Improving business decision making: valuing the hidden costs of production in the palm oil sector
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Synthesis

** This introductory note provides a brief outline of the Palm Oil study commissioned by the UNEP TEEB Office (http://www.teebweb.org/agriculture-and-food/). Specifically, it presents the objectives of the study, the methodologies employed, the results, and future work that may be commissioned to meet the goals of the TEEBAgriFood project.
Introduction to the study

Palm oil is the world’s most popular vegetable oil, widely used in the food, personal care, chemicals and energy sectors. Over 56 million tonnes of palm oil was consumed in 2013 and this is expected to double by 2050. Its popularity is due to palm oil’s high productivity, low cost and versatility compared to other vegetable oils.

However, the rapid growth of palm oil production in some countries is having serious environmental and social impact costs due to carbon dioxide emissions and air pollution from using fire to clear rainforest and peatland for new plantations, water pollution and harm to health from applying fertilizers and pesticides to crops, methane released from palm oil mill effluent processing facilities, land property rights violations during land expansion and substandard wages and working conditions.

TEEB believes that the root cause of these problems is that the agriculture sector is too often considered in isolation from the society that it feeds, and the environment that supports it. Instead, business and society need to shift their thinking towards a systems-based approach which recognizes the reality that agriculture, society and the environment are all connected. Natural and human capital accounting are used to reveal these mutual inter-dependencies and show how they can be reflected in production costs and market prices.

Objectives, and scope of the study

This Palm oil study is organized in two parts. First, a materiality assessment quantifies and monetizes the main natural capital impacts of palm oil across the 11 leading producer countries. This is followed by a case study that quantifies and monetizes natural capital impacts in more detail in Indonesia, the largest palm oil producer, and also quantifies and monetizes a selection of human capital impacts. A scenario analysis illustrates how natural and human capital accounting can be used in Indonesia to compare a selection of alternative techniques for growing palm oil, which may lower impact costs.

Approach and Methodologies

The materiality assessment studies the visible and invisible natural capital costs linked to the growing, milling and refining stages of palm oil production. It does not include the transportation, food processing and consumption stages. Palm oil and palm kernel oil were included within the scope of the analysis; other by-products such as fatty acid distillate or palm kernel expeller were excluded. The Indonesia case study looks at the visible and invisible natural and human capital costs associated with five specific growing and milling practices.

The analysis combines the use of secondary global life-cycle assessment studies and the application of country-specific valuation coefficients, where data availability and quality is sufficient. The first step is to understand the drivers of change by devising appropriate key performance indicators that measure the relationship between palm oil systems, human systems, and ecosystems and biodiversity.
The second step is to understand the consequence of the impact to a specific end-point. An end point is the primary receptor of this impact—society, the environment, or the business itself. Impacts are quantified in biophysical terms. Examples of metrics, or valued attributes, are changes in life expectancy or changes in species richness due to the emission of pollutants. Biophysical models are used to estimate these metrics, based on a thorough literature review, and adapted to reflect local conditions.

The last step consists of converting the biophysical metrics into monetary terms that reflect the costs and benefits to specific beneficiaries of the change in valued attribute using a valuation coefficient. The output of this step is a valued impact that reflects cost or benefit of specific practices and associated use of inputs and emissions on human health and ecosystems. In this sense, the valuations reflect the damage on different endpoints: the damage to ecosystems and/or the damage to human health.

Results

Materiality assessment across 11 producer countries

The results show that palm oil production in the 11 countries assessed has a natural capital cost of $43 billion per year compared to the commodity’s annual value of $50bn. Of this cost, crude palm oil accounts for $37.5bn while palm kernel oil accounts for $5bn. Indonesia has by far the biggest share of the total natural capital cost at 66%, while Malaysia is second at 26%.

Overall, producing one tonne of crude palm oil (CPO) has a natural capital cost of $790 while one tonne of palm kernel oil costs $897. If these costs were added to the weighted average market price of $837 per tonne of palm oil in 2013, the overall cost per tonne would almost double. The natural capital intensity of palm oil production varies widely between countries, which may have implications for siting palm oil operations or sourcing palm oil.

The cost of Indonesia’s palm oil industry is driven by the large size of its production and its high natural capital intensity. The total natural capital cost of palm oil production in Indonesia is almost $28bn while its natural capital intensity is $950 per tonne. Land-use change is the biggest single impact in Indonesia, mostly due to GHG emissions from peatland drainage and clearing rainforest.

Palm oil production in Malaysia has much lower natural capital intensity than Indonesia due to the lower cost of land conversion. Only 12% of Malaysia’s plantations are planted on peatland and 30% on forested land.

Climate change due to GHG emissions from palm oil production, mostly as a result of land-use change, is responsible for 89% of the natural capital cost per tonne of palm oil. The use of fertilizers is responsible for 22% of the cost. Palm oil mill effluent contributes 12% of the cost, largely as a result of the climate change impacts of methane emissions. The impacts of pesticides contributes 3% of the cost per tonne. The upstream impacts from manufacturing fertilizers, pesticides and other raw material inputs are responsible for 3% of the cost (see Figure 0.2).
Indonesian case study results

The case study on Indonesia shows how natural and human capital accounting can be used to assess alternative palm oil production practices to reduce the impact costs of the sector. The case study illustrates this approach by focusing on three practices with the largest natural capital costs and two practices with substantial expected human capital costs. These are land selection and clearing, fertilizer application, palm oil mill effluent remediation, wages and occupational health and safety.

The results show that converting primary forest on peat soil using burning techniques has highest natural capital cost due to GHG emissions and air pollution. Converting grassland and already-disturbed forest using mechanical means has a natural capital benefit as the palm oil plantation sequesters more carbon than the previous land use. The results also show that converting forest or peatland by burning appears less financially costly than mechanical means, but entails a higher natural capital cost.

Over the lifetime of the plantation, using an optimized mix of organic fertilizer containing pruned palm oil fronds, empty fruit bunches and palm oil mill effluent combined with chemical fertilizers has the lowest natural capital cost at $1,640 per tonne palm oil, compared to $3,080 per tonne palm oil where chemical fertilizer use is not optimized. Optimization also has the lowest financial cost due to the lower quantity of fertilizer needed.

Installing methane capture equipment on palm oil mill effluent treatment processes to generate energy is also identified as best practice to reduce natural capital costs. It also results in a 17% financial cost saving due to the sale of Certified Emissions Reduction credits.

The results also show that underpayment and occupational health impacts have a total human capital cost of $592 per full-time employee, or $34 per tonne of palm oil and $53 per tonne of palm kernel oil. This is comparable in size to the combined natural capital impact of fertilizer manufacturing and pesticide application.

If plantation owners paid a living wage to casual workers, the human capital cost of underpayment would be reduced to zero, while plantations remain profitable with margins reducing from 28% to 24%. The human capital return on investment for this intervention is 11%, which means that the decrease in human capital costs is higher than the decrease in the net cash flow of the plantation.

Wearing personal protective equipment reduces instances of pesticide poisoning, cutting the human capital cost of occupational health by 6%. The human capital return on investment for this intervention is 130%. As these results do not take into account positive effects of improved labor conditions on net cash flow or projected financial losses due to reputational and other risks, they should not be considered as a complete financial business case analysis for these interventions, but as a means to include human capital costs in business decision making.

The following table (based on the TEEBAgriFood Evaluation Framework) depicts the various ecosystem services impacts that were evaluated in this study. The framework indicates which services were examined qualitatively, and which were assessed with monetary values.
## Coverage of the TEEB Agrifood Framework in this study (Interim Report Citation)

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<th>Value chain stages</th>
<th>Production (and associated waste)</th>
<th>Processing and Distribution (and associated waste)</th>
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Qualitative discussion
Study Recommendations

Businesses can act to improve the sustainability of palm oil production through implementing more sustainable production practices such as increasing yield and conversion rates and optimizing the quantity and quality of inputs used, and by relocating to areas less vulnerable to social and environmental impacts. These elements should be considered together to identify trade-offs and ensure that the overall natural and human capital impact of the system is minimized.

In terms of policy, internalization of negative externalities will help to steer the palm oil production sector towards a trajectory that minimizes losses of natural and human capital. This can be done for example via voluntary commitments, environmental or social taxation or environmental and social regulation. These measures should however not increase food prices for vulnerable shares of the population. Efforts to improve palm oil production to reduce human and natural capital costs should also be made through policies.

Further research

Palm oil plantations have significant social and natural components that were not explored in this study. Palm oil landscapes provide a number of important ecosystem services such as soil erosion control, biodiversity, water regulation, other agricultural production that support subsistence livelihood. Moreover, it covered only the production side of palm oil and did not account for any costs or positive benefits associated in distribution and consumption side of the equation, as well as food security aspects, access, distribution, markets, agribusiness, supply chain, waste reduction which are all important parts of food systems. These are important areas for future research. Relatedly, other qualitative social impacts such as food security, the role of gender in agroforestry systems, cultural values, labour conditions, land dispossession etc. should also be examined further.