



Costs of food waste in South Africa: Incorporating inedible food waste



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ARTICLE INFO

Article history:

Received 2 June 2014

Accepted 1 March 2015

Available online 26 March 2015

Keywords:

Inedible food waste
Composting
Anaerobic digestion
Opportunity cost
Externality
Landfilling

ABSTRACT

The economic, social and environmental costs of food waste are being increasingly recognised. Food waste consists of both edible and inedible components. Whilst wastage of edible food is problematic for obvious reasons, there are also costs associated with the disposal of the inedible fraction to landfill. This is the third in a series of papers examining the costs of food waste throughout the value chain in South Africa. The previous papers focused on the edible portion of food waste. In this paper, costs associated with inedible food waste in South Africa are estimated, in terms of the value foregone by not recovering this waste for use in downstream applications, such as energy generation or composting; as well as costs associated with disposal to landfill. Opportunity costs are estimated at R6.4 (US\$0.64) billion per annum, or R2668 (US\$266) per tonne. Adding this to the previous estimate for edible food waste of R61.5 billion per annum (in 2012 prices; equivalent to R65 billion in 2013 prices) results in a total opportunity cost of food waste in South Africa (in terms of loss of a potentially valuable food source or resource) of R71.4 (US\$7.14) billion per annum, or R5667 (US\$567) per tonne. Thereafter, estimates of the costs associated with disposal of this food waste to landfill, including both financial costs and externalities (social and environmental costs), are taken into account. These costs amount to R255 (US\$25) per tonne, giving rise to a total cost of food waste in South Africa of R75 billion (US\$7.5 billion) per annum, or R5922 (US\$592) per tonne. This is equivalent to 2.2% of South Africa's 2013 GDP.

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1. Introduction

Food waste can be defined as food losses throughout the food supply chain, including during production, storage, transportation, and processing; as well as food that is discarded at retailers and in the kitchens of restaurants and households (Lundqvist et al., 2008). As such, it includes food losses that arise before food reaches the end-user (pre-consumer food losses), as well as food that is discarded by consumers (post-consumer food waste). Globally, it is estimated that food waste throughout the food supply chain (including both pre- and post-consumer food waste) amounts to 50% of all food that is produced for human consumption (Lundqvist et al., 2008). According to Ventour (2008), up to 81% of food waste consists of food that could have been eaten, if it had been managed, distributed or prepared in a different way (i.e. edible, or avoidable, food waste). Only 19% of food waste, consisting of inedible items such as peelings and bones, is truly unavoidable.

Food waste, particularly if disposed of (e.g. to landfill) rather than recovered, is problematic for a number of reasons. These include wasted resources and emissions in the food supply chain,

opportunity costs associated with loss of a potentially valuable food source or resource for use in other processes (e.g. energy generation or composting), and costs (financial costs, as well as negative social and environmental impacts or 'externalities'¹) associated with the disposal of organic waste to landfill. The 2012 South African National Waste Information Baseline Report (Department of Environmental Affairs, 2012) estimates that organic waste (comprising mainly garden waste and food waste) contributes about 13% (by weight) of the South African general waste stream, and that approximately 65% of this organic waste is disposed of to landfill.

On a per capita basis, overall food losses throughout the supply chain are far higher in developed countries than in developing countries. For example, according to Gustavsson et al. (2011), total food losses amount to 280–300 kg/person/annum in Europe and North America respectively, compared to 170 kg/person/annum

¹ The positive or negative side effects (external benefits or costs) of a particular economic activity (e.g. landfilling) that are not incurred by those with a direct financial stake in the activity (e.g. the landfill owner or operator), but are instead borne by other groups in society and/or by future generations, or are dispersed throughout society as a whole. Externalities associated with landfilling are not reflected in the financial statements of the landfill owner or operator, but affect social well-being more generally (Nahman, 2011).

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in sub-Saharan Africa. The causes of food waste in high income countries relate mainly to consumers buying more food than they need, portions being too large, and farmers retaining harvests when market conditions are unfavourable (Gustavsson et al., 2011; Gunders, 2012; Institution of Mechanical Engineers, 2013; Betz et al., 2015). On the other hand, in developing countries, food waste arises mainly due to managerial and technical difficulties and limitations in harvesting techniques, storage and cooling facilities, infrastructure, packaging and marketing systems (Parfitt et al., 2010).

As such, patterns of food waste differ markedly between developed and developing countries. Approximately 42% of total food waste in the European Union is generated by households, 39% by production and processing industries, 14% by the food service and catering sector, and 5% by the retail/wholesale sector (European Commission, 2010). European consumers throw away between 30% and 68% of the food that they buy, depending on the country (Ventour, 2008; Katajajuuri et al., 2014; Beretta et al., 2013; Betz et al., 2015; Gjerris and Gaiani, 2013). By contrast, in sub-Saharan Africa, consumers are only responsible for approximately 3.5% of overall food waste, with the bulk being generated during the pre-consumer stages of the food supply chain (Gustavsson et al., 2011). Consumers in Europe and North America generate, on average, 95 and 115 kg of household food waste per person/year, respectively; while consumers in sub-Saharan Africa waste only 6 kg of food per person/year (Gustavsson et al., 2011).

The costs of food waste tend to be under-valued (and therefore often downplayed by policy-makers), particularly in developed countries, where food represents only a small proportion of consumers' total budgets (Gunders, 2012; Institution of Mechanical Engineers, 2013). However, even in developed countries, the total costs of food waste can be significant. In the UK, for example, the cost of household food waste is estimated at about £10.2 billion per annum, or £420 per household per year (Ventour, 2008). Jones (2004) estimated annual food waste across the supply chain in the USA at US\$90–100 billion; while Venkat (2011) estimates a total cost of US\$198 billion, of which households are responsible for approximately US\$48 billion. More recently, the costs of food waste in Finland have been estimated at €400–€550 million per year, or €460 per household per year (Katajajuuri et al., 2014); and in Sweden, €585 per household per year (Gjerris and Gaiani, 2013).

In previous papers (Nahman et al., 2012; Nahman and De Lange, 2013), the authors estimated the costs of food waste across the value chain in South Africa, in terms of the loss of a potentially valuable food source, and in terms of the financial and external costs (externalities) associated with disposing of food waste to landfill. Firstly, Nahman et al. (2012) estimated the cost of post-consumer food waste in South Africa at approximately R21.7 billion (US\$2.7 billion) per annum², or 0.7% of South Africa's 2011 gross domestic product (GDP)³. This included the costs of wasted edible food, valued according to weighted market prices for income group-specific food baskets⁴ (obtained from the South

African Consumer Price Index for Food (Statistics South Africa, 2011a,b)); as well as both the financial and external costs of disposal to landfill (based on Nahman (2011)).

Thereafter, Nahman and De Lange (2013) extended the analysis by assessing the costs of edible food waste throughout the entire food value chain, from agricultural production through to consumption at the household level. First, food waste at each stage of the value chain was quantified in physical units (tonnes) for various food commodity groups. Then, weighted average representative prices (per tonne) were estimated for each commodity group at each stage of the value chain, based on market prices at each stage of the chain for a range of representative commodities within each group. Finally, prices were multiplied by the food waste quantities, and the resulting values were aggregated across the value chain for all commodity groups. In this way, the total cost of food waste across the food value chain in South Africa was estimated at R61.5 billion per annum (including pre- and post-consumer food waste); equivalent to 2.1% of South Africa's 2011 GDP.

However, both of those papers focused specifically on the edible portion of food waste (i.e. avoidable or potentially avoidable food waste), and ignored the inedible portion (unavoidable food waste such as peelings and bones), the costs of which cannot be estimated using the same methods as for the edible portion. In this paper, the costs of the inedible portion of the food waste stream in South Africa are estimated; based on opportunity costs (i.e. the potential value that is foregone by not recovering this waste for use in downstream applications, such as energy generation or composting). We then synthesise the results from the previous two papers with the results from the current paper (updating all values to 2013 prices), accounting also for the financial and external (social and environmental) costs of disposing of food waste to landfill. In this way, it is possible to provide a more complete assessment of the costs of food waste in South Africa.

2. Data and methods

In previous research on the costs of food waste in South Africa, costs were estimated largely on the basis of food commodity prices, with the rationale that the 'costs' of discarded food can be equated to the potential value of that food if it could have been saved and used to feed those in need. Food commodity prices were used to derive representative prices per tonne for a range of food commodity groups, which were multiplied by the quantities of edible food waste currently being generated, to estimate the total costs of edible food waste in South Africa.

In the case of inedible food waste, however, food commodity prices cannot be used, since inedible food waste by definition cannot be used to feed the hungry. Nevertheless, inedible food waste can be used as an input into other processes, such as composting, bio-energy generation, or the production of animal feed; and therefore has value in its own right. As such, to the extent that inedible food waste is discarded (e.g. to landfill) rather than used as an input into other processes, there are opportunity costs associated with the loss of a potentially valuable resource.

In this paper, we develop a methodology for estimating the opportunity costs of inedible food waste that is disposed of to landfill, in terms of the foregone value that could have been derived had the food been used as an input into two such beneficiation processes, namely biogas production through anaerobic digestion, and composting (see Bernstad and La Cour Jansen, 2011 and Smith et al., 2014). We use this method to derive a unit cost per tonne of inedible food waste, which is multiplied by the quantities of inedible food waste currently being generated, to provide an estimate of the opportunity costs associated with inedible food waste

² R = South African Rands. In the previous papers (Nahman et al., 2012 and Nahman and De Lange, 2013), an exchange rate of R8 to the US\$ was assumed (average over January–October 2012). In the current paper, a rate of R10 per US\$ was used, based on the average between March 2013 and March 2014 (www.oanda.com).

³ In the previous papers, we used the nominal 2011 GDP for South Africa of R2.96 trillion at current prices (Statistics South Africa, 2012). Gross Domestic Product: Second Quarter 2012. Statistical Release P0441. Pretoria: Statistics South Africa. In the current paper, we use the nominal 2013 GDP of R3.4 trillion at current prices (Statistics South Africa, 2014). Gross Domestic Product: Fourth Quarter 2013. Statistical Release P0441. Pretoria: Statistics South Africa.

⁴ Obtained from the South African Consumer Price Index for Food (Statistics South Africa, 2011b). Consumer Price Index: October 2011. Pretoria: Statistics South Africa.

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