# The Modular Harvest System™
# A Case Study

LILA, Inc., (Local Infrastructure for Local Agriculture)

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# Introduction

The Hudson Valley is an ideal place for pasturing livestock and there is strong market demand for meat from these animals in nearby metropolitan centers. However, many producers have found it difficult to take advantage of this demand because of limited access to USDA licensed slaughterhouses in the region.

In 2008, Glynwood Center, a nonprofit based in Cold Spring, NY created a Task Force to analyze this situation and create an effective response. In conjunction with the Task Force, Glynwood created a small specialized consulting team to support this initiative.

The result of the first phase of this effort was the launch of the first USDA licensed mobile slaughterhouse for large animals east of New Mexico. This occurred in April of 2010. With this major milestone achieved, the next phase of the effort is the creation of the network of docking sites that will allow the slaughterhouse (the Modular Harvest System™ or MHS) to rotate through the Valley.

Glynwood created an affiliate, Local Infrastructure for Local Agriculture, Inc. (LILA) to, among other things, own and oversee the operations of the MHS. The key consultant for the Task Force process has become the President of LILA.

This Case Study is part of LILA's program of sharing insights gained from this initiative to date, and encouraging replication of mobile facilities where appropriate.

# Addressing the Needs of the Livestock Community in the Hudson Valley

**Defining the Problem**

Our goal in undertaking this project was to craft a solution for the Hudson River Valley livestock growers who felt that the infrastructure for harvesting their animals was inadequate. We invited what we believed to be a broad array of interested parties – ranging from livestock growers to butchers and other meat processors, economic development officials, environmental/agricultural advocates, and community leaders. This group became known as the Task Force, and approximately five individuals constituted the core working group in moving the project forward. Our first objective was to define the problem clearly because there were various complaints from different sectors of the community, including these:

- Slaughterhouses were over-booked during the high (Fall) season
- Accessible slaughterhouses sometimes offered poor service, sub-standard production quality, and limited professionalism
- Slaughterhouses were so distant that animals being hauled many hours were stressed upon arrival
- Humane treatment of the animals was not a priority for some plant operators
- The costs of slaughter and processing were too high for small growers
- A USDA-inspected plant was not "conveniently" located

These six general complaints were not all addressed by our Task Force because, from a purely pragmatic viewpoint, we were not positioned to solve them.

The first two considerations described the current condition of the "slaughter marketplace" which clearly was at its limit. Existing slaughterhouses in or near the Valley did not wish to expand or add longer hours, a business decision our group was in no position to question. Management of those entities was also not within out control, and the only potentially beneficial action open to us was to change the competitive landscape with additional slaughtering capacity.

The scarcity of slaughter slots during the busy (Fall) season is a feature of the meat business in the Northeast that can be marginally mitigated with a variable price scale but on the whole, growers are unable or unwilling to shift their slaughter schedule to Spring or Summer months.

The acceptable timeframe for livestock transport is a matter of widely-varying opinion. Most observers believe that, in general, it is not the hours on the trailer that are stressful, but rather the procedures of loading, off-loading, and exposure to new surroundings, that are unsettling. And these procedures often are less than perfectly humane, with loud noise, impatient handlers, and a variety of disturbing conditions to which animals are uniquely sensitive. Generally speaking, the larger the plant, the heavier the workload, the less attention to individual needs of the animals, and the more problematic the handling environment. Our Task Force could not address those conditions at existing plants, but recognized the need to consider them carefully at any new facility.

Cost and convenience are in the eye of the beholder. If one is selling directly to consumers in a high-end market, and particularly if one is selling beef, the cost of slaughter is spread over a large amount of weight, and the slaughter cost per pound is probably not the most relevant consideration. With small ruminants, or in a less expensive marketplace, or when the buyer is a distributor, even $0.05 per pound is relevant. A conveniently-located facility is every livestock growers' wish; practically speaking, however, this is unrealistic. In the greater Hudson Valley, what would be convenient for one community in the southwest end of the Valley would be a two-three hour drive for those in the northeast corner. Our objective was to find some "middle ground" that served as many producers as conveniently as possible.

**Geographic Particulars**

The Hudson River Valley is variously defined as a group of somewhere between 10 and 14 counties; the Hudson Valley map (following page) indicates the counties that normally are used to define the region. According to the latest USDA survey, the animal population in the Valley is as follows:


| | |
|---|---|
| Beef cows: | 14,632 |
| Sheep and lambs: | 13,555 |
| All goats: | 7,759 |
| Hogs and pigs: | 3,180 |

What the statistical data does not reveal, however, are the number of livestock growers who are singularly focused on the New York City and Boston markets, both within two – three hours of the Valley.

These cities offer sellers a very substantial number of marketing opportunities, and an above-average price point, but also a brutally competitive marketplace with very demanding standards of quality.

The geographic features of the Valley that most influenced our analysis of the slaughter deficiency problem were these:

- The number of small farms (under 50 head slaughtered per year) whose product generally goes into a "specialty" or "high-end" market
- The long distances between the farm units
- The multi-species make-up of the agricultural landscape, with no one species dominant
- The character of the communities in the Valley that, in general, is not predominantly agricultural, and on-balance disinclined to support the construction of a new, in-situ slaughter plant
- The existence of butchers/cutters/processors that had skills to cut meat, but no facilities to kill livestock
- The growing demand from restaurants and other food service entities for beef sides, primal parts, or whole carcasses of smaller ruminants – in other words, carcasses unprocessed after slaughter
- The awareness of "food issues" – including health, humane animal considerations, value differentiation and "local sourcing" – that typify not only many residents of the Valley, but many buyers of meat products in nearby metropolitan regions.

These features made consideration of a mobile slaughter unit a worthwhile option. The same conclusion would not necessarily be justified in other geographic areas.

**Key Questions in Addressing a Perceived Deficiency in Slaughter Facilities**

What reliable number of growers/buyers are seriously in need of infrastructure, and more importantly, what percentage would actually utilize new capacity. This is a difficult assessment because some growers are genuinely dissatisfied with their current options, but also unwilling to shift established business relationships. It is optimal to define key growers who could anchor a new facility by agreeing to ship their animals on a regular basis, if and when the facility is completed.

What is the competitive landscape insofar as other facilities are concerned: might it be less expensive to expand an existing facility than to build a new one? Are there services that could be added on to existing plants that would satisfy the needs of the farm community? These are far less costly alternatives to new construction, if management at an existing plant is responsive to the opportunity.

What is the make-up of the grower community, and how strong is their commitment to utilize a new facility? Is the agricultural community growing, static, or diminishing?

What is the local receptivity to construction of a stationary slaughter facility, including the views of the zoning authorities?

Is a slaughter facility all that is required, or are processing and refrigeration also necessary?

Where is the market(s) for the finished product, and what are the features of that market? Is it primarily retail (where buyers want retail cuts that can be frozen) or is it food service, where buyers expect to do additional processing?

## The Dynamics of the Value Chain

**Disaggregation of the Value Chain**

Slaughter is the all-purpose term used to describe the lack of infrastructure that exists in the Hudson Valley's livestock industry, but it does not properly describe the entirety of the deficiency. There are many components of the animal harvest process including these principal steps.


In a perfect economic world, each of these steps would be handled by one business entity, with each activity assigned its proper cost, and a profit margin associated with the entire production chain. More often, however, the value chain is highly fragmented, with each step handled by a separate entity, each adding its own margin of profit. More than anything else, this fragmentation adds to the costs of the end-product, normally making it uncompetitive on a price basis with product from larger processing businesses.

We attempted to disaggregate the value chain in order to determine what parts were available within the Hudson Valley and which weren't; which appeared to be profitable, and which were being subsidized by other parts of the value chain. Most slaughterhouses in the Valley also do processing, but not all processing shops can, or wish, to slaughter. Although this generalization does not apply to every entity we assessed, slaughtering is generally a separate fee, and that fee, in our judgment, does not properly reflect the cost of the assets, the labor, and the overhead

involved in slaughter. In the Hudson Valley, the "market rate" for slaughter is in the vicinity of $70-$100 for beef, depending upon the location, with "add-on" fees charged, for such services as rendering and haulage. We believe that fee is at least 25%-40% below the actual costs directly attributable to the activity.

Optimally, everyone in the industry would increase their fees for slaughter to reflect the actual costs. Although farmers will complain that this is objectionable, it actually would benefit the grower, because slaughtering and butchering are separate tasks, individual "arts", and should be able to stand on their own as business units that could compete both on price and on service – i.e., the degree of professionalism with which the animals are handled, the degree of "humane treatment", the service component in dealing with customers, and other intangibles. If a business person is not making money on one aspect of the business, that aspect is not likely to receive the proper attention from management. With respect to overall costs, it is easier and less costly to establish a USDA-inspected butcher shop than to establish a USDA-inspected slaughter and butcher shop. Given limited barriers to entry, competition in butchering should increase, prices should drop, quality should improve, and thus the cost to a grower for these two functions combined should not increase.

In the Hudson Valley, it was apparent that there were these types of entities already in existence:

- Skilled butchers with the ability to upgrade to USDA-inspected facilities
- Skilled butchers with an already USDA-inspected facility
- Live animal hauling services for growers without livestock trailers
- Refrigerated trucking for product retrieval
- Marketing services for growers uninterested in marketing their own meat
- Distribution and delivery services.

Not all these services were entirely adequate for every grower, nor were they necessarily inexpensive. But unlike the slaughter component, they were at least present in some form. What appeared to be largely absent, and still is, were aging facilities, especially dry aging for middle meats, though this could be added to other business units if demand were sufficient. The Task

Force determined that the service most needed, for the widest benefit in the agricultural community, was the addition of slaughtering capacity – and because no one location was equidistant for every grower, and because no single community was ready with zoning approval and a willingness to have a stationary facility built, we determined a mobile facility was optimal.

## Key Questions in Addressing the Dynamics of the Value Chain

What pieces of the chain exist now in the community, and what is the most essential missing link?

Are there skilled butchers available with a willingness to upgrade from a custom shop to a USDA inspected shop, or are cut and wrap facilities required as well as slaughter?

Can necessary livestock transport and refrigerated trucks be locally sourced? If not, this is another costly infrastructure component that must be financed.

Are most growers selling their own cuts from their own farms or from farmers' markets? If so, USDA inspection may not be entirely necessary. There are other types of plant inspection that may serve equally well, depending on the State.

## Design Consideration in Mobile Slaughter Units

There are several USDA inspected mobile slaughter units that have been placed in service in this country, and a handful in other countries. The Task Force evaluated each of those designed for mixed species livestock and visited most of them. There are four primary considerations in evaluating the design features of the slaughter unit:

- Is it intended to operate at a common docking station or at individual farm units or both?
- Is it meant to be a totally self-contained livestock processing facility at one extreme, or totally dependent on external capacities on the other extreme? Or is a middle ground between those extremes most suitable?
- Is it intended for multi-species or primarily for one species?
- Is the objective to maximize throughput in the trailer, or to minimize the number of additional mobile components in the modular system? These are antithetical objectives.
- What is the viewpoint of the USDA's FSIS Filed Inspector regarding indoor/outdoor slaughter?

**Location**:

In early stages of analysis, the task force began thinking that the slaughter unit would be able to go from farm to farm, but the discipline of cost control at every step of the value chain forced us to move away from this ideal. Like any industrial plant, money is made by the mobile unit when the facility is operating, and money is lost when it is not. Every time a mobile unit moves, it must go through rigorous washing, breakdown of facilities and incur the expense of travel. The crew is still being paid, but not to produce a product. Secondly, the necessary mechanics of leveling a large trailer on potentially uneven ground, the inaccessibility of many farm roads, and the inefficiencies of constantly adapting to new docking situations made farm visits an extremely expensive option. The possibility of insisting that each farm prepare a proper site for the trailer seemed far less reasonable than selecting a common "community" site.

**External Needs**:

The common docking site concept also supported the notion that local communities would be independently responsible for constructing the necessary infrastructure to accommodate their farm community, or that the farmers themselves could encourage their local officials to assist in providing an appropriate site. This option enabled us to specify the optimal features of a docking site which include:

- A one acre paved or blacktopped level surface in an area zoned for agricultural or light industrial use with a secure perimeter.
- Animal overnight housing for at least 20 cow-equivalents meeting welfare standards
- Appropriate passage between livestock housing and the slaughter trailer
- Exterior lighting of the trailer area
- A plan for disposal of three separate waste streams; offal, wash water and manure
- Electrical connectivity (220 V) and a potable water supply $\geq$ 20 g.p.m.
- Connection to a sewage plant or in-ground tanks for temporary waste storage
- On-site or nearby composting opportunity
- Availability of a front-end loader or fork lift
- A built structure, insulated and heated, for storage of materials and possibly for mechanical connections
- Additional locked storage for holding hides and/or rendering products

Additionally, we believed that butchers and other value-added businesses would be closer to a common docking site than to any single farm site, and that transport then of the carcasses, post slaughter, would be facilitated. Financially, the optimal use of the slaughter truck is to use its limited space exclusively for slaughter, not for all the other necessary elements of the process, such as transportation of water, storage of carcasses, or office space for the USDA inspector. Therefore we added a second module to our design, a refrigerated truck unit where cooled carcasses can be stored and then transported to a processing unit, without moving the larger, more complex slaughter trailer.

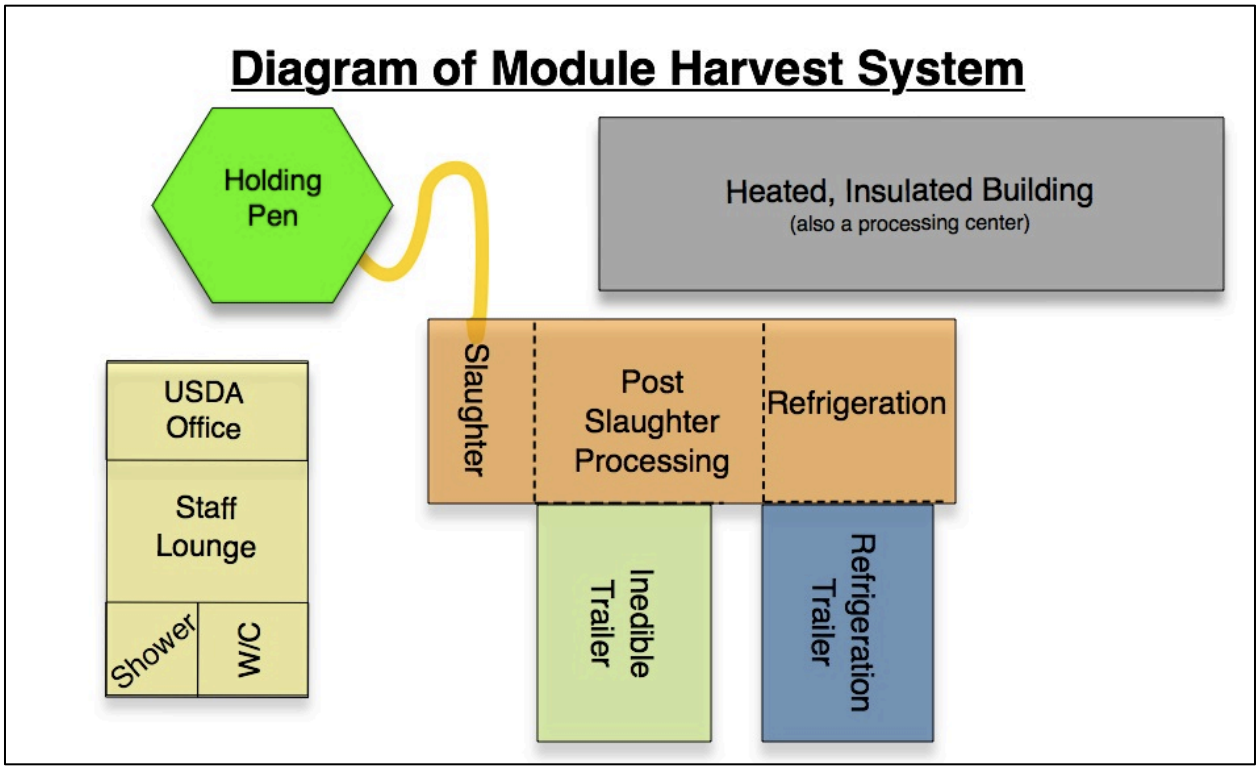
**Species Specificity**:

Our goal was to serve all livestock growers in the Valley, including those who grew sheep, goats, pigs and beef. One critical variable for compliance with FSIS regulations is the fact that hanging carcasses must not drag on the floor. The height of the slaughter trailer is approximately 10⅝ feet, and thus enables us to comply with the regulation. Cull dairy cows, however, may be too large to hang in the trailer, as may certain very sizeable meat breeds. We accepted this limitation, however, recognizing that cull dairy cows would not be the mainstay of the unit's throughput, since these animals are typically not sold into high-end, specialty markets.

One major consideration of the analytical process was to evaluate whether the unit would be able to serve the Jewish and Muslim communities with kosher and/or halal slaughter. Demand from these groups in our particular geography is substantial, and offers growers a potential premium. The FSIS allows for "ritual slaughter" and it is our intent to pursue both opportunities. This raises the question of whether pigs can be slaughtered in the same facility; our current advice from both groups is "maybe." In any event, pigs in our area are frequently used for spit roasting, which requires that the skin be left on the animal after slaughter. Doing so requires a scalding tank which we do not have and did not plan for in this particular phase of development. Our current intent is to add a separate module to the Modular Harvest System in order to segregate pig meat from other species.

**Inside/Outside Slaughter**:

The willingness of the FSIS to accept outdoor slaughter is, according to our understanding, a function of the local supervisor's inclination. Because we believed our regulatory framework was unreceptive to external slaughter, and because we concluded that indoor slaughter was more hygienic and more appropriate in our climate, we chose to design a unit that accommodated inside kill. We further took the view that this approach was safer for the operator and less stressful for the animal.




**Questions that Determine Macro Design Features of Slaughter Facility**

If the goal is to have the unit travel to individual farms, the costs will be high due to the downtime of the truck on the road; are the growers prepared to accept that cost?

If the truck is to call at individual farms, each must have the appropriate features to accommodate the truck: can each farm provide adequate potable water, appropriate facilities for the inspector, adequate electrical power, approved composting for offal, and the necessary infrastructure for items such as pressure tanks, hot water, and storage for liquid wash supplies?

Is the local FSIS office amenable to outside kill, and if so, do all the potential users of the facility accept this as an appropriate procedure?

What are the primary species to be killed, and should the knock box reflect the size components of more than one species, as well as ergonomic considerations for the operators?

Is religious certification in slaughter a significant potential market and if so, should pigs be killed in the trailer?

How far is the nearest aging/processing business; if the slaughter truck is used to move carcasses, a great deal of space is consumed by the necessity of having refrigerated hanging capacity in the slaughter unit. If a second refrigerated truck is utilized, it should be able to receive the carcasses on a rail from the slaughter unit, and therefore be accommodated in the original design.

## Regulatory Considerations

There was never any question that the Task Force sought to put in place a USDA-inspected facility. New York does not offer State inspection wherein meat products that have been custom processed can be sold through the ordinary retail channels or into interstate commerce. We were told by many people in New York to expect combative resistance from FSIS to the idea of a mobile facility, but that was not our experience. We were thoroughly conversant with regulatory guidelines in stationary plants and sought to replicate them in designing a new mobile unit; our goal was not to ask for any "special accommodations" from the FSIS. Our HAACP plan and our SSOP reflect the requirements of an ordinary slaughter facility.

The design we settled on segregates the waste product from slaughter into a separate trailer – referred to as an "inedible trailer" and this unit became the third module of the System. Offal from each animal is segregated into a trolley that moves hydraulically from the slaughter trailer into the inedible trailer, where it can be separated into manure and offal and dropped down into receptacle bins under the trailer. In some geographic areas, near-by renderers will retrieve the offal; because they typically charge by weight, it is not economic to dispose of manure through the renderer if another alternative such as composting is available. Composting is an optimal procedure to accommodate the manure waste stream. Cornell has developed a static composting technique for offal and carcasses which is clean, efficient and very rapid. Local authorities differ, however, on whether a farm can compost renderings from its own farm only, or from other farms in addition to its own. Where composting is allowed, offal, blood and manure can be trucked to the windrows; the resultant product is highly desirable to landscapers and horticulturalists. Septic tanks with grease traps can accommodate the wash water until it is evacuated for disposal at a landfill or municipal water plant. In the optimal location, it can be piped directly into a sewage treatment plant, depending upon local regulations.

The fourth module of our System is for the FSIS inspector; an MGM movie trailer was redesigned to accommodate a toilet and shower, a separate office for the inspector, and a small office and lounge for the crew. Human waste must be segregated from animal waste and we thus added a separate septic tank to address this regulation at our first docking site.

## Questions for Assessing the Regulatory Climate

Arrange a meeting with the local FSIS office to discuss your plans and evaluate their receptivity to the concept of a mobile unit. Typically, it is the Field Inspector who will be the appropriate individual for answering questions.

Every location differs in how many regulatory bodies are involved in an approval process. It may be necessary to visit with town official, county officials or over-arching regulatory bodies such as watershed districts. Often there is disagreement between governing authorities, but the most demanding regulatory hurdles are the best place to start; it is far easier to move to more relaxed standards than it is to retrofit to more demanding standards.

Local & State regulatory bodies will each weigh in on the disposal of three waste streams: offal, manure, and wash water. Each community has their own regulations and consequently it is essential that dialogue be initiated early on in the process. Each docking site may have different requirements.

Are rendering companies close by? What is their charge for hauling? Some are eager to acquire product and will haul away the product without charge. Others can be very costly.

Calculate the maximum amount of waste that will be derived from the maximum number of animals to be slaughtered; is this amount acceptable to the local sewage plant?

Are holding pens for the animals compliant with FSIS standards or other humane animal standards? The FSIS inspects the entire footprint of the area used by our four modular units, including the pens where animals are housed prior to slaughter. There should be approximately 40 $ft^2$ per animal.

## Advantages and Disadvantages of Mobility

There are many advantages to having a mobile facility. They include the following:

- Local approvals for a docking site, used by a mobile unit, are typically less difficult to obtain than approval for a stationary site, depending on the nature of the community.

- Communal docking sites diminish the need for – and the lead-time for – site approval; our experience is that most communities will not find a temporary facility objectionable, especially because it is comparatively small, (twenty cow-units per day) and truck traffic is limited.

- Locations can be "tested out." If demand for slaughter continues to grow in any one area, there is a logical case to be made for a stationary plant; if demand is weak in another area, that docking site can be repurposed.

- If docking sites are located properly near livestock growers, the farmers will have less travel time and less cost invested in each animal; this is particularly true for smaller farms that do not have sufficient animals to fill a livestock truck on each trip to slaughter.

- The capacity to provide fresh local meat to a community is a powerful catalyst for economic development; not only are ancillary services required, value-added production such as meat smoking, charcuterie, retail butcher shops and restaurant trade can be supported by the availability of fresh, local meat.

- A mobile facility can more easily be shut down during the slow season without losing the experienced crew, so long as this understanding is agreed to at the outset.

**Docking Sites**:

A docking site is merely a place where the slaughter unit can be situated in order to operate. The ideal docking site is very dependent on the facilities in the area; there is no need to duplicate, or compete with, businesses that already offer the services required. A docking site can be as simple as a small building for utilities and storage, combined with an existing barn or simple structure to house animals overnight. It can also be an extensive "food center" where aging, cut and wrap, and other value-additions are centered. Some potential sites envisage inclusion of a distribution center for foods in addition to meats, including storage and warehousing. Sites can be publicly or privately owned, cooperatively owned, or leased.

There are also several drawbacks associated with mobile facilities, including these:

- Every docking site requires some form of siting approval, depending on local regulations – the more docking sites, the more approvals required.

- Depending on the defined territory of the assigned FSIS inspector, moving the units to a new location may result in the assignment of another inspector; there sometimes is discontinuity in regulatory interpretation amongst different inspectors, thus compounding the compliance burden.

- The crew operating the unit is one of the most critical components of the slaughter procedure; they must be able to travel daily to the worksite, wherever the unit is docked, and not spend excessive amounts of time commuting.

- The cost of moving the units is not insignificant; neither is the labor involved in hooking the units into the proper configuration. We have endeavored to come as close to "plug and play" as possible, in order to minimize set-up time. Weather will also play a part in moving the units, particularly during Northeastern winters.

- The mobile facility can only accommodate a limited number of animals; our limit of twenty cows (or cow-equivalents) is probably the maximum; is if there is verifiable

demand for more than twenty cow-units per day on a continuing basis, a stationary plant is probably the more sensible economic alternative.

## Capital Sources and Public/Private Partnerships

Slaughter facilities are costly. Mobile units are less expensive, but depending upon their features and their complexity, they are not inexpensive. And it is an inarguable fact that the fixed costs associated with this activity are high, relative to the variable costs; this is the principle reason operators/owners are incentivized to build large, automated plants, where the throughput can be increased exponentially. Nevertheless, costly plants are built every day, and financing is normally available, assuming a high probability that the plant will be profitable.

That assumption is questionable in a slaughter plant, however, because the fees charged do not reflect true costs in a normal accounting model. Secondly, the pattern of seasonality is a troublesome feature of the business, given that unlike the resort industry or the airlines industry, owner/operators rarely adjust their prices to compensate for slow demand in some months, and excessive demand in others. This means that equity capital is largely unavailable, because returns are too low, and bank loans are even more problematic. An industry that does not return a fair profit on capital invested, and cannot reasonably expect profitability to grow, is unlikely to attract either investors or lenders. The fact that a slaughter plant is mobile does not change these realities.

In this instance, Glynwood Center assumed the financial responsibility for the work of the Task Force, including the extensive analysis performed of the slaughter industry and meat processing. Glynwood also devoted its own resources and those of generous philanthropists who were prepared to underwrite the costs of the Modular Harvest System. Our intention in accessing philanthropic funding was to supply the capital required to initiate the operation of a mobile slaughter capacity in the Hudson Valley, since other forms of capital seemed unavailable. LILA, being a not-for-profit corporation, does not engage in business or seek to earn any return on the assets that have been provided. Rather the objective is to demonstrate (1) a working model for mobile slaughter that comports with regulatory requirements for stationary plants (2) a modular design that offers greater operating flexibility than other mobile units and (3) a business model that we believe is supportive of a new paradigm in the meat processing industry.

One aspect of that paradigm is known as a "Public/Private Partnership" – a familiar methodology in the financial services industry. These partnerships bring together public capital (meaning philanthropic and/or government funding) and private capital (meaning borrowed funds or equity investment funds.) Each source is tapped for funding that provides that particular funding source the return it seeks; in the case of public funding, the goal is a "social return" – a programmatic objective, such as support for agriculture, or rural economic development. For private capital, the objective is typically a "financial return." LILA is providing the MHS assets to the private sector for a nominal fee. The absence of debt to finance the acquisition of slaughter assets enables LILA to support the goals of our benefactors, whose social objectives are to see that livestock agriculture prospers in the Hudson Valley.

There is no single, formulaic approach to acquiring funds from either the public sector, or the private sector; each requires a sustained consistent effort and more than anything else, sheer persistence. In most communities, there are local or regional foundations whose social objectives are known or knowable through sources such as the Foundation Library, http://foundationcenter.org/. Government grant programs are easily identified through http://www.grants.gov. Most relevant programs are directed by the USDA, but others may be available through the Commerce Department or local Economic Development entities.

It should also be said that capital resources are necessary but insufficient to pursue a slaughterhouse development program; the single most important resource is human capital. Without clear leadership, the project is unlikely to succeed. We were fortunate to have a strong Task Force with financial acumen, legal talent, experience in the livestock/slaughter industry, engineering skills, and political insight. These disciplines are all essential to complete the task of building and mobilizing a Modular Harvest System.