1,000,000 tons or more given market growth projections. Likewise for 2015, while the data cited by SOMO/Terre des Hommes from a report by Transparency Market Research put the volume at 950,000 tonnes, COMTRADE put the figure at only 390,000 tonnes.

429 million) as well as volumes (846,505 tonnes). In the near future, this market is expected to grow at almost 3% per year in value for the period 2021-2031.[28]

A significant part of mica mining worldwide is done in the form of artisanal and small-scale mining, as opposed to industrial mining. One country where this is practiced is India, possibly the world's largest exporter of mica.[29] Mica mining in these conditions requires intensive labour – both the mining of block/sheet mica, and picking mica scrap out of the leftovers left from digging the mine shaft. Breaches of human rights are quite common in these mica mining setups, from dangerous working conditions, precarious employment, child labour, discrimination and exploitation. These risks are all the more important in the cases of illegal mica mining which are quite frequent in countries such as India.

Civil society organisations as well as the major industry actors using components made from mica both acknowledge that the low wages much below the living wage which are received by mining employees (and the low income made by independent mica miners and pickers), as well as the illegality and informality of the mica picking and mining activities, sit at the heart of many of these problems. In 2020, the Responsible Mica Initiative, a non-governmental organization created to establish fair, responsible and sustainable mica supply chains, established a taskforce to develop quantitative benchmarks on living income and living wages in the mica sector, starting with Bihar and Jharkhand in India.

However, the consequences of the implementation of living wages on the costs for the industry actors along the chain is unknown. In order to enable such changes in the mica industry, there is a need to:

- evaluate the concrete impacts of paying living wages / incomes, as well as legalizing and formalizing the mica sector
- evaluate the capacity of the different use sectors (paintings, cosmetics, electronics, automotive industry, construction…) to buffer such costs increases,
- but also to better understand to which extent different stakeholders along the processing chain of mica could take on their margins to cover living wages and living income at the picking/mining and processing stages.

In this context, RMI commissioned BASIC to conduct a study with three objectives:

1. To provide relevant estimates for the distribution of value, costs, taxes, and net profit margins of a set of semi-finished industrial goods made predominantly from mica, with a focus on the share of costs corresponding to the wages of mica processing employees and/or mica miners and pickers… and the share that these semi-finished industrial goods represent in the total costs of a set of finished goods sold to consumers.
2. To build an operational tool enshrining this model and enabling users to display all the results of the calculations , make customised estimates based on key variables (mining types, quality, etc.) and build simulations of the introduction of living wages / income and payment of taxes at the mining stage.

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[28] TMR, cited in SOMO and Terre des Hommes, "Global mica mining and the impact on children's rights," 2018, and TMR, "Mica Market," January 2022

[29] See Figure 14 below.

3. To write a report that summarises findings, including a guide to the online tool.

Given the complexity of the industrial goods being composed of mica, and of the related value chains, BASIC and RMI agreed to let the study focus on a limited set of goods and mica mining/processing countries in order to serve as a "proof of concept" that can be extended in a second stage to more products, countries and end-use sectors.

The three main sectors that were retained for the study were: paints and coatings; cosmetics; and automobiles (excluding electronics/circuitry). This in turn entailed modelling about 20 intermediate products (such as pigments and mica board) and eight finished products (nail enamel or anti-corrosion paint, for instance).

Category	Finished product
Paints and coatings	DIY Anti-corrosion paint DIY Architectural paint (interior/exterior) OEM refinish paint
Cosmetics	Nail enamel Eyeshadow Lipstick
Automotive	Thermal car Electric car

Table 1. List of finished products examined by this study, by category: paints and coatings, cosmetics, and automotive

The remainder of this report is divided into two sections. Section 2: Mica and its ecosystem lays down the bases for the mapping of the scrap mica value chain, with a review of mica and its uses, mica mining worldwide and mining conditions in India. The main steps of the value chain are laid out and the basics of the mica model are introduced. Section 3: Scenarios for change explains the modifications to the basic/current mica value chain that could be applied in three different prospective scenarios in India – legalisation of mining, legalisation with a living wage, and the formation of mica worker cooperatives. This section presents each of the scenarios, its assumptions and costs, and gives a brief overview of its impacts on prices at various points in the chain.

DISCLAIMER: Figures presented in this report are almost always the result of research validated by multiple sources, and therefore quantitative figures are often averages of multiple data points. Further, some degree of simplification of reality is needed to build models and scenarios. Individual situations in reality may therefore vary from the figures given in the model and three scenarios. For more on how price and cost values were obtained for the model, see Annex 1: Modelling methodology.

2. Mica and its ecosystem

In this section of the report, we present mica and its properties, its principal uses, how it is mined and collected, and what are the stages of the value chain from raw mica through successive transformations until one reaches the finished product. Our focus is on the scrap mica value chain,

which feeds into three main categories of finished products studied here: cars (except electronics), cosmetics, and paints and coatings.

2.1. Setting the stage: What is mica?

Mica is a naturally occurring mineral with extraordinary properties that make it highly sought-after in many industries. Specifically, mica remains stable when confronted with all kinds of stressors – it can withstand temperatures above 900°C, has a high dielectric strength (is inert to voltage differences), and reacts to neither UV light nor moisture. It is lightweight, flexible, and strong. These properties of mica are exploited in numerous objects and industries: electronics, cars, airplanes, aerospace, household appliances, plastics, heavy industry, to name a few. In addition, mica, when ground under the right conditions, acquires a shimmering quality that is sought-after to produce pigments. These pigments are then used in cosmetics as well as paints and coatings, and particularly in automotive paint.

Broadly speaking, mica is collected into one of two forms: sheet mica and scrap mica. Sheet mica is typically derived from blocks of mica that have a book-like structure. The "pages" of the book are individual mica sheets which are cobbed by hand from the mica block with sharp knives. Depending on their thickness, sheets are suitable for different purposes. The thickest are used as-is and cut or punched into shapes; the intermediate size is used to make capacitors; and the thinnest pieces are bound with resins at high temperature to produce micanite (also known as built-up mica), a substance that can be moulded into different forms – sheets, washers, tubes, boards…, flexible or rigid, while retaining all of mica's beneficial qualities. Block mica is found deep underground – up to a dozen or so meters –, where it is sought out by artisanal miners due to its high value.

Figure 1. Images of book mica, from which mica splittings and thins are cobbed by hand [30]

[30] Images are royalty-free from Shutterstock.com.

Figure 2. Images of book mica, from which mica films, splittings, and thins are cobbed by hand. Image courtesy of RMI

Figure 3. Crude mica (left) and mica splittings (right). Photo courtesy of RMI

While mica blocks come from underneath the ground, mica scrap is typically found at the earth's surface, as a by-product of digging the mine shaft. The heaps of debris surrounding each mine shaft are a mix of dirt, mica, and other minerals. The scrap mica value chain starts here, where workers dig through the debris (in Hindi: *dhibra*) looking for the tell-tale shine of mica flakes. After being sorted to remove impurities, mica scrap is then processed and valorised in the form of flakes and powder. Depending on the quality of the scrap and the method used to transform it, mica scrap can fetch very different prices by weight; the end-use of scrap mica is also dictated by the quality of the scrap. For instance, low-quality powder used as an adjuvant to the slurry in oil drilling wells fetches a much

lower price than mica suited to make ultra-high quality pearlescent pigments, although both are in powder form.

Figure 4. Hammering away to release mica books (left) and sorting through piles of debris/*dhibra* (right). Photo courtesy of RMI

Historically, mica blocks were much more valuable than mica scrap. However, in the last 50 years the development of new technologies, particularly in the pigments and electronics businesses, dramatically increased demand for scrap mica and its derivatives. Our study focuses exclusively on the scrap mica value chain.

2.2. Uses and transformation of scrap mica

Error! Reference source not found. below illustrates the scrap mica transformation chain in its main c omponents.

Figure 5. Simplified scrap mica value chain. Source: BASIC, 2022

Scrap mica transformation flowchart

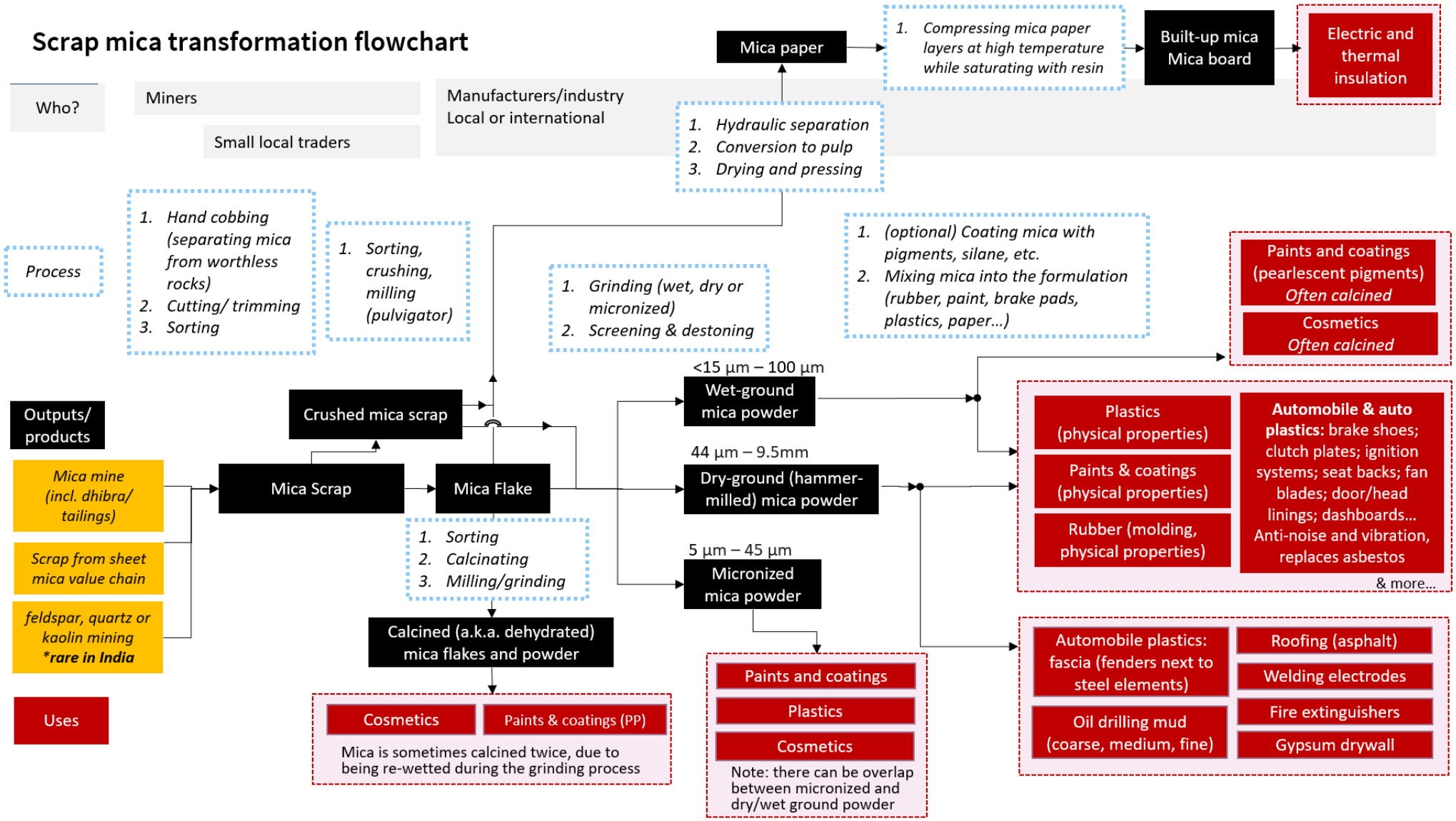

Figure 5 makes it possible to see how mica scrap is transformed – the different operations applied to mica are described in the rectangles with dashed blue lines; intermediate products in black; and final applications of the product in red. This flowchart of the mica transformation chain was used as the basis of the model for the scrap mica value chain (detailed in section 2.5).

In Figure 5Error! Reference source not found., one can see how mica is first into crushed scrap and flakes, which are in turn transformed into mica paper or different forms of ground mica, i.e., mica powder. Mica paper is an excellent thermal and electrical insulator and has a wide array of uses. It can be pressed with resins at high temperatures to create a more rigid product known as mica board. This last product is used as an insulator in electric vehicle batteries.

There are different ways of grinding mica flakes into powder: conventional export language distinguishes between dry-ground (hammer-milled), wet-ground (the "finer" and more expensive type of grinding that is preferred for the substrate to pearlescent pigment), and micronised mica (i.e., ultra-fine mica). In reality, these qualifications often overlap: that is, wet grinding and dry grinding can both produce mica powder that is in the "micronised" size range, despite there being an instrument called a microniser. Mica powder has an extremely diverse portfolio of uses, from paints and coatings to plastics to welding electrodes, drilling mud and various parts of automobiles.

Calcination is a process that dehydrates mica and facilitates delamination (splitting into very thin sheets). Much mica that is used in pearlescent pigments and from there into OEM coatings or cosmetics is calcined at least once, if not twice, during processing.

Figure 6. High-quality mica scrap. Photo courtesy of RMI

Figure 7. Mica flakes made from *dhibra* or crude mica. Photo courtesy of RMI

Figure 8. Calcined mica. Photo courtesy of RMI

Figure 9. Different types of mica powder (calcined at top, ordinary at bottom). Photo courtesy of RMI

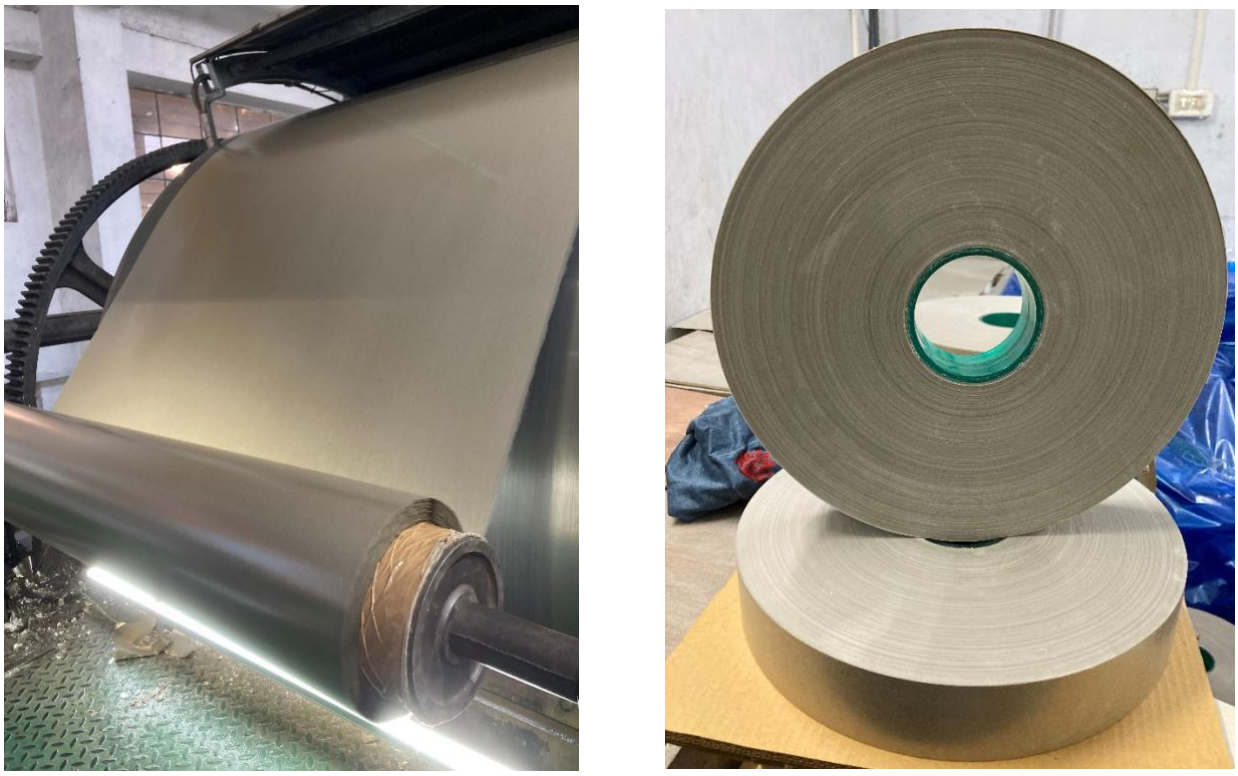

Figure 10. Mica paper (left) and mica tape (right). Photo courtesy of RMI

In this study, we focus on three main sectors of use for scrap mica: paints and coatings, cosmetics, and automotive. The key players in these industries are presented below.

In paint and coatings, based on data from 2021, the number-one company was PPG, which is an RMI member, with sales around 16.8 billion USD. AkzoNobel, also an RMI member, ranked third (11.37 billion USD), while another RMI member (BASF Coatings) ranked seventh (3.90 billion USD).

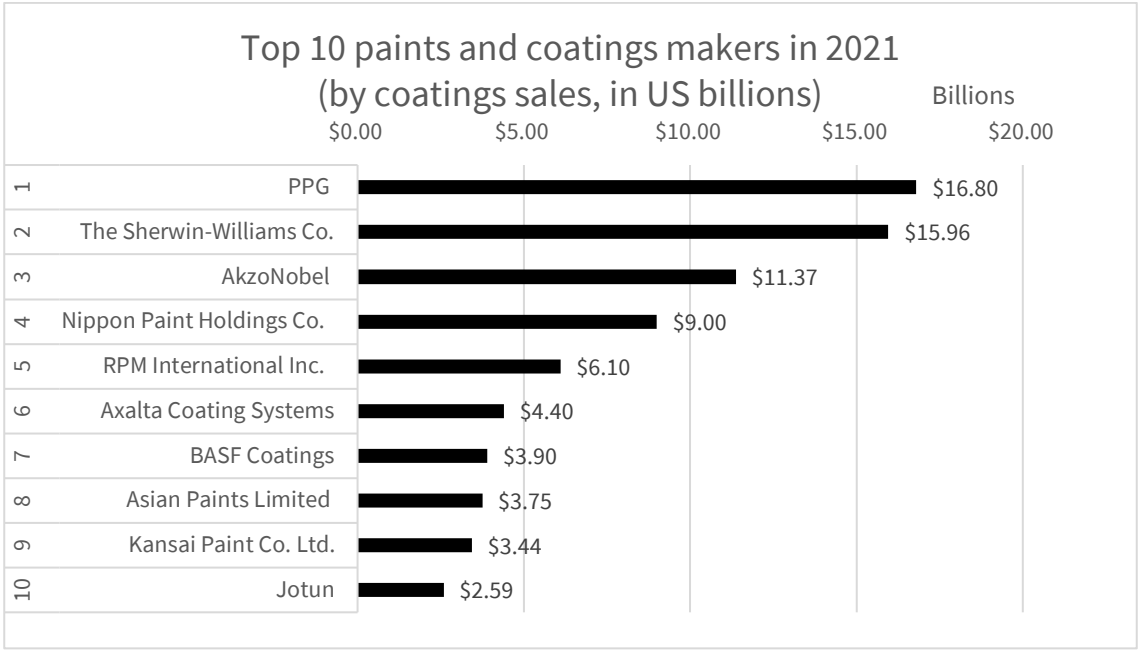

Figure 11. Top 10 paints and coatings companies, based on sales of coatings in 2021. Source: BASIC, adapted from Paints & Coatings Industry Magazine, July 2022[31]

ple, in 2021 only just over 500,000 tons were reported, when a more likely figure would be around 1,000,000 tons or more given market growth projections from 2015.

In the cosmetics industry, the top-ten list contains several RMI members, including number-one L'Oréal (33.93 billion USD revenue), number-5 Shiseido (8.73 billion USD), LVMH at rank 7 (6.63 billion USD), and Coty at rank 9 (4.71 billion USD).

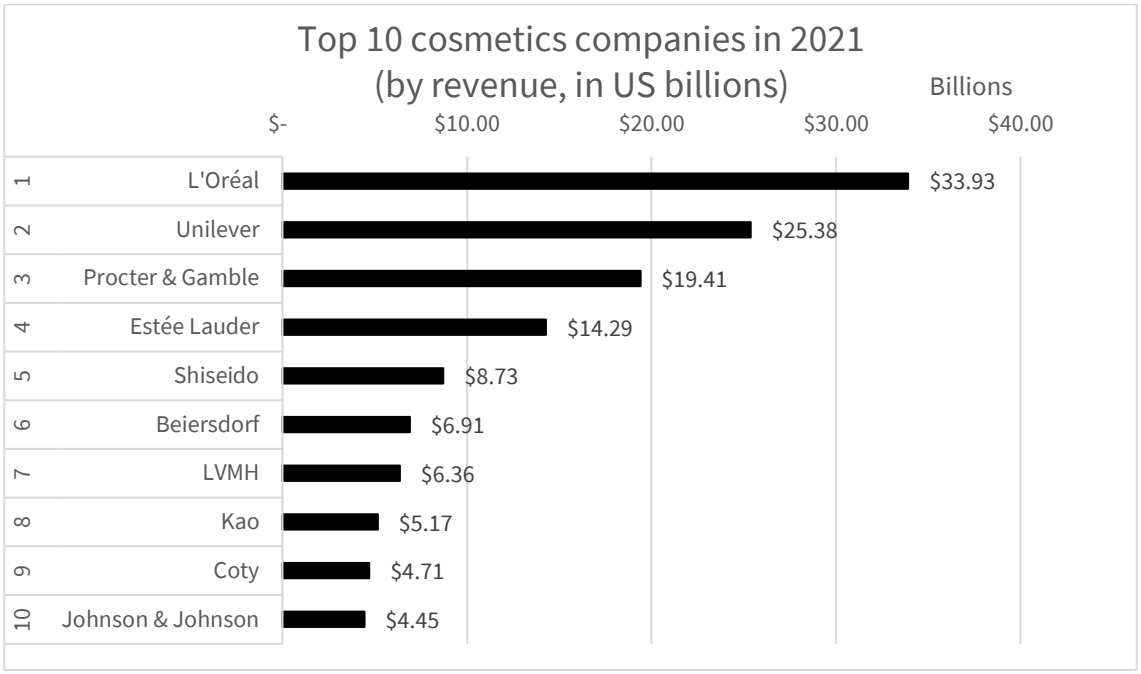

Figure 12. Top 10 cosmetics companies, based on sales in 2020. Source: BASIC 2022, adapted from Cosmetics Technology, 2021[32]

[32] Cosmetics Technology, "Top ten cosmetics companies in the world," 26 February 2021, http://www.tinyurl.com/2cn9fc3s

We also mapped the main vehicle companies, ranked by number of vehicles sold in 2021 – see Figure 13. Toyota takes the lead, followed by Volkswagen (which is an RMI member through its subsidiary, Porsche). The next RMI member is BMW, which ranked 10th in vehicle sales in 2021. RMI member Mercedes Benz ranked 12th.

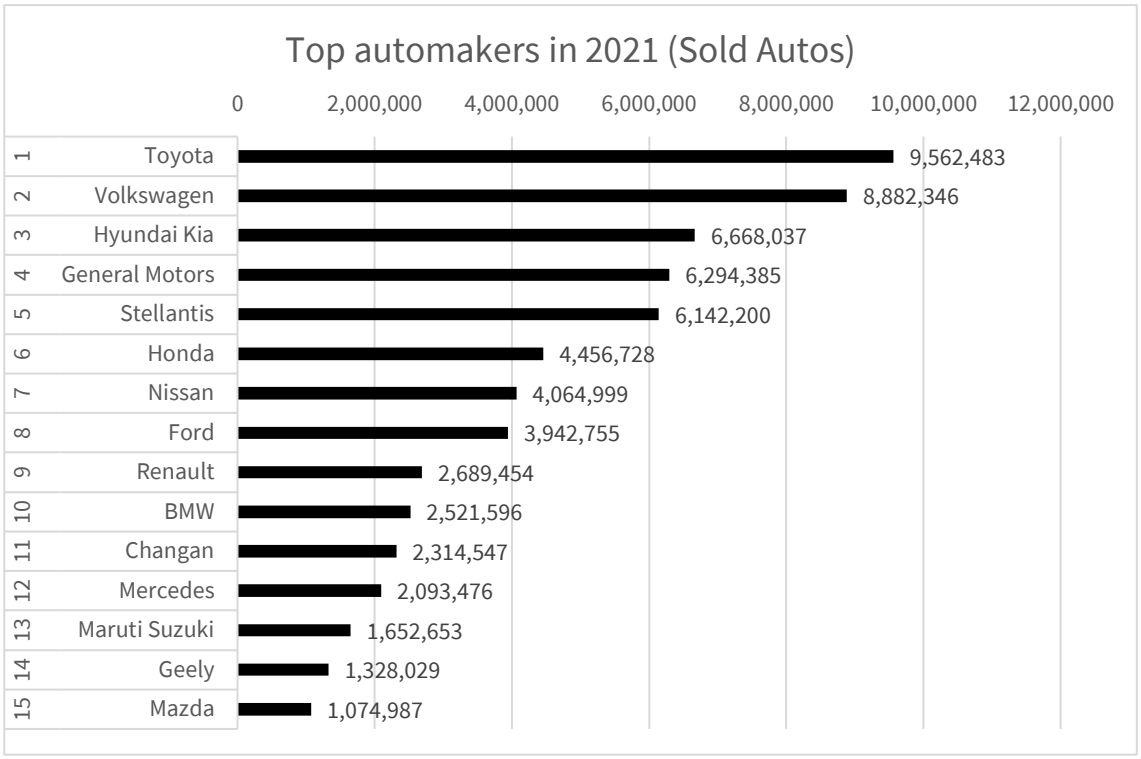

Figure 13. Top 15 automakers, based on number of vehicles sold in 2021. Source: BASIC, adapted from F&I Tools[33]

[33] F&I Tools, "Worldwide Car Sales by Manufacturer," 2022, http://www.tinyurl.com/2dznulef

2.3. Mica mining worldwide

Statistics on global mica reserves are hard to come by, as are reliable statistics on mica production. However, it is clear that India is a major player in the mica business. The latest data from the British Geological Survey published in 2022 places China as the world's top mica producer, followed by Madagascar and the USA (see Figure 14 below), but these figures should be taken with caution.

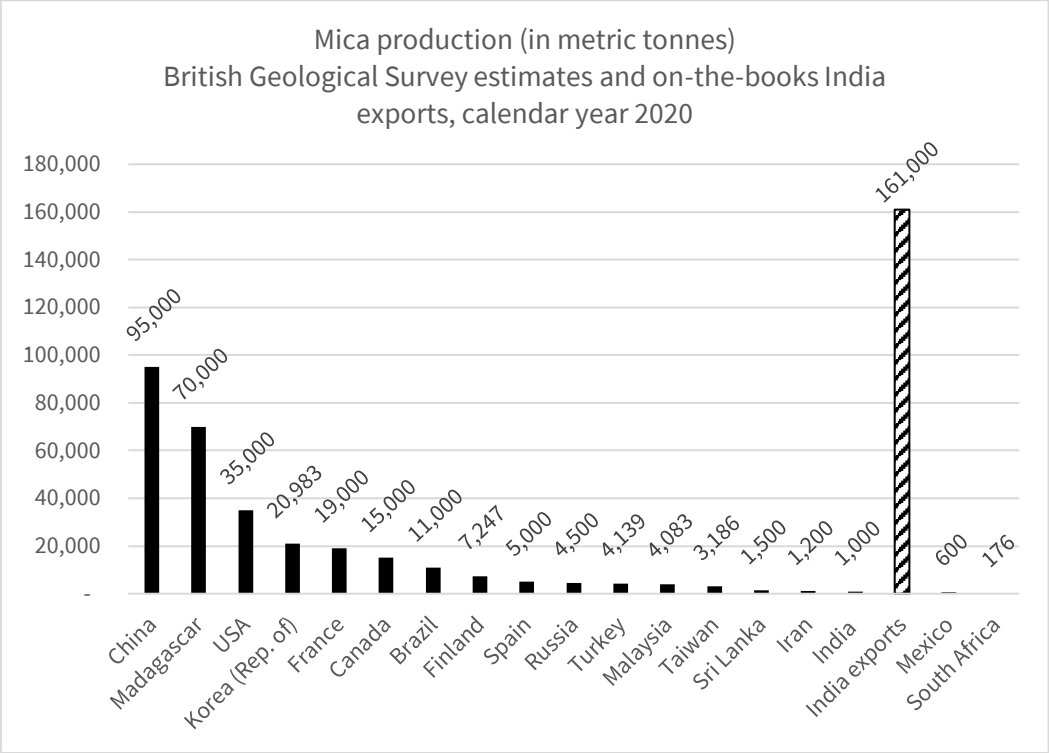

Figure 14. World mica production in metric tonnes by country of origin; in black stripes, export of raw mica from India (HS code 2525), calendar year 2020[34]

Indeed, in these official statistics, India lags far behind at 1,000 metric tonnes produced per annum.[35] However, customs data betray the fact that this estimate is far below the real production coming out of India. In the calendar year 2020, according to customs data, India's exports of raw and worked mica, of all kinds, represented a minimum of 161,000 metric tonnes worth 75 million USD, i.e. more or less the production of China and Madagascar combined by weight. The sub-contribution of scrap mica and its derivatives (flakes, powder, and mica scrap) to this total across the last three years (Oct.1, 2019 to September 30, 2022) was on average per year 106,000 tonnes worth 43 million USD.[36,37] The

[34] Source for mica production: British Geological Survey, "World Mineral Production 2016-2020," 2022; for export data from India, analysis of customs data from Datamynes, HS codes 2525, calendar year 2020. For India, UN Comtrade lists slightly lower figures for calendar year 2020: exports weighing 130,000 metric tonnes worth $57 million.
[35] British Geological Survey, "World Mineral Production 2016-2020," 2022.
[36] BASIC analysis of customs data from Datamynes, HS codes 2525 and 6814, calendar years 2019 through 2022.
[37] That same year, India also exported significant volumes of worked mica (HS code 6814: fabricated mica, built-up mica/micanite, mica paper…), for a total value of 6.4 million USD. BASIC analysis of customs data from Datamynes, calendar year 2020. Unlike price, reliably calculating the weight of worked mica (HS code 6814) from customs data is not possible, because the products are usually categorised as "numbers" or "pieces" without any indication of their weight.

disparity between export data and production data points to the fact that much of the mining in India is currently illegal – outside the purview of the state – and therefore cannot be tracked by the authorities.[38]

Not all of Indian mica comes from Bihar and Jharkhand. The largest deposits occur in Jharkhand,[39] but mica is also mined in Andhra Pradesh and Rajasthan. However, in these two provinces mica is mined industrially and legally. According to one interviewee familiar with the market, approximately 10-20% of mica on the market comes from Andhra Pradesh and Rajasthan, and the remainder comes from Bihar and Jharkhand.[40] The figure below, borrowed from Thompson-Reuters and using 2015 data, is consistent with this estimate.[41]

[38] A similar tendency to underreporting the contribution of Bihar and Jharkhand to the Indian mica sector may be at work in the Indian Bureau of Mines's calculation of mica reserves. Although Bihar and Jharkhand are often singled out for their extraordinary reserves of mica (in the so-called Bihar Mica Belt), in Bureau of Mines data for 2020 Andhra Pradesh is cited as having 20 times the reserves that Bihar has and 150 times more than Jharkhand. It seems possible that the low figures in Jharkhand and Bihar are the result of under-reporting from State authorities, who have jurisdiction over mica as it is a "minor" mineral. See Indian Minerals Yearbook 2020 59th ed.: Minor Minerals, 30.16 : Mica, July 2021

[39] The latest estimates published by the JSMDC date to 1995 and claim that Jharkhand has reserves of 13 million tonnes of mica. JSMDC. "Mineral Reserves & Production," 1995. https://www.jsmdc.in/web/MineralReservesProduction.php

[40] BASIC Interview with mica expert, 1 April 2022

[41] Unfortunately, Datamynes export data did not specify where the mica originates from; it was therefore impossible to use the data to estimate provenance as in Figure 15.

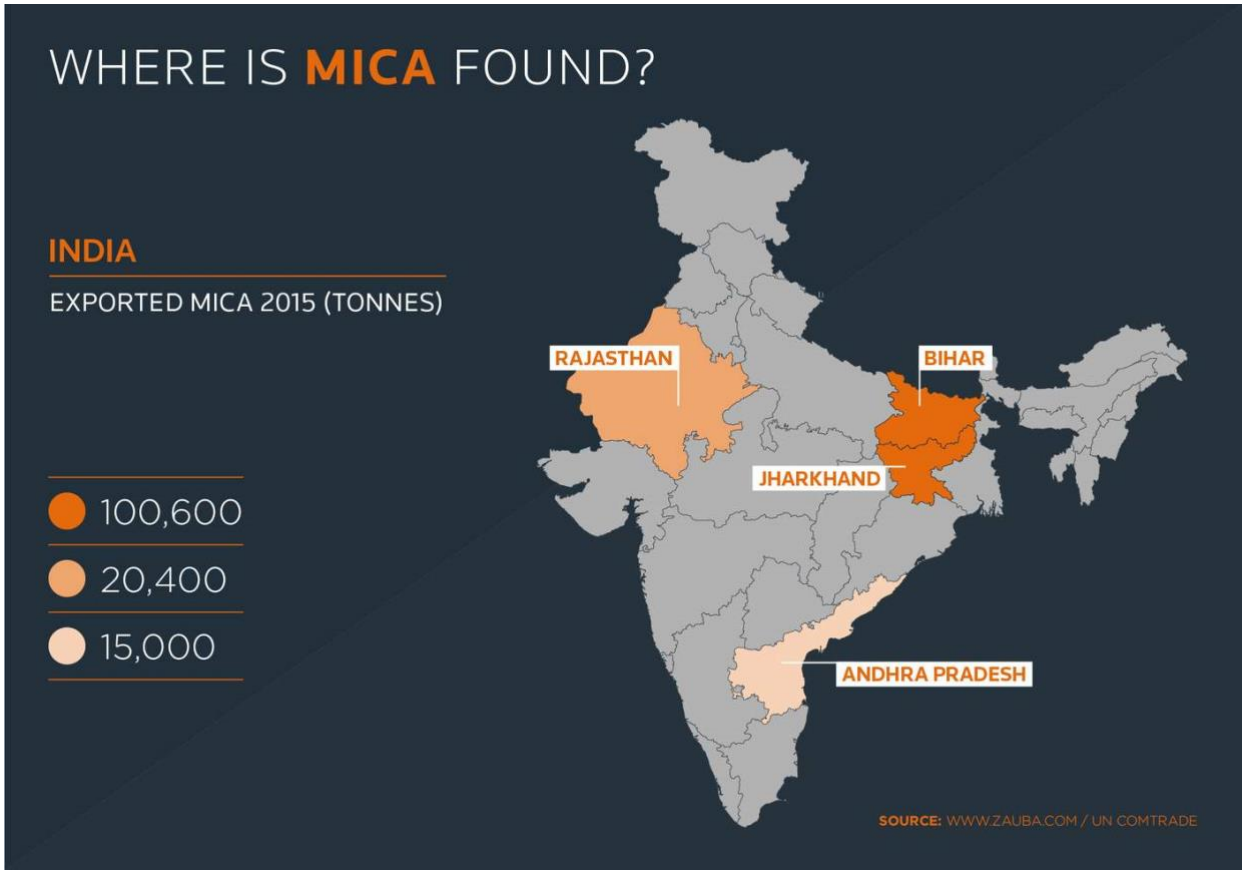

Figure 15. Estimated origins of exported mica within India, based on 2015 export data. Figure taken from Thompson Reuters, 2016 or 2017[42]

According to another interviewee, mica from Rajasthan and Andhra Pradesh is not suitable for making pearlescent pigments because of its chemical make-up, heavy metals content, and calcination temperature. Nonetheless, many industries are allegedly trying to find a way to make pearlescent pigments using Rajasthan mica due to the chaotic and illegal nature of the market in Bihar and Jharkhand.[43] As this study focuses on artisanal and small-scale mining, only Bihar and Jharkhand will be considered within the India perimeter.

2.4. The mica mining context – India

In India, the illegality of mica picking (for scrap) and mining (for blocks/sheets) is only one among many factors that create an situation of precarity for mica workers and their families. In India mica pickers and miners are price takers. They are rarely organised in any kind of cooperative that would be able to negotiate a better price, and there are virtually no inspections by the state to ensure that

[42] Figure found in Bliss, "Child Labour in India's Mica Mines : The Global Beauty Industry," Geography Bulletin Vol 49, No 3, 2017; citing Thompson-Reuters, "Where is mica found?", 2016 or 2017, http://www.tinyurl.com/227wy5cb
[43] BASIC Interview with mica expert, 9 February 2022

a minimum wage equivalent is paid; inspections rather take the form of raids on illegal mines or confiscation of trucks carrying mica.[44]

As a result of these factors, mica pickers and factory workers do not earn a living income or wage (see explanation of a living wage below). This is true of mica pickers in Bihar and Jharkhand, as well as factory workers in Jharkhand. Indeed, in the February 2022 Living Wage study commissioned by the Responsible Mica Initiative it was highlighted that accounting for the revenues from mica-related activities only, the gap in living income reaches 81% for mica pickers in Bihar and 72% for mica pickers in Jharkhand. Factory workers earn a little under half of a living wage.[45] As a result of this poverty and living hand to mouth, in India mica-picking families are often in debt to loan sharks, for instance to pay for unexpected events such as a health emergency, or school fees, or food.[46]

Living wage & living income: A brief overview
A living wage (or living income) is "a level of income that allows an individual worker to meet his/her basic needs and those of his/her family, at decent standards."[47] Living wages (or living incomes) are calculated based on costs of living, which are calculated as a "basket" of costs enabling a decent standard of living. The basket contains items such as quality housing, sufficient and nutritious food, childcare, education, healthcare, and a percentage left for leisure and precautionary savings to face unexpected expenditure. The research to date on the mica mining ecosystem in India, conducted by the Fair Wage Network on behalf of RMI, suggests that there is a large gap between what mica pickers and factory workers earn today and what they would need to be paid to earn a living income and wage (see Figure 16). *Note: this study refers to living wage when a person is a fully-fledged employee of the company, and a living income when the person is not.*

[44] BASIC Interview with mica expert, 1 April 2022; Child In Need Insitute, "Child Labour in Mica Mines of Koderma & Giridih District of Jharkhand," 2018; Centre for Responsible Business, "Road-Map for Sustainable and Inclusive Mica Industry in Jharkhand: Balancing Interest of the State, Business and People," 2018. https://c4rb.org/insights/report/MICA-Roadmap.pdf.

[45] Responsible Mica Initiative, FairWage Network, Sentio Advisory Initiative, "Report on wages, working and living conditions of Mica workers in India," February 2022

[46] Child In Need Institute, "Child Labour in Mica Mines of Jharkhand- A situation analysis report," 2018.

[47] Fair Wage Network, Annex to Responsible Mica Initiative, FairWage Network, Sentio Advisory Initiative, "Report on wages, working and living conditions of Mica workers in India," February 2022

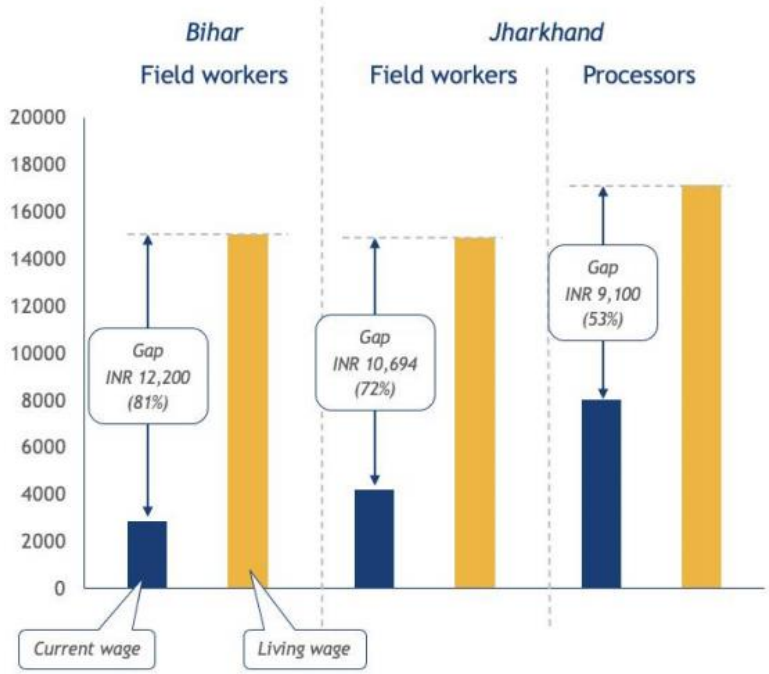

Figure 16. Current income, living income, and income gap for pickers in Jharkhand and Bihar, and factory workers in Jharkhand.

Source: RMI, Fair Wage Network, and Sentio Advisory Initiative, "Report on wages, working and living conditions of Mica workers in India," February 2022

Working conditions in mica mines are dangerous, as India conducts artisanal, small-scale mining (ASM) in conditions that are accident-prone. According to NGOs and media on the ground in India, it is not uncommon for people to die when a mine shaft collapses, or to be injured in accidents.[48,49] Breathing in dust can be an irritant causing silicosis, asthma and bronchitis, illnesses common among children and adults in mica picking communities.[50] There is additional risk of repetitive stress injuries and musculoskeletal disorders: back pain is a commonly reported health impact of mining and mica picking.[51] Injuries and abrasions to the skin are common given mica's sharp edges, on the whole of the body but especially on hands and feet.[52] In factories, workers are also known to suffer from tuberculosis, cough, and asthma due to exposure to dust without personal protective

[48] Reuters, "Blood Mica: Deaths of child workers in India's mica 'ghost' mines covered up to keep industry alive," 3 August 2016 and Child In Need Institute, "Child Labour in Mica Mines of Jharkhand- A situation analysis report," 2018
[49] SOMO and Terre des Hommes, "Child labour in Madagascar's mica sector," November 2019
[50] Child In Need Institute, "Child Labour in Mica Mines of Jharkhand- A situation analysis report," 2018
[51] SOMO and Terre des Hommes, "Child labour in Madagascar's mica sector," November 2019 and International Labour Organisation and Madagascar Ministry of Mines and Strategic Resources, "Rapport provisoire: Recensement des exploitants du mica," 22 June 2021
[52] SOMO and Terre des Hommes, "Child labour in Madagascar's mica sector," November 2019 and International Labour Organisation and Madagascar Ministry of Mines and Strategic Resources, "Rapport provisoire: Recensement des exploitants du mica," 22 June 2021

equipment (PPE).[53] In India, it is typically boys and men who do the shaft digging, while women and younger children pick mica out of the waste heaps left behind by mining. In factories in India, women mostly do the secondary sorting of mica, while men operate the heavy machinery.

In India, mica pickers and miners are unable to work 3 to 4 months out of every year due to the rainy season. They sometimes try to diversify their activities, for instance agriculture (herding or growing plants) or running a small shop; however, there are villages where nearly everyone is a mica picker and must make their dry-season income support them through the rainy season.[54]

To make things worse, public services are poorly developed in mining areas. In India, many mica mines and their *dhibra* dumps are located near remote villages in the forests of Bihar and Jharkhand, where public services are underdeveloped. Schools, day-care centres (e.g. Anganwadi centres in India), health clinics are absent, dysfunctional, or far away, and government adult employment schemes are not available.[55] Bihar and Jharkhand have high levels of absenteeism in schools: around 40% of children are enrolled in primary school, but not present, against an average of 29% in India.[56]

Gender and caste in the Indian mica industry
According to many studies,[57] the mica industry in Jharkhand and Bihar is highly gendered, in the sense that women and men do not conduct the same type of work. Men, and sometimes boys, are virtually the only ones who dig mining shafts and work underground to collect book mica. Women and smaller children usually work around the mining shafts, sorting through piles of *dhibra*. There is also a role for women workers at home, who sort mica coming out of nearby *dhibra* dumps and sell it to dealers in a putting-out system. There is also a gendered element to work in factories. In factories, the most labour-intensive work and work involving machines is left to male workers (grinding, operating pulvigators, pulverisers, micronisers, destoning machines, calcination machines). Female workers are involved in screening and handpicking (removing foreign material), if the mica bought by the processor is of insufficient purity. According to one source, many mica pickers and miners belong to the lowest castes – Scheduled Tribes and Scheduled Castes.[58] People above these castes reportedly work farther down the value chain, for instance as small village-level traders or *munshi* (agent). It is worth noting here that many major mica export businesses are family-based enterprises that have worked in the mica sector for generations, and it is unlikely that many of these operators are from Scheduled Castes or Tribes.

[53] Responsible Mica Initiative, FairWage Network, Sentio Advisory Initiative, "Report on wages, working and living conditions of Mica workers in India," February 2022

[54] International Labour Organisation and Madagascar Ministry of Mines and Strategic Resources, "Rapport provisoire: Recensement des exploitants du mica," 22 June 2021

[55] SOMO and Terre des Hommes, "Beauty and a Beast: Child Labour in India for Sparkling Cars and Cosmetics," 2016

[56] SOMO and Terre des Hommes, "Beauty and a Beast: Child Labour in India for Sparkling Cars and Cosmetics," 2016 citing statistics from 2015..

[57] BASIC interview with mica sector experts, as well as all studies by SOMO and Terre des Hommes, and Chattopadhyay, Molly. "Sub-Contracting System and Women Workers: A Study of Mica-Manufacturing Industry of Jharkhand." Sociological Bulletin 56, no. 2 (May 2007): 33–51. https://doi.org/10.1177/0038022920070206.

[58] Child In Need Institute, "Child Labour in Mica Mines of Jharkhand- A situation analysis report," 2018

In this difficult context, many families resort to their children to make ends meet. Child labour in the mica industry is well-documented.[59] The number of children engaged in mining activities was estimated at at least 30,000 children – and potentially more – for Jharkhand and Bihar in 2016, out of a population of 300,000 artisanal miners.[60] Children typically accompany their parents to mining sites, where they help with mica picking at the surface or (boys only) dig in underground tunnels to carve out mica blocs.

Since awareness about the child labour problem emerged in the early-2010s, numerous initiatives have been undertaken to increase the transparency and integrity of the mica value chain, with the aim of eradicating child labour. Early on, private companies sponsored building schools and health centres, bought children bicycles so they can go to school, and worked with NGOs to create villages with children-friendly conditions as well as monitoring mines for child labourers.[61] The Responsible Mica Initiative is the most ambitious and comprehensive initiative to tackle this problem to date.

It should be noted that since 2015, mica in India has been considered a "minor" mineral, meaning that – as opposed to "major" minerals, which are managed by the central government – it is to be managed at the State level. This evolution in the law opens many avenues for better regulation of a sector that, for the last thirty to forty years, evolved in illegality and outside the purview of the state, despite its considerable dollar value.[62] Media reports about working conditions and child labour in mica mines have also put direct pressure on local authorities to exercise better oversight of mica mining by legalising the sector.[63]

2.5. The structure and functioning of the scrap mica value chain

This study's remit is to focus on three broad families of mica-containing finished products: paints and coatings, cosmetics, and cars (excluding electronic components). The specific products retained within each sector all contain mica, specifically mica from the scrap value chain. The sheet mica value chain is therefore out of scope for this study and will not be analysed in the below; our focus is on the scrap mica chain. After an overview of the five main steps of the value chain, we dig a little deeper into the use of mica in the paints/coatings, cosmetics, and automotive industry.

2.5.1. Overview: the five-step value chain

[59] SOMO and Terre des Hommes, "Beauty and a Beast: Child Labour in India for Sparkling Cars and Cosmetics," 2016; SOMO and Terre des Hommes, "Global mica mining and the impact on children's rights," 2018; Child In Need Institute, "Child Labour in Mica Mines of Jharkhand- A situation analysis report," 2018

[60] Terre des Hommes, "Behind the Glittering Facade – Exploitation of Children in Mica Mining in India," 2022; and interview with Indian mica expert.

[61] SOMO and Terre des Hommes, "Beauty and a Beast: Child Labour in India for Sparkling Cars and Cosmetics," 2016

[62] The key moment when Indian mica fell into illegality was the 1980 Forest Conservation Act, which banned mining in forested areas. At the time, "mining was declared 'illegal' due to non-renewal of leases, [but] mining still continued in the state (illegally), coupling the problem by adhering to lesser safety and security measures for the miners." Centre for Responsible Business, "Road-Map for Sustainable and Inclusive Mica Industry in Jharkhand: Balancing Interest of the State, Business and People," 2018. https://c4rb.org/insights/report/MICA-Roadmap.pdf

[63] Thomson Reuters, "India Begins Legalising Mica Mining after Child Worker Deaths Expose." Reuters, May 4, 2017, sec. Thomson Reuters Foundation. https://www.reuters.com/article/india-child-labour-idINKBN1802AD

For a better understanding, the scrap mica value chain – as it relates to paints/coatings, cosmetics, and cars –can be divided into 5 segments. They are as per Figure 17 below:

Figure 17. Overview of the scrap mica value chain in India

1. Mica picking. This is undertaken by mica pickers, who pick mica and sell this mica on to dealers.
2. Sorting, Primary Processing, & Export. This stage contains many sub-steps.
    a. It begins with dealers, who collect mica from villages and deliver it to aggregators. Aggregators undertake a meticulous sorting process to separate higher from lower quality mica scrap. Quality is defined by the mica's colour, size, and resistance to high temperature, among other characteristics. Mica is purchased from aggregators by primary processors, who are sometimes also exporters. In this primary processing, mica scrap is turned into mica flakes, high-quality crushed mica scrap, and mica powder, of high or low quality (depending on the quality of the material and the method used to grind the mica). Exporters conduct spot checks for mica quality and arrange for export. In India, export is most often by sea from Kolkata or Mumbai, depending on where the mica is collected. The biggest destination for semi-processed Indian mica (flakes, scrap, powder, part of HS code 2525)[64] is by far China, which captures 70 to 75% of both value and weight.

[64] The HS code 2525 covers raw or semi-refined mica, namely flakes, powder, scrap, and derivatives of sheet mica (such as mica blocks and mica splittings – code 252510). For consistency's sake since we are focused on the scrap mica value chain, this last code 252510 has not been included in the analysis. Its exclusion does little to change the analysis: when the sheet mica family products are included, the distribution of FOB prices and metric tonnage remains almost identical, confirming Japan and China's lead as manufacturers of mica-based semi-finished and possibly also finished goods.

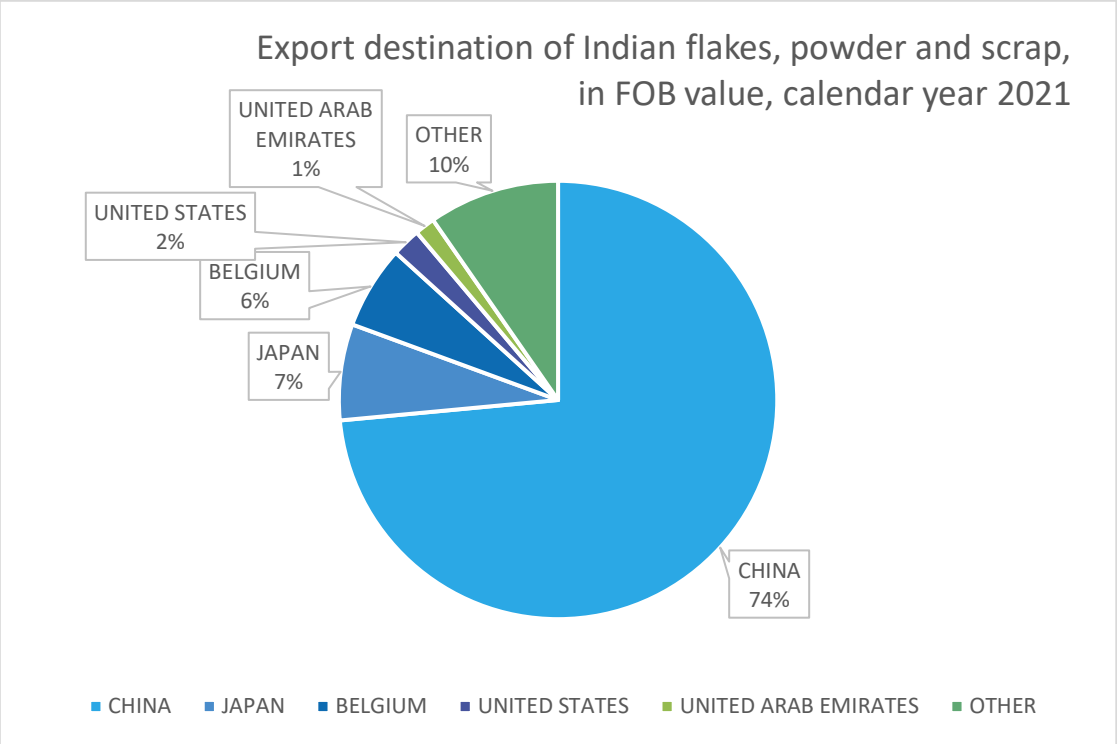

Figure 18. Country of destination for exports of Indian raw mica (flakes, powder, and scrap) in calendar year 2021, in total FOB value. Source: BASIC 2022, based on Datamynes data

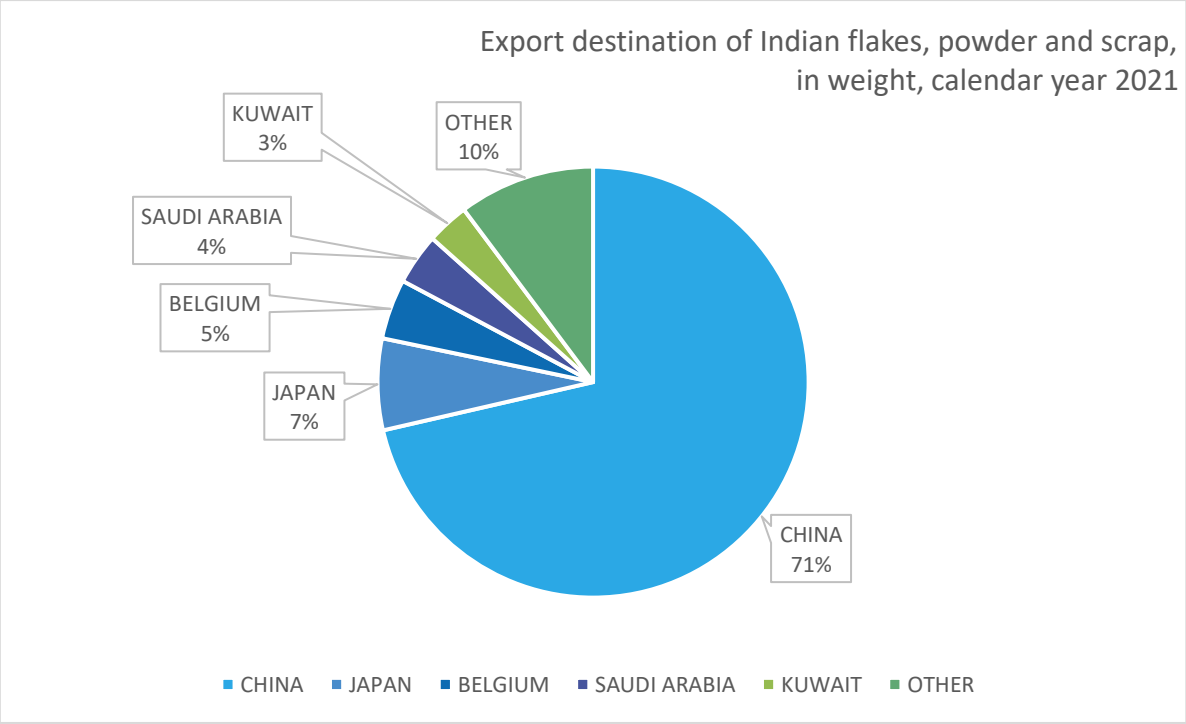

Figure 19. Country of destination for exports of Indian raw mica (flakes, powder, and scrap) in calendar year 2021, by weight in metric tonnes.[65] Source: BASIC 2022, based on Datamynes data

[65] Note: some data rows could not be processed because they were not denominated by weight.

At this stage in the value chain, mica pickers capture a small but visible chunk of the total value. For instance, the below Figure illustrates the distribution of costs, taxes, and margins for high-quality mica flakes exported from India. Pickers **capture just over a quarter of the value of the exported product** (in red in Figure 20 below), and they make no margin as they live hand to mouth (see Figure 16 in Section 2.4).

How to read a BASIC model's bar-chart value diagram
When clicking on a product in the value chain (anything rectangular-shaped), the model returns a bar-chart diagram like the below. The chart makes it possible to see value accumulation at different stages in the chain. → Different colours designate different stages in the chain: 1. Production (red), 2. Sorting, Primary processing, and Export (orange), 3. Grinding, Pressing, and Pigment manufacturing (yellow); 4. Finished product manufacturing (beige); 5. Retail (blue). In Figure 20 below, two stages are visible: Production and Sorting/Primary processing/Export. → The left-hand graphic reports the percentage of value added by actors at each stage; the right-hand graphic breaks down the value into costs, taxes, and margins (where applicable).

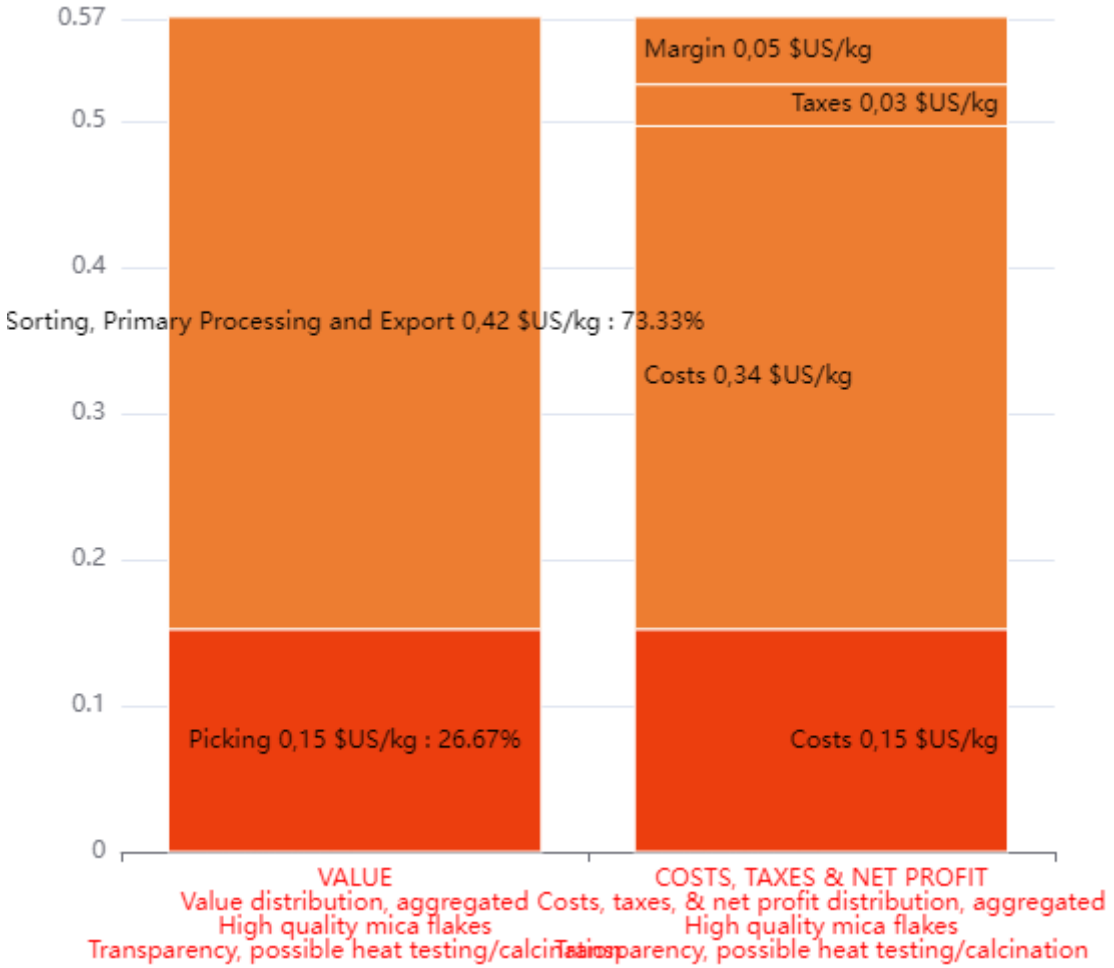

Figure 20. Value distribution of high quality mica flakes, India, export stage: value distribution (left) and costs, margins, and taxes (right). Source: BASIC 2022

3. Secondary processing: Grinding, Pressing, & Pigment manufacturing. The raw mica products that result from primary processing are handled by (mostly) non-Indian (and often Chinese – see figures above) industrial stakeholders who add value to the product in a variety of ways.
    a. One such way is to turn the mica flakes into mica paper. Much like ordinary paper, the mica flakes are separated hydraulically, converted to pulp, and then subject to drying and pressing (sometimes with an additional binder). Mica paper, which is flexible, can then be turned into thicker semi-rigid mica board, through further stages of pressing sheets of mica paper together with resins/epoxies at high temperatures.
    b. Another way is to turn mica flakes into mica powder.
        i. When this is done through dry grinding, mica loses much of its lustre, but it becomes suitable as filler for paints and can be incorporated into any number of substances, notably plastics, paints, and bituminous sheets.
        ii. When this is done through another, more expensive process known as wet grinding, a high-quality, shiny substrate is the result. This mica comes in the form of platelets and can then be coated with other substances (metal oxides), generating what are called pearlescent pigments. It is common for pigments manufacturers to import mica flakes and then wet-grind them in-house before coating them to make pigments.

According to the hypotheses of our model based on bibliographical research, pigments manufacturers bring in an average of 18% margin once all other costs are covered.[66] We assume for the purposes of the model that stakeholders at this stage in the value chain wish to keep their margins constant in the event of changes in cost structures.

When modelled, it becomes apparent that pigments manufacturing represents a significant value-add to powdered mica. This can be seen in Figure 21 below: if we take the example of a middle-of-the-road pigment (for instance, automotive grade TiO2 coloured pigment), the Indian contribution to pigments value at the bottom of the chart is largely diluted by the value-add at the pigments/industrial stage at the top of the chart (99% of the value).

[66] For the bibliography used to estimate these margins, see "Bibliography – Company profits" section. The margin can be visualised in the model by clicking on individual products (rectangular shapes) and scrolling down to see the bar-chart value distribution diagram.

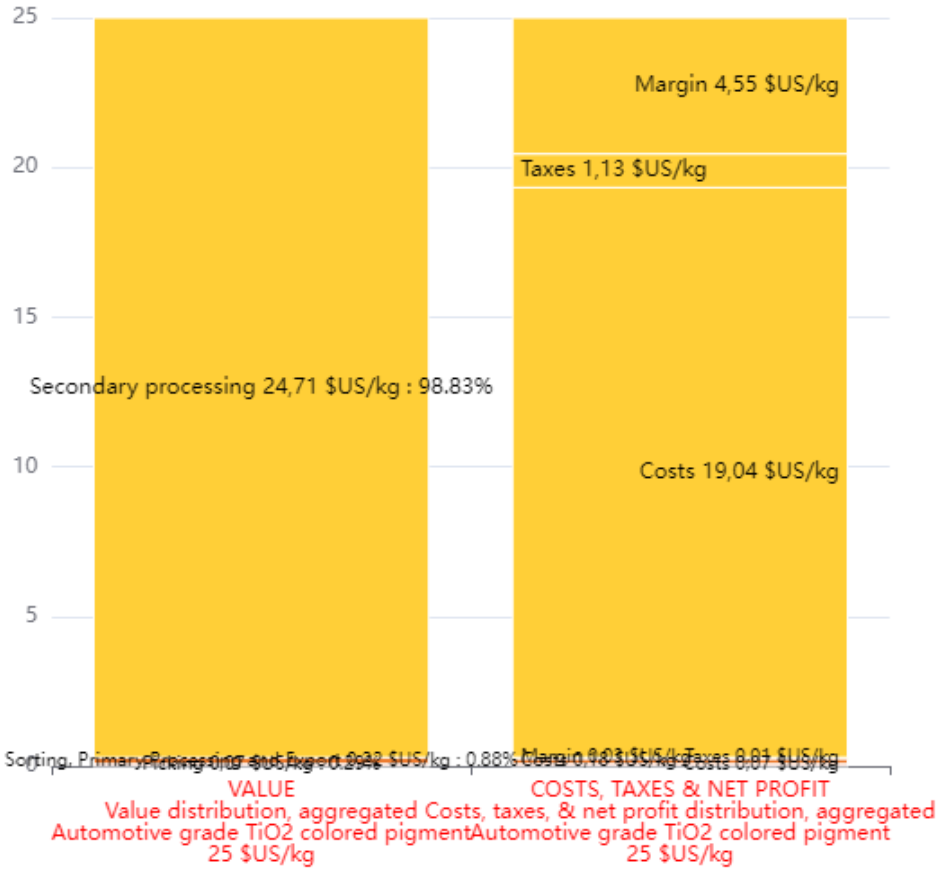

Figure 21. Value distribution for automotive grade coloured pigment at the secondary processing level (pigment manufacturing). Source; BASIC 2022

4. Finished product manufacturing. Many products are manufactured worldwide from the semi-finished products at step 3:
    a. High-quality mica board ends up as an insulation material for electric vehicle batteries.
    b. Pearlescent pigments end up in paints and coatings, as well as cosmetics (including nail enamel, eyeshadow, and lipstick).
    c. Paints containing pearlescent pigments end up on the surfaces of automobiles.
    d. Low-quality mica powder/filler is used in paint, and high-quality filler goes into eyeshadow.
    e. Low-quality mica powder/filler is mixed in with other substances to produce bituminous sheets, which dampen the effect of sound and vibration inside a vehicle.

    Based on a study of profits as reported in company financial reporting,[67] we make the following assumptions about the margins of companies:

[67] These numbers are based on the references given in the section entitled "Bibliography – Company profits."

→ Cosmetics companies make a 14% margin (concerns lipstick, nail enamel, and eyeshadow)

→ OEMs make an 11% margin (concerns thermal cars and electric vehicles)

→ Paints manufacturers make a 12% margin (concerns OEM refinish paint, DIY architectural interior/exterior paint, and DIY anti-corrosion paint)

Once again, the value-add by finished products manufacturing dwarfs the value at the previous stage: taking eyeshadow (before retail) as an example, the finished goods manufacturing stage represents 98% of the value added.

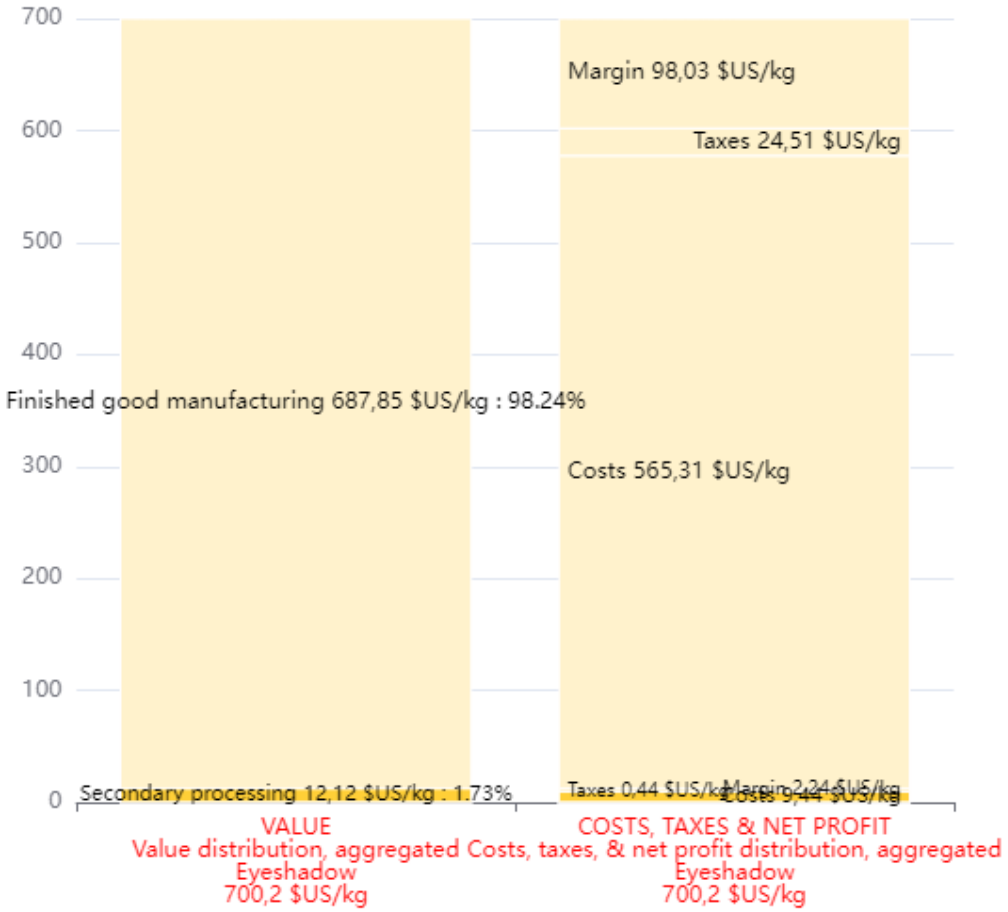

Figure 22. Value distribution for eyeshadow, finished product manufacturing stage. Source: BASIC 2022

5. Retail. The final step in the chain is when the finished product reaches the end-user. Finished products in our model are the following: cars; eyeshadows, nail enamels, and lipsticks; and non-OEM paints and coatings (anti-corrosion, DIY interior/exterior for example). We make the hypothesis that the price from finished product to retail doubles, and that there is a 20% Value Added Tax.[68] Again, the value added at the retail level is larger than the finished product manufacturing stage, and all other prior stages in the chain are barely visible.

[68] For an explanation of this working hypothesis, refer to Annex 1: Modelling methodology.

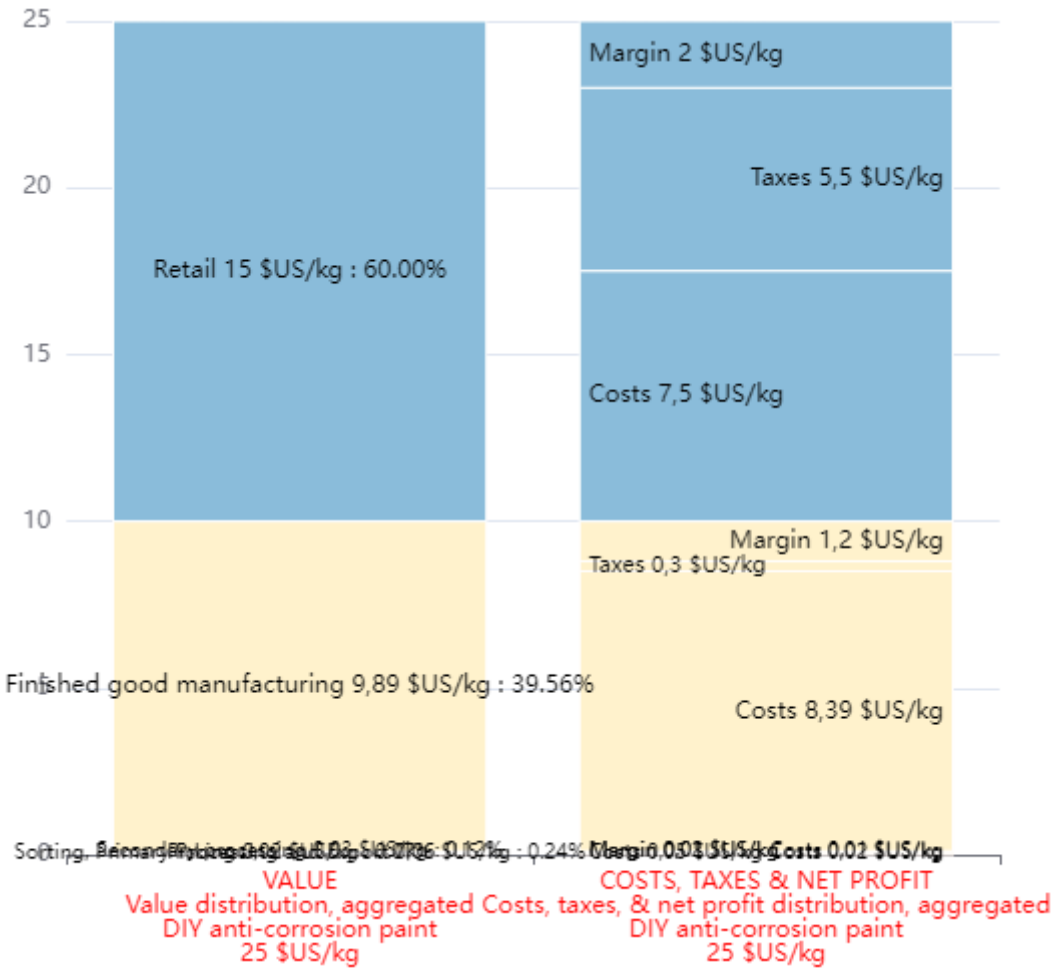

Figure 23. Value distribution for DIY anti-corrosion paint, retail level. Source: BASIC 2022

2.5.2. Mica in the paints and coatings value chain

This subsection explores in greater detail the role of mica in paints and coatings. Mica is used in paints and coatings in two main forms: mica filler and mica-based pigments. As a filler, i.e. as plain mica powder, mica improves the quality of paint:

> "Mica acts as a reinforcing pigment to reduce checking and cracking while at the same time controls chalking in outside latex, oleo resinous, alkyd, and alkyd-modified latex exterior paints. [Mica] mechanically strengthens the paint layer and gives greater resistance to electricity, heat, light, moisture and chemicals. Overlapping layers of mica form a hard shield, which improves the overall durability of the paint."[69]

As a filler, mica can represent 0 to 30% of the formula, depending on the final use.[70]

Mica is also used as a substrate for pigments. Concretely speaking, to make pigments, mica is ground to a very fine powder whose components are like microscopic platelets. The mica platelets are then

[69] Continental Trade, "Paints," n.d., https://www.continentaltrade.com.pl/paints-612
[70] BASIC email correspondence with mica sector expert, 6 May 2022

treated through a complex series of industrial operations, by the end of which they are covered with any number of substances – typically titanium dioxide (TiO_2) or iron oxides or a mixture of both.

There are several different categories of pigments that emerge from this process, depending on the technology used. We identified four typical categories and named them as such in the model. They are, in increasing order of complexity and cost:

1. Silver-white pigments: platelets coated in a thin layer of TiO_2 which appear silver – first image in Figure 24 below;
2. TiO_2 coloured pigments: platelets coated with successively thicker layers of TiO_2 which take on coloured tones – first image in Figure 24 below;
3. Metallic pigment: platelets coated in iron oxides which take on golden-metallic tones – second image in Figure 24 below;
4. Multilayer pigment: platelets coated in a combination of these coatings which take on spectacular iridescent properties – third image in Figure 24 below.

These pigments are mixed into paints to give them their colour. It is estimated that mica-based pigments make up 0.1% to 3% of any given paint, depending on the sought-after effect. This number can increase if the paint in question is sold as a concentrate.

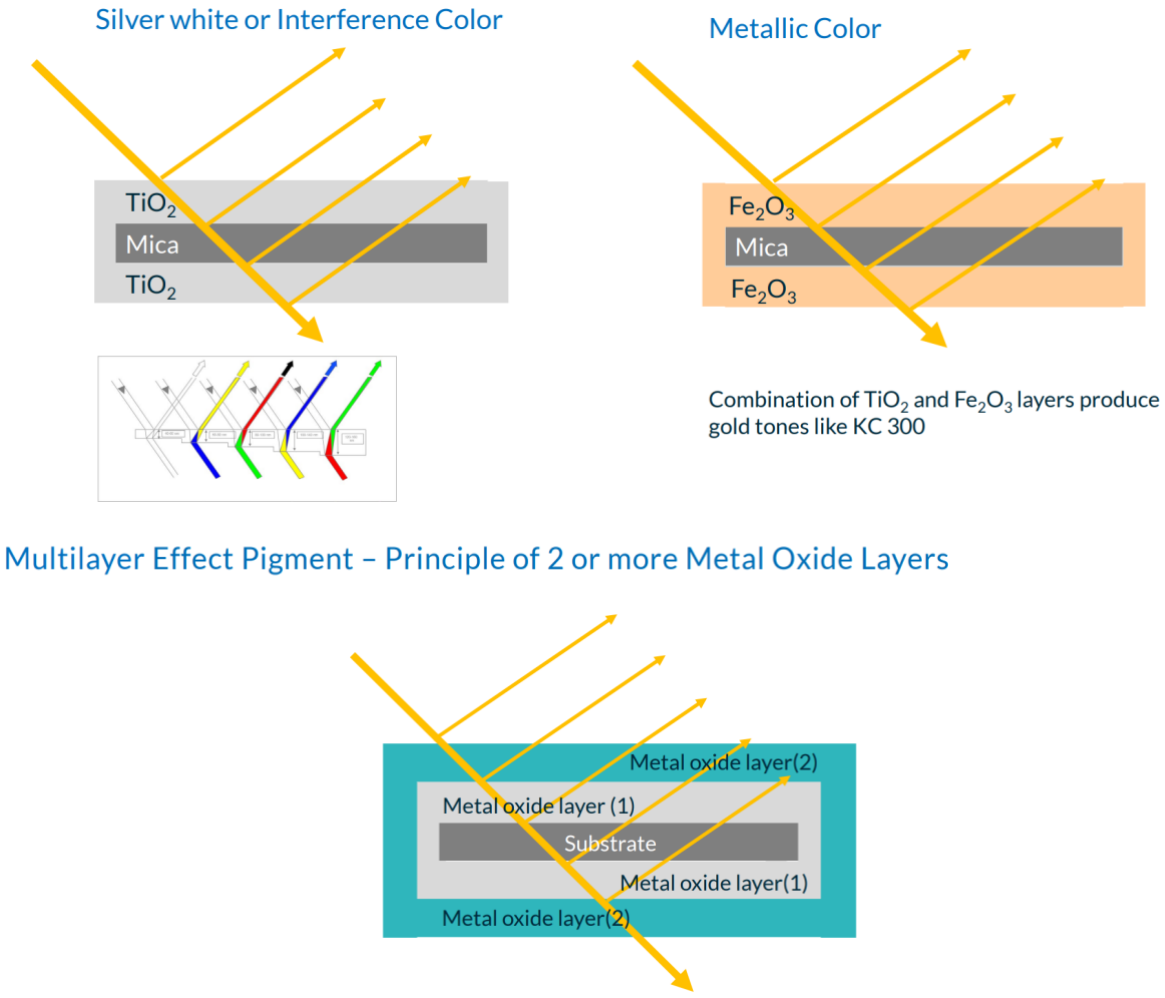

Figure 24. Illustration of how different oxides surrounding mica produce different pearlescent pigments. Source: image courtesy of Kuncai, Global Corporate Presentation 2022

It should be noted that there are some additional challenges, and thus different industrial processes, that are particular to individual segments of the paints and coatings industry. For instance, pigments destined to go outdoors need to undergo a waterproofing treatment – this is for instance one of the steps in manufacturing pigments for OEMs. The car industry also needs pigments that will last a very long time and resist to UV radiation, extreme temperatures, moisture, etc. Pigments must also display a high batch-to-batch consistency. In addition, vehicles must be coated with a treatment to prevent an explosive reaction during the stage where pigments are sprayed onto the car. This step, called passivation, adds a cost to the production process. To deal with this complexity, it is common for the coatings section of an OEM factory to be staffed with employees of the coatings company.

There are further challenges in other categories: for OEM refinish the paint must exactly match the colour of the original, making this one of the most challenging markets. Meanwhile, pigments destined for the cosmetics industry have no such need for stability or replicability over time, but they face extremely exacting standards for purity that are defined in regulation (no quartz dust, no microbial activity, no heavy metals, nano TiO_2 presence must be declared on the label in some countries…).

The value-add in the paints and coatings business is significant. This is already visible at the pigments stage, which is an intermediate product from the standpoint of paints and coatings manufacturers. Indeed, where the mica entering the manufacturing process typically costs less than 1 USD per kg, the output (pigments) begins at 7 USD/kg for the lowest-quality silver-white pigments and goes all the way up to 90 US/kg on average for multilayer/specialty cosmetics pigments. As a result, the value chain distribution of pigments shows that the pigments manufacturing stage dwarfing all upstream stages: see Figure 25 below as an example.

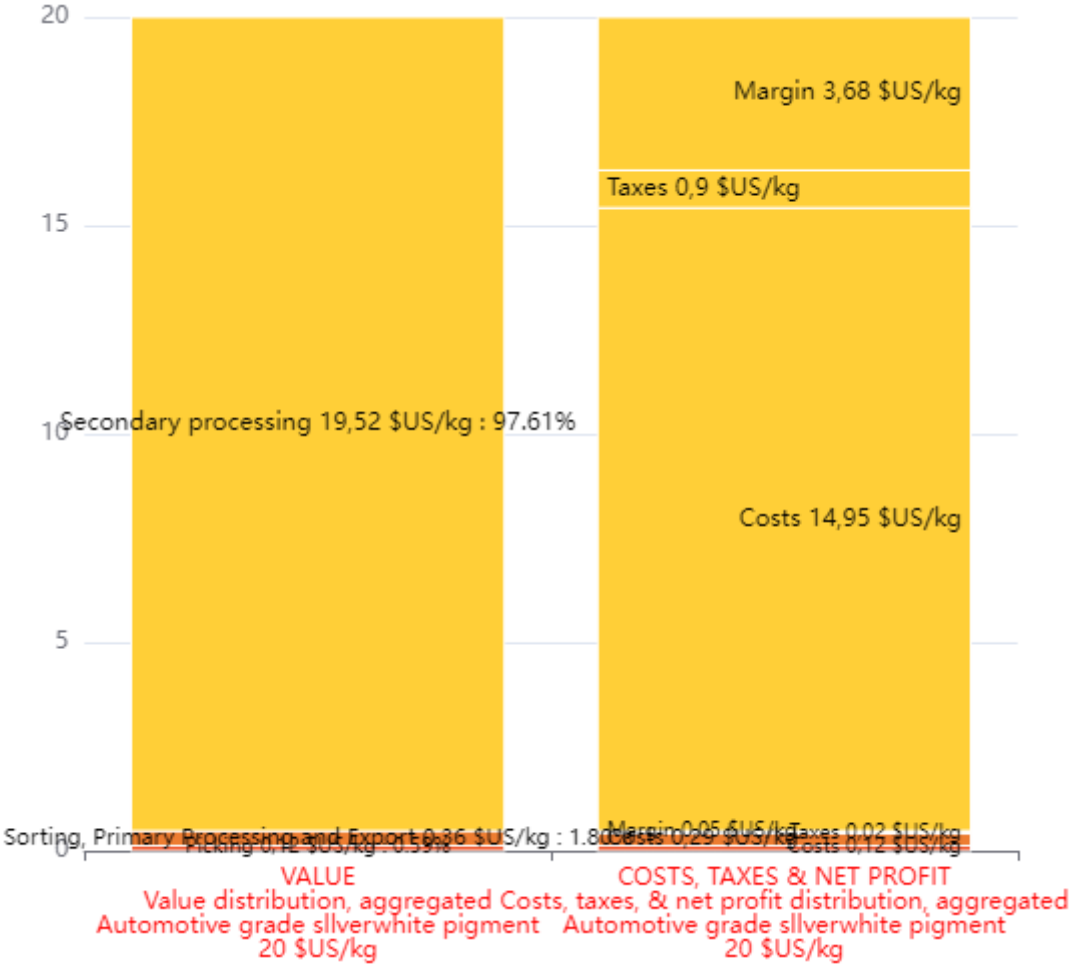

Figure 25. Example of a value-add diagram in the pigments industry: the case of automotive grade silverwhite pigment. Source: BASIC, 2022

However, the value chain does not stop at pigments: it goes all the way to paints and coatings that use these pigments. For the purposes of the model, we focused on a few categories of paints and coatings: architectural paints (interior/exterior) as they represent the majority of the market[71]; OEM and OEM refinish coating, as they are central to the mica content in cars; and anti-corrosion, as the latter has high quantities of mica filler.[72] In the below example of interior/exterior paint, the retail value of 18.5 USD/kg is largely comprised of the retailer's cut (60%), followed by the manufacturer (38%); the stage where pigments are manufactured is only 2.2% of the final price; less than 0.5% of the value is added from India (mining, primary and secondary sorting, and primary processing and export).

[71] Fortune Business Insights, "Paints and Coatings Market Size, Share & COVID-19 Impact Analysis," April 2022
[72] BASIC interview with paints sector expert, 11 May 2022

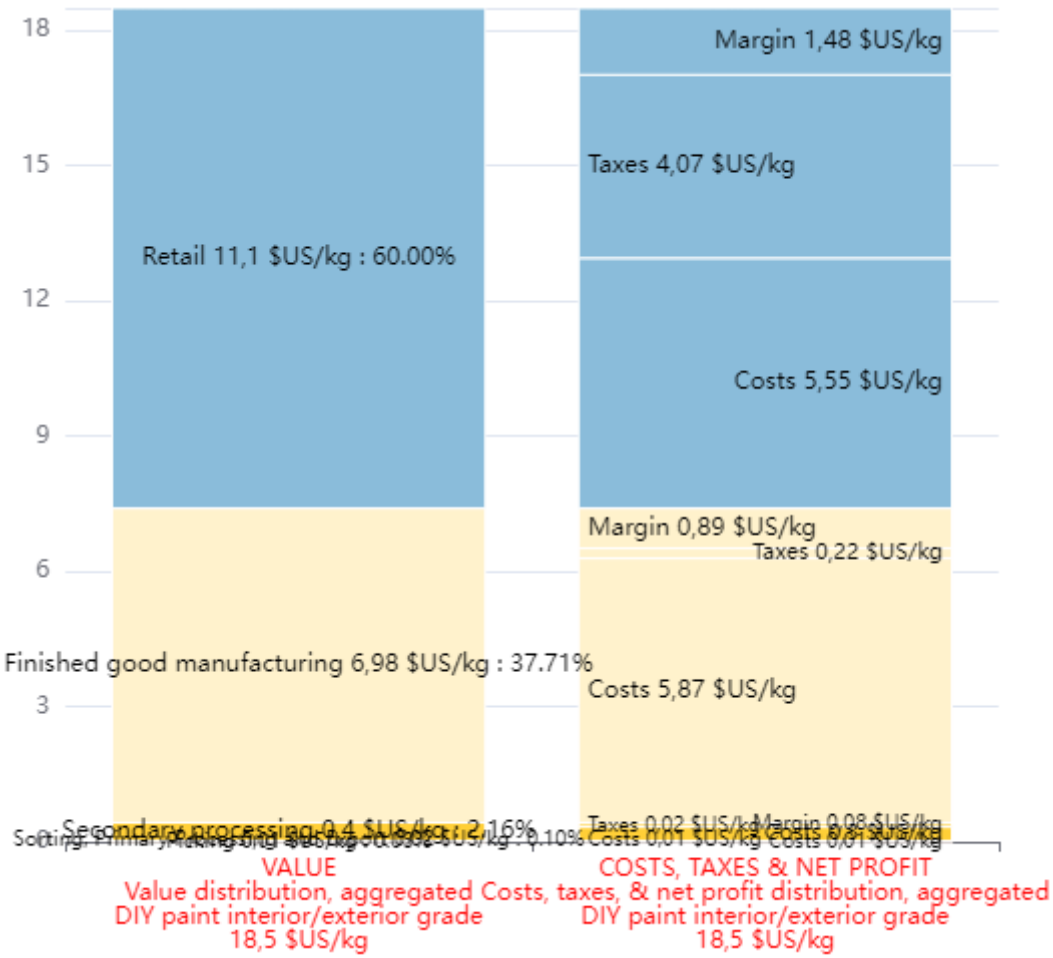

Figure 26. Example of a value-add diagram in the paints and coatings industry: the case of interior/exterior architectural grade paint. Source: BASIC, 2022

2.5.3. Mica in the cosmetics value chain

This subsection explores in greater detail the role of mica in cosmetics. As noted above, mica is an important component of some cosmetics products, in particular lipstick, eyeshadow, and nail enamel. It enters the cosmetics value chain at the level of pigments: pigments and powder intended for cosmetics are the most expensive grade on the market. In lipstick and eyeshadow, ultra-high-quality mica powder is used as a filler (there is no filler in nail enamel). Mica is also used in all three products in the form of pearlescent pigments, which give lipstick, eyeshadow, and nail enamel their iridescent qualities. Mica powder and pigments used for cosmetics must conform to strict regulations concerning the absence of impurities, heavy metals, or microbial activity.

These specifications, and the high quality of the pigments used, make cosmetics a very high value-add type of product. To give the example of eyeshadow, illustrated below in Figure 27: by weight (as a % of total value of around 1,900 USD per kg of eyeshadow), retail captures approximately 60% of the value added, finished goods manufacturing captures just under 40%, and everything upstream (including pigments) represents the remainder, around 0.65%.

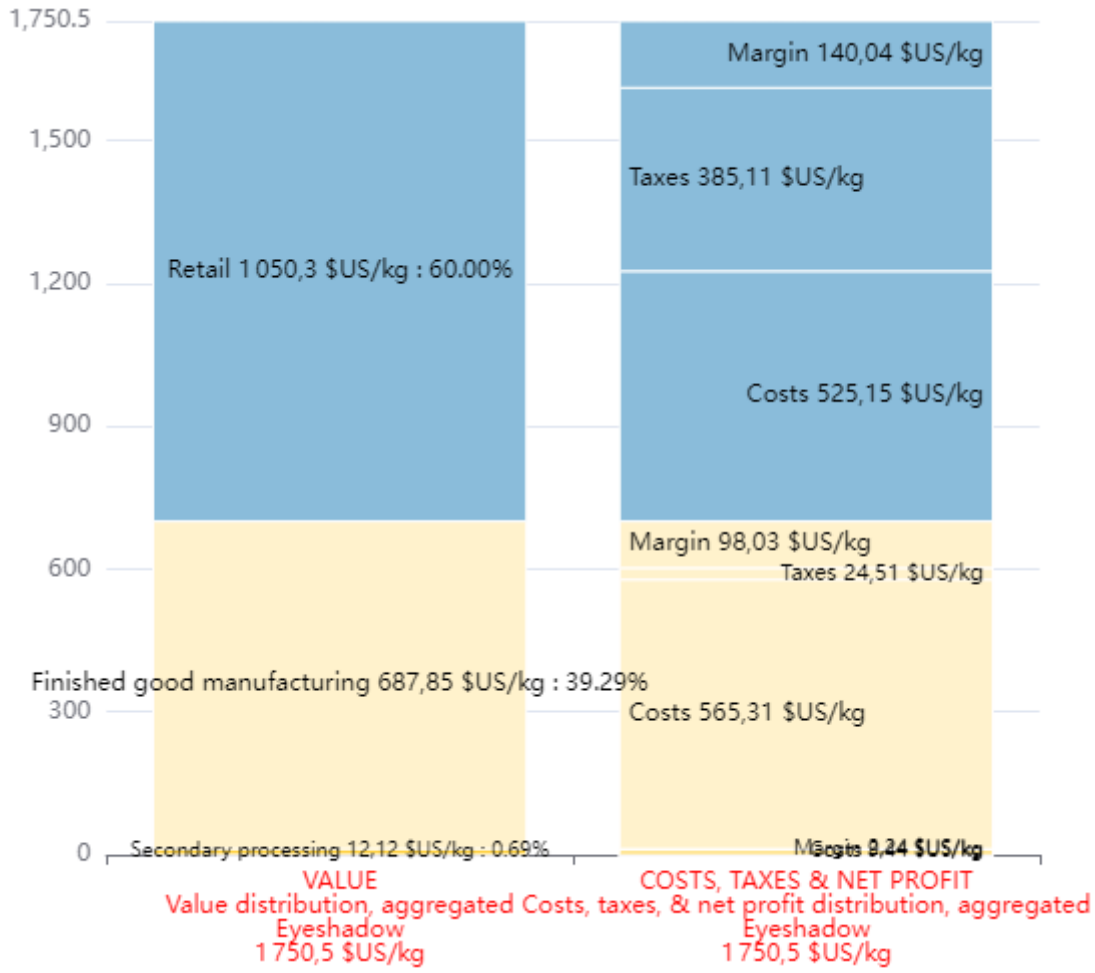

Figure 27. Example of a value-add diagram in the cosmetics industry: the case of eyeshadow. Source: BASIC, 2022

2.5.4. Mica in the automotive value chain

This subsection explores in greater detail the role of mica in automobiles. For this study, we are mandated to focus on mica in cars *other than* the mica used in electronics. Instead, we identified some of the parts of cars that contain the most mica: specifically, the mica in paints and coatings, the mica in droning insulation (insulation against vibration and noise), and the mica used to house and insulate batteries in electric vehicles.

- Coatings: for information on how mica is used in paints and coatings as well as the requirements for OEM and OEM refinish paints (see the section 2.5.2 above on mica in the paints and coatings value chain). It is estimated that in a single car there is about 100g of mica: 2% of paint is mica-based pigment, out of 5kg of paint per car.
- Droning insulation: droning insulation takes the form of bituminous sheets that are attached to the steel armature of the car to convert kinetic energy into thermal energy, thereby damping the sound and vibration disturbance to car passengers. The exact quantity of droning insulation in cars is unclear; there may be between 400g and 6 kg, depending on the estimate.

- Electric vehicle battery insulation: to prevent thermal runaway[73] in electric vehicle batteries, mica paper/board is used to insulate individual fuel cells from each other, and to insulate the totality of the battery from the remainder of the parts of the car. Mica's ability to resist and thus compartmentalise sources of heat becomes incredibly helpful here. The quantity of mica used varies greatly depending on the nature of the vehicle. According to our research, hybrids start at around 500g mica insulation per car; full electric starts at 1.5 or 2kg of mica but can go up to 8, 10, or even 15 kg for heavy-duty vehicles. This technology is very new.

These three components have different profiles in terms of value distribution.

- The products that concentrate the greatest value downstream are paints and coatings: out of the approximately 350 USD per kg sales price of OEM paints, about 0.2% of the value comes from upstream.
- Things are marginally more moderate for droning insulation: the insulation itself costs approximately 3.42 USD/kg as manufactured from mica powder that costs 0.18 USD/kg (5.2% of the total).
- Meanwhile, things are most balanced for EV batteries: a battery sells for approximately 11.5 USD/kg (5,750 USD for 500 kg), while the upstream component (mica mining-first transformation-export-manufacturing as board) costs about 3.25 USD.

[73] As explained in an article by OEM provider Tapecon, "Thermal runaway (or TR, for short) is a phenomenon that can affect rechargeable energy storage systems, including lithium-ion (Li-ion) batteries and valve-regulated acid (VRLA) batteries. The dangerous condition occurs when the temperature rapidly rises inside one of the battery cells. The excess heat combined with lower internal resistance to the charging current enables the temperature to rise quickly even further and affect other cells. This pattern will repeat until the battery is removed or fails – hence the "runaway" of thermal runaway," In terms of risk to the user, "Once the thermal runaway process begins, it is very unlikely that the condition will stop on its own. If the temperature increases and isn't effectively dispelled, the inevitable result will be the battery overheating. The heat will cause significant damage to the battery and its compartment. In some cases, the battery may leak toxic chemicals or gas. Beyond battery damage, thermal runaway poses severe risks to the product's users and surroundings, including sudden system failure and dangerous events such as fire or explosions. While traditional combustion vehicles can also experience these hazardous situations, fires with EVs can be more extreme," Tapecon, "Understanding Thermal Runaway, and solutions for designing safer batteries," n.d., http://www.tinyurl.com/22k54sxb

3. Scenarios for change

The present study aims to support the RMI and its members in decision-making by building a comprehensive quantitative model of the scrap mica value chain, from mine to finished product. The model, in its basic configuration, maps the status quo. However, it also enables evaluation of three scenarios for a possible future that protects the human rights of mica pickers and their children. The model is hosted on a web-based platform,[74] where it is possible to toggle several scenarios, each of which is more ambitious than the previous in terms of human rights protections.

Throughout the value chain, the quality of mica appears to dictate the price of the products derived from it. However, value accumulation is such that by the time semi-finished or finished products are ready for sale, the contribution of raw mica – high or low quality – to the price of the final good is infinitesimal. This is why RMI commissioned BASIC to build a quantitative model of the mica value chain that can be used to explore possible scenarios, possible futures in which mica workers are better paid, and see how this increase in costs upstream of the chain can be equitably dispatched across the multiple downstream stakeholders of the value chain. In this section we will review the objective of a living wage, and three potential scenarios that could, in the future, significantly alter the mica value chain. Each scenario is presented along with its main hypotheses and inputs, as well as the major conclusions from each.

3.1. Background: the objective of a living income

RMI is convinced that to reach its goals of child labour free and responsible supply chains, mica value chains delivering a living income to workers in the mica sector would be a decisive enabler, with a particular focus on vulnerable categories of people, such as mica pickers and factory workers. Paying a living income or living wages to upstream mica pickers and workers becomes hence another objective of the RMI. Our focus in this study is on the scrap mica value chain, materialised in the form of mica picking by mica pickers; new digging and mining by mica miners is outside the scope of the study.

One of the working assumptions is that as incomes increase for adults, there is less of a need for families to send their children to work in mica picking. This is why all of the scenarios below include an increase in income for mica pickers and factory workers. However, higher incomes may be not sufficient, for instance in the case of villages where schools are remote. More of an effort needs to be made to support families holistically – with healthcare, childcare, and education services, for instance – in order for an increased income to really make a difference. Hence, the most ambitious of the three scenarios, the cooperatives scenario, includes provisions that could be made for childcare (using the worker welfare fund) and, implicitly, improved picker/worker knowledge of and access to government services once the mica pickers' activity is legalised.

The scenarios are the following:

[74] http://micavaluechain.lebasic.com/

1. Current state value chain is the status quo: the value chain starts with mica pickers receiving 8 Rs/kg from dealers, who sell to aggregators, who sell to processors/exporters. The mica picking activity is mostly illegal.
2. "Scenario 1: Legalisation" explores a world where mica picking is legalised. The government issues permits to processors to pick mica in designated areas. The permit holders arrange for mica collection from the mica pickers through existing mica dealers. Thanks to government oversight, mica pickers' income more than double to reach the minimum wage equivalent. Factory workers also see their wages increase to the legal minimum, which would amount to an approximately 11% increase in their current salary.[75] In this scenario, secondary sorting and aggregating is conducted directly by processors; unless processors choose to rely on them, aggregators are no longer part of the scrap mica value chain.
3. "Scenario 2: Living income" considers a world where all mica workers earn a living income. The basic configuration is the same as in scenario 1: processors bid on mica dumps and arrange for mica picking and collection via existing dealers. However, in this scenario there is a nearly 5 times increase in incomes for mica pickers relative to the status quo (2.5 times more than in scenario 1), and a doubling of income for mica factory workers (2 times more than scenario 1). As in scenario 1, secondary sorting and aggregating is conducted directly by processors; unless processors choose to rely on them, aggregators are no longer part of the scrap mica value chain.
4. "Scenario 3: Cooperatives" posits a world where mica pickers organise themselves to form village-level cooperatives. These cooperatives conduct a first-level sorting of the mica and sell it to the JSMDC, the state level administration for mining, which conducts secondary sorting (typically the role of an aggregator). The mica is then auctioned off. The assumption is made that the JSMDC is able and willing to buy mica at a living-income level, and that JSMDC staff are also paid a living wage. The scenario also includes more ambitious provisions for the social wellbeing of mica picker families.

The three scenarios should be seen as building on one another: Scenario 1, resembling what the JSMDC has done in the past but with an improvement in wages; Scenario 2, which follows Scenario 1 but with more ambitious income targets; and Scenario 3, which is a complete innovation on the current system and appears to be the direction taken by Jharkhand authorities at present.

The status quo and three scenarios have some shared assumptions which are described in the table below.

[75] Responsible Mica Initiative, FairWage Network, Sentio Advisory Initiative, "Report on wages, working and living conditions of Mica workers in India," February 2022

Overarching shared assumptions
• To assess the quantity of mica picked per day, we based ourselves on the Fair Wage Network Living Wage study commissioned by RMI.[76] The study found that mica pickers in Jharkhand pick approximately 20 kg of mica per day, while those in Bihar pick only 11 kg per day, as mines are more remote from their villages. Given that these values are themselves averages, we averaged the two values to obtain the daily mica picking value: **we assume mica pickers pick approximately 15.5 kg/day.** • In the model, both **mica pickers and factory workers work 26 days a month**, as per the Jharkhand State's own definition of work time per month in its minimum wage calculations. • India has a rainy season that lasts four months (from June through September). During this period, mica pickers conduct almost no work at the *dhibra* dumps; however, they may choose to undertake other activities, such as agriculture or running a small shop. **We chose to index income calculations on the eight-month dry season when *dhibra* pickers are at work.** No adjustment was made to cover the "lean period" of four months during the rainy season; income figures calculated below are for an ordinary month/week/day in the dry season. • Were mica to be sold in India, it would be subject to a 5% Goods and Services Tax (GST). However, GST is not owed on items destined for export, so the state would actually reimburse the exporter for any GST that was paid on the mica purchased upstream. However, GST is owed upstream of the chain. We have simplified the simulation by placing **GST as a cost to the processor,** because it is the last in the chain to pay GST before export. • We assume that once the mica value chain enters the fold of legality, this is accompanied by **the appearance of new taxes.**[77] We have identified to date three taxes that the State might levy, but not all of them are likely to be applied. The first tax – a 4% royalty on mining proceeds – is not expected to be paid because it has historically applied only to mica mining permits, not picking permits: the equivalent of royalty in a picking permit is the auction price of mica.[78] Theoretically, companies meeting the net-income threshold would be liable for corporate income tax; however, it is estimated that only one-third of aggregator-processor-exporter firms are liable for this tax, while others are under the threshold: therefore it is not taken into account in the model, which needs to be representative of the majority scenario. The third tax is a transit tax (estimated at 3,000 Rs per ton) that would be paid by the leaseholder.[79] This is included in the three prospective scenarios. The JSMDC also levies a special auction tax on mica at auctio in Scenario 3.

[76] Responsible Mica Initiative, FairWage Network, Sentio Advisory Initiative, "Report on wages, working and living conditions of Mica workers in India," February 2022; BASIC Interview with mica sector expert, November 2022.
[77] Responsible Mica Initiative and FTI consulting, "Jharkhand Sustainable Mica Policy Framework and Vision," July 2020; International Seabed Authority, and RMG Consulting. "Analysis of Tax Regimes: Comparative Analysis in 15 Countries," 12 October 2020; Better World Foundation, "Designing Innovative and Holistic Community Based Business Models for Mica Pickers in Coherence and Adherence with the Policy," n.d. (after 2020).
[78] BASIC interviews and correspondence with mica sector experts, discussing the 4% royalty rate for mica mining, 2022
[79] Better World Foundation, "Designing Innovative and Holistic Community Based Business Models for Mica Pickers in Coherence and Adherence with the Policy," n.d. (after 2020)

DISCLAIMER: The current-state value chain is constituted as: mica picker → dealer → aggregator → processor. It should be underlined this model approximates reality to the best of our ability, but the reality in the field may be more complex. In particular, some actors may be in a state of quasi-vertical integration while others have much looser ties with their suppliers and clients.

This should be borne in mind when examining the adjustments made to the value chain in the scenarios below. The adjustments reconfigure certain relationships: in scenarios 1 and 2, the role of aggregators becomes ambiguous (they potentially disappear), and in scenario 3, both dealers and aggregators potentially disappear entirely. Our model incorporates these changes, but it should be underlined that it is a simplification of reality and a prospective exercise, not a prediction for the future. In particular, the boundaries between dealer-aggregator-processor-exporter are not necessarily hard and fast, and existing actors will likely seek – and perhaps succeed – in securing a role for themselves even in a scenario where their current position hypothetically disappears.

3.2. Scenario 1: Legalisation

3.2.1. Description

The legalisation scenario is based on the notion that State authorities – in India, the Jharkhand State Mineral Development Corporation (JSMDC) – issues licenses to pick from geographically demarcated *dhibra* dumps. This brings mica picking into the fold of legality, with several benefits. For the State, mica picking becomes a source of revenue that is also under loose government supervision. For mica pickers and for factory workers, state supervision leads to higher incomes/wages – the minimum wage is paid – and greater control of their working conditions.

This scenario tracks closely with what the JSMDC has done in the past. Namely, in this scenario the Department of Mining and Geology catalogues the existing *dhibra* dumps and appraises their value (size, mica quality, etc.). Then, the JSMDC organises auctions to the highest bidder to exploit *dhibra* dumps legally, at a starting price that is based on an appraisal of the mica content and value in the dump.

Scenario 1 assumes that the JSMDC will renew such auctions in the future, but that there will be stricter control over payment to mica pickers. The modelling tool assumes that it is typically processors who will bid on *dhibra* dumps. Processors will also take on the secondary sorting and aggregating function that was previously the remit of aggregators, potentially by staffing this task themselves instead of relying on existing aggregators.

In addition, it is implicit in this scenario that there is greater government oversight on these stakeholders. Specifically, the model assumes that by being brought into the fold of legality, pickers will begin to receive the equivalent of Jharkhand state-level minimum wage for unskilled labour, with an additional bonus for higher quality of mica.

The legalisation scenario has several advantages. First, mica pickers would be guaranteed a minimum income equivalent to the minimum wage for unskilled workers. Factory workers would also benefit from a legal minimum wage. In addition, mica picking becomes legalised. This offers a better,

more stable business environment for processors and exporters. For the State, legalisation offers a source of taxes that are to be paid to the government (see inset below).

3.2.2. Assumptions and key numbers

The below table explains the values inputted into the default configuration of the model for Scenario 1.

The numbers: Scenario 1
• Picker incomes/Mica price: Minimum wage for unskilled labour in Jharkhand is, as of April 2022, 326.86 Rs per day. On the assumption that daily mica collection is around 15.5kg/day, this means that mica pickers would be paid approximately 21 Rs/kg, i.e. around two and a half times what they currently make. This is the minimum price that would be guaranteed for pickers, but as in all scenarios, mica of greater quality would receive a premium. In addition, is it estimated that mica pickers require Personal Protective Equipment (shoes, masks, and gloves): a little more than 3 Rs/kg is allocated to PPE as a cost of doing business for miners, bringing the total price of mica to 24.17 Rs/kg. • Mica factory workers: the salary of mica factory workers rises slightly (approximately 11%, from 8 032 Rs/month paid today to 8 903 Rs/month minimum wage).[80] We assume that mica sorters working for processors will also earn minimum wage; this increases costs at the aggregation stage. • Costs: The increase in mica price (picker incomes) and factory workers' wages entails an increase in costs for downstream stakeholders. In addition, the license holder must pay a set price for each kg of raw matter at the dump at the time of auction. This price is assessed by the Department of Mining and Geology in coordination with the JSMDC; it has previously stood at around 2 Rs/kg for the dump material (entire dump including mica scrap but also sand, stones, dust, biotite…). If the contents of a *dhibra* dump is assessed at 2 Rs/kg at the time of auction and is paid as such by the license holder, then the license holder will need to factor at least 2 Rs/kg to his costs to recoup the value of the picking license. In reality, because the mica dump contains the aforementioned impurities, the effective price of mica is potentially greater than the auction price. • Taxes: As noted above, GST of 5% is charged to the processor, as well as a 3 Rs/kg transit tax.

[80] Currently minimum wage has increased. In the Living Wage study, minimum wage was reported as 8770 Rs/month However, in Oct 2021 semi-skilled MW was 8579.02 Rs/month and in April 2022 semi-skilled MW was 8903.13 Rs/month. We have retained the latter number, as it is more recent.

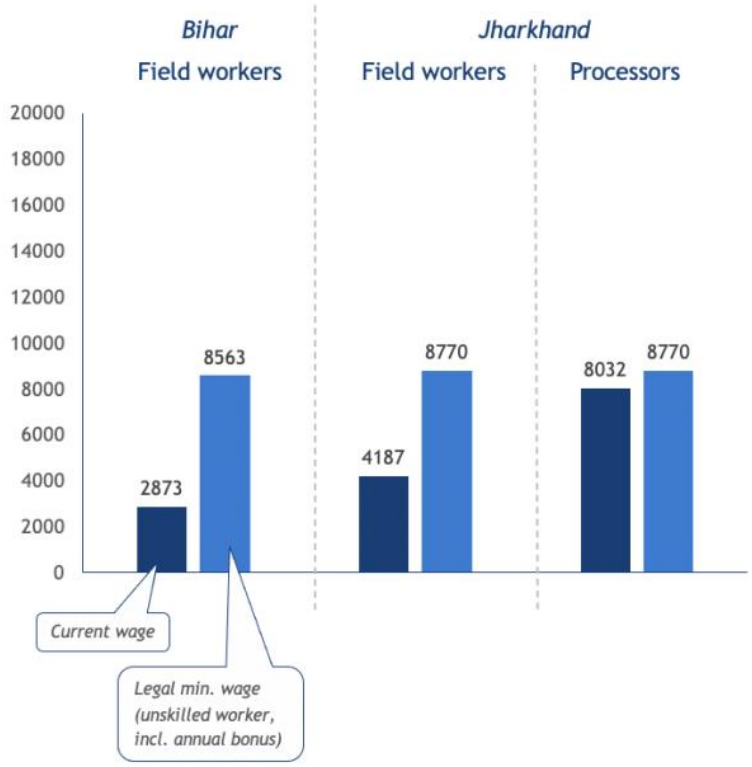

Figure 28. Comparison between current average income and legal minimum income for mica field workers and processors in Bihar and Jharkhand (gross, INR/month, 2021 estimates). Source: RMI/Fair Wage Network Living Wage study

3.2.3. Impact

With mica input at around 24 Rs/kg, the price of mica going into primary processing increases to 0.46 USD/kg. This raises prices between 0.010 to 0.43 USD/kg extra at the primary processing stage. High-quality powder and flakes thus sell for around 1 USD/kg, as against around 0.55 USD/kg in the status quo. Going into pigments, mica ground by pigments manufacturers increases in price; this increases pigments price by approximately 0.18 to 0.33 USD/kg. The price of intermediate products such as OEM grade paint, vehicle droning insulation, mica board (multilayer laminate), and EV batteries also increases mildly.

In terms of finished products, strictly speaking in absolute terms the most impacted product is electric cars (2.21 USD increase per car); however, in relative terms (price increase divided by price) all increases are less than 1% of the finished price and most are less than 0.10%. For this reason, the costs-margins-taxes diagram for finished products is almost identical in the status quo and in Scenario 1, as can be seen in Figure 29 below – taking the example of anti-corrosion paint. The relative value contribution of the upstream part of the chain, other than final manufacturing and retail, is negligible.

NOTE: Value distribution graphs given in Section 3 are screenshots to illustrate results. For better resolution, we recommend using the online platform: when you click on an item in a rectangle, the two bar charts appear – the current scenario's chart on top, and the status quo chart below.

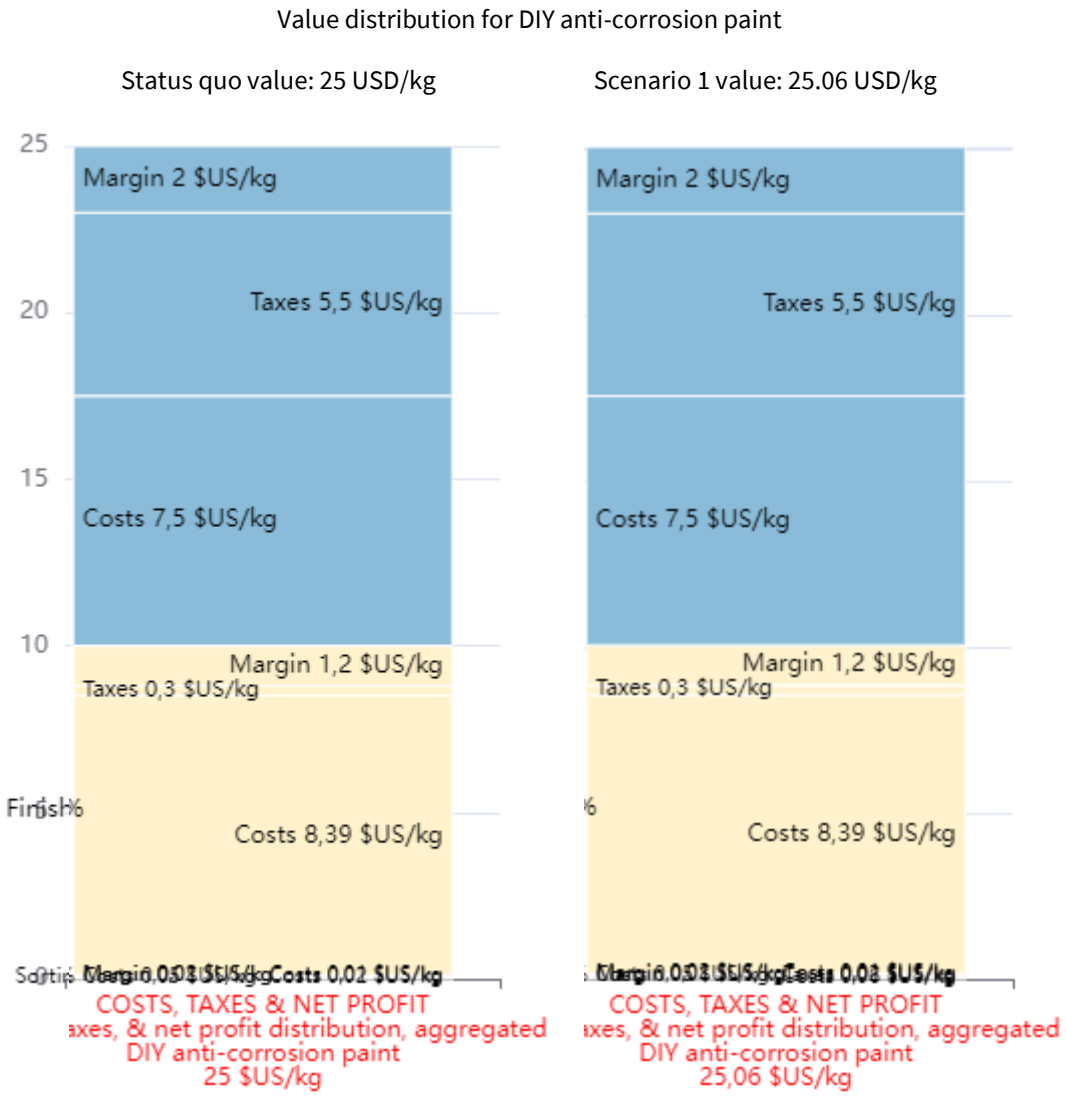

Figure 29. Value distribution for DIY anti-corrosion paint, status quo vs. Scenario 1. Source: BASIC, 2022

Only when semi-finished products are examined does the value distribution change appear more clearly. This can be seen, for instance, in the case of low grade silverwhite pigment. Although the cost of secondary processing does not change significantly, the part of the value captured by mica pickers and workers, in red and orange, is greater in the Scenario 1 diagram than the status quo – see Figure 30 below.

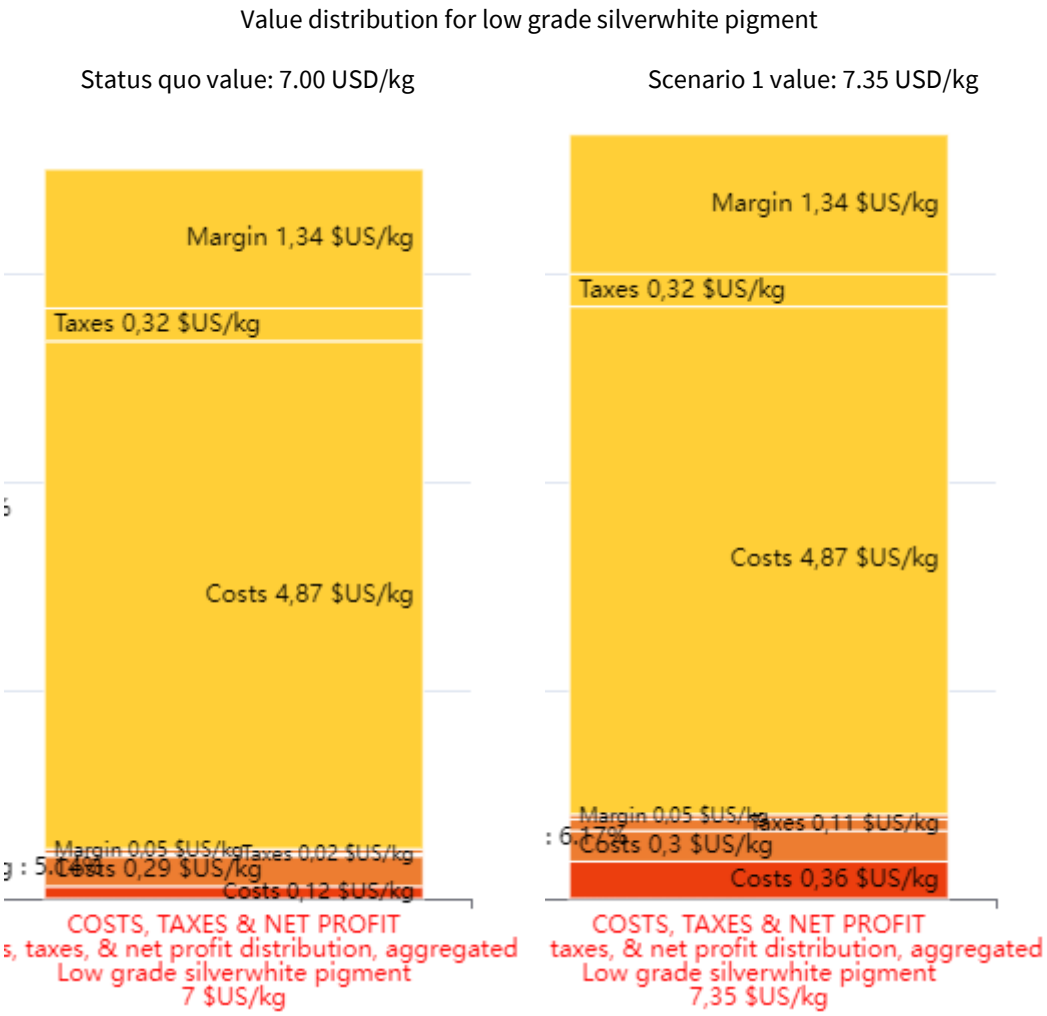

Figure 30. Value distribution for low grade silverwhite pigments, status quo and Scenario 1.

3.3. Scenario 2: Living income

3.3.1. Description

In scenario 2, the basic configuration is the same as Scenario 1. However, pickers and factory workers receive a living income/wage. This is a more ambitious scenario that very likely requires a coordinated approach between upstream and mid-stream stakeholders to reach an agreement in terms of the redistribution of extra cost down the chain, for major players. Without such an agreement, buyers may try to identify alternate sources of mica that are cheaper than that delivered by living-wage consortium stakeholders. However, Scenario 2, like Scenario 3 below, is believed to be more impactful on child labour, as wages reach the point when it is no longer necessary to supplement family income with income from child labour.

3.3.2. Assumptions and key numbers

The below table explains the values inputted into the default configuration of the model for Scenario 2.

The numbers: Scenario 2
• Pickers incomes/Mica price: For mica pickers, a living income is approximately 15,000 Rs/month, or 577 Rs/day for 26 days of work a month. However, they continue to receive payment based on mica quantity and quality. Brough back to the average of 15.5 kg collected per day, with a living income workers receive 37 Rs/kg for their mica, i.e. approximately 4.5 times what they are currently paid (8 Rs/kg). In addition, is it estimated that mica pickers require Personal Protective Equipment (shoes, masks, and gloves): a little more than 3 Rs/kg is allocated to PPE as a cost of doing business for miners, bringing the total price paid to pickers to 40.17 Rs/kg. • Mica factory workers: For a mica factory worker, the part of family income that is salary from the mica factory increases by about 80%, from 8,032 Rs/month to 14,652 Rs/month. • Costs: The increase in mica price (picker incomes) and factory worker wages entails an increase in costs for downstream stakeholders, such as dealers and processors, in the form of wages as detailed above in scenario 1. Also, as in the above, the picking license holder must also pay the price of the license at around 2 Rs/kg. • Taxes: As noted above, GST of 5% is charged to the processor, as well as a 3 Rs/kg transit tax.

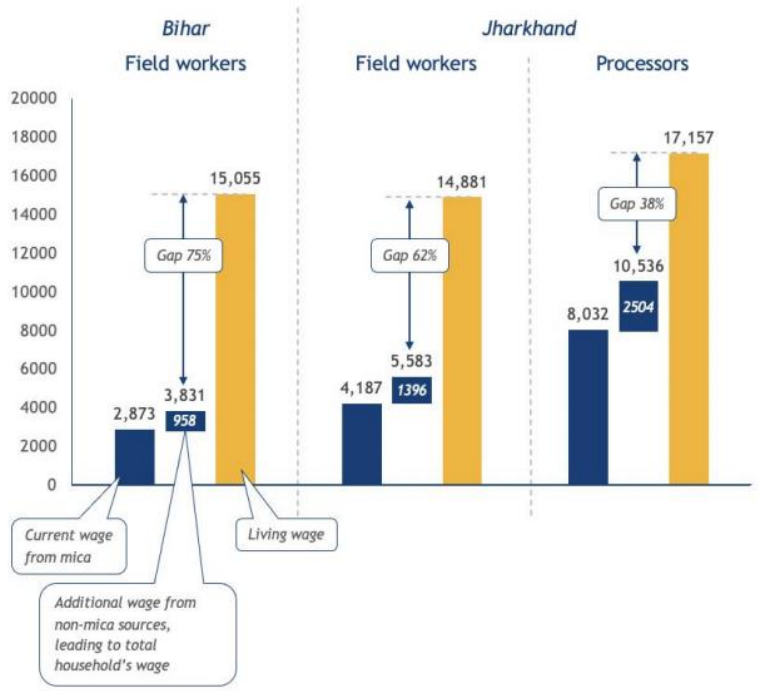

Figure 31. Total income from mica and non-mica activities earned by the whole household, compared to the household living income, for mica field workers and processors in Bihar and Jharkhand (gross, INR/month, 2021 estimates). Source: RMI/Fair Wage Network Living Wage study

3.3.3. Impact

With mica input at just over 40 Rs/kg, the price of mica going into primary processing increases to 0.70 USD/kg. This raises the price by around between 0.19 to 0.86 USD/kg extra at the primary processing stage. High-quality powder and flakes thus sell for around 1.50 USD/kg, as against around 0.55 USD/kg in the status quo. Going into pigments, mica ground by pigments manufacturers increases in price; this increases pigments price by 0.36 to 0.66 USD/kg. The price of intermediate products such as OEM grade paint, vehicle droning insulation, mica board (multilayer laminate), and EV batteries also increases.

In terms of finished products, strictly speaking in absolute terms the most impacted product is once again electric cars (4.42 USD price increase per car); however, in relative terms (price increase divided by price) all increases are less than 1% of the finished price and most are less than 0.1%. For this reason, the costs-margins-taxes diagram for finished products is almost identical in the status quo and in Scenario 2, as can be seen in Figure 32 below – taking once again the example of DIY anti-corrosion paint. The relative value contribution of the upstream part of the chain, other than final manufacturing and retail, is negligible.

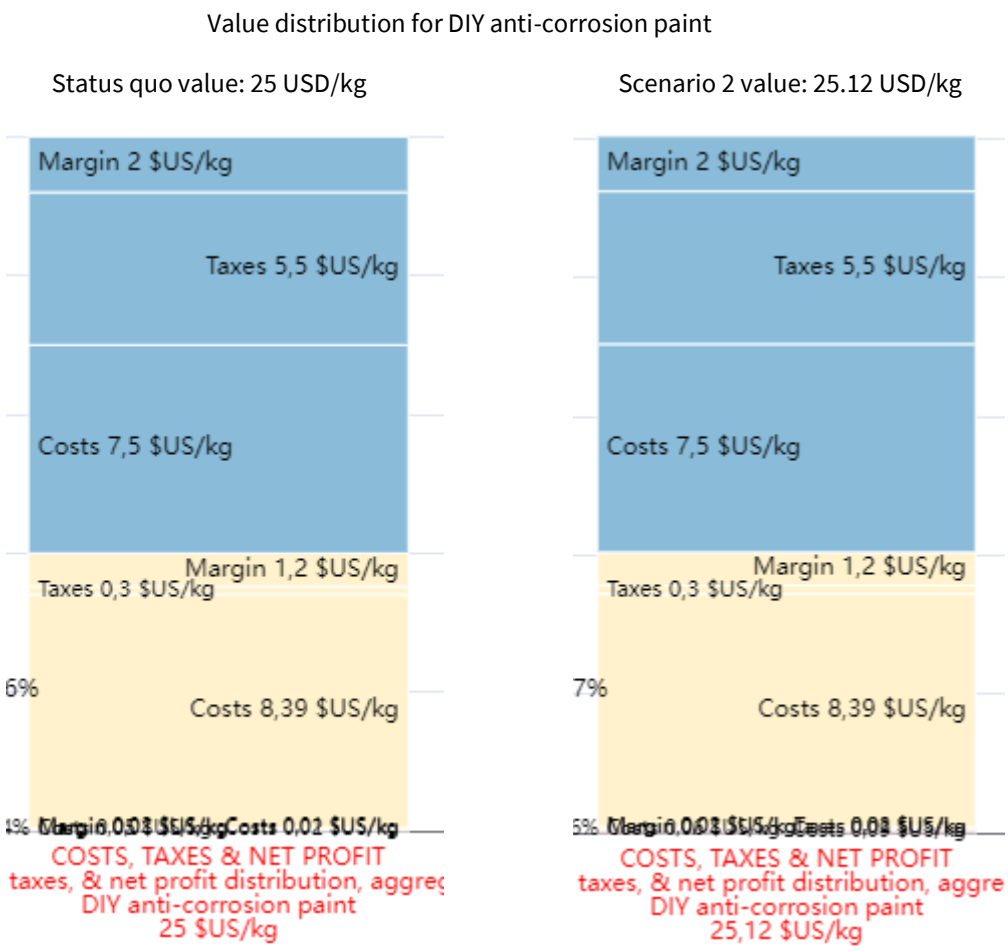

Figure 32. Value distribution for DIY anti-corrosion paint, status quo vs. Scenario 2. Source: BASIC, 2022

As in Scenario 1, only when semi-finished products are examined does the value distribution change appear more clearly. This can be seen, for instance, in the case of low grade silverwhite pigments.

Although the cost of secondary processing does not change, the part of the value captured by mica pickers and workers, in red and orange, is greater in the Scenario 2 diagram than the status quo – see Figure 33 below.

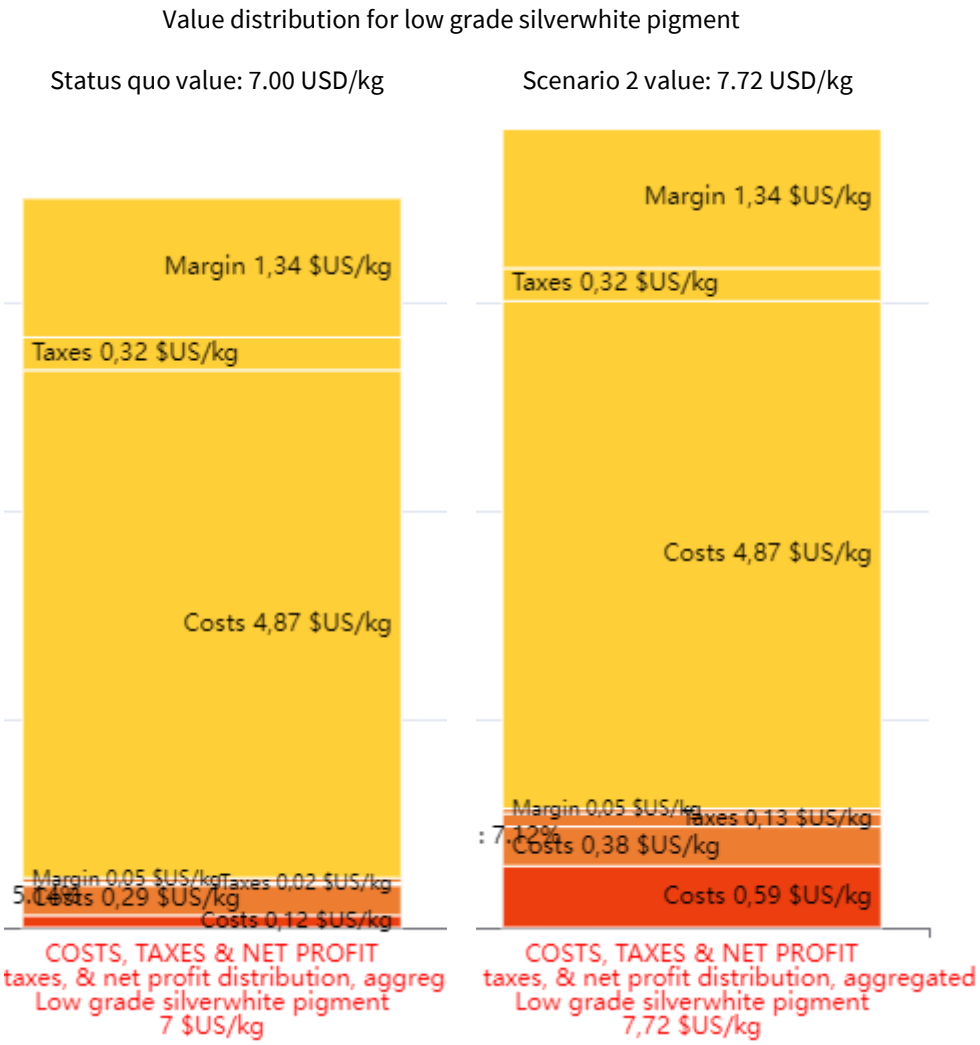

Figure 33. Value distribution for low grade silverwhite pigment, status quo and Scenario 2.

3.4. Scenario 3: Cooperatives

3.4.1. Description

Scenario 3 is the most advanced and ambitious of the three scenarios, both in terms of its political complexity and in terms of the gains in social justice attained. In Scenario 3, villages form Community Based Organisations (CBOs), i.e. cooperatives. The cooperatives are quite large: they bring together 10 to 15 villages of approximately 40 mica pickers each, for a total of 5,000 members. While the cooperative has representatives at the village level, the core of activity focuses around the Village

Collection Centre (VCC), which aggregates output from these 10 to 15 villages. Output is considerable; approximately 7,750 kg mica per day, i.e. 201,500 kg/month and 1,612,000 kg per 8-month year.[81]

In the cooperative scenario, all mica pickers are registered members. The cooperative coordinates the work of mica pickers, ensures that good working conditions are in place, distributes PPE, spot-checks for child labour, and pays mica pickers a fixed price per kg with a quality bonus. Employees at the VCC – about 15 of them per cooperative – do a preliminary sorting of the mica. Cooperatives sell the mica to the JSMDC, which collects the mica and then conducts additional sorting and screening with the help of about 20 workers at the District Collection Center (DCC). The JSMDC then puts the mica up for sale, in an auction format. Ideally, mica pickers are paid a living income by the cooperative, which sets prices for mica; factory workers also continue to receive a living wage as under Scenario 2.

From an administrative standpoint, Scenario 3 is more ambitious than the other two. Mica pickers are issued registration cards and are invited to open banking accounts; wages are paid by the cooperative into this account.[82] The cooperative, in turn, is paid by JSMDC, which pays for the mica based on the account of wages disbursed by the cooperative. Movement of mica from picking site to village to VCC can be done only with a valid authorization issued by JSMDC. At the next stage, trucks carrying mica from village to district level storage places would be outfitted with GPS trackers to increase accountability. The setup is such that in theory, additional efforts can be made towards traceability, such as linking every bag of mica that enters the processing stream to one mica picking village of origin.

Like Scenario 2, Scenario 3 is interesting from the standpoint of child labour, as living incomes/wages are paid and the mica can be traceable. The scenario also includes more ambitious provisions for the social wellbeing of mica picker families. For instance, the JSMDC envisages collecting tax of approximately 5% on the price obtained for the mica dump at auction. A little under half of this tax (1% or 2%) would be given back to the cooperative. The cooperative is then free to use this money in the most relevant ways so as to improve the general welfare, for urgent priorities such as mine safety, education, healthcare, water, and sanitation.[83] As concerns child labour, the cooperative could use its funds for projects that increase school attendance, such as by covering fees for school and school meals, or by giving children in remote villages the means to go to school (bicycles, for instance). Money could also be allocated to childcare, to ease the burden on school-age children for watching over their younger siblings.

3.4.2. Assumptions and key numbers

[81] BASIC Interviews with RMI staff, September – October 2022; Better World Foundation, "Designing innovative and holistic community-based business models for mica pickers in coherence and adherence with the policy," n.d. (after 2020)

[82] In the model described by Better World Foundation, workers can also receive their wages directly from the cooperative, which seems to suggest some of these transactions are in cash. (see Better World Foundation report "Designing innovative and holistic community based business models for mica pickers in coherence and adherence with the policy," n.d. (after 2020), page 9).

[83] Centre for Responsible Business, "Road-Map for Sustainable and Inclusive Mica Industry in Jharkhand: Balancing Interest of the State, Business and People," 2018. https://c4rb.org/insights/report/MICA-Roadmap.pdf

The below table explains the values inputted into the default configuration of the model for scenario 3.

The numbers: Scenario 3
Pickers income/Mica price: pickers are paid a living income by the cooperative – see scenario 2 for how this is calculated, and scenario 1 for general-order questions about the cost of holding a picking license for *dhibra*. In Scenario 3, however, we assume that mica pickers are better organised and that more concerted efforts are made to train them and to monitor workplace standards. As a result, the cost of PPE is transferred to the cooperative, and it increases to approximately 6 Rs/kg. Mica factory workers: factory workers are paid a living wage – see scenario 2 for how this is calculated. Costs to cooperative: in this scenario, we introduce for the first time a cooperative, which takes the place of the dealer, and therefore have to account for its costs. They include the costs of: o Hiring a cooperative coordinator (skilled labour, estimated 1 person per cooperative) o Hiring part-time local liaisons in each of the 10-15 villages that are members of the cooperative o Building and maintenance of a storage facility for mica at the VCC and potentially also in villages o Hiring mica sorters: 15 for every cooperative's VCC o Annual training on workplace safety standards, purchasing Personal Protective Equipment, and financing inspections/monitoring o Purchasing, refuelling, and staffing several vehicles to transport mica from picking site to village and from village to the VCC o The mica picking lease/permit Costs to JSMDC: in this scenario, we introduce for the first time the JSMDC, which takes the place of the aggregator, and therefore have to account for its costs o JSMDC pays for transport of mica from VCCs to DCCs o JSMDC also finances the initial costs for putting in place the administrative system of the cooperative, including ▪ individual mica picker registration cards ▪ an accounting system to keep track of how much each mica picker is owed ▪ a traceability system including GPS tracking of trucks o JSMDC also pays for all the costs related to holding the auction of mica bought from the cooperatives o JSMDC must employ people with skills similar to those of people working for aggregators, namely mica sorters, at the District-level Collection Centre

Taxes: There is an effective tax of 5% levied by the JSDMC off the auction price (of which just under half is given back to the cooperatives for a mica picker welfare fund). Bidders would also pay General Sales Tax and the 3 Rs/kg Transit tax.[84]

3.4.3. Impact

The structure of Scenario 3 is different in terms of stakeholders and internal organization, and its downstream impact is slightly more significant than that of Scenario 2. For instance, in terms of prices the impact on mica going into primary processing mica stands at 0.83 USD/kg, versus 0.70 USD/kg in Scenario 2. High-quality powder and flakes then sell for around 1.25 to 1.60 USD/kg, as against around 0.55 USD/kg in the status quo. Going into pigments, mica ground by pigments manufacturers increases in price; this increases pigments price by 0.43 to 0.78 USD/kg. The price of intermediate products such as OEM grade paint, vehicle droning insulation, mica board (multilayer laminate), and EV batteries also increases mildly.

In terms of finished products, strictly speaking in absolute terms the most impacted product is once again electric cars (5.17 USD price increase per car); however, in relative terms (price increase divided by price) all increases are less than 1% of the finished price and most are less than 0.1%. For this reason, the costs-margins-taxes diagram for finished products is almost identical in the status quo and in Scenario 3, as can be seen in Figure 34 below – taking the example of anti-corrosion paint. The relative value contribution of the upstream part of the chain, other than final manufacturing and retail, is negligible.

[84] It is unclear whether bidders must pay any additional tax. According to the report on the cooperatives scenario, bidders should purchase a minimum of 1 metric ton and pay "Royalty, Transit tax @ Rs.3000 per ton" along with "any other taxes." Better World Foundation, "Designing innovative and holistic community-based business models for mica pickers in coherence and adherence with the policy," n.d. (after 2020)

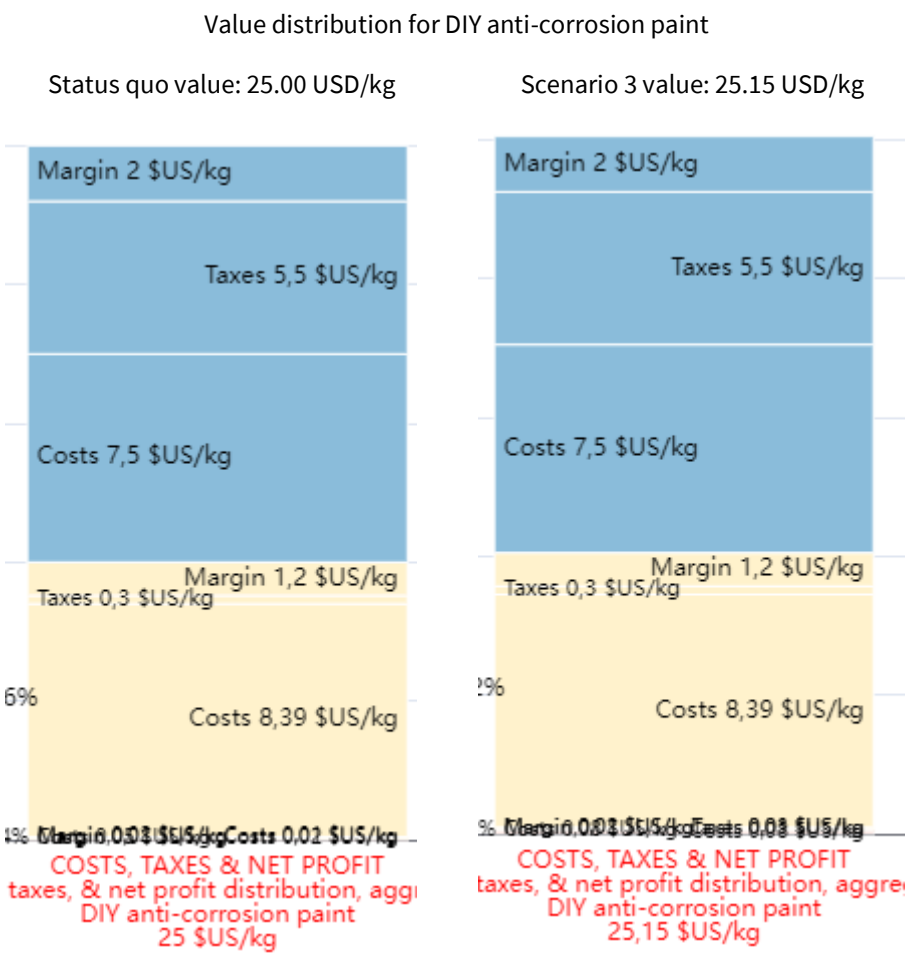

Figure 34. Value distribution for DIY anti-corrosion paint – status quo vs. Scenario 3. Source: BASIC, 2022

Only when semi-finished products are examined does the value distribution change appear more clearly. This can be seen, for instance, in the case of low grade silverwhite pigments. Although the cost of secondary processing does not change, the part of the value captured by mica pickers and factory workers, in red an orange, is much greater in the Scenario 3 diagram than the status quo – see Figure 35 below.

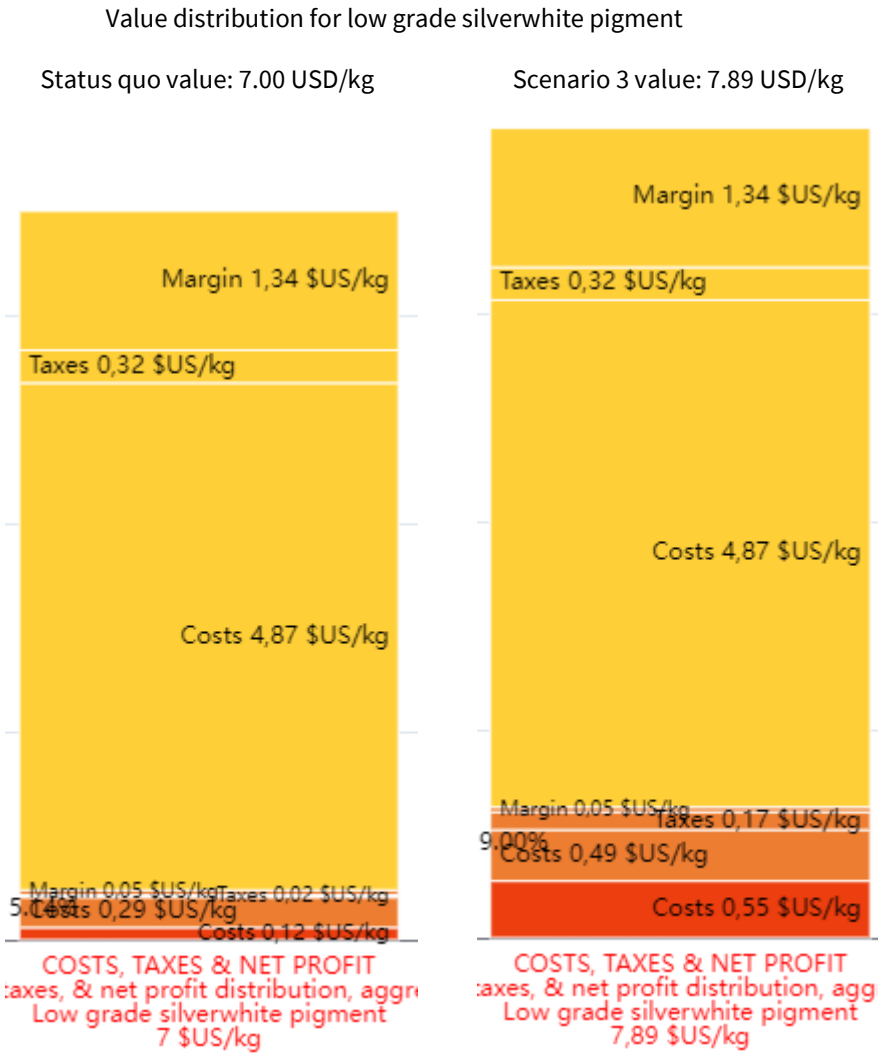

Figure 35. Value distribution for low grade silverwhite pigment – status quo vs. Scenario 3. Source: BASIC, 2022

3.5. Impacts on price, per product

The table below details the change in price for individual finished products in the status quo and under each of the three scenarios.

	Paints and coatings price (per KG)			Cosmetics price (per KG)			Vehicles price (per vehicle)	
Finished product	DIY anti-corrosion paint	DIY architectural paint (interior/ exterior)	OEM refinish paint	Nail enamel	Eyeshadow	Lipstick	Thermal car	Electric car
Status quo price	$ 25.00	$ 18.50	$ 105.00	$ 840.00	$ 1,750.50	$ 3,750.00	$ 28,128.45	$ 36,750.00
Scenario 1 price	$ 25.05	$ 18.52	$ 105.01	$ 840.00	$ 1,750.66	$ 3,750.03	$ 28,128.51	$ 36,752.21
Scenario 2 price	$ 25.10	$ 18.53	$ 105.01	$ 840.01	$ 1,750.83	$ 3,750.05	$ 28,128.58	$ 36,754.42
Scenario 3 price	$ 25.12	$ 18.54	$ 105.01	$ 840.01	$ 1,750.88	$ 3,750.06	$ 28,128.60	$ 36,755.17

Table 2. Price of finished goods studied in the survey, status quo and all three scenarios: legalisation, living income, and cooperatives.

Of the three cosmetics products, only one – lipstick –could be modelled as a finished product because it is the only one with a virtually identical, standard weight per item (3.5 grams). Eyeshadow and nail enamel are too variable in terms of packaging size (1 colour, 4 colour, 12 colour palette for eyeshadow; 5 mL, 10 mL, 15 mL for nail polish…); they are therefore only reported in KG above. If we apply a 3.5 grams per lipstick, the finished product price is as below. Note that this is just an indicative figure: the packaging (tube) is not taken into account.

Finished product	Lipstick price (per lipstick)	
Status quo price	$ 13.1250	*NOTE: The reference price per lipstick utilised was the average of Sephora-brand lipsticks, at 12.5 euros. We chose this figure because it is the least expensive and thus represents the "worst-case" scenario in terms of the impact of an increase in the price of mica. The median price for lipstick, when 30 brands were considered, was 30.89 USD.*
Scenario 1 price	$ 13.1251	
Scenario 2 price	$ 13.1252	
Scenario 3 price	$ 13.1252	

Table 3. Estimated price per lipstick in the status quo and all three scenarios, using 3.5g as the estimated weight per lipstick.

4. Conclusion

This study has examined the value chain for Indian mica, from the mine down to final consumer goods for three key sectors: paints and coatings, cosmetics, and automobiles (excluding electronics). As an output of the study, the mica value chain was modelled dynamically, in an online tool[85] that makes it possible to see both the current state of the value chain and what the chain would look like if mica pickers and factory workers were to be paid a minimum wage-level income or a living income.

The online platform traces value addition along every step of the chain. Starting from the mine, it identified five relevant outputs of primary mica processing at the export stage; around twenty intermediate products in the middle of the chain; and eight finished products at the retail stage. Each item in the model was assigned a price value, based on extensive interviews and bibliographical research. Where taxes and net profit margin were known, they were included in the costs/value-add in-between individual items. Given the focus on distribution of value in the upstream, Indian part of the chain, an effort was also made to obtain the detailed cost breakdown for the different Indian actors – dealers, aggregators, processors, and exporters, as well as cooperatives and the JSMDC in scenario 3.

Three scenarios were explored as variations from the current state of the value chain: (1) Legalisation, (2) Living income, and (3) Cooperatives. In the first scenario, the JSMDC organises auctions for dumps of *dhibra*; processors bid on these dumps and acquire a permit, and they employ mica pickers and workers at minimum wage – around 330 Rs/day, or 8,690 Rs/month. In scenario 2, the configuration is the same, but mica pickers and factory workers are paid a living income – 15,000 Rs/month for rural mica pickers, and 17,000 Rs/month for urban aggregators and factory workers. Scenario 3 departs more markedly from the status quo. It posits the existence of large mica picker cooperatives (500 members) who hold the mica mining permit and sell their mica to the JSMDC, which then puts it up for auction. In Scenario 3 as well, everyone earns a living income, including JSMDC employees.

Exploring the minimum income and living income scenarios in the value chain model makes it clear that in the current state, the greatest value-add is in the middle and end of the chain, after primary processing. The semi-finished mica products coming out of primary processing cost less than 1 USD/kg in the current state, but the products derived from them range from around 3 USD/kg for mica paper and board to 90 USD/kg for cosmetic-grade multilayer pigments. Further down the chain, value continues to accrue: the price per kg of OEM paints, for instance, is estimated as reaching 350 USD/kg. Retail also adds considerable value, such that finished cosmetics cost approximately between 900 and 4,000 USD per kg.

The consequence of this large value-add down the chain is that when prices are modelled to reflect a minimum wage equivalent or a living income for mica pickers and workers long with supply chain formalization under cooperatives, the impact on the price of intermediate products and finished retail products is negligible. In absolute terms, the extra cost at the retail stage is ordinarily less than

[85] http://micavaluechain.lebasic.com/

0.30 USD/kg,[86] or less than 0.1% of the per-kg price in most cases. This suggests that with a concerted, coordinated effort from actors down the chain, it should be possible to legalise and formalise the sector as well as pay a living income to mica pickers and workers with a minimal impact on both costs and net profit margins.

Legalising mica picking, whether through auctions to the highest bidder or through the creation of cooperatives selling straight to the JSMDC, also offers the potential for new revenue streams for the State. Goods and Services Tax is already in place for much of the chain but could hypothetically be better enforced in a legalisation scenario. In all prospective scenarios, the government earns money through the payment of mica picking licenses. In a cooperatives-with-auction scenario, the government may also choose to levy a tax on the auction price of mica. With more operators leaving the realm of illegality, it may be possible to tax corporate profits. A transit tax and royalty have also been mentioned as possibilities. Taking all of these taxes into account, in a situation where mica pickers organise into cooperatives and the JSMDC purchases and then auctions this mica at a living-income equivalent, total proceeds to the State from taxes on the scrap mica sector are estimated at 1,105,076,068.66 INR per annum, i.e., approximately 13.350 million USD.

Although ending child labour in the mica value chain is a complex problem, providing a living income for mica pickers and factory workers is a first and necessary condition for achieving this goal. The scenarios explored in this study are improvements on the current situation because they ameliorate incomes and working conditions for mica pickers and factory workers. The model that is a companion to this report suggests that if they are accompanied with sufficient political will, these scenarios could see the light of day, endowing the mica value chain with the sustainability and respect for human rights that its stakeholders wish to attain.

[86] Except for electric vehicles: in absolute terms, as detailed above, the price of electric vehicles can increase up to nearly 4.50 USD extra per vehicle (Scenario 2: Living Income). This is the highest absolute value increase of any finished product. However, in relative terms, and just like the other finished products, the increase is infinitesimal next to the price of the product itself (set at 35,000 € for one electric vehicle).

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This is the general bibliography for the report. The subset of the bibliography used to review profit margins for different industries is given in a separate bibliography.

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Annex 1: Modelling methodology

The purpose of this section is to lay out the main methodology utilised to build the mica value chain model. The overview section explains the difference between the mica value chain structure on the one hand, and prices and costs on the other. Then, more detailed information is provided on the sources of information that were used to determine the value chain structure as well as price/cost information, as well as how data points from these sources were amalgamated to arrive at a single average value for the purpose of modelling.

It is relevant here to underline that making choices for a model is difficult business, as it entails a making a drastic simplification of reality. Individual data points collected in interviews were sometimes incomplete; often, they were not as systematic or exhaustive as one might have liked, or the data points were difficult to "plug in" to the model. In these cases, an educated guess was made to exploit the data in a manner most fitting with the exigencies of the model. Likewise, a concerted effort was made to triangulate data from multiple data sources. In the model, all but a few values for product prices are based on at least 2 independent sources. This is discussed in greater detail below.

Overview

The mica value chain model is articulated around a succession of prices and costs, beginning with the upmost section of the value chain (mica picking) and going all the way to retailed finished product (finished product for the consumer, such as car, lipstick, nail enamel, DIY paint, etc.). There are two fundamental inputs that structure the model and enable it to work. These are:

1. The mica value chain structure, i.e. the architecture of the value chain. Figure 36 below illustrates this value chain structure, which is like a complex flowchart. The value chain structure retraces each individual step in the value chain from upstream to downstream, including convergences (several products used to produce the next one) and divergences (one product used to produce several different products), and providing a picture of mica's different transformations and uses. In the model, the value chain structure is visible and embodied in the model's flowchart-like structure, and in how different elements relate to one another. In the diagram below (Figure 36) as well as the one farther down (Figure 37), objects with prices are represented as rectangles along with their price, while operations (i.e. value-adding transformations) are represented as ellipses, along with their value added. An example of a decision concerning the mica value chain structure is the decision to retain 5 semi-finished mica products as an output of primary processing. This decision is independent of information about prices.

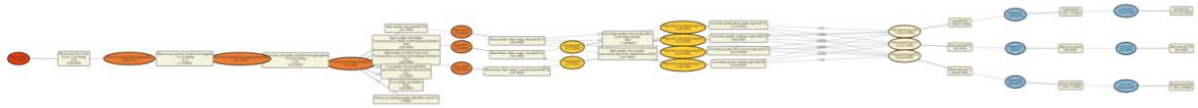


Figure 36. Simplified value chain structure for mica, from mining in India to cosmetic retail in Europe, i.e. the 'skeleton' of the value chain. Source: BASIC

2. Prices and added value for mica-based products, from mine-gate to processors and exporters all the way down to retailed finished products. The model distinguishes between *prices*, which represent the price at which an item is sold, from *added value*, which represent the value added by an operation between two products in the chain. For instance, the price of "Mica scrap, primary sorted and bagged" (mica collected by dealers) is around 13 Rs/kg, and the cost of the next operation applied to this mica is "Secondary sorting and bagging," an operation conducted by aggregators, which costs 7.72 Rs/kg. For the Indian part of the value chain, it was possible to arrive at a detailed cost breakdown for dealers, aggregators, primary processors, and exporters.

Figure 37. Example of a series of prices and costs in the value chain model. Source: BASIC

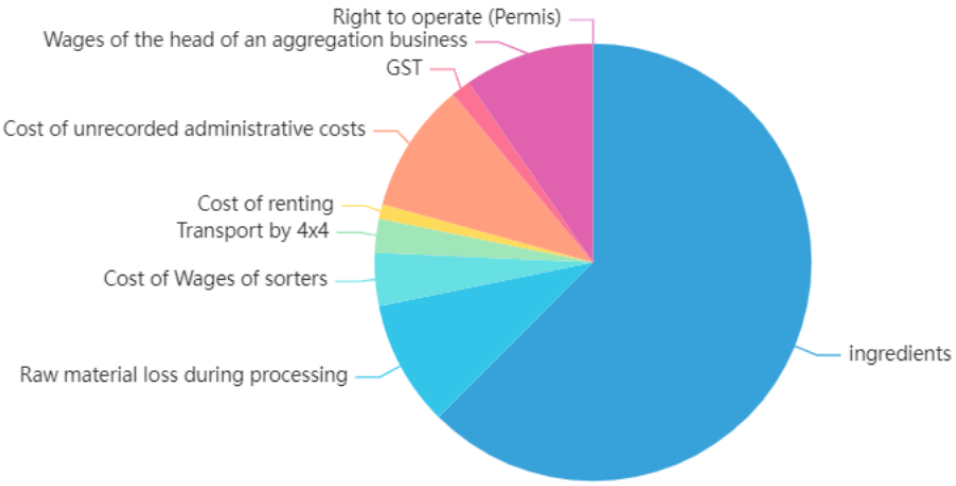


Figure 38. Example of a cost structure breakdown: Secondary processing value-add diagram

Mica value chain structure

The mica chain value structure was initially developed based on a bibliographical review encompassing how mica is mined, how it is collected and transformed, in what semi-finished and finished products it ends up, and (when this information was available) where in the world each of the links in the chain takes place. This led to an initial flowchart illustrating the scrap mica value chain from mine to finished product (see below Figure 39). Being a draft document from early in the study, there are some inaccuracies in this diagram: for instance, the role of calcined mica was unclear as of May 2022. Interviews subsequently helped to clarify what calcined mica is, and why and for what it is

used. The updated and corrected scrap mica transformation flowchart is given in

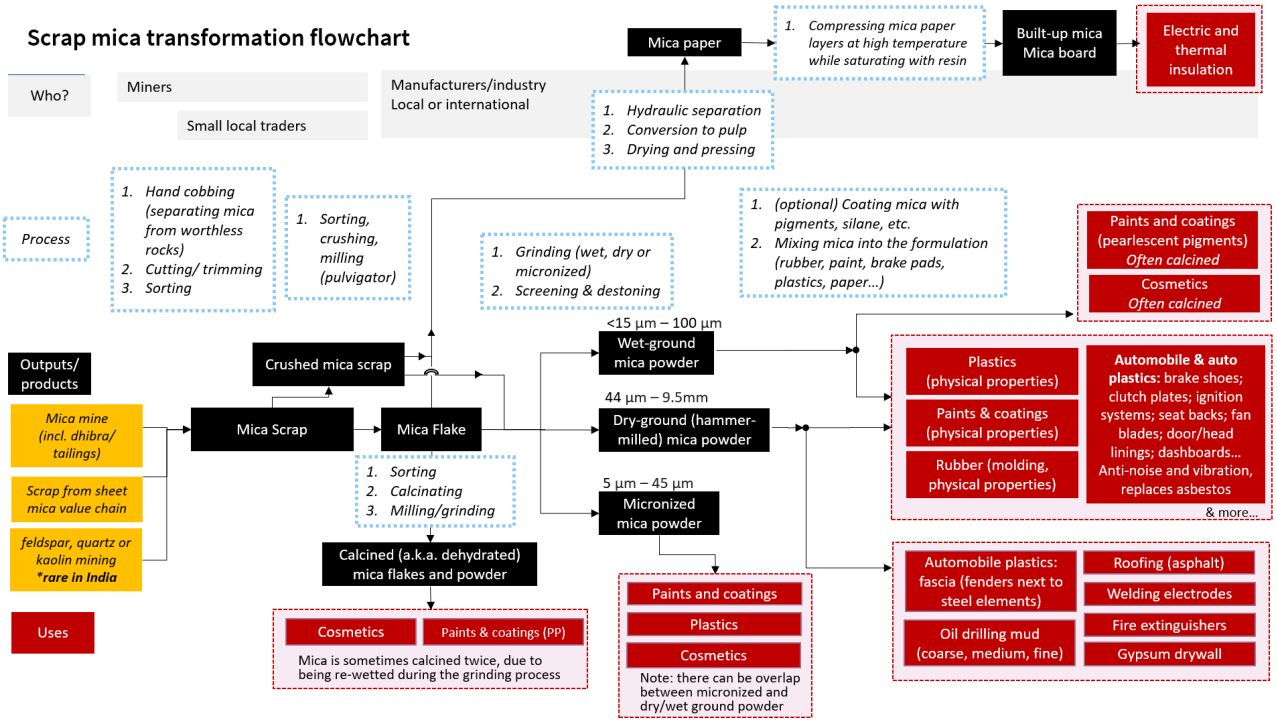


Figure 40 and in the main text of the report (Error! Reference source not found.).

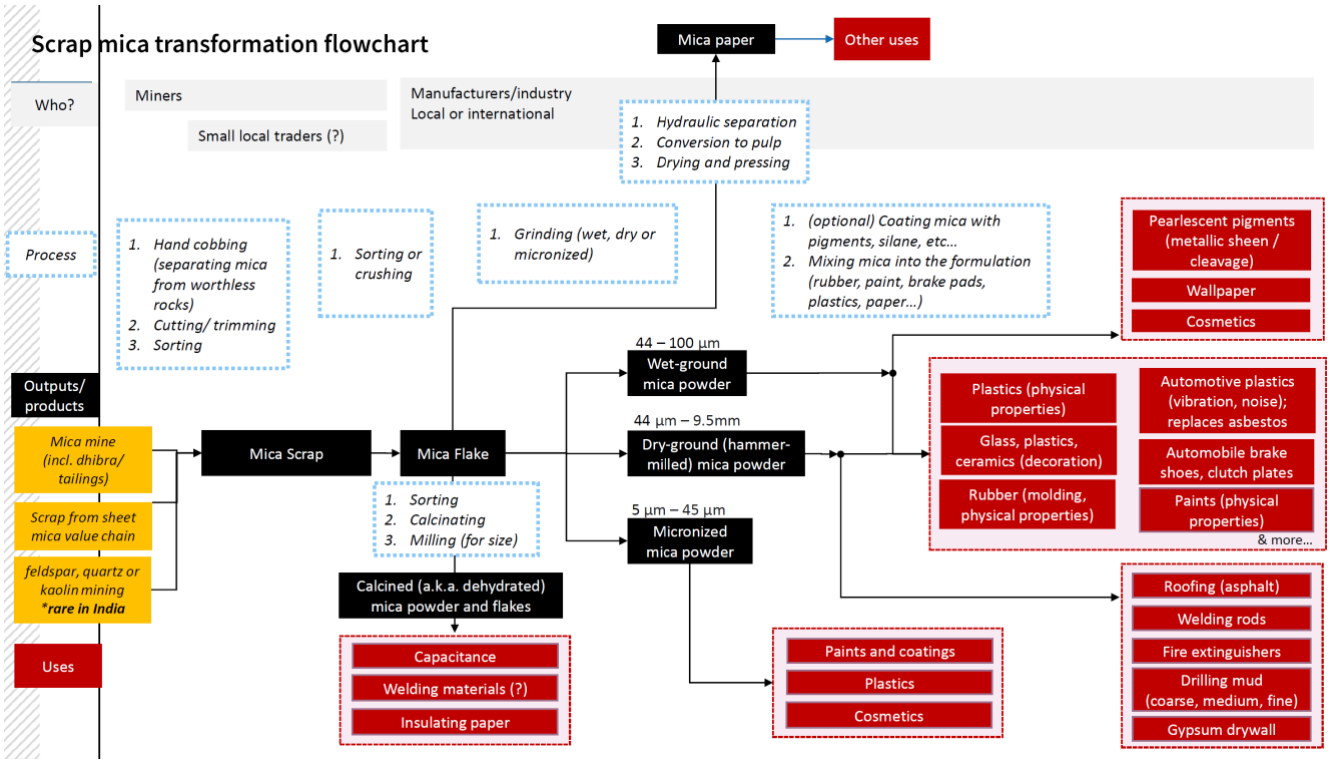


Figure 39. Simplified scrap mica value chart from the initial bibliographical review. Source: BASIC, May 2022

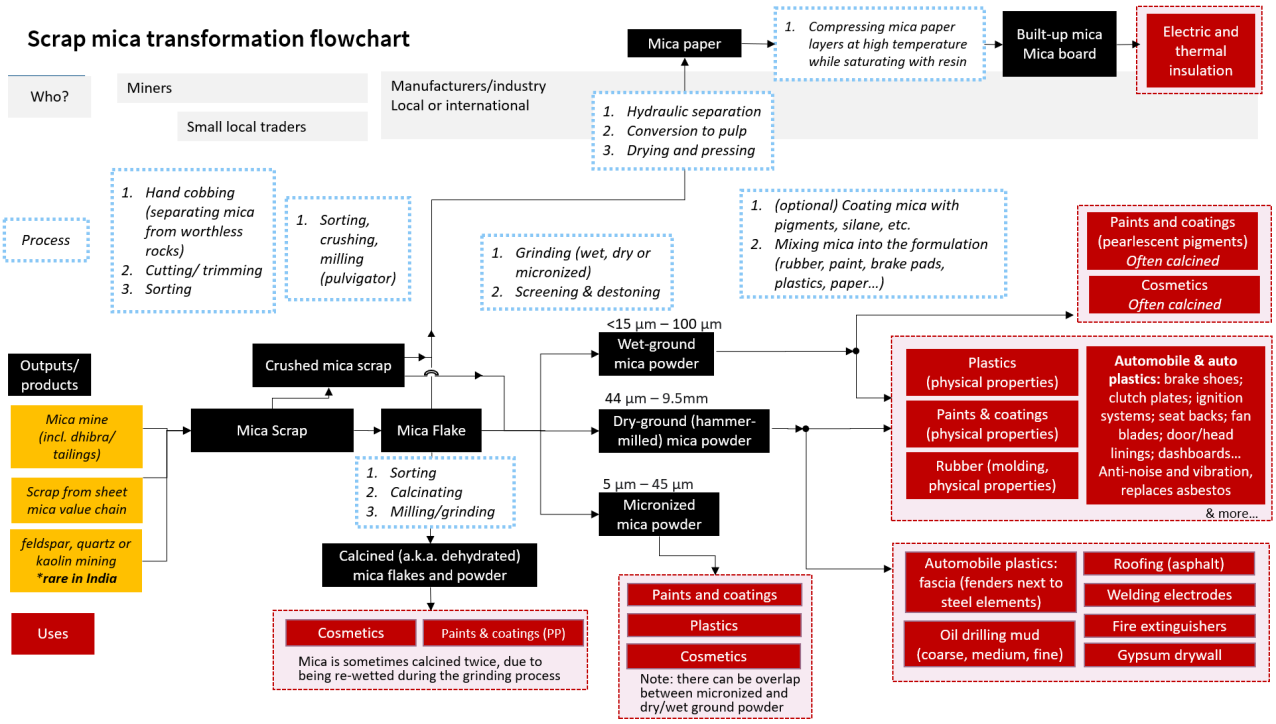


Figure 40. Simplified scrap mica value chart corrected at end of survey. Source: BASIC, November 2022

Subsequently, our interviews with RMI members and other stakeholders as well as more research made it possible to settle on a more detailed and more accurate vision of the value chain. Among the improvements were:

(1) breaking down the India value chain into picker → dealer → aggregator → processor → exporter
(2) designating key products that summarise the complexity of the products on offer, such as the choice of 5 outputs from primary processing
(3) refining our understanding of the pigments business as a 3x4 matrix of three grades of quality and four types of pigments (see next section for more detail)
(4) settling on a five-part breakdown of the value chain, from mica pickers all the way down to final consumer, as indicated in Figure 41 below:

1. Mica picking
2. Sorting, Primary processing, and Export
3. Grinding, Pressing, and Pigment manufacturing
4. Finished product manufacturing
5. Retail

Figure 41. Five-part scrap mica value chain, from mine to final consumer. Source: BASIC, November 2022

Altogether, this phase of the research made it possible to build the "skeleton" of the model – the first dimension of the model, i.e. the value chain structure. Simultaneously, interviews at this time were also indispensable to obtaining information on the second dimension of the model, i.e. prices and value added, as explained in the following section.

Value chain prices and costs

This section describes how prices and costs were attained for input into the value chain model. The model was inspired by the work that led to Figure 39, and it broadly reflected its structure. However, a key difference is that the model was to contain information on prices and costs, margins, and taxes. Further, the downstream – and to a lesser extent, the upstream – sections of the value chain were entirely revamped to account for the physical flow and transformation of matter as described by our interviewees. This section on values and costs is organised into five sub-sections – one for each of the five subparts of the value chain (see Figure 41 above).

In terms of sources, there were three main sources of information for obtaining data on prices and value added. They are:

1) General bibliographical research, on mining and mica picking in India and on the price of semi-finished and finished products derived from mica
2) Interviews conducted with BASIC, mostly with RMI members
3) Fieldwork conducted by RMI members in India

We also counter-verified our figures against the Descartes Datamynes database, which contains detailed customs data on every shipment of mica (HS code 2525) and worked mica (HS code 6814) out of India from the mid-2010s to today.

Value chain prices and costs: Mica picking

The mica picking stage of the value chain refers to the stage where dealers purchase raw material mica from mica pickers. It is possibly the single most important stage in the value chain, as this first price represents the income that mica pickers receive for their work. It is also the basis upon which

all subsequent actors build their prices, and it is the value that would move in the event that any of the scenarios described in the study were to occur. To obtain this figure, we used especially all of our information sources: bibliography, interviews, and RMI fieldwork.

In the real world and at present, the actual value of this parameter varies greatly, from place to place, and most importantly based on the quality of the product. For scrap mica, estimates range from a low of as little as 5.5 Rs/kg to a high of as much as 45 Rs/kg. Several interviewees used 10 Rs/kg as a simplified reference value. One important source for information on this data point was the work conducted by RMI's field workers, who were able to conduct multiple interviews with dealers to ascertain the price of mica but also their cost structure and how it is passed on downstream to aggregators. Taking all this information into account, we set the reference value of scrap mica at 8 Rs/kg.

Value chain prices and costs: Mica sorting, processing, and export

The next section of the value chain encompasses everything that takes place in the field, from the initial purchase of mica from the mica picker by dealers, through to secondary sorting by aggregators, though to primary processing into 5 major semi-finished products (plus one waste product with value of zero), through to export of these products to stakeholders downstream. To obtain the values in this section, we relied equally on all three main sources of information: bibliography, interviews, and RMI fieldwork, plus counter-verification with customs data.

Both price and costs data for this section of the chain was heavily supported by interviews and fieldwork by RMI staff, who conducted structured interviews with dealers, processors and aggregators. For prices (rectangles in the model), raw data was often in the form of price brackets reflecting lowest to highest quality mica. We chose intermediate values within those brackets – starting with a simple average, and then adjusting based on the costs of the step preceding the rectangle if need be. Prices and costs were counter-checked with existing bibliographical information, other interviews conducted by BASIC, and customs data to make sure the figures made sense.[87]

At these stages, there begin to be losses along the chain. For instance, as mica is progressively cleaned and sorted by dealers and aggregators, there is a loss in the volume of mica on the order of 5 to 10% at each step.

Some additional assumptions at these stages:

1) We consider primary processing to be a single operation of transformation, which produces five semi-finished products and a sixth item – waste by-product not suitable for sale. The reason there is waste is that while virtually all powdered mica by-products can be sold (in particular to the petroleum industry as an add-on to the slurry used in drilling), not all mica processing factories go to the trouble of selling their leftover powder on this market.

[87] The counter-verification against customs data did not uncover significant differences with the values of the 5 semi-finished mica products, with the exception of high-quality mica powder, which priced at about 50% higher than our value from interviews and RMI fieldwork. This discrepancy is likely because our interviewees in India had lower standards for "high quality powder" than the standards we used to filter the customs data. As is often the case with mica, quality has a high impact on price.

2) Further, in our model we took care to take into account that the outputs of any added-value calculation be coherent with the data, according to the following formula SUM(Quantity or ratio x Price of each output) = Scrap mica content + Costs + Margins.

Value chain prices and costs: Secondary processing

The secondary processing section of the value chain covers the activities of pigments manufacturers, mica board manufacturers, and manufacturers of bituminous sheets for vehicle droning insulation. For secondary processed mica, we based our prices on extensive interviews with RMI members on their production costs and sales prices for various products, complemented with bibliographical research.

In the case of pigments, our research quickly identified that pigments were both of four different types (i.e., chemical composition and industrial process) and three different grades (from lowest quality, for DIY paint to highest quality, cosmetics grade pigment, with automotive pigments somewhere in between). This meant that we needed to fill a three-by-four price matrix. This was done by cross-checking every data point given by interviewees, particularly RMI members, and assigning it and any others like it to the correct section of the matrix. The values rendered into the model were the result of averaging all the values collected in the research, with minor adjustments to give greater weight to sources that appeared more credible, precise, or otherwise well-informed.

As in the previous section, there are losses at the secondary processing stage. We estimate them to be on average around 10%, but with considerable variation from stakeholder to stakeholder.

Value chain prices and costs: Finished product manufacturing

As for secondary processing, for finished products, we based our prices on extensive interviews with RMI members on their production costs and sales prices for various products. This was complemented with bibliographical research on the same. Wherever information was available, we factored in average margins per company sector.

At this stage of the value chain, we did not give a detailed breakdown of costs for all the value-add operations. This is because collecting such information was prohibitively time-consuming, given the variety of stakeholders and the complexity and worldwide nature of such information. Only for the upper end of the chain in India were we able to obtain detailed cost breakdowns, thanks to the presence of additional manpower for research, as well as a relatively straightforward and narrow research mandate (dealers, aggregators, processors). We did, however, obtain information through interviews and bibliographical research on average margins for the largest classes of industrial/final product manufacturer in the value chain, i.e. pigments manufacturers, OEMs, cosmetics manufacturers, and paint manufacturers (for bibliographical sources see Bibliography – Company profits).

Value chain prices and costs: Retailing

Our model assumes that retailers add 100% to the value of the finished product, i.e., they sell a product for double the price at which they buy. This is based on two sources: first, an interview with an expert in the retail sector, who explained that before-tax price to consumers is typically about double the out-of-factory price. Second, this value squares with BASIC's own research into the food sector, where practices are similar: out-of-factory price doubles to make the before-tax customer price in retail. In our model, out-of-factory prices for finished products are based on this backwards calculation: from the tax-free retail price, the price is halved to obtain the out-of-factory price.

We set the VAT rate at 20% percent, taking as our basis European countries – France, Germany, and the UK with 20%, 19% and 20% respectively. For reference, in the USA the median value added tax rate (combined state and local taxes) is 6.98%.[88]

Scenario building

Prices and costs for the purpose of scenario building relied heavily on interview data collected by RMI staff in India, alongside bibliographical research both online and in reports on the mica sector (see "Bibliography – General" section). Some figures were calculated based on a combination of raw data and back-of-the-envelope estimates, such as amortisement costs for vehicles or the cost of wages for mica sorters at the secondary sorting and aggregating stage.

Scenario building entailed identifying new costs that would have to be borne by stakeholders along the chain in each of three conditions: legalisation, living income and cooperatives. For Scenarios 1 and 2, we make the strong hypothesis that dealers, and aggregators/processors are able to transmit the cost increase down the chain rather than paying it themselves. In other words, none of these upstream actors need to lower their margins. In Scenario 3, we recreated an entirely new value chain and filled in its values from scratch (new hypotheses and new stakeholders along the chain).

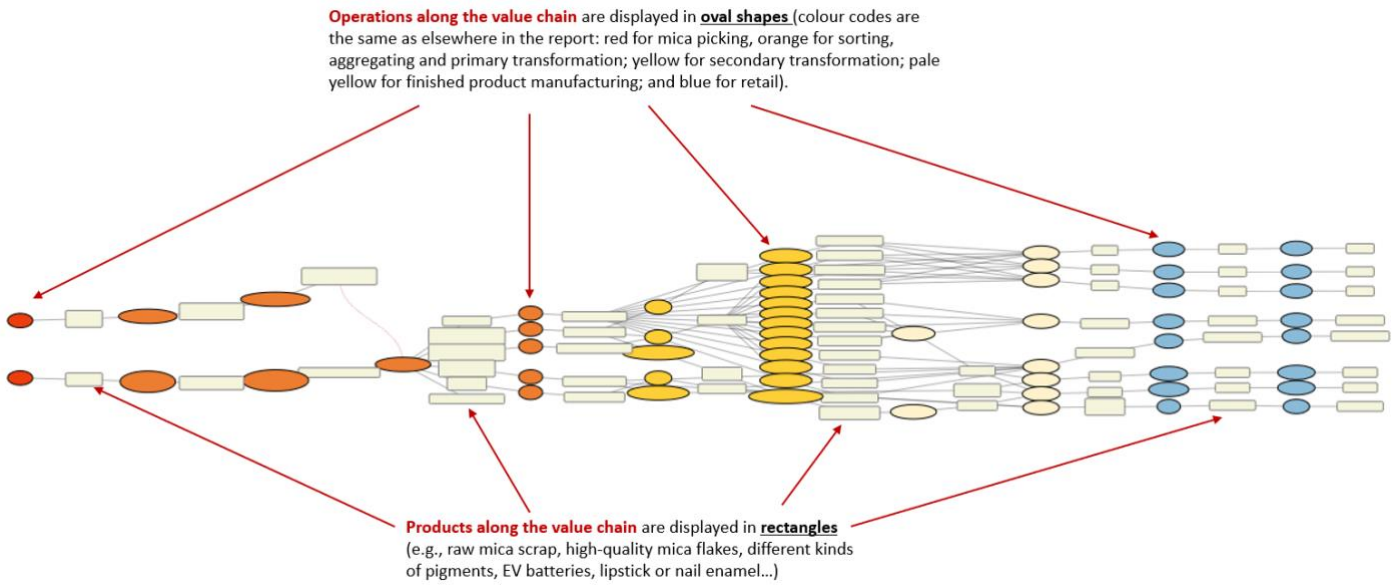
Price increases were transmitted along the chain in absolute terms, proportional to the contribution of mica to the products along the chain. In other words, once the model leaves India (after export), we hypothesise that absolute value increases are transmitted down the chain, prorated for the content of mica in any given product. This is why in some cases, the absolute increase in price for mica is lower downstream of semi-finished products (for instance, pigments), i.e. the mica price increase may be higher at the primary processing stage than it is at the pigments stage because mica content in the downstream product is less.

[88] See https://taxfoundation.org/2022-sales-taxes/ for state and local taxes.

Annex 2: Guidance document for the online tool

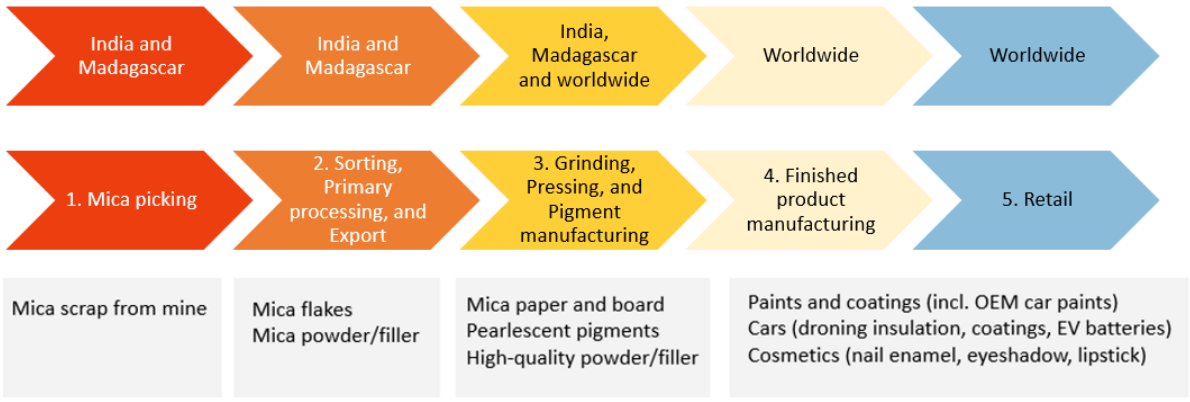
Contact for the website: theodore@lebasic.com

This website works first with a detailed diagram that shows the different modelled products and physical operations along the chain. Operations along the chain are displayed in oval shapes, while products along the value chain are displayed in rectangles:

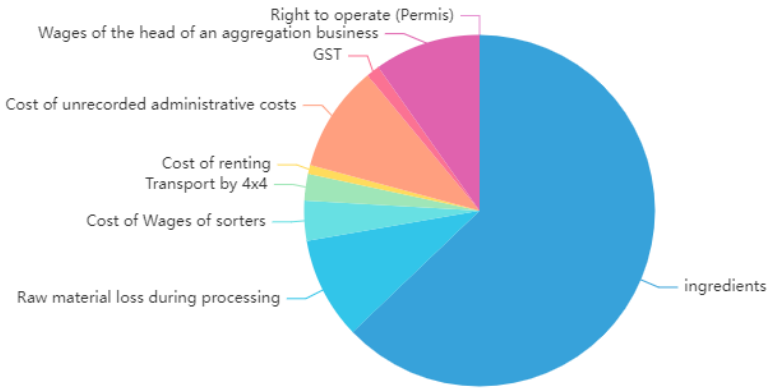


Throughout the model, colour codes correspond to the different stages in the value chain:

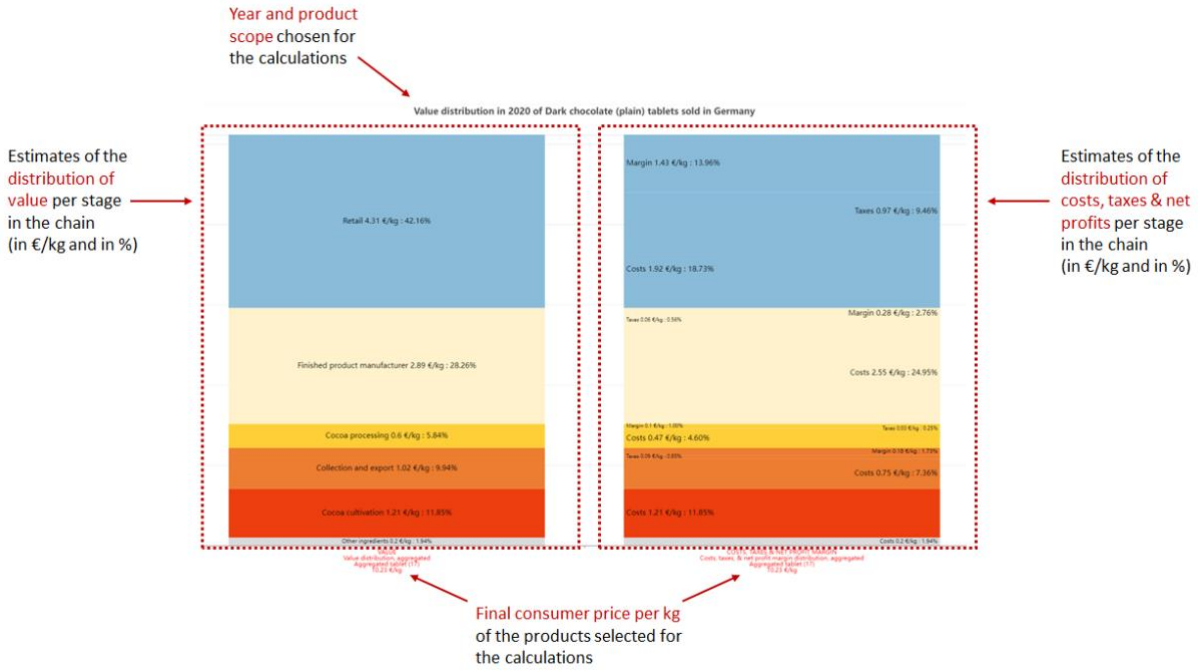
- Red: Mica picking
- Orange: Sorting, Primary processing, and Export
- Yellow: Secondary processing (Grinding, Pressing, and Pigment Manufacturing)
- Pale yellow: Final product manufacturing
- Blue: Retail



When clicking on any of the operations displayed in an oval in the Value Chain diagram, a pie chart appears below showing the breakdown of the costs, taxes and net profit margins associated with this operation. By moving the mouse pointer over this pie chart, it is possible to display the exact amount (in USD/kg) and the proportion of total costs (in %) of each slice of the chart. The below is an example obtained by clicking on "Secondary processing and aggregating" in the Current value chain tab:

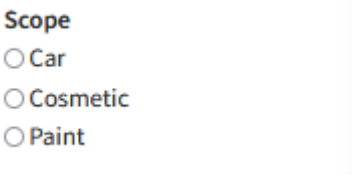


When clicking on any of the modelled products displayed in a rectangle in the Value Chain diagram, the distribution of value, cost, taxes, and net profit margin from the mining up to this specific modelled product appears.

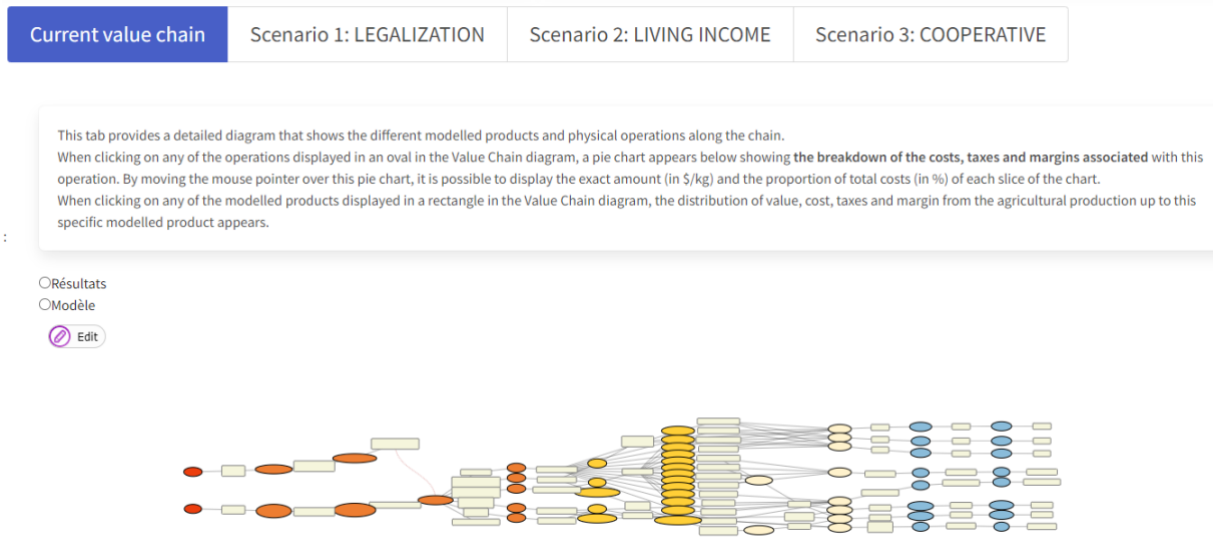


Each colour shows you the average amount of value, costs, taxes and margins modelled for the five main typical group of actors of the value chain, as detailed above.

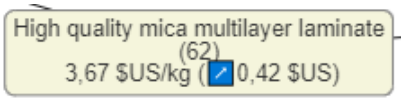
On the left of the webpage, you can select to display only one specific sector:



The model also enables you to choose to visualse the impact of each of the three scenarios, by clicking on the large buttons on top of the screen.

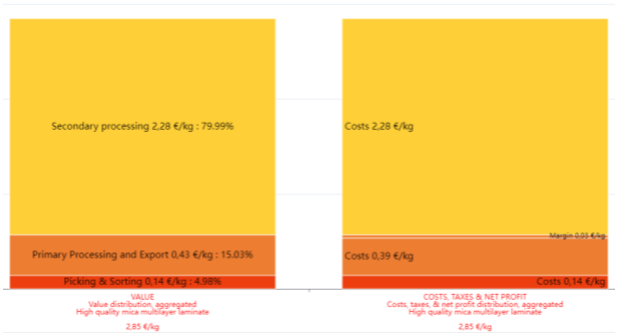


For each product (rectangle) in the value chain, the new price resulting from the scenario is given inside the rectangle, alongside the increase in price marked by parentheses and the ↗ icon. For example, in this example taken from Scenario 1, the new price of high-quality mica multilayer laminate is 3.67 USD/kg, which is 0.42 USD/kg above the price of the status quo:

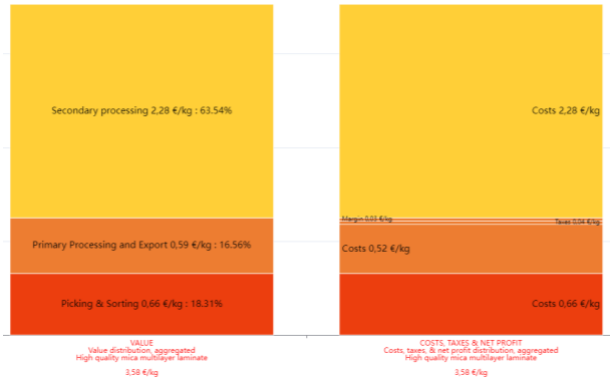


When clicking on any rectangle (product) in the model within an individual scenario, it becomes possible to see the difference between this scenario and the status quo. Specifically, upon clicking on a rectangle (product), two bar charts appear below: the first is the value distribution graph for the current scenario, and the second is the value distribution graph for the status quo.

Here is an example for high quality mica multilayer laminate in Scenario 3: at left is the status quo graph, and at right is the Scenario 3 graph. The greater share of value captured by mica pickers and factory workers, in red and orange, is clearly visible:

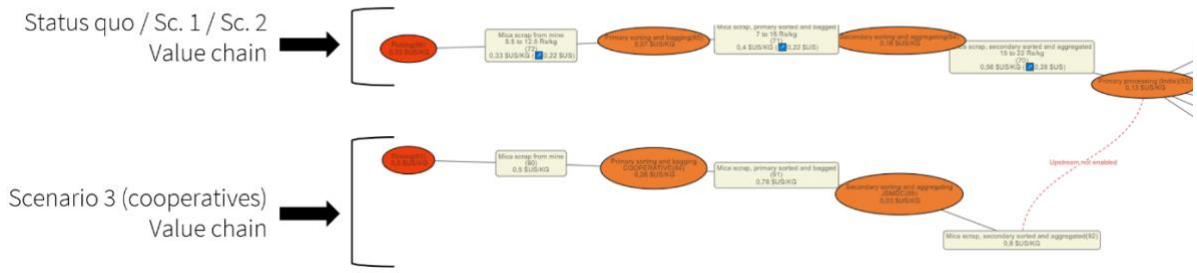


Value distribution for multilayer laminate, status quo
Price: 2.85 USD/kg



Value distribution for multilayer laminate, Scenario 3
Price: 3.58 USD/kg

With Scenario 3 being the most advanced and sought-after of all scenarios, we decided to make it easier for users to benchmark the different scenarios (status quo, 1, and 2) against that Scenario 3. Consequently, the model displays the upstream part of the Scenario 3 value chain on the side of the relevant scenario value chain. The Scenario 3 value chain can be recognsed from its counterpart by its branching off to the side as well as the presence of a dotted red line:



In Scenario 3, the additional value chain displayed is that of the status quo/current value chain.