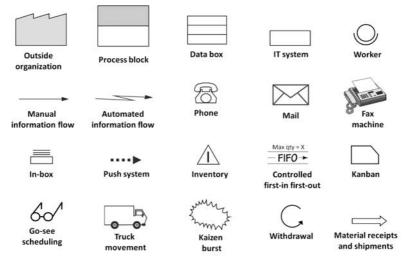
APPENDIX A Value Stream Mapping Icons

The icons that are often used in office and service value stream maps are depicted in Figure A.1. Remember that a value stream map is a storyboard designed to visually reflect the current state and an improved future state. In creating maps to reflect work flow within your organization, you may find a need to complement this set of icons with your own standardized icons. Value stream mapping icons should be intuitive and unambiguous representations that enable quick and deep understanding by all parties who will be viewing the maps. Use whatever icons best represent how work and information could or should move through your value streams.

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FIGURE A.1	Common	value	stream	mapping	icons



Here are brief descriptions of each icon shown:

- Outside organization. Outside organizations are external customers, external suppliers, and outside third parties to whom you outsource activities within the value stream.
- Process block. The process block houses a concise, highlevel description of each process in the value stream in verb-plus-noun format and the name of the function that performs the process.
- Data box. The data box contains process-specific information such as process time (PT), lead time (LT), and percent complete and accurate (%C&A). It can also include additional information specific to the process, such as batch size or frequency, percent effectiveness, and other barriers to flow. The data box is placed directly below the corresponding process block.
- IT system. The name of each application or system that is used to support the value stream is identified within this icon—one icon per system. IT systems are connected to process blocks or other IT systems with the appropriate information flow icon.
- Worker. The worker icon symbolizes an aerial view of a person sitting in a chair and is used to note the number of workers who perform that specific process within the value stream. The icon is typically placed in the lower portion of the process block it represents.
- Manual information flow. The straight-arrow icon illustrates the flow of information from people to IT systems, and from IT systems to people. The arrowhead indicates the direction of information flow.
- Automated information flow. The "lightning bolt" arrow illustrates the automated flow of information flow between

IT systems, or between IT systems and people. The arrowhead indicates the direction of information flow.

- Phone, Mail, Fax machine. These icons are used to specify how information is relayed. The envelope can be used for either electronic or postal mail communication. Other communication icons could include lips or a mouth for verbal communication, a stick figure for walking information to another area, and various symbols for instant messaging, intranet, classified communication systems, and so forth.
- *In-box.* The in-box is used to depict work-in-process, and includes work that is waiting to be worked on, is in the process of being worked on, or has been completed but hasn't been passed to the next process in the value stream. The quantity of work present observed during mapping is written below the icon. Some organizations prefer to use a triangular inventory icon for this purpose, described below.
- Push system. The push arrow is used to depict when work is being passed from one process to the next, without regard for whether the downstream process is available or has the capacity to work on it.
- Inventory. The inventory icon represents physical items or work-in-process that is queued at each process block. The quantity observed during mapping is written below the icon.
- *FIFO controlled first-in first-out*. A type of pull system where the maximum quantity of work that can queue before a process is established in order to manage overproduction and control throughput times. This maximum quantity is indicated above the FIFO lane icon. When that maximum is reached, the upstream supplying process is signaled to discontinue passing additional work until the work quantity in the queue is less than the maximum quantity allowed.

When the queue becomes full, a temporary reallocation of resources is often needed to assist in relieving the bottleneck.

- *Kanban*. A type of pull system where the downstream process authorizes (via some sort of signal) the upstream process to replenish what has been consumed (e.g., physical inventory, queued work, and so on).
- Go-see scheduling. A type of reactive scheduling system characterized by nonstandard human monitoring. As a result of this monitoring, adjustments to work prioritization are made.
- Truck movement. A variety of icons, such as trucks, cars, trains, airplanes, ships, and so on, can be used to show how work is physically transported. The frequency of movement is typically noted within or below the icon.
- *Kaizen burst.* These irregularly shaped "starbursts" contain the macro-level improvement activities required to transform the value stream from the current state to the value stream vision. As the improvements are made, the kaizen bursts should be highlighted, crossed off, or removed from the future state map to show the real-time status of the transformation.
- Withdrawal. The withdrawal arrow depicts a condition whereby a downstream process pulls material or work from an upstream "supermarket."
- Material receipts and shipments. The hollow arrow depicts the movement of physical material, such as raw material, parts, reagents, finished goods, and so forth.

Appendix B Outpatient Imaging Services Value Stream

Improving the outpatient imaging value stream was selected as a demonstration project for a hospital that was just beginning its Lean journey. This value stream was selected for the hospital's first experience with value stream mapping for several reasons: (1) the hospital was facing increased competition from a new neighboring imaging center and had lost market share; (2) the referring physicians had been complaining about excessive turnaround times for receiving reports; and (3) the department had experienced high technologist turnover for the previous two years.

As the charter was being created, it became obvious that the mapping team needed to narrow its scope, so the team decided to focus on its highest volume and highest margin service at the time: CT scans. The mapping activity was held on three consecutive days and included the following team members: vice president, operations; director, imaging; manager, imaging; director, scheduling and preregistration; manager, admissions and patient experience; director, finance; office manager for one of the highest-volume referring physicians; and one radiologist.

The gemba walk was powerful. None of the team members knew how the full value stream operated, and several team members

noticed problems in the way the department was physically arranged and the overall appearance of the patient care areas. Discussing value stream performance with the technicians began to shine a light on the issues that contributed to low morale and high turnover. The team also noted other problems such as extended patient wait times, out-of-stock supplies, and delays in report transcription and approvals. On the plus side, the team was impressed with the way the administrative and clinical staff interfaced with patients and the care with which the expensive capital equipment was maintained. Including the voice of one of the key customers on the mapping team proved highly beneficial in defining customer value.

By the end of the first day, the current state value stream map was complete (Figure B.1) and the mapping team was both unified and clear about its future state mission. You'll notice that the Rolled %C&A is the product of the individual %C&As for all process blocks, whereas the Total LT and Total PT are the sums of the individual LTs and PTs for process blocks 5 through 11. The team made this choice because quality at the first process block (referring physician) was a key contributor to poor patient satisfaction and excessive rework by hospital staff, whereas the time in blocks 1 through 4 didn't contribute to poor value stream performance. In this nonurgent outpatient environment, patients often request appointments at a convenient time rather than the first available appointment window. We didn't want to skew the total lead time when the customers (patients) themselves were requesting the delay. The same is true on the future state map.

The future state value stream design phase included a number of "spirited discussions" (as they often do), but once the team members reached consensus on the countermeasures they felt would improve the value stream and created the future state map (Figure B.2), they were eager to begin making improvement. Table B.1 shows the cur-

rent state and projected future state summary metrics. With the exception of one kaizen burst (implementing voice recognition technology to eliminate the need for a third party to transcribe dictated reports into written form), the future state map was fully realized within five months. The improvements were designed, tested, refined, and implemented through a series of four kaizen events, two projects, and one just-do-it.

One of the biggest aha's as a result of current state mapping was the number of redundant and disconnected IT systems and applications that were supporting the value stream. This revelation led the hospital to shift budget dollars and rearrange capital expenditure priorities to accelerate its conversion to a more comprehensive enterprise solution. Another aha was the degree to which the referring providers were contributing to patient dissatisfaction and delays because 35 percent of the time patients arrived unprepared and/or without a proper physician order. The third largest surprise was the degree to which a cumbersome IT log-on problem caused the radiologists to batch report review and approvals. During one of the follow-on kaizen events to design, test, refine, and implement improvements, the IT team member fixed the years-long log-on problem in a matter of 35 minutes, thrilling the radiologists and cutting a full day from the overall lead time.

This value stream improvement effort led to a stronger partnership between the hospital and its referring providers, resulted in an improved patient experience, reduced frustration for the imaging staff, and improved satisfaction among the referring providers. Due to improved morale, the hospital experienced no technologist turnovers in the 12 months following the completion of the value stream improvement activity.

Improvements in the examination portion of the value stream also created the capacity for the hospital to earn an additional \$500,000

in annual revenue without adding equipment or staff. *This is a significant result and one that most organizations fail to fully appreciate*. The freed capacity that was created by shaving *only two minutes* from the time it takes a technologist to conduct a CT scan created the ability for the hospital to perform one additional CT scan per technologist per day. In this five-day-per-week outpatient operation, that gain created the ability for the hospital to earn the additional \$500,000. This is an excellent example of how seemingly minor improvements add up.

FIGURE B.1 Current state value stream map for outpatient imaging

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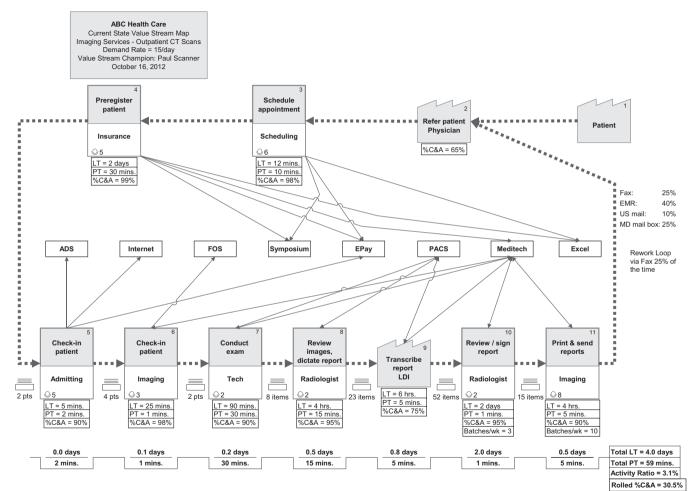
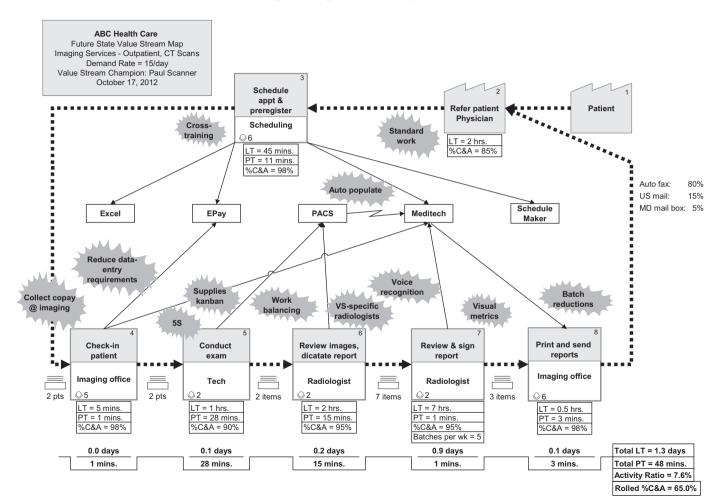


FIGURE B.2 Future state value stream map for outpatient imaging

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Metric	Current State	Projected Future State	Projected % Improvement
Total Lead Time	4.0 days	1.3 days	67.5%
Total Process Time	59 minutes	48 minutes	18.6%
Activity Ratio	3.1%	7.6%	145.2%
Rolled % Complete & Accurate	30.5%	65.0%	113.1%

TABLE B.1 Current state value stream map for outpatient imaging

APPENDIX C Purchasing Value Stream

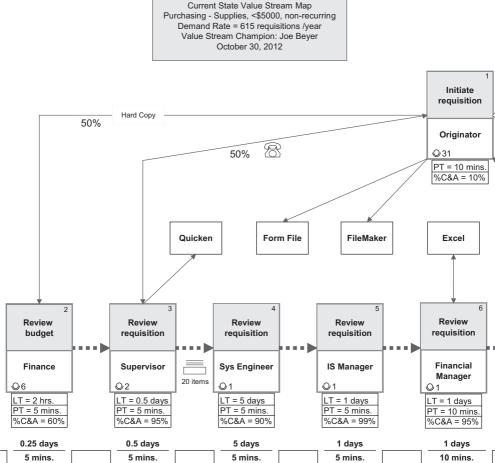
Figures C.1 and C.2 and Table C.1 illustrate the use of value stream mapping to improve a support value stream. In this case, the leadership team with responsibility for engineering design had been receiving many complaints from their staff about how long it was taking to receive the equipment and supplies they needed to design sophisticated electronics for their external customers.

During the initial meeting with the client, value stream mapping was selected over process mapping because it presented a better means for visualizing the significant delays between handoffs and it would help generate alignment among a fractured leadership team. Attempting to map all possible types of purchases didn't seem prudent, so the leadership team opted to map the following conditions: nonrecurring supplies purchases that cost \$5,000 or less.

Through rethinking who needed to approve and process the purchase requisitions, eliminating the use of unnecessary software applications, shifting who entered the requisitions into the system, dedicating business unit-specific purchasing agents, and standardizing the work, the team was able to cut the delivery time in half and free managers' time for more meaningful and higher priority tasks, without introducing significant risk into the process.

FIGURE C.1 Current state value stream map for supplies purchasing

ABC Aerospace



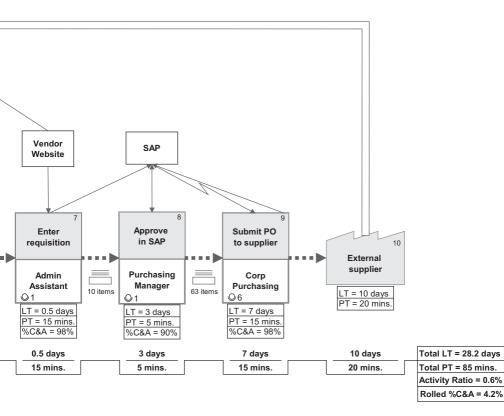


FIGURE C.2 Future state value stream map for supplies purchasing

ABC Aerospace Future State Value Stream Map Purchasing - Supplies, <\$5000, non-recurring Demand Rate = 615 requisitions/year Value Stream Champion: Joe Beyer October 31, 2012 Enter requisition in SAP Provide SAP Originator access ©31 PT = 30 mins. Integrate Form File Use budget in & FileMaker %C&A = 85% place of Quicken Vendor Requisition FileMaker SAP Website checklist Standard work Dedicated buyers 3 Cross-Review Approve Submit PO to training requisition in SAP supplier External supplier Supervisor Dept Manager Corp Purchasing LT = 10 days **0**6 2 items ©2 3 items Q1 3 items PT = 20 mins. LT = 0.5 daysLT = 6 hours LT = 1 days PT = 20 mins. PT = 5 mins. PT = 5 mins. %C&A = 95% %C&A = 98% %C&A = 98%

0.5 days	0.75 days	1 days	10 days	Total LT = 12.3 days
5 mins.	5 mins.	20 mins.	20 mins.	Total PT = 50 mins.
				Activity Ratio = 0.9%
				Rolled %C&A = 77.6%

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Metric	Current State	Projected Future State	Projected % Improvement
Total Lead Time	28.2 days	12.3 days	56.4%
Total Process Time	85 minutes	50 minutes	41.2%
Activity Ratio	0.6%	0.9%	50.0%
Rolled % Complete & Accurate	4.2%	77.6%	1,747.6%

TABLE C.1 Performance metrics for supplies purchasing value stream

APPENDIX D Repair Services Value Stream

The value stream mapping activity shown in Figures D.1 and D.2 and Table D.1 was a kickoff to a company-wide Lean transformation. The company had two customer-facing value streams repair and installation—and decided to begin with the one that was the higher margin service, was experiencing the greatest growth, and involved the greatest number of employees: repair services.

The improvement efforts around this value stream break from what many would believe is traditional Lean thinking. First, the mapping team decided to centralize dispatch—at least for the short term—to get its arms around dispatching-related problems, leverage technology, standardize the process, and efficiently gain the intel it needed to assess technician skills and design a career track skills development program. Many believe that decentralization represents Lean thinking, but not always. You have to consider the full picture and consider the target condition before making that decision.

The future state map also illustrates a case in which *adding* inventory made sense (compare the frequency of visiting a parts store at process block 7 in the current and future state maps). Many people who are new to Lean automatically assume inventory should always be reduced. But not when it interferes with providing customer value. This client's customer calls are nearly always emergency situations, so taking an additional 90 minutes to pick up a needed part or an additional day for special orders eroded customer trust and risked market share losses.

Notice that the projected activity ratio is *lower* in the future state. This is an example where, because the process time reduction percentage was greater than the lead time reduction percentage, value stream performance appears to have worsened, but it hasn't. Significant improvements are being made to both the process time and lead time, and that's a good thing!

You may wonder why the lead time for process block 2 is 0.0 on the summary timeline. That's because we selected days as the units of measure and opted to only include one decimal point, which rounds to 0.0.

Another element of this value stream transformation activity that's worth noting—and is reflected on Table D.1—is that, at first glance, the lead time reduction for the value stream isn't all that impressive (10 percent). However, notice that the lead time for the final process block (collections) is 60 days on both the current and future state map. The user-defined metric on Table D.1, "total lead time excluding collections" reflects the fact that invoicing is now occurring 7.1 days earlier, which is 63 percent faster than in the current state and creates a significant improvement in cash flow. This is an example of where segmenting the map and looking at the metrics through different perspectives can be helpful.

Realizing this future state took approximately one year, the longest of any future state cycle either of us has been involved with in recent years. But this was a situation where the COO and CEO were both seasoned Lean leaders and had the experience to keep the team on task while they were simultaneously developing the workforce, introducing supporting Lean practices, and developing a continuous improvement culture. If your leadership isn't as seasoned, we recommend shorter value stream improvement cycles.

Appendix D (continued on next page)

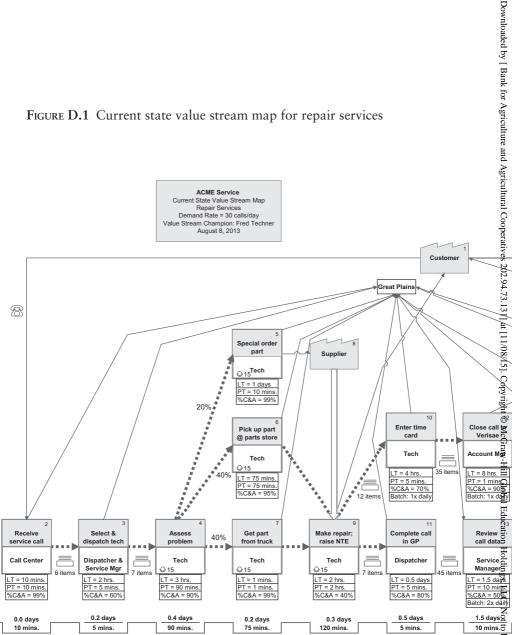


FIGURE D.1 Current state value stream map for repair services

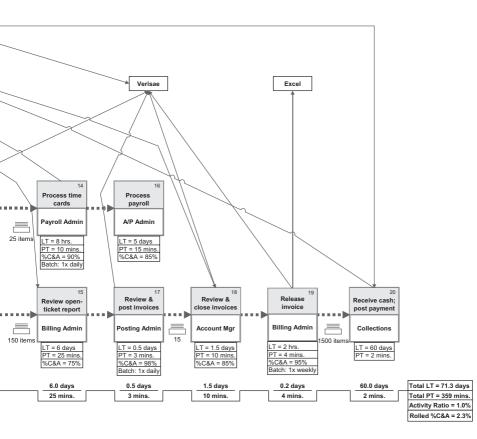
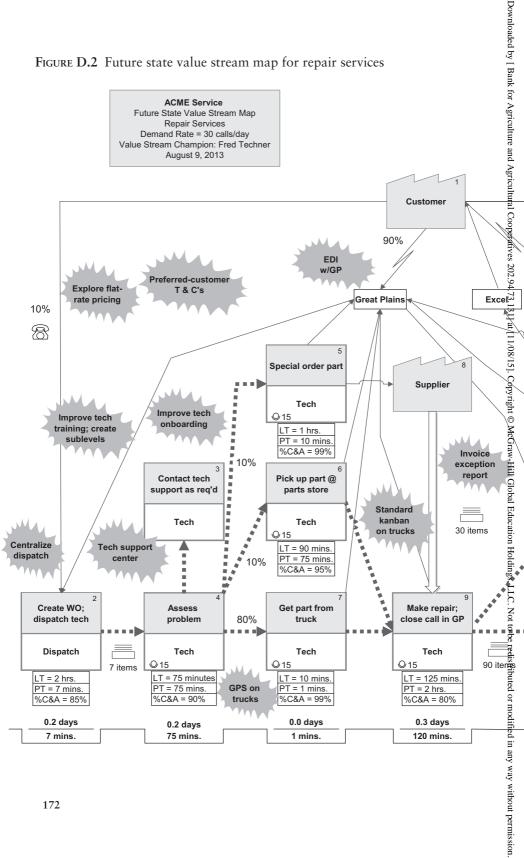
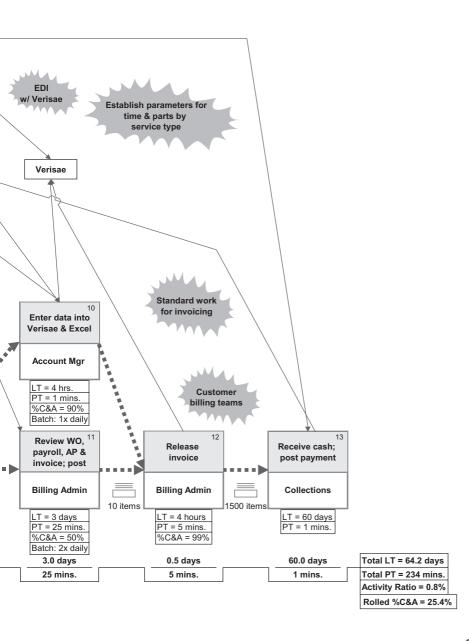


FIGURE D.2 Future state value stream map for repair services







Metric	Current State	Projected Future State	Projected % Improvement
Total Lead Time	71.3 days	64.2 days	10.0%
Total Lead Time Excluding Collections	11.3 days	4.2 days	62.8%
Total Process Time	359 minutes	234 minutes	34.8%
Activity Ratio	1.0%	0.8%	-20.0%
Rolled % Complete & Accurate	2.3%	25.4%	1004.4%

TABLE D.1 Performance metrics for repair services value stream

APPENDIX E Shelving Systems Value Stream

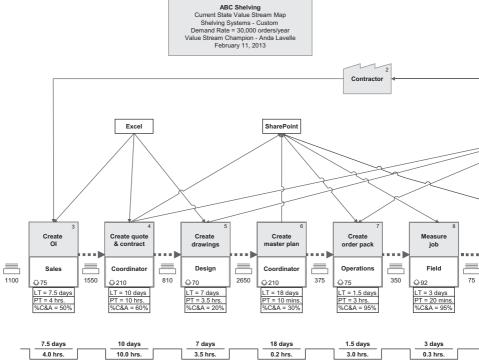
The impetus for the value stream mapping activity shown in Figures E.1 and E.2 and Table E.1 was twofold. First, the client wanted to learn what value streams and value stream mapping were all about. While it had been on the Lean journey for several years, it had only experimented with a few of the tactical tools and wanted to explore the fuller benefits that deploying the broader set of Lean principles and practices offered. Second, its competition was starting to deliver higher quality more quickly and at lower cost, and this organization wanted to keep its position as the top shelving supplier.

One of the biggest aha's during current state mapping was the discovery that it had been taking the company an average of 17.5 business days (a little over three weeks!) to generate a quote, which was 23 percent of the total lead time and 29 percent of the quote to final inspection lead time which excludes the billing process.

Note the incredible improvement in Rolled %C&A—from 0.1 percent to 31.6 percent. This is an apt reflection of the power of service level agreements and standard work.

In addition, it was able to eliminate eight hours of non-valueadding hands-on work (process time). While this may not seem significant for a large value stream, given its volumes, this translates into 240,000 freed hours per year, which is the equivalent of 123 FTEs. As the construction industry began to rebound from the recession and the client once again experienced growing demand, this freed capacity reduced the need to increase staffing that would have otherwise been necessary.





Also, by more fully utilizing its Oracle ERP system, the client was able to discontinue using an application, which saved \$250,000 annually in licensing expenses. This type of discovery would likely be missed if the organization had relied solely on process-level mapping.

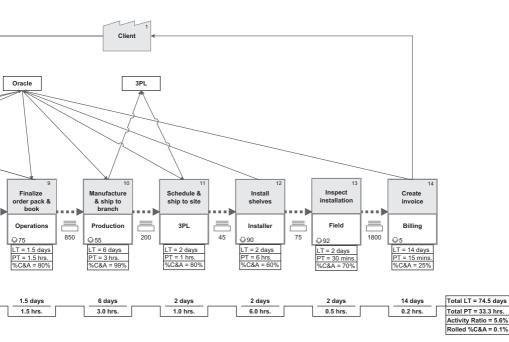
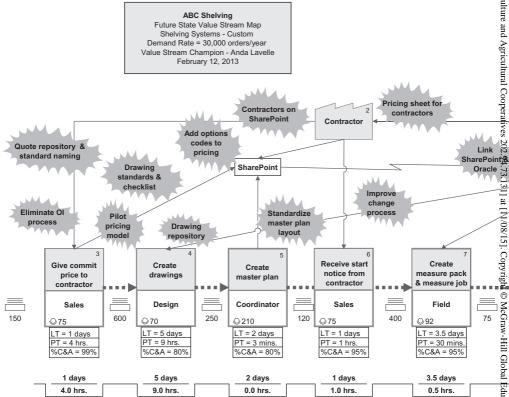
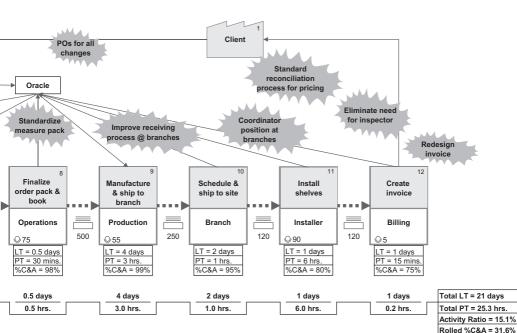


FIGURE E.2 Future state value stream map for custom shelving systems





Metric	Current State	Projected Future State	Projected % Improvement
Total Lead Time	74.5 days	21 days	71.8%
Total Process Time	33.3 hours	25.3 hours	24.0%
Activity Ratio	5.6%	15.1%	169.6%
Rolled % Complete & Accurate	0.1%	31.6%	31,500.0%

TABLE E.1 Value stream performance metrics for custom shelving systems

APPENDIX F Software Development Change Request Value Stream

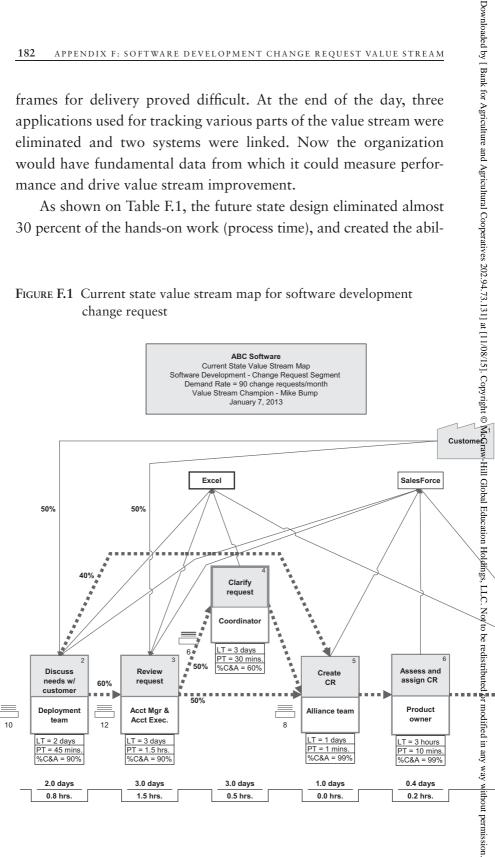
This example demonstrates the use of value stream mapping to improve a segment of a larger value stream. The value stream mapping activity shown in Figures F.1 and F.2 and Table F.1 was a demonstration project at a software firm that was interested in broadening its Agile development work to include enterprise-wide Lean management practices. The mapping team included the vice president of sales, director of account management, director of operations, marketing manager, director of product management, and two scrum masters.

During the three-day mapping activity, the team had numerous discussions about the role of software testing, customer involvement and responsibility, striking the right balance of iterations, and how "minimal" a minimally viable product should be. Another philosophical discussion centered on redefining how and when sales, account management, and technical teams interfaced directly with the customer. A third major discussion centered on the practice of "grooming" the backlog versus eliminating the backlog.

One of the largest current state discoveries was that the organization had no easy way to track customer requests from order to receipt. As a result, understanding customer demand and the time frames for delivery proved difficult. At the end of the day, three applications used for tracking various parts of the value stream were eliminated and two systems were linked. Now the organization would have fundamental data from which it could measure performance and drive value stream improvement.

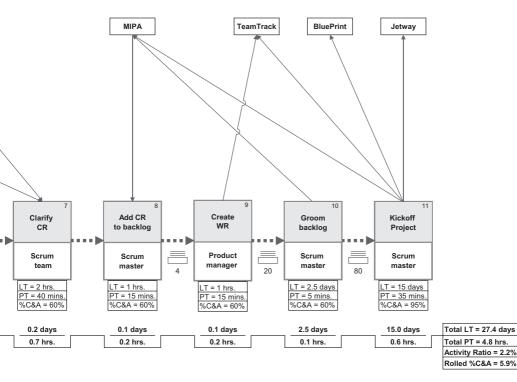
As shown on Table F.1, the future state design eliminated almost 30 percent of the hands-on work (process time), and created the abil-

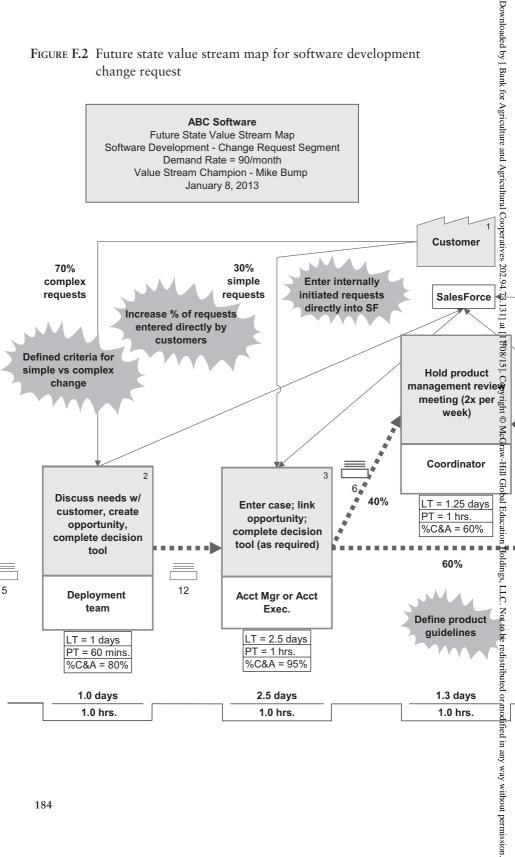
FIGURE F.1 Current state value stream map for software development change request

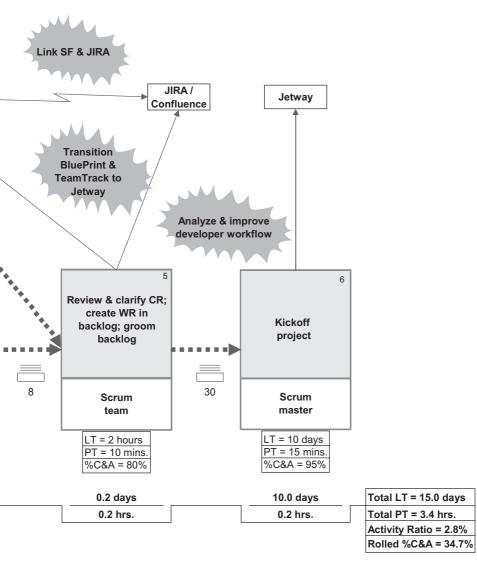


ity for the firm to deliver completed software projects in half the time, with far higher quality and stronger relationships between the functions that make up the value stream.

As with any value stream, there's still more work to be done. This company is currently in stabilization mode and will begin its second round of value stream improvement shortly after this book goes to press.







Metric	Current State	Projected Future State	Projected % Improvement
Total Lead Time	27.4 days	15.0 days	45.3%
Total Process Time	4.8 hours	3.4 hours	29.2%
Activity Ratio	2.2%	2.8%	27.3%
Rolled % Complete & Accurate	5.9%	34.7%	488.1%

 TABLE F.1 Value stream performance for metrics software development change request

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