working paper

Screening for human rights impact in corporate supply chains

A methodological proposal for quantitative assessment and valuation — Novartis case study

valuing nature

ecometrics

January 2021

Autors

Samuel Vionnet	Valuing Nature
Damien Friot, PhD	Ecometrics
Sonja Haut	Novartis
Raju Adhikari	Novartis

Corresponding author
Samuel Vionnet — sv@valuingnature.ch

Suggested citation

Vionnet et al. (2021) **Screening for human rights impact in corporate supply chains - A methodological proposal for quantitative assessment and valuation - Novartis case study -** Working Paper - Valuing Nature.

Design
Lucía Menéndez De la Riva

Content

1.

Introduction

The private sector is increasingly under pressure to address human and labor rights issues worldwide[1], not only in their operations but also in their supply chains. Companies with complex supply chains are facing operational and reputational risks as a consequence of economic globalisation. However, companies' visibility of their supply chain is limited, very often to a selected few direct suppliers which limits the capacity stakeholders, including the companies themselves, to take action and address those risks and impacts. Reducing risks and creating social value, aligned with the SDGs, is key to long term value creation.

Despite past efforts around transparency, selection and knowledge of suppliers, issues such as child labor, forced labor, corruption, living wage, working poor, and so on, are still very present in many regions of the world connected to the global economy.

Several reasons can be listed for these lack of actions, among which, the absence of adequate tools for screening human and social capital risks over entire supply chains and prioritization. A series of approaches do already exist (including supplier audits, partnerships with NGOs and research institutes or consulting services providing prioritization maps, etc.), but does not provide a granular, transparent and comprehensive enough view.

We identified three main limitations of current approaches:

First,
companies mostly rely on generic external data not connected to their own activities, or purchasing patterns (e.g. a generic map of countries showing high risks of child labour) rather than on data connected to their activities (e.g. considering the size of their activities in a particularly risky sector in a specific country).

Second,
the underlying data used in these assessments usually considers issues from a limited viewpoint, for instance sectorial or geographical coverage, while both are needed to understand where to act. Additionally, when single issues (e.g. child labor) are considered in isolation to overall human rights issues, it greatly limits the capacity to generate valuable insights.

Third,
the supply chains beyond the first tier are rarely considered because of a lack of information on how they are constituted.

1 https://social-human-capital.org/protocol

In this paper, we present a methodology to assess the human and social capital risks (in particular the human and labor rights issues) in the operations and supply chain of a company in order to go beyond these limitations. This approach is based on economic and human right statistics, as real data on labor/human risks is extremely difficult to collect for a large company, with potential blocking points to obtain traceability on goods and services. Using the large amount of public data currently available and modern quantitative methods enables us to bring valuable insights to companies for addressing human and social risks in their supply chain, and refining their sustainability strategy.

Assessing vs. measuring

It is important to emphasize that this approach enables assessing (i.e. estimation done through a model, based on a range of secondary data sources) —but not measuring (i.e. collecting specific primary data from a supplier on its practices)— the likelihood and impact of potential risks in a company's supply chain. Results reflect the average impacts and risks according to the structure (sector and location) of the spending of a company and existing public data and statistics. We are not claiming that the identified cases are real occurrences of human rights issues, but that their likelihood and impact is high according to current available data and knowledge.

In general, risk assessments allow the high level prioritization of the areas that would require a measurement on the specific risks (through audits for instance). As such, assessing and measuring risks are complementary.

This approach combines company-specific data (spent per sector and country) with a detailed model of the world economy (global Multi-Regional Input-Output model) extended with human/labor rights indicators (e.g. the number of working children) per sector and country. It enables re-constructing the most likely (i.e. average behaviour/relationships) value chains of a company and quantifying each indicator per sector and country. This evaluation is transformed into a risk assessment by applying an impact valuation approach (i.e. social and human capital accounting) to estimate the economic costs to society of each human/labour rights issue, adding thus a layer of prioritisation (per issue, country, supplier, etc.).

This approach is part of an emerging field, within the multi-capital accounting field[2], currently made possible by the increased availability of data, models and maturity of expertise. Few other publications exist on this topic. First attempts have been made, for instance, by the "social hotspot database[3]" focusing on products Life Cycle Assessment rather than on organizations, and using subjective value-based aggregation methods of the indicators.

2 https://capitalscoalition.org/

3 http://www.socialhotspot.org/

Interestingly, other researchers recently published a similar approach (Measuring child labor, forced labor and human trafficking in global supply chains: a global input-output approach—technical paper[4]). This approach is focused at sectorial and regional level and uses a very similar approach described in this paper, however it does not connect the results to specific companies supply chains.

Adding to those initiatives, the presented approach goes beyond current practices and innovates on three aspects:

Cross topics comprehensive view

The range of human rights topics addressed is very wide, avoiding a view in silo that is often seen those days (e.g. gender equality, child labour, etc).

Value chain scope

The scope of the analysis is wider than just direct operations or direct suppliers, covering the full supply chain of any company.

Quantitative indicators

Indicators are developed for quantitative risk assessment, including the option to express them through economic costs to society and business costs.

Applying the approach to the case of Novartis allowed us to deploy the approach and identify the labor rights risks across the company supply chain. It is important to state again that we are assessing, and not measuring, the likelihood and impact of the potential risks to Novartis suppliers. We are not claiming that there are real cases of human rights issues. Nevertheless, the results developed in this paper will provide valuable insights to companies, in particular Novartis, to continue developing its sustainability strategy.

4 Alsamawi et al. 2019. **Measuring child labour, forced labour and human trafficking in global supply chains: a global input-output approach.** 8.7 Alliance. ILO, OCED, IOM and UNICEF.

2.

Approach to quantify human and social capital risks

Our integrated model relies on four blocks. The central block is a representative and coherent model of the world economy, derived from Input-Output tables published by national offices of statistics of 44 countries (representing more than 90% of the world economy) and 5 regions (to cover the data gaps to cover the rest of the world). This model, called Exiobase[5], has been compiled and harmonized into a consistent model through an EU funded research project. Domestic economic activities and international trade are modelled for around 200 activity sectors per country/region.

The integrated model connects the global economic model with the spend of a company (second block) on one side (per activity sector and country) and with human right issue data sources (third block) on the other side (see **Figure 1**). The fourth block is the economic impact valuation approach (cost to society pathway) applied to the risk output provided by the model.

Figure 1

Illustration of model first three key pillars of information combined together to provide potential risk and impact data over the entire supply chain of a company.

5 The dataset is publicly available at www.exiobase.eu.

Connections between blocks are based on bridge tables matching the different classifications (between sectors and between countries/regions). Spend data is available from internal reporting systems of companies and is usually already aggregated and harmonized between categories of suppliers. The combination of the spend with the economic model enables the computing of all activities generated by a company globally through its supply chains, including all tiers. Different indicators can be generated, for instance on value-added or taxes collected per sector and geographies. Labor requirements per skill level (low, medium, high) can also be computed per sector in each country/region, which is an important bridge to the social indicators, as very often social risks can be found in low-skill jobs and is a factor of employment volume. The social indicators are computed by combining the output presented previously with data collected from publicly available statistics on social issues (mainly from international organisation like ILO, UNICEF or the World Bank). Most of the data collected is either available for a limited number of countries or sectors, but rarely for both comprehensively. To address the data gaps, the collected data is extrapolated to cover all countries and sectors using statistical techniques and similarities, e.g. a similar level of GDP per capita in PPP or being on the same continent for countries, and e.g. per type of sector (primary, secondary, tertiary) for sectors. The selected approach is based on expert advice.

The indicators covered, in the case of Novartis, are:

Child labor

Work that deprives children of their childhood, their potential and their dignity, and that is harmful to physical and mental development.

Forced labor

All work or service which is exacted from any person under the threat of a penalty and for which the person has not offered himself or herself voluntarily.

Corruption

Inefficiencies in tax collection and spending coming from the corporate taxes.

Gender income inequalities

Gap of income between men and women, usually in favor of men.

Migrants

Number of migrant participation in workforce per origin and status.

Working hours

Number of additional hours worked beyond the local standards, usually between 40 and 45 hours per week.

Working poor

Workers earning less than US$1.9 per day, with additional classification up to US$5.5/day.

Living wage

Wage gap to living wage, the latter defines a basic but decent level of living.

Occupational safety

Accidents and fatalities.

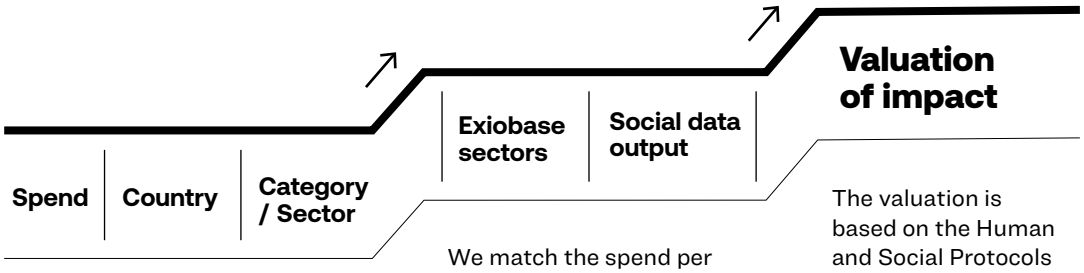
Additional information on each indicator including its data source, the applied matching approach and the impact valuation method is provided in Appendix 6.1. Note that an indicator can represent both a positive and negative impact in this methodology.

The fourth block of the methodology relies on impact valuation methods, under the Human and Social Capital Protocol published by the WBCSD and complemented by specific methodologies developed by Valuing Nature (see appendix 6.1 for more info on the valuation methods). The impact pathways used focus on the cost to the society, although a more direct pathway focused at cost to business could be used as well as an alternative in the future.

The linear process for the calculation of the potential social risk and impact is provided in **Figure 2**.

Figure 2

Linear process illustration to calculate potential social risk and impact.



Spend data from company categorized per country and spending category / sector.

We match the spend per country / sector of the company's spend with the secctor / country of the **Exiobase data.**

By multiplying the spend amount by the exiobase indicators (expressed per unit of spend), we calculate how much **social impact** relates to the company spend.

We account not only for the tier 1 but **all tiers** in the suppy chain of the company.

The valuation is based on the Human and Social Protocols available publicly and together with the methodology developed by Valuing Nature.

The valuation reflects value to society (damage or benefit) and allows to compare different social indicators with the same unit to understand their relative importance.

The results of the integrated model are available both in term of quantitative output (e.g. number of potential cases of child labor) and impact (e.g. cost to society of the potential child labor cases).

They are available at high granularity (per sector in each country/region of the model, and per tier in the supply chain).

According to the level of granularity of the spend, the results presentation can be customized in order to be classified per:

Tier level and country	Expressed per **tier level and country** through the **entire supply chain** (usually, splitting the first tier from the other tiers since the relationship with the company is different).
Country/ business unit	Classified using the spend information per **country/ business unit** where the **spend originated**, where the **direct supplier is located** or where the **impact occurs** (usually a spend originates from a single country, to a direct supplier in a single country, but the impact is usually spread worldwide in many countries).
Purchasing category	Classified per **purchasing category** (e.g. marketing, transport, plastic packaging, etc) or per **economic activity sector** (e.g. defined by the activity sectors of Exiobase dataset).

This flexibility in the analysis and its traceability allows for more relevant insights to be derived and reported. It reaches a level of transparency that has not been matched in the past.

There are however a few limitations that are important to consider:

- Matching the spend categories of a company to the sectors of the global economic model data is not always straightforward, as very often a different system of categorization of activities is used. This introduces uncertainties in the results (uncertainties can be estimated by running different set of matches and looking at the differences).

- Matching the categories of the social indicators to the sectors of the global economic model is based on expert assumptions since those indicators are often computed per country from different agencies, but not very often per sector. The used assumptions/models could be refined.

- The global economic model also has limitations. It is a model of the world economy requiring assumptions for its construction. The model is also initially based on a model of the economy from 2011, which has been extrapolated to 2019 for this exercise based on inflation and exchange rates mainly. In addition, several Input-Output databases do exist and differ in the number of included sectors, geographical coverage and labor indicators. The choice of Exiobase has been driven by the fact that its credibility is established since it has been built by a consortium of renown European universities and is currently in by governmental agencies in several countries, e.g. in Switzerland and the EU. Exiobase has a relatively good sector coverage but lacks spatial granularity (for small economies in particular), which could be improved for instance.

- The impact valuation field is quickly evolving and expanding, but does not currently have an international standard for valuation factors and valuation techniques. As much as possible, our valuation techniques are based on real economic variables, such as income, market prices, replacement costs, etc. We try to avoid basing the valuation as much as possible on stated or revealed preferences, as these methods lacks direct connections with the real economy.

- Results express a potential impact or risk that is modelled. The reality of human rights issues observed in the real supply chain of a company can be very different since it is influenced by various factors such as Codes of Conduct and other relationships put in place with suppliers.

3.

Selected results for Novartis

Given the sensitivity of the topic of human rights for any company, it is important to remember that we are here assessing potential risks and impacts that may, or may not, be occurring. The purpose of this analysis is to provide insights on what are the biggest human rights risks in a company's supply chain, and where are there geographically and in which sector. The insights also provide an understanding of human rights risks and impacts prioritization, through the lens of societal costs.

The following results are an illustration of the application of the approach to real data from a large multinational company: Novartis (pharmaceutical company). The objective is to demonstrate the added value of the approach, not to provide a comprehensive analysis of Novartis supply chain's human rights risks and impacts.

Only a few indicators are analyzed here after at a high level, given the large volume of results generated during the study and the objective of illustration that we have. The whole spend of Novartis is accounted for: above approx. US$20 billion overall, detailed for 418 purchasing categories (matched to the 200 sectors of the global economic model) and over 169 countries (detailed either by business units or suppliers, also called vendors for each country). In order to protect confidentiality, aggregation techniques have been used, which limits the analysis and interpretation that can be derived from the results presented in this paper.

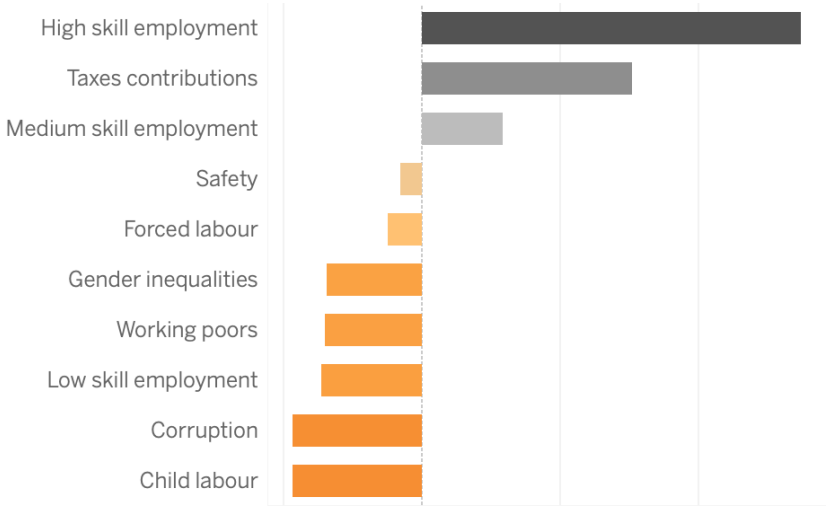
The overall supply chain of Novartis involves an estimated 677'000 full time equivalent employees, calculated with our model: 27% at high skill, 58% at medium skill and 15% at low skills employement. Most of the jobs are created in Asia, Western Europe and North America. As the human and social capital risks are mostly related to the generation of employment, it is important to keep these numbers in mind for the analysis of the following results.

3.1 Overall human and social capital risks' value of Novartis supply chain

The **Figure 3** shows the economic impact for the society of a selection of the indicators covered in our analysis, aggregated at the highest level. It serves the purpose of high-level prioritization, which is the first added value of this type of analysis. The net value to society is overall positive, although it is not necessarily the objective of the analysis to aggregate the results into a net result, and we intentionally removed the scale to focus on the relative importance of each topic.

Figure 3

Economic impact (positive and negative) of a selection of social indicators covering the entire supply chain of Novartis.



We observe that high and medium skills employment, as well as taxes contributions, overall bring a positive impact, although large variations exist depending on the region. This positive value is linked to wages from medium and high skill employment, which is higher than the living wage and therefore generates a positive impact for the lives of many employees. Taxes contribution (corporate taxes on production added-value) contributes positively to social value, while corruption limits its actual full potential. The other topics assessed show a potential negative impact starting from safety (both injuries and fatalities), forced labour and gender inequalities (based on the difference of compensation between women and men). Working poor and low skill employment are closely connected, as they share the same driver (low wages), while working poor is a specific category of low skill employment, defined by the poverty line suggested by the UN (below US$1.9 to US$5.5 per day). Both, working poor and low skill employment generate a net negative impact, as the level of wage are below the living wage threshold, which defines a basic but decent life in line with human rights. Finally, child labor shows the biggest

potential negative impact, not necessarily driven by the number of cases, which is not relatively high given the activity sectors involved in the supply chain of Novartis but driven by the potential negative societal impact each can have. Indeed, child labor has long term consequences that generate an important negative social value, reducing the opportunities for the future life of the children involved.

A regional and sectorial analysis brings more insight than the overall aggregated results. **Figure 4** and **Figure 5** present the split of each indicator per broad geographical region and aggregated activity sector. We observe for instance that low skill employment negative impact mostly comes from the Africa region and India/Asia in particular (connected mostly to indirect suppliers, from tier 2 and above), while child labor potential issues come from Africa as well as India and Asia mostly (involving mostly Tier 2 suppliers, although potentially Tier 1 as well). We observe in general the typical polarized picture of the world between developed and developing countries.

Those results, when analysed under the lense of the spend, help prioritize the business units, suppliers and regions where more interventions are needed. It usually provides a different prioritization than business-as-usual and common risk assessment processes existing in companies, which is a good challenge for routine practices of risk assessment and suppliers relationship management within companies which systematically focus on the known common issues connected only to the biggest direct suppliers.

The results could be broken down per tier in the supply chain, in particular splitting the 1st Tier (direct suppliers to Novartis) from the other upstream tiers. They are however aggregated here for simplicity reasons.

Figure 4

Regional analysis of the cost to society (impact valuation) of selected social indicators.

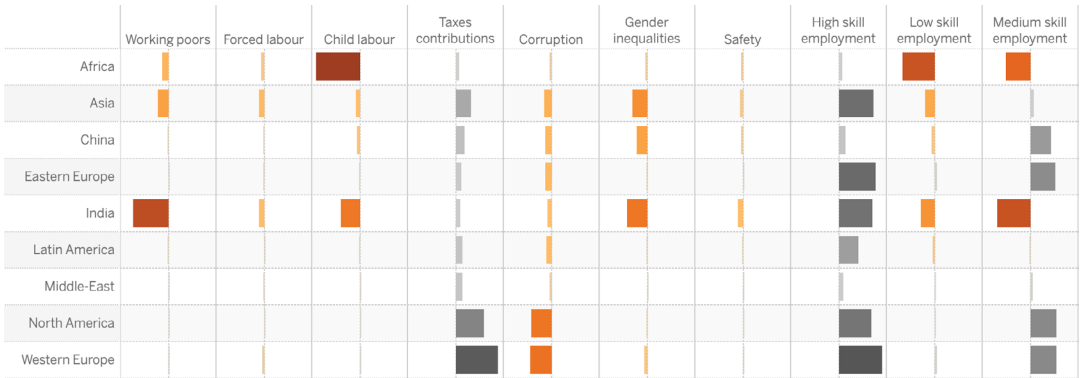
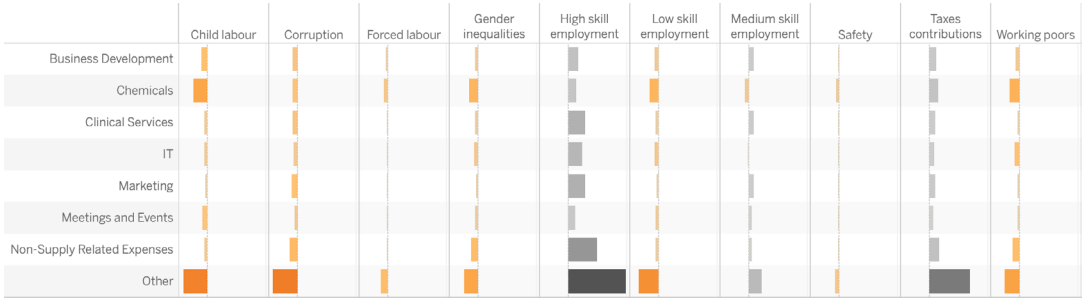


Figure 5

Sectorial analysis of the cost to society (impact valuation) of selected social indicators.



3.2 Employment and wages

The analysis of both the impact and output in parallel provide interesting insights. We present in the **Figure 6** the results of the employment impact in the supply chain of Novartis. Common practice is to consider all employment as beneficial for the society, however there is a big difference of quality of jobs per sector, region and depending on the level of skill of the person employed.

In our analysis, we used the living wage concept as the defining threshold of positive or negative value of employment. The living wage defines a basic but decent level of life that allows a household to get good nutrition, housing, health and education, etc. By modelling the level of wage per skill level in the supply chain of Novartis associated to the employment results, we were able to benchmark it with the living wage threshold defined at country level. Any employment with a level of wage below the living wage is considered to drive a negative impact, while a wage above the living wage threshold results in a positive impact. The economic value of the impact is calculated based on a correlation between income and well-being (using the unit DALY, which stands for Disability Adjusted Life Years), reflecting the utility of money. In short, this model determines the utility (or value) of money, using the quality of life as the yardstick (see Vionnet & Haut 2018).

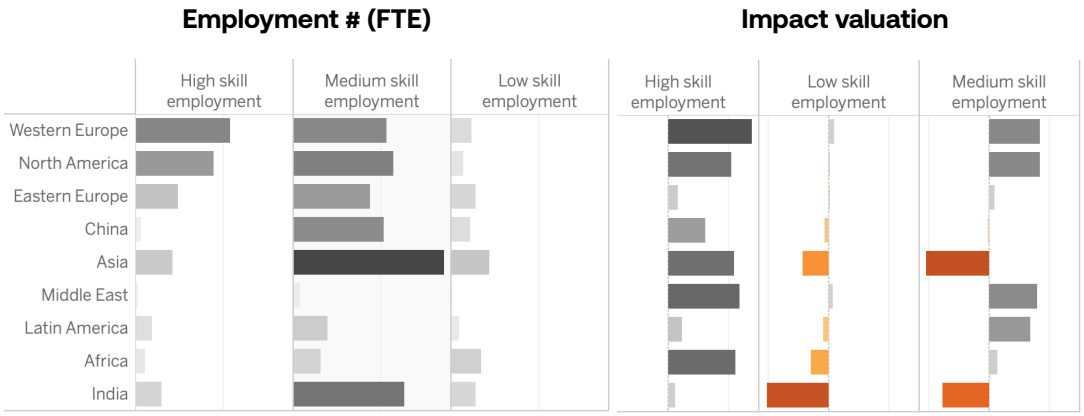
Figure 6 shows the aggregated results per region and employment per skill level. Both the economic impact for the society and the number of jobs is presented next to each other. We observe directly that some jobs in some regions result in negative impact, which is the case specifically for low skill jobs in Asia, Africa and Latin America. Even medium skill jobs have a negative impact in India and Africa mostly where prevalent wages are relatively low even for medium skill positions. Most of the positive impact is driven by regions with higher levels of development, mostly in Europe and North America. Overall the value of jobs for

the society has a net positive impact accounting for all employment in the supply chain of Novartis. Still, the challenge remains to reach a living wage, as implied in the human rights declaration, for all employment in all regions. This objective can help reduce systemic income inequalities in the world.

This type of analysis will support a company to understand where wages might represent a risk in its supply chain and help prioritise engagement with suppliers or sectors (through partnerships) to address the quality of jobs in some regions and specific activity sectors.

Figure 6

Economic impact for the society of employment and # of jobs per skill level and region.



3.3 Child labour risk geographic analysis and prioritisation

Diving into the capacity of the model to bring interesting insight, we show below an analysis to trace the potential risk of child labor occurring in the supply chain of Novartis (**Figure 7**). Note that the illustration is kept high-level as the goal is to illustrate the potential of the approach only.

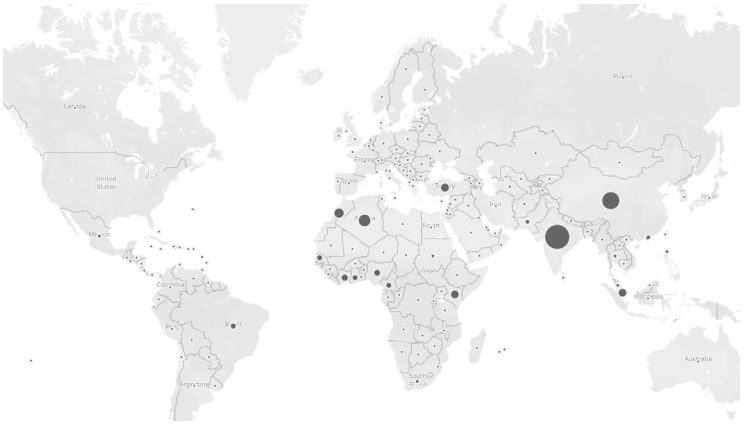
Figure 7

Child labour potential cases shown through three different angles: locations, from which supplier they originate from and where the child labour cases overlap with the locations of the direct suppliers.

Child labour
Locations.

Child labour
Origin of suppliers.

Child labour
Child labour in the same country as direct suppliers.



We first show where the potential cases of child labor occur (see the top map of the **Figure 7**) primarily in Africa and Asia, which is consistent with existing statistics. When we look at the second figure (middle map), we observe that the suppliers that are linked to those potential cases of child labor are mostly located in North America, Europe and Asia. This latter region, Asia, observes an overlap between the potential cases of child labor from suppliers and the location of the suppliers. The final map at the bottom of the figure highlights the potential cases of child labor that occur in the same country where the spend originates. It is likely that first tier suppliers might be linked to child labor cases for those latter results and might become a priority for engagement with selected suppliers. Those latter can be traced through the spend data, connected to the detailed analysis of the societal impact assessed.

The analysis can be detailed per tier in the supply chain as well as per activity sector and spending category (business unit and category), which will add to the value of the insight obtained.

4.

Applications and conclusions

This integrated approach to identify human rights issues in the supply chain of a company is innovative and brings powerful insights to develop further the sustainability strategy of any company.

We foresee that such model could be used, within companies, for:

- **Awareness raising:** To understand whether potential risks exist in the supply chain, how big they could be and where they are located (country and sector).
- **High level prioritization of Human Rights topics for corporate sustainability strategy** according to their relative societal impact, assessed from an economic and societal impact perspective.
- **Prioritization of action per country/sector for planification of audits and corrective actions (setting policies/corporate commitment, etc.)** Results provide a breakdown per country and per sector, for each of the human rights topics addressed. It can be broken down per origin of purchase (spend category) and per end sector where the issue occurs.
- **Engagement with suppliers (mainly Tier 1) by sharing the heat-maps of likely risks and improving them with supplier data** to better identify risks and put in place corrective actions.
- **Integration of Human rights risks into business risks assessments.**
- **Communication (annual report) and engagement of stakeholders** (internal/external)

Such approach could also be used by external stakeholders/investors to screen companies and engage in discussions with selected companies, ensuring that the rights policies, strategies and action plans are in place to ensure compliance with human rights.

> **This approach could become a valuable tool in helping Novartis pinpoint those specific hotspots of human rights risk in our supply chain—although granularity is everything and this approach will need to be combined with (and could inform) other existing approaches to address human risks such as audits, contractual relationships, partnerships with other stakeholders, etc.**

Frank Seier,
Senior Advisor Human Rights
(and former Head of Human Rights),
Novartis

Human rights is a topic of increasing importance in the private sector, in light of the current Sustainable Development Goals (SDGs), of the current coronavirus crisis and of the change of behaviors and expectations of many stakeholders (investors, employees, customers, governments, etc). This approach provides a concrete way to identify potential human rights risks and impact in the supply chain of companies at a level of details and precision that was not possible until now. Companies will use more and more data and analytics to inform their strategy and we hope to see companies adopting such approach to better understand human rights risks in their supply chain and create a positive impact for a fairer and better world.

5.

Selected references

A

Alwamawi et al. (2019) **Measuring child labour, forced labour and human trafficking in global supply chains: a global input-output approach** —Technical paper. 8.7 Alliance— ILO, OECD, IOM and UNICEF.

Anker R., (2011) **Estimating a living wage: a methodological review**. International Labour Office (ILO).

C

Cabrera (2018) **Estimación de la tasa de extracción como una medición alternativa de la desigualdad en Guatemala, El Salvador, Costa Rica y República Dominicana.** Plaza Pública (www.plazapublica.com.gt).

Corruption Performance Index (2018) https://www.transparency.org/en/cpi

G

Global Slavery Index — https://www.globalslaveryindex.org/ (for the statistics per country, 2019)

L

Living wage global dataset — https://www.valuingnature.ch/post/living-wage-world-dataset

M

Mauro et al. (2019) **The cost of corruption**. Finance and Development journal, September 2019.

Montenegro and Patrinos (2014) **Comparable estimates of returns to schooling around the world.** World Bank.

S

Schultz and Strauss (2008) Eric V. Edmonds "**Child Labor**", Chapter 57 of Handbook of Development Economics, Volume 4. North Holland.

U

UNICEF data on child labour — https://data.unicef.org/topic/child-protection/child-labour/

V

Vionnet & Haut (2018) **Measuring and valuing the social impact of wages—the living wage global dataset and the health utility of income,** Methodological paper and case study. (https://www.valuingnature.ch/post/2018/07/20/valuing-the-impact-of-wages-on-human-capital)

W

Waxenecker (2019) **Desigualdad y poder en Guatemala — Economía de Caputra.** Paraíso Desigual (www.paraisodesigual.gt)

WBCSD (2019) The human and Social Capital Protocol

WBCSD (2020) CEO Guide to Human Rights. https://docs.wbcsd.org/2020/10/WBCSD_CEO_Guide_to_Human_Rights.pdf

World Inequality Database — https://wid.world/

6.
Appendix

6.1 Social risks data sources, sectorial matching and impact valuation

6.1.1 Child labour

Child labour statistics are relatively well covered by UNICEF (estimates at country scale per gender). UNICEF data (https://www.unicef.org/protection/child-labour) indicates an average rate of child labour of 15% over 80 developing countries covered. The maximum rate is 49% in Ethiopia, 42% in Sierra Leon and 41% in Benin. Most of the cases happen in Africa, followed by Asia and Latin America. All cases of child labour are considered in this paper except for domestic work.

Information per activity sector is much less known, although it is known that most of the child labour happens in agriculture, followed by restauration/hotel and manufacturing according to Schulty and Strauss 2008. To complement data from UNICEF, we used this latter publication to estimate the distribution of child labour per sector in each country. When the sector data was not available for a country, we used the world average distribution: 66% of child labour in agriculture, 13.9% in the hospitality sector and 7.2% in manufacturing. Based on a single source, the quality of this data can be considered relatively uncertain.

The match with the world economic model is done by computing a relative rate of child labour for the low skill employment for each sector in the model. Child labour along supply chains is then computed as an additional workforce using the computed number of low skills employees in the supply chain.

The valuation of child labour is based on the following reasoning. Child labour has two main effects on the life of individuals. The first is short term and represents a risk of injury or fatality. Due to a lack of relevant data, this effect is not considered in this paper. The second, at long term, is the loss of opportunities in life due to a lack of education. The decrease of income due to lower education attainment is estimated to be, on average, a loss of income of

10% per year of education not achieved (average value provided by Montenegro and Patrinos (2014)). For every case of child labour identified, we estimate that one year of education is not achieved. Income is estimated as the GNI per capital provided by the World Bank and hasn't been computed per country, but rather as a world average. A more precise assessment could be done using countries level parameters.

The net present value of lost income is then calculated over a 20 years period: this is a conservative approach since it represents only a fraction of the average working lifetime of a person. No discount rate has been applied. We then translated the lost income amount into a change of well-being (reduced life expectancy), using the Health Utility of Income model (utility of money) developed with Novartis (see Vionnet & Haut 2018). The social impact is expressed in term of life quality whenever possible, instead of just monetary flow.

6.1.2 Forced labor

Forced labour is all work or service which is exacted from any person under the threat of a penalty and for which the person has not offered himself or herself voluntarily (ILO). Different sources of data exists, including the ILO and the Global Slavery Index Initiative, which provide insights into the prevalence of forced labour per country and per sector. Exact numbers differ when compared with other publications but there are roughly 16 million persons in forced labour in the private sector (the number would be higher accounting for all types of modern slavery like sexual exploitation, state imposed labour, child labour, etc.).

The most useful statistics per country is provided by The Global slavery Index initiative (https://www.globalslaveryindex.org/, statistics for 2019) as the data is provided per country. We matched the data of forced labour per sector for each country, using the standard distribution of labour among activity sectors. We only allocated forced labour to the low-skilled employment statistics of each identified sector. Employment per skill level is provided by the IO dataset.

Forced labour has three main effects on the life of individuals. The first is at short term and represent a risk of injury or fatality that is higher than normal. Due to lack of data, we didn't consider this effect. The second effect is the loss of quality of life at longer terms due to low income resulting from the situation of forced labour. We estimated a loss of 50% of the quality of life, that we expressed in the form of DALY, for each year of forced labour (estimation). It is to say that every case of forced labour in the supply chain of Novartis results into a 0.5 DALY. Every year of forced labour have also long terms effects, however, to avoid double counting we didn't account for this (i.e. this situation of forced labour might be continuing year after year, as a result it is difficult to link one specific year of work to the long term effects).

The DALY is valued in monetary term using a production model, assuming that the value of one DALY is equivalent to the average GDP per capita of OECD countries (38'148 CHF/capita). A DALY is worth the same everywhere in the world, aligned with human rights.

6.1.3 Corruption

Corruption is one of the main inefficiencies that prevent our economic and social development. In some countries, most of the resources are diverted and extracted for the benefit of a few, at the expense of entire populations. This is the case particularly in Africa, but also for some Asian and Latin American countries, for which the net wealth (accounting for human, social and natural capital) is decreasing over time[6]. Corruption is inter-connected in both the public and private sector. It is particularly difficult to identify when it happens indirectly through the supply chain of a company.

We developed a measure of the amount of money lost due to corruption, based on the Corruption Perception Index developed by Transparency International. This measure also relies on some independent research on the fraction of public resources that is diverted in some specific countries[7], [8], [9].

The unit of the corruption measure is in USD lost to corruption per USD of added value. It can be interpreted as the fraction of added value created in the value chain of Novartis that is being captured by corrupted entities and leaving the states with less resources to invest in public goods and services.

The measure of corruption is applied to each country and sector, according to their added value created, provided by the IO dataset. It is clear that there are other drivers to corruption, and potentially some activity sector more prone to corruption than others, but we neglected those at this stage.

We used studies such as Mauro et al. 2019 and Cabrera 2018 to estimate two effects due to corruption: 1. the reduced public income due to tax avoidance and 2. the misuse of public funds. The first article indicates a potential loss of income of 4% globally when comparing countries with little or a lot of corruption. We used this conservative estimate as a maximum for the most corrupted countries (although it is in practice much higher). The second article indicates that on average more than 40% of the public funds are mis-used due to corruption in countries with a high rate of corruption. We used this estimate as a maximum.

We then used the Corruption Performance Index to develop a linear model to calculate the loss of income/mis-used of funds based on the GDP of each countries and the tax revenue (as a % of GDP). Countries with low corruption have no cost (which is a simplification).

---

6 Lange et al. (2018) **The changing wealth of nations 2018: building a sustainable future.** Washington, DC: World Bank.

7 Mauro et al. (2019) **The cost of corruption** — Graft results in lost tax revenue, but it also takes a social toll. Finance & Development — September 2019

8 Montenegro and Patrinos (2014) **Comparable estimates of returns to schooling around the world.** World Bank.

9 Schultz and Strauss (2008) Eric V. Edmonds "**Child Labor**", Chapter 57 of Handbook of Development Economics, Volume 4. North Holland.

The impact valuation accounts for a societal return of 1:1 at the moment, given the difficulty of measuring the societal impact of public spending. This might be refined in the future.

References

https://www.transparency.org/research/cpi/overview (Corruption Performance Index, 2018).

Mauro et al. (2019) **The cost of corruption**. Finance and Development, September 2019.

Waxenecker (2019) **Desigualdad y poder en Guatemala** — Economía de Caputra. Paraíso Desigual (www.paraisodesigual.gt).

Cabrera (2018) **Estimación de la tasa de extracción como una medición alternativa de la desigualdad en Guatemala, El Salvador, Costa Rica y República Dominicana.** Plaza Pública (www.plazapublica.com.gt).

6.1.4 Migrants, informal workers and working poor

Those three topics have in common that they are a fraction of the workforce and measured in number of employees' equivalent. We used ILO stats as the main source of data per country.

Migrants, working poor and informal workers are a fraction of the existing workforce. Working poor are an aggregation of workers receiving <US$1.9PPP/day (extremely poor), <US$3.2PPP/day (moderately poor) and <US$5PPP/day (near poor). Just as a side note, these thresholds are still far away from a living wage in most of the countries of the world.

Informal worker is defined by persons who do not have secure employment contracts, workers′ benefits, social protection or workers′ representation. They are not regulated, registered or protected by an existing legal or regulatory framework. Migrants are all non-national persons, employed in any country that is not the original country of the worker. Informal worker is defined by persons who do not have secure employment contracts, workers′ benefits, social protection or workers′ representation. They are not regulated, registered or protected by an existing legal or regulatory framework. Working poors are an aggregation of workers receiving <US$1.9PPP/day (extremely poor), <US$3.2PPP/day (moderately poor) and <US$5PPP/day (near poor). Just as a side note, these thresholds are still far away from a living wage in most of the countries of the world.

We used ILO stats as the main source of data per country.

Those three topics have in common that they are a fraction of the workforce and measured in number of employees. Migrants, working poor and informal workers are a fraction of the existing workforce. Allocated to sectors within countries based on the composition of the workforce directly. Working poor and informal workers were allocated only based on the low-skilled workers statistics.

Migrants was not included in the impact valuation, because there is in principal nothing especially bad or good of having migrants in an economy. Informal workers were not included as well to avoid double counting, as the workforce accounted for in the supply chain of Novartis already includes informal workers and they are valued through the general employment impact valuation. Working poor were valued through the same principle as the employment impact, assuming an average wage of US$2.5PPP/day (or US$900/year) and using a world average annual living wage of US$7,432/year. The gap between the two wages defines a negative impact due to loss of life opportunities as described in the Health Utility of Income model (see Vionnet & Haut 2018).

References:

ILO STAT (access November 2019).

6.1.5 Gender inequality

Gender inequality is a widespread issue worldwide, which is characterized by different factors, including the income gap between genders. We used the data on income differentiated per gender from the ILO to calculate an income gap between women and men, applied to the entire direct and indirect workforce of Novartis.

The data was used proportional to the workforce provided by the IO model. We applied this data only to the positions occupied by women, which was also provided by the IO model.

The impact valuation is based on the same principal than general employment impact valuation. We used the gap of income to calculate a gap of well-being using the Health Utility of Income model (Vionnet & Haut 2018).

References:

ILO STAT (access November 2019).

6.1.6 Safety

Safety statistics on injuries and fatalities are widely available from ILO statistics, per country and per broad activity sector. We used those statistics applied to the workforce calculated in the IO model to derive the total yearly number of injuries and fatalities in the value chain of Novartis. However this modelling neglect health issues, as not enough data on the topic exists.

The data was used proportional to the workforce provided by the IO model. We allocated more cases to the low-skilled workforce (70% of total) than to the medium-skilled workforce (20%) and high-skilled workforce (10%).

Cases of injuries and fatalities were directly related to DALYs, based on the number of years lost and their weight. We considered that fatalities lose 30 years of life, thus 30 DALYs. Injuries were assumed to be 2 months on average, with a disability weight of 30%.

The DALY is valued in monetary term using a ideal production model, assuming that the value of one DALY is equivalent to the average GDP per capita of OECD countries (38'148 CHF/capita). A DALY is worth the same everywhere in the world, to respect human rights.

Reference:

ILO STAT (access November 2019)

6.1.7 Overtime

Overtime was considered whenever the official working time exceeded 42h per week. It is not a problem as such, but can lead to labour rights abuse still in some cases.

The data was used proportional to the workforce provided by the IO model, allocating overtime equally for all level of skills.

Overtime was not considered in the impact valuation, as positive and negative impact can happen from this situation. Further research is needed to value those.

Reference:

ILO STAT (access November 2019)

6.1.8 Employment, wage and living wage

Employment is the one of the key values delivered by an economic system for the society. The value of employment is determined partly by the wages received. We focused on the wages to derive the value of employment, using the Health Utility of Income (HUI) model developed together with Novartis in a past project (see Vionnet & Haut 2018).

Working force is directly an indicator of employment, which we separated into skills levels to match a specific wage level, informed by income inequalities data (source: WID). We used the average of Q1 and Q2 (i.e. quintiles) for low-skills jobs, Q3 for medium skill and Q5 for high skill.

The impact of a wage is defined in comparison to a baseline called “living wage”. A wage below the living wage will ultimately lead to negative impact, while a wage above this baseline will create a positive impact. We used the Health Utility of Income model to inform the utility of the wage gap with the living wage. The utility was defined in terms of health outcome (quality of life and life expectancy), using the social determinant on health research from the WHO showing the correlation between income inequalities and health inequities.

The working poor are discounted from the employment impact and reported separately to avoid double counting.

References:

World Inequality Database (https://wid.world)

Living wage global dataset (https://www.valuingnature.ch/post/living-wage-world-dataset)

Health Utility of Income model (https://www.valuingnature.ch/post/2018/07/20/valuing-the-impact-of-wages-on-human-capital)

6.2 Input-Output modeling and sectors matching

Multi-Regional-Input-Output (MRIO) models are economic models describing inter-industrial relationships on a regional scale, possibly the world. They integrate the full production, trade and consumption linkages between sectors and countries, following the IRIO (Interregional Input-Output) philosophy (Miller and Blair, 1985). MRIO models can be computed using the approach developed by Leontief (matrix inversion)[10] (Miller and Blair, 2009). In this paper, the company spend is run as a demand to the world economy in order to compute the full economic activities required to produce the considered goods and services.

Due to the reduced number of available models and their infrequent release, IO datasets have to be adapted to match the current economic situation in terms of exchange rates and inflation, e.g. using constant PPP values from the World Bank, and to consider new economic and efficiency improvements, e.g. in terms of Labour use. In this paper, the original global model has been conserved but nominal exchanges rates and inflation have been considered so that the model and the spend match for 2019.

Potential sources of models are WIOD (www.wiod.org) and Exiobase (www.exiobase.eu), two models developed by EU-funded projects. WIOD is a 35 sectors, 41 regions MRIO model covering the 1995–2011 period, while Exiobase v.3 is a 163 industries, 48 regions MRIO model for the period 1995 to 2011. Both are extended with information on Labour use per sector and country, compiled from various sources among which the ILO or KLEM. Exiobase 3.4 is applied to compute the results of the case study.

Such models are nowadays regularly applied for economic analysis or environmental analysis of countries or companies. They are however more and more used for assessing human and social capital impact, as in this paper once they have been extended with the relevant sets of indicators.

10 https://en.wikipedia.org/wiki/Environmentally_extended_input-output_analysis


valuing
nature


ecometrics