

# **Choosing Pharmacy Automation**

# A blueprint for success



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# **Table of Contents**

Overview	4
What is Pharmacy Automation?	5
Determining Automation Needs	6
Model Review	7
Benefits of Different Distribution Models	8
Process Review	12
Desired Improvements	14
Stakeholder Implications	14
Goals of Automation Implementation	15
Automation Solutions	16
Storage Carousels	16
High-Speed Packagers	17
Robots	18
Inventory Management Software	19
Requests for Proposals (RFPs)	20
Writing Your Request for Proposal (RFP)	20
Forming an Automation Review Committee	21
Ranking/Selecting Vendors	21
Conclusion	23
Appendix A: Change Management Resources	24

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# Overview

Hospitals today are held to an increasingly higher standard of accountability for the overall patient experience. Every department contributes to patient care, with pharmacy and nursing on the front line - providing pain and symptom reliefas well as reassurance. The timely dispense and delivery of correct medications is critical to improving patient outcomes and fostering a positive experience. For this reason and many others, hospital pharmacies are considering automation solutions. Whether on a large scale or small, the right automation can improve patient safety, reduce medication waste and drug shortages, reduce costs and enable staff to spend more time focusing on clinical activities.

Automation is a substantial investment; this paper provides guidance on planning for and selecting the appropriate automation solution for your hospital. It will identify key considerations for helping you determine your needs, write a meaningful RFP and make a vendor selection.



# What is Pharmacy Automation?

Over the past several decades, technology has become commonplace. Even robots and automation are no longer something seen as futuristic or a luxury; rather they are a vital component in achieving cost, safety and efficiency goals. However, the term automation has become somewhat ubiquitous. For this reason, the National Association of Boards of Pharmacy (NABP) define automated pharmacy systems as "including, but not limited to, mechanical systems that perform operations or activities, other than compounding or administration, relative to the storage, packaging, dispensing or distribution of medications, and which collect, control, and maintain all transaction information."<sup>1</sup> Throughout this paper, the term automation will refer to automated pharmacy systems as defined by the NABP as stated above.

SOURCE

1 — National Association of Boards of Pharmacy Model State Pharmacy Act, article 1, section 105(f), p.10. August 2018.





### **Determining Automation Needs**

Before beginning the automation request for proposal, conduct a thorough review of your current distribution model and practices to help you determine what your needs are. While vendors will assist you in determining which types of automation will help you achieve your goals, it's important to have a clear idea of your immediate and long-term goals, objectives and measures of success for automation purchase and implementation before you engage with a vendor to evaluate solutions.

As part of this needs assessment, it's critical to build a clear business case for improving your total medication administration process and reducing medication dispensing errors—from the pharmacy to the patient—and not just improving workflow efficiencies and optimizing pharmacy operations.



### **Model Review**

Medication distribution models vary significantly between hospitals—even those of similar size and census.

«Today, 58% of hospitals use a point-of-care (POC) model. Following the POC model is centralized distribution in 22% of hospitals. Completely decentralized and hybrid models make up a total of 20% of pharmacy distribution models.<sup>2</sup>»

When was the last time you reexamined the model you're using to see if it is accomplishing what you intend—safety, effectiveness and efficiency? Rarely do hospitals completely change models without impetus— a pharmacy relocation, renovation or new facility, a desire to move toward an automated pharmacy, or a sentinel event. Depending on the triggering event, your facility may need to make a major change in your medication distribution model. To determine if you should continue with your distribution model with the addition of automation, or if the implementation of automation is the right catalyst for a model change, start by answering the following questions.

- What medication distribution model does our pharmacy currently use? Is it a hybrid model, centralized or decentralized model?
- Are we part of a health system that has a distribution center? Are we becoming a distribution center for other hospitals?
- Is this model working effectively for all stakeholders (i.e., pharmacy, other hospitals, nursing and patients)?
- Are we dissatisfied with our current model? What is the primary root cause of the dissatisfaction (for all stakeholders)?
- What would another model look like at our hospital? Would it positively or negatively affect our customers (nurses, patients)?
  Are there recommendations that may provide guidance?

The answers to these questions will prepare you for determining what type of automation you may want to purchase. For instance, a true centralized model might use a full-scale robot to handle cart fill rather than a high-speed packager. While you do not need to know exactly what you're looking for, you should be able to describe your model preference to avoid proposals that include solutions that do not fit within your desired model.



<sup>2 —</sup> State of Pharmacy Automation, Pharmacy Purchasing and Products, Page 54. August 2020

### **Benefits of Different Distribution Models**

No distribution model works for every hospital. Each model has recognized benefits that can be enhanced through the use of the right automation solutions.



#### **Point-of-Care**

The most common method of distribution is the point-of-care model, which distributes 80% or more of inpatient medications from automated dispensing cabinets (ADC) on the patient unit, which are restocked from the central pharmacy.

#### Advantages<sup>3</sup>

- Eliminates waiting for medications from pharmacy
- Verifies the "5 Rights of Medication Administration"
- Minimizes chance of medications being missed
- Increases accountability and report capabilities

#### **Disadvantages**

- Less pharmacy control
- High cost of equipment purchase/rental over time
- Poor interoperability of Information Systems
- Opportunity for workaround creation

#### SOURCE

3 — Grotting, John B., M. Yang, J. Kelly, M. Brown, B. Trohimovich, "The Effect of Barcode-Enabled Point-of-Care Technology on Patient Safety," Literature Review. Bridge Medical, Inc., October 2002.



#### Centralized

In a centralized model, 80% or more of inpatient beds receive medications from the central pharmacy. In an automated centralized pharmacy, a robot and/or a carousel is the main dispensing platform, often to unit dose carts which are used to transport medication to the nursing floor for patient administration.<sup>4</sup>

#### **Advantages<sup>5</sup>**

- **Disadvantages**
- Provides greater pharmacy control and involvement
- Capability to provide patient-specific medications, cassettes
- Fewer missing doses/lower rates of diversion and waste
- Reduces inventory levels that need to be maintained
- Allows nurses to spend more time with patients
- Increases accuracy of patient billing

- More 'work' for pharmacists and technicians
- Slower turnaround times
- Opportunity for 'borrowing' medications
- Not all medications can be stored together (i.e., refrigerated, large volume IVs)
- Nurses 'share' access to medications (equipment dependent)

- 4 State of Pharmacy Automation Survey. Pharmacy Purchasing & Products. 2018; Page 52
- 5 Paparella, Susan, "Medication distribution systems: An interdisciplinary conundrum," Optimizing the Medication Use Process Convention. PowerPoint Presentation. April 2008. Accessed July 22, 2014.





#### Decentralized

In a decentralized model, 80% or more of inpatient beds receive medications from satellite pharmacies and/or automated dispensing cabinets.<sup>6</sup>

#### Advantages<sup>7, 8</sup>

- Reduces turnaround times
- Minimizes chance of medications being missed
- Increases accountability and report capabilities
- Automates controlled-substance inventory reconciliation processes
- Improves nursing staff satisfaction, due to perceived reduced nursing labor

#### **Disadvantages**<sup>9</sup>

- Less pharmacy control
- Increases in costs due to duplication of medication inventory
- Higher cost of equipment purchase/rental over time
- Increases nursing staff workload (depending on configuration and number of cabinets)
- Greater nurse manipulation of products

- 6 State of Pharmacy Automation Survey. Pharmacy Purchasing & Products. 2018; Page 52
- 7 Gerwitz, Randy, "Managing compliance when medication goes mobile," Health Management Technology. Website. November 2013.
- Rough S, Temple J. Automation in practice. In: Brown TR, ed. Handbook of Institutional Pharmacy Practice. 4th ed. Bethesda, MD: American Society of Health-System Pharmacists; 2006:329-52.
- 9 Gray, John P., B. Ludwig, J. Temple, M. Melby, S. Rough, "Comparison of a hybrid medication distribution system to simulated decentralized distribution models," American Journal of Health-System Pharmacists. Vol. 70, Page 1323. August 1, 2013.





#### Hybrid

A hybrid model combines centralized and decentralized medication dispensing to inpatient beds, meeting neither of the conditions of either model exclusively.<sup>10</sup>

#### **Advantages**

- Provides quick access, with PRNs kept on the patient floor
- Promotes control and accuracy, with patientspecific meds still dispensed by pharmacy
- Divides dispensing labor between pharmacy and nursing

#### **Disadvantages**

Depending on the level of hybridization, can represent the worst of both models

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#### SOURCE

10 — State of Pharmacy Automation Survey. Pharmacy Purchasing & Products. 2018; Page 52.



### **Process Review**

After identifying and reviewing your model, look at your medication distribution and administration on the process level. This should quickly reveal what is working and what can be improved.

Analyze existing pharmacy dispensing workflows and nursing medication administration workflows to find "waste" or non-value added steps in the processes. Use observation methods and techniques to track every step in the process, employing tools such as spaghetti charts, 5S and lean innovations/ methodology and swim lane diagrams to map process flow diagrams and workflows. Next, look for ways to implement automation and robotics to reduce waste and non-value added steps as well as streamline these processes to allow pharmacists and nurses more time to focus on direct patient care activities. Next, track and analyze the time spent on your processes. How long does it take for medications to be prepared in the pharmacy for distribution to the patient floors (whether that be cart fill, cabinet fill, etc.)? How long does it take for nurses to locate, verify and administer medications? Are they spending more time locating medications than with their patients? Automation can reduce these processes significantly, often by 20-40%<sup>11</sup> by eliminating extra manual steps and multitasking.

Additionally, look at opportunities to reduce errors including how many times a medication is handled before it reaches the patient. One study found that 'human factors were the cause of 68.4 percent of all errors, followed by miscommunication.'<sup>12</sup> Removing some of the manual (i.e., human) interactions will reduce the opportunity for errors.



<sup>11 —</sup> Kasbekar, N. "BoxPicker and PillPick from Swisslog," Pharmacy Purchasing and Products. Volume 10, Issue 7, Page 40. July 2013.

<sup>12 — &</sup>quot;Certain factors increase risk of medication errors in the neonatal intensive care unit (NICU)": Research Activities October 2011, No. 374. October 2011. Agency for Healthcare Research and Quality, Rockville, MD. Website.

## A «Critical-to-Quality» matrix that focuses on three broad categories: patient safety, operational efficiency and cost containment<sup>13</sup> will help you organize your findings to further your case for automation.

Table A: Critical-to-Quality (CTQ) Matrix <sup>14</sup>					
		Cen	tralized	Decentralized	
Patient Safety	Weight	Rating	Weighted	Rating	Weighted
Increasing patient satisfaction by increasing nurse time at the bedside	6		0		0
Reduce the incidence of misplaced medications	7		0		0
Reduce the incidence of mislabled medications	5		0		0
Flexibility in acquiring stat medications	7		0		0
Support pharmacist clinical involvement on nursing units	7		0		0
Ability to reflect most current order set	7		0		0
Improve medication security between point of acquisition (RN) and administration	4		0		0
	43.0				
Operational Efficiencies	Weight	Rating	Weighted	Rating	Weighted
Reduce incidence of missing medications	5		0		0
Minimize new order turn-around time	7		0		0
Ease of entry/access to medications	5		0		0
Minimize touch points in the new order process	4		0		0
Flexibility to add/remove medications as needed (par, min/max)	4		0		0
Standardize inventory within locations	6		0		0
Location proximity to patient	6		0		0
	37.0				
Cost Containment	Weight	Rating	Weighted	Rating	Weighted
5 year cost of ownership (hard \$\$)	6		0		0
Increased nurse value added time	7		0		0
Increased pharmacist value added time	7		0		0
	20				
Total Weighted Score	100		0		0

SOURCE

- Killian, D., Cooper, William C. "Transforming to a Point-of-Care Distribution Model." Pharmacy Purchasing and Products, Vol. 10, Issue 2, Page 16. February 2013.

14 — State of Pharmacy Automation Survey. Pharmacy Purchasing and Products. 2013;10(8):14-15.

### **Desired Improvements**

Automation solutions have been shown to improve patient safety, reduce cost, inventory diversion and expired drugs and improve the efficiency of pharmacy and nursing operations. While many benefits will be realized regardless of the solution implemented, making a specific list of improvements you require can be used to prioritize choices. Situational examples, in particular, provide vendors with insight into the experiences and events driving the need for change. This also provides direction as to how specific solutions will help you accomplish your goals.

## **Stakeholder Implications**

Decisions made by the pharmacy about dispensing models and automation affect nursing, information technology and even facilities personnel. During the discovery phase, meet with each affected department about current processes to gather further input for consideration. Nurses are especially important stakeholders because any changes made in pharmacy directly impact their processes and therefore impact patient care. With any technology implementation, it's critical to involve the Information Technology department, as they must plan to have trained staff to work on your project. They will also be able to provide technical details to consider for any new software, interfaces and security requirements.

Remember to consider stakeholders within your pharmacy (buyers, technicians), as their input and buy-in will be imperative to a successful execution.

### **Goals of Automation Implementation**

Automation is not a magic bullet to achieve the perfect pharmacy practice model. Recognize that technology is simply a tool to enable good processes and the human factor of technology implementations is as critical as the choice of technology itself. With an ideal practice in mind, set realistic goals of what you would like to accomplish with the implementation. As discussed in your model review, organize and prioritize your goals. Finally, in order to be able to determine if goals have been achieved, they must be measurable.

Example 1: Reduce diversion by 30% during the first year of automation use.

In order to measure this, you need to know your current diversion rates and have a process in place to track possible diversion before and after implementation. Example 2: Reduce waste due to drug expiration by 20% during the first six months of use.

Many pharmacies have no idea how much inventory is lost due to expirations. In order to accurately compare expirations before and after automation, record expiration quantity and associated costs for up to six months prior to implementation. As previously noted, you will need a process in place to measure after implementation.

These are just two examples of the many goals that are achievable with automation. Others include reductions in cart fill/cabinet fill time, improved billing accuracy, better inventory control, increased inventory turns and more time at the patient bedside for both nurses and pharmacists.

# **Automation Solutions**

Automation has come a long way since its introduction in the 1970's. From the first unit-dose packager to robots that compound IV bags, technology is advancing more each year. For the purposes of this paper, we'll discuss four primary technologies used in inpatient hospital pharmacies today: storage carousels, high-speed unit-dose packagers, fully automated robots and inventory management software.

### **Storage Carousels**

First implemented in the 1970's, storage carousels have since been further enhanced with safety and efficiency features, and offer high-density storage of medications. Carousels are designed to support a systematic approach to maximize picking efficiency, reduce picking errors and condense storage footprint. To optimize workflow with carousel utilization and increase safety, look for the following functions and features:

**Scan In/Out Technology** – More than just a means to track inventory levels, scanning each medication ensures storage in the proper bins and assists in picking accuracy, which accounts for a majority of preventable errors.

**Dynamic Storage** – Look-alike, sound-alike (LASA) drugs have caused many preventable medication errors. Of errors related to LASAs, 64.4% originate at the dispensary, with pharmacy technicians committing the initial error in 39% of cases and pharmacists in 24% of cases.<sup>15</sup> To prevent such errors, the solution you choose should have the ability to store LASAs separately. Additionally, fastmoving drugs should be accessible or delivered to the operator quickly.

**Secure Storage with Limited Access** – Access to the automation should be limited to authorized users via secure login. You want to improve your chain of custody by ensuring security and traceability in order entry.

**Modular Design** – A modular design and on-site assembly allows for placement in tight spaces, reclaiming valuable pharmacy space.

**Multi-Environment Storage** – Some high-density storage solutions provide the option to have refrigerated storage. This further enhances workflow and provides a smaller footprint for space-conscious pharmacies.

SOURCE

15 — Kaufman, Michele B. Preventable medication errors: Look-alike/sound-alike mix-ups. Formularywatch.com. February 1, 2009. Accessed July 10. 2014.



### **High-Speed Packagers**

Viewed as a commodity item, high-speed packagers were the first piece of pharmacy automation widely adopted. Since their introduction, a variety of safety and efficiency enhancements, including on-board computers and RFID-enabled canisters, have been made. When comparing equipment, verify that at a minimum, the packager has the ability to do the following:

**Pause/Job Interruption** – Occasionally you may need to package something for immediate distribution. Your automated packager should allow you to stop a batch process, package and dispense the STAT dose, and then resume the original order.

**Out-of-Stock Medication Skip** – During largebatch operations, inventory of a single medication may become depleted. Rather than having to stop operation, replenish the medication and then restart packaging from the beginning, the packager should offer a "skip" function. This allows packaging to continue by moving onto the next medication. Once all packaging is complete, the out-of-stock medication can be refilled and packaging resumed.

### Robots

Pharmacy robots provide packaging, storage and dispensing of unit doses on a large scale. While performing essentially the same functions, there are key features that will increase productivity, efficiency and safety.

**RFID-Enabled, Secure Canisters** – One of the biggest opportunities for error occurs when medications are removed from original packaging. To prevent this, canisters should be checked by a pharmacist, then secured. Once secured, the canister should not be able to be tampered with or opened until it needs to be refilled.

**Vacuum Suction** – While gravity is used in highspeed packagers, vacuum is ideal for robots. Vacuum suction, coupled with various sizes of straws and canister openings, prevent multiple pills from being dropped into a single unit-dose bag.

**Integrated Packaging and Storage** – A major benefit of a full-scale robot is reducing manual process steps. A robot that offers true workflow optimization and safety should be capable of packaging unit doses, then transferring them automatically to secure storage until ordered. **Multitasking Operations** – Pharmacies manage several tasks at any given time and so should their automation. Robots should be able to package and dispense simultaneously. Some robots offer additional simultaneous functions such as automated returns.

**Organized Dispense** – When handling patientspecific medications, organization of unit doses is critical for easy location, verification and timely administration by nursing. Ideally, patient-specific medications should be organized onto a patientspecific ring or into an envelope, keeping all the medications for a single patient together.

Automated Returns – Unused medications brought back from the patient floors need to be returned to inventory for billing and inventory reconciliation. Ease the process with a robot that provides automated returns, allowing you to insert unused doses, which are scanned and returned to inventory automatically.



### **Inventory Management Software**

Inventory Management Software (IMS) is the backbone of an automated pharmacy. Some pharmacies even utilize IMS as a standalone product. A good inventory management solution will provide you with:

**User Friendly Interface** – Easy-to-use software promotes system adoption, which increases compliance and, in turn, improves data integrity.

**Configurable Dashboards** – Information is only valuable if you can read it quickly and take action. Your software should help you advance the operational health of your pharmacy by providing data analysis to help you uncover business insights. **Device Independence** – Software is only as useful as the interfaces it supports. Inventory management software should not have to be tied to a specific product or device. Completely device-independent software can be utilized without other automation and interface with solutions regardless of vendor.

**Web Access** – It is your inventory information; you should be able to access it anywhere you need to. No longer limited to workstations within the walls of the pharmacy, you should be able to access data from anywhere in the hospital or even from home.

With each type of automation, you also need to inquire about interface capabilities and vendor willingness to interface with your existing technology suite, including competitive products.



## **Requests for Proposals (RFPs)**

Once you have reviewed the available technology, you'll want to solicit proposals to allow you to evaluate the solutions and their respective vendors. Before drafting an RFP, be sure that you have answered the following questions about your automation project:

- Have we (pharmacy and stakeholders) identified the issue(s) we expect automation to address?
- Have we aligned the organization around what our medication distribution model will be moving forward?
- Do we have an effective change management program in place to help staff adjust, adapt to and accept the new automation?
- Are our stakeholders in agreement about the goal of implementing automation (save time, reduce costs, increase productivity, improve patient safety, reduce missing meds, etc.)?

# Writing Your Request for Proposal (RFP)

When writing your RFP, outline the discoveries made as a result of the questions previously mentioned and the process that has gotten you to this point. In addition to outlining what your equipment requirements are, determine vendor expectations, software interfaces and functionality requirements, financial considerations including budget cycle, and timeline for installation and go-live.

Divide your RFP into five sections – technical requirements, software functionality and interfaces, vendor qualifications and expectations, financial considerations and timeline – to make it easy to organize and review responses for consideration. The five categories allow you to get the information necessary to assess the vendors and rank them accordingly, eliminating those that do not meet your requirements.

If you do not already have a standard RFP template, Healthcare Information and Management Systems Society (HIMSS) offers a free template (see himss. org) that can be downloaded and customized to suit your needs. Additionally, if you've already been working with a vendor, you can have them assist you in writing your RFP.

### Forming an Automation Review Committee

As previously mentioned, implementation of automation has hospital-wide impact. With this in mind, a review or value-analysis committee that includes a member from each affected department will provide constructive feedback on and analysis of proposed solutions. Today an estimated 48% of hospitals are using a value-analysis committee or purchase review committee in the product and vendor selection process.<sup>16</sup> This committee may include members from the information technology, facilities, nursing and patient safety departments in addition to the pharmacy project champion.

The person selected from each department to participate in the committee may not necessarily be the head of the department. On your committee, include those who will be managing the change and implementation. These people also may take part in the vendor kick-off meeting once the committee has made a selection. If you have not already secured executive backing for your project, having an interdepartmental committee presents a united front further demonstrating a well thought-out project.

### **Ranking/Selecting Vendors**

Once your review committee is formed, you will need to implement a process for reviewing each RFP you receive from vendors. At a minimum, you'll want to create a matrix so that you can compare responses to the RFP requirements from the participating vendors. This matrix allows the committee to compare vendors on a level field and eliminate those who are unable to satisfy the requirements.

Next, provide the committee with references from the narrowed down field of vendors, or engage a subset of the committee to contact references and report on findings. Your vendors should be able to provide you with references that have a similar hospital profile in terms of size and dispensing model. Contact two to three references for feedback on the automation and their overall satisfaction with the solution and the implementation process.



<sup>16 —</sup> R. Saadi, N. Ferko, P. Ehrhardt, D. Grima, "Strategies for Medical Device Manufacturers to Address Hospital Value Analysis." Medical Device and Diagnostic Industry, May 7, 2013. Accessed July 8, 2014.

During the final phase of consideration, arrange for a site visit to see the automation in use at a hospital. The site visit offers the opportunity to see pharmacy staff utilizing the equipment, observe the workflow and speak with users about their experience with the equipment and the vendor. For two vendors that are very close in the technology evaluation, site visits may provide you with insight that determines which solution will work best for your pharmacy and the vendor that will best support your goals.



The chart below provides an example of a vendor rankingusing criteria recommended for safe and effective medication use.<sup>17</sup> Determine a scale that works for your organization. You can do a simple positive/negative or rank from one to four (as shown in Table B), one being below average, four excellent.

In this example, Vendors B and C would move onto the next round of consideration.

Table B: Vendor Ranking Matrix							
	Vendor A	Vendor B	Vendor C	Vendor D			
Demonstrated Improved Safety/Efficiency	2	4	3	4			
Integration/Interoperability Capabilities	3	3	4	3			
Vendor Reputation	3	4	3	3			
Promotes Standardization	4	4	4	3			
Flexible Design/Configuration	2	4	2	2			
Regulation/Legal Compliant	4	4	4	4			
Reliable/Adequate System Support	3	3	4	2			
Robust Reporting Capabilities	2	2	4	2			
Downtime Planning Support	4	2	3	2			
Total	27	30	31	25			

SOURCE

17 — Urbanski, Christopher, B. Giacommeli, "Implementing Medication-Use Systems: Meeting Stakeholder Requirements." 15th Annual — ASHP Conference for Leaders in Health-System Pharmacy, 2010. Accessed July 25. 2014.



# Conclusion

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Automation can significantly impact your pharmacy operations. In order to ensure that impact is positive, it is essential to follow a formal evaluation process prior to purchase. Taking the steps outlined helps ensure the selection of the best automation for your pharmacy. A review of your current distribution model and its effectiveness, a consultation with your stakeholders and the establishment of goals prior to requesting proposals from vendors increase the likelihood of project success. With a growing market of automation options, doing the background work outlined in this paper provides you with a compass to successfully navigate the automation marketplace.

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# **Appendix A: Change Management Resources**

Jorgenson, Jim RPh, MS FASHP. "Challenges to Choosing an Automation Consultant." Pharmacy Purchasing and Products. May 2013 – Vol. 10 No. 5.

Jorgenson, Jim RPh, MS FASHP. "Compete Successfully for Capital Budget." Pharmacy Purchasing and Products. June 2013 – Vol. 10 No. 11.

Jorgenson, Jim RPh, MS FASHP. "Leveraging Consultants to Improve Automation Outcomes." Pharmacy Purchasing and Products. June 2013 – Vol. 10 No. 6.

Tarhanidis, Peter. "10 Tips for Sustainable Change Management." Blog. Voices on Project Management. Project Management Institute, 4 December 2013. Web. 11 July 2014.

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