Don't Waste a Drop!

Maximising the Value of F&A Waste Streams

Rabobank International

Food & Agribusiness Research and Advisory

paul.bosch@rabobank.com
+31 30 71 24439
justin.sherrard@rabobank.com
+31 30 71 23182

www.rabotransact.com

Contents

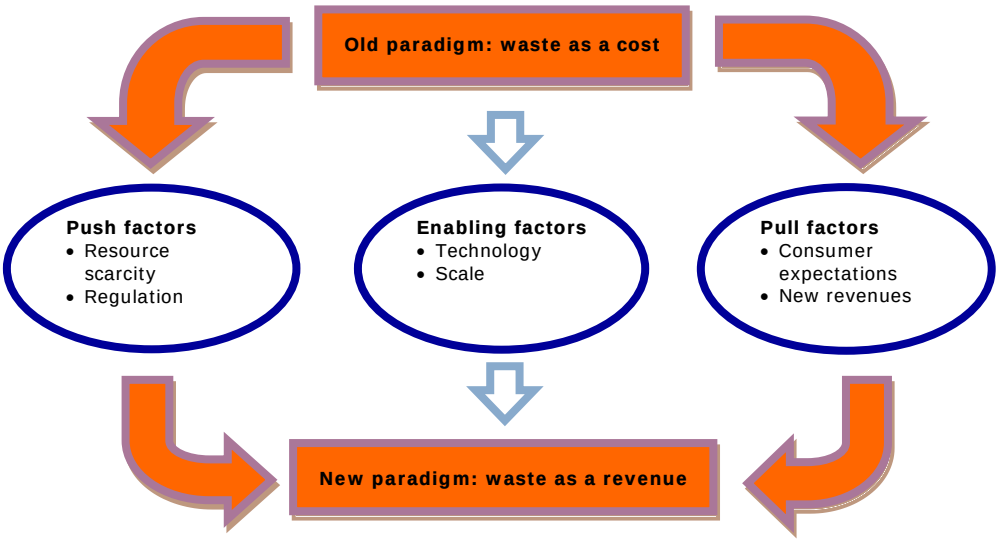
Organic waste generated in the F&A sector was once seen as a problem, but leading companies are now shifting this from the cost to the revenue side of the ledger. The renewed focus on F&A waste is being driven by rising agri commodity prices and resource scarcity, growing regulatory pressure around waste disposal, the opportunity to hit company sustainability targets, and technology developments. F&A companies should be thinking about waste, and many are, but while they once aimed to minimise waste and its associated costs, there are now examples in all sectors and in all parts of the supply chain of waste being utilised to access new markets for energy and materials, and generate higher returns in the process. Different business models lie behind these examples and there are several criteria to satisfy in getting this right. Rabobank believes more F&A companies will follow—the drivers behind this shift are too important to ignore. Leaders and early adopters are most likely to get the best returns.

Waste valorisation makes growing sense

Each year, well over 1 billion tonnes of waste is generated along food & agribusiness (F&A) supply chains around the world, and almost 2,000 cubic kilometres of water, or more than 500 million Olympic-size swimming pools, are required to produce this wasted food (*see Box 1*). In a world where nearly 1 billion people suffer from hunger and malnourishment—despite steady increases in food production over recent decades—and where the world's water resources are under stress, this level of waste makes no sense.

Recognition of the problem of food waste, and thinking about whether and how to act upon it, has grown for F&A companies in recent years. The new F&A waste forcefield highlights the main push and pull factors that are increasing awareness and the enabling factors that facilitate the resulting actions (*see Figure 1*).

Figure 1: The new F&A waste forcefield



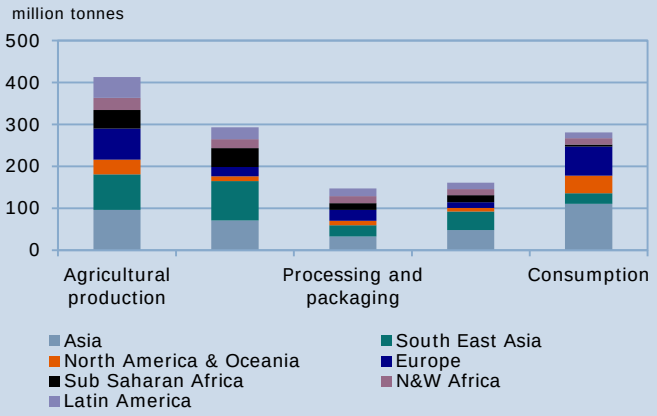
Source: Rabobank, 2012

These changes are leading F&A companies to recognise that it makes growing sense to place more value on their waste. How and when to do this and which valorisation pathways to choose are the questions many F&A companies are struggling with. Rabobank will publish follow-up papers in the coming months that elaborate on the opportunities and risks in specific pathways for waste valorisation.

Box 1: Waste in F&A supply chains

Some 1.3 billion tonnes of food are lost in global F&A supply chains each year. In developing countries, waste tends to be greatest in the agricultural production and post-harvest stages of the chain, whereas in developed countries, food tends to be wasted at the consumer end of the supply chain.

Food waste has proven difficult to monitor given the breadth of supply chains and limited interest from governments and F&A companies in the past. As a result, some data is based on assumptions. Growing interest has led to greater efforts to measure and monitor waste streams. The United Nations Food and Agriculture Organization (FAO) has greatly improved awareness of the food waste challenge by publishing data in recent years. The EU has also made funds available for further research on food waste.



Source: Rabobank, based on FAO, 2011

The new F&A waste force-field makes the case for action clearer

Higher agri-commodity prices and volatility have increased the F&A companies' focus on input costs and have raised broader concerns over resource scarcity. At the same time, governments are tightening regulations around waste management (e.g. through new or higher taxes and levies), and requiring higher standards for discharge into the environment. For example, the EU Landfill Directive progressively reduces the use of landfill for biodegradable waste; in 2017 no more than 35 percent of biodegradable waste will be allowed into landfills and, as a result, F&A companies are effectively forced to treat rather than dispose of their organic waste. Together, resource scarcity and regulation create a push for F&A companies to see waste as a revenue opportunity.

Corporate commitments to reduce the impact on the planet and support its people are not new. For example, leading F&A companies have set various targets related to the environment and waste (*see Figure 2*). In addition, F&A companies and sector organisations have responded to consumers' interest in sustainability by introducing product eco-labels and standards as well as becoming more efficient in their use of water, energy and materials. Living up to corporate sustainability commitments in a cost-cutting business environment is challenging, making the opportunity to meet these commitments while generating new revenues by utilising waste as a resource particularly attractive. In combination, corporate sustainability commitments and new potential revenue streams create a 'pull' for F&A companies to see waste as an opportunity rather than a problem.

Figure 2: Leading F&A companies' waste and sustainability commitments

	Waste reduction	CO2 reduction	Energy	Water reduction	When
Heineken		40%*	Reduction target	25%*	2020
Friesland Campina	20%*		Reduction target	20%*	2020
Coca-Cola	Zero waste	5%		20%*	2015
Mars Food	Zero waste	100%	100% renewable	25%	2015
Heinz	20%	20%	Reduction target	20%	2015
Starbucks			Reduction target	25%	2015
Walmart	Zero waste		100% renewable		Not known

Note: * target based on sales, related to resource-intensity of product

Source: Rabobank, based on corporate sustainability reports, 2012

The shift from waste as a cost to waste as a revenue is enabled by new technologies and the growing scale of F&A company operations. New technologies allow waste to generate higher cashflows—as in the production of bio-based products—and scale, which mean greater volumes of waste are available or that approaches can be replicated across an F&A company.

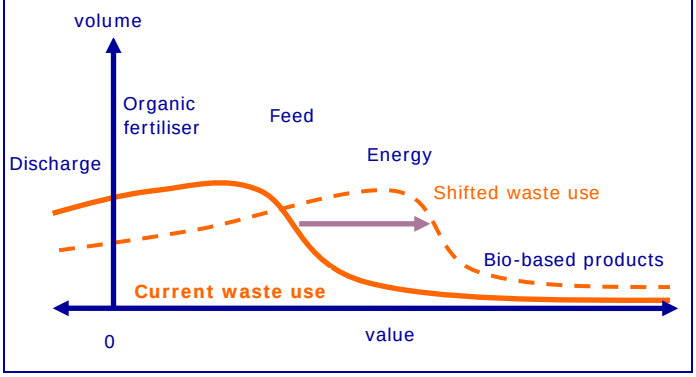
New pathways, new opportunities

Accessing new pathways for waste requires a new mind set or paradigm for F&A companies. Until recently, companies had focused primarily on reducing waste through efficiency improvements. Indeed, efficiency improvements reduce not only the cost of waste disposal, but also the costs of labour, energy and raw materials otherwise spent on producing foods that will not be consumed. Although further efficiency gains can still be achieved, by using improved technology and better resource management for instance, such gains may be limited, especially if process efficiency is already high. The new paradigm therefore stimulates companies to think less about reducing waste and more about finding pathways to increase the value of waste streams. These new pathways are returning positive cashflows for these companies, making them attractive examples for other F&A companies to follow (*see Figure 3*).

Mature by-product markets demonstrate the potential

Companies that limit themselves to implementing efficiency measures may miss out on the opportunities to generate new cashflows and revenues. In some sectors, F&A waste streams have traditionally been treated as by-products, and these tend to have a low value placed on them, covering costs and, in some cases, providing a modest return. The use of sugar beet pulp in animal feed, vegetable residues in compost and animal fats in the oleo-chemical industry are all examples of relatively straightforward valorisation of F&A waste—these are longstanding uses of F&A by-products. Ongoing gains have been made in the use of these by-products so that in some cases they can become material cashflows. In the animal protein sector, for example, the sale of by-products continues to evolve in mature markets. In total, some 10 million tonnes of animal fats are produced and sold as by-products of meat processing, representing a value of over EUR 7 billion. Furthermore, the FAO estimates that residual waste from slaughterhouses has a potential global economic value of some EUR 500 million. With resources becoming increasingly scarce and technology improving, F&A companies will continue to pursue opportunities to increase the potential returns through existing by-products pathways.

Figure 3: The shift in waste pathways is to higher value



Source: Rabobank, 2012

Shifting by-product use and increasing revenues

Some companies are looking beyond the possibilities of established by-products. Two pathways with the potential to increase revenues beyond the current value of by-products are energy and bio-based products.

Utilising waste as a feedstock for on-site energy (power and heat) generation is proving to be valuable for some F&A companies. Combustion (as a raw feedstock or through pyrolysis to create a gasified fuel) and anaerobic digestion both enable companies to generate electricity and heat for their own use and to sell any additional energy to the grid. Such initiatives are often cost driven. Downstream, increasing and volatile energy prices are a

challenge to food processing industries where energy costs can be high. Upstream, dairy farmers have to deal with increasing volumes of manure as their herd numbers increase. EU legislation limits the use of manure as fertiliser and off-site disposal is costly. Global dairy companies like Danone, Fonterra, FrieslandCampina and Nestlé have introduced programmes to support farmers to install biogas plants and convert their own waste into electricity and heat. In general, renewable energy subsidies, and the application of heat, can make on-site energy production more profitable than selling the waste as animal feed.

Bio-refining is another approach to unlocking higher value from F&A waste streams. Bio-refining is able to process F&A waste into a variety of bio-based products, such as high-value chemicals and pharmaceuticals, and high-volume materials including bioplastics, fertilisers and next generation fuels. The production of chemicals and materials is relatively new but can generally generate higher revenues than the unprocessed by-product or energy pathways. CSM subsidiary Purac, for instance, produces high value biochemicals and is investigating currently available by-product streams that can be used as feedstock. Other companies, such as Harvest Power and Orgaworld—the latter through its 'greenmills' programme—are targeting opportunities to retrieve valuable elements such as nitrogen and phosphorus from mixed waste streams.

In addition to revenues, practicality and sustainability considerations can influence company decision making about waste valorisation pathways: energy and bio-based materials offer advantages here as well.

- On-site energy generation can help F&A companies meet corporate targets for greenhouse gas emissions and renewable energy (see, for example, companies listed in Figure 2).
- Both energy and bio-based materials pathways offer consistent price and demand profiles. This is in contrast to animal feed, where markets can be seasonal and prices can be volatile depending on global grain markets. Energy pathways are also more forgiving of quality fluctuations and health and safety concerns.
- Bio-based products may appeal to some consumers from a sustainability perspective. According to the 'waste hierarchy'[1] this is considered 'upcycling' of resources as their value could represent many times that of by-products.

Comparing waste valorisation pathways

Considerations that inform company decision making about waste management pathways include the potential to add value to the business, sustainability issues and practical barriers to implementation (*see Figure 4*).

Figure 4: A comparison of waste valorisation pathways

		Value-added	Sustainability by waste hierarchy	Practical barriers
Discharge Use external parties to treat/clean waste, often paying a gate fee		Negative	Low	Low
Waste reduction Improve process management and efficiency		Moderate	High	High
Composting Using waste as organic fertiliser, for instance on farmland		Moderate	Low	Low
Feed Livestock farmers use protein rich waste to enrich animal feed		Moderate	High	Low
Onsite energy generation Higher value than discharged waste that gets incinerated by third parties	Combustion	High	Moderate	Moderate
	Anaerobic digestion	High	High	Moderate
Bio-based products Alternative waste uses (e.g. for high-value chemicals and high-volume materials		High	High	High

Source: Rabobank, 2012

Revalorising F&A wastes

Leading F&A companies across different sectors have invested in waste valorisation and are benefiting from new revenues. It is happening in different stages of the food supply chain, in different sectors and in different regions in the world (*see Figure 5*).

Some companies are focusing on previously unused waste streams:

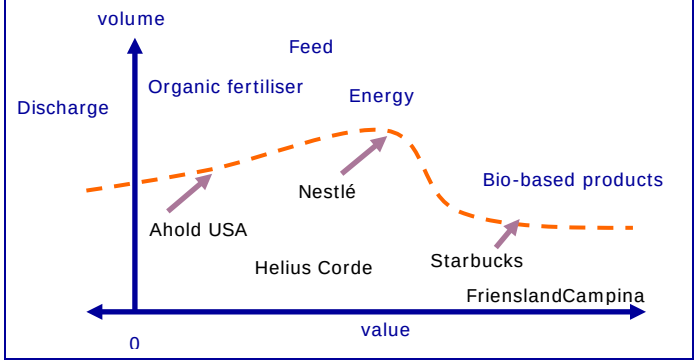
- **Ahold USA** has committed to identifying appropriate partners to develop an organics composting programme. The intention is to divert wastes, including fresh and bakery items, into compost, rather than sending them to landfill or for incineration.

- **Nestlé** has expanded its technology to produce energy from coffee grounds to 20 of its 32 global Nescafé factories. Each year, Nestlé has 800,000 tonnes of coffee grounds left over from processing, and this is used to produce 3.15 petajoules of energy, or 3.5 percent of its energy consumption.

Other companies have shifted sales of by-products to higher value destinations:

- **FrieslandCampina's** milk prism project uses the whey that they once sold as a by-product to refine into higher value 'pure' products such as casein and lactose.
- **Corde** (The Scottish Combination of Rothes Distillers) formed a joint venture with energy project developer Helius in 2009 to produce on-site renewable energy (heat and power) from whisky distillation wastes. These by-products were previously sold (where possible) as animal feed.
- **Starbucks** recently announced it is exploring ways to use enzymes to tackle its waste problem and to ease waste disposal costs. The enzymes break down food waste and coffee grounds into sugars and subsequently into succinic acid, which can be used to produce a wide range of products, including plastics.

Figure 5: Examples of F&A companies shifting waste to higher value pathways



Source: Rabobank, 2012

Although these examples are diverse, the companies involved have satisfied a number of criteria that successful waste valorisation pathways are built on:

- **Ambition:** generally, senior company management does not focus on waste management, yet maximising the value of waste streams requires investment that may extend beyond operational budget lines. Having the ambition to valorise waste, often expressed through corporate sustainability goals, provides a basis for engaging senior management.
- **Scale, continuity and characteristics of waste streams:** variation in the quantity, quality, safety aspects and other characteristics of waste streams needs to be known and understood. In cases where scale is limited, F&A companies can work together to access more interesting waste valorisation pathways. Waste streams high in proteins, sugar and starch have more options, particularly in relation to bio-based product pathways, than fibrous wastes, which are better suited for energy production.

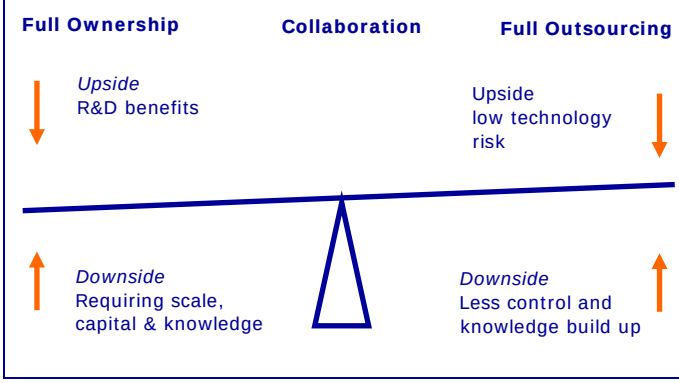
[1] The waste hierarchy is a theory that ranks the different approaches to food waste (reduce, reuse & recycle), based on social and environmental contribution.

- **Commercial maturity of technology:** this is particularly the case for separation and refining technologies.
- **Co-location:** partnerships in managing waste are usually best managed at nearby locations, given the costs of transporting waste. The availability of different pathways depends on the proximity of potential offtakers for waste. The higher the potential value of waste streams, the less co-location is an issue.
- **Knowledge:** technologies and potential offtakers are often not well known and waste costs are hidden. Companies that are engaged in and monitor waste management are usually better able to identify opportunities. Benchmarked sectors have an advantage.

Organising waste valorisation

Three models have evolved to enable the higher valorisation of F&A waste streams. They include full ownership of the waste valorisation pathway, a collaborative model and one based on full outsourcing of waste valorisation (*see Figure 6*).

Figure 6: New models that can increase the value of F&A waste streams



Source: Rabobank, 2012

Full ownership requires more management focus and supply chain knowledge, and delivers R&D benefits to the company that owns the waste stream. This model can work well in situations where the F&A company has the required knowledge as well as access to technologies and finance to implement a particular waste valorisation pathway. The other end of the spectrum, the outsourcing model, where a specialist waste management company is engaged and consulted to manage the whole valorisation process, reduces the level of control and potentially scale, required by the F&A company. It furthermore 'outsources' technology risk. The F&A company typically receives a royalty payment for the waste stream, depending on the waste valorisation pathway selected.

The collaboration model can be based on a partnership between an F&A company and a specialist waste management company, where the former contributes the waste streams and the latter the processing technology, and one party or the other manages the offtake arrangements for the resource flows. An example is the recently announced collaboration between brewer AB InBev and Blue Marble Bio, a biorefinery company. In such models, the costs and benefits are shared between the parties, with the F&A company often providing finance and the specialist company providing the technology and operational expertise.

An alternative form of collaboration is between F&A companies. One emerging example is the creation of a waste hub, whereby a number of F&A companies within a local area pool their waste streams, thereby creating sufficient scale to open up a range of valorisation pathways. If waste streams can be guaranteed, long-term offtake agreements can be forged for the resulting energy or material outflows, providing the basis for a robust business model that can attract finance.

What next? How F&A companies are getting started

Globally, food waste statistics are alarming and no one in the F&A sector could fail to appreciate the need for action. The global food waste situation warrants more attention from the entire sector, and the need for action is only compounded by the water and energy losses associated with food waste.

F&A companies have long recognised that they can and should take action on food waste themselves—reducing waste and seeking opportunities to utilise by-products. Progressive companies have aimed for zero waste, but two changes in recent years are redefining the end-game. First, there is a growing appreciation of the enormity of the global food waste issue as more reliable data becomes available. At the same time, opportunities are now being seized to treat organic waste as resource flows with the potential to generate positive cashflow. The case for action is becoming stronger as the push and pull factors in the new F&A waste forcefield become clearer. The key questions for F&A companies are:

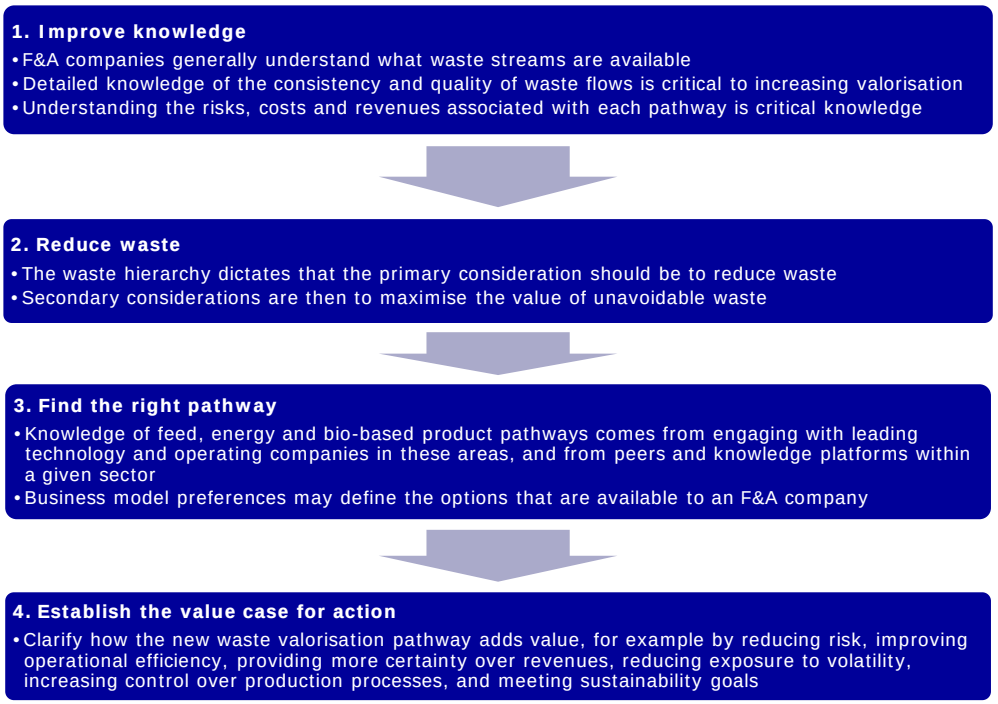
- If you are taking steps to shift wastes to the revenue side of the ledger, are you maximising the value of your waste?
- If you have not yet taken steps to shift waste, how much potential value are you missing out on?

In markets with low growth outlooks, resource efficiency initiatives such as maximising the value of waste can represent important areas to grow margins and introduce new cashflows. Given the lengthening list of companies taking action on waste to generate positive cashflows, it makes sense for F&A companies to increase management's attention to waste.

Enabling action

Once management's attention has increased and once corporate goals are clear, four steps enable action to increase the valorisation of F&A waste (*see Figure 7*).

Figure 7: Four steps to enable the increased valorisation of F&A waste



Source: Rabobank, 2012

Rabobank expects that F&A companies will continue to increase their focus on waste, to pursue opportunities to increase the value of waste streams, and that attention will increasingly shift to the higher valorisation pathways. Right now, the higher valorisation pathways tend to present higher risk profiles and greater returns for F&A companies that have established a value case for action. As this trend of increasing the value of waste streams picks up momentum, risks will decrease, and as a result, first mover advantages and the associated returns could come under pressure. This points up why now is the time for F&A companies to address food waste and start maximising its value.