

Applying Oiconomy Pricing

First experiences of producers applying real cost sustainability assessment of products

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Abstract

The Oiconomy approach provides a normalized way of measuring and communication of (un)sustainability. In this standard (un)sustainability is expressed in a virtual monetary unit, the “ESCU” (Eco Social Cost Unit). As closely as possible, the ESCU score of a product equals the hidden preventative costs, or externalities, related to a product, the costs that should have been spent to avoid any of the damage that the product causes during its entire lifecycle. This assessment addresses preventative costs for all UN-SDG sustainability aspects including Planet-aspects (climate impacts, biodiversity, land use, resource depletion, circularity), People-aspects (working conditions, fair wages, health), and Prosperity-aspects (corruption, fair inequality, fair trading). Added to the standard economic price of the product the ESCU score represents the total costs of a fully sustainable alternative for the product. The ESCU also provides a normalized means of transfer of (un)sustainability through the supply chain enabling all players in the supply chain to build on each other’s data.

This paper presents the result of a pilot project with three companies, operating in global value chain, applying the Oiconomy Sustainability Assessment Tool.

Goals of the Oiconomy Project are to develop a uniform and aggregable measurement of the preventative cost distance to sustainability for products. With this it aims to make ‘preventative costs’ a permanent topic in the supplier – customer communications. The project encourages end-producer companies and their whole value chains to calculate and implement sustainable solutions. The tool provides an innovative comprehensive measurement of environmental sustainability and social responsibility.

In a pilot project three Dutch end-producer companies (one selling spices to consumers, one producing kitchen topping and one producing medical devices) applied the new methodology together with their

suppliers, partly in low-income countries (Indonesia, Ukraine, Egypt). The goal of the pilot study was to test whether the tool was clear enough to be applied by company experts instead of external consultants, to identify points of improvement before further market introduction and share experiences which forms of presentation of the outcomes in the supplier – customer communications and evoke collaboration about further performance improvement. The methodology has so far been described in various scientific articles in the *International Journal of Life Cycle Assessment* and the *Journal of Cleaner Production*, yet without real life testing.

In the paper we will show the results of these calculations for the three cases, the experiences of the companies and the implications for the market introduction of the tool.

Keywords: True Cost Accounting, Life Cycle Assessment, Sustainable Value Chain Management, Corporate Sustainability

1. Introduction

Corporate sustainability (CS), also described as corporate social responsibility (CSR, MVO), presents the role of the business world in contributing to the full complexity of the current massive sustainability challenges. This problematic complexity is illustrated by the 17 Sustainable Development Goals (and 169 sub-goals) agreed upon in the United Nations. It includes a twin agenda of integral environmental and societal fairness: the triple-P agenda (Planet, People, Prosperity) (Vermeulen, 2018). The World Business Council of Sustainable Development (WBCSD) argues that this critical agenda cannot be realized without effective engagement by the private sector. As a crucial element of their programs for business engagement they state that “better information equals better decision-making; disclosing sustainability risks and impacts, and pricing them appropriately, is increasingly where the market is heading for” (WBCSD, 2022).

However, the practice of corporate sustainability performance measurement rather still looks like the Babylonian confusion of speech. First problem is that many competing measurement tools exist, mostly addressing only a few or one of the 17 SDGs, not integrating the environmental and social dimension. Second, these tools focus on measuring the negative impacts produced, thus not showing companies what they could or should do, but rather blaming and shaming them. Third, many of these assessment tools are based on general available data on negative impacts for product categories, provided by tools and repositories, like Ecoinvent, Gabi and Simapro, using national averages. Thus, companies cannot fully show the own specific improved performance compared to competitors. The assessment of both

the environment and social performance cannot yet be appropriately integrated in one consistent comprehensive system.

As a solution for these needs the Oiconomy Pricing methodology was developed. It presents a practical tool for companies which enables them to make a full triple-P spectrum assessment together with their main suppliers, in the standard monetary language in the market, which a focus on solutions (prevention options), rather than on negative impacts on nature and society. Some forms of monetary approaches in product assessment do exist at this moment (like TruePrice), however the transparent, non-profit, science-based approach and the focus on prevention instead of damage costs are unique in the world, as well as the feature that companies apply the methodology themselves and can integrate that in their supplier base information systems.

2. Methods

The Oiconomy Pricing methodology has been developed in the PhD research of dr. Pim Croes, who defended his PhD thesis (Croes, 2021) on January 14th, 2021. The research focussed on positioning the core idea of the approach in the existing field of life cycle assessment and sustainability performance measurement (Croes and Vermeulen, 2015), justifying the methodological ground rules. The methodology for establishing default values, applied when companies do not have the company specific preventative cost information themselves, was elaborated with state-of -the art reviews and check on data quality of existing global databases for examples of social impact indicators, including fair wages, levels of inequality and corruption prevention (Croes and Vermeulen, 2016a, 2016b, 2019). The methodology includes a systematic analysis of methods used for including positive impacts in the methodology, preventing forms of greenwashing in this respect (Croes and Vermeulen, 2020). This scientific groundwork resulted in 5 articles published in the Journal of Cleaner Production and the International Journal of Life Cycle Assessment.

The negative hidden costs measured in Oiconomy Pricing are covering all 17 UN SDGs and all triple-P pillars (Planet, People, Prosperity). Table 1 displays the included aspects in measuring the preventative costs towards a fully sustainable product. In contrast to many environmental assessment methods, Oiconomy Pricing addresses all SGD related sustainability aspects in a consistent and comprehensive methodology. It enables fully integrated assessment and prevents (unintended) trade-offs between sustainability aspects. All prevention costs are expressed in a virtual monetary unit, the “ESCU” (Eco Social Cost Unit). This represents the costs that should have been spent to avoid any of the damage that the product causes during its entire lifecycle and can be transferred into any currency. Besides negative hidden costs, positive externalities, a positive externality occurs when a third-party benefits from activities or consumption of a product without contributing to the (full) costs of the

transaction (Benoît Norris et al., 2009). Croes & Vermeulen (2020) formulated a list of criteria for the allocation of positive costs.

Table 1. Included aspects Oiconomy Pricing

Pillar	Aspect	Measures prevention costs towards:
Planet	Emission of toxic gasses	Zero emissions of harmful gasses/substances to air, soil and water (bulk gasses, toxic emissions and agri-chemicals)
	Use of scarce resources	Use of renewable resources instead of virgin (scarce) resources
	Biodiversity	Preservation of (original) biodiversity
	Land use	Optimizing yields for food production
	Waste & Disposal	Sustainable disposal of waste and optimized lifetime of product
People	Human health risk	Reduced human health risks
	Labour	Fair remuneration & safe labour conditions
		Fair inequality between lowest and highest salary within company
		Sufficient contribution to health insurance, personal development, and pension plans
		Ensuring occupational health & safety
		Mitigation of child labour.
Prosperity	Economic Responsibility	Fair payment to suppliers
		Responsible financial management
	Corruption & Conflict	Prevention of corruption & conflict

The system copies the normal economic price build-up in the supply chain for the hidden costs of preventing environmental, social and economic harm, inflicted as consequence of the production, use and disposal of the product. The actors themselves make the assessments and calculations and transfer the results to the next in the supply chain. When self-provided (“foreground”) data are not available,

the system provides default (“background”) data. There are two types of data used in the system 1) performance data and 2) data on prevention costs. Performance data is data measuring the sustainability performance of companies (e.g. kWh used). Performance data should be foreground data as much as possible, as this reflects the reality of activities in the supply-chain. Data on prevention costs reflects data on the cost of sustainability mitigation measures (e.g. investing in solar panels). It is preferable to use company-specific prevention costs, however this takes time as companies need to assess the costs of specific mitigation measures. If such data is unavailable, generic data-base sourced data on sustainability mitigation measures are used.

Trustworthiness of the data is obtained by verification and certification according to international standards. A draft standard is available for certification purposes and an assessment tool for the actors in the supply chain.

The core design principles of the Oiconomy system of the approach are:

1. All triple-P pillars (Planet, People, Prosperity) are included, covering all 17 UN SDGs. The word “sustainability” therefore includes social and economic responsibility.
2. (Un)sustainability is determined by the additional costs for a sustainable product version, expressed in “Eco Social Cost Units” (ESCU’s).
3. ESCU’s are transferred as one total value, but also separately for the 10 aspect categories.
4. Verification of the reliability of the data takes place by means of certification on the Oiconomy standard (in the future).
5. Information about the sustainability performance in the form of ESCU’s is transferred and documented in the value chain like normal prices (without the margins). The Oiconomy System is a bookkeeping system for the yet hidden preventative externalities.
6. By only transferring information in the form of aggregated ESCU’s, intellectual property of production specifications of suppliers remains safe.
7. The Oiconomy system is a type of “Life Cycle Assessment”, but measured by the value chain actors themselves, instead of afterwards by scientists, consultants or NGOs based on general databases.
8. Without demonstrable specific data, generic default values from a database are used, but the companies can continuously improve these with their specific data and investment calculations.

To apply Oiconomy pricing, the Oiconomy Sustainability Assessment Tool has been developed. It leads the practitioner through all stages of the product life cycle and along all aspects of sustainability. By means of a questionnaire, all aspects of sustainability are measured, and the hidden cost are

automatically calculated. Figure 1 displays the process of calculation hidden costs through the Oiconomy Assessment Tool. The first step in applying the assessment is scoping of the supply chain. The practitioner needs to identify suppliers that are within 80% of the purchased value of a product. The suppliers that fall within the 80% scope needs to be included in the Oiconomy Pricing Assessment. The tool then challenges selected companies to self-provide their specific (“foreground”) costs to prevent causing harm, or in other words the extra costs (without margin) for the sustainable version of the product. However, in absence of foreground prevention costs, the tool provides default (“background”) data, which are based on either internationally determined conventions, science, or benchmarks.

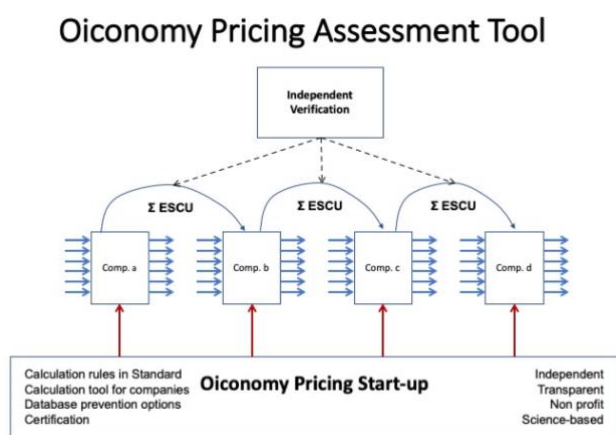


Figure 1. Oiconomy Pricing Assessment Tool

From November 2021 to March 2022, three pilot companies applied the Oiconomy Pricing, with one part-time researcher at UU available for explanations and support. The end-producers (one selling spices to consumers, one producing stone kitchen topping and one producing medical devices) involved their main suppliers to measure their hidden costs. The goal was to test whether the tool was clear enough to be applied by company experts instead of external consultants, to identify points of improvement before further market introduction and share experiences which forms of presentation of the outcomes in the supplier – customer communications and evoke collaboration about further performance improvement.

3. Results and Discussion

3.1 Case study 1: stone kitchen countertop

The first case under assessment was a company called Arte, that produces stone kitchen counter topping. The company is located in the Netherlands and produces various types of stone kitchen counter tops. The unit under review is 1 m² of stone kitchen countertop and the exact product properties are not disclosed due to confidentiality of supply-chain partners. The supply-chain of the stone countertop was traced back by including 80% of the purchased value. This identified the most relevant supply-chains for stone: Feldspar, Clay and other chemicals (Figure 2). The stone surfaces manufacturer and Arte supplied foreground data and the clay, feldspar and chemical suppliers were assessed using background data from databases. The results reveal that the total hidden costs of 1 m² of stone countertop is € 32,44 (Figure 3). The sales price of 1 m² stone countertop is € 912 meaning the hidden costs are adding 3,56% onto the sales price.

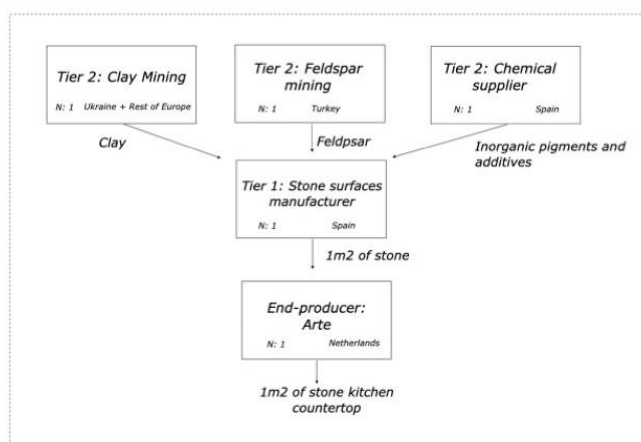


Figure 2. Scope of assessment

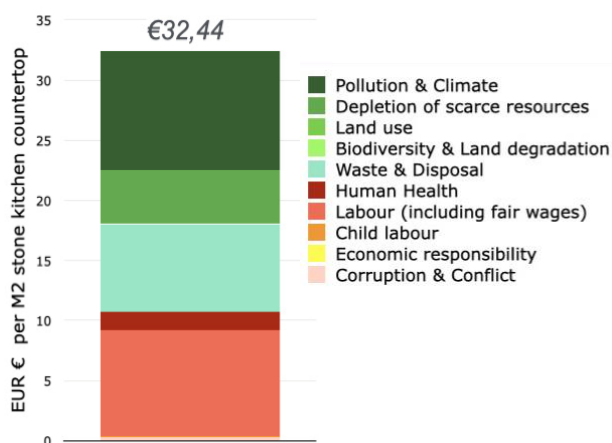


Figure 3. Breakdown negative hidden costs

The main negative hidden costs come from the category Pollution & Climate. Pollution & Climate measures the cost to prevent polluting emissions to soil, air and water. Most of the costs come from the manufacturing process and transport of the stone surfaces producer (€ 5,15), other costs include the energy usage of Arte (€ 1,54) and the mining operations of clay and feldspar (€ 2,41 and € 0,85). The second biggest category is Labour. Labour measures fair wages, fair inequality and other labour conditions. The bulk of the costs come from the stone surfaces manufacturer in Spain as they could not demonstrate the absence of various labour aspects.

There is a high risk of child labour in the feldspar and clay mines in Ukraine and Turkey. The lack of demonstrated evidence of the absence of child labour led to the allocation of €0,12. € 0,12 is the amount necessary to replace the children with adults earning the fair minimum wage. In the category Waste &

Disposal, the cost- distance to sustainable disposal is measured for both processing-waste and end-of life waste. Negative costs emerge from the end-of- life disposal as the demolition of the countertop creates inert waste (€ 4,20). Furthermore, hidden costs found include cost to prevent the depletion of scarce resources. The stone surfaces manufacturer uses a lot of fossil resources, that lead to negative costs of € 1,33. Additionally, the water consumption for 1 m² of countertop is 0,17 m³ and is extracted in a water-scarce area, which leads to negative hidden costs of € 3,09.

Besides negative hidden costs, positive costs were calculated (Figure 4). Positive costs of € 6,89 were found, which was spent by Arte and by the stone surfaces manufacturer. Among other things, Arte invested in extra preventative medical care for their employees (category: Social Responsibility), and set up the Responsible Stone Foundation that aims to eradicate child labour in the communities nearby stone quarries by supporting quality education (category: Economic Responsibility).

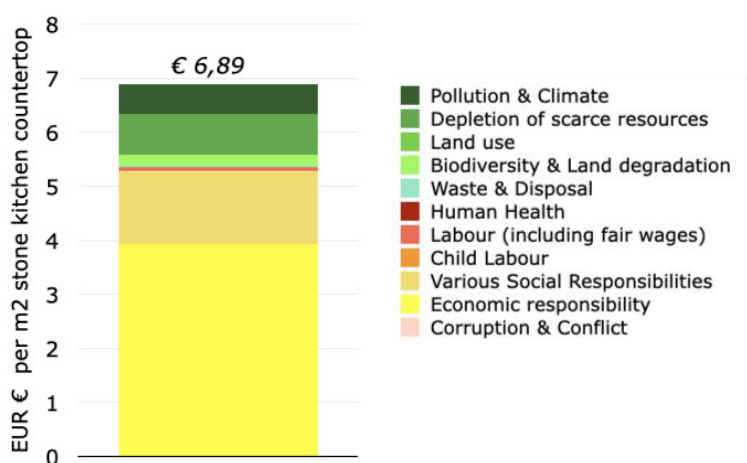
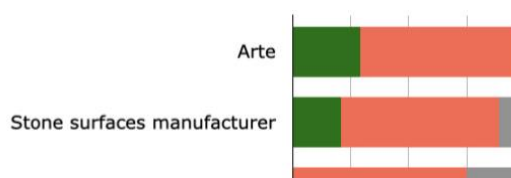


Figure 4. Breakdown of positive costs per m² stone countertop

3.1.1 Data specificity assessment of m² stone kitchen countertop

Performance data is data measuring the sustainability performance of companies (e.g. kWh used). The data specificity of performance data of this analysis is displayed in Figure 5. Arte was able to complete the assessment using mainly company-specific data. The stone surfaces manufacturer also actively took part in this pilot but was not able to demonstrate all the data, so partly, background data was used. Regarding the feldspar and clay supplier only background data was used.

Prevention costs are data on the costs of sustainability mitigation measures (e.g. investing in solar panels). The data specificity of prevention costs of this analysis are displayed in Figure 6. None of the value-chain partners were able to provide much foreground prevention costs, as it takes time to make investment proposals to mitigate impact. This should be a focus when the assessment is repeated.



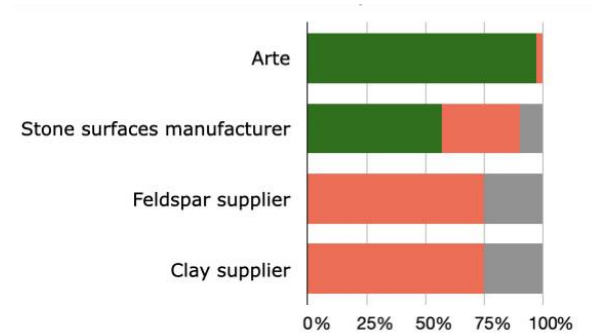


Figure 5. Data specificity of performance costs



Figure 6. Data specificity of prevention costs

3.2 Case study 2: Medical Device

The second company under assessment was a company called ADMC Group, located in the Netherlands. ADMC produces medical equipment in the rehabilitation and physiotherapy field. The product under review is a pack heater. The pack heater is an electrical box that can heat packs used in heat therapy. The supply-chain of the pack heater was traced back by including 80% of the purchased value. This identified the most relevant supply-chain: the steel components (outer-body of the pack heater, inner body, the net, the cover and the handle) (Figure 7). ADMC and the steel workshops were able to provide data on their sustainability performance and data from the steel producer and steel trader was sourced using databases. The total hidden cost of a pack heater is € 130,12 (Figure 8). The sales price of a pack heater is € 1600, meaning the hidden costs are adding 8,13% onto the sales price.

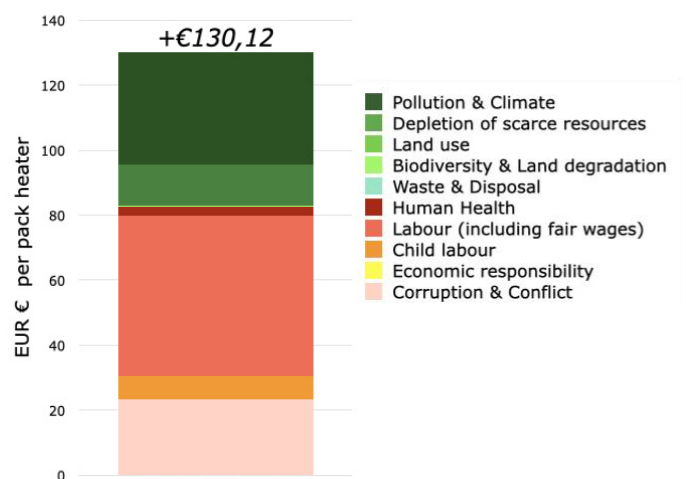
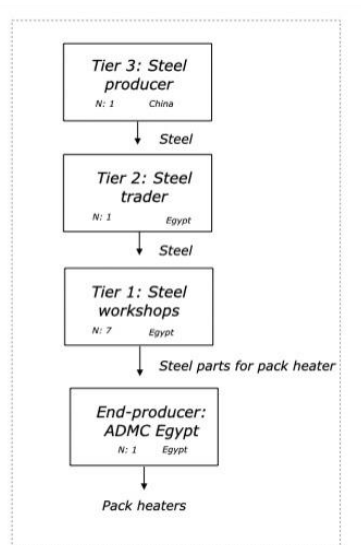


Figure 7. Scope of assessment

Figure 8. Breakdown negative hidden costs

The main negative hidden costs come from the category Labour. Labour measures fair wages, fair inequality and other labour conditions. The main costs come from the steel workshops as employees receive a remuneration that is far below the fair minimum wage as determined by the Oiconomy Standard. Employees in the workshops earn € 55- 65 per month, while the fair minimum wage is € 129 per month. Increasing the price of the product so employees receive a fair minimum wage leads to negative costs of € 24,88. Besides fair remuneration, the employees do not receive sufficient contribution to health insurance nor is their occupational health & safety sufficiently managed (€ 3,69). Besides the steel workshops, steel traders were allocated default costs on Labour, as no company-specific data was gathered (€ 9,46). Gathering specific data on the steel trader or cutting out this middle-men could eliminate these costs. The second biggest impact category is Pollution & Climate. The electricity consumed by the steel workshops (€ 12,12), ADMC (€ 9,00), and CO₂ emissions during steel production (€ 11,42), contribute mostly to this. The negative costs on Depletion of scarce resources are background costs for the primary production of steel in China (€ 11,42).

Besides negative hidden costs, positive costs were calculated (Figure 9). Bonus ESCU's are based on actual company spending, benefitting others than the ones involved in the transaction. Positive costs of € 17,56 were found, all of this was spent by ADMC. ADMC invested to train their employees, reimburse medical expenses and contribute to a project to prevent child labour, by among other things providing microcredits and by organizing capacity raising activities.

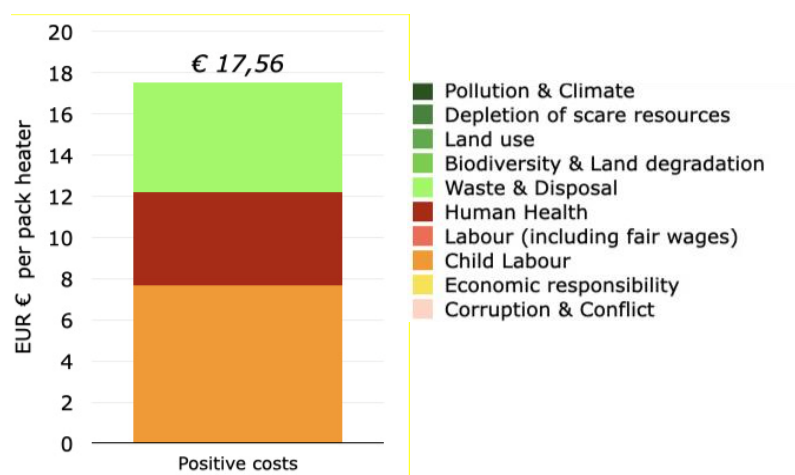


Figure 9 Positive costs per pack heater

3.2.1 Data specificity assessment of pack heater

The data specificity of performance data of this assessment is displayed in Figure 10. ADMC Group was able to complete the assessment using mainly company-specific data. Data on the steel workshops was retrieved through a questionnaire, conducted by a local NGO. Regarding the steel trader and steel producer data was mostly obtained using generic databases.

The data specificity of prevention costs of this analysis are displayed in Figure 11. None of the value-chain partners were able to provide much company-specific prevention costs, as it takes time to make investment proposals to mitigate impact. This should be a focus when the assessment is repeated.

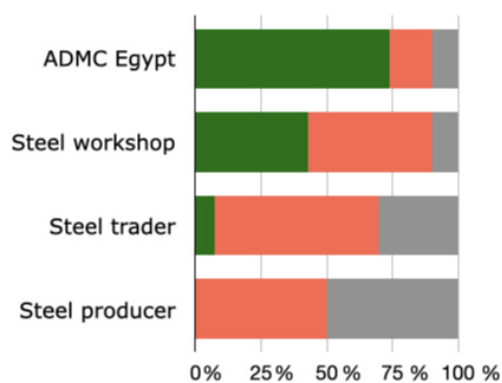


Figure 10 Data specificity of performance costs

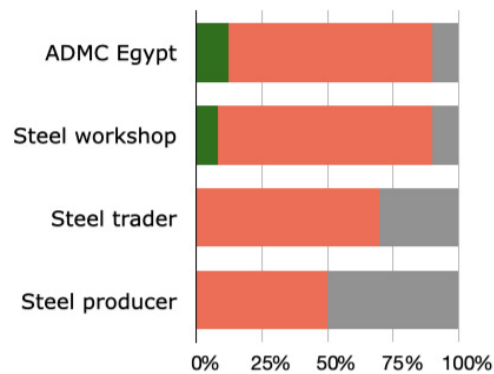


Figure 11 Data specificity of prevention costs

3.3 Case study 3: White pepper

The third company under assessment was Verstegen Spices & Spauces, located in the Netherlands. The product under review was 1 jar of ground white pepper. Verstegen sells white pepper sourced from Indonesia, where the pepper is cultivated by smallholders and sold to the pepper exporter. The supply-chain of white pepper in a jar was traced back by including 80% of the purchased value. This identified the most relevant supply-chains: the plastic cap, the white pepper and the glass jar (Figure 12). The total hidden costs of 1 jar of grinded white pepper are € 1,03 (Figure 13). The sales price of a jar is € 2,99 meaning the hidden costs are adding 34% onto the sales price.

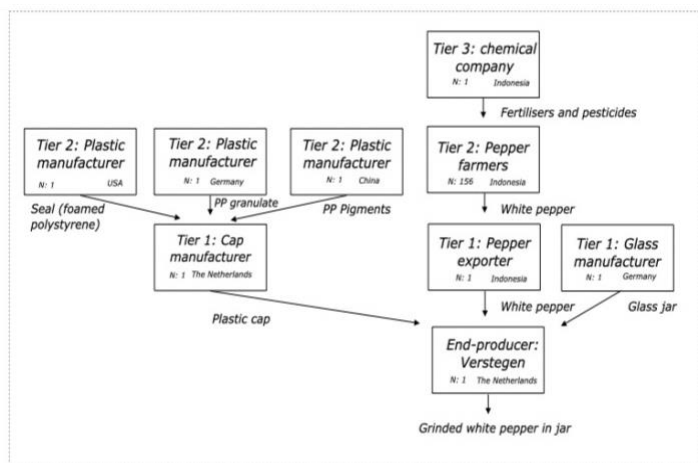


Figure 12 Scope of assessment

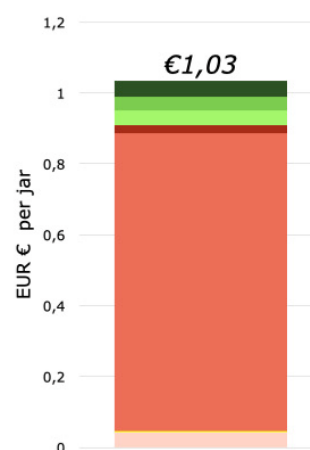


Figure 13 Breakdown negative hidden costs

The main negative hidden costs come from the category Labour. Labour measures fair wages, fair inequality and other labour conditions. The glass manufacturer has a salary inequality ratio of 98,7 between the lowest and highest paid salaries within the company. This is above the fair inequality ratio of 23,8. This leads to costs of € 0,76. Additionally, the pepper farmers do not offer their employees health insurance or ensure occupational health & safety (€ 0,04). The second and third biggest cost categories are Pollution & Climate and Corruption & Conflict. Most costs to mitigate pollution are caused by the pepper farmers using fertilizers (€ 0,01) and through the production of glass (€ 0,19). Pepper farmers and pepper exporters are most susceptible to Corruption and have no active governance to mitigate that (€0,04). Other hidden costs that were found, include costs to prevent biodiversity loss. Verstegen, together with the pepper exporter, invested in Agroforestry solutions to increase biodiversity. Through this project, supply- chain specific mitigation costs were used to calculate prevention costs.

Besides negative hidden costs, positive costs were calculated (Figure 14). Positive costs are based on actual company spending, benefitting others than the ones involved in the transaction. Positive costs of € 0,89 were found, 98% of this was spent by Verstegen. Verstegen invested to increase yields, contributing to food security (expressed in the category Land use). The project also led to increased livelihoods of pepper farmers (Economic Responsibility).

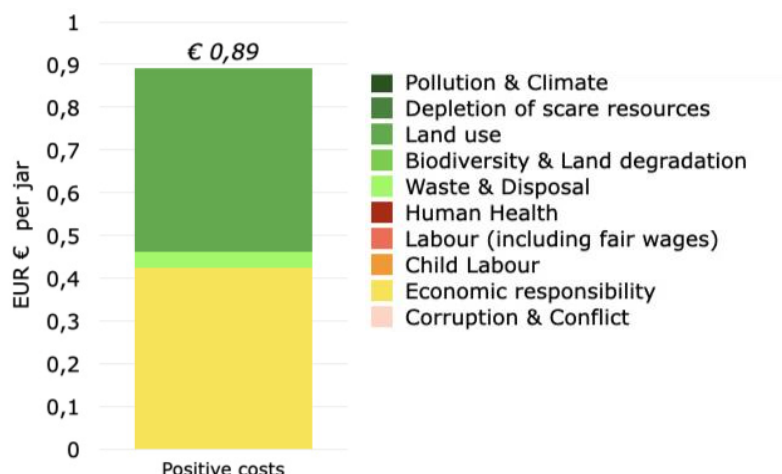


Figure 14 Positive costs per jar of white pepper

3.3.1 Data specificity assessment of white pepper

The data specificity of performance data of this analysis is displayed in Figure 15. Verstegen, the pepper exporter, the pepper farmers and the cap manufacturer were able to complete the assessment using mainly company-specific data. The data of the glass manufacturer was mainly obtained through generic databases.

The data specificity of prevention data are displayed in Figure 16. None of the value-chain partners were able to provide much company-specific prevention costs, as it takes time to make investment proposals to mitigate impact. This should be a focus when the assessment is repeated.

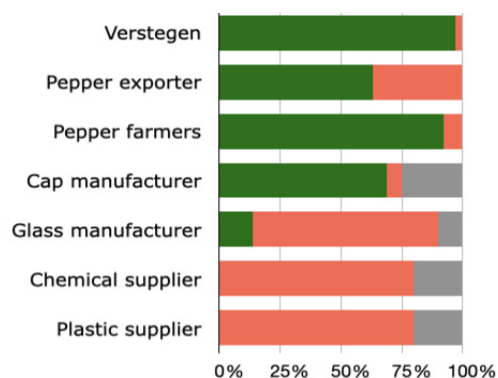


Figure 15. Data specificity of performance costs

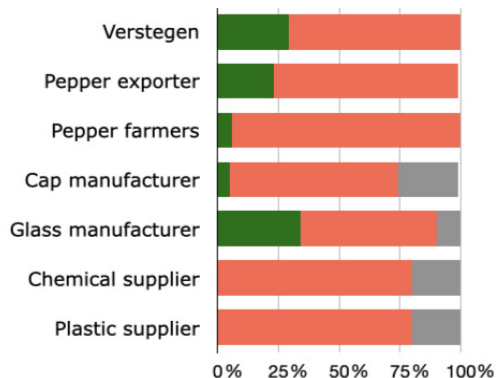


Figure 16. Data specificity of prevention costs

3.4 Main observations and learnings from case studies

The case studies have resulted in observations and learnings that have implications on the Oiconomy assessment tool, further support that is necessary and on further development of the Oiconomy pricing methodology. The following observations were made:

1. All pilot companies have independently started reaching out to their main suppliers after the initial scoping of the assessment. With the background support from the UU team all three companies were able to complete the full scope assessment.
2. The pilot companies were in good contact with their main suppliers and were able to convince and motivate the most relevant suppliers to join the pilot. Large suppliers of small elements of the product were hard to convince. In these cases, background-data-based assessments were made. *In the future users will need to be supported in filling such gaps.*
3. For various aspects, the method includes a self-assessment of the quality of corporate governance, based on the worldwide applied form of management systems, applying the plan-do-check-act approach. The tool includes questionnaires which have been experienced as too detailed especially in the case of small and medium size enterprises. The rationale for using this needs to be better communicated to users, while a simplified version is needed for SME's.
4. It may be tempting to calculate net positive value by distracting the negative costs from the positives but this is not the intention of the system. The negative hidden costs are derived from prevention of hidden impacts and the positive costs are extra benefits for people and planet. Negative costs cannot compensate the positive costs. In our discussions we see the temptation to do this. *We have to more explicitly communicate the difference.*
5. Full scope assessment is quite labour intensive the first time, mainly because the companies lack data or the knowledge who has the data even in their own company. Future assessments will therefore be much easier. *Based on the pilot experiences a guidance for starting to use of Oiconomy can be developed. Before starting an assessment, a **quick ex ante check** on applicability and product scoping can be done. Training opportunities and materials, online available explanations and justifications will be provided in the next stages.*
6. Where more remote tiers of suppliers (3rd, 4th tier etc.) are involved, it is harder to achieve direct participation and collaboration. This is especially relevant when small or medium size enterprises are involved in middle- or low-income countries. Maintaining the full PPP scope in these cases raises objections of two types: a- the total contribution to the total ESCU of the end-product will be marginal, and b- these remote suppliers may have many other clients, not being interested in such assessments. Despite this **dilution effect** in a specific value chain, the total of small contributions may still be relevant for prevention. Yet, the fact that the 1st tier suppliers could be involved, also raises the expectation that in the

longer term, when the requirement to engage in the system reaches the 3rd, 4th tier etc. suppliers from several customers, these 3rd, 4th tier suppliers can also be engaged. *However, we plan to develop standard ESCU values for a short list of (100-200) inputs in the remote supplier tiers to solve this dilution issue. Most of the environmental default data on remote tier suppliers are already in the system. Science will have to add the socio-economic default data.*

7. Partly overlapping with this issue is that in remote tiers of suppliers, tool users may need to collaborate with **small suppliers with low level capacities**, not used to business administrations or even illiterate. One can not expect such small suppliers to contribute to the assessment. *We will clarify the role of the supplier tier that is closest to such low developed suppliers, giving them the responsibility of applying the tool.*
8. The presentation of the overall results shows **very different distributions of hidden costs** between the sustainability aspects. This expressed the tailor-made approach showing the specifics of the supply chains analysed. Some relative high scores as well as very low scores surprised both the companies as well as the UU team. Correctness of the calculations were checked. *In some cases the underlying background data will be re-evaluated. We observe that an interpretation protocol for reading the end results is needed. Relative high prevention costs does by principle not equal relative high priority. Each sustainability aspect identified as have (some) hidden negative costs will need to be addressed. Low costs prevention options may still very well have high impact in reducing emission and unfair social conditions.*
9. Current positives were sometimes calculated as the positives of the entire organization divided by the % of revenue of the product under review, while they were location specific. However, we aim to only measure the positives linked to specific value chains. *We will adjust the standard by distinguishing rules for value-chain specific positives and organisation-wide positives to the related products.*
10. The participating end-producers in this pilot found Oiconomy pricing to be a useful tool in starting the dialogue with suppliers, increasing transparency, and jointly working on a more sustainable product. The participation companies also appreciated the insights that an overview of the hidden costs provided as it gives them with a tool to measure the progress towards their sustainability goals. Also, Oiconomy Pricing revealed hidden cost on sustainability aspects that companies were previously unaware of. Overall, the companies found Oiconomy Pricing to be a useful tool in navigating the complex field of sustainability.

4. Conclusion

The goal of the pilot study was to test whether the Oiconomy Pricing tool is clear enough to lead to calculations of hidden cost by company experts instead of external consultants, to identify points of improvement of the methodology and to test whether the method evokes collaboration about further sustainability performance improvement along the supply-chain.

Applying Oiconomy Pricing, the negative and positive hidden cost of a stone kitchen countertop, a medical device and a jar of white pepper were successfully calculated. The analysis revealed preventative costs of € 32,44 per m² stone kitchen countertop, € 130,12 per pack heater and € 1,03 per jar of white pepper. Through the Oiconomy Tool company-experts were guided in making the assessment and sometimes needed additional support from the UU-team. Based on the issues encountered the UU-team was able to improve the Oiconomy Tool and will make training and instructions materials to raise capacity within organizations. Also, several points of methodological improvement were identified: questionnaires to check the quality of corporate governance needed to be simplified for SME's, the relationship between negative and positive costs needs to be clarified and standard ESCU's need to be calculated for raw material producers far upstream in the supply-chain. The pilot reached its objective of increasing supply-chain collaboration to improve sustainability, as the end-producers all started dialogues with suppliers on to lower their environmental and social burden. Additionally, Oiconomy Pricing was able to provide companies with a holistic sustainability assessment of their product, showing preventative costs for sustainability aspects that companies were previously not aware of.

Oiconomy Pricing is relevant as transparency and due diligence are increasingly incorporated into corporate responsibility legislation. Non-financial disclosure is required for large groups of companies, especially in the international market. Full sustainability costs accounting tools can serve the implementation of this new legislation. Also, Oiconomy Pricing can serve as a tool in sustainable public procurement policy, having suppliers substantiate their bids with the Oiconomy price.

References

Benoît Norris C, Mazijn B et al (2009) UNEP guidelines for social life cycle assessment of products, UNEP/SETAC. UNEP/Earthprint, Paris, France

- Croes, P. R. (2021). Comprehensive in-supply chain life cycle assessment of the preventative cost-based externalities of products. An assessment methodology as first step to a sustainable and responsible true price economy: "Oiconomy". PhD thesis, Utrecht University, Utrecht
- Croes, P. R. and Vermeulen, W. J. V. (2015) 'Life Cycle Assessment by Transfer of Preventative Costs in the Supply Chain of Products. A first draft of the Oiconomy system', *J. Cleaner Prod.*, 102, pp. 178–187.
- Croes, P. R. and Vermeulen, W. J. V. (2016a) 'In search of income reference points for S-LCA using a country level sustainability benchmark (part 1): fair inequality. A contribution to the Oiconomy project', *Int. J. Life Cycle Assess.*, 21(3), pp. 349–362.
- Croes, P. R. and Vermeulen, W. J. V. (2016b) 'In search of Income Reference Points for S-LCA using a Country Level Sustainability Benchmark (part 2): Fair Minimum Wage. A Contribution to the Oiconomy project', *Int. J. Life Cycle Assess.*, 21(3), pp. 363–377.
- Croes, P. R. and Vermeulen, W. J. V. (2019) "Quantification of corruption in preventative cost-based S-LCA: a contribution to the Oiconomy project," *Int. J. Life Cycle Assess.* 24(1), pp. 142–159.
- Croes, P. R. and Vermeulen, W. J. V. (2020) 'The Assessment of Positive Impacts in LCA in general and in Preventative Cost-based LCA in particular. A contribution to the Oiconomy Project', *Int. J. Life Cycle Assess.*, 2021, 26(1), pp. 143–156.
- Vermeulen, W. J. V. (2015). Self-Governance for Sustainable Global Supply Chains: Can it Deliver the Impacts Needed? *Business Strategy and the Environment*, 24(2), 73–85.
- Vermeulen, W. J. V. (2018). Substantiating the rough consensus on concept of sustainable development as point of departure for indicator development (restricted version). In S. Bell & S. Morse (Eds.), *Routledge Handbook of Sustainability Indicators* (pp. 59–90). Routledge.
- Vermeulen, W. J. V., Croes, P. R. and Van der Feen, L. (2022) Oiconomy / RVO Pilot Project - Report. doi: 10.5281/zenodo.6480958.
- WBCSD (2022), CEO Guide to the Sustainable Development Goals, <https://sdghub.com/ceo-guide/>