Cost Analysis for a Cross Dock Alternative to Supply Local Produce from Food Hub to Grocery Store via a Large Regional Distribution Center

In coordination with the North Carolina Growing Together project (2013-2017), individual supply chain scholars and teams of MBA students at the Supply Chain Resource Cooperative at NC State University's Poole College of Management at have worked with NCGT staff and partner entities to investigate and address food business processes and supply chain issues across the local-to-mainstream supply chain.

This project report summarizes student team work on solutions to the scale mismatch between local food suppliers and large-scale grocery distribution systems. The project uses the accepted distributional practice of warehouse cross docking[1] to build a value chain between local producers and a grocery store chain. The "local to local" distribution model uses the food hubs' comparative advantage in aggregating source-identified product while taking advantage of centralized distributional efficiencies in the grocery industry. The cost-to-serve model generated for this project was used by a food hub to calculate the relative costs of various distributional options to reach a set of grocery stores. Results for this example indicated that if the hub expands to more than six stores, it should use a combination cross dock and backhaul arrangement with the regional distribution center to serve its customer stores.

For grocery retailers, cross docking solutions with food hubs can offer a way to achieve local-to-local sourcing and distribution. For food hub owners and advocates of local food systems, cross docking can offer an opportunity for food hubs and their growers to garner a larger portion of the food dollar while staying competitively priced, to build brand awareness among consumers which could translate into higher prices, and to build interdependent and cooperative value chains with partner retailers. A value-chain from grocery store to food hub would entail frequent communication and collaboration to build value for both entities--the hub and the grocery store. The outcome of such a collaborative effort is a supply chain that works for both supplier and retailer -- giving a competitive edge to supermarkets who stock authentically local foods, and to their suppliers, small and mid-sized farmers who have an additional profitable market channel for their products.

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For more information on NC Growing Together supply chain research, contact Research Coordinator rebecca_dunning@ncsu.edu, and see the project website: http://www.ncgrowingtogether.org/research/

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[1] **Cross docking** refers to a distribution system where products received at a warehouse do not enter into the warehouse stock (e.g., are not moved by forklift into the produce "surplus " or "slots" in the warehouse), but instead are immediately readied for shipment to another location.

INTRODUCTION

Grocery industry logistics for fresh produce have become very efficient in moving large volumes of commodity produce around the globe to achieve a steady and diverse selection for American consumers at relatively low prices. Supply chain efficiencies hinge on rapid movement of product through regional distribution centers, which hold costs down, while procurement practices favor large-scale vendors delivering large and often consolidated loads from farms in Mexico and California. Inventory management systems contribute to an efficient system for moving produce quickly and reliably from warehouse to store shelf. What this supply chain is unable to do, however, is cost-effectively source locally-produced products and distribute these products to stores in the same geographic footprint. Food hubs have arisen as a partial solution to this, aggregating product from small and mid-sized growers, but the additional costs associated with volume distribution to stores can be cost prohibitive.

This project report summarizes student team work on solutions to the scale-mismatch between local food suppliers and large-scale grocery distribution systems. The project uses the accepted distributional practice of warehouse cross docking to build a value-chain between local producers and a grocery store chain. The "local to local" distribution model uses the food hubs' comparative advantage in aggregating source-identified product while taking advantage of centralized distributional efficiencies in the grocery industry. The cost-to-serve model generated for this project was used by a food hub to calculate the relative costs of various distributional options to reach a set of grocery stores. Results for this example indicated that if the hub expands to more than six stores, it should use a combination cross dock and backhaul arrangement with the regional distribution center to serve its customer stores.

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DESCRIPTION OF FOCAL GROCERY CHAIN AND FOOD HUB USED FOR COST ANALYSIS

Foodlandia (pseudonym) is a regional grocery store chain with stores across three mid-Atlantic states. The store sources produce from a regional distribution center located centrally to its footprint. The chain has sought to distinguish itself from the incursion of new supermarkets in its service area by branding itself as a "community" grocery store, with one aspect of this being the offering of produce grown by local farmers. Through prior experiences with local produce, the corporate produce manager recognizes the value of selling local produce to attract and maintain customers, but notes that shoppers are not willing to pay more for local produce (whether labeled as sourced within-state or within the community) compared to a non-local source. Foodlandia's regional distribution center (RDC) (which provides a wide range of grocery items to 11 grocery chains and over 600 stores across 11 states from its 1 million square foot warehouse) is unwilling to designate a separate slot for local product, and thus Foodlandia has sought to source produce directly from local farms.

Until recently Foodlandia relied on limited shipments of a few seasonal items – strawberries, tomatoes, and peaches – from farms delivered direct to individual stores. To lower the transaction costs associated with

dealing with multiple vendors, Foodlandia also established a relationship with a food hub, which aggregates produce from 15 core and 25+ subsidiary farmers for package and sale to a variety of retail and wholesale customers. The hub is currently delivering produce through the spring, summer, and fall seasons in its own truck to three Foodlandia store locations. The hub also delivers product to the regional distribution center (at prevailing wholesale prices), where it is co-mingled with nationally and globally sourced product and then distributed to both Foodlandia stores and to other supermarket chains.

The remainder of this paper explores potential logistical scenarios for the hub to serve more Foodlandia stores with source-identified products. This paper reports costs for various options to assist the hub in making the determination of whether or not and how to expand its relationship with Foodlandia.

COST-TO-SERVE ANALYSIS

Cost-to-serve analysis measures the total cost of bringing particular products to particular customers. For the local-to-local scenario, the costs will include all expenses associated with transporting product from the hub to its final store destination, including the cost of labor for loading and unloading. Production costs and store-to-hub ordering costs are the same regardless of the transportation option, and thus are not included in the analysis.

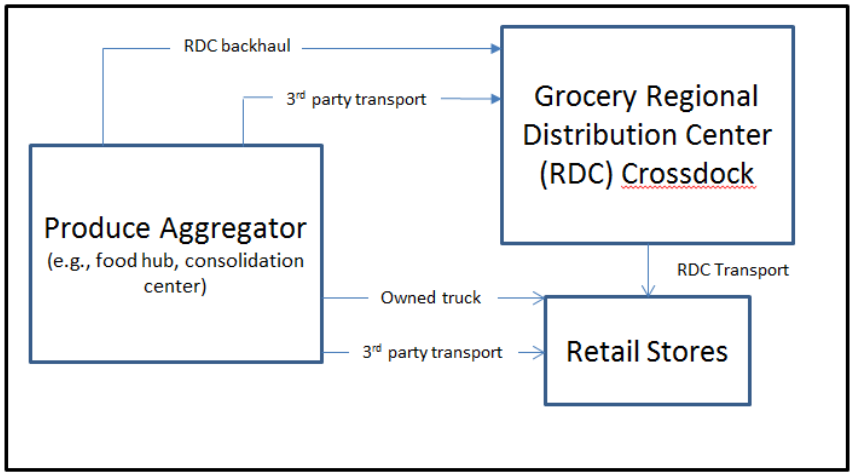
The hub has, to date, delivered product using its own vehicle to three nearby stores. Hub management is considering whether or not to expand deliveries to additional stores, and whether or not to continue using its own vehicle or use another option. One option is to hire a contract carrier to deliver palletted product to stores. A second option is to have a contract carrier deliver pallets of store orders (one pallet per store) to the RDC as a "cross docked" item, with the RDC then delivering the pallet to the stores along with the regular order. In cross docking, product never enters into the warehouse inventory system. Instead, the product is delivered and remains in the delivery area where it is then moved to trucks for distribution to stores (Figure 1). This RDC frequently uses cross docking to receive and distribute deli meats, frozen deli products, and dairy products that need to go to stores within 24 hours, thus it is a familiar practice. This logistics practice moves only a very small (1-2%) of the RDC's product. Most product enters warehouse inventory slots, as depicted in Figure 2.

Figure 1. Cross docked items can arrive at a regional distribution center (RDC) as a mixed pallet – with more than one type of item in differently sized cases. The product does not enter the warehouse slotting system and instead remains in the receiving area where it is loaded directly onto trucks for delivery to stores.

Figure 2. Inventory management systems within regional produce distribution centers optimize the placement of product into the warehouse slotting system. The inventory system rotates pallets of single items through inventory and into available "picking slots" on a first-in first-out basis.

A third option is to work with the RDC to backhaul pallets from the hub to the RDC for crossdock and delivery. For this option the cross dock and delivery to stores would be the same as the second option, but the RDC itself would pick up the palleted store orders from the hub for a fee and transport these to the RDC. A schematic of these options is depicted in Figure 3.

Figure 3. Distribution Options, Produce Aggregator to Retail Grocery Store



The variables for the hub to consider are the costs associated with each of the options and the variation in the number of stores and volume of product delivered per store. Differences in anticipated volume will influence the hub's need to do advanced production planning with its growers. The amount of product anticipated ranges from a low of 30 cases per week (10 cases for each of 3 stores) to a high of 360 cases (30 case delivered to each of 12 stores). Calculations were made for 3, 6, 9 and 12 stores.

Tables 1 and 2 give the calculated cost-to-serve for the six store and 12 store options (the 3 store and 9 store options are not presented here). For each table there are four delivery options: food hub's own truck delivers direct to store, third party delivery direct to stores, third party delivery to RDC, and backhaul to RDC. For delivery direct from hub to store the mileage for six stores is 75 miles; for 12 stores it is 163 miles. For delivery to the RDC the distance is 98 miles regardless of the number of stores. Cost per mile is $3.48 per loaded mile for the hub's own truck. The third party provider quotes a fixed rate of $450 for the 6-store route

and $570 for the twelve-store route. The RDC's transport backhaul fee is $250 for any number of cases and pallets in this example. Handling costs at the RDC are $50 per 10 pallets, and thus $50 for the 6-store option and $100 for 12 stores. Because the direct-to-store options do not run through the RDC, there is no cost for this option. The cost to pack the pallets and load on a truck at the hub are equivalent and thus not included in the analysis. The cost to unload the pallets using a pallet jack or forklift are included in the third party transport costs, are a fixed $25 fee charged by the RDC for the volumes in this example, and are assumed to be $5 per pallet in labor costs for hub personnel if the hub does its own direct-store deliveries.

For the six store option (and any number of stores fewer than six, calculations not shown here) the least costly option, based on the cost per case in the final column of the table, is for the hub to use its own truck and deliver orders directly to each of the stores, regardless of the number of cases per store For twelve stores (Table 2), (and 7-12 stores, calculations not shown here) the least costly option is to pay for the fixed $250 backhaul fee and associated handling fees at the RDC, and have the RDC deliver each pallet to the stores. Because the Truck Transport Cost is overwhelmingly the major cost of the moving the product from the hub to its final destination, the cost per case drops precipitously as more cases are delivered. Third party delivery is never the

Table 1. Estimated Cost per Case for Different Store Delivery Scenarios from Food Hub to Set of Grocery Retail Stores: Six Store Option

Distribution Mode	Cases Delivered to Each Store	Total Number of Cases	Total Mileage Traveled	Total Cost to Transport	Total RDC Handling Costs	Total Cost to unload pallets at RDC or Stores	Total Cost	Cost per Case
Hub Truck Direct to Store	10	60	75	$261	--	$30	$291	$4.85
3rd Party Direct to Store	10	60	75	$450	--	--	$450	$7.50
3rd Party to Cross dock	10	60	98	$375	$50	--	$425	$5.42
Back Haul to Cross dock	10	60	--	$250	$50	$25	$325	$4.85
Hub Truck Direct to Store	20	120	75	$261	--	$30	$291	$2.43
3rd Party Direct to Store	20	120	75	$450	--	--	$450	$3.75
3rd Party to Cross dock	20	120	98	$375	$50	--	$425	$3.54
Back Haul to Cross dock	20	120	--	$250	$50	$25	$325	$2.71
Hub Truck Direct to Store	30	180	75	$261	--	$30	$291	$1.62
3rd Party Direct to Store	30	180	75	$450	--	--	$450	$2.50
3rd Party to Cross dock	30	180	98	$375	$50	--	$425	$2.36
Back Haul to Cross dock	30	180	--	$250	$50	$25	$325	$1.81

Table 2. Estimated Cost per Case for Different Store Delivery Scenarios from Food Hub to Set of Grocery Retail Stores: Twelve Store Option

Distribution Mode	Cases Delivered to Each Store	Total Number of Cases	Total Mileage Traveled	Total Cost to Transport	Total RDC Handling Costs	Total Cost to unload pallets at RDC or Stores	Total Cost	Cost per Case
Hub Truck Direct to Store	10	120	163	$571	--	$60	$631	$5.25
3rd Party Direct to Store	10	120	163	$570	--	--	$570	$4.75
3rd Party to Cross dock	10	120	98	$375	$100	--	$475	$3.96
Back Haul to Cross dock	10	120	--	$250	$100	$25	$375	$3.13
Hub Truck Direct to Store	20	240	163	$571	--	$60	$631	$2.63
3rd Party Direct to Store	20	240	163	$570	--	--	$570	$2.38
3rd Party to Cross dock	20	240	98	$375	$100	--	$475	$1.98
Back Haul to Cross dock	20	240	--	$250	$100	$25	$375	$1.56
Hub Truck Direct to Store	30	360	163	$570	--	$60	$631	$1.75
3rd Party Direct to Store	30	360	163	$570	--	--	$570	$1.58
3rd Party to Cross dock	30	360	98	$475	$100	--	$475	$1.60
Back Haul to Cross dock	30	360	--	$250	$100	$25	$375	$1.04

selected option, but becomes more competitive with the other options as the number of cases per store increases. This is because the 3rd party delivery charges a flat fee, and because the pallets can be stacked and loaded into one truck up to 12 pallets (1 per store) containing 360 cases of product.

This particular RDC has relatively low cross dock handling fees, at $50 charged per 10 pallets. Other warehouse distributors may have much higher cross dock fees, backhaul charges will vary by company and distance, and unloading fees may also differ. Each of these can be plugged into a spreadsheet to calculate costs per case.

Other considerations should also come into play as the hub expands to service additional stores and higher volumes. When product moves through the warehouse RDC through the regular slots system, the RDC assumes liability for errors and returns on product delivered to stores. For cross docked items the hub itself must assume this responsibility. Because the product is packed for delivery at the hub, and thus does not go through the RDC's produce quality control process, hub employees must be trained to screen product properly. This may work out to the advantage of the hub, however, in that the hub's past experiences making direct sales from farm to store have revealed that store managers are somewhat more lenient in the sizes they are willing to accept, thus allowing the hub to sell more product as #1 Grade. Perhaps more importantly, the relationships that form between store managers and the hub, assuming good communication between the two, can create an avenue for customer feedback on desired products that can support the creation of a true value chain—one where cooperation and interdependence across the chain create value for all chain members (Clements, Lazo, & Martin, 2008; Handfield & Nichols, 2002).

SUMMARY AND IMPLICATIONS

Grocery industry logistics for fresh produce have become very efficient in moving large volumes of commodity produce around the globe to achieve a steady and diverse selection for American consumers at relatively low prices. Supply chain efficiencies hinge on rapid movement of product through regional distribution centers, which hold costs down, while procurement practices favor large-scale vendors delivering

large and often consolidated loads from farms in Mexico and California. Inventory management systems contribute to an efficient system for moving produce quickly and reliably from warehouse to store shelf. What this supply chain is unable to do, however, is cost-effectively source locally-produced products and distribute these products to stores in the same geographic footprint. Food hubs have arisen as a partial solution to this, aggregating product from small and mid-sized growers, but the additional costs associated with volume distribution to stores can be cost prohibitive.

This paper presented the analysis of one solution, using the accepted distributional practice of warehouse cross docking, to build a value-chain between local producers and a grocery store chain. The "local to local" distribution model uses the food hubs' comparative advantage in aggregating source-identified product while taking advantage of centralized distributional efficiencies in the grocery industry. The cost-to-serve model generated for this paper was used by a food hub to calculate the relative costs of various distributional options to reach a set of grocery stores. Results for this example indicated that if the hub expands to more than six stores, it should use a combination cross dock and backhaul arrangement with the regional distribution center to serve its customer stores.

The cross dock option does require extra time and care at the hub, but allows the hub to profit from the fees the RDC is charging the store for its product. These upcharges vary, but are typically no less than 15% of the value of the produce. The hub may be able to garner the entire 15%, or it can share this savings with stores. At the same time, the hub can build its brand at its partner grocery stores, perhaps sufficiently enough to garner an additional premium for its produce over non-source-identified product.

For grocery retailers, cross docking solutions with food hubs can offer a way to achieve local-to-local sourcing and distribution. For food hub owners and advocates of local food systems, cross docking can offer an opportunity for food hubs and their growers to garner a larger portion of the food dollar while staying competitively priced, to build brand awareness among consumers which could translate into higher prices, and to build interdependent and cooperative value chains with partner retailers. A value-chain from grocery store to food hub would entail frequent communication and collaboration to build value for both entities--the hub and the grocery store. The outcome of such a collaborative effort is a supply chain that works for both supplier and retailer -- giving a competitive edge to supermarkets who stock authentically local foods, and to their food hub and farmer suppliers.

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