

What is Extended Value-Stream Mapping?

An extended value stream is simply all of the actions—both value-creating and wasteful—required to bring a product from raw materials into the arms of the customer. The relevant actions to be mapped consist of two flows: (a) orders traveling upstream from the customer (or from the sales department when forecasts substitute for confirmed orders) and (b) products coming down the value stream from raw materials to customer. Together these constitute a closed circuit of demand and response.

Value-stream mapping is the simple process of directly observing the flows of information and materials as they now occur, summarizing them visually, and then envisioning a future state with much better performance.

Maps of the extended value stream can be drawn for products currently in production or for future products being planned. The only difference is that the “current state” map for a product in production shows conditions as they exist today while the “current state” map for a new product shows the “business as usual” approach to making the product compared with alternative “future states” and “ideal states” with less waste and greater responsiveness.

Selecting a Product Family

The whole point of value-stream mapping is to disaggregate operational issues to the level of specific products, where they can be more easily acted on by managers. To do this you need to start at the furthest point downstream (toward the customer) to be mapped and to define product families at that point. Typically a product family will include a group of product variants passing through similar processing steps and using common equipment just prior to shipment to the customer. For example:

- In a power tools business, a product family might be medium-sized electric drills utilizing a common chassis and passing through a common assembly cell as the last manufacturing step, even though the finished product has many different features and customer labels. Alternatively the mapping team might define the product family as the motor going into the medium drills and map back upstream from that point.
- In the auto industry, a product family might be a car platform (e.g., Ford Explorer and Mercury Mountaineer) produced in an assembly plant. Alternatively it might be a major component supplied to auto assemblers—let’s say an alternator—using a common design architecture and assembled in a cell, but with varying power outputs and with different attachment points for different vehicles.

Where Should I Start?

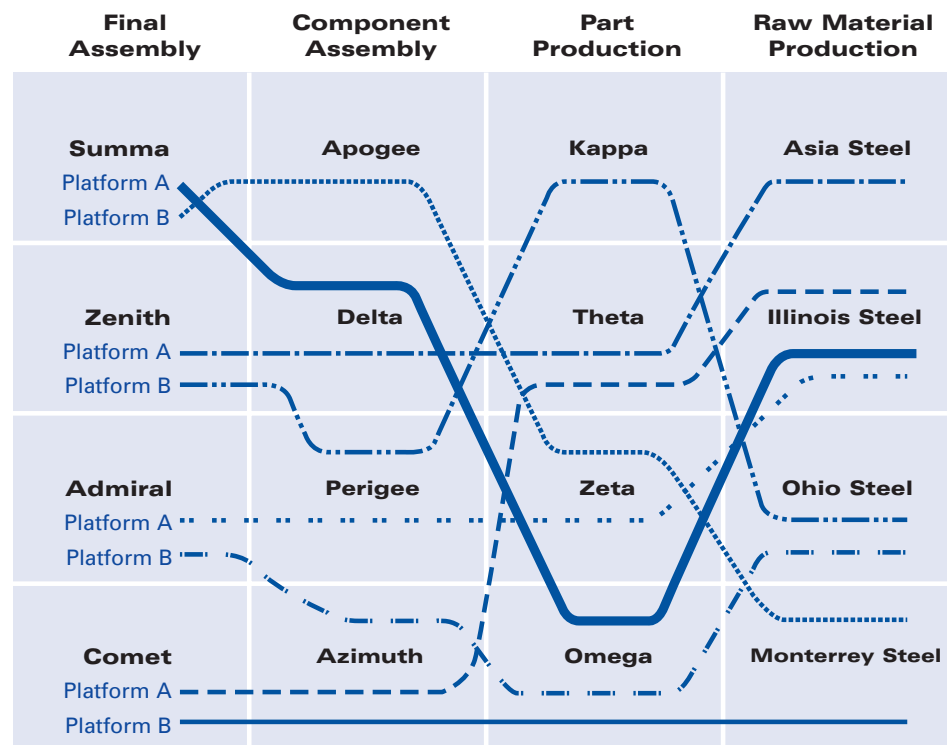
Because products not yet in production seem easier and cheaper to rethink than products already in production, we often hear that extended or macro-mapping should focus on new products. And it is certainly an excellent idea to create “business as usual” and alternative “future state” and “ideal state” maps for every new product family as a core part of the product development process.

However, we do worry that concentrating on ideal states for products entering production at some point in the future will remove the pressure to improve stagnant value streams for current products that will continue in production for years to come. It’s our belief that organizations truly committed to value-stream thinking will tackle both their existing value streams for current products and those envisioned for new products.

- In the aerospace industry, a product family might be an entire airframe (e.g., the Boeing 737 or Airbus A320). Alternatively, it might be a major sub-assembly (for example, the vertical tail). The sub-assembly may have many variants for different buyers of the completed aircraft. For example the tail structure might incorporate different aerals and fairings for navigation and communication equipment. And the products within the family chosen for mapping might differ slightly in dimensions. For example, the basic tail design might be slightly longer for use on a stretched airframe. However, the vertical tail clearly constitutes a product family because all variants follow the same manufacturing path and have no commonality with tails for other aircraft, even if they are made in other areas of the same facilities by the same firm utilizing parts from the same suppliers.

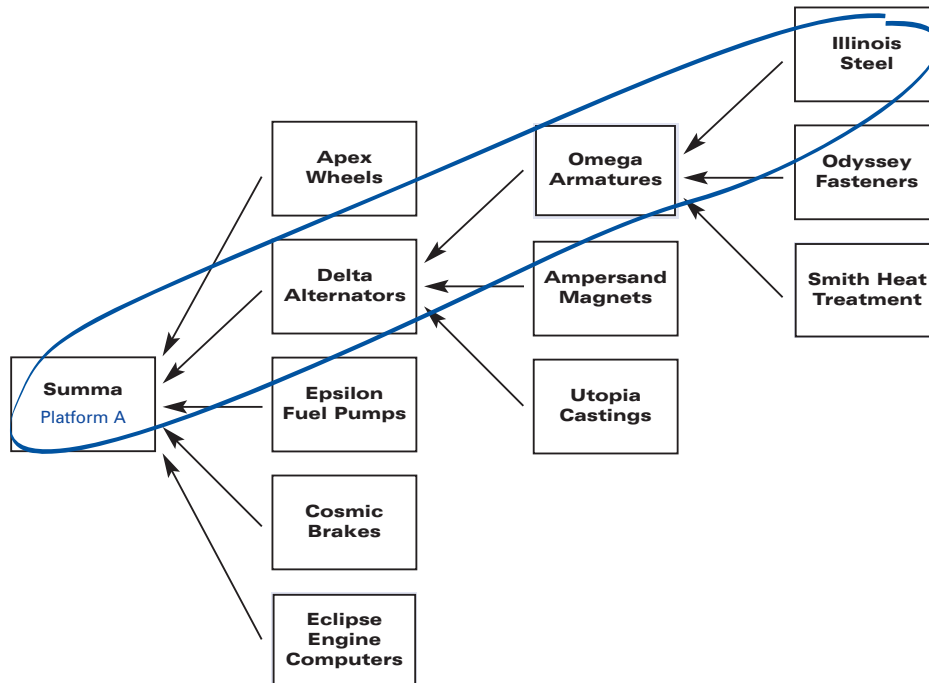
Note that the same product family may be supplied to a number of different end customers and have cosmetic differences causing the casual observer to overlook product commonality. Nevertheless from the standpoint of the firm or facility at the downstream end of the map, the product is clearly a family.

Note also from the chart below that firms along similar value streams often have complex relations with each other. Delta supplies similar components to both Summa and Zenith; Omega fabricates similar parts for Delta and Azimuth; and Illinois Steel supplies materials to Theta and Zeta as well as Omega. Extended mapping cuts through this clutter to focus on just one stream in order to think of improvements that can eventually apply to all streams.



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Product Families from Summa's Perspective



Because the product family is defined from the vantage point of the final step mapped, the concept is essentially “fractal.” That is, you can define product families from many starting points and map backward up value streams of varying lengths. For example, what appears to be a product family for an armature manufacturer (large armatures for alternators) is simply one of many component parts for an alternator producer (who might define a product family as large alternators). And the large alternator is just one component among many from the standpoint of the auto assembler who defines product families in terms of vehicle platforms.

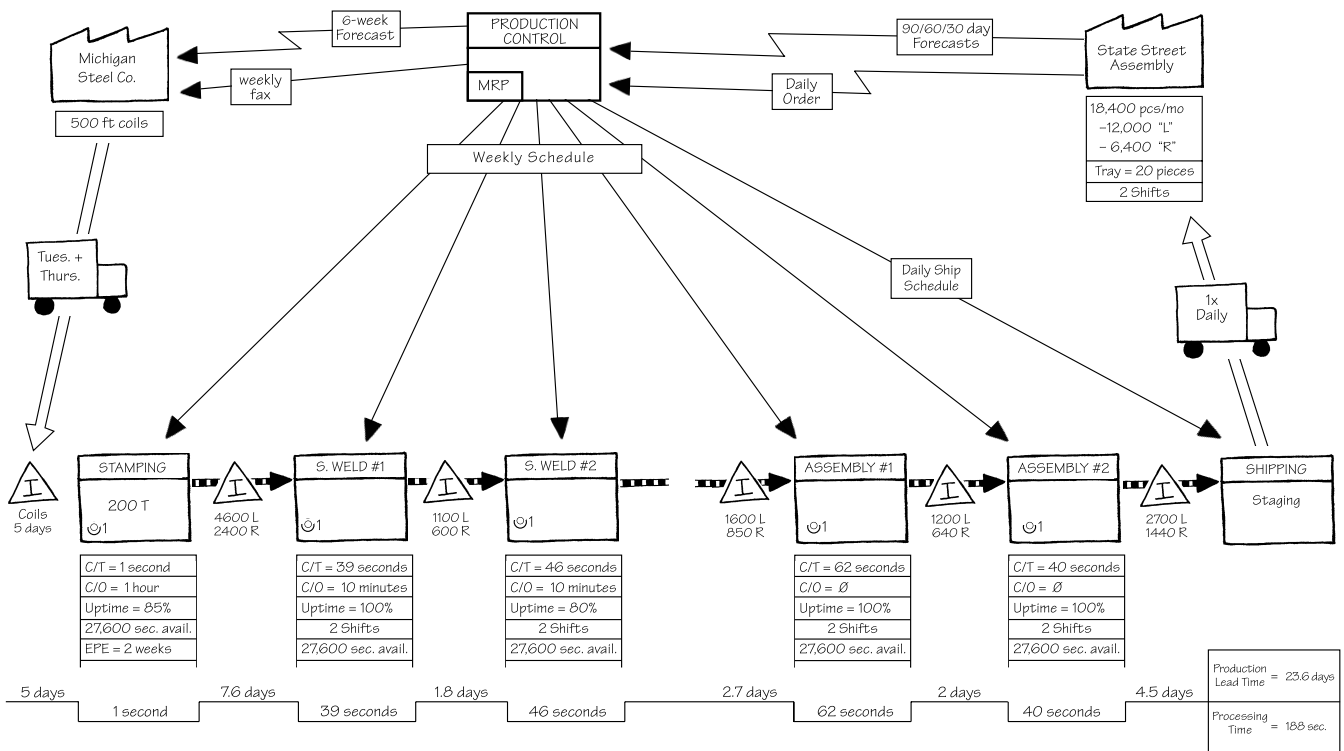
As you select your start point and move back upstream, it is best for your first map to follow the path of a single family and a single component in the product. *This is because the first objective of extended mapping is to achieve a breakthrough in shared consciousness of waste and to identify systematic opportunities for eliminating the waste.* It is highly likely that the wastes identified by following one component back upstream will occur in roughly equal measure in every component going into the finished product. The alternative approach of mapping the value stream of every component going into the product is time-consuming and costly and we have found that it overwhelms managers with too much data.

In subsequent rounds of mapping—if the collaborators in the mapping process find ways to work together and achieve useful results—additional maps can be created for many or all of the components and parts going into a finished product. But to get started, keep it simple and focus first on achieving a breakthrough in raising your team’s consciousness!

Determining a Manageable Field of View

The ideal map would truly show the whole. That is, it would start with the end customer who uses or consumes the product. The map would then follow the product all the way up the value stream to molecules in the ground (or in the recycling bin), showing all the wasted actions and information loss en route. However, just as trying to map all of a product's parts back upstream is overwhelming, trying to see too far with your current vision may be fruitless. We advise novice mappers that a lot can be learned by looking one or two facilities and firms upstream from wherever you start. This is the minimum scope of extended mapping.

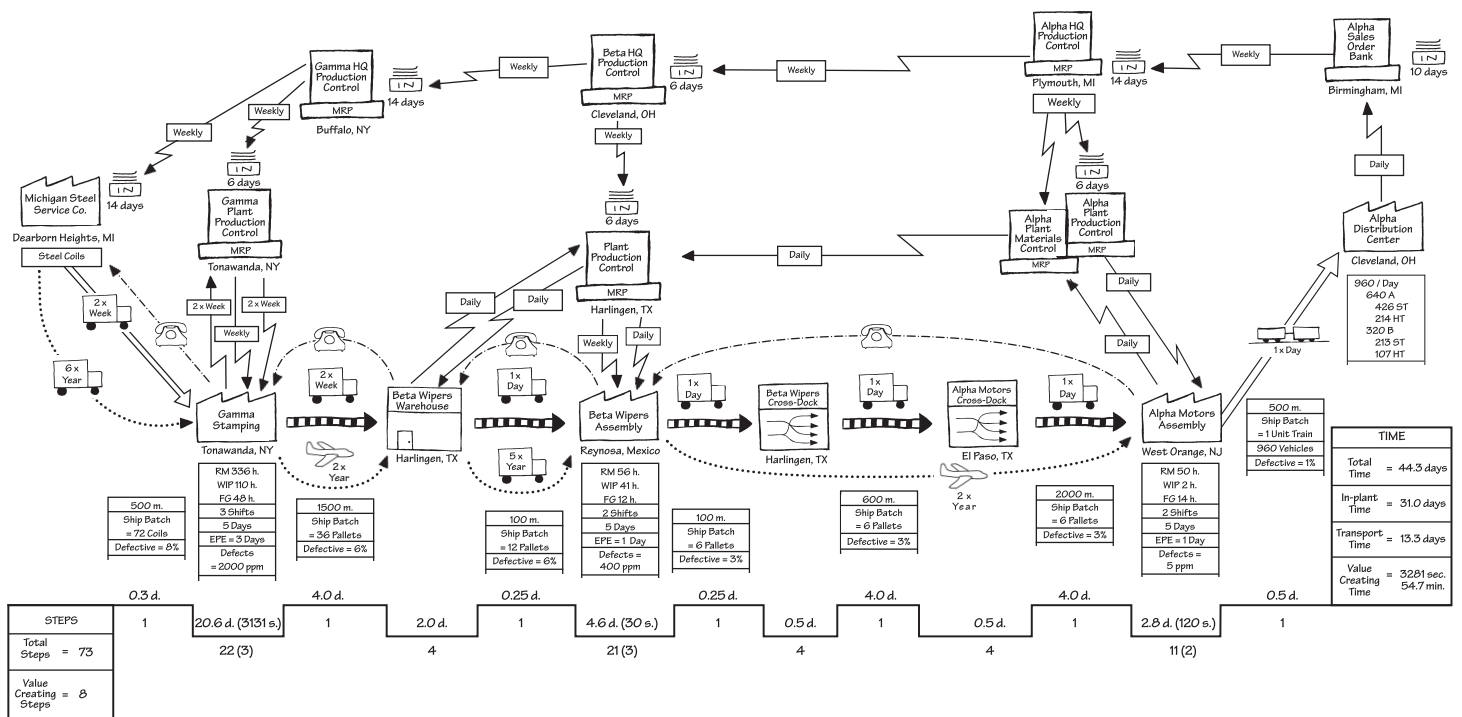
Single Facility Field of View — Learning to See



Even at this minimum scope, note that the scale of maps changes dramatically between *Learning to See* (facility-level maps) and *Seeing the Whole*. The facility boxes that are the primary units of analysis in this breakthrough guide are the same size as the individual process boxes (“stamping,” “welding,” “assembly”) in *Learning to See*. Vast expanses of people and equipment within facilities have been shrunk into tiny boxes so we can see the big picture!

In this guide, we will draw maps with an intermediate field of view, starting at the distribution center for the completed product and proceeding upstream to raw materials (e.g., rolls of steel). For those with more ambition and with full cooperation from upstream facilities and firms, it is both possible and desirable to start near the end customer and work far back upstream toward raw materials.

Multiple Facilities Field of View — *Seeing the Whole*



Choosing a Leader and a Value-Stream Team

We hope that you are experienced with facility-level mapping as described in *Learning to See* and have appointed value-stream managers for all of the value streams within your facilities. We are convinced that this is critical to gain the full benefit of mapping at the facility level. What's more, the knowledge of facility-level value-stream managers will be invaluable for quickly drawing accurate maps of the extended value stream.

However, by their nature, extended maps cross facilities and firms. Suppose managers are in place for the segments of the stream within each facility. Who has the responsibility for directly managing the total stream across firms, to connect the maps and lead the improvement process? The reality in most cases will be “no one.” So there is a need for a new type of manager who we will call the “Product Line Manager” (PLM).

The Product Line Manager

This individual in the most downstream firm needs to be much more than a technician concerned with one facility. Indeed, for optimal results the Product Line Manager needs to be a business manager. This means “business” in the sense of taking responsibility for making money and growing market share with the product family in question. And it means “manager” in the sense of looking concretely at the precise actions that need to be taken all along the value stream to remove waste and cost while improving quality and responsiveness.

The most successful firms we have encountered using these techniques have PLMs who think about product marketing and engineering as well as production and purchasing. With all the elements of marketing, design, production, and supply chain under his or her oversight, this individual is in a unique position to judge the performance of the many functions touching the product. Indeed, as we will see in a moment, a continuing assessment of functional performance along with precise prescriptions for improvement is one of the most important benefits of product line management.

However, we do not usually recommend what is sometimes called a “product team” structure in which all of the engineering, operations, purchasing, and marketing employees supporting the product are put on a dedicated team. Doing this causes a large amount of organizational disruption during the transition and this structure still does not address the behavior of upstream partner firms. What's more, it is really not necessary in most cases if the PLM takes an energetic approach to the job.



Perhaps the best known example of what we are talking about in the manufacturing world today is the Chief Engineer for a car platform at Toyota (a job position also called the *shusa*). This individual is widely known by everyone in the company and takes responsibility for the success of the product in terms of return on investment and market share. Yet the Chief Engineer, like our proposed PLM, actually has no direct authority over marketing (which is done by a large marketing department), over engineering (which is done by the various parts of the large engineering department), over production (which is done by the operations department), and over suppliers (who are managed by the purchasing department, and the production control and logistics department.) Instead the Chief Engineer, working with a tiny group of assistants, is the one person who can “see the whole” and think about the necessary contributions from every functional activity and every upstream firm to create and deliver a successful product as judged by the end customer.

The PLM in the most downstream firm will be even more effective if there are similar individuals in each of the upstream firms so that for any product a quick evaluation can be conducted by a small group composed of one PLM per firm.

But this is not likely to be the case. Indeed, in today’s world very few firms have true PLMs. (One of our concerns in preparing this breakthrough guide has been that the very managers most able to benefit from it don’t currently exist in many firms!) Thus to get started, someone from one of the functional areas in the most downstream firm will probably need to take the lead and aim to achieve a breakthrough in consciousness. This individual probably will have little formal authority for overseeing the value stream and will therefore need to lead by example and by raising hopes about possible joint gains.

We can’t guarantee that anyone anywhere along a value stream can succeed in raising every participant’s consciousness to transform the entire stream. We can guarantee that anyone anywhere can raise the important issues and make constructive change a possibility where it was previously impossible ... if they have the courage to act.

Anyone Can Start Anywhere

One of our most surprising experiences in developing this breakthrough guide was encountering the general manager of a supplier firm who had read *Learning to See* and then approached his OEM customers and his upstream suppliers proposing to jointly map their shared value streams.

Needless to say, the customers were a bit surprised at first because suppliers are rarely proactive about anything but selling their latest products. And the suppliers were surprised because they had previously only heard from this firm in the context of price negotiations. A proposal to jointly discuss the process of value creation was totally unexpected.

Nevertheless several customers and suppliers accepted the challenge. By jointly evaluating several sample streams they soon learned that the OEMs, the supplier, and the supplier’s suppliers were working at cross purposes on information management and conducting many activities in the wrong place at the wrong scale with a large cost penalty. Thus an effort by one firm mid-way along the value stream to raise consciousness caused all of the parties to think in new and more productive ways.

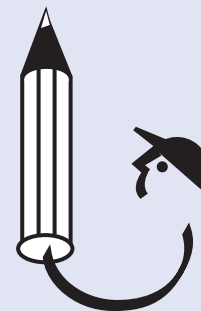
To be successful, the mapping leader needs to be someone who can gain the respect of upstream partners by conducting a rigorous and fair process. Logical candidates are from purchasing, production control, logistics, operations, or a process improvement function like quality or process engineering. Any of these can work. However, assigning a buyer from purchasing to be a mapping leader can lead to problems if upstream participants believe that the real purpose of mapping will be to uncover waste at suppliers, followed by demands for immediate price reductions. Thus a purchasing function will probably need to assign mapping leadership to someone from its supplier development group if all participants are to be convinced that the process is fair, balanced, and aimed at win-win-win outcomes.

The value-stream team needs to include representatives of all the firms and facilities that share ownership and management of the stream. Ideally, it would also include the relevant departments within each firm—sales, operations, production control and logistics, purchasing, manufacturing engineering, information management, and product engineering. However, this can make the team too large to walk the value stream together, which is often a critical learning experience. Thus we generally recommend a small team with a minimum of one representative per company. The team can query the functions supporting the value stream as necessary to fill in missing information.

The Wrong Role for Consultants and Staffs

An understandable inclination in any firm with busy line managers—and this surely includes practically all firms—is to delegate the task of creating value-stream maps to outside consultants or to internal staff groups, typically in operations planning or process improvement departments. However, in our experience this is misguided. The findings of the consultant or staff expert are rarely credible to the managers who need to take action and the consciousness raising experience of walking the value stream together—discovering the waste and jointly agreeing to a cross-firm action plan—simply never happens. A beautiful report is produced by the consultant or staff team—and in our experience the beauty and precision of the maps is generally inversely proportional to their usefulness—but the findings are then filed away and soon forgotten.

Remember: Only managers taking clear responsibility can fix the mess. So the same managers ought to draw the maps.



Taking a Walk

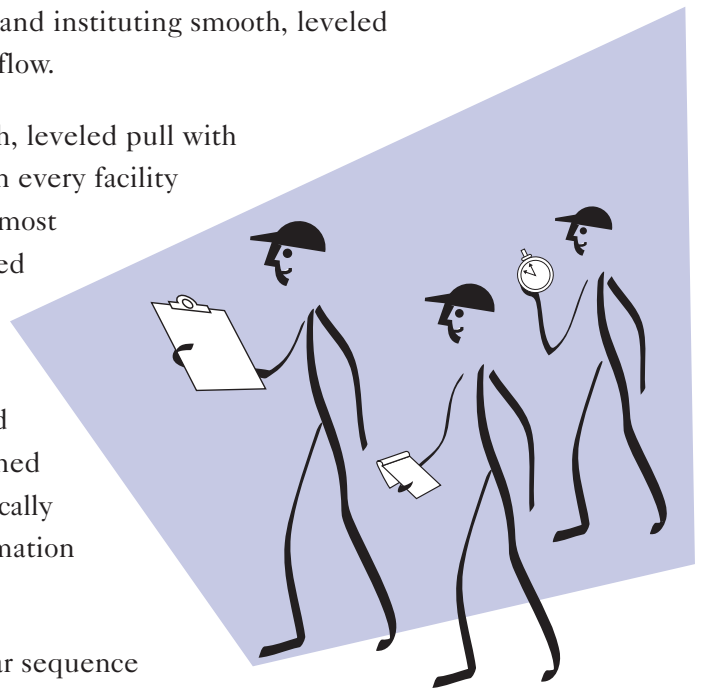
Once designated, the leader and the team need to take a walk together along the value stream, draw the current-state map, and then ask, “Which steps create value?, Which steps are waste?, Why is order flow so erratic?, Why is quality so erratic?, Why are deliveries so erratic?, How can value be enhanced for the end-customer?”

Once the map is drawn so that the current state of an existing value stream is known precisely, it’s time to create the first of two “future state” maps that remove wasted steps while stabilizing processes and simplifying information flows. Future State 1 achieves the future state shown in *Learning to See* within each facility touching the product. This means introducing continuous flow (as described in *Creating Continuous Flow*) wherever possible and instituting smooth, leveled pull between the areas of continuous flow.

Future State 2 then introduces smooth, leveled pull with frequent replenishment loops between every facility touching the product. In the process, most warehouses are eliminated, or converted to cross dock operations.

An Ideal State may then co-locate at one site all of the activities required to proceed from raw materials to finished goods, in the process eliminating practically all transport links and needs for information management.

You may or may not find this particular sequence appropriate for your own value streams. In particular, if you are mapping a new value stream for an entirely new product you will probably want to skip directly from the current (business-as-usual) state to an ideal state. We follow the three-step sequence, beginning with Future State 1, in this breakthrough guide because we believe that this is likely to be the most typical approach.



Two Final Benefits

A Diagnostic for Functions

As teams draw their current-state value-stream maps, they are likely to make a surprising discovery. Most problems identified along the value stream will trace directly to the performance of various functions—information technology, production control, logistics, product engineering, operations, purchasing. What’s more, weaknesses in functional performance discovered in the sample value stream will almost certainly be present in every other value stream the firms touch. In our experience, the functions want to support the value stream for each product. But they have a hard time seeing the connection between their activities and the needs of the product.

Thus an important benefit of the mapping process—in addition to a breakthrough in consciousness about the magnitude of waste and the enormous opportunities for improvement—can be to give much clearer guidance to each function about its role in supporting value streams. *A real bonus can be achieved if the improved functional performance can then be applied to all value streams within the participating firms.*

A Diagnostic for Relations Between Firms

As teams start mapping, they are likely to make yet another discovery. Today we all use language stressing partnership and cooperation between firms sharing value streams. However, mapping teams in most cases will discover an enormous gap between these high-level principles of collaboration and the day-to-day reality down at the level of each value stream. If the value-stream map shows widespread confusion and counter-productive actions between firms at the value-stream level, it will be obvious that “partnership” at the top isn’t translating into competitiveness at the bottom.

Fortunately, value-stream mapping provides a clear and consistent language for firms to start an intelligent conversation with each other about the root causes of their shared cost, quality, reliability, responsiveness, and communications problems. (Indeed, we believe a relentless, fine-grained focus on improving each value stream, rather than high-level agreement on principles, is what has given Toyota its edge in creating the world’s leanest supply base.) *A real bonus can be achieved if the practical lessons of shared value-stream management can then be applied by each firm to its relations with its other customers and suppliers.*