

## Forum Paper

# Creating value: a sufficient way to eliminate waste in lean design and lean production

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### Abstract

*Waste elimination* is a by-product of lean process, lean design and lean production management. Viewing it as the *raison d'être*, focus or purpose for lean is itself wasteful.

The paper shows how an alternative purpose—*creating value* for customers and end users—is likely to result in more effective waste elimination *and* lead to more satisfied customers.

The second part of the paper outlines the creative process as described by Robert Fritz, views Last Planner® as a creative process, draws some lessons from that viewpoint and then examines the waste reduction processes inherent within the Last Planner System.

**Keywords:** waste elimination, value, creative process, Last Planner.

### Introduction

Following the subtitle of Womak and Jones *Lean Thinking: Banish waste and create wealth in your corporation* (2003, 1996) and the first word in the book—*Muda*—many authors, advertisers and academics have focussed on the waste elimination benefits of making a lean transformation.

Womak and Jones' purpose was to communicate an idea and to do that they needed to sell their book. That sub-title gets your attention. They retain your attention in the book with a continuing focus on waste (and on making money). Just because it sold and continues to sell their book, workshops and lean interventions; just because managers and organisations, owners, clients, designers and constructors want to cut waste and make a fortune, doesn't mean that focusing on waste elimination is the best way to do their purpose and generate wealth.

As Womak and Jones suggest (1996, 29) in their first lean principle, the purpose of an organisation is to create and deliver *value* to customers and end users. Value is

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defined as *a capability defined by the customer/end user and provided to them at the right time and cost* (1966, 311)<sup>2</sup>.

As Ballard *et al* note: *Products have value only to the extent that they can be used to fulfil purposes. A product may be said to be more valuable either if it allows greater fulfilment of purpose or fulfils purpose at less cost. A product that does not fulfil purpose has no value regardless of its cost. The cost of products is what must be sacrificed in exchange for their use and can be divided between cost to acquire and cost to use.* (2001, 2)

What construction owners/clients want is somewhere for people to learn, live, play, work, shop—or whatever the capability/end-use/purpose of the new or refurbished structure is.

Waste is anything that creates no value for the owner/client/end-user. Notice that **waste is defined in terms of value**. We can only know waste by knowing value first. Thus, in theory at least, there is no absolute definition of waste, it is all relative.

There are many general categories of waste. For example, Taiichi Ohno's seven wastes: overproduction, waiting, transportation, processing, inventory, movement, making defective products (1988, 19-20)—subsequently other activities have been suggested: behavioral waste - human behaviors that add no value and can be eliminated (Bob Emiliani<sup>3</sup>), complexity<sup>4</sup>, dangerous working practices (Toyota), excess information, (Robert Hall quoted in Schonberger 2001, 72), figuring what to do or how to do it, (Laraia 1999, 180), making do (Koskella 2004), not speaking, not listening (Macomber & Howell 2004), not taking advantage of people's thoughts (wasting good ideas) (Donald Dinero quoted in Macomber & Howell 2004); not using people's talents, under-using people's skills and capabilities, (Suzaki 1987, 208; 1993, 140), providing something that the customer doesn't value<sup>5</sup>.

But even Ohno's wastes are not absolutes. Some overproduction has value, as when a process is not yet capable of switching between products virtually instantly and yet customers want instant delivery - overproduction creates a temporarily necessary buffer; many customers value transportation to their door even though they may not value transportation between work stations in the factory.



**Figure 1: Deming's chain reaction. If you start by reducing cost, quality goes down, followed by productivity—and costs then go up. Try to improve productivity first and you generally have to throw money at the situation.**

Just as Deming's Chain Reaction shows (1986, 3; Figure 1) that focussing on quality is the only way to consistently both reduce cost and improve productivity, this paper will show that the only way to reduce waste *and* create wealth is to focus

<sup>2</sup> The discussion of value in Wandahl and Bejder (2003) and Barshan et al (2004, 434) covers a wider range of definitions than are used in this paper including social, moral and ethical *values*. These may influence an individual or organisation in their choice about what *utility/capability* they want, but are not relevant to the specification of what they do want. This paper uses *value* in only the Womak and Jones sense.

<sup>3</sup> <http://www.theclbm.com/faq.html> 22 Sep 04

<sup>4</sup> attributed to Womak and Jones on [http://www.dur.ac.uk/agility/howdoi\\_utilisations.html](http://www.dur.ac.uk/agility/howdoi_utilisations.html) 16 Sep 04

<sup>5</sup> Womak and Jones quoted on [http://halmacomber.com/jammin/2004\\_05\\_16\\_archive.html](http://halmacomber.com/jammin/2004_05_16_archive.html) 16 Sep 04

on that value, that quality, which the customer, the end-user, wants and is willing to pay for.

While waste elimination is a by-product of lean operations in design, construction, manufacturing and service, it is not, in the sense used here, the purpose of an enterprise. Delivering *value* is.

Waste is a problem. It *is* something designers, constructors and clients want to eliminate because it creates no value for the customer and yet it is a cost to them. Producing waste is not the purpose of people in design, construction, manufacturing, FM or service.

If we focus on waste elimination, rather than the value that customers seek, we run the risk that we will throw the baby out with the bathwater - eliminate something that generally creates no value for customers, but sometimes does.

Eliminating apparent waste in a sub-process can optimise that sub-process but at the expense of sub-optimising the project as a whole.

So setting out to eliminate waste *per se* from a project or an organisation in isolation from the *value* purpose of the project or organisation is potentially wasteful:

1. Waste is defined in relation to value. Every customer's value requirement is unique so what is waste for one can be value for another.
2. Focusing on waste elimination (instead of value) draws attention away from the core purpose of any economic activity in both the public and private sectors—*creating value* for a chosen group of customers/end users.
3. As the waste elimination cycle (Figure 2, next section) demonstrates, attempts are likely to fail.

By planning from the future, for example with a reverse phase schedule, only those activities that create value for the end-user or enables subsequent trades to create value for end-users/clients/owners are included.

## Problem solving vs Creating

25 years ago Robert Fritz drew a clear distinction between *fixing problems* and *creating* what you want (Technologies for Creating® 1979-1990). These distinctions are summarised in the following table:

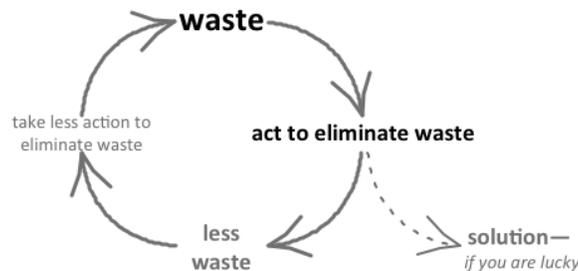
The key difference between creating and problem fixing is the motivation. The former is driven by desire for something you want to exist for its own sake and in its own right. The latter is driven by the intensity of the situation that needs sorting out or getting away from - e.g. too much material on site. There are times when it is appropriate to *problem fix* [such as when you have a puncture in the dumper or materials have not arrived when needed], but what most organisations want are results, i.e. value delivered.

When focusing on waste, attention is on what you *don't* want so it is easy to lose sight of value – what the customer or end-user wants. Even so the waste will reduce. As waste is reduced, so the motivation to continue eliminating it tends to fall, particularly when there are more demanding problems or wastes emerging. As attention shifts to these more pressing problems, the initial waste you tried to eliminate can re-emerge.

**Table 1: distinction between fixing problems and creating results**

key differences	<b>Create</b> (or bring into being) something that has not existed before.	<b>Problem Fix</b> <sup>6</sup> - move away from, try to fix or eliminate something unwanted.
direction	<i>towards</i> what you do want	<i>away from</i> what you don't want
focus	future <i>and</i> current reality	past or present
motive	<i>desire</i> for end result	<i>problem intensity</i>
action	pro-active	reactive, responsive, circumstantial.

The waste elimination cycle (Figure 2) illustrates why, when focussed on waste elimination, it is easy to get into an oscillation in which the amount of waste increases and decreases. We see this pattern very clearly on sites. One trade falls behind, pressure is put on and it catches up. Pressure is then reduced as attention shifts to another trade that is now even more behind and the first trade lets things slip again, whereupon pressure increases again .... Only the more trivial examples of waste are likely to be eliminated altogether using this approach.



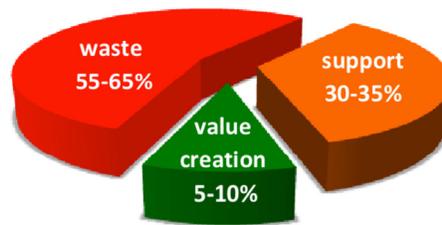
**Figure 2: waste elimination cycle**

By contrast, focusing on the value you want to create and systematically creating it is inherently more rewarding and more effective. You deliver value and waste is eliminated (or perhaps not even created) in the process.

If seeking value leads to reduction of waste, why, some ask, does reducing waste not lead to the creation of value? There are many ways to reduce CO<sub>2</sub> emissions from motor-cars. One way is to stop people using them. If you did that CO<sub>2</sub> production would decline dramatically, but the value of the motor-car to the user would tend to zero as for most of us what we value in a motor-car is not the car itself but *mobility*. Only by focussing on mobility *and* sustainability together will manufacturers arrive at a vehicle that reduces harmful emissions at a reasonable cost while providing mobility.

There is lots of waste in construction. A link exists between waste on a project and project cost but the link between value and waste is not clear. It is, in theory, possible to produce all value and no waste and it is certainly possible to produce the desired value and lots of waste as well—that is how construction is generally done now—estimates of the amount of waste start at around 55% as shown in Figure 3.

<sup>6</sup> Some people with a mathematical, engineering, architectural or design background may use the term problem solving to include *design and mathematical problems*. In Fritz's terminology these are *creations*.

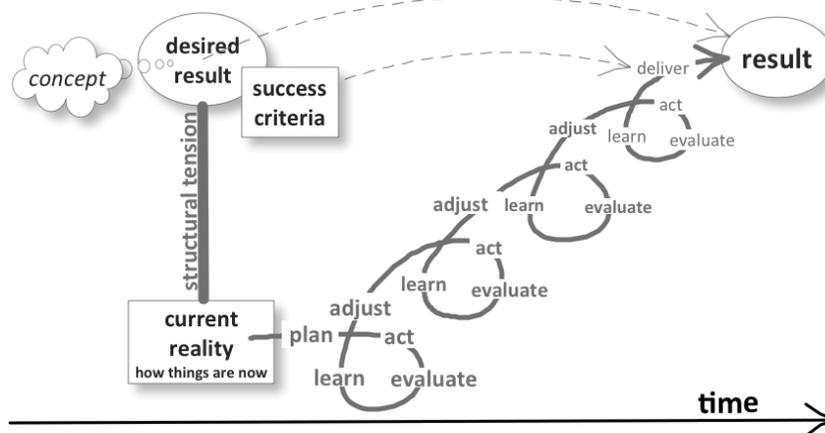


**Figure 3: proportion of construction effort creating value (5-10%), supporting value creation (30-35%) and wasted (55-65%) - much of the activity that supports value creation is logistics.** (sources: Construction Industry Institute; Cameron Orr, AWD personal communication with author; Constructing Excellence (forthcoming) review of the decade since Egan)

## The creative process

In addition to describing the key differences between Creating and Problem Solving, Fritz has provided a description of the creative process (Figure 4). Derived from observation of creative people (Fritz trained as a composer), Fritz asserts that this is the same process used by creators of the calibre of Mozart, Beethoven and Spielberg.

The Last Planner System is an unwitting manifestation of this creative process. I will now outline that process and then show how LPS maps on to it.



**Figure 4: the creative process**

As in design and construction, Fritz’s creative process begins with the result (design, building, structure, paper, etc.) you or your client **wants** to create. An integral part of clarifying the end-result is establishing the *critical success factors*<sup>7</sup> and making a personal or team commitment to it<sup>8</sup>.

One of Fritz’s requirements for a good end-result is that, if it involves a named other person or party, they must sign-up to it with you. If they are not willing participants there is every likelihood that they will prevent you from getting what you want. Saying “I want to be married” is very different from saying “I want to be married to Pat”, particularly if Pat has designs on someone else. To paraphrase Eldridge Cleaver *If they are not part of the solution, they will be part of the problem.*

<sup>7</sup> or *conditions of satisfaction* (Macomber & Howell 2003)

<sup>8</sup> In Fritz’s process it is important that the end-result does not involve any person who is not personally committed to the result. To do otherwise is to create the conditions for failure. In last Planner the emphasis on ensuring that all partners are in a position to say no reflects this (if they don’t feel able to say no you cannot trust their yes).

Step two defines *current reality* in relation to the result. Current reality is defined as *assets relevant to the desired result that already exist and are in your control*. At the start of a project it may be little more than a site, a small amount of cash and a good relationship with your bankers or other backers.

It is important that current reality is described exactly as it is, warts and all. Exaggeration can make the project seem easier than it is and get people to commit who would not otherwise do so. The disaffection engendered will create distrust and work against the result later in the process. Understating the assets to try and propel (manipulate) the team into action can be equally harmful to the project overall and to trust within the project team.

The challenge then is to turn current reality—the way things are now—into what customers/end-users want. It is important to keep project current reality up-to-date as it changes over the creative process.

As Beckhard and Harris' *change equation* (1987, 98), suggests change is only likely where there is:

a vision of a desirable future (= *desired result*),  
dissatisfaction with the way things are now (= *current reality*) and  
knowledge of the first steps to take (= *plan*).

Fritz asserts that we will only agree to an end-result that is aligned with what we want. We will only be motivated to take action when there is sufficient tension (Fritz calls it *structural tension*) between the desired end-result and the way things are now. That *structural tension* provides energy for change provided everyone at least knows how to start. An outline plan (=milestone plan) for how to get from where we are to the result we want, coupled with a detailed plan (= phase plan) for the first step or two, will help release the energy.

There is no point in detailed planning for every step as the route is likely to change as the team *learn* along the way through a systematic application of scientific method—taking action, reviewing the effects of that action, learning from it and then adjusting both current reality and the plan for future action so that we move relentlessly toward the desired end result (= e.g. learning from reasons for late delivery). This Act—Evaluate—Learn—Adjust<sup>9</sup> process continues until the result is complete.

This, in essence, is the creative process described by Fritz.

## Last Planner is a creative process

Last Planner is an example of the creative process. The connections are shown in Table 2 below. Although Fritz described the creative process some years before Ballard and Howell developed LPS, I have no evidence that either was aware of Fritz's work.

I am assuming here that Last Planner and/or Responsibility-based Project Delivery™, an LPS derivative, is used to manage end-to-end design and construction production. In construction we assume that the design is an accurate representation of what the customer wanted shortly before the design was completed. Predictable

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<sup>9</sup> This is similar to the Shewhart cycle: Plan—Do—Check—Act (Deming 1986)

production of a building to a design that doesn't capture the capability that the client seeks is waste—creating what the client *does not* want.

Like the creative process, **Last Planner is a form**, not a formula. There is a form for limericks, haiku and sonatas. We can use the form to classify and as a template for creating examples of the form. We cannot use the form as a formula. We have to think the haiku or sonnet through from first principles every time, just as we do when we work with LPS or the creative process.

**Table 2: table showing mapping between creative process and LPS**

Creative process	Last Planner	A task or activity
<i>End result</i>	Project—the realised building or structure—delivered to the client and/or end user's satisfaction	Completion of the task to the satisfaction of the next trade
<i>Critical success factors</i>	Conditions of satisfaction	Handover requirements
<i>Current reality</i>	MakeReady process	Current constraints/ current status in the production plan
<i>Structural Tension</i>	Can we deliver this project promise on time?	Will we get this done to the satisfaction of the next trade when we have said we would?
<i>Plan</i>	Master milestone programme/schedule Phase programme/schedule MakeReady process Weekly/daily production plan	Method statement Task allocation (in the production plan)
<i>Act</i>	Production	Production
<i>Evaluate</i>	Assess PPC Chart and study reasons for delayed completion	How are we doing relative to the handover requirements and when we said we'd deliver?
<i>Learn</i>	Process improvements to MakeReady and Production Planning processes	How can we do this task more safely, simply, easily
<i>Adjust (the plan)</i>	New Weekly/daily production plan Update MakeReady process Amend Phase programme/schedule if necessary Amend Master milestone programme/schedule if absolutely necessary	Brief adjustments discussed and agreed as we work, in the canteen, involving the crew/gang/team

**The creative process is recursive.** So is Last Planner. The project is a promise, each phase becomes a promise and so does each task or activity. Each phase or task is a creation in its own right. As Fritz says *“the longer term and more complex the scope of the creation, the more structured and formal the process. The shorter the timeframe and scope, the less formal the demands of the process.”* (2003,13)

Some trade foremen run their own production planning meeting with their team immediately prior to the main Production Planning meeting ensuring that they have input from their team to take to the later meeting.

## So what?

What can we learn from thinking of Last Planner as a form, not a formula, as a creative process?

The importance of setting a clear end result and keeping it in view—even if **this means changing it** as the owner/client/end-user requirements or value changes. This applies to the project overall and to tasks within a project - each task can be seen as a creation.

The importance of specifying accurately the conditions of satisfaction/ handover requirements so that it is clear to everyone when the project or task is complete. Clarity of capability required and the criteria that the client/end user is seeking to satisfy<sup>10</sup> will help both designers and constructors deliver that, just as clarity of handover requirements to the decorator will help the plasterer know what surface quality to handover.

The importance of specifying accurately current reality in relation to any result or task—telling it like it is, good or bad, builds trust in and with the whole team. As Gerry Chick from BAA told a meeting in London<sup>11</sup>, “*Bad news provides good information. Bad news early is even better.*” Last Planner enables bad news to surface quickly before it becomes a major issue. It can also provide signals of immanent bad news that may enable the team to head it off.

Its recursive nature—and the smaller the work chunks (& batches) the more relaxed we can be with the form.

If a phase or a task involves another person or party, they must sign-up to the promise with you. If they don't, they have the power to derail it. As Gunde Odgaard pointed out recently<sup>12</sup> *only workers [operatives] create value for end-users* so it is vital that they are involved in planning the work. Drawing on his experience of Last Planner as a Danish Construction trades union leader, he went on to say “*if staff are brought into the decision-making and planning they will do almost anything.*”

The *plan-act-evaluate-learn-adjust* cycle emphasises the importance of scientific method in the implementation of LPS and implicit in the analysis of past production plans—PPC and reasons for delayed completion. It also involves everyone in continually improving the way the work gets done at the workface (a feature of the Toyota Production System as Spear *et al* have pointed out (1999, 2004)).

Do *first run studies* to establish the safest, simplest, easiest way to do critical, hazardous or oft repeated tasks. Apply the *plan-act-evaluate-learn-adjust* cycle to improve any repetitions.

Over-preparation is wasteful. Any plan is a best guess and is out of date before the ink is dry. This applies to the Master Programme/Schedule, phase programmes, even the weekly work programme. Be clear about the intention; keep the end in mind. Be open to opportunities to work more safely, simply, effectively and easily.

### How is waste elimination implicit in the Last Planner System?

Clarity of end result and conditions of satisfaction/handover requirements helps ensure only that work which is necessary to deliver the result and satisfy the conditions is done.

The Value Stream Analysis implicit in Collaborative Programming/Reverse Phase Scheduling acts as a check for activities that create no value (i.e. Waste).

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<sup>10</sup> There is an ugly but useful NLP phrase—*crieterial equivalent*—which means what is the observable, tangible, sensory characteristic that will tell the client or end-user that an abstract criterion has been met?

<sup>11</sup> Construction Productivity Network meeting 17 September 2003 London on Last Planner. For a copy of the notes: [http://www.ciria.org/acatalog/copy\\_of\\_copy\\_of\\_17\\_September\\_2003\\_\\_E3151\\_.html](http://www.ciria.org/acatalog/copy_of_copy_of_17_September_2003__E3151_.html)

<sup>12</sup> 22 September 2004. Remarks to a seminar—Disconnected Agendas: collaborative working and workforce casualisation in the UK construction industry, Reading UK.

Collaborative Programming/Reverse Phase scheduling uses the *talents* of the whole team and tries to keep things as simple as possible—and no simpler.

The adoption of lean logistics, risk analysis, 5S and other good practices, coupled with MakeReady, will increase quality and reduce the amount of *fire fighting* on a project, further reducing waste. The focus for these activities is the project promise.

MakeReady reduces the waste of *waiting* by ensuring that everything is in place before tasks go into production.

MakeReady and reduced fire fighting means that there is more time to plan tasks. This can help reduce:

- *over-processing* - time to think through the method statements means that we can use the most appropriate tools and equipment;
- *dangerous working practices* and reduce accidents and even absenteeism;
- *defective work*;
- the volume of materials (*inventory*) on site as they can be called up at a justified time;
- the need for *making do*;
- *figuring out what to do or how to do it* because the information and method statement are in place;
- over-ordering.

The Production Planning meeting reduces *waiting* by cutting down on interdependencies and at the same time improves work flow.

The Production Plan reduces the *movement* of operatives on site as they know what they will be doing; lean logistics can help them receive materials when they need them.

The production plan and daily reviews in RbPD reduces rework in the design.

Clarity about the last responsible moment reduces rework and makes space for a more flexible response to changes in client requirements

Analysis of reasons for late delivery helps the team learn from the waste that there will inevitably be, and learn how to reduce that in the future.

Daily stand-up production review meetings with the trade foremen on site ensure that continual evaluation, learning and adjustment goes on to further reduce wasteful actions and to improve the flow of work.

None of these actions are taken with the intention of reducing waste – they are taken to create value. All the above waste elimination happens as a by-product of the value creation process using Last Planner.

## Conclusion

Waste only exists in relation to value. Value is different for each end-user/client/owner. Thus the definition of waste will be different for each. Just as one generation's music is another generation's noise, one owner's value can be another customer's waste. Thus setting out to eliminate waste from a project or an organisation in isolation from the value purpose of the project or organisation is potentially wasteful. It is also a distraction from the main purpose. With the waste

elimination cycle (Figure 2: waste elimination cycle) I showed that, for all but the most trivial examples of waste, the elimination attempt is also likely to fail.

As well as being a production and relationship management tool, I have shown Last Planner is a creative process. It will still be necessary to solve problems, even eliminate waste, but when this happens it will be within the context of and supporting a desired future state, the project promise, the end-result, *value*. I have shown that many elements of the Last Planner process eliminate waste as a by-product so cutting the need for specific waste reduction interventions.

Creating value *and only value* is the best way to reduce waste in design and construction.

## Trademarks

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