Memorial Sloan Kettering
Cancer Center

Using RFID Technology to Optimize Hospital Supply Chain

2016 Application

For Business Transformation & Operational Excellence Awards

MSKCC Mission, Vision and Values

Memorial Sloan Kettering Cancer Center (MSKCC) is the world's oldest and largest private cancer center having devoted over 130 years to exceptional patient care, innovative research, and outstanding educational programs. Throughout the 25 locations that make up MSKCC, over 400 subtypes of cancer are treated and 146,855 patients are seen every year. More than 22 thousand inpatient admissions with more than 150 thousand inpatient days and over 20 thousand surgical cases are performed each year at MSKCC. Within a limited New York City footprint are two narrow and vertically stacked buildings contain 15 thousand SKUs stocked in over 25 thousand stocking locations that support more than 50 operating/procedure rooms and 18 inpatient units.

MSKCC mission, vision, and values are:

- Mission: To change how the world treats and thinks about cancer.
- Vision: Collaboration between physicians and scientists to provide patients with the best care available while working to develop better methods of preventing, controlling, and ultimately curing cancer. Guiding care providers, who deliver the majority of cancer care, to the most advanced and innovative technology. Educating future physicians and scientists who will impact the future of cancer treatment and biomedical research around the world.
- Values: Passion for healthcare and compassion for patients. Innovation in thinking about and treating cancer and innovation in technology and conducting research regarding cancer.

An efficient flow of supplies is crucial for effective cancer treatment, development in scientific research, and spreading knowledge and we are always testing new products and adjusting our supply systems to be more usable, all encompassing, and accurate that we are continuously improving and moving towards our goal of curing cancer.

The goal for Supply Chain Department is provides timely, responsive, accurate, efficient, and effective procurement services to support all services through the use of technology for automation, data analysis and predictive analytics for superior decision making. We seek continuous improvement of the procurement and inventory management processes through competitive business strategies and advanced technologies.

Special Circumstances Supply Chain Faces

Since the Patient Protection and Affordable Care Act (PPACA) has been enacted in 2010, the act was intended to increase health insurance quality and affordability, lower the uninsured rate by expanding insurance coverage and reduce the costs of healthcare. Reducing costs while maintaining, and improving, the quality of healthcare services has always been a goal. Because of how extensive the services are that MSKCC provides, a smooth flow of supplies from order to usage is crucial to maintaining efficiency and reduce costs. The supply chain department is quintessential for the goals of these objectives to be realized.

MSKCC procures and manages over $600 million in medical supplies each year and provides numerous services ranging from patient care to education and research. Tracking and transporting inventory across the various MSKCC buildings is a challenging but quintessential task that must be done well otherwise none of the services would be able to be delivered. The inventory systems in place to manage the consumable inventory throughout the numerous clinical services offered at MSKCC were ineffective, inefficient and even inaccurate because they relied on large amounts of manual labor. A self-automated system was necessary to increase effectiveness, efficiency, utilize talent and reduce costs.

MSKCC needed a system, which can automatically replenish supplies when depleted, allows us to set up minimum and maximum PAR values for each item, shows real-time on-hand inventory quantities and activities, and reduces the costs associated with manually managing our inventories.

Supply Chain Process Improvement Project

The MSKCC Supply Chain Inventory Management Process is the process described in this application. The seven steps are organized within the classic four phases of the Plan, Do, Check, Act process improvement and learning cycle used by many high performing organizations.

Plan Phase

Step 1. Planning

Start from 2012, reducing supply chain costs has become an institutional goal. The SCI team has a role in the evaluation and acquisition of the Inventory Management Information System (IMIS). The objective of the process is to create an automated, end-to-end supply chain solution with the goal of moving toward a lean healthcare environment while increasing satisfaction and efficacy of all stakeholders involved in the hospital environment. The system provides real-time, accurate and automated decision support for healthcare inventory management. This process will achieve:

Goal 1: Increased Operational Efficiencies/Waste Reduction

- Manage all expiring items
- Increase visibility of on-hand inventory
- Eliminate stock outs
- Manage obsolescence
- Enhance compliance with regulatory requirements
- Reduction in time spent ordering supplies so productivity can be shifted
- Reduction in time spent documenting supplies used in a case

Goal 2: Improved Financial Measures

- Enhance clinical documentation/charge capture
- Improve financial control of supply transactions
- Establish a fully automated perpetual inventory process
- Reduce carrying costs
- Improve reporting

Goal 3: Improved Staff Satisfaction and Patient Safety

- Improve clarity and ease of documenting supplies used in a case
- Increase value-added activities for clinicians
- Improve clarity of supply availability will allow for improved case scheduling
- Improve process of ordering supplies with less time spent managing inventory

Step 2. Business Process Redesign, Data Conversion, and Interface Development

The Supply Chain Informatics (SCI) team in conjunction with hospital procurement, inpatient/critical care nurses, perioperative services, and hospital finance identifies gaps and redesigns business processes for each area. In the process of data conversion and business process redesign, SCI team cleans and recreates an item master file, identifies cost saving and performance improve opportunities at each area and formulates action plans to achieve the goals and targets. SCI team developed key areas of focus: inventory visibility and real-time monitoring via Radio-frequency identification (RFID) technology, eliminating manual counting and manual key-in orders process, and eliminating nursing manual documentation process.

Do Phase

Step 3. Development, Implementation, and Operations

SCI team works with software vendor – ARC Healthcare Technologies implement the key initiatives identified in the Plan Phase, and develop our own IMIS – Helios that fits in Low Unit of Measure (LUM) distribution, fulfills real-time inventory monitoring needs, achieves electronic invoice matching goal, and sends automated purchase orders to

vendors. The Do Phase comprises staged enhancements that include First Year OR Implementation and Follow-up, Second Year Inpatient Floor Implementation and Update, Third Year Regional Implementation and Upgrade. In 2017, Helios will be the inventory management system throughout MSKCC facilities.

Check Phase

IMIS monitors process performance in achieving inventory reduction, taking corrective action, as necessary, to achieve desired performance, and conducts internal audits to assure the process is working effectively, and our key customers are satisfied.

Step 4. Monitoring, Measurement, and Analysis

IMIS monitors Inventory Performance Indicators in real-time through the Operational, Financial and Supply Reports.

Step 5. Nonconformities, Correction, Corrective and Preventative Actions

IMIS evaluates deviations of actual inventory system performance from expected performance and develops corrective action plans and preventative measures.

Step 6. Internal Audits of IMIS

To ensure the IMIS is functioning properly and further identify areas for inventory reduction improvement, Helios conducts yearly inventory cycle/periodic count audits at each MSKCC facility.

The Act Phase

Step 7. Management Review, Evaluation, and Continual Improvement

Supply Chain Informatics team conducts monthly systematic fact/evidence-based evaluation and improvement, including innovation, of the Helios and actual performance to plan.

We Work with Our Suppliers, Partners and Collaborators

The new IMIS system, Helios, gives the ability to work with our medical supply vendors. Vendors see fewer returns because our system tracks the expiration dates of products thus reducing waste for all parties involved. This is especially useful for the most expensive tools and products, such as OR items, because it is a larger loss if they are not used before their expiration date. By having thorough documentation of inventory information, we can negotiate with vendors to determine the best course of action for specific products.

The Director of Logistics PeriOperative Services states, “We were looking for a system that would provide us with a greater level of transparency and accountability in the life cycle of disposable surgical products utilized within the surgical environment. An application that would optimize the supply charge captures process by simplifying the identification and documentation of surgical products. Very early on in the project development process, we recognized that a RFID based Inventory Management System was the only technology option for meeting our outlined goals. We are now 20 months post implementation and the Helios System has exceeded our expectations and is well on its way to achieving the outlined project goals. We have had tremendous early successes: Supply usage documentation has always been a challenge in the surgical environment, leveraging the capability of RFID we have developed a proprietary device that has revolutionized the way in which supply usage is captured in the surgical environment. The positive feedback from the clinical staff has been overwhelming and this is reflected in our improved charge capture results. Additional successes include; real-time inventory visibility using RFID-enabled shelving for more expensive items and RFID KanBan system for low-cost items, improved expiration date management, Real-time total inventory value look-up, and an inventory replenishment process is now far less labor intensive and improving in accuracy each day.”

The goal of the RFID-based IMIS is to increase operational efficiencies/waste reduction, improve financial measures, and improve staff satisfaction and patient safety. For the customer, this means that they don't have to manually perform periodic and cycle counts, manually enter orders and manually document patients' usages. The system is a perpetual system, continuously tracking inventory in real time. This makes it easier to locate and transport supplies when they're needed. The system automatically restocks inventory upon depletion which eliminates the need for customers to track and order supplies. Another function of the system is that it documents which products contain latex, a common allergen, which keeps our patients safer, thus, helping to ensure our organizational success and growth.

Provide the Best Care to Patients

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a formal public reporting initiative asks all patients to rate their experiences regarding their inpatient stay. These ratings are shared with the public and impact hospitals' reputation and standing in the community it serves. Only 61percent of patients in New York State and 70 percent of patients nationwide score their satisfaction as 9 or 10. MSKCC scores 83 percent. Also, 65 percent of patients in New York State and 71 percent of patients nationwide think they definitely recommend the hospital to others. MSKCC scores 91 percent. Top two indicators can influence patients' satisfactions - "being involved in decisions about my care", and "being informed about my care". Other factors like how well they were treated and how fast they were treated. With the current state of RFID-based MMIS system, Supply Chain can allocate our inventory efficiently and effectively. There is fast turnover rate with no stock-out events. Patients can get the high safety and quality inventory support as they needed.

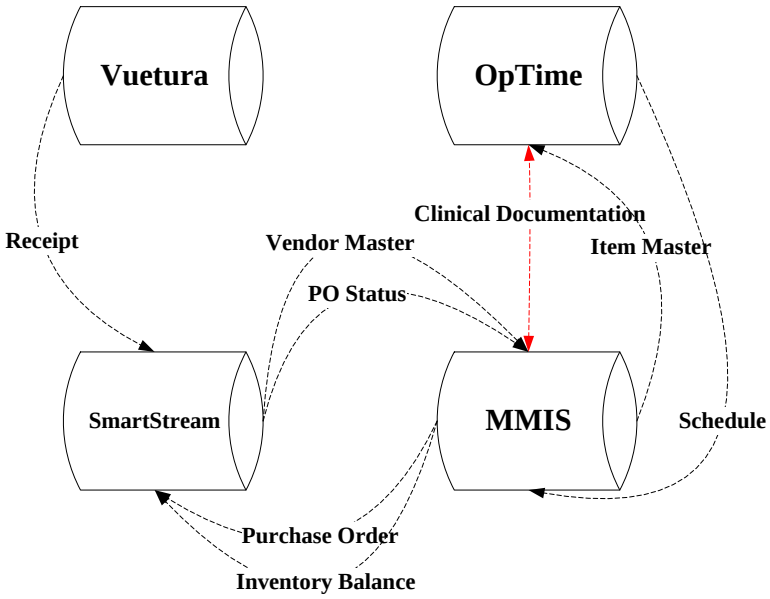
Key System Development Process

The SCI Team worked with our principal customers (Nursing, PeriOperative Services, Operational managers, Financial managers) to determine key requirements of the Inventory Management Process in the Plan Phase, Step 1, Planning, and Step 2, Business Process Redesign, Data Conversion, and Interface Development. Key requirements include Customer requirements as well as Internal (Hospital System) requirements, such as process transparency, outcomes, efficiency, ROI, est.

The SCI team studied existing inventory management systems, calculated the value to be gained potentially, adapted gap analysis, and worked with customers on the discussion of different methodologies, and they identified the main issues at MSKCC that could be solved by the process we researched. What we discovered is that the key elements towards choosing a solution are centered on ease of use, fast paced/real time recording, highly customized (non-repetitive) order fill, a high degree of item variability per case. Various systems utilized by MSKCC to facilitate inventory management will interface with the MMIS.

Systems

- MMIS – currently this system does not exist at the Institution, however as shown we anticipate this system serving as the Peri-op department's IMS for consumable, stocked supplies.
- OpTime – the Institution's Operating Room Information System (ORIS). Operating room cases are scheduled in OpTime, and clinical supplies used in a case are documented in OpTime. Additionally, OpTime generates and transmits charges to the billing systems.
- SmartStream – the Institution's enterprise resource planning (ERP) system. SmartStream is the system in which purchase orders are generated and transmitted to vendors, receipts are input, and invoices match with purchase orders. In addition, SmartStream is the General Ledger (accounting information system).
  Vuetura – the Institution's receiving and package tracking system. Receipts against purchase orders are input by the Receiving Department and transmitted to SmartStream to enable invoicing against the purchase orders.



The diagram depicts the interface exchanges that will occur among the four systems. The diagram above depicts inbound and outbound interfaces from the various systems interacting with the IMIS. Outbound interfaces are represented by arrows leaving the system; incoming arrows are meant to represent an inbound interface to the system.

Process Cost Control

The director of Supply Chain manages overall costs of the IMIS, through the Plan Phase, vendor selection, and Do Phase, Implementation of the IMIS. SCI teams compared ROIs from two vendors, see below, and made a decision on choosing the one had four years pay-back period. Upgrades usually need to "pay back" (with reduced hard and soft cost) the cost of the upgrade with five years. Key hardware and software upgrades are evaluated against the cost of the upgrade. SCI team monitors progress on the upgrade through Check Phase. Deviations are also addressed in the Check Phase.

	ARC	SAIC
Project Labor[1,2]	$ 254,110	$ 156,381
Software Development[2]	299,610	523,500
Hardware[2]	701,384	1,256,310
Total Implementation Cost	$ 1,255,104	$ 1,936,191
Maintenance, Licenses & Tags[3]	$ 171,923	$ 461,165
Five-Year Total Cost of Ownership	**$2,114,719**	**$4,242,016**

Notes:
1- Project labor includes staffing (ex: RFID engineers) and related travel expenses.
2- Onetime cost for implementation at Memorial Sloan-Kettering Cancer Center.
3- Recurring annual costs for maintenance, warranties, software licenses, and tags.

	Year 1	Year 2	Year 3	Year 4
Cost reduction	$ 660,000	$ 240,000	$ 240,000	$ 240,000
Revenue Enhancement	$ 432,000	$ 432,000	$ 432,000	$ 432,000
Net benefit	$ 1,092,000	$ 672,000	$ 672,000	$ 672,000
Cum. Benefit		$ 1,764,000	$ 2,436,000	$ 3,108,000
	System Cost	$ 3,000,000		
	Payback Period	4 years		

Organizational Learning

The key lessons learned from the improvement, Supply Chain focus on material spending cost reduction are deeply embedded in MSKCC material management operations. The material spending cost reduction plan sets clear expectations that inventory on-hand carrying cost reduction and fast inventory turn on high-cost items are key operational initiatives of the system. All facility storage locations are held accountable for reducing the costs. SCI team performed ABC analysis to classify inventory item into groups by annual dollar value and expense. All inventory items are listed in descending order, from the highest annual dollar usage to the lowest. See below for the stratification.

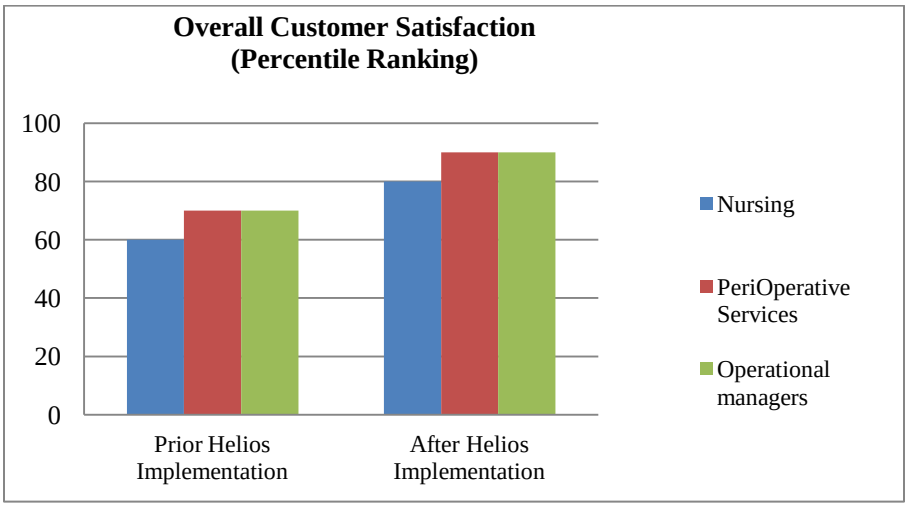
Inventory Items	Expense	Priority
10% Items	70% Expense	A Category
20% Items	20% Expense	B Category
70% Items	10% Expense	C Category

"A Category" accounts for 70% of total inventory expense, so SCI team works with material operating manager concentrating on managing the inventory items included in that category to make the most impact for the organization.

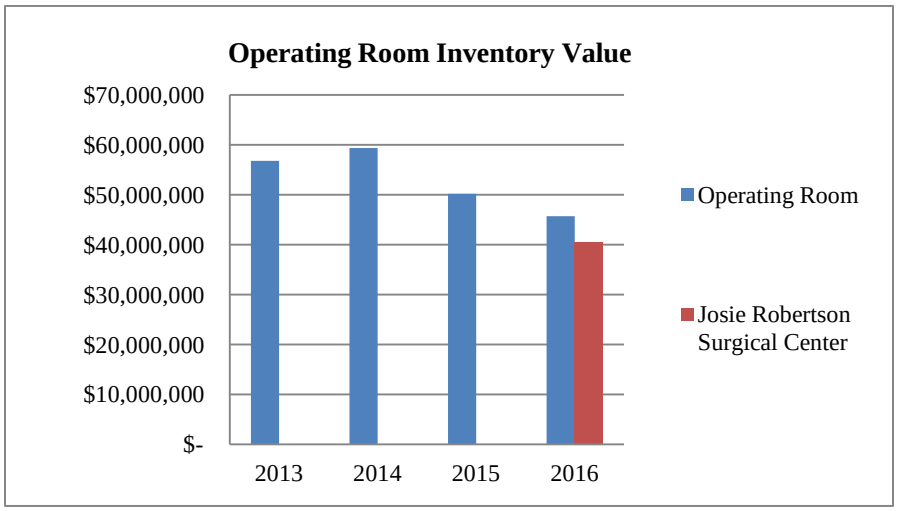
Process Results

The overall purpose of MSKCC Inventory Management Information System (IMIS), Helios, is to create an automated, end-to-end supply chain solution with the goal of moving toward a lean healthcare environment while increasing satisfaction and efficacy of all stakeholders involved in the hospital

environment and to reduce inventory expense and on-hand carrying costs. Helios is integrated with organizational needs of delivering real-time effective services and serves as expressed in the Mission and Values. Results data presented are linked, aligned, and integrated with the Helios. Helios measurements are segmented, as appropriate, by all SCI customers. Performance measurement results and 2015 and 2016 projections are shown for all customers, processes, and action plan results.



The report shows the in-process and outcome metrics related to customer satisfaction with the MMIS, Helios. Customer satisfaction data are shown by percentile ranking. Percentile ranking allows SCI team to compare all MSKCC customers among themselves. A 90 percentile score indicates MSKCC has better customer satisfaction than 90% or all customers using the same survey. In most cases, a percentile score of greater than 80% indicates a benchmark – excellent performance within an industry.



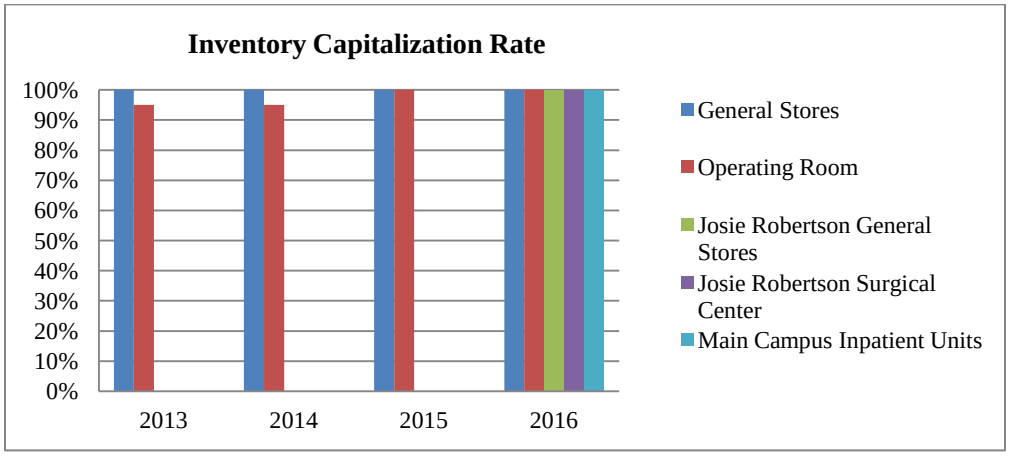
The 2014 year is the baseline inventory management prior to implementing Helios. Ease of clinical documentation (wand supply versus manually typing into a computer) leads to increased Nursing satisfaction. Anticipated 93% time reduced documenting clinical supplies (average supplies per case, 15 seconds in the old manual typing way 2014, 1 second new way in 2015, and difference multiplied by the number of RFID items). The better process of documenting supplies lead to better compliance by

Nursing, which enhanced revenue by 5% in 2015 compare to the baseline year. SCI team calculated the Economic Order Quantity (EOQ), which is a calculation of the most efficient maximum order quantities, through considering lead times, carrying costs, ordering costs, and available space. The calculation helped us to define the minimum and maximum PAR values for each item in Helios and gained the ability to increase ordering and usage efficiency. The net reduction of inventory is at 7% compared to the 2015 base year.

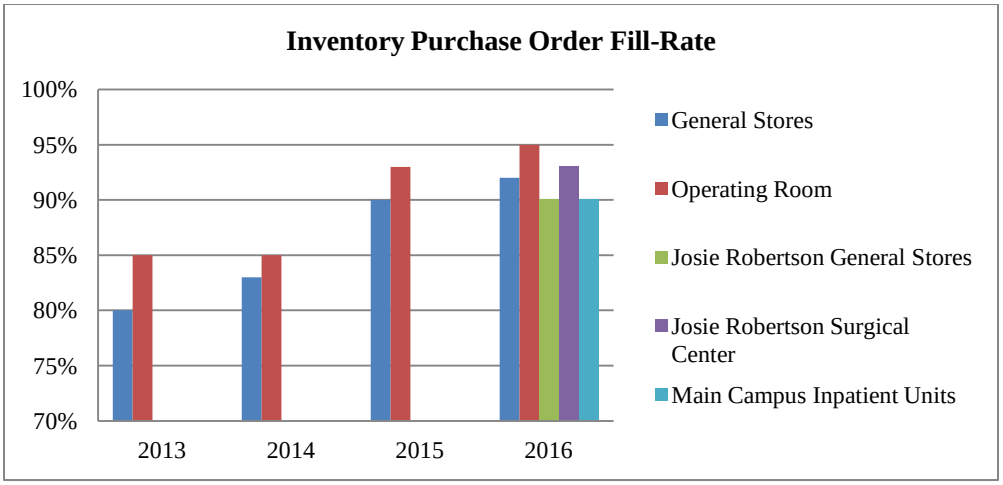
The new MMIS, Helios, gives us the ability to increase and monitor our consignment inventory, which are products that are housed in the facility but purchased only when used. Consignment inventories usually are high-value items with variety sizes including implants, screws, tissues etc. We contracted with 14 consigned vendors and held 1142 consigned unique items, which is 28.35% of our total unique type of inventories, roughly $2.43 million dollars. By increasing consigned items, we also improved our hospital cash flow.

Location	On Hand Value	Owned	Consigned
General Stores	$599,870.09	100%	0%
Operating Room	$7,136,240.78	66.80%	33.20%
Josie Robertson General Stores	$8,783.30	100%	0%
Josie Robertson Surgical Center	$826,008.36	92.62%	7.38%
Total	$8,570,902.53	71.65%	28.35%

The system allows us to have a greater inventory control from ordering to consuming. The capitalization rate is used to determine the present value of cash receipts. Not only does this help MSKCC's cash position, but by placing the supplies in an asset inventory more frequent and better management of the items is necessary, resulting in better inventory control. The result in MSKCC main campus inpatient units is significant. Prior to Helios implementation, the inpatient unit has 0% capitalization rate and 100% in 2016.



The percentage of line items requisitioned that are successfully supplied to the requisitioning customer are significantly increased from 2015, the base year of Helios implementation, and 2016 compare to 2015 the base year.



The percentage of line items requisitioned that are placed on back-order and still due to the customer are significantly decreased from 2015, the base year of Helios implementation, and 2016 compare to 2015 the base year.