DARDEN BUSINESS PUBLISHING
UNIVERSITY of VIRGINIA

UV5989
Rev. Jul. 12, 2011

BUSINESS PROCESS MAPPING

The purpose of this technical note is to explain how to utilize process maps as tools to show workflow steps, clarify process expectations and responsibilities, and see possibilities for eliminating waste and redundancy. The note explains when to utilize a process mapping tool, why it works, and how to apply basic mapping tools. There are four types of process maps presented in this note:

1. Process Flowchart Map
2. Swim Lane Flowchart Map
3. Suppliers-Inputs-Process-Outputs-Customers (SIPOC) Tool
4. Value Stream Map (VSM)

When To Use Process Mapping

There are multiple scenarios in which process mapping can be a valuable exercise, including when:

- You need to document and establish a common understanding of current processes and associated operational requirements and deliverables;
- Your group and other process participants or impacted areas do not fully understand the flow and focus of an entire process;
- The existing process for completing the product or service is extremely complicated;
- An existing process is inefficient and produces waste, but you are not clear where this is occurring or how to remedy the situation;
- Your process is not adequately meeting your internal or external customer needs, or you do not know enough about those needs;

This technical note was prepared by Andrew Snyder (MBA ’11) and Robert D. Landel, Henry E. McWane Professor of Business Administration. It was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation. Copyright © 2011 by the University of Virginia Darden School Foundation, Charlottesville, VA. All rights reserved. *To order copies, send an e-mail to* sales@dardenbusinesspublishing.com. *No part of this publication may be reproduced, stored in a retrieval system, used in a spreadsheet, or transmitted in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without the permission of the Darden School Foundation.*

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- Process governance is weak because owners function independently by executing process activities with little or no knowledge of preceding or dependent activities; and
- You are beginning a new project and need to clarify how all the moving pieces will fit together.

Process mapping is a relatively easy to apply visualization tool that can help multiple parties arrive at a common understanding of existing process flows, while stimulating fact-based improvement conversations. Before engaging in a process mapping exercise, a process owner and process exercise leader should carefully assess whether the following conditions are in place:

- There is a defined start and end to the process. Although this sounds relatively easy in practice, coming to a common understanding of when a process starts and when it ends can be incredibly difficult. The process map owner must have a clear idea of the mapping boundaries before starting.
- There are shared process-mapping objectives across exercise participants. The process map owner must clearly communicate the goals of a process mapping exercise. If the goal is to eliminate costs, but participants are contributing recommendations that might add costs, the exercise may prove less valuable.
- There is leadership buy-in and participation, specifically among parties that have accountability for completing steps in the current process. Unless all impacted areas are present during a process mapping exercise, you risk that the Current State process map will fail to reflect reality and that recommended improvements will not be implemented.
- There is a defined time table for completing the exercise.
- The exercise requires participants to spend time in the process on gemba walks—observing and talking to contributors to the process and collecting impressions and data.

Process Flowchart Map

The simplest of the process maps is the Process Flowchart Map, and it is the basic tool for process improvement studies using Lean-Six Sigma methodologies. As its name suggests, a flowchart illustrates the flow of a specific process from left-to-right or top-to-bottom. Generally speaking, a flowchart is appropriate to use when documenting specific activities and activity choice points within a process or system flow contained in only one or two work areas. It can also be useful for diagramming a multidepartment process at a high level. While flowcharts can be used to identify value-added steps and inefficiencies, most often they are used as a tool to improve overall understanding of the process and to document the current activities. By going on a gemba and focusing on conveying the “as is” information in a step-by-step flow sequence, you can concentrate on capturing what is really happening in each individual step and why.

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Detailed process flowcharts also identify the inputs and outputs for each process step. Inputs are generally listed above the process step, and outputs are listed below. Describing the inputs and outputs within a process flowchart provides participants with greater specificity regarding how the current process works. Moreover, by identifying the current inputs and outputs of each process step, participants can identify gaps and redundancies, as well as initiate conversations surrounding how each input and output can be measured. Once inputs are defined, the reader can then identify each as *noise* (N) or *controllable* (C). Noise variables are those that participants cannot control within the process. Controllable variables, as the name suggests, are variables that participants can control and change. For example, control variables are often subsections of an organization's Standard Operating Procedures (SOPs).

Detailed process flowcharts can also identify whether a step is value added (VA), non-value added (NVA), or necessary non-value added (nNVA), where:

- VA is an activity for which the customer is willing to pay. Value added tasks increase the market form or function of a product;
- NVA is an activity the customer is not willing to pay for, meaning it does not increase the market form or function of a product; and
- nNVA is not something the customer is willing to pay for but is nonetheless a necessary support task that must be completed in the manufacturing process.

In many improvement studies, the Process Flowchart Map exercise has uncovered opportunities for eliminating redundancies, reducing delays, or improving quality. Once a Current State process flowchart is created, participants in the exercise should then identify possible action steps to address problem areas and make recommendations to the process owner(s).

As illustrated in the Process Flowchart Map example (**Exhibit 1**), there are many flowchart symbols and color schemes that can be used. One can create Process Flowchart maps using basic computer software such as Microsoft Excel, PowerPoint, and Visio. Still the basic rule of thumb for all process maps is communication and clarity. If you chose obscure symbols that only part of the audience can read or understand, there is a good chance that your communication could fail. Remember, process maps should be simple to read and understand.

Swim Lane Flowchart Map

The Swim Lane Flowchart Map is an extension of the Process Flowchart Map. A Swim Lane Flowchart Map is utilized when multiple groups are involved in a process, and there are process "hand-offs" among the groups, a characteristic that adds complexity to the model. A *swim lane* is a visual element used to illustrate who or what is working on a particular subset of a process; thus the map explicitly shows the organizational responsibilities for the process flow.

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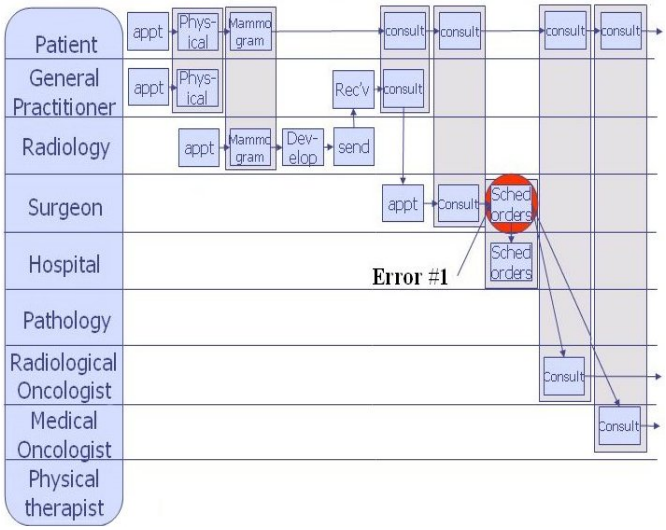
The Swim Lane Flowchart Map differs from other flowcharts in that processes and decisions are visually grouped by placing them in lanes, allowing the one who does the work activity to visualize flow activities. Parallel lines divide the chart into lanes, with one lane for each person, group, or subprocess. Lanes are labeled, preferably according to function or work group, as opposed to individual names, to show how the work is organized.

A Swim Lane Flowchart Map is a stronger tool than a simple Process Flowchart Map for identifying waste because it can clarify who is responsible for each step and how delays and mistakes occur. It can also identify when multiple parties believe they are responsible for the same tasks or alternatively when process steps are being avoided by multiple parties.

Other than the use of swim lanes, a Swim Lane Flowchart Map is created in much the same way as a Process Flowchart Map. The swim lane example that follows in **Figure 1** illustrates the process of caring for a patient who has been diagnosed with a medical condition requiring multiple consultations with healthcare specialists.

Figure 1. Swim Lane Flowchart Map.



Data source: John Grout, Berry College, http://facultyweb.berry.edu/jgrout/processmapping/Swim_Lane/swim_lane.html.

SIPOC Tool

The Suppliers-Inputs-Process-Outputs-Customers (SIPOC) Tool is helpful for scoping and defining a process mapping exercise before an improvement team is formed and the improvement *Measurement* and *Analyses* phase begins. Often a Six Sigma project uses the SIPOC Tool in the *Define* stage, and it can help identify gaps where the process is not meeting customer expectations. It provides an upfront structure for discussing a complex process before a

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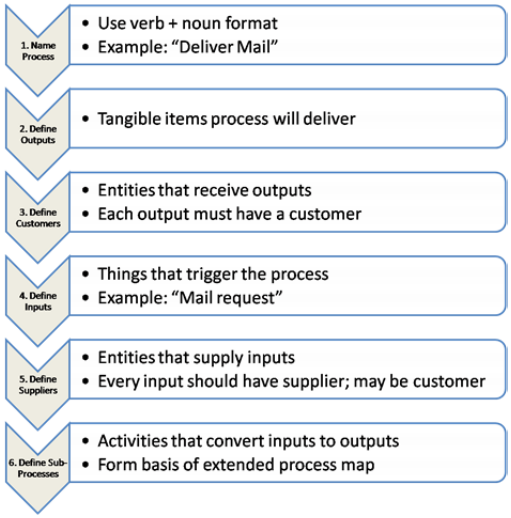
flowchart or Value-Stream Map (VSM) is drawn. The flow chart below in **Figure 2** illustrates the six-step process for developing a SIPOC.

Figure 2. Six-step process for developing a SIPOC.



A completed SIPOC can be used to establish metrics for each input and output. Metrics are often missing from completed SIPOC's but are critical for aligning expectations and modifying behaviors between suppliers, business recipients, and customers. SIPOC metrics may take many forms and address different stakeholders' needs and requirements, including:

- Input Metrics: Input metrics are captured at individual process steps and are used to gauge the quality of an input to the process. If input metrics are unmet, this can serve as a warning sign that the outputs of a process will also fall below expectations.
- Critical to Quality (CTQ) or Output Metrics: CTQ or output metrics are what the recipient or customer of a process expects to receive from a product or service. CTQ or output metrics may be written in qualitative or quantitative form.
- Outcome Metrics: Outcome metrics are used by an organization to understand whether the process met the quality expectations of an end-user or customer. They are "lagging indicators" of a process in that data is usually collected after a product or service has been delivered.
- Senior Management Metrics: Senior management may require top-level metrics to gauge the overall health of a significant business process. Top-level metrics can be aggregated from the other three metric forms above and compiled into a single data point. It is important that whichever metrics used provide perspective for all stakeholders including suppliers, process business owners, and customers.

An example of a complete SIPOC is shown in **Exhibit 2**.

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Value Stream Map

A Value Stream Map (VSM) is the most in-depth type of process map and extremely valuable for identifying value-added activities and showing various categories of waste and inefficiencies. It is a powerful visualization tool used to convey both the process activities and opportunities for eliminating wastes. An example of a complete Value Stream Map is shown in **Exhibit 3**. There are three key differences between a VSM and the three aforementioned process maps. First, it defines the *value* of each step as constructed from the customer's point-of view. Second, the map shows the information links used to plan and control the flow activities in producing a product or service. VSMs most often focus on identifying opportunities for improvement in cycle time or customer lead time. A VSM is a valuable tool for use with the following:

- Establishing quantitative baselines for planning improvements;
- Illustrating the flow of materials and information currently being utilized to bring a product or service to a customer;
- Visually representing every process in the material and information flow using standard industry symbols and common language; and
- Showing how a process or system currently functions.

All VSMs share some common features:

- Legend: Details who, what, where, and why.
- Kaizen Bursts: Captures ideas on waste and inefficiency opportunities.
- Timeline of process steps: Quantifies how long each step takes in the process, including time between steps;
- Identifies whether a step is value added (VA), non-valued added (NVA), or necessary non-value added (nNVA) (see definitions above).

Once an accurate Current State Map is developed, VSM participants can begin to focus on identifying and eliminating waste or non-valued added activities. NVA activities can be categorized into these seven types of waste (remember the acronym TIMWOOD):

1. Transport waste
2. Inventory waste
3. Motion waste
4. Waiting waste
5. Overproduction waste
6. Overprocessing waste
7. Defects waste

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The development of a Current State VSM, followed by a Future State Map has the same factors for success as the Process Flowchart Map and Swim Lane Flowchart Map. Ultimately, all functional areas that are part of a specific material flow must be included in any VSM exercise. There must be leadership buy-in and support to ensure that the Current State mapping does not suffer from poor support and that the Future State mapping can be implemented as designed.

Developing a VSM is similar in preparation to other process maps in that the time commitment is usually significant. As a rule of thumb, large manufacturing companies commit anywhere from one to two days to conduct VSM workshops. VSMs must also separate a process owner from the VSM facilitator. While a process owner is ultimately accountable for the success of a VSM exercise, an independent facilitator should be responsible for leading the session. An independent facilitator helps to confirm that all functional areas have a voice at the table. As a last piece of advice, remember that VSM workshops are most valuable when parties can “see” the process. Therefore, as with other process mapping tools, you are encouraged to include gemba walks at the beginning of each VSM exercise.

Conclusion

Process Flowchart Maps come in many forms, from the flowchart useful for comprehension and understanding to the Value Stream Map, valuable for quantifying and prioritizing waste elimination opportunities. Regardless of which type of process map you utilize, remember that it is a tool to help build a clearer high-level understanding of processes or the details of subprocesses. Process mapping exercises are successful when all participating entities are clear regarding the purpose and scope, committed to an accurate and shared representation of the Current State, and motivated to implement actions necessary for turning an improved Future State Map into reality.

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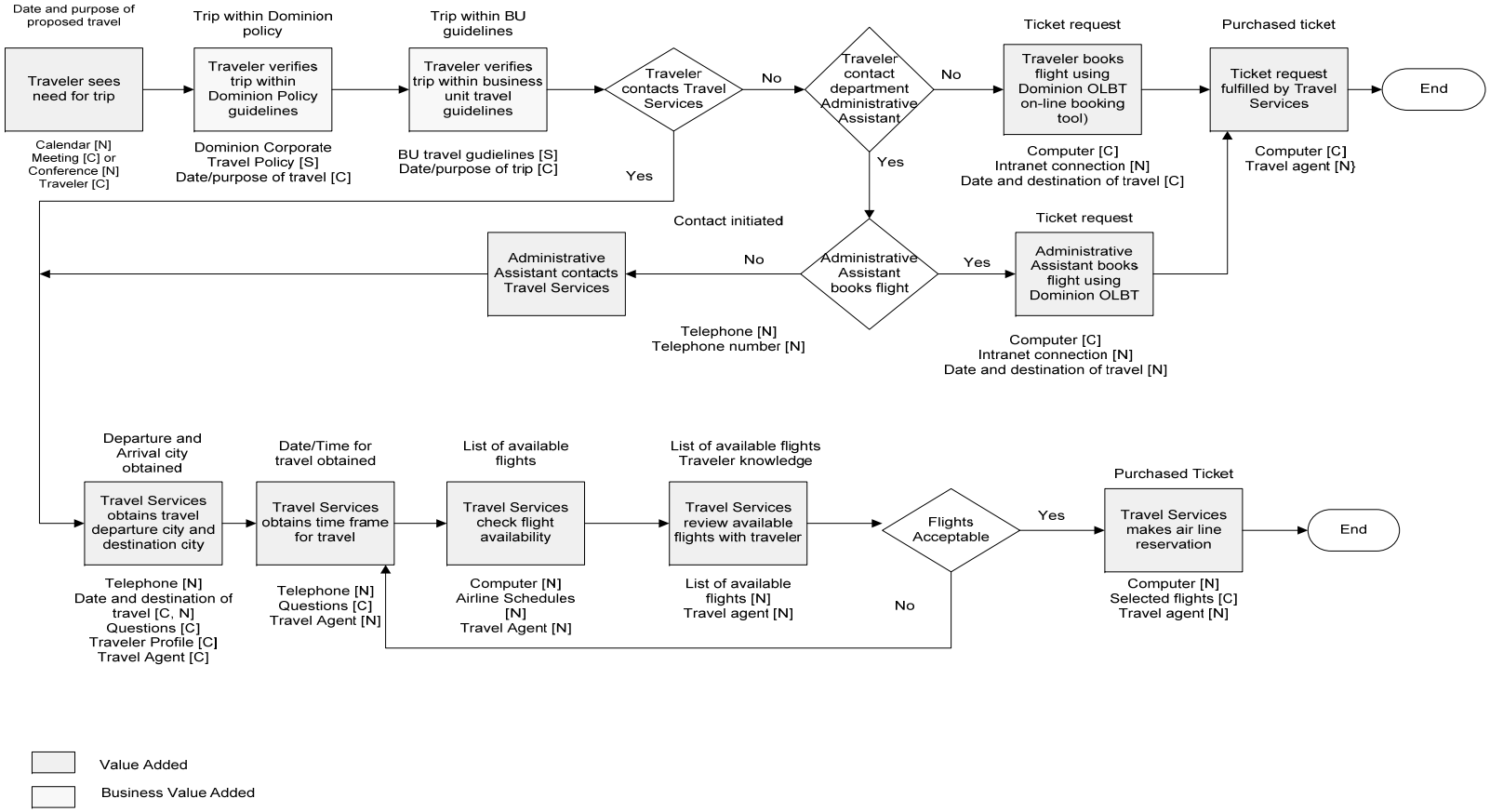
Exhibit 1

BUSINESS PROCESS MAPPING

Process Flowchart Map for Purchasing a Ticket



Data source: Property of Dominion Resources, Inc., Travel and Corporate Services; used with permission.

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Exhibit 2

BUSINESS PROCESS MAPPING

Suppliers-Inputs-Process-Outputs-Customers (SIPOC) Tool

Suppliers	Inputs	Process		Outputs	Customers	
(Providers of the required resources)	(Resources required by the process)	(Top-level description of the activity)		(Deliverables from the process)	(Anyone who receives a deliverable from the process)	
		Requirements			Requirements	
			Traveler needs airline ticket			
Dominion employee	Phone/e-mail/Intranet	Ability to communicate		Purchased airline ticket	Low impact on employee personal time	Dominion employee (traveler)
	Calendar	Destination and dates of travel			Reasonable fare	
					Preferred departure city	
					No long layovers	
					Obtain seating requested	
					Less than 2 connections	
					E-ticket	
ABC Travel Co. (contractor)	Travel profile	Requirements of traveler	Commercial airline ticket purchase			
	Questions	Knowledge of travel destination, dates, and times				
Commercial airline	Air travel schedules	Updated		Booked air reservation	E-ticket	Commercial airline
Dominion	Employee travel policy	Guidelines address air travel requirements		Purchased airline ticket	Minimum ticket cost	Dominion
						Low impact on employee work/life
						Within policy guidelines
						Low probability of ticket being rebooked
				Ticket purchased		

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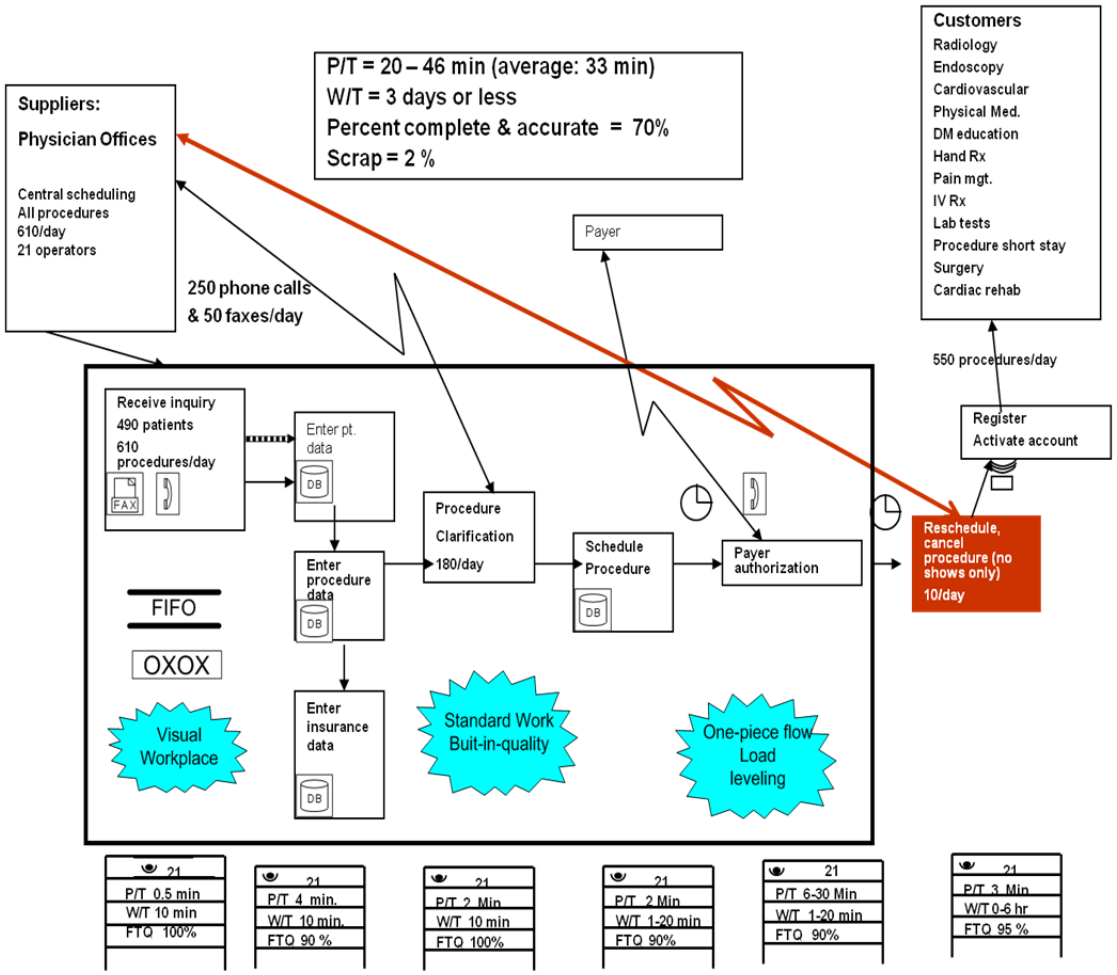
Exhibit 3

BUSINESS PROCESS MAPPING

Value Stream Map Detailing the Process Associated with Hospital Procedure Scheduling.



Data source: University of Michigan, http://sitemaker.umich.edu/jbilli/files/value_stream_maps_in _healthcare.ppt.

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