

A Proposal for the Elimination of Landfill in Vietnam

by Dr. Paul Olivier

Vietnam has thousands of scavenger families, and these resourceful people play an important role in recycling paper, cardboard, plastics, glass and metals. No private or public company within Vietnam has the means or motivation to compete with scavengers in the hand-sorting and recycling of waste. However scavengers perform this vital service, not out of love for the environment, but as a means of earning a living.

But more than half of the weight reporting to landfill in Vietnam consists of food waste, a waste that up until now offers no economic benefit to scavengers. But all of this is set to change with the development and manufacture in Vietnam of a process and apparatus that transforms food waste into high-value feed products.

The process requires no energy, no electricity, no chemicals, not even water. It is totally self-contained and does not emit a drop of effluent, and aside from a small amount of carbon dioxide, it does not produce methane or any other greenhouse gases.

The unit housing this process operates with the simplicity of a garbage bin. It has no moving parts, and it requires very little servicing and maintenance, very little expertise or experience to operate. The average Vietnamese scavenger could learn to operate such a unit at optimum efficiency within a period of a day or two.

The process does not emit offensive odors, and it drives away houseflies and other filth-bearing flies. It is housed within a plastic container called a biopod®. Situated out-of-doors in a shaded area, any number of biopods can be coupled together to handle unlimited quantities of waste.

The process effects a reduction in weight and volume of food waste that at times reaches as high as 95%, and this rapid reduction in weight and volume takes place within a period of less than 24 hours. Since food waste can be reduced and recycled in proximity to its point of origin, it eliminates much of the cost associated with the transport of food waste, and most importantly, it eliminates all of the cost associated with the land-filling of food waste.

This process does not demand the introduction of anything foreign or exotic. It is powered by the larva of the black soldier fly (*Hermetia illucens*), an insect found throughout the whole of Asia, and even though this insect has lived alongside humans for thousands of years, it has never been associated in any way with the transmission of disease.

In view of the wide variability of putrescent waste presented to it, this benign creature possesses one of the most robust digestive systems within nature. It has the ability to thrive in the presence of salts, alcohols, ammonia and a variety of food toxins. It can survive for almost two hours when submerged in rubbing alcohol, and it can be

centrifuged at 2,000 g without harming it in any way. In addition to food waste, it can digest swine, human and poultry waste.

Upon reaching maturity, it has been rigidly regimented by evolution to migrate out of the biopod and into a collection bucket without any human or mechanical intervention. This self-harvesting grub represents a bundle of nutrients that rivals in commercial value fish meal valued at over \$1,200 US per ton, and for every 100 kg of food waste deposited into a biopod, approximately 20 kg of live larvae can be harvested. Here is a unit that any Vietnamese scavenger can operate, and here is a product that any Vietnamese scavenger can sell.

This proposal presupposes that food waste be kept source-separate. Black soldier fly larvae do not eat paper, cardboard, plastic, glass and metals, and these materials of marginal value should never come into contact with putrescent waste. Imagine how much safer and easier their work would become if, in the sorting of recyclables, scavengers did not have to deal with the mess and stench of decomposing food waste. When food waste is kept source-separate, recyclables are cleaner and command higher prices, and a lot more material gets recycled in a lot less time.

The current waste collection and disposal strategy in HCMC calls for radical change.

Throughout the city scavengers can be observed at the end of the day cutting open trash bags and spreading their contents out on sidewalks. This often happens late in the day when lighting is not adequate, and therefore a lot of recyclables are missed. The scavenger leaves behind on the sidewalk a waste that is predominantly food waste, and this mess is repeatedly visited by dogs, cats, rats and filth-bearing flies. Without a doubt this practice serves as a powerful vector for the transmission of disease. Some restaurants set out waste in late evening, and a similar routine is carried out by scavengers in early morning.

Official waste collectors follow behind to sweep up the mess left behind by scavengers on sidewalks, and as they transfer this waste into push carts, they can be observed hurriedly hand-sorting recyclables that scavengers had missed. Since their job is to sweep and transport, this second attempt to recycle is poorly done. When the push cart arrives for transfer into a garbage truck, a third round of hand-sorting takes place, and finally when all is brought to landfill, a fourth round of hand-sorting takes place on the dump site itself. From the first to the fourth attempt to hand-sort waste, all takes place outdoors, and during rainy season, this filthy mix of waste is often flooded with water.

No attempt is made to safeguard the condition of recyclables. No attempt is made to assist scavengers in the recycling of waste. Each step in the collection, transport and land-filling of household waste in HCMC is messy, disorderly, inefficient, expensive and unsafe. So why not propose something entirely different?

Let us assign to each scavenger the task of collecting, transporting, sorting and processing the waste of approximately one hundred households. One hundred households

generate each day on average 100 kg of food waste and another 100 kg of recyclables and non-recyclable residues. A nominal 4-foot diameter biopod can easily process 10 kg of food waste per day, and therefore a scavenger would have to operate ten biopods to process the food waste of the one hundred households under her care.

A scavenger would be able to harvest on average 2 kg of larvae per biopod per day, or a total of 20 kg of larvae per day from ten biopods. At a value of 4,800 VND or \$ 0.30 US per kg, this represents daily revenue of 96,000 VND or \$6.00 US, and monthly revenue of 2,880,000 VND or \$180 US.

The residue left behind by black soldier fly larvae serves as a wonderful substrate for the cultivation of red worms. Alongside her ten biopods, a scavenger could also operate a red worm bin. Red worms in Vietnam sell for 50,000 to 70,000 VND per kg (\$3.13 to \$4.38), and their castings sell for 2,500 VND or \$ 0.16 per kg.

In addition to 100 kg of putrescent waste, 100 households will produce roughly 100 kg of non-putrescent waste. Scavengers should be able to find a home, as we shall see, for every gram of this non-putrescent material, and from it they should derive considerable economic benefit, perhaps equal to the revenue they might receive in the sale of larvae, red worms and castings.

To handle the entirety of the waste generated each day in HCMC (estimated at roughly 3,000 tons of putrescent waste and 3,000 tons of non-putrescent waste) approximately 30,000 scavengers would be employed operating 300,000 biopods. If such a massive recycling program has any chance of success, it must be driven primarily by the value of waste. But for waste to acquire value, certain conditions must be met.

The household should make its waste available to the scavenger in two containers: the first container for food waste and the second container for everything else (with the exception of hazardous materials). Insects and animals would not have access to the contents of this first container, and the scavenger will be able to sort the contents of this second container with ease and efficiency.

The scavenger would be obliged to collect the contents of the first container on a daily basis. But since the second container would not contain putrescent material, it could be stored indoors for whatever period of time works best for the scavenger and the households she services.

In a single sorting process the scavenger will recover from this second container a much greater quantity of recyclables of a much higher quality in a lot less time. These recyclables will never be co-mingled with food waste; will never be dumped on side walks and exposed to animals, insects and rain; will never be reloaded onto push carts and transferred to garbage trucks; will never go through multiple rounds of hand-sorting on a daily basis; will never be transported long distances and dumped in landfills; and consequently will not be around for hundreds of years to pollute the air, ground and water in the vicinity of HCMC. All of these useless activities will be eliminated.

As she visits each household on a daily basis, the scavenger will have the opportunity to monitor and control the quality of source-separation. She would be quick to point out any unacceptable co-mingling that might slow her down or render her work unsafe or unsanitary. She would be quick to spot the presence of hazardous materials that should never be allowed to come into contact with food waste or recyclables. If households under her care should fail to source-separate food waste properly or attempt to dispose of hazardous substances improperly, she should have the freedom to call upon a special branch of environmental police empowered to impose significant fines. A large portion of the money collected in fines should be remitted to the scavenger in compensation for the time and revenue lost in the collection and processing of waste.

But to motivate a household to do proper source-separation, it is not enough to penalize bad behavior. The household that source-separates its waste properly should be rewarded by paying nothing to municipal government for the disposal of its waste. At the same time we suggest that municipal government pay nothing to the scavenger for the collection, transport and disposal of waste. And finally, since the scavenger receives no gate fee from the city, the household should make its waste available to the scavenger free of charge.

In this way the scavenger pays nothing to the household, the household pays nothing to municipal government, and municipal government pays nothing to the scavenger. This formula allows all three parties to benefit. But how do conventional waste management companies fit in?

If the scavenger is obliged to work with waste management companies, then the stage is set for continuous conflict and confrontation. Since waste management companies do not sort, recycle or process waste, they will always be viewed by scavengers as parasitic and exploitative. The scavenger must have free access to waste at its source, and she alone is uniquely positioned to assign it its highest value.

Someone might argue that waste management companies will always have a minor role to play in hauling to landfill any organic and inorganic residues that scavengers do not value as recyclable. But even such low-level participation in this concept is questionable.

Non-biodegradable organic residues not valued by scavengers as directly recyclable can be sorted, baled and sold by scavengers to cement companies. Such organic residues, when properly sorted by scavengers, have a calorific value in many cases as high as coal, and they constitute a wonderful alternative fuel for the production of cement. Far less fossil fuels are used in the production of cement, and even the ash from these residues becomes vitrified and is rendered inert and safe.

Another possibility would be to sell these non-biodegradable residues to companies operating gasifiers, and the clean synthesis gas (consisting mainly of hydrogen, carbon monoxide and methane) could power turbines to make electricity. This synthesis gas could also be steam reformed and transformed under pressure into methanol or ammonia.

Biodegradable organic residues too high in moisture to be gasified or too low in nutrients to be processed in biopods could be composted. And finally non-metallic inorganic residues not valued by scavengers could be crushed, sized and sold as low-grade aggregate.

Since none of these organic or inorganic residues require transport by means of garbage trucks or must be dumped in landfills, conventional waste managements companies have no role to play. This happens, not by design, but as an inevitable consequence of market forces that assign value to waste within the unique framework of scavenger micro-economic activity.

If there were a way for waste management companies to compete with scavengers in bringing recyclables to market, they would have already figured out how to do so, and there would be no trace of scavenger activity within Vietnam. If waste management companies cannot compete with scavengers in collecting and sorting recyclables, how could they compete with scavengers in recycling food waste or in preparing organic and inorganic residues? All of these activities are marginal, some more so than others, and they are feasible only to the extent that government deals directly with scavengers or scavenger co-operatives, with no company or other entity involved. Only by maximizing scavenger profitability through the elimination of unnecessary levels of control will a sound micro-economic base be created that permits virtually all household waste to be diverted from landfill.

Some types of household waste will provide greater revenue for the scavenger than others, and if the scavenger is obliged to divert from landfill all of the waste entrusted to her, no company or entity should be allowed to scavenge from her the more profitable items. Unless she has total control over her waste, she will never attain the level of profitability she needs to divert it from landfill. In this instance we might characterize the scavenger of the scavenger as a form of mafia, and municipal government must work out an effective means of eliminating or minimizing such parasitic interference.

Since scavengers are the only people to have demonstrated over the years an ability to sort and recycle waste in Vietnam, does it not make sense to expand and broaden the scope of their activities? Do they not represent an endless pool of labor eager to make money in cleaning up the environment? Are they not perfectly positioned to do a lot more than what they are currently doing? Are they not uniquely positioned to add value to the whole of household waste?

Even though municipal government should pay nothing to scavengers for diverting the colossal waste of eight million people from landfill, it should not stand aside and do nothing at all. Municipal government could empower scavengers in a variety of ways:

1. by improving their working conditions and providing them with training;
2. by protecting them from mafia middlemen who typically exploit their labor;
3. by encouraging them to form cooperatives free of middleman control;

4. by helping them to negotiate and obtain the highest prices for their larvae, recycled products and residues;
5. by equipping them with gloves, face masks and other safety equipment;
6. by monitoring their health, especially their exposure to toxic substances;
7. by leveling fines on households co-mingling food waste with everything else;
8. by leveling fines on households depositing hazardous waste into the two collection bins serviced by scavengers;
9. by granting tax incentives to companies manufacturing goods from recyclables recovered by scavengers;
10. by granting tax incentives to fish farms, chicken farms or feed companies utilizing larvae cultivated by scavengers;
11. by granting tax incentives to companies producing cement, methanol, ammonia or compost from non-recyclable organic residues made available by scavengers;
12. by granting tax incentives to companies producing low-grade aggregate from non-recyclable inorganic residues made available by scavengers;
13. by restricting the import of recycled materials into Vietnam that undermine the scavenger economy;
14. by providing scavengers with small manual or motorized carts that would allow them to collect and transport waste with ease and efficiency;
15. by organizing material recovery facilities well equipped with picking tables, balers, crushers and other accessories needed to facilitate the hand-sorting of recyclables and preparation of organic and inorganic residues;
16. by providing scavengers secure and ample space to operate their biopods;
17. by providing scavengers with micro-loans and other forms of financial assistance to purchase the equipment they need;
18. and most importantly, by continually celebrating their status as the champions and heroes of the entire recycling effort in Vietnam.

In this way Vietnam could eliminate the entire waste management infrastructure associated with garbage trucks and landfills. If organized correctly, scavenger co-operatives could take over every aspect of solid waste management within Vietnam. The primary emphasis of micro-economics is away from big companies with big capital, and this approach makes it possible for a large number of Vietnam's poor to benefit directly from the fruit of their labor and to prosper as never before. Government expenditure on waste management will be greatly reduced, landfills will no longer exist, and Vietnam, unlike China and most other countries in Asia, will be a world leader in the recycling of waste.

Socialist Vietnam should not turn to the West for high-tech solutions concerning the disposal of its waste. Given an abundance of black soldier fly larvae and scavengers, Vietnam has a uniquely Vietnamese way of eliminating landfill, while achieving a level of sustainability that exists nowhere else on earth.

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