

Recapturing value from waste for developing green food value chains

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ABSTRACT

The foundations of the research conducted rest in the realms of the green economy, the circular economy and green growth. It considers in particular green food value chain development in rural, peri-urban and urban bottom-of-the pyramid (BOP) contexts. The BOP refers to the circa four (4) billion people of the world population earning between US\$1 and US\$5 per day and of which about 1.8 billion of these people live in urban slums. Many of the people who live in such BOP contexts earn their livelihoods from participating in food value chain activities with their know-how and the available resources they can access and use. In such frugal contexts, work is often devoted to not only producing and distributing food, but also to the identification, collection, re-using and recycling (valorisation) of waste that food value chains can generate. It is in this context of recapturing whatever value may be left in waste, which is the focus of this article: it considers how such recapturing of value from waste can contribute to developing greener food value chains and thus contribute to the reduction of the food waste and consequently the carbon foot prints of food value chains. The article provides a step-by-step guideline for field practitioners in how to tackle recapturing value from waste. The paper derives primarily from field-based researches. In 2013 an initial field research was conducted in the Tanzania, which was then followed by an extensive literature research and review. The preliminary findings were then supplemented by further field research conducted in Kenya, Tunisia, Egypt and Tanzania in 2014. In 2015 country-based case study researches were conducted in Iran, Trinidad and Tobago and Peru and in 2016 and 2017 another extensive literature review was conducted. Further field research was conducted in Zambia in 2016 and 2017.

Keywords: Green food value chain, recapturing value from waste, waste valorisation,

Introduction

For many people around the world who are living in rural and urban areas, malnutrition and hunger are daily injustices which are increasingly aggravated by food waste. Further the consumption of water, land and its nutrients, the usage of ecosystem services, and carbon and other emissions effected for the production and distribution of edible food that is wasted, is yet another large impingement that contributes to climate change which still affects the most vulnerable in many societies the world over. Moreover, and in many circumstances, edible and non-edible food waste is going into municipal landfills which provides for a significant source of methane production and contributes to climate change: food that is produced but not eaten is responsible for adding 3.3 billion tonnes of greenhouse gases to the planet's atmosphere that ranks food wastage as the third top emitter after the United States of America and the People's Republic of China (FAO, 2013). Thus edible and non-edible food waste has the potential to pollute all the vital components of living environments both locally and globally (Plesca & Visan, 2010).

Preventing and reducing waste, as shown in Figure 1, is of course the priority strategy that should be adopted and applied to operations, activities and processes found within developing green food value chains. This is the preferred strategy as it will prevent waste at the origin, for example improved planting methods and harvesting methods that prevent and reduce crop losses or improved rice milling processing methods that prevent or reduce broken rice. Prevention and reduction of waste can positively contribute to, for example, improved nutrition and food security for growing

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populations and reduce carbon emissions. In summary these strategies are preferred as these can attempt to avert waste at the origin of where it occurs in the food value chain.



Fig. 1: Preferred strategies for recapturing value from waste. (Source: World Bank, 2012a)

However, recapturing value (valorisation) from food waste, can also increase the efficiency of food value chains, providing for nutritional, economic and environmental benefits, including lower costs for businesses and lower prices for consumers. Thus it can be said that waste is a resource in the wrong place (Konya, Zitte & Ugwulor, 2013). Many business and employment opportunities are created in the context of food waste collection and recycling (valorisation) and such environmental, economic and social innovation has the potential to play an important role in developing a wider green economy that is socially inclusive. In particular waste valorisation is one of the three main strategies used for developing greener food value chains, see Hilmi, (2018).

It has been documented that green food value chain development is an effective and efficient method of reducing food waste as well as consequently contributing, for example, to reducing the carbon footprint of food production and distribution (see Hilmi 2014, Hilmi 2016a; Hilmi 2016b; 2016c, Hilmi, 2018). For example, in countries as diverse as Iran, Peru, Tunisia and Zambia, developing green food value chains was found to contribute not only to food waste valorisation, but also to reducing emissions and thus contributing to mitigation of climate change as well as adaptation to it. UNCTAD, (2018) provides that keeping product materials longer in the economy via reuse or recycling could reduce carbon dioxide emissions by 33 percent, serving as a cost-effective mechanism for climate change mitigation. The economies of many poor countries, traditionally provide for activities of reuse and recovery as these are common necessity and survival strategies adopted by many of the people in such countries. Data is limited, however it appears that poor economies are more circular than those of richer countries (UNCTAD, 2018). Such circular systems, thus require business models that streamline circular flows, not only for products, but also for by-products and waste materials across similar or diverse industries, (Batista *et al.*,2018).

Within this context and background a green food value chain is defined as one that needs to provide value at each stage by proactively reducing the usage of the natural environment (natural resources, ecosystem services, and biodiversity), to diminish or mitigate adverse impacts, or even have positive impacts, while at the same time considering disposal and recycling patterns of generated waste, to recapture value at every stage of the food value chain and thus further reduce environmental impact (Hilmi, 2014, Hilmi 2016a, 2016b; 2016c;2018; FAO and CIHEAM, 2016).

This definition is a basis on which to define a conceptual framework for developing green food value chains. The framework, shown in Figure 2, provides for a circular (and open-ended) non-linear flow of forward and reverse food values that progress from the natural environment to final markets. The forward flows increase not only food economic value, but importantly food environmental, social, and cultural values; the food value that is wasted is recaptured with reverse flows that reset such food value from an economic, environmental, social, and cultural point of view.

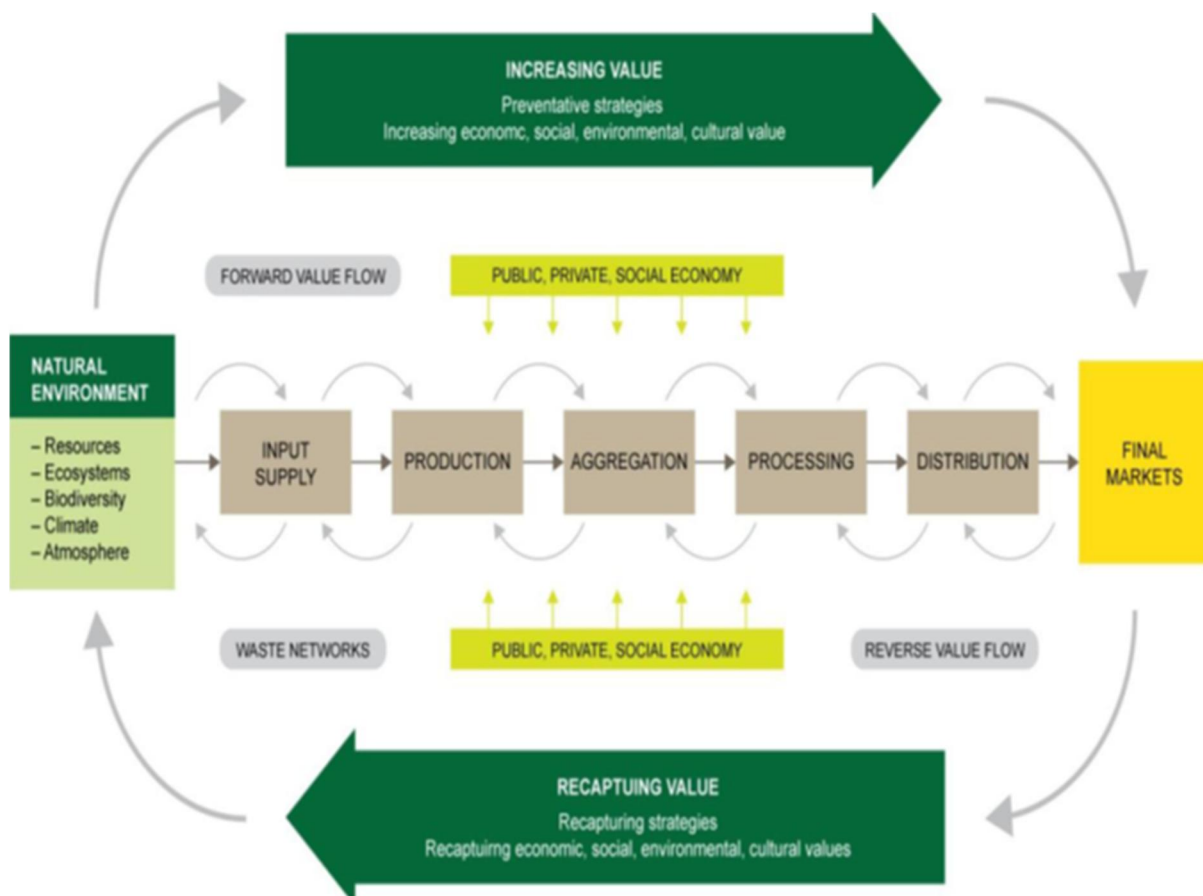


Fig. 2: The green food value chain development framework. *Source:* Martin Hilmi (FAO, 2014)

The main aim of this article is the recapturing strategies of the green food value chain development process as in Hilmi, 2018 and as shown above in Figure 2. The article is organized as providing an introduction to recapturing value from waste, covers waste and waste streams in food value chains, the context in which waste occurs and gives an in-depth treatment of the intricacies of the subject matter and subsequently provides a practical step-by-step guideline of how field practitioners can tackle recapturing value from waste.

Methodology

The article is based mainly on field research and hence much of the findings presented derive from this. In 2013 an initial field research was conducted in Tanzania, where a purposive sample of 146 key informants were interviewed with informal unstructured interviews, followed by an observational (pictographic) study of defined agri-food value chains (rice, maize, soybean and red and white meat). This was then followed by an extensive literature research and review. The preliminary findings of both the field research as well as the literature review were used to guide a second field research conducted in Kenya (mango value chain), Tunisia (tomato value chain), Egypt (tomato and wheat value chain) and Tanzania (rice, maize, soybean and red and white meat value chains) in 2014, which used purposive sampling and interviewed 169 agri-food value chain actors in various value chains with informal unstructured interviews and providing also for observational (pictographic) studies. This field research was in 2015 supplemented by country-based case study researches conducted in Iran (pistachio value chain), Trinidad and Tobago (poultry value chain) and Peru (coffee value chain). This was then followed in 2016 and 2017 with another extensive literature review and further field work conducted in Zambia in 2016 and 2017 on the vegetable value chain, which used purposive sampling and interviewed 183 value chain actors with informal unstructured interviews, followed by an observational (pictographic) study of the defined agri-food value chain.

Waste streams

To be able to consider recapturing strategies in developing green food value chains it is necessary to understand the process of appraising, assessing and analysing waste streams. A waste stream is the popularly known term for defining organized and coordinated chains that deal with waste deriving from food value chain activities. But waste streams are also sometimes referred to as waste channels and also reverse channels.

A waste stream system is commonly comprised of a multitude of (informal) networks for recapturing value from waste, but is usually composed of two stages. The first stage of the process is comprised of: identification of waste, defining waste composition and characteristics, collection of waste, transport of waste, and separation of waste. The second stage of the process, commonly referred to as a “*shadow*” value chain and can also include “*by-product*” and/or “*sub-products*” value chains, provides for processing the waste, recapturing the residual value left in the waste (valorisation) and marketing the valorised products back to the same or other food and non-food value chains. Such chains are termed *shadow* value chains as they can operate only as a result of the activities provided by other food value chains. In other words, they work as derived (and parallel) value chains.

Consequently, recapturing value from waste in food value chains can be defined as the organized and coordinated effort of efficiently and effectively operationalizing forward and waste networks that enable the identification, quantification, and valuation of value in waste and the recapture of such value for productive and commercial uses in the same food chains and/or in other food chains. It is important to understand how these waste streams can address important natural environmental, social and economic aspects of green food value chain development. For example, the growing scarcity of primary resources, means that using residual value in waste holds considerable economic and environmental potential (GIZ, 2011b).

Food and other waste along food value chains

Waste is commonly characterized by its density, organic and non-organic parts, the biodegradability of organic parts of waste, moisture content of organic waste, the carbon-to-nitrogen ratio of organic waste and the potential energy content found within. Each stage of the food value chain, from production to consumption, can potentially provide for an array of differing types of waste, as is shown in Figure 3. Waste products are commonly unwanted products occurring in a value chain that are considered useless and of no commercial value, unless a use and value can be found for such waste products (GIZ, 2013).

Production	Handling and Storage	Processing and Packaging	Distribution and Market	Consumption
Definition				
During or immediately after harvesting on the farm	After produce leaves the farm for handling, storage, and transport	During industrial or domestic processing and/or packaging	During distribution to markets, including losses at wholesale and retail markets	Losses in the home or business of the consumer, including restaurants/caterers
Includes				
Fruits bruised during picking or threshing	Edible food eaten by pests	Milk spilled during pasteurization and processing	Edible produce sorted out due to quality	Edible products sorted out due to quality
Crops sorted out post-harvest for not meeting quality standards	Edible produce degraded by fungus or disease	Edible fruit or grains sorted out as not suitable for processing	Edible products expired before being purchased	Food purchased but not eaten
Crops left behind in fields due to poor mechanical harvesting or sharp drops in prices	Livestock death during transport to slaughter or not accepted for slaughter	Livestock trimming during slaughtering and industrial processing	Edible products spilled or damaged in market	Food cooked but not eaten

Source: Based on Lipinski et al., 2013.

Fig. 3: Food waste along the food value chain

In countries in development food waste commonly arises as a result of limitations in financial, managerial and technical aspects of harvesting, storage, cooling, packaging and marketing as well as in infrastructure (Nahman & de Lange, 2013). Other factors that contribute to food waste are imputable to urbanization, increased globalization of trade, dietary transitions (Pafitt *et al.*, 2010), poverty, low levels of environmental awareness and inadequate management of environmental knowledge. It is estimated that food waste within some food value chains can be as high as 50 percent (Nahman & de Lange, 2013). The amount of waste in food value chains commonly will vary by: country; level of industrialization; infrastructure; rural and urban areas; population size; income level; consumption patterns; lifestyles; the type of produce/livestock value chain; food value chain actors; storage and refrigeration facilities; price subsidies; the level and type of food processing that has occurred; and the economic, environmental, social and cultural value of waste. For example, and in general terms there tends to be more waste in horticultural value chains, than in grain value gains and there tends to be more waste produced in urban areas than in rural areas and more organic waste produced in countries in development than in developed countries.

The composition of waste usually derives from dietary habits, culture, traditions, lifestyle, climate, seasonality and income status (Ezeah *et al.*, 2013). In general terms in low, lower-middle and middle-income countries the majority of waste, for example, generated in urban centers is organically-based. For example it is estimated that organic waste, out of total waste generated, in the Asia-Pacific region in low income countries represents about 65 percent of all waste, while still in the same region and in middle income countries, it is about 51 percent and in high income countries it is 36 percent (UNESCAP, 2015). Usually rural areas in a country will produce more organic waste than urban centers.

By the very nature of food being biologically based and perishable, food value chains can provide for numerous and in many instances uncontrollable outcomes (see Figure 3). These outcomes can commonly occur at farm level, for example yields are below expectations as per bad weather, and harvesting and on-farm storage techniques do not enable appropriate preservation of some of the crops. Moving up the food value chain towards post-harvest, processing and wholesaling and the retailing stages can still provide for uncontrollable outcomes, for example some of the crops are not processed and preserved appropriately as per lack of knowledge in improved processing and conserving methods. At these stages of the chain, food has increased in value as per time, form, place, usage and ownership value. Hence more value is lost by waste at these stages of the food chain than in previous input and production stages of the food value chain. Consequently, and in theory, in these later stages of the food value chain there should be more economic, environmental and social incentives to prevent waste and where waste does inevitably occur more economic, environmental and social incentives (investments) to recapture the loss in value.

A loss in value in one part of the food chain may provide to be beneficial for others in either other parts of the same food value chain and/or more commonly for those who work in other value chains. For example, scavengers who provide picking operations outside fish processing facilities for fish heads, bones and fins can be seen as beneficiaries of such a fish processing operation. Scavengers manage to recapture value from apparently unusable and unsalable products. In other words, waste from one food value chain can spur initiatives in other food value chains. This is most common in livestock and fish value chains, but can also occur in other food sectors. For example, spent grains from brewing beer can be provided to animal feed value chains as well as being sold to be reused as nutrient-rich inputs for farm soils.

Commonly it is thought that recapturing value from waste, pending on the value found in the waste, is a simple cost-benefit analysis approach that can provide more benefits than costs. However, it is not only the economic aspects that need to be considered in the cost-benefit analysis, but also and importantly the environmental costs as well as the social costs and the consequent social and environmental benefits in recapturing value from waste. In some instances, for example, it may be found that recapturing value from waste may have only economic (income) and social (employment) benefits, with little environmental benefits. In other instances, it may be that there are far more environmental and social benefits than economic. There will be trade-offs to take into account in considering the costs and benefits of recapturing value from waste.

The context of recapturing value from waste

As provided previously, commonly more waste is generated downstream, at retail and consumer level in the food value chain in industrialized countries and upstream, at farm, post-harvesting and processing level in developing countries (WEF, 2011). This provides for an initial indication of where efforts can be focused on to attempt to first reduce waste at farm, post-harvest and processing levels, but also and importantly provide for strategies and programmes that can attempt to recapture the value that remains in the waste generated. Commonly waste is best collected nearest to its origin, as it will provide to be less costly in terms of separation of differing waste and can also attempt to avert cross contamination of waste (GIZ, 2011a).

The use of waste, in other words the recapture of value from such waste, valorization, should focus on reusing food waste, for example, firstly for human consumption where possible, secondly for animal consumption, thirdly for compost, and fourthly for energy. This hierarchy of recaptured value in waste is a commonly accepted goal, but is not easy to implement as for obvious food quality and safety concerns destined for human as well as animal consumption of waste food. There are many challenges to this, especially in countries, which have large segments of their agri-food sector which operates informally. Compost is also commonly a reachable goal and can support the reduction in use, for example, of fertilizer and thus contribute to lessening the carbon footprint. Waste used for energy generation is also seen as a viable goal as this waste competes effectively with crops grown only for energy purposes, save for that waste volumes, the type of waste and its energy values are not easy to estimate and provide for the required volumes in a constant and timely supply.

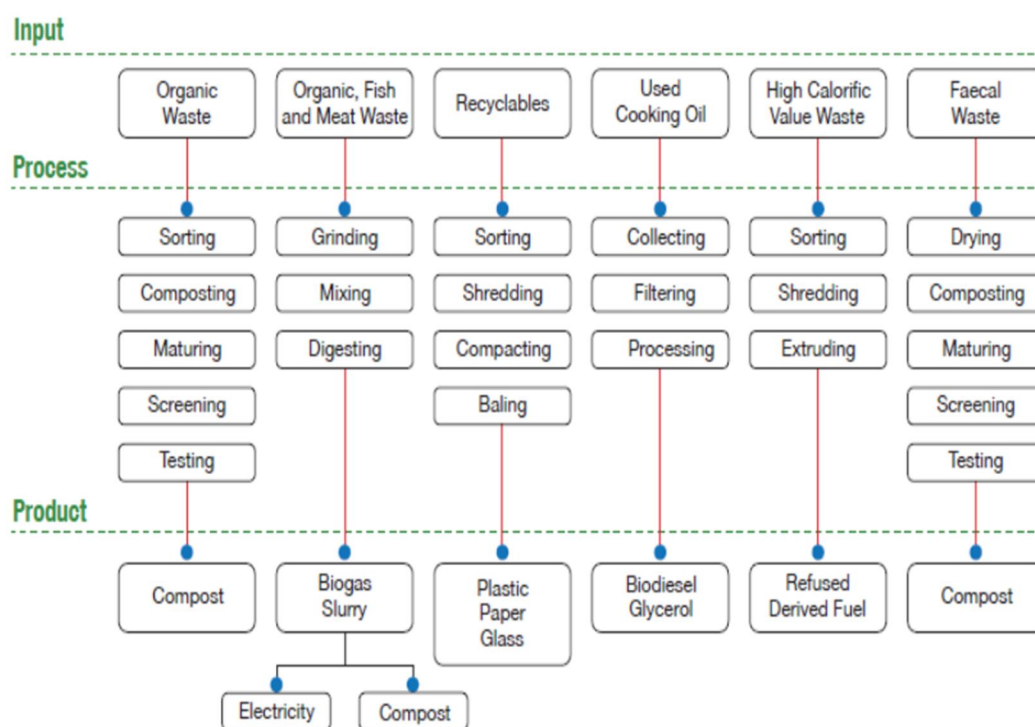


Fig. 4: Examples of organic waste valorization (Source: UNESCAP, 2015)

The informal economy and informal food sector

The collection and recapture of value from waste occurs in waste streams and shadow value chains that usually, but not always, operate in the informal economy. The informal economy can be defined as any economic activity that is not subject to government regulation and taxes and is not easily measured (Chambwera, MacGregor & Baker, 2011). Typically the informal economy is seen as a transition phase to the formal economy, but in many countries the informal economy is a reality as it provides for employment, is flexible, adapts better and faster to changing situations and

provides readily available income (Chambwera, MacGregor & Baker, 2011). There is no strict separation between the formal and the informal economy (Chambwera, MacGregor & Baker, 2011) as both seem to be complementary parts of a single system and the stronger the formal economy, the stronger the informal economy (Ratner, 2000). The informal economy is correlated with levels of development in the sense that the more developed a country is, commonly there is less of an informal economy (Chambwera, MacGregor & Baker, 2011). However the informal economy appears to be growing in both developing and developed countries as in recent years formal labour markets have been unable to absorb growing numbers in the workforce (Chambwera, MacGregor & Baker, 2011). Informal economies are often found to have high degrees of coordination, based on trust networks, which can overcome obstacles of poor market institutions as informality is the expression of the marginalized and the excluded (De Pozo-Vergnes, 2013).

The informal economy is often misunderstood and underestimated. The scale, size and structure of the informal economy is shaped by several factors: it has limited enforcement of legal obligations, does not have the high costs of operating formally, and is commonly used as a refuge in economic downturns. The informal economy appears to have several competitive advantages: no paying of taxes, no minimum wage, no regulations to comply with, and no formal environmental laws (Chambwera, MacGregor & Baker, 2011).

However, informal economies have found to be more proactive and alert to increased resource scarcity and to climate change than formal markets (Benson, 2014). In some cases, the informal economy has been found to be very innovative in generating solutions to environmental concerns (Benson, 2014). Informal economies usually have been found to:

- have smaller ecological foot prints than formal economies;
- rely a lot on the local environment for its sustainability;
- have more knowledge about opportunities and threats to resources;
- are not sheltered from climate change, but provide alternatives to deal with it;
- are resilient, dynamic and innovative;
- have their own way of organizing capital and distributing surplus, which makes it a form of community economy or a solidarity economy;
- involves the upkeep and distribution of traditional foods;
- develops national as well as regional networks as per kinship;
- have strong motivational drivers of resource efficiency and innovations (Benson, 2014).

However operators and consumers in informal economies have weak voice in government and in policy design, especially in terms of environmental policy. This, for example, is yet another point that makes policy-making in the area of recapturing value from waste a perilous operation as interested stakeholders have no voice in the process.

Many field-based development projects, that focus on food value chain development, often overlook the implications that the informal economy can have. For example as much as 80 to 90 percent of smallholder markets are informal (De Pozo-Vergnes, 2013). The informal food sector relates to activities of food production, transport, and retailing, for example, that occur in informal settings and are not under the direct preview of national governments (FAO, 2013). The main characteristics of the informal food sector are:

- It targets households with very small budgets;
- It can provide for low safety, hygiene and quality in food;
- It has an absence of specialization: informal food trade develops more by the diversification of products sold;
- Work conditions are far from decent in many cases and there is plenty of harassment;
- It requires very low capital investment to start a business;
- There are strong relationships between production and consumption;
- There are common social and cultural affinities among actors in production and distribution;
- There is the absence of accounts and taxes not paid at all or in a small amount;
- It is vulnerable to seasonal changes;
- It focuses on local sourcing of food;

- It provides for linkages between rural and urban areas, even though typically has large inadequacies in terms of transport;
- There is permeability with the formal sector in terms of relationships and linkages;
- It seemingly has a poor environmental record (FAO, 2013).

Waste collection and valorization in the informal food sector

In developing countries though, open landfills¹ tend to have comparatively lower operational costs and technical standards than other organized operations to recapture value from waste. In many countries landfills are still a goal. To some degree this provides for competition in recapturing value from waste as it may provide to be cheaper to dispose of waste in this way than attempt to recapture value in waste. The dumping of waste is the main source of carbon emissions in developing countries (Couth & Trois, 2010), and can also provide contamination of surface and ground water, soil, fauna and flora as well as hazards to human health (ISWA, 2015).

However, in landfills there are operations that are provided for recapturing value from waste. Waste pickers, as an example, provide for extracting value from landfills that are found and with these operations tend to recapture residual values left in food and packaging materials. In Brazil, for example, waste pickers have specific legislation devoted to them. Waste pickers are guaranteed by law and can organize themselves into formal associations, (Correa & Xavier, 2013). These picking operations, even though conducted in harmful working environments and conditions, and with considerable risks, do provide for the economic and social needs of people and communities.

The inefficiencies in water, energy, land use, wasted calories, emissions as well as challenges in terms of consumer behavior, food storage, distribution infrastructure, processing, and transport practices (WEF, 2011) are only some of the issues that need to be considered in looking at recapturing value in waste.

Waste surveying and auditing both in the food value chain as well as in the waste streams generated by the food value chain are necessary steps to take. In measuring waste, it is important to:

- Determine the location of waste generation: Where does it occur in the food value chain?
- The next step is to verify for the what: What food is wasted? What packaging is wasted?
- The volume of waste: How much waste is generated by the food value chain?
- The frequency of waste: How often is waste provided?
- Estimate the residual value: What value may be left in the waste?

However measuring waste requires experienced people to identify and categorize waste according to end use as different wastes are recycled according to their relative costs as compared to the production of virgin resources (Konya, Zitte & Ugwulor, 2013). No one size fits all when recapturing value from waste.

Most recycling and valorization of waste provides for economic opportunities and economic value. The economic value is not just per se, but also, for example, provides for job creation as well as providing other opportunities (UNEP,2011). Some of these opportunities are for example such aspects as a growth in resource markets as natural resources are becoming scarce and the emergence of new and innovative technologies(UNEP,2011). The benefits of such recycling and valorization need to consider natural resource and energy saving, creation of new businesses and jobs, potential reuse of food for consumer and animal consumption, compost production, energy produced from waste, reduced greenhouse gas emissions, as well as contributing to equity and poverty eradication (UNEP,2011).

Enabling conditions, though, do need to exist for developing recapturing value from waste. There are financial, economic, policy and regulatory measures, institutional arrangements between formal and informal structures (UNEP, 2011) that are required to support the development of recapturing value in waste. From a financial perspective there are needs for private investment and

¹ The term open landfill is a term used to define a location where a site is used for the indiscriminate deposit of solid waste which takes place with either with no - or at best - very limited measures to control the operation and to protect the surrounding environment (ISWA, 2015).

micro-financing initiatives, for example. Economic incentives to develop recapturing of value from waste require financing (such as recycling credit), standards and fiscal incentives, for example. Policy and regulatory measures could focus on waste management, land use, virgin material replacement legislation, for example as well as cater for institutional arrangements between formal and informal structures via the simplification of formalization processes.

In the informal food sector, commonly, there are various categories of operators that collect and valorise waste. In general terms in waste collection there are itinerant waste buyers that move along route and collect recyclables from farmers, processing enterprises and consumers, for example. There are street and dump site waste pickers as well as others, for example who work for formal waste collection companies, mainly in urban centers, but informally pick waste that has been collected for their own informal business. In the recapturing value from waste sector (valorisation) there are intermediate dealers (middlemen) composed of primary and secondary dealers, intermediate processors, brokers, recycling small and medium enterprises and wholesalers. The middle men usually purchase from collectors and after some kind and type of processing of the waste sell it onwards as a secondary “raw material”. These operators are commonly highly skilled at identifying waste with potential value and in locating customers within certain markets (Ezeah *et al.*, 2013). Usually the operations and activities carried out by such operators, waste collectors and middlemen, and the system they adopt to valorise waste costs less than formal operators and systems.

In many instances operations carried out in waste collection, occur in parallel to formal and fully recognized waste collection enterprises, which are typically owned and operated by the public sector or in partnership with the private sector. There are also cases, for example such as those of Brazil and Colombia, which provide legal rights to waste pickers, who work and operate in the informal waste collection sector. A good deal of waste collection, recycling, reuse and sales of valorized products occur in the informal economy: some estimates suggest that about two percent of the urban population in Asia and Latin America depend on waste picking as a livelihood strategy (Wilson *et al.*, 2009). In urban areas alone, in some developing countries, it is estimated that about 15 million people earn their livelihoods from waste picking (Medina, 2008).

Some of the firms that operate in waste collection may not be totally informal. They may be recognized formally and registered as, for example a transport service, a food processing enterprise, but may well operate informally as a waste collector and/or waste valoriser. Commonly, but not always, the recapture of value from waste is sub-divided into two sub-sectors: the informal collectors sub-sector (waste stream) composed mainly of individuals and/or micro-enterprises that collect waste and the informal valorisation sub-sector (shadow value chain) composed of individuals, cooperatives and family and micro enterprises which extract any value from waste that can be sold (GIZ, 2011a). Through increased recapturing and recycling rates the informal economy helps to reduce the depletion of raw materials, natural resources and the energy that would otherwise be used in developing new products (GIZ, 2011b), thus contributing to mitigation of emissions. The informal economy potentially can have high rates of recovery. Recovery rates can be as high as 80 percent, and in a number of cities in developing countries it has been estimated that recycling rates are between 15 to 20 percent (Wilson *et al.*, 2009). Table 1 shows the recovery rate of materials in defined cities and shows that the informal sector is far more active, motivated and effective in value recovery from waste in terms of quantities.

Usually operational costs are higher in the informal sector, than in the formal sector, but the higher revenues obtained from the recaptured value from waste result in a much lower cost per tonne and in most cases provide for a net benefit (GIZ, 2011a). Seemingly all valorisation efforts along the food value chain, in other words the recapture of value from waste, tend to be profitable (GIZ, 2011a).

However, recapturing value from waste can have considerable informational and knowledge barriers. This is simply because recapturing value from waste simply occurs in the informal economy and consequently not much is known about where, how, what and why value from waste may be recaptured. Hence much of the recapture may go undetected and pass under the radar of project designers and policy-makers, for example. Thus formulating appropriate and targeted project objectives for field projects, for example, to make food value chains greener and the inherent recapturing value from waste function may be offset and misguided as such processes lack the necessary understanding (and information) to tackle such complex issues.

Table 1: The comparison between the formal and informal sector in material recovery in seven major cities.

City	Formal sector		Informal sector	
	Tonnes	Percent of total	Tonnes	Percent of total
Cairo	433,200	13%	979,400	30%
Cluj	8,900	5%	14,600	8%
Lima	9,400	0.3%	529,400	19%
Lusaka	12,000	4%	5,400	2%
Pune	-	0%	117,900	22%
Quezon City	15,600	2%	141,800	23%

Source: GIZ, (2011b)

Markets in which valorised products are sold, for example business markets for recycled food packaging materials, tend to have five times more volatility than, for example, markets for virgin materials which are close substitutes (OECD, 2007). This volatility in turn leads to uncertainty and discourages investment, thus undermining the viability of recycling in general (OECD, 2007). Thus the main issues that have been detected in terms of barriers and market failures for markets of valorised products are:

- Search and transaction costs are high;
- Information failures as well as incorrect market signals consequently provide for failure to recycle the correct amounts and choose the appropriate kind of recycling facilities;
- Consumer perception of such markets vary considerably as risk awareness can be high affecting final demand;
- Price volatility;
- Technological externalities;
- Concentrated market power;
- Sub-optimal policy decisions;
- Subsidized substitutes from virgin materials (OECD, 2007 & UNEP, 2011).

Some of the challenges above are difficult to address, for example what can be done to reduce price volatility? How can search and transaction costs be reduced? (OECD, 2007). Also suppliers are not easy to find since materials are spread across differing food sub-sectors of different nature and geographical areas, and predicting how much material will be available and when it will be available is difficult (OECD, 2007). Further recycling markets are derived markets; they exist as a “by-product” of other decisions made in other markets. Moreover, the quality of materials will vary widely, making it difficult to value and this can result in significant costs for buyers and sellers as well as in agreeing on price and transaction costs as these are even more difficult to ascertain as materials may be mixed or where characteristics of waste are not detectable (OECD, 2007).

There are many valorized products in shadow food chains and markets, the world over. For example there are numerous markets that cater for livestock by-products, such as cow intestines and pig bones, other markets can cater for fish sub-products such as fish skins for human consumption, other markets may cater for sub-products, such as apples that are deformed in shape and bruised and may be sold for fermentation purposes or for compost. There are also an array of yet still “other products” for example sugar chain shrubs left after harvesting in the field that can be used for animal grazing/feeding and /or for producing biofuels; nut shells that can be used as fuel so as to generate energy in nut processing enterprises and so forth. Moreover, food is packaged in sacs, boxes, and jars for example to provide for protection, storage and transport. This packaging has a value and can be used over and over again. In many countries there are many shadow value chains and markets that cater for selling recycled packaging.

Hence these valorized products can tentatively be classified as those products that are perishable in nature (by-products, sub-products, etc.) and those that are non-perishable (packaging, pallets, etc.). The products can be further classified as final consumer and business market products,

as well as for example, what kind of specific markets within these two overall categories they are destined for. For example, in business markets sugar cane shrubs may be destined to animal feed markets as well as energy markets to make bio-fuels. All in all these products still contain some value that may be usable and marketable, and hence have market access and /or others that are simply a form of maximizing utility, for example after sugarcane harvesting, the shrubs are used for livestock grazing/feeding. So long as these products still have some economic, social and environmental value, they can be of utility.

The collection of waste is commonly done by muscle or animal power traction and in some instances by motorized vehicles. This is environmentally sound as the divergence of organic waste, for example from landfills, averts far more carbon emissions than motorized vehicles used for waste collection. Further the reintroduction of materials into food chains causes a reduction in the emissions of pollutants generated during the production and marketing of food, it reduces the quantity of waste that is destined to landfills and consequently less greenhouse gases are emitted as a lower content of organic material goes into landfills (GIZ, 2011a). Much of the recaptured organic matter is redirected to composting and/or animal feed markets. In some instances, organic matter can be transformed into biogas also (GIZ, 2011b). This reintroduction of these “secondary raw materials” are provided with a lower energy rate, thus lower energy consumption, reduced emissions and primary raw materials are not used (GIZ, 2011b). Overall this tends to provide a smaller carbon footprint to waste channels and shadow value chains that operate in the informal food sector.

Quality, hygiene and safety

Quality, hygiene and importantly safety are crucial issues in food as well as in food packaging materials as it is difficult to tell if waste has contaminants which will need to be removed when being recycled and valorised. If sellers know they will not be detected on quality, this will provide a downward spiral for markets and if buyers have no criteria about contaminants, they may recycle to highest quality standard the recycled product can set (OECD, 2007).

In many countries the law forbids the marketing and selling of food products after their sell by date. For example, products that have an expiry date on them and are not edible anymore should not be marketed. But such foods are often marketed all the same. However, the great challenge is that such markets mostly operate in the informal sector and cannot be regulated by formal standards. Most of these markets operate with informal and mutually agreed upon (informal) standards. But even if these informal standards may work for trade reasons, they may work less from a health, safety and nutrition point of view. Many times serious safety risks can erupt with consequent health risks. Thus this implies that there is a need for formal standard implementation for recapturing value in valorized product markets and such standards need to comply, at minimum, in the case of food for example, on the basic standards as those provided by the Codex Alimentarius.

As like for quality, consumers, both final consumers and business buyers, may need to be persuaded to buy valorized products. This would be more common in business markets pending on the level of need. However, there is a lack of information about origin and reliability (commonly recycled materials need to match the same criteria as virgin products) and there are also concerns with the perceived high risks of such products (OECD, 2007).

There is also the fact of market domination by virgin product enterprises that can and have undercut competition in markets for recyclables. This has come about via vertical integration. However, there is also the opposite case that market power in recyclable markets is good as it will encourage sales and use of such products, restricting supply to increase prices (OECD, 2007).

Women

There is a large women component to recapturing value from waste in food chains that needs to be considered. Women have an important role in recapturing value from waste as women interact, commonly, with food at each stage of the food value chain 41 percent of the times on average and for 85 to 90 percent of the time are involved in food preparation (Lipinski, 2013). This means, and in the real world occurs, that a good deal of value that is recaptured from waste is done by women. Women tend to be employed more in the informal valorization sub-sector than in the formal one (GIZ, 2011a). However as in many other roles that women play in food value chains, they face both formal and

informal barriers related to such aspects as, for example, waste picking, transport of waste, economic returns earned from waste recycling, differing legal rights, etc.

Understanding recapturing value from waste for green food value chain development

More often than not waste streams and shadow value chains remain undetected and underestimated by those involved in developing and upgrading food value chains. For example, some of the waste streams and shadow value chains that are found in informal bottom-of-the pyramid (BOP) settings can be very complex and intricate sets of networks, with specific activities conducted within, that can be subdivide along tribal groupings, with defined activities in such waste networks devoted to specific tribes.

A lack of information, awareness, knowledge and understanding on how waste streams and shadow value chains operate, how they can contribute to livelihoods and reduce carbon emissions, for example, can potentially undermine green food value chain development project design and implementation, policy formulation and planning.

In waste streams, and related shadow value chains, usually little is known for example about what are the quantities of generated waste? What is the composition of this waste? Is this waste mostly of organic or non-organic origin? What is the economic and natural environmental value that is recaptured from the waste? What is the quality of these valorised products? What prices do such products sell at? What is the competition in these waste streams and shadow value chains? What is the nature of competition in such chains? How can these aspects of competition be addressed by field practitioners, project designers and those working for the public sector in policy making? How can these factors be appraised and the findings of such field research implemented into field-projects and policy-making processes?

Recapturing value from waste provides numerous opportunities to enhance green economic growth, low carbon development and consequently developing greener food value chains. Recapturing value from waste offers numerous and diverse business opportunities that are usually fulfilled by private sector operators working, usually but not always, in poorer (informal) markets, BOP markets, with their micro-business enterprise operations. However, such business opportunities, it has been found, are also in the spectrum of more formal small, medium and large enterprises.

The recapture of value from waste offers numerous opportunities also at community level, for example in terms of increased opportunities for employment and earning income. In many communities, the world over, numerous people are already employed in this area of the food sector, but work in indecent conditions, within hazardous environments and tend to earn very low incomes, even though in some instances what is earned is well above the minimum legal wage. For example, in a study conducted by GIZ in 2010 in six (6) cities it was found that operators earned between 110 to 240 percent above the minimum legal wage (GIZ, 2011a). Recapturing value from waste also provides for increased opportunities in terms of increased food security. Markets, for example, that sell animal sub-products, such as animal ears may be unacceptable for some consumers as food, but for other consumers may provide to be acceptable, thus contributing to their daily nutritional intake. Pending on perceptions such products may be seen by some actors in the food value chain as sub-products, but by others may be perceived as a delicacy. However, in these markets there are often and unfortunately matters related to hygiene, safety and quality of such products. Such shadow (sub-products) value chains and markets though, have the potential to be rendered safe and hygienic and importantly far more regulated if more awareness, information and knowledge are provided on such markets and importantly on their related food value chains.

By creating awareness, understanding and knowledge, via a practical hands-on process, it is hoped that policy- makers, project designers and field practitioners as well as the private sector will be able to tackle better the many challenges posed by developing green food value chains.

The process of recapturing value from waste in food value chains: appraisal, assessment, analysis, strategies and actions plans

To reiterate recapturing value from waste in food value chains can be defined as the organized and coordinated effort of efficiently and effectively operationalizing forward and waste networks that enable the identification, quantification, and valuation of value in waste and the recapture of such value for productive and commercial uses in the same food chains and/or in other food chains.

The first step in looking at recapturing value from waste is to understand where in the food value chain waste streams are commonly found. Mostly waste is generated at farm, post-harvesting and processing level in developing countries (WEF, 2009). This information can be used as an initial indicator of where “waste hotspots” may be found. However, along the food chain other waste streams may also be found. Waste streams can also be generated for example while produce is in transport, for example, between a farmer and a processor. Waste generated from food value chains can take many routes (networks).

For waste in a food value chain it is important to appraise food value chains and networks and food value chain stakeholders and at the same time determine the location of waste hotspots: Where does waste occur in the food value chain? (waste hotspot). The next step is to verify for the what: What food is wasted? What packaging is wasted? The volume of waste ascertained: How much waste is generated by the food value chain? And the frequency of waste: How often is waste provided? Following this estimates of the residual value in waste should be made: What value may be left in the waste? In other words, what value can be recaptured. This is commonly referred to as the diversion rate. It is seen as a percentage of the total waste that can be recaptured and valorized. For example, 40 tonnes of waste can be recycled and valorized and 60 tonnes cannot. This amounts to 100 tonnes of waste, of which 40 percent of this (diversion rate) can be recycled and valorized. Thus 40 percent of the waste has value in it, while 60 percent does not.

Step 1: Form a multi-stakeholder working group

To tackle waste streams in developing green food value chains, and in the same manner as the process of developing green food value chains (see Hilmi, 2018), the first step is to form a multi-stakeholder working group (MSWG) composed of local stakeholders (public, private, non-profit, and community-based organizations) and others, for example waste pickers who will be affected by the intended changes resulting from the process of recapturing value from waste for developing green food value chains (see Box 1).

To include some stakeholders, for example informal waste pickers and traders may be a challenge as per their informality, and hence their hesitation to come out into the open as well as the fact that many of such stakeholders, rarely if ever have “any voice” in such development initiatives. It has been found that to involve such stakeholders, referrals and networks can be helpful. However, it is important to reassure such stakeholders that their participation in a MSWG will not raise any matters with local authorities and that trust building is essential.

Box 1 Factors to consider in forming and facilitating a multi-stakeholder working group

- Undertake an in-depth stakeholder analysis: What are their attitudes? How are they organized?
- Include primary stakeholders (for example farmers, processors, traders, waste collectors, waste traders, waste sellers, waste valorisers, processors, wholesalers, distributors, retailers, consumers, importers, exporters) and secondary stakeholders (for example extension services, banks, transport services, R&D agencies, regulatory agencies, electricity suppliers, NGOs, public health inspectors);
- Apply principles of collaboration, openness, and mutual respect
- Focus on supporting and enhancing relations and trust among stakeholders and emphasize the need for inclusiveness so that all are represented and all have an equal voice;
- Highlight ownership of consultations by all and that all are accountable;
- Information concerning ‘how; what and why’ is distributed to all to create understanding and legitimacy;
- Identify existing mechanisms and procedures for consultation and how they can be utilized;
- Assess other mechanisms and procedures that may be required to successfully facilitate stakeholder consultations;

(Source: Hilmi, 2018)

Step 2: Identify a food value chain(s) that needs greening via the recapturing value from waste strategy

It will be important at this second step of the process to have general objectives of the intended intervention. The objectives need to be set in agreement with all members of the MSWG and should be set in general terms. This is suggested as more specific objectives can be set in Step 3 of the process as more information will be available and consequently a better understanding of the current situation of the food value chain and related waste streams and shadow value chains will be available. For example some general objectives could be:

- The impact of waste and consequent environmental impact provided by a food value chain;
- Greening the operations of waste pickers and waste valoriser enterprises;
- The contribution of waste valorization to the natural environment and climate change mitigation.

Most commonly food value chain analysis is considered only for linear food pathways going from farm production to consumption and usually does not consider waste streams and shadow value chains. In this regard the selection of which food value chain(s) to analyze and understand better in terms of waste will require thus also to consider waste streams and shadow value chains.

A first step is to conduct a desk research and review to ascertain if any food value chain studies, for example, have already been conducted and have considered such aspects as waste streams. In the literature research and review it will be important to look for country studies, for example, that focus on food sector analysis in general, specific food value chains (livestock [e.g. sheep], horticulture [e.g. tomatoes], fish [e.g. sardines], etc.), the stakeholders involved, as well as studies that consider waste in general and food and food packaging waste in particular and can possibly provide information on the quantities of waste, how frequently waste is provided, waste composition, waste streams, shadow value chains, waste stream stakeholders, etc.

In this initial desk review it will be important to start to ascertain possible leverage points that can be used for green food value chain upgrading. A leverage point is a “place” (point) in a food value chain, waste stream and shadow value chain where it is possible to intervene for development purposes and where a “solution” can be realistically applied. For example, a leverage point can be waste pickers: providing worker rights to waste pickers, which may be a first step in attempting to formalize waste stream operation. A leverage point can be classified as low if a small amount of change causes a small change in the food value chain. A leverage point can be classified as high if a small amount of change causes a large change in the food value chain.

Once completed, the desk research can provide for an initial listing of food value chains that have a potential for further greener development and upgrading in terms of recapturing value from waste.

In the situation where the literature review does not provide sufficient information, and budget and time permits, a field research should also be conducted at this stage. Field tools for analysis that can be used for such appraisals can be rapid-market appraisals, market research as well as end market research (see Box 2). However, the focus of these field methods should not only focus on market aspects found in the food value chain(s), but also and importantly markets found in waste streams and shadow value chains. An emphasis in these preliminary appraisals also needs to be provided on stakeholders and importantly the identification of key informants. These are people who have considerable knowledge of in-country food value chains, markets, etc. Further what should be considered also is the initial identification of where in the food value chain waste “hot spots” can be found. In other words, where in the food value chain most waste is generated. As previously mentioned, mostly waste is generated at farm, post-harvesting and processing level in developing countries (WEF, 2009).

Box 2 Market appraisal methods

Rapid market appraisal

A rapid market appraisal provides a quick, flexible, and effective way of collecting, processing, and analysing information and data about markets and marketing systems (CRS, 2009). A rapid market appraisal comprises a wide range of simple methods and tools for collecting quantitative as well as qualitative information in order to minimize the costs and delays in providing timely and sufficiently detailed information (CRS, 2009).

For more detailed and further information on this method and tools and how to use it in the field see: CRS.2009. A guide to rapid market appraisals for agricultural products, Baltimore, USA

Link: <http://www.crs.org/sites/default/files/tools-research/guide-to-rapid-market-appraisal-for-agricultural-products.pdf>

Market research

Market research is the systematic and objective search for, and analysis of, information. Market research seeks to set about its task in a systematic and objective fashion. This means that a detailed and carefully designed research plan is developed in which each stage of the research is specified. Such a research plan is only considered adequate if it specifies: the research problem in concise and precise terms, the information necessary to address the problem, the methods to be employed in gathering the information and the analytical techniques to be used to interpret it (FAO, 1997).

For more detailed and further information on this method and tools and how to use it in the field see: MEDA.2007. Market research for value chain initiatives,

Link: <http://www.meda.org/docman/meda-publications/general-technical/value-chain/59-market-research-for-value-chain-initiatives-information-to-action-a-toolkit-series-for-market-development-practitioners/file>

End market research

End markets (retail/consumer markets) are important as this is where the overall performance of a food value chain is ultimately determined. End market research involves understanding how markets are segmented (price-driven versus quality-driven, mass market versus niche market, supermarkets versus traditional retailers versus food services, etc.). At its simplest level, end market research should be designed to answer questions related to key business and investment decisions at the value chain and firm levels (USAID, 2008). End market research is composed of two phases: phase 1: Secondary end-market research, and phase 2: Primary End-market Research. The actual analysis to facilitate decision-making is structured around Six Cs (Choice, Context, Channels, Customers, Competitors, and Communication.). Linear progression through the Two Phases and Six Cs provides a clear roadmap for designing and implementing an effective and efficient end-market Research effort (USAID, 2008).

For more detailed and further information on this method and tools and how to use it in the field see:

USAID.2008. End market research toolkit,

Link: http://beamexchange.org/uploads/filer_public/3f/5e/3f5ec4e0-4227-4ef6-8e8d-039fe95cc01f/valuechainendmarkettoolkit.pdf

Once results from the desk research and from the field research are ascertained a list of a potential food value chain(s) to upgrade can be compiled via recapturing value from waste.

Step 3: Select a specific food value chain(s) for greening via the recapturing value from waste strategy

Having conducted Step 2 of the process it will now be possible to set more clear and concise objectives for the green upgrading in terms of waste streams and shadow value chains. For example, specific objectives could be:

- To reduce the environmental impact of waste streams deriving from small and medium agri-food enterprises (SMAEs) and provide capacity building and development in environmentally sound waste management and treatment practices for waste stream stakeholders;
- Provide applicable and feasible standards related to the recycling of food packaging materials that are easily applicable and adaptable, and economically feasible, to waste stream operators.

The more specific, clear and concise the objectives are in this Step of the process the easier it will be to select which food value chains, waste streams and shadow value chains to analyze further and the easier it will be to guide the research process implied, including importantly the diagnosis step of the process and importantly strategies, plans and implementation schedules for upgrading. It is important that all members of the MSWG contribute to and agree to setting the objectives.

The food value chain(s) can be prioritized based on the specific objectives set as well as specific criteria developed for the selection process. An example of such criteria could be:

1. The potential to have a positive environmentally impact with interventions in recapturing value from waste.
2. The competitive potential of intervention on farmers, traders and small processing enterprises.
3. The potential to be inclusive in terms of women.

However, it is suggested to use clear and concise criteria based on selection tools that can support the process. A food value chain selection methodology can be found in box 3.

Box 3 Food value chain selection

Guidelines for value chain selection

These guidelines offer a holistic and structured approach to value chain selection. They combine four different dimensions of value chains: economic, environmental, social and institutional. Since the four dimensions are interconnected, overlooking any one of them during value chain selection will affect the next phase of value chain analysis and development. The guidelines include clear criteria and a set of tools to aid in the selection process. For more detailed and further information on tools and how to use them in the field see:

GIZ. 2015. *The guidelines for value chain selection: Integrating economic, environmental, social and institutional criteria*, Eschborn, Germany

Link: <https://www.giz.de/fachexpertise/downloads/giz2015-en-guidelines-value-chain-selection.pdf>

Based on the findings from the above process a food value chain(s) can be selected and it is critically important that all members of the MSWG agree to the selected food value chain(s).

Step 4: Map a food value chain(s) considering: waste hotspot and waste streams and shadow value chain analysis, and provide for a stakeholder analysis

This step in the process looks at mapping the selected food value chain(s) and identifying within the food value chain(s), waste streams and shadow value chains' stakeholders and waste hotspots. Thus it will involve three processes to be conducted simultaneously:

1. Mapping the selected food value chain, waste streams and shadow value chains;
2. Mapping the stakeholders and providing for a stakeholder analysis;
3. Conducting a waste hotspot analysis.

For conducting these it is suggested to start with commonly available value chain mapping tools. A functional and behavioral approach can be taken for mapping the food value chain, waste streams and shadow value chains as well as an institutional approach (see Box 4).

Box 4 Approaches to food value chain mapping

Functional

The functional approach to value chain mapping looks at the activities (functions) that are provided within a process. For example, buying, selling, financing, transportation, banking, risk bearing, market information etc. There are exchange (buying functions), physical (storage functions) and facilitating (financing functions) functions. The approach describes and analyses functions in the process.

Institutional

This approach looks at “who does what” in the process. It relates to, for example, traders, processors, retailers, etc. Other institutions can be stock exchanges, produce exchanges, banks, etc. The approach describes and analyses actors in the process.

Behavioral

This approach considers the behavioral elements of the process by looking at ,for example, how traders behave within the process. It also considers behavioral aspects between actors in the process by considering for example power structures, relationships, partnerships, etc, between a farmer and a trader. The approach describes and analyses behaviours in the process.

Mapping a food value chain, waste streams and shadow value chains provides a pictographic view, and not only, of the food value chain under investigation. It provides a general overview of the food value chain, it identifies the constraints and solutions at the varying stages of the food value chain, can visualize networks in the food value chain and in waste streams and shadow value chains, and identify food value chain stakeholders, key informants and the linkages and relationships among them (see box 5).

Box 5 Mapping food value chains tool book

The intent of this tool book is to provide easy to understand and importantly to use tools for field practitioners for mapping food value chains. The emphasis here is to look at food value chain mapping tools that link food value chain development with the poor. This is as such as per the BOP settings of many food value chains and related waste streams and shadow value chains. For more detailed and further information on this method and tools and how to use it in the field see:

DFID.2008. *Making value chains work better for the poor: A toolbook for practitioners of value chain analysis*, Phnom Pehn

Link: <http://www.fao.org/3/a-at357e.pdf>

In mapping the food value chain, it is critical to consider waste surveying and auditing, as seen previously, with the following questions:

- Determine the location of waste generation: Where does it occur in the food value chain?
- The next step is to verify for the what: What food is wasted? What packaging is wasted?
- The volume of waste: How much waste is generated by the food value chain?
- The frequency of waste: How often is waste provided?
- Estimate the residual value: What value may be left in the waste?

However, it is important to remember that for measuring waste requires experienced people to identify and categorize waste according to end use as different wastes are recycled according to

their relative costs as compared to the production of virgin resources (Konya, Zitte & Ugwulor, 2013). No one size fits all when recapturing value from waste.

Concurrently to mapping the food value chain a stakeholder mapping and analysis needs to be conducted. The process of stakeholder mapping involves *Identifying* who are the stakeholders in the food value chain, waste streams and shadow value chains, mapping them and understanding their views and priorities. A stakeholder analysis is basically a methodology for taking into account (profiling) the attitudes, interests and needs of those who are involved directly and indirectly in food value chains, waste streams and shadow value chains. Its primary intent is to better understand the relations, linkages, partnerships and power structures among stakeholders (stakeholder profiling) and who is likely to have an effect or be affected by proposed actions of change. It organizes stakeholders according to the possible impact they can have on proposed changes and what impact such actions may have on them (see Box 6).

Box 6 Stakeholder mapping and analysis

The analysis is used to assess and better understand stakeholder expectations, where gaps are, how these can be addressed and how they can be revitalized, how they will react to changes and how they may embrace them. For more detailed and further information on this method and tools and how to use it in the field see:

GTZ. 2007. *Multi-stakeholder management: Tools for stakeholder analysis: 10 building blocks for designing participatory systems of cooperation*, Eschborn, Germany

Link: <http://www.fsnnetwork.org/sites/default/files/en-svmp-instrumente-akteuersanalyse.pdf>

At the same time of mapping the food value chain and related stakeholders it is also necessary to focus the mapping exercise on the waste hotspots that may be found in the food value chain. Usually, but not always, waste in food value chains is found where natural environment resources are not being used appropriately: in other words, inefficient use of resources. As such knowing where environmental hotspots are found in a food value chain can potentially be a good indicator of where waste hotspots can be found. So concurrently to mapping the food value chain and its stakeholders it is also important to use a tool for assessing where environmental hotspots occur in a food value chain (see Box 7).

Box 7 Environmental hotspots analysis

This is a tool that can be used for providing an initial and indicative understanding of where in a food value chain environmental hotspots may exist. It is a rapid appraisal tool, based mainly on literature review and key informant interviews. For more detailed and further information on this method and tool and how to use it in the field see in specific Annex 3 (pages 36 to 39) in the following document:

GIZ. 2015. *The guidelines for value chain selection: Integrating economic, environmental, social and institutional criteria*, Eschborn, Germany

Link: <https://www.giz.de/fachexpertise/downloads/giz2015-en-guidelines-value-chain-selection.pdf>

Step 5: Provide for the current state of the selected food value chain(s), waste streams and shadow value chains

Following what has been done in Step 4, the results should provide information that can enable a better understanding of the current situation. This will provide not only field-based information, for example reports on stakeholders, etc., but will also provide pictographic (maps) on the current status

of the food value chain, waste streams and shadow value chains. This information should importantly provide for a better understating of waste streams and shadow value chains. This should provide a better understanding of how waste occurred, where did it occur, the composition of the waste, the volumes of waste, the waste streams that derived, the stakeholders and related shadow value chains involved. Importantly it should enable to track the multitude of waste systems and networks that can derive out of a food value chain. Importantly these results need to be shared with the MSWG and discussed.

Step 6: Diagnose the current status of the food value chain(s), waste streams and shadow value chains

From the analysis that derived from the previous Step a diagnoses should be conducted on the “gaps” that exist between what the food value chain, waste streams and shadow value chains are in their current situation and what is expected, for example by the key stakeholders in the future, by project objectives, etc., in other words in its green upgraded status. This comparison will be effective as it will be based on the specific objectives set out in Step 3 and will enable to identify leverage points for upgrading and thus this should render upgrading strategies and planning highly more targeted.

As mentioned previously a leverage point is a “place” (point) in a food value chain, food network, waste stream and shadow value chain where it is possible to intervene for development purposes and where a “solution” can be *realistically* applied. For example, a leverage point can be waste pickers: providing worker rights to waste pickers, which may be a first step in attempting to formalize waste stream operation. A leverage point can be classified as low if a small amount of change causes a small change in the food value chain. A leverage point can be classified as high if a small amount of change causes a large change in the food value chain.

Importantly in identifying leverage points it is suggested that the leverage points that can generate the most buy-in from stakeholders are initially chosen and tackled. This will create consensus among the stakeholders and it will enable participation and thus later on down the line of green upgrading food value chains, waste streams and shadow value chains, more arduous leverage points can be tackled more easily. It is advisable that criteria are developed in the selection of which leverage points to tackle initially with green upgrading interventions. The criteria could be based on for example:

- Which leverage points can bring the most consensus among stakeholders;
- Which leverage points can bring less economic disruptions to stakeholders;
- Which leverage points can bring more rapid gains, in a short time frame, so as to foster consensus, participation and collaboration among stakeholders; etc.

Step 7: Take action: Provide for an upgraded food value chain strategy and plan that fills the gaps found

Having identified leverage points for upgrading, this step of the process should provide detailed strategies, plans and implementation schedules to intervene in the chosen food value chain, waste streams and shadow value chains. Strategies, plans and implementation schedules will inevitably vary considerably based on the intended objectives of the upgrading and the priorities found as per the leverage points. However, and importantly, the upgrading should be focused and *realistic* on what can actually be done and ensuring that economic and environmental benefits are prioritized. This process should consider key stakeholders’ perspectives and expectations and thus should be regarded as being inclusive. In other words, that in setting strategies, plans and implementation schedules for upgrading it is critical to include the MSWG and other interested and affected stakeholders by the planed interventions.

A detailed budget plan will also need to be provided that outlines clearly and concisely the required budget for the plan, who will be responsible for the budget and how sending processes and allocations will take place and when.

Once completed the upgrading plan, which includes the implementation schedule and budget, it needs to be shared with all interested parties.

Step 8: Develop an upgraded map of the food value chain considering all processes and key stakeholders

One good way of presenting the upgrading plan to all those involved in the activities required for the upgrading process is a visual map of the upgraded food value chain, waste streams and shadow value chains. This should provide clear indications of what is the current structure of the value chain, waste streams and shadow value chains, what will change and what is expected of the upgraded food value chain, waste streams and shadow value chains. This visual description should be accompanied by promotional material devoted to stakeholders that can provide information and generate support for the intended upgrading process underway (see Box 8).

Box 8: Implementation and action with stakeholders

Encouraging active participation and consultation with members of the MSWG and other stakeholders to contribute to the implementation and access process and if done correctly will:

- Involve seeking the views, ideas, needs and desires of individuals, organizations and others in the food chain, waste streams and shadow value chains in the implementation phase⁴
- Build and maintain long term relationships with and among stakeholders in the implementation phase⁴
- Provide a permanent platform for the exchange of information among stakeholders in the implementation phase⁴
- Establish ownership, better understanding of what is at stake and recognize the likely impacts in the implementation phase⁴
- Enable stakeholder competencies, capabilities and resources to be used synergistically in overcoming obstacles that will likely arise in the implementation phase⁴
- Provide fundamental inputs into the decision-making process of the implementation schedules.

Facilitating dialogue involves creating a favourable environment among stakeholders and is based on a clear understanding of *how it is done*, *what will be done* and *why is it being done*. When stakeholders have confidence in the consultation process and its legitimacy, differences will still persist, but can co-exist without disrupting the process. Knowing stakeholders' attitudes towards possible changes and bringing parties together to share ideas, needs, and wants, will provide an environment to move from consultations to active dialogue.

The ultimate aim of facilitating, encouraging and hosting dialogue and encouraging stakeholder contributions is to set up a working group that can work jointly on the upgrading strategies, plans and implementation schedules. Thus the creation of a working group for this step of the process is advisable.

Importantly the strategies and plans made need to be implementable, hence particular attention needs to be paid to the feasibility and viability of the implementation process and the time schedule involved. This will commonly require good management and coordination among the stakeholders, the various activities that have been identified to upgrade the food value chain, waste stream and shadow value chains.

Step 9: Set up a monitoring and evaluation system

It will be necessary to set up, design, staff and implement a monitoring and evaluation system. This will enable progress to be checked regularly and, importantly, enable evaluations on how matters are progressing in the upgrading. Some of the matters to consider in setting up a monitoring and evaluation system are provided in Box 9.

Box 9 Matters to consider in setting up a monitoring and evaluation system

Main issues to consider in effective monitoring and evaluation:

- A baseline of indicators needs to be set up. Bottom-up monitoring needs to be undertaken, with the specific objective of capturing the impact of interventions.
- Monitoring needs to be undertaken periodically, measuring predetermined indicators.
- A specific period for monitoring needs to be agreed upon and supported. What can go wrong?
- changes in the implementation environment, such as a change in local authorities, changing priorities;
- price instability, animal disease, food safety scares that change the competitiveness of the market;
- policy changes that have a detrimental impact.

An effective M&E system will:

- provide ‘hard facts’ and play a crucial role in keeping the plan on target;
- allow priorities to be reassessed and encourage more effective use of resources;
- increase understanding and learning as to why particular interventions have been successful or not;
- inform those involved in decision-making and improve their performance; and
- encourage stakeholder ownership and inevitably long-term sustainability.

Step 10: Hold regular multi-stakeholder working group meetings

Regular MSWG meetings should take place to discuss, debate and importantly act on opportunities and challenges provided by the progression of the various plans devised. This will help clarify matters which may have been raised and importantly build a common consensus around possible solutions.

Conclusions

Recapturing value from waste has clear advantages from an environmental, social and economic point of view and contributes to climate change mitigation and adaptation. In this process, the public sector will be needed, as for example public policies are needed to attempt to regulate the hygiene standards of valorisation markets, via training of waste pickers and small valorization enterprises. Importantly though, an inclusive multi-stakeholder approach is required including all local level stakeholders. This will also be important, for example, in knowledge transfer of how for example shadow value chains work in recapturing value from waste and how this can be beneficial from an economic, social and environmental perspective. The collaboration and understanding among various stakeholders can enable such knowledge to be made more available, adaptable, and scalable to others and can provide ‘voice’ to the voiceless who commonly operate in waste streams and shadow value chains. Thus it is clear that far more awareness creation targeted at decision-/policymakers in the public sector as well as in donor nations and donor financed projects that deal with greening food value chains is needed. This will not only raise awareness of the necessity to develop green food value chains, but also bring into the limelight the waste streams and shadow value chains and those who operate in it, who are usually marginalized, undervalued, and in some instances invisible to policy and development processes.

The way forward

Seeing the complexities, peculiarities and specificity tied to local conditions of many waste streams and shadow value chains there is a need for more research to be conducted in this area in why, how, and when such waste streams and shadow value chains operate and how this information can support awareness creation, information sharing, project development and policy formulation. Further, findings from such research can support development initiatives better understand and importantly implement how to further green upgrade waste streams and shadow value chains within such informal contexts. Consequently, there is a clear need to apprehend more information, know-how, lessons learned, and experiences on greening practices of waste streams and shadow value

chains including: activities, processes, systems, institutions, organizations, and behaviors. Moreover, such practices will need to be categorized and ranked and guidelines on best practices identified. Guidelines for best practices could also be provided to policy-makers to support their attempts in greening waste streams and shadow value chains.

Supporting the public sector is important, owing to its role in emanating policies and legislation, and hence more research is also required in terms of how and what the public sector can do to support recapturing value from waste. Most of the research conducted has shown that recapturing value from waste functions mostly with little, if any, public support. This situation needs to be modified and in order to do this the public sector not only requires awareness campaigns, but also and importantly guidance, especially at local level. Thus, crucially, more research is required in providing guidelines for best practices for the public sector in how recapturing value from waste can support the development of a low carbon economy at local level.

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