Full Cost Accounting of Food Wastage

WORKING PAPER

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Introduction

Traditional accounting systems deal predominantly with actual monetary costs. Matters outside of this, particularly where the monetization is difficult to determine, or has not been perceived nor valued, are treated as externalities (matters outside the business equation). As stakeholders, including stockholders, consumers and policy-makers, become more aware and concerned about the potential environmental and social impacts of economic activities, they are demanding better accounting. The Full-Cost Accounting (FCA) process makes transparent both direct and indirect costs. Although sound work is emerging in some aspects of environmental accounting (such as measuring the carbon footprint), there is not yet an all encompassing methodology for FCA. This paper seeks to kick-start an international discussion on possible components of FCA, in order to better take into account the direct and direct impacts of food wastage on the economy, society and the physical environment.

Background

Approximately one third of global food production for human consumption is lost or wasted[1]. The direct economic impact of this food wastage amounts to 750 billion USD per year (FAO, 2013). This astonishing figure is a conservative estimate, based on producer prices only and excluding fish and seafood wastage. Moreover, the full economic cost of food wastage includes the environmental and social costs that are not reflected in food prices. Examples include the costs of land degradation, deforestation, water pollution and overuse, biodiversity loss and greenhouse gas emissions that contribute to climate change. These external costs do not directly affect economic agents along the supply chain; rather they are borne by nature and people. Ultimately, the shadow of food wastage has implications for the availability of food and on access to productive resources for food security. By placing increased pressure on the environment, a wasteful and inefficient food supply chain threatens to undermine the very base of agricultural production. This is most acutely felt by vulnerable and food insecure people, whose livelihoods directly depend on natural resource assets that are unduly depleted by food wastage.

Phase I of the FAO Food Wastage Footprint (FWF) project focused on the impacts of food wastage on greenhouse gas emissions, water consumption, land occupation and biodiversity loss (more info here). Phase II extends that analysis by defining methods for the economic valuation of environmental and social costs of food wastage, as well as evaluating the costs and benefits to be derived by different food wastage mitigation scenarios, depending on the wastage reduction targets and investments (more info here). To do so, there is need to establish a framework for the FCA of food wastage; this Working Paper is a very first attempt to define the likely and workable components of an FCA framework and gather views, expertise and suggestions from the E-Forum.

[1] **Food loss** refers to a decrease in mass (dry matter) or nutritional value (quality) of food that was originally intended for human consumption. These losses are mainly caused by inefficiencies in the food supply chains, such as poor infrastructure and logistics, lack of technology, insufficient skills, knowledge and management capacity of supply chain actors, and lack of access to markets. In addition, natural disasters play a role.
Food waste refers to food appropriate for human consumption being discarded, whether or not it is kept beyond its expiry date or left to spoil. Often this is because food has spoiled but it can be for other reasons such as oversupply due to markets, or individual consumer shopping/eating habits.
Food wastage refers to any food lost by deterioration or waste. Thus, the term "wastage" encompasses both food loss and food waste.

Improvements to Environmental Impact Modelling

Phase I of the FWF utilized a Life-Cycle Assessment (LCA) to estimate the global environmental impacts of food wastage, comprising four components: carbon, water, land and biodiversity[2]. Carbon emissions, blue water consumption and land occupation area were determined quantitatively, while biodiversity loss was assessed using a semi-qualitative/quantitative method. In Phase II, these calculations have been integrated into a mass flow model built to evaluate the sustainability of food systems and make development scenarios projections – SOL-m. This model[3] has several advantages: it covers the entire agricultural sector (rather than specific crops), includes additional environmental impacts (non-renewable energy use, nitrogen and phosphorus eutrophication, land degradation, and pesticide use), and allows for the analysis of food waste in combination with other interrelated topics, such as food availability and food supply and demand linkages on a global scale.

Analytical Framework for FCA of Food Wastage

The FWF project seeks to assess the wider environmental and social costs of food waste, to complement the economic cost evaluation. The magnitude of these external costs represents a critical research gap; much of the necessary data is scattered or unknown and a framework for analysis is missing. Moreover, this research is crucial to inform the debate on how to respond to the food wastage challenge, as the broad societal costs are born by all citizens, and not just food producers and operators.

In cases where the financial costs alone may not warrant investment to mitigate food loss or waste, a full internalisation of the external costs and benefits may convince decision-makers to take action to reduce food wastage. On the other hand, food wastage has positive aspects, such as providing greater price stability[4]. Individual actors along the supply chain are equipped with imperfect information about markets or producing conditions and thus, may prefer to waste food; to manage the risks of imperfect information, it is rational to produce or purchase more food than is absolutely required on average. By evaluating the external costs and benefits of food wastage, a FCA will help establish the economic rationale for food wastage reduction and contribute to identifying socially optimal levels of food wastage.

A draft analytical framework for the FCA of food wastage is outlined below. The framework has been developed based on a review of the scientific and grey literature and interviews with experts inside and outside FAO. While the analytical framework is intended to be widely encompassing, the FWF project will not attempt to quantify the full range of costs associated with food wastage. Rather, it will deliberately concentrate on environmental and social costs where reliable data sets and appropriate methodologies are available.

Basic Mechanism and Impacts of Food Wastage

Food loss and waste occur at different stages throughout the supply chain. Consequently, more food needs to be grown at the agricultural production phase to supply a given level of consumption (compared to the counter-factual scenario of zero waste). This additional production is achieved by intensifying[5] food production or increasing the amount of land in production. Intensification and increased land use leads to greater natural resource depletion (e.g. water, energy, forests), capital use (e.g. machinery, buildings, fertilizers, pesticides) and pollution (e.g. nitrate, greenhouse gases), contributing to climate change, biodiversity loss and the degradation of ecosystem services. By

[2] The FWF analyses eight commodity groups, through five stages of the food supply chain, across seven world regions.

[3] SOL-m was developed by FiBL for FAO; for further details see FAO (2012).

[4] For example, in the event of an external shock, food that would otherwise have been wasted, due to visual or non-health related quality criteria, could be added to food supply, hence contributing to price stability.

[5] Intensification of production means producing more on the same land or from the same animal.

placing increased pressure on the environment for food production, these impacts cause environmental and social costs. The basic mechanism and impacts of food wastage are displayed in Figure 1.

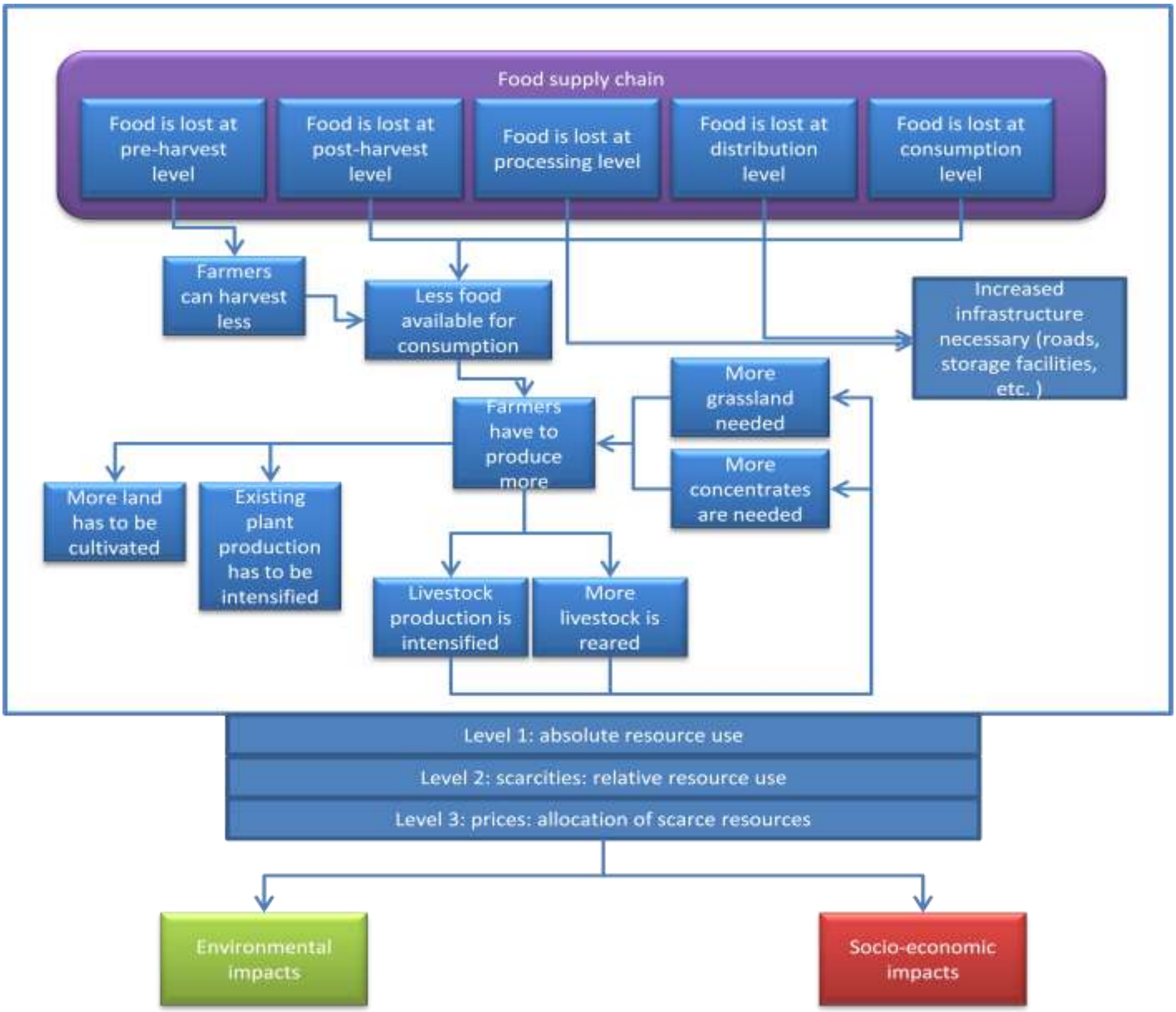

Figure 1: Basic mechanism and impacts of food wastage

Typology of Environmental and Social Costs

The full environmental and social costs of food wastage are numerous and often complex. For example, the valuation of biodiversity that is lost due to the additional production required to compensate for food wastage depends on reliable scientific indicators to measure impacts and economic methods to value ecosystem services that are not traded in markets. While the FCA approach moves beyond financial costs alone, it will inevitably be a partial estimate of the full cost of food wastage based on the environmental and social costs that it is possible to quantify. The following typology has been developed to classify costs based on their properties and determine the environmental and social costs that can be evaluated.

Firstly, it is important to distinguish between internal and external costs of food wastage. Costs that are internalized are reflected in market prices and taken into account in economic decision making. By contrast, external costs are not included in market prices. These hidden costs are borne by society as a whole, different stakeholder groups, or future generations. From a moral point of view, internalization of external costs is a question of fairness. While internal costs are widely quantified, the magnitude of external costs is often unknown. For these reasons, the analytical framework for FCA focuses on the external environmental and social costs of food wastage.

Other important considerations include whether externalities are positive or negative, how they affect different stakeholder groups and where they occur in the supply chain. As has been alluded to already, food wastage can have positive, as well as negative impacts. While agricultural intensification and deforestation impose negative external costs, agricultural expansion may also provide positive external benefits through the provision of ecosystems services, landscape and cultural values[6]. Likewise, the social impacts of food wastage can have positive and negative impacts for various stakeholder groups, depending on the stage of the supply chain where wastage occurs.

Three Levels of Costs

Three levels of costs can be distinguished. The first level of food wastage costs corresponds to the internal and external costs of food production, at each stage of the value chain, for food that is eventually lost or wasted. These are the ***absolute costs*** of food wastage that can be directly linked to quantities of food lost or wasted.

The second level of food wastage costs takes into account the ***relative costs*** of increasing scarcity. Following the basic mechanism outlined above, a food system that is inefficient in terms of food wastage needs to produce more to supply a given level of consumption. In addition to the absolute costs of food waste, this also places increased pressure on natural resources in aggregate. These relative costs are more complicated to assess as they depend on an assessment of the imminent scarcity of the relative resources. For example, a relatively large quantity of water wasted where water is abundant will have a smaller cost in terms of increasing scarcity than a relatively small quantity of water wasted in dry regions and seasons.

The third level of food wastage costs cover ***market effects*** – changes in prices that determine the allocation of scarce resources to various utilizations in an economy[7]. The assessment of these costs is more difficult than the first and second levels, requiring estimates of demand and supply price and cross-price elasticities to estimate changes in total societal welfare. Methodologically, this would require the use of a general equilibrium model capable of capturing the interactions and feedbacks of an economy. This is beyond the scope of the FWF project that will focus only on level one and two costs. Nevertheless, by estimating the static costs and benefits of food wastage and its impacts on society, resource use and the environment, the current work provides an important input for full economic modeling in the future[8].

[6] The various negative and positive external costs and benefits have been demonstrated in the debate about the multifunctionality of agriculture (e.g. OECD, 2001).

[7] From an economic perspective, the third level encompasses the first and second levels of costs. The distinction is made here in order to help frame the problem of food wastage cost accounting and determine which costs will be evaluated by the FWF project.

[8] The need for a full economic modelling of dynamic food wastage impacts may be addressed in the future through the work of fora, such as the High Level Panel of Experts on Food Security and Nutrition (HLPE) established in 2010 as the science-policy interface of the UN Committee on World Food Security.

Non-Market Valuation and Benefit Transfer

The internalized costs of food wastage can in principle be taken from market prices. To evaluate the absolute external costs (level one), the FWF project will draw on the non-market valuation[9] literature for major environmental and social impacts (Pearce *et al*., 2006; Bateman *et a*l., 2011). A number of non-market studies have been conducted to examine the costs of agricultural impacts on the environment. For example, non-market valuation studies have focused on biodiversity (Christie *et al.*, 2006), environmental degradation (Croitoru and Sarraf, 2010), and the total environmental impacts of agriculture (Pretty *et al*., 2000).

To translate the results of these primary valuation studies from specific locations to other similar contexts (countries or regions), the benefit transfer method will be applied (Ready *et al*., 2004). Where estimates of externalities are not available for all countries or at a global level, and further primary data collection is too expensive, benefit transfer is often the next best alternative (Pearce *et al*., 2006).

International benefit transfer exaggerates some of the difficulties faced when conducting transfers between countries. The most striking issue is differences in incomes. The methodology accounts for differences in exchange rates, inflation, purchasing power and national income levels. Differences in cultural heritage, shared values and experience that are difficult to measure may also influence willingness-to-pay (WTP) for environmental goods and services. These differences are likely to be more pronounced at the international level (Ready and Navrud, 2006).

This provides a broad, initial indication of the scale of external environmental and social costs of food wastage. However, due to the assumptions involved in the quantification of external costs and benefit transfer at a global scale, these results should be treated with a degree of caution. To convey some of the uncertainties, sensitivity analysis or Monte-Carlo Simulations (Rubinstein, 2009) will be used and results will be presented as a range around a central value.

It is anticipated that the FWF project will not be able to quantify all relevant environmental and social impacts of food wastage in monetary terms because of missing data or a lack of appropriate indicators or data. In these cases, it may be possible to make a qualitative assessment. An alternative option for illustrating the correlation and exploring the linkages between food wastage and other social impacts is overlaying maps of food wastage quantities with natural resources scarcity, food insecurity and poverty for different countries.

Valuation of Environmental Costs

The major environmental impacts of food wastage are mapped in Figure 2. Increased agricultural production and intensification cause level one and two impacts through two main drivers: pollution and natural resources depletion. Level one environmental impacts include the direct effects of soil degradation, deforestation, and air and water pollution, as well as further consequences from climate change and the loss of biodiversity and ecosystems services. The classification of these environmental impacts, their associated costs and potential methods for quantification are listed in Annex 1. While Figure 2 covers the full range of environmental impacts, Annex 1 provides some indication of the costs that it will be possible to measure as part of the FWF study. Level two environmental impacts occur as water, land, energy and nutrients become increasingly scarce. Potential indicators and methods for the evaluation of level two impacts are listed in Annex 2.

[9] Non-market valuation techniques develop hypothetical markets to estimate people's willingness-to-pay (or willingness-to-accept) for a given environmental good or service. The two most common methods are contingent valuation and contingent choice studies.

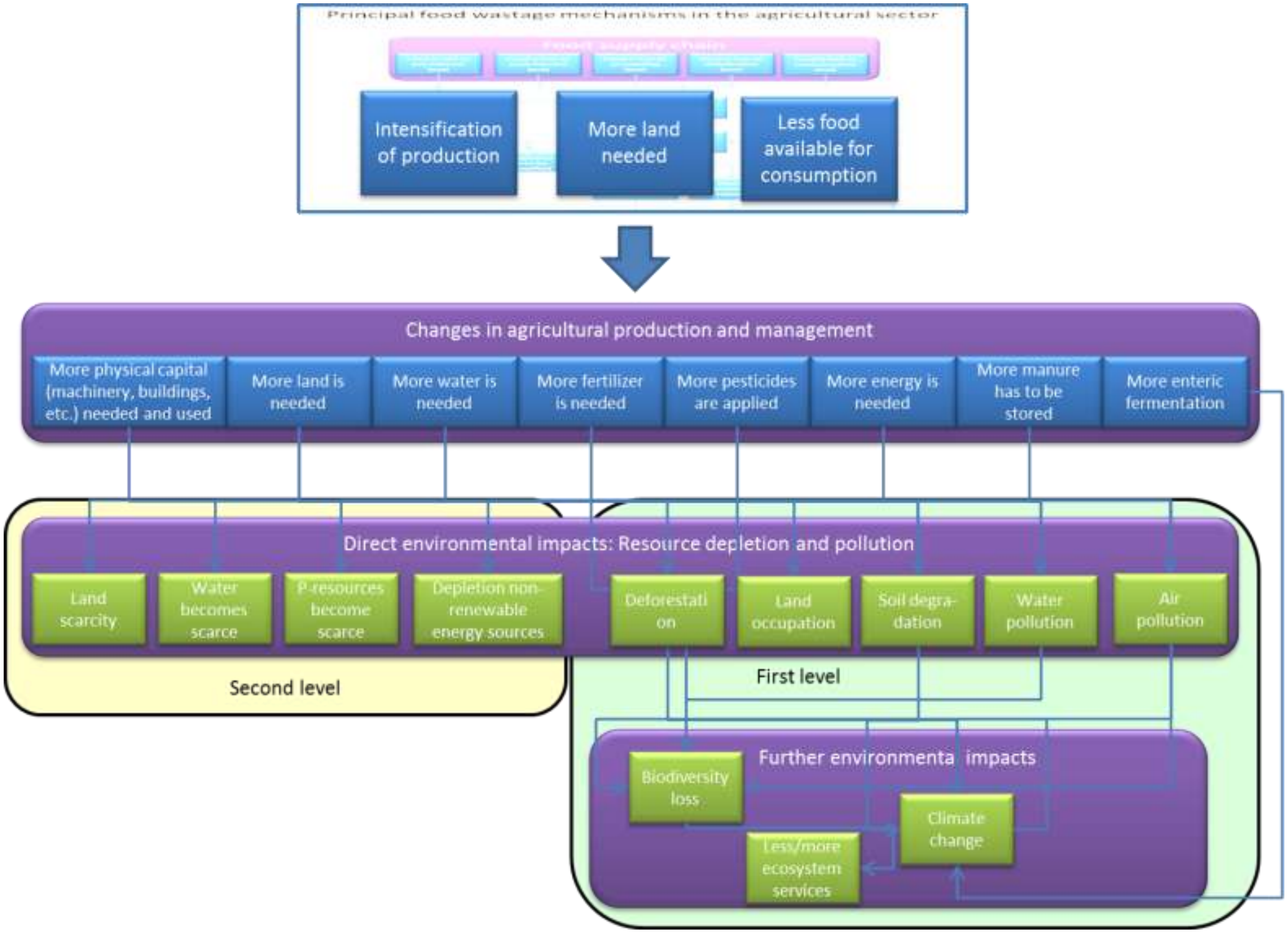

Figure 2: Environmental impacts of food wastage (The small box at the top represents the three main drivers of food wastage identified in Figure 1)

Valuation of Social Costs

The impact of food wastage on food prices illustrates some of the complexity involved in analysing social costs. Intuitively, food wastage is likely to increase food prices by increasing demand at downstream stages of the value chain and by increasing the scarcity of natural resources (as an input to food production). This will affect different stakeholders in different ways. Rising food prices lead to the positive impact of increasing producer surpluses and therefore, added value of the food sector. The negative consequence of the rising food prices is a decrease in consumer surplus, which leads to reduced access to food by the non-food producing rural and urban population and lowers their disposable income (as a larger share is needed for food purchase). This impact particularly hurts the poorest strata, who spend a larger proportion of their income on food. Even among rural food producers, 69% are net food importers and subject to the negative effects of price rises (FAO, 2008). Differing effects also occur depending on where in the supply chain food wastage occurs. Generally, actors at the supply chain level where food losses occur are most directly affected (e.g. farmers harvest and subsequently earn less). All other levels of the supply chain suffer indirectly due to higher prices. On the other hand, it can be economically beneficial for preceding supply chain levels if the following supply chain level treats food wastefully. For instance, the fact that consumers discard perfectly edible food means that more food than is absolutely necessary is produced. This leads to higher demand for food at the previous stages: agriculture, trade, processing and retailing.

The environmental impacts of food wastage also lead to a number of socio-economic costs. Compared to many of the environmental costs, the social costs of food waste are even more complex, making them exceedingly difficult to quantify. For example, most of the environmental costs identified are classified as level one ‘absolute’ costs of agricultural production. By contrast, an assessment of the social costs of higher food prices, or increased labour demand[10] depends on level three ‘market effects’ that are beyond the scope of this study. Therefore, the FWF study will focus on the analysis of the social impacts of food wastage on a smaller selection of critical issues. For example, health-related costs will be evaluated only in terms of exposure to pesticides and other pollutants.

As the FWF project looks at the issue of food wastage predominantly from an environmental perspective, social costs of food waste considered are incurred as a result of natural resources depletion and degradation. This relationship is an important issue in terms of the vulnerability of rural livelihoods, market-marginalized groups and rural hunger. For instance, it has been estimated that ecosystem services and other non-marketed natural goods account for 47 to 89 per cent of the 'GDP of the Poor' (TEEB, 2010). The degradation of land and ecosystems services further reduces agricultural productivity in the form of a feedback loop. The livelihoods approach has been adopted to assess the reduction in access to natural resources (DFID, 1999), which analyses investment and disinvestment in five types of capital (natural, physical, financial, social and human).

Environmental impacts and subsequent social costs of food wastage are shown in Figure 3. Again, the impacts and costs mapped in Figure 3 cover a broad spectrum, whereas the costs that will be evaluated quantitatively are restricted to those where sufficient data and appropriate methods are available. An initial shortlist of these costs is presented in Annex 3.

[10] Increased agricultural production due to food wastage potentially leads to higher demand for rural labour. This can have positive and negative effects. Increasing rural employment and family income is positive from a social perspective. However, in areas facing a shortage of labour, increased labour demand could be a problem. Increased labour demand will have social costs if this increases child labour and reduces school attendance.

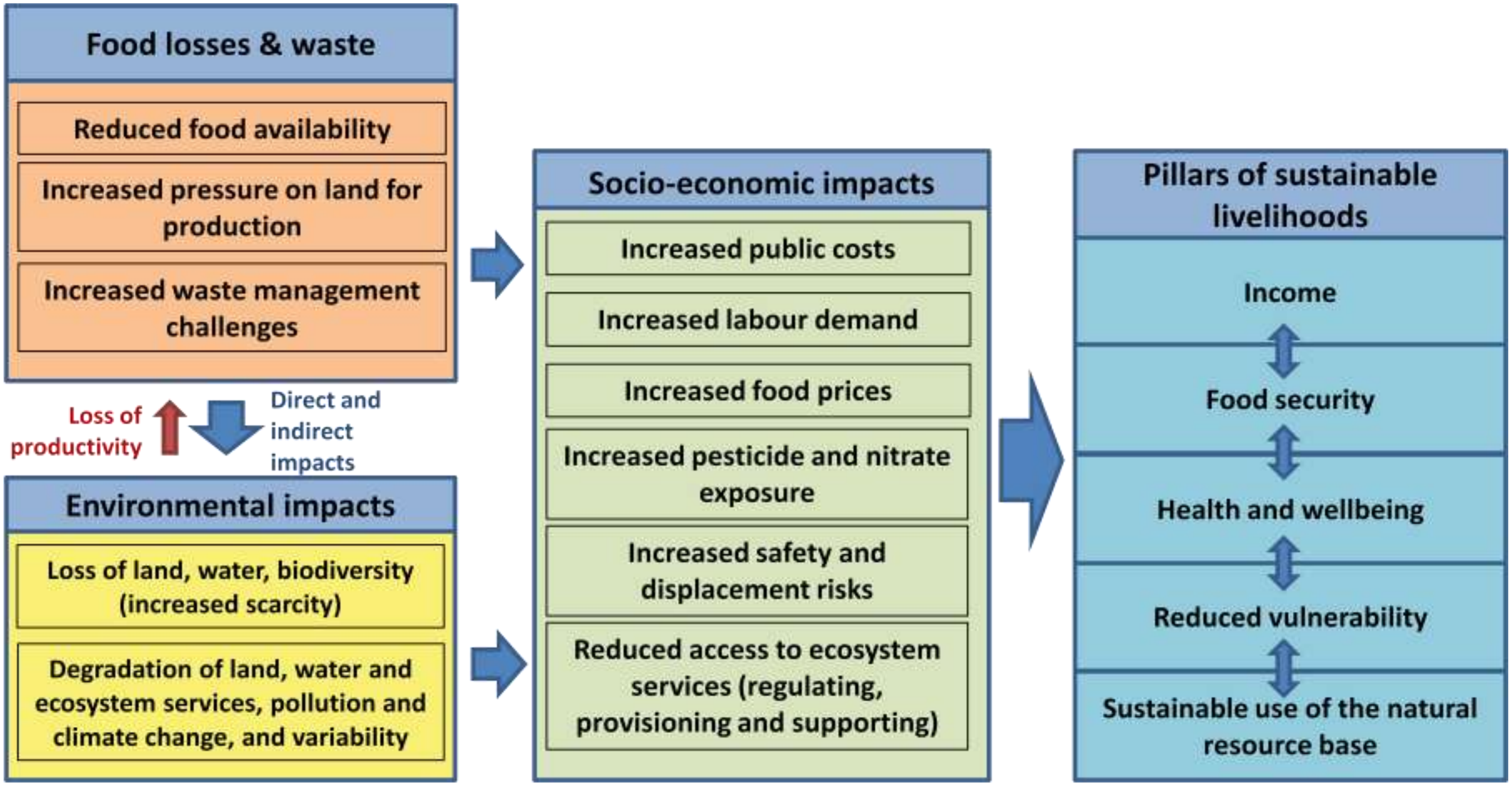

Figure 3: Environmental drivers and subsequent social costs of food wastage.

Note: the pillars of sustainable livelihood are based on DFID (1999).

Conclusions

Preliminary results for the quantification of environmental costs will be presented as part of the weekly briefing papers, alongside a short discussion of valuation challenges relating to carbon emissions, water pollution and overuse, land degradation and biodiversity loss. Also, examples of the range of environmental costs involved will be presented to illustrate the implications of different methodological choices.

While the analytical framework for FCA presented above is intended to be widely encompassing, the quantification of costs will inevitably prioritise some aspects over others. By necessity, several impacts, where data availability or quality is low and monetization is challenging, have been excluded. Therefore, the assessment of the environmental and social costs of food wastage will provide a conservative estimate of the full external costs. On the other hand, this could introduce a bias against the positive externalities that stem from agricultural landscapes. The damage costs from pollution are generally much easier to assess than the positive external benefits associated with recreational, cultural and aesthetic values (Pretty *et al*., 2000).

It is emphasized that the global model used and the nature of non-market valuation and benefit transfer techniques require a number of assumptions. Where detailed data on the full environmental and social costs of food wastage are missing and additional data collection is expensive, benefit transfer is the best option available to extrapolate from more reliable data sources. This provides a broad, initial indication of the magnitude of environmental and social costs at a global scale. The intention is to highlight the real environmental and social costs of food wastage, contribute to the policy debate on the food wastage challenge and provide a framework to stimulate further research at a 'higher resolution' scale.

The FCA approach prioritizes an economic conception of food wastage. Monetization through FCA and cost-benefit analysis (CBA) offer an established framework of concepts to structure the analysis, including an assessment of the relevant trade-offs involved in food wastage reduction, how to design effective and cost-efficient policies, and how these can be structured to compensate those who 'lose' from food waste mitigation. We argue this is ***one*** important aspect of the discussion. The normative debate about the socially desirable response to food wastage should also include a wider range of perspectives and values. During the E-Forum on Full Cost Accounting of Food Wastage we encourage participants to share any alternative views on food wastage and suggest practical ways that these can be incorporated into the analytical framework.

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Annex 1: Possible environmental indicators

Classification of possible environmental impacts of food wastage and their costs (Level 1). Green = first priority, appropriate indicator linked to food waste and estimates for costs likely available at global level or for single countries; Yellow = second priority, appropriate indicator linked to food waste and estimates for costs potentially available; Red = third priority, appropriate indicator likely not available linked to food waste and/or estimates for costs.

Cost	Physical impact indicators	Economic value indicator	Quantification methodology and comments
Climate change			
Temperature increase	CO2-eq	Available damage cost estimates	Benefit transfer
Increase of extreme weather events	CO2-eq	Available damage cost estimates	Benefit transfer
Water use			
Infrastructure cost for irrigation	m3 water: SOL-m, Aquastat	Market price and external cost estimates	Calculation of irrigation costs based on literature and expert opinion. Difficulty: partly internalised in price
Opportunity cost for using water	m3 water: SOL-m, Aquastat	Available external cost estimates	Benefit transfer
Water pollution			
Nitrate in sources of drinking water	Nitrate surplus calculated in SOL-m	Costs for cleaning the water	Calculation of factor costs for cleaning based on literature and expert opinion or replacement cost estimates
Pesticides in sources of drinking water	Qualitative pesticide use indicator from SOL-m (pesticide types and amounts unknown)	Costs for cleaning the water	Calculation of factor costs for cleaning based on literature and expert opinion or replacement cost estimates
Phosphorus in sources of drinking water	Phosphorus surplus calculated in SOL-m	Costs for cleaning the water	Calculation of factor costs for cleaning based on literature and expert opinion or replacement cost estimates
Land occupation			
Opportunity cost for using land	Hectares of arable land and grassland from SOL-m	Average production value per ha of land and year, calculated with SOL-m	Benefit transfer from literature values on opportunity costs (rental value of land can also be used as a proxy)

Other external costs due to land occupation	Hectares of arable land and grassland from SOL-m	External cost estimates	Benefit transfer from willingness-to-pay or willingness-to-accept studies (contingent valuation or choice modelling)
Cost	**Physical impact indicators**	**Economic value indicator**	**Proposed methodology for quantification of costs and comments**
Soil degradation			
Opportunity costs for lost or infertile soil	SOL-m (qualitative indicator), GLADIS data	Average production value per ha of land for 100 years, calculated with SOL-m	Opportunity cost. Difficulty: partly considered in market prices, partly not (depending on regions)
Off-site damage caused by soil erosion	SOL-m P runoff potential	Available external cost estimates	External: benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Damage costs of lost or infertile soil	SOL-m (qualitative indicator), GLADIS data	Average production value per ha of land for 100 years, calculated with SOL-m	Internal: market price External: benefit transfer
Loss of biodiversity and ecosystems services			
Species loss due to pesticide deposition to sensitive ecosystems (incl. marine)	Qualitative pesticide use indicator from SOL-m	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Species loss due to P-deposition to sensitive ecosystems (incl. marine)	P-Eutrophication	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Species loss due to N-deposition to sensitive ecosystems (incl. marine)	N-Eutrophication	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Species and habitat loss due to climate change	CO2-eq emissions	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Species and habitat loss due to land use change of natural and semi-natural habitats including deforestation	Deforestation potential calculated in SOL-m	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Loss of pollination services	Hectares of land additionally sprayed with pesticides	Use values of pollination services	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources

Species and habitat loss due to land use change on cultivated land	Grassland overexploitation calculated in SOL-m	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Species and habitat loss due to land use change from wetlands	Wetland destruction potential could be modelled in SOL-m similarly to deforestation	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Species and habitat loss due to land use change from grasslands	Grassland destruction potential could be modelled in SOL-m similarly to deforestation	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Habitat loss due to pollution of waterbodies	Trophic index	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources
Overexploitation of fish and seafood resources	Fishery status (Costello et al. 2012)	Use and non-use values of biodiversity and ecosystems lost	Benefit transfer studies (WTP) or replacement cost estimates for lost ecosystem services and resources

Cost	**Physical impact indicators**	**Economic value indicator**	**Proposed methodology for quantification of costs and comments**
Landscape amenities			
Loss of landscape assets	TBD	Use and non-use values of landscape amenities	Benefit transfer from willingness-to-pay or willingness-to-accept studies (contingent valuation, choice modelling or travel cost method) or replacement cost estimates.

Annex 2: Possible scarcity indicators impacts of food wastage (Level 2)

Scarcity	Issue	Indicator	Possible representation
Land	Food insecurity	Availability of fertile land	Mapping of food security maps and land scarcity maps
	Less access to production factors		
Phosphorus resources	Food insecurity	Available phosphorus resources	
	Less access to production factors		
Fossil energy	Food insecurity	Available fossil energy resources	
	Less access to production factors		
Water	Food insecurity	Available fresh water	Mapping of food security maps and water scarcity maps
	Less access to production factors		

Annex 3: Possible social indicators

Classification of possible social impacts of food wastage. Green = first priority, appropriate indicator linked to food waste and estimates for costs likely available at global level or for single countries; Yellow = second priority, appropriate indicator linked to food waste and estimates for costs potentially available; Red = third priority, appropriate indicator likely not available linked to food waste and/or estimates for costs.

Cost	Physical impact indicators	Economic value indicator	Quantification methodology and comments
Damage to human health			
Acute effects of pesticides	Pesticide use: Qualitative indicator: SOL-m	Treatment cost + loss of life expectancy, loss of income	Calculation of treatment costs and value of human life estimates using benefit transfer
Chronic effects of pesticides	Pesticide use: Qualitative indicator: SOL-m	Treatment cost + loss of life expectancy, loss of income	Calculation of treatment costs and value of human life estimates using benefit transfer
Chronic effect due to nitrate contamination	Nitrate: SOL-m	Treatment cost + loss of life expectancy, loss of income	Calculation of treatment costs and value of human life estimates using benefit transfer
Particulate matter pollution	Estimated biomass burning in agriculture	Treatment cost + loss of life expectancy, loss of income	Calculation of treatment costs and value of human life estimates using benefit transfer
Labour			
Increased demand for labour with positive consequences for the workers (additional employment and income)	Hours worked, ILO data	Value added or wage payments	Benefit transfer from income surveys
Increased demand for labour with negative consequences for the workers (exploitation; hazardous working conditions)	TBD (maybe ILO data)		

Note: social cost indicators have not yet been developed and this table is a sketch of the type of quantifiable indicators needed; suggestions are welcome.