

The Salvation Army in Dallas: The Supply Chain Challenges of a Non-Profit Organization

Arunachalam Narayanan

Teaching Note[‡]

Case Overview

This case introduces the reader to The Salvation Army, a non-profit humanitarian organization. The primary mission of this faith-based organization is to rehabilitate people who have lost their self-direction. This is achieved by providing them a place of hope at The Salvation Army's adult rehabilitation centers (ARCs). An ARC provides shelter, food, clothing, medical/psychiatric assistance, meaningful work or vocational training, and finally fellowship and spiritual guidance. The main support for the rehabilitation centers come from the sale of donated items at Salvation Army thrift stores. This case is unique because it deals with community aid humanitarian operations and sustainability topics, rather than disaster management.

Humanitarian organizations are typically not-for-profit entities, and they operate in both uninterrupted (*development aid*) and interrupted (*disaster aid*) environments (McLachlin et al. 2009). Development aid is often delivered in places where disruptions are likely, i.e., in environments that are likely to transition from uninterrupted to interrupted, and back again. Most case studies available today in the humanitarian and non-profit operations management domain deal with either disaster or development aid.^{1,2} But, humanitarian organizations such as The Salvation Army, Goodwill, and Feeding America also have a primary mission apart from disaster relief—that is *community aid*. This aid relates to hunger relief, eradication of poverty, or rehabilitation of people on a day-to-day basis. These organizations have strategic, operational, and tactical problems that can be effectively addressed using operations management tools (Narayanan and Altay, 2012).

These community-aid organizations play an important role in sustainability and recycling. They divert several billion pounds of clothing and household goods from landfills by recovering the value in these unwanted materials. Corporations have also partnered with these groups to increase the impact of their social and sustainable initiatives³. Along the way, these aid organizations also create jobs and job training opportunities for people in need of work. Goodwill's "reduce, reuse, repurpose" slogan and Salvation Army's "don't throw it away – invest it in people" explain their environmental impact in a nutshell.

The main focus of this case is on the problems faced by Major Carl Earp at his Dallas ARC facility in Texas. As with every rehabilitation center, his goal is not only to generate enough revenue from the family and thrift stores to pay for the religious mission at the ARC, but also to send about 31% of the revenue generated to the head office in Atlanta for strategic initiatives. At present, the Dallas ARC could afford to send only 14% of revenue back to the head office. To add to this burden, recently one store was lost to a freak accident when a bus ran through the store after being hit by a wrong-way driver. Unfortunately the driver of the wrong-way vehicle was under insured, so The Salvation Army lost a store that had been generating \$40,000 in monthly sales. Now, Major Carl is looking for some innovative ways to increase revenue or reduce expenses to reach his goals.

[‡] Arunachalam Narayanan of University of Houston prepared this teaching note as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

¹ <http://www.ecch.com/educators/ordering/selecting/featuredcases/inseadhrq>

² <http://www.ecch.com/educators/search/results?s=5B0A37D19007B1C66A86BCCDD83BF678> (Search string: humanitarian; Accessed on March 1st, 2012)

³ <http://www.goodwill.org/press-releases/goodwill-and-dell-expand-free-computer-recycling-programs/>

Learning objectives

This case is designed to elicit classroom discussion in operations management courses on non-profit/humanitarian and sustainability topics. The objectives of this case include:

- Demonstrate the challenges of community aid organizations, and understand their conflicting objectives between social and economic goals.
- Upon completion of the case analysis, students must make recommendations for revenue generation or expense reduction at the humanitarian organization. They should also provide a plan of action for implementing it, while keeping in mind their non-profit and social values aspects.
- Identify and understand the unique role these organizations play in sustainability. In the end, students should be able to identify new ways of how these organizations could improve their environmental impact and be a social innovator of sustainability practices.

All of the data for the case analysis included in the case exhibits are provided to facilitate analysis by the students. The students will have had ample opportunity to acknowledge the unique challenges and opportunities of a humanitarian organization. This exercise will also provide the students a platform to hone their skills in developing or evaluating a business plan for a nonprofit organization.

Intended Audience

The case is appropriate for discussion in a class that has a supply chain or operations management with non-profit or sustainability focus. This case can be administered to juniors, seniors or graduate students (M.S. or M.B.A.).

Possible Teaching Strategy

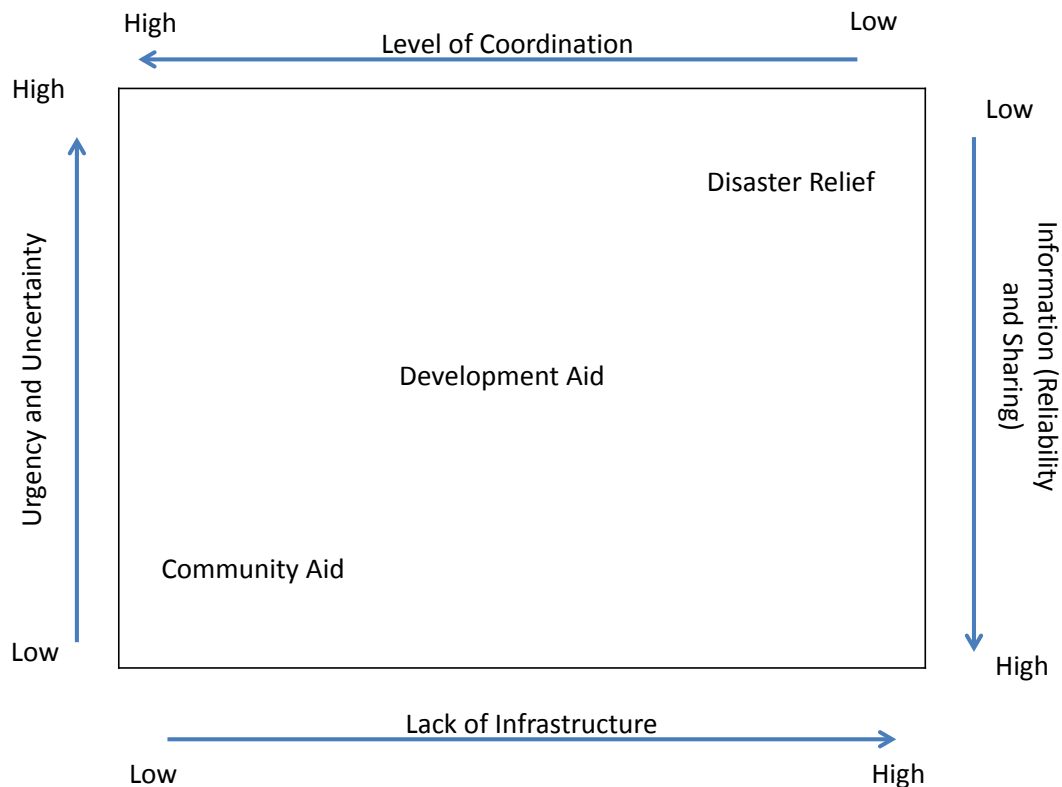
There is more than enough material in the case to occupy a 75-minute class period, or even two 50-minute class periods. Below is a possible teaching strategy for a 75-minute class period. The students should read the case study in advance. As part of their preparation, the students should have analyzed the case and show up for class with their recommendations for Major Carl Earp of Salvation Army, Dallas. This could be ensured by having students, individually or in small groups, turn in a two-page write up outlining their findings. Note that prior to class the students will typically focus on operational issues associated with the case, such as increasing the efficiency of the reclamation process for the donated goods. In class, the instructor must expand the analysis to include the strategic issues of non-profit organizations in general.

10 minutes: Talk about the unique aspects of humanitarian SCs, and specifically focus on the distinction between the different relief/aid operations

There are non-profit supply chains that provide aid and relief to people in need. Exhibit TN 1 shows the three different types of humanitarian supply chains (Narayanan and Altay, 2012). The most common one discussed in media and literature is disaster relief. These SCs are characterized by a lack of infrastructure (destroyed by natural or manmade disaster) and a lack of reliable information regarding need in the region of calamity. There are thousands of decision makers (with no coordination) and an urgent need of supply materials to save lives. The second one, development aid, usually takes place after providing immediate relief. This SC relies heavily on local organizations for distribution and dissemination of information and relief materials. The third one is community aid SCs, which this case focusses on. They have an established infrastructure (network of local facilities with materials, people, and logistics equipment) and some amount of demand certainty for their operations. These organizations also coordinate relatively well and share information with their donors and other facilities in the region. Examples of such organizations include The Salvation Army, Goodwill, and Feeding America and its network of food banks. These organizations/SCs also

transition into a relief agency when a disaster strikes, either assisting the aid operations or leading the relief effort.

Exhibit TN 1. A framework of Humanitarian SCs

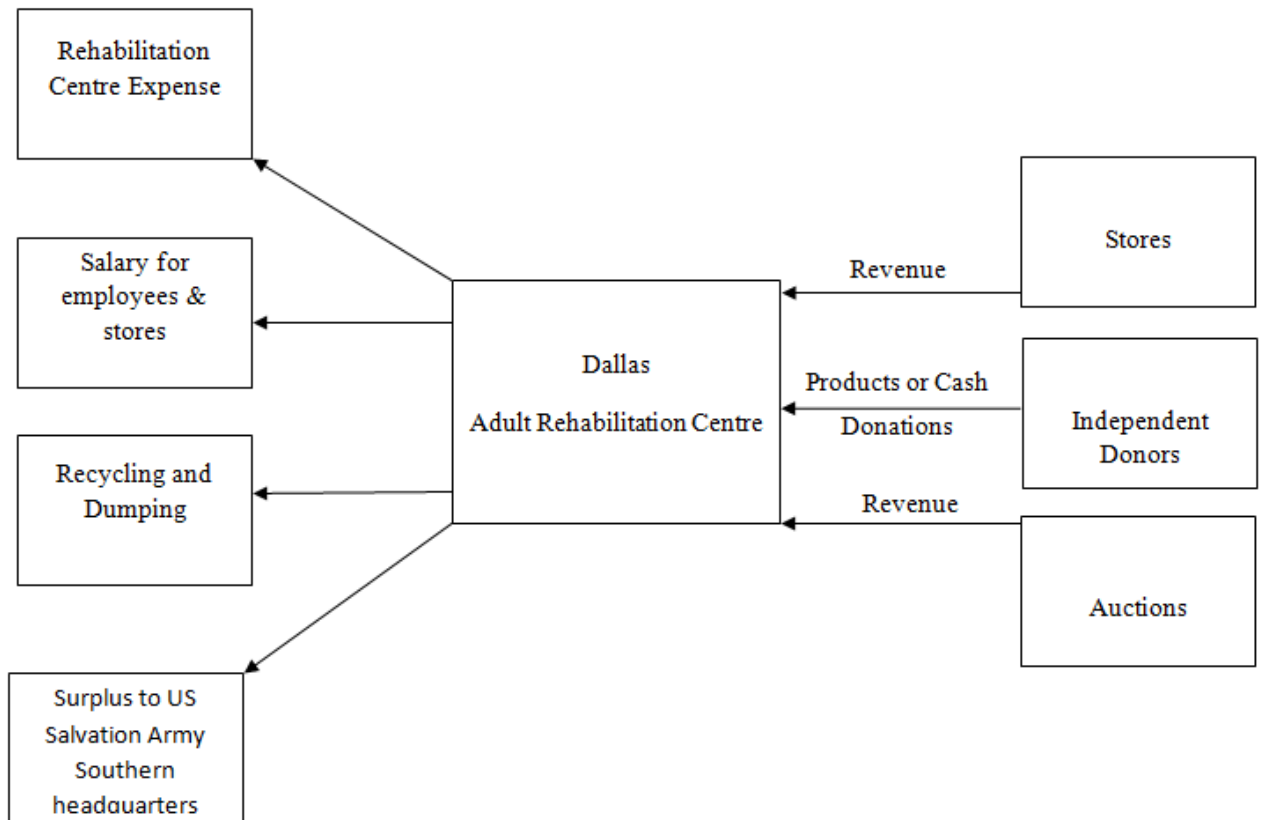


Adapted from Narayanan and Altay (2012)

10-15 minutes: Discuss the origins, mission, and business model of The Salvation Army (SA) and its Dallas operation

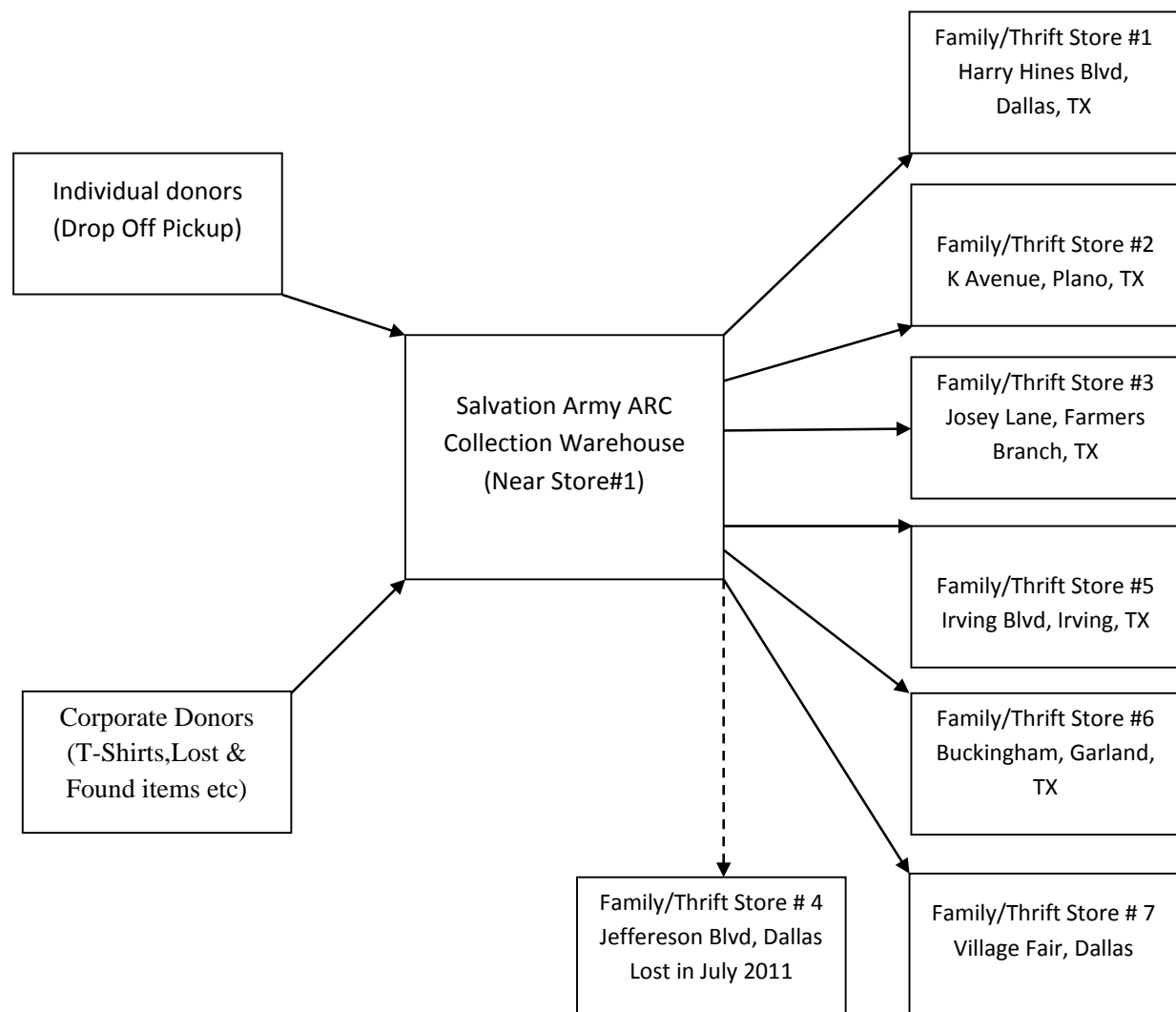
1. Briefly discuss the distinct role of the organization structure at SA (general, major, captain, lieutenant, and corps). This will also lead to who works, attends or, utilizes SA's non-profit services. Some of the initial human resource issues can be briefly explored in this session.
2. Ask one of the students to draw a financial flow chart of the SA-Dallas ARC. Discuss the significance of each entity in the flow chart. A typical financial flow of the Dallas operation is given below.

Exhibit TN 2. Financial Flow in the Dallas ARC



3. Walk through a donated item's product flow in the Dallas-ARC supply chain. Stress the uncertainty in supply and lack of control of demand at the stores. Exhibit TN 3 depicts a simple supply chain view of product flow at this facility.

Exhibit TN 3. Product Flow in the Dallas Adult Rehabilitation Center's Supply Chain



15-20 minutes: Reclamation process, store stocking policies, and other sources of revenue and donations

This might be a good time in the class to ask how many students have donated items to a group like SA and if they know what happened to those items.

1. With classroom contribution, walk through the reclamation process of The Salvation Army. List possible ways that this process could be improved, such as hiring extra help during peak seasons to avoid storage issues.
2. Discuss innovative ways of turning inventory at the thrift stores to increase traffic. List the pros and cons of the discount policy of SA-Dallas. For example, one argument against it would be that there is not enough shelf display time for making the high-priced sale.
3. With the help of the class, review the auction process of the junk and surplus donated items.
4. Evaluate the recycling effort of SA-Dallas, and identify the underlying opportunities and resources needed for the effort.
5. Plot the store locations by their preferential order on a Dallas Map, and discuss the store sales by item types. It is important to point out the income level in the neighborhood and correlate it to the sales at each location. Keep in mind, the items are sent to these stores based on the

preferential order decided by SA-Dallas (store # represents that preferential order). This could be a good point to debate in the classroom with the help of student participation. The table below should aid in the discussion.

Table TN 1. Store Locations, Sales, and Median Income in the region

Store	Address	City	Zip code	Average Annual sales	Median Income
Store #1	5554 Harry Hines Blvd	Dallas	75235	\$3,694,512	\$32,030
Store #2	5900 K Avenue	Plano	75074	\$1,367,645	\$88,195
Store #3	12895 Josey Lane	Farmers Branch	75381	\$591,185	\$59,148
Store #4*	1617 W Jefferson Blvd	Dallas	75208	\$462,540	\$35,135
Store #5	1145 E Irving Blvd	Irving	75060	\$762,781	\$43,682
Store #6	1418 West Buckingham Road	Garland	75040	\$730,218	\$51,679
Store #7	4810 Village Fair	Dallas	75224	\$672,725	\$33,515

*Store destroyed by the accident

10 minutes: Role of these organizations in sustainability

This section can be expanded or shortened based on the course topic. In the US, many individuals and corporations donate their used, excess, and unwanted items to non-profit organizations such as SA. For example, HEB in Texas donates its grocery items (excess and close to expiration date) to the Texas food bank network through their Food Bank Assistance Program⁴. Most grocery items come in cardboard boxes—the box in which Dole bananas arrive are a hot commodity at food banks. HEB and other grocery retailers donate them to these organizations. Another example of collaboration is between Dell and Goodwill group. Through the Dell Reconnect program, more than 200 million pounds of electronics have been collected⁵. Even at SA-Dallas, we see an interesting model of collaboration with a local transportation company for their unclaimed items and lost baggage. Major Carl Earp estimates revenue in excess of \$150,000 per year through this relationship.

These organizations collect the unwanted and used items in circulation and recover some useful value out of them before recycling or sending them to trash. Goodwill estimates that it collects two billion pounds of clothing and household goods every year⁶. In this specific example, SA disposes about 700,000 lbs. of trash every month at its central warehouse in Dallas, TX. This should give us an idea of the amount of material collected. When addressing sustainability in classrooms, it is essential to describe these organizations. They not only add social value, but they also encourage and enable sustainable practices.

⁴ <http://www.heb.com/page/about-us/community/community-involvement>

⁵ <http://www.goodwill.org/get-involved/donate/donation-acceptance-guidelines/#computer>

⁶ <http://www.goodwill.org/about-us/environmental-impact/>

10 minutes: Current challenges

This discussion could be a detailed one, or it could be combined with the next section.

1. Walk through the financial statements of SA-Dallas ARC, and identify the opportunities for additional revenue or expense reduction. Examples include the dump fees and the amount of revenue generated through junk and auction sales.
2. List the reasons for unsold donated items. Identify ways to increase sales.
3. Discuss the challenges brought by store #4's accident and the best way to move forward. It is important to point out that SA-Dallas has not only lost \$40,000 in monthly sales, but it has also lost storage or shelf display space at the store.
4. Briefly discuss the pros and cons of soliciting needed items.

15-20 minutes: Recommendation (revenue generation or expense reduction) and prioritization

1. Tabulate the available options of SA-Dallas on the board (as shown in Exhibit TN 4) and perform an SWOT analysis for each of them.
2. Do the SWOT analysis, keeping in mind the economic and social impact of each of the alternatives.
3. Ask questions such as:
 - a. Why this is a good option?
 - b. Will this be perceived well by the donors?
 - c. What are the likely costs involved in this option?
 - d. What is the time frame for return?
 - e. Will it benefit our primary mission immediately?
 - f. Is this aligned with SA's social mission?
 - g. Does SA-Dallas have the right resources for this option?
4. Finally, after discussing the options, prioritize these opportunities with the help of the class.
5. Before the end of the class, come up with an action plan for the selected options.

What Happened

Major Carl Earp and Roderic Horton are working with their advisory council for developing a plan of action for 2012. This includes working with a university group to attract innovative ideas from their graduating senior students as part of their class work.

Two ideas they are looking to move forward include:

1. Identifying a location for their new store. They are looking at neighborhoods with appropriate income level, store accessibility, and attractive lease rates.
2. Hiring a young full-time employee or intern to explore the e-commerce and social media potential in increasing revenue (avenues for selling donated goods) and raising new donations.

Here are few specific events that happened after the case was written and analyzed by a group of undergraduate students:

1. Reduction in Expenses
 - a. Increased use of the trash compactor:
Disposal fees/Dump fees – dropped by 50% from about \$9000/month to \$4000-\$4500/month, through better utilization of the compactor (initially used only once every week). By compressing the trash, the number of truck trips was reduced by 50%.

- b. Telephone/communication expense

A telephone consultant identified 14 unused lines and some dead ones. By removing them, telephone expense was reduced by 33%.
- 2. Increase in revenue
 - a. Recycling

There has been a considerable increase in the recovery rate and revenue of recycled metal.

 - i. Clothing recycling (rag sales) is up by \$162,490 (31.23%)
 - ii. Books, shoes, mattresses are up by \$148,626 (273.01%). This number relates to the others category in Table 2 of the case study.
 - iii. Scrap metal (junk) is down to \$81,736.00 (40%). It is down partly because of the types of items donated. The items are either sold in the store as is or do not have a lot of metal to scrap. Another reason is that SA-Dallas is still not efficient in this process. The organization is looking at increasing this portion of revenue by adding labor and establishing standards in the recovery process.
 - b. Ebay sales

Since the case was written, this is by far the most interesting development at Salvation Army-Dallas. SA-Dallas has started to sell used goods through the ebay auction website (Web address: <http://myworld.ebay.com/salvationarmydallasarc>). The average revenue per month is about \$5,400, and the best month's revenue has been \$8000. A quick look at the items reveals that SA-Dallas finally found a way to sell electronics, collectibles (guitars, silverware etc.), and digital equipment at a good price, rather than selling such items cheaply at the stores or warehouse sales.
- 3. New stores

It has been difficult to secure a new location for the new store, as most of the available retail space in Dallas has restrictions in place for used merchandise stores. These restrictions are usually found in retail chains' leases from stores such as Kohl's, Target, etc. So now SA-Dallas is looking at standalone locations, rather than a strip mall type of facility.
- 4. Others
 - a. Computer products:

Computer products are still processed internally and sold in stores if they are in working condition. Non-working products are sold in the "as-is" wholesale auction. Corporate partnerships with companies such as Dell and Goodwill are yet to be explored—and it would have to be a central level (SA head office) effort rather than regional.
 - b. Social networking:

SA-Dallas is now listed in Facebook and Twitter and offers special discounts to those who find the site and "like" them. The organization is also tracking internet search engines such as Google and Bing for those seeking information on "charity donations, used clothing, The Salvation Army, auto donations, etc." Reports on the effectiveness of search keywords are compiled at the end of every month to track their performance.
 - c. Technology to aid truck drivers:

The truck drivers are now provided with iPads, which contain their workload (number of pick-up stops) for the day. This has increased their efficiency in trip planning (map assistance) and acceptance of donations. The driver can take photos of items deemed unusable (trash and junk), which are verified by the supervisor for immediate approval / rejection. This reduces unwanted donations in the stores and warehouses. The driver can also generate a receipt and email it to the donor.

d. Repair/Service personnel:

SA-Dallas has not yet made any contacts with The Home Depot, The Container Store, and others to repair donated appliances and furniture. These relationships are usually initiated at the national level.

Conclusions and Implications

This case study provides a first-hand view of how a non-profit organization works. It also shows how difficult it is for administrators to manage the conflict between economic and social objectives. In the classroom, we always stress efficient and effective management of for-profit supply chains. This case exemplifies the different needs and challenges in a not-for-profit world. This case is also a good example of actions when a private corporation's partnerships with NGOs benefit society.

The student should appreciate the intricacies involved when decisions are made at these organizations. They could turn away donations that they deem unnecessary because of storage or human resource constraints, but that decision could have a lasting effect on future donations from the individual or corporation. They could hire individuals with better management and technical skills, but that would go against the core mission of providing gainful employment or rehabilitation to people in need. In the end, students should be able to identify business opportunities and prioritize them by their feasibility (of adoption) and their economic, environmental, and social impact.

The lessons learned here are valuable in a variety of industries and business scenarios. The case will help sharpen students' strategic thinking skills and get them thinking about how non-profit business ventures operate. Also, it will lead them to think out of the box and appreciate the role of these aid organizations in creating and promoting sustainability among people and corporations. All these are critical skills for a successful operations management professional.

References

1. McLachlin, R, Larson, PD and Khan, S (2009), Not-for profit supply chains in interrupted environments: The case of a faith-based humanitarian relief organization, *Management Research News*, 32 (11), 1050-64
2. Narayanan A, Altay N (2012), Humanitarian SCs -A framework to identify and classify research areas and needs, 23rd Annual POMS Conference, April 2012, Chicago, IL.

Exhibit TN 4. Summary of options considered

Options	Strength*	Weakness*	Opportunities*	Threats*
Opening a new store (also where?)				
Salvaging the specialty donated items stocked in the warehouses				
Establishing new cooperative models with private corporations				
Selling unsold electronics/appliances and other collectibles through other means (Make sure the students mention the avenues before analyzing its strength)				
Use of social networks for soliciting donations				
Improvements (what?) in recycling				
Process improvements (what?) in the reclamation process (this could be by item type)				
Dump Expenses (Ways to reduce or subsidize them)				
HR issues (technicians for repairs)				
Corporate relationships for recycling				
Any other innovative idea ...				

**Analyze these options with respect to their economic and social impact, perceived donor perception, and SA-Dallas's capability to implement them.*

Perdue Farms: A Vertically Integrated Supply Chain

Ling Li
Teaching Note

I. Case Synopsis

Perdue Farms is a privately owned food processing company. Founded in 1920 by Arthur and Pearl Perdue, the PERDUE® brand is a household name today. The current chairman and CEO is Jim Perdue who holds a Ph.D. in fishery. He has guided the company through continued growth and changes while holding to the values established by his grandfather and father. As Jim Perdue said:

“I’m proud of our company’s heritage and proud to be carrying on our commitment to quality. I’m proud of everyone in the Perdue organization — our associates and our farm family partners. Together, we’re building upon our foundation of quality.”

II. Learning Objectives

- Be able to describe a production process.
- Understand the factors that determine the choice of various supply chain configurations, such as vertical integration, outsourcing, etc.
- Conduct an SWOT analysis.

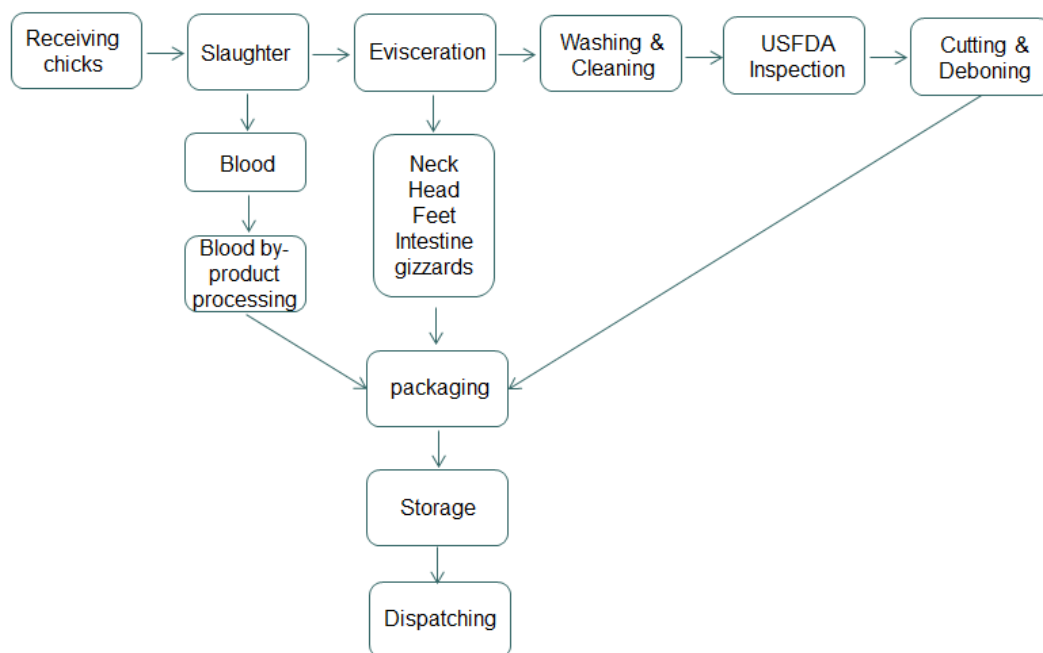
III. Answers to the questions

1. *Have you consumed Perdue Farm’s products? Which one of Perdue’s products do you like best? Which one you do not really care for?*

Answer: this question is to stimulate class discussion.

2. *Describe the production process at the chicken processing facility.*

Answer:



3. *Is the vertically integrated supply chain that Perdue Farms operates the best option for Perdue? Why?*

Answer: Yes. A vertical supply chain is good for controlling food safety in a process industry and ensures quality starting from eggs. The egg is a Perdue-owned top-secret recipe.

4. *Compare the poultry industry's vertical supply chain model with Dell's direct model that outsources most of its operations. Is this the best operations management / supply chain model for both industries? Why?*

Answer:

Perdue Farms' vertically integrated supply chain

- Competitive priorities: low cost, consistent production quality
- Production nature: process industry, food product
- Product nature: The product is made of raw material (chicks) and is not impacted by technology advancement.
- Safety requirement: highly regulated
- No after-sales services but nurture loyal customers: Why do customers repeatedly buy our products?
- Compete on low price, consistent quality, and on-time delivery because it is a process industry that produces large-volume products based on forecasts using historical sales data.
- Price elasticity
- Message to the Market: "We Do It For You"

Dell's direct model supply chain

- Competitive priorities: flexibility, delivery time based on due dates, design quality
- Production nature: electronic appliances, discrete production
- Product nature: technology advances very fast, parts & components could change at a moment's notice
- Safety requirement: low
- Available and low-cost after sales services
- Managing a large supply network
- Message to the Market: "Have It Your Way"

5. *Analyze the entire production lead time, starting from eggs. How does lead time affect production planning? Are there any risks and bottlenecks?*

Answer:

Lead time

- Hatch: 21 days
- Weight grow: 28-42 days (4-6 weeks)
- Processing and packaging: 1 day
- Total production lead time: 50 – 62 days

Risks

- Natural disasters such as floods
- Bird flu
- Transporting chicks to farms and transporting matured chickens to the processing plant
- Food safety

Bottlenecks

- During the evisceration stage of the process, where inspection takes place;
- Or any point during the production.

6. *Discuss Perdue's strengths, weaknesses, opportunities, and threats. What new operational ideas and changes would you recommend to Perdue management to realize its vision 2020?*

Answer:

- Strengths:
 - Well-known brand name
 - Good quality product
 - Using Sam's Club as a marketing strategy
 - Family-owned company, easy to control and make decisions
- Weaknesses:
 - Difficult to change customers' dietary preferences
 - Family-owned company, sometimes does not respond to the market needs as fast as publicly traded companies
- Opportunities:
 - Domestic markets
 - Low-carb diet
 - New product development
 - Strategic partnerships with the restaurant industry
 - Global markets
- Threats:
 - Red meat regaining popularity
 - Tyson and other brands
 - Natural disasters and bird flu

Improving Stanford Blood Center's Platelet Supply Chain¹

Yenho Thomas Chung, Feryal Erhun, and Tim Kraft
Teaching Note

(An Excel spreadsheet accompanies this teaching note.)

Introduction

A platelet is a particle found in the blood of all mammals that enables the coagulation of blood; platelets are transfused to patients to treat or prevent bleeding during surgery and other medical conditions associated with platelet deficiency or function defect. Platelets' shelf life for transfusion purposes is up to five days in the U.S.; however, due to testing, platelets are generally not released to inventory (for distribution) until 48 hours after the collection time. Therefore, usable platelet shelf life is generally three days. This extremely short product shelf life compared to other blood products makes the inventory and supply chain management of platelets a challenging task. However, the challenges are not limited to short shelf life. The unit production cost of platelets, which includes collection, testing, processing, and distribution costs, is high in general. Thus, losing a platelet unit due to expiration is a burden for blood centers. In 2004, almost 17% (974,000 out of 5,729,000 processed units) of platelet units that were collected in the U.S. were outdated without being transfused (AABB 2005). Yet another challenge is the limited pool of platelet donors. There is no artificial substitute for platelets; that is, platelets can only be collected from human beings who are altruistic. Finally, platelets cannot be converted to alternative products or kept frozen for future use. Hence, if there is a mismatch between supply and demand leading to excess inventory, the excess inventory of platelets is lost.

Motivated by these facts, the goal of this case study is to introduce students to the challenging task of managing the platelet inventory at Stanford Blood Center (SBC). Specifically, by solving this case study, students should gain an appreciation and understanding of: (1) supply chain coordination in a health-care setting, (2) the complexities involved with managing perishable inventory, and (3) the impacts of supply chain contract design. Students will be exposed to a practical modeling scenario, where SBC's objective function is not necessarily to maximize profit or minimize costs but, instead, to maximize customer service and well-being. The case is flexible enough that it can be taught as an in-class discussion or homework assignment, and used for either an undergraduate or master's level course.

Learning Objectives

- Introducing students to supply chain management concepts in a healthcare setting
- Demonstrating the complexities involved in managing perishable inventory
- Analyzing a supply chain coordination issue with both quantitative and qualitative reasoning
- Introducing students to contract and incentive design

¹ This case was prepared by Yenho Thomas Chung (LG CNS Entru Consulting Partners), Professor Feryal Erhun (Stanford University), and Professor Tim Kraft (University of Virginia) based on field research of an actual business situation. Some names, dates, and data are disguised, and some material is fictionalized for pedagogical reasons. It was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation. The authors would like to thank their collaborators at Stanford Blood Center and Stanford University Medical Center for their efforts. This case is partly based on the research article by Fontaine et al. (2009).

Analysis and Solution

Students are charged with developing recommendations for how to reduce the number of outdated units. To do this, there are three keys areas of potential improvement the students should analyze: the collection process at SBC, the rotation process at SBC, and the inventory management process at Stanford University Medical Center (SUMC). Using the data set provided with the case, students should be able to identify key problems in both SBC's and SUMC's processes and use these to generate recommendations for improvement. Note that the data set provided is only for SUMC and does not include local hospital data. Also, depending on the pedagogical goals of the course and instructor, further recommendations may be made regarding the use and design of contracts.

SBC Collection Process

Using either simple pivot tables or basic excel functions, students can determine the average outdate rate by drawn data. As shown in Figure 1, platelets drawn on Wednesdays through Saturdays have the highest outdate rate, while platelets drawn on Mondays or Tuesdays have the lowest outdate rates. Recall that drawn blood samples require two days of testing. Therefore, units drawn on Wednesdays and Thursdays are primarily available on the weekends, when demand is low. Conversely, units drawn on Mondays and Tuesdays are available during peak demand times during the week (Figure 2). The high average outdate rates for Fridays and Saturdays are likely due to SBC drawing extra units on these days since it does not collect on Sundays.

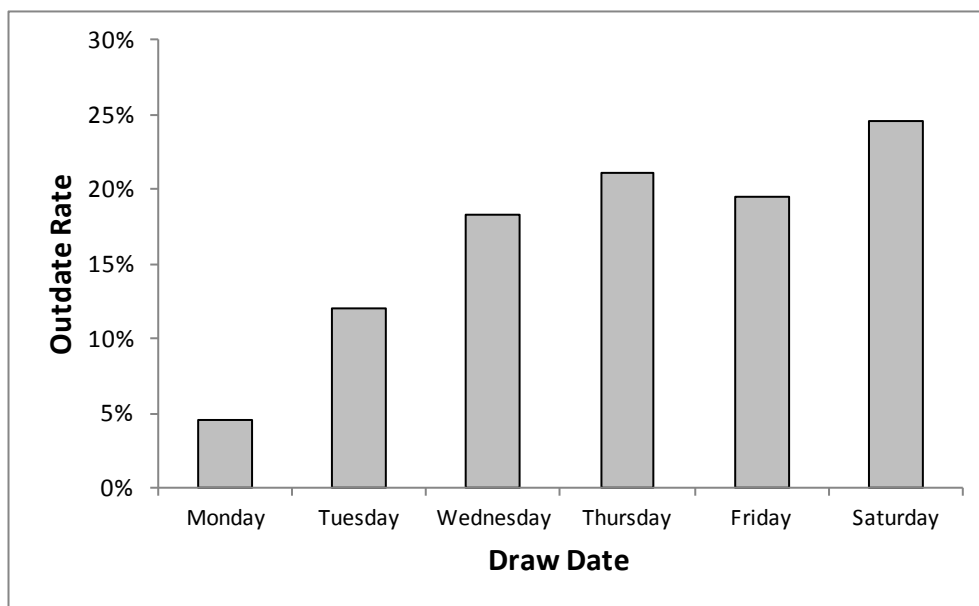


Figure 1: Platelet Outdate Rate by Drawn Date (Adapted from Fontaine et al. (2009))

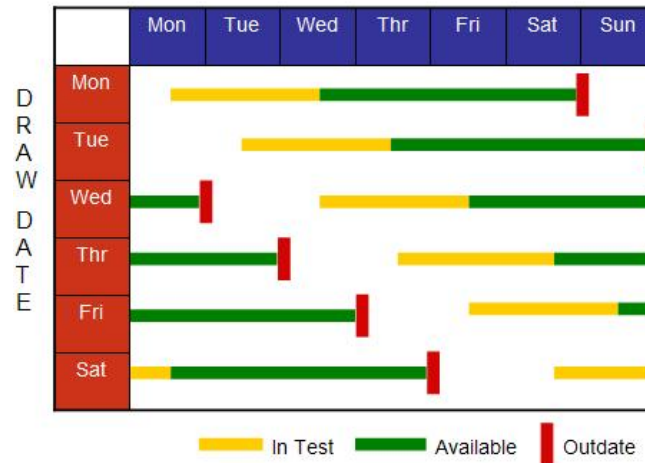


Figure 2: Platelet Availability Schedule (Source: Fontaine et al. (2009))

Figure 3 verifies that platelet demand is significantly lower on the weekends.

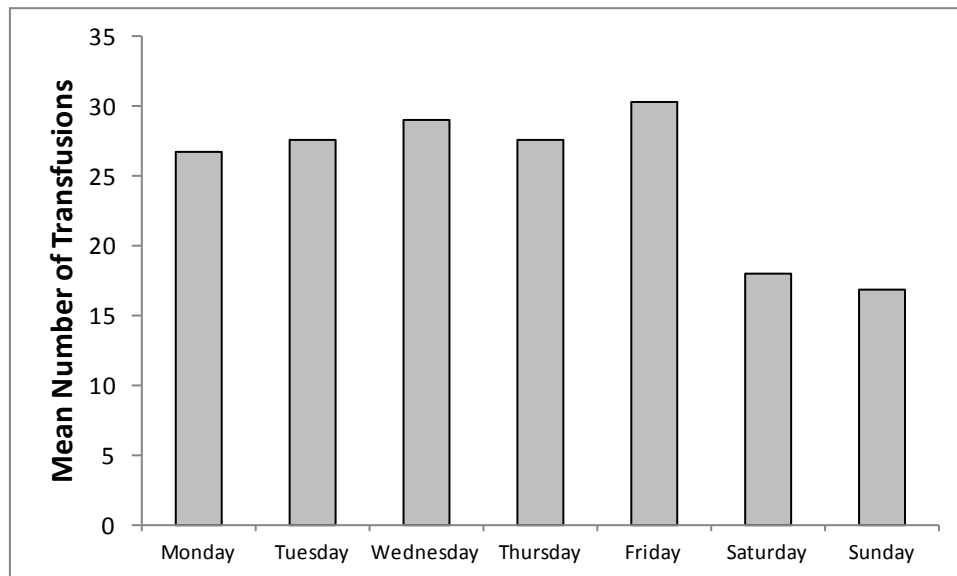


Figure 3: Average Platelet Demand by Day (Adapted from Fontaine et al. (2009))

Student's Potential Recommendation: Increase the number of collections earlier in the week and reduce the number of collections later in the week. In doing so, a new collection schedule at SBC would allow a more appropriate distribution of the platelet donations in response to the hospital demand.

Additional recommendations students may make include implementing a new ordering policy at SUMC. By setting different order-up-to levels for weekdays and weekends, SUMC can better balance its supply and demand. In addition, SUMC may want to consider decreasing its daily orders and shifting some safety stock to SBC.

SBC Rotation Process and SUMC Inventory Management Process

Second, using the data set provided, students can analyze SBC's rotation process. Specifically, students can identify which types of units are most likely to go outdated. As shown in Figure 4, short-dated units are typically more likely to go outdated. Further analysis of the data reveals that 25%-30% of these units at SUMC were leapfrogged by a non-expiring unit, that is, an outdated platelet that could have been transfused when another non-expiring unit was used in its place. This result is not surprising given the contract agreements between SBC and the hospitals. Under a consignment contract, the small hospitals have no incentive to use expiring units. In addition, under a cost-sharing contract, SUMC incurs costs for not using four-days-old or younger units, but SUMC does not incur this cost for five-day-old units.

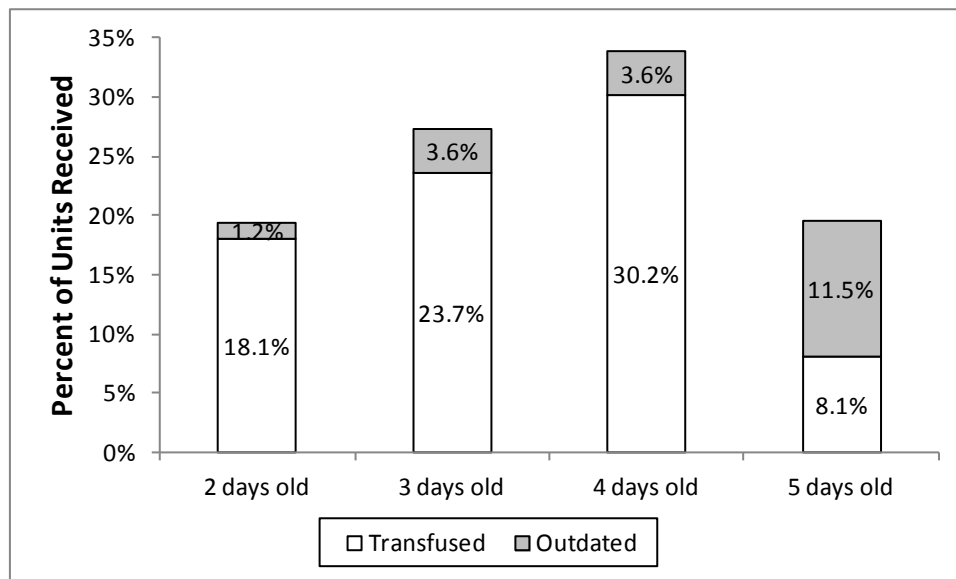


Figure 4: Percent of Units Received by Age (Adapted from Fontaine et al. (2009))

Student's Potential Recommendation: Rotate the units from the small hospitals to SUMC *one day* after delivering the units to the small hospitals.

To improve the organization and platelet selection process at SUMC, students may recommend that SUMC develop better processing, storage, and selection methods to further reduce the risk of leapfrogging resulting in outdated platelets. This may include implementing an FIFO-type storage and retrieval system.

Discussion Questions

The following are assignment questions that may be used either during an in-class discussion or for students' write-ups.

1. Based on the data provided, are there any potential imbalances between the existing demand and supply patterns?
2. Identify the characteristics of outdated items at SBC / SUMC. Is there any connection between these characteristics and any of three processes discussed (i.e., collection, rotation, and issuing)?
3. To decrease the outdate rate of platelet units, what recommendations should be made to improve the platelet supply chain between SBC and SUMC? Is there any incentive for either party to follow these recommendations?
4. Identify at least one problem in each processing area (collection, rotation, and issuing), and provide a solution for each of them.

Teaching Plan

The following is a sample outline for an in-class discussion.

1. Introduction: The instructor may want to start the discussion with a broad overview of why SBC's supply chain is unique compared to a typical supply chain (e.g., a consumer electronics retailer).
 - a. What makes SBC's supply chain unique? How is it different from a typical supply chain?
 - i. SBC's objective is not necessarily to maximize profit
 - ii. It is non-linear in that SBC constantly must redistribute its supply (Can you think of other examples where this may occur?)
 - iii. Given the contracts negotiated – SBC has two “different” customer bases (Is this a unique? Can you think of other examples where this might occur?)
 - b. What aspects of SBC's supply chain are not unique?
 - i. Difficult to coordinate as parties may have differing incentives
 - ii. Requires communication between entities
 - iii. Uncertain demand and supply – variability causes issues
 - c. The instructor may also want to discuss the complexities involved in managing perishable inventory
2. Key Issues
 - a. What are the key areas that the MS&E team needs to address?
 - i. SBC's collection and rotation of inventory
 - ii. SUMC's inventory management
 - iii. Students may also want to address the choice of contracts
 - b. What do the data tell us?
 - i. Review the results found in the Analysis Overview
 - c. What qualitative issues are there?
 - i. It is important that students incorporate qualitative reasoning into their analysis
3. Recommendations
 - a. Review student recommendations
4. Additional: In this setting, how important are the contracts negotiated between the different entities?
 - a. The instructor may want to revisit the topic as an opportunity exists to introduce students to contract and incentive design
 - b. Can you design a better contract? What is your objective in this new contract?
5. Overview of what happened and key takeaways

What Happened

Source: Fontaine et al. (2009)

To reduce the number of outdated units, it was critical to understand the inefficiencies in the SBC-SUMC platelet supply chain. A number of areas were examined by the MS&E team, including inefficiencies in platelet usage and in the ordering and delivery process between SBC and SUMC as well as between SBC and the smaller hospitals that it serves. The study was performed over the time period of January to April 2006 (Baseline). Three areas were identified for improvement: (1) the collection process at SBC, (2) the rotation processes at SBC, and (3) the inventory management processes at SUMC. The team's recommendations were first implemented at SBC and then at SUMC (Phase II). A post implementation analysis (Phase III) allowed the identification of improvements made to the overall platelet supply chain performance.

The first series of improvements (Phase I) occurred during the summer of 2006 after implementation of the set of recommendations by the supply chain experts to SBC. To better meet the platelet transfusion demand at SUMC, SBC increased the number of collections on Mondays and decreased them on Thursdays; the implementation of the new collection schedule at SBC allowed a more appropriate distribution of the platelet donations in response to the hospital demand. Additionally, the rotation schedule of platelet units between SBC and the smaller hospitals was improved by reducing the rotation at the smaller hospitals from two days to one day to allow a greater number of fresher units to be sent to SUMC. As a result of these two improvements made in 2006, the overall outdate rate of platelet units improved significantly from 20% in the first quarter of 2006 to 14% during the first two quarters of 2007 and to 11% in the third quarter of 2007. Based on the recommendation to improve the platelet-ordering practices to SBC and platelet selection by SUMC Transfusion Service, a new standard operating procedure for platelet inventory management at SUMC Transfusion Service (Phase II) was developed. As a result of this second improvement in SUMC Transfusion Service operations, the overall platelet outdate rate for both SBC and SUMC Transfusion Service decreased down to 9% in the third quarter of 2008 (Phase II). Furthermore, as a result of the improvements made to platelet inventory management, the age of the units transfused decreased significantly, potentially improving the service provided to the patients. The mean age decreased from 4.0 days (in 2006) to 3.8 days (in 2008). The median age decreased from 4.4 days (in 2006) to 3.9 days (in 2009).

The team's study resulted in improvements in the system performance by reducing the outdate rates at SBC is apparent. However, it also enabled open communication between SBC and SUMC, which was quite unlikely at beginning of the study. Both SBC and SUMC now view themselves as long-term partners and are working together to improve the supply chain.

References:

- [1] AABB. Nationwide Blood Collection and Utilization Survey Report. www.aabb.org. 2005.
- [2] Fontaine, M.J., Y.T. Chung, W.M. Rogers, H.D. Sussmann, P. Quach, S.A. Galel, L.T. Goodnough, F. Erhun, 2009. Improving Platelet Supply Chains through Collaborations between Blood Centers and Transfusion Services. *Transfusion*, **49**(10):2040-2047.