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David S. Cochran  
*Indiana University - Purdue University Fort Wayne, cochrand@ipfw.edu*

Rick Sereno  
*Oji Intertech*

Wendell Aldrich  
*Oji Intertech*

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David S. Cochran
Indiana University Purdue University
Fort Wayne (IPFW)

Wendell Aldrich
Oji Intertech, Inc.
North Manchester, IN

Rich Sereno
Oji Intertech, Inc.
North Manchester, IN

Abstract
The purpose of this paper is to provide a systems engineering perspective about the future of Enterprise Engineering that includes the design of the value stream(s) and performance measurement, including lean accounting structure. In the future, it is important that system designers and engineers understand the importance of gaining collective agreement about customer needs, enterprise requirements and the implementation of physical solutions to sustain an enterprise. Enterprise Design is described as an iterative learning-loop process to achieve design requirements through standard work. Examples of the pitfalls of standard costing in both the management and design of systems will be provided, with an emphasis on why the "Lean Accounting Box Score measures" should be aligned with the customer needs and functional requirements of the value stream once the enterprise is designed.

Keywords
Enterprise Design, Lean, Value Stream, System Design, Lean Accounting, Enterprise Engineering

1.0 Approach
The approach of this paper is to provide examples of how to integrate system design methodology and its practice within industry in order to establish sustainable systems that are lean. The design methodology is called Collective System Design (CSD) [1, 2, 3]. The application of interest is the Oji Intertech Extruder Value Stream that produces laminated and special coatings for industrial paper products.

The motivation for this work is the sustainability of systems / value streams that are intended to become lean. Some sources state that ninety percent of all “lean” implementations are not sustained after 3 years [4]. Director Ohba disclosed, “the difficulty in introducing TPS, among 60 US manufacturers, only 20 could achieve some results, and only 10 could sustain continuous Kaizen” [5]. Hopp and Spearman note that, “Lean Manufacturing provides many useful tools for improving operations. But the methodology is one of imitation and, as such, does not offer a general approach for improving any operation” [6]. Collective System Design (CSD) is based on axiomatic design theory, which has been applied to product development and systems; it enables definition of functional requirement sets as in set-based concurrent engineering [7, 8]. Like Quality Function Deployment [9], the goal of any design is to separate the tools or means of achievement from the objectives [10] or purpose, called the design intention by Peter Senge [11]. With CSD, the objective / purpose of the value stream is called the FR (Functional Requirement) and the means of achievement is called the Physical Solution (PS). CSD describes imitation as copying tools / best practices (PSs) without the people who work in the value stream understanding system purpose or, worse still, not agreeing on system purpose.

Collective System Design facilitates work teams to design Value Streams to achieve the FRs that the team identifies. CSD provides an open framework for learning and experimentation, since the physical solution, PS, is treated as a hypothesis, and the best way of knowing right now, of how to achieve an FR. This approach follows from Toyota's implementation of PSs through standard work as, “a record of problems solved,” meaning that the current standard work is the best way that a team knows how at the present time to do the work (PS) intended to achieve an FR [12].
To develop systems that are lean and sustainable, CSD emphasizes the use of a Language for System Design, the alignment of performance measures to FRs (see Figure 1), Respect of People, and design implementation and improvement through the Shewhart Cycle – Plan Do Study Act (PDSA) or Plan Do Check Act (PDCA) [13].

**CSD Thinking: Functional Requirements & Physical Solutions**

Motivation: Describe our Thinking; Collective Agreement about Purpose(s); Focus on the work; Measures re-enforce doing the work…

Fig 1. Collective System Design (CSD) Starts with the Tone of the Leadership in an Organization

The flame model illustrates that thinking, structure and work in an organization are guided by the tone and mindset of the people. The process of design links to the flame model in Figure 1. The design language communicates the thinking. The design process aligns the FRs or purpose of the design to Customer Needs. The second step of design is to propose a Physical Solution (PS) to achieve an FR. The PS is the physical “how.” Section 4, describes that the PSs are implemented by Oji Intertech, Inc. through Standard Work. The FR is a measure on the FR. The FR describes the desired purpose of the system and the FR is an outcome measure on the FR. The PS is a measure on the PS implementation. A measure on a PS typically determines whether the PS that is proposed is being done. The PS is typically binary (yes or no). The issue is that a PS can be done right but may not achieve the FR. Within industry practice, KPIs (Key Performance Indicators) may be a mixture of FR and PS, but should be tied to the goals or FRs of an organization [14].

**2.0 Enterprise Engineering**

The context of the use of the word “system” in this paper means systems that include the thoughts and actions of people; this concept is gaining awareness in the engineering profession. Enterprise Engineering employs tools like UML, IDEF and Enterprise Function Diagrams [15]. Enterprise engineering addresses the complexities of man-made systems and posits that enterprises may be purposefully designed [16, 17].

Enterprise Engineering must explicitly state the roles and actions of people in the design and sustainability of an organization. Spear and Bowen regarding, “The DNA of the Toyota Production System” first acknowledged this approach. It characterized systems as a series of customer-supplier connections consisting of unambiguous yes / no responses… these responses may be from people or other means (i.e., electronic, visual) [18]. This approach attempted to describe the role of people in the value stream. CSD follows from this way of thinking that we should include the roles and actions of people in the system design itself and is proposed to be a methodology for Enterprise Engineering that is considered to be a “sub discipline of systems engineering” [19]. One definition of Enterprise
Engineering does not mention people in its definition [20]. Enterprise Engineering should consciously address the way that we design the work and improvement of the work to develop and produce products (and services) as “systems.” This distinction about the work of people in systems is a key opportunity that Enterprise Design and Engineering to become lean affords; it postulates that we can design the enterprise and the work of people within an enterprise who produce products and services. The way that work is done and why it is done becomes part of the design, and the focus of observation and improvement.

Enterprise Engineering impacts the professions in business management, accounting and engineering. The challenge is to align performance measures with the FRs that drive the design of the value streams that are intended to meet customer needs. This idea impacts the way accounting, engineering, operations management and senior leaders / business owner’s work and act in their respective roles and professions within an enterprise. This thinking is part of the answer to the question, “if lean is so easy, why is it so hard?” - since the work must change [21].

If we characterize the design of an enterprise as consisting of one or more value streams… the recognition should be that this is the physical architecture of the system, but does not state the thinking or logic about what the system must do. Similarly, in systems engineering the functional architecture defines the physical elements of a system and their interaction [22]. Collective System Design guides the people who work within a system to first determine and collectively agree on the logical design of a system. The FRs define what the value stream must accomplish and the PSs define the proposed solution. The FR-PS relationship is developed prior to defining performance measures. This approach focuses attention “working on the work,” rather than manipulation of the numbers [23].

One core principle of systems engineering is that the system boundary must be defined. The value stream may be used to establish the system boundary. A critical component of systems engineering is that the interfaces with the external environment must be defined [24]. Is it possible to predict whether a design will work in advance of the physical implementation, whether the design will be any good or not? Classical Engineering seeks to be able to predict results and outcomes in a stable manner. Yet systems that include the thoughts and actions of people within a system boundary do not always have predictable results and outcomes. These types of systems are defined as complex systems, because a decision-maker does not necessarily know the outcome of a decision in advance [25]. The challenges of Enterprise Design include:

1. Terminology: Lean, Systems, Process, etc. -- all mean different things to different people
2. The lens through which a person sees is imperfect; it is difficult to discern bias or ‘rules in use’. For example, rewarding the fire fighters, rather than fire preventers in an organization [26].
3. The concept of cost and that Enterprise Functional Requirements can be traded off to reduce “cost.”
4. Unnecessarily sub-dividing the whole of a system into chimneys and islands.

**3.0 Collective System Design for Enterprise Design and Engineering**

Collective System Design (CSD) is a methodology for Enterprise Design and Engineering to provide a way to codify and to articulate lean / TPS thinking and principles… and beyond [27]. A value stream design language to express the thinking is used in the practice of CSD at Oji Intertech, Inc. to gain collective agreement to align customer needs, value stream purpose (FR) and performance measures (FRm) and the means of implementation (PS) among work teams as shown in Figure 1. CSD addresses 4 design points:

**3.1 Four Points of Enterprise design**

1. **Collective Agreement** – is the most important and difficult aspect of system design. It requires both a process and an art of facilitating agreement among people about the FRs for each value stream. Collective agreement requires getting everyone on the same page about what their particular value stream needs to accomplish (FRs) to meet customer needs. The Value Stream Map defines the physical architecture, while CSD Mapping defines the logical architecture, the thinking as relationships of FRs, PSs and measures.

2. **Designing each Value Stream to be Stable, Robust and Controllable** – is the process of designing a value stream to have predictable output in terms of delivery and quality even though variation exists. This type of design requires the Enterprise Designer to think about the organization structure and the human intervention necessary to resolve problem conditions within a value stream [28]. Design for system stability provides the ability to achieve the FRs of a system design that Toyota’s House Model (Figure 2) illustrates.
TPS (aka “Lean”) is an Enterprise Design that responds to Customer Need about Quality & Delivery (in addition to price)

![Diagram of Toyota House Model]

Figure 2. Toyota House Model

When Toyota first invited researchers to investigate and to learn about Toyota, the term Toyota Production System (TPS) was used. Ohno said that, “the basis of the Toyota Production System is the absolute elimination of waste” and that the two pillars needed to support the system are “just-in-time and autonomation” [29]. Just-in-time, Ohno describes as the “ideal state” as part of a flow process in which, “the right parts needed in assembly reach the assembly line at the time they are needed and only in the amount needed,” but points out that any “upset in prediction, a mistake in the paperwork, defective products and rework, trouble with the equipment, absenteeism --- the problems are countless” would result in, “producing parts without regard to later processes.” And Ohno points out that worse still, “there would be no distinction between normal and abnormal states on each assembly line.” The consequence or result of implementing TPS was later described as “lean” [30].

Toyota’s first pillar of Just in Time means to produce only the quantity of product and variety of product when the customer (i.e., plant, cell, operation) requires it (see Table 1, FR2 and FR3). The second pillar, the Jidoka pillar, of Toyota’s House Model states the FR to not produce a defect or to not advance a defect to the next operation (Table 1, FR4). A Pokayoke device (Table 1, PS4) is a Physical Solution (PS) that prevents a defect from being advanced to the next operation. Notice that a Pokayoke is a physical device, a PS, whereas Jidoka establishes an FR, on the system design – to either not make or to not advance a defect. The physical device may be a detect Pokayoke or it may be a prevent Pokayoke device, that prevents a machine from running [31]. The language for system design states this design relationship as illustrated in Table 1 as PS4 achieving FR4 (PS4→FR4).

FR1 of any system design is to provide a safe and healthy work environment. Not achieving FR1 and the other FRs in Table 1 results in higher cost. The design objective is to achieve all of the FRs in Table 1... at the lowest total cost.

3. **PDCA for Improvability** – is the process for implementing a value stream / system design. Standard work defines the content (steps), sequence and timing of all work [32]. An important way of thinking about Standard work is, as mentioned, “a record of problems solved,” according to Ken Kreafle former quality manager for Toyota Motor Manufacturing Kentucky (TMMK); meaning that the standard work represents the best way that we know today of how to do a work task... regardless of whether the work task is done by managers in an office or out on the factory floor. All work may be made repeatable. When work is repeatable and consistently done from person-to-person, it becomes improvable. This way of thinking was fundamental to Dr. Deming who through his teachings brought the quality revolution to Japan. Work that cannot be repeated is not improvable, because the way that work is done is undefined. The purpose for standard work is to make all work improvable.
4. Integration of Design and Improvement – to provide collective agreement and direction about the purpose of a value stream. The integration of PDCA and the CSD Mapping (see Figure 3) deals with how one should design for system stability while at the same time addresses the fact that we live within a complex system.

Table 1. Proposed Functional Requirements of any Enterprise Design

**Fundamental FR**
FR1: Provide Safe, ergonomically sound and healthy (i.e., climate, noise, air quality, etc.) work environment
PS1: Health and Safety Policy

**Delivery FRs: from JIT**
FR2: Produce the Customer Consumed Quantity (per time interval)
PS2: Subsystems (cells) designed to achieve takt time (machines and people: standard work combination)

FR3: Produce the Customer Consumed Product Variety (per time interval)
PS3: Single Minute and / or Zero Changeover Time

**Quality FRs: from Jidoka**
FR4: Do Not Advance (or make) a Defect
PS4: Detect (or Control) Pokayoke Devices

**Robustness FR:**
FR5: Achieve FR1, FR2, FR3, FR4 in spite of variation (problem conditions)
PS5: Pull System (Takt, Standard Work in Process Inventory and Pull – information in reverse of material flow)

**Controllability FR:**
FR6: Immediately identify an abnormal condition and resolve in a pre-defined way
PS6: Information about whether system is producing to takt time within control time interval (i.e., requires use of Heijunka as pace setter for pull signal)

**Improve the Designed System FRs:**
FR7: Improve the Designed System (or Value Stream)
PS7: Use of PDCA Learning Loop and Collective System Design Map to Define and Improve Standard Work

FR8: Force Getting Better – On Purpose, Cause Problem Conditions to Arise
PS8: “Tighten the Rope” – Standard Work in Process Inventory (SWIP) Reduction

**Sustainability FRs:**
FR9: Understanding and Communication of Customer Needs, and Adaptability to Change
PS9: Enterprise Engineering… that includes Collective System Design

**Subject to Achieving the FRs effectively for the Lowest Total Cost**

3.2 Improving the Achievement of the System FRs
FR8 recognizes that once the system is designed to achieve FR5, the Robustness FR, that we may force continuous improvement. Initially achieving FR5 requires us to not only pull production, but may also require us to add Standard Work-In-Process (SWIP) inventory (which appears to be opposite to “lean”). FR8 is to cause improvement. PS8 is to systematically reduce the SWIP to cause variation to surface. The system design is inter-related. PS6 is associated with FR6, To Immediately Identify a Problem Condition and Resolve in a Pre-Defined Way. PS6 is done in conjunction with PDCA to eliminate the sources of variation that the reduced SWIP exposes. In Japan, this approach is referred to as “Tightening the Rope” [33], but this approach assumes that people implementing TPS understand the unstated FRs of the system design.

FR9 is the avoidance at the enterprise level of obsolescence. Markets and times change, therefore the design must be able to express changes in customer needs. Some call this expression the voice of the customer. Collective agreement requires enterprise personnel to actively state new FRs to reflect change. Figure 3 illustrates that as FRs for a value stream change, the CSD map changes. In turn PSs are updated, new standard work is developed for each new PS, which in turn starts the PDCA cycle of improvement.
4.0 Integrating Collective System Design into Operations

Oji Intertech, Inc. is a wholly owned subsidiary of Oji Interpack, Ltd. which is a wholly owned subsidiary of Oji Paper, Ltd. Oji Paper Ltd. has a total of 190 subsidiaries and 81 affiliates that are active in a variety of business fields including pulp and paper products, converted paper products, wood and tree planting, real estate and transportation. Oji Paper was founded in 1873, established in 1949, employs 24,000, and has gross sales over $10 Billion. Oji Intertech, Inc. started life as a small, one-product company selling a corrugated fiberboard headliner substrate to Nissan and Honda. Over the years, Oji Intertech, Inc. has diversified their products and markets. Today, Oji Intertech, Inc. enjoys top-line-sales in excess of $25,000,000 per annum and delivers a wide variety of products to multiple automotive O.E.M.’s and industrial packaging companies.

In 2009, Oji Intertech, Inc. started their lean journey with the focus of copying the lean tools to form the Oji Intertech, Inc.’s Production System, see Figure 4. The organization showed quick gains by implementing value stream mapping, pull systems, visual control, A3, and Six Sigma, but over time found difficulty in sustaining a “tool box” approach. There existed no means to tie these subcomponents to the overall objective of the enterprise. This lack of focus made it difficult for associates to understand the reasons behind these tools, leading to the sustainability issues.

Figure 4. Oji Intertech, Inc. production system before Collective System Design utilizing lean tools
The company’s leadership recognized that Collective System Design provided a framework to unify Oji Intertech, Inc.’s internal programs and identify gaps in fulfilling company objectives. The extruder value stream was selected as a pilot for Collective System Design. The team wrote up a design intention document using the Six-Sigma charter format. From this format, the CSD language of system design enabled the teams to state FRs and associated PSs for the extruder value stream for all stakeholders, see Figure 5.

Figure 5. Oji Intertech Production System utilizing Collective System Design

The team selected FR6 – Do Not Advance a Defect or Make a Defect (Figure 5) as a starting point. Through collective agreement, the team decided that material-handling damage was the largest problem for passing defects to the next operation. The team used a fishbone analysis to understand all of the variables that were contributing to material-handling damage. Through the fishbone analysis, lack of following standard work was identified as creating large variance in material handling methods. In order to reduce the variance, improvements were made to the existing standard work through collective agreement. The routine standard work is labeled as “White Sheet”

<table>
<thead>
<tr>
<th>FRs</th>
<th>PS</th>
<th>FRm</th>
<th>PSm</th>
<th>Aligned with enterprise requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Functional Requirement (PS)</td>
<td>Physical Solution (PS)</td>
<td>Functional Requirement Measurement (FR, m)</td>
<td>Physical Solution Measurement (PS, m)</td>
</tr>
<tr>
<td>FR2</td>
<td>Environmentally friendly</td>
<td>Compliance to laws</td>
<td>1. No Spills</td>
<td>1. Percent Audit Compliance</td>
</tr>
<tr>
<td>FR3</td>
<td>Create an environment that promotes respect and teamwork while removing barriers to pride in workmanship</td>
<td>Strategic Plan</td>
<td>1. Oji Intertech Operating System Transition Assessment</td>
<td>1. Deployment Action Plans</td>
</tr>
<tr>
<td>FR6</td>
<td>Do Not Advance a Defect or Make a Defect</td>
<td>Detect (or Prevent) PokaYoke devices</td>
<td>1. First Pass Yield</td>
<td>1. PFMEA Detection Score</td>
</tr>
<tr>
<td>FR7</td>
<td>Produce the customer consumed quantity per time interval</td>
<td>Pull Production System</td>
<td>1. On Time Delivery</td>
<td>1. PFEPP Min/Max Levels</td>
</tr>
<tr>
<td>FR8</td>
<td>Produce the customer consumed product variety per time interval</td>
<td>Single Minute and/or Zero Changeover</td>
<td>1. Percent to Takt</td>
<td>1. Changeover Time</td>
</tr>
<tr>
<td>FR9</td>
<td>Achieve FR1- FR8 in spite of variation</td>
<td>Standard Work</td>
<td>1. Process Behavior Charts</td>
<td>1. PFEPP Min/Max Levels</td>
</tr>
<tr>
<td>FR11</td>
<td>Improve the Design System</td>
<td>Use of PDCA Learning Loop</td>
<td>Year Over Year Improvement</td>
<td>1. Number of PDCA Loops Completed</td>
</tr>
</tbody>
</table>
standard work, which defines the best-known procedure at the present time. In contrast, “Green Sheet” standard work is the standard work procedure the team has identified when a problem condition does occur.

The team members at the sponsoring company use the Coaching Kata, See Figure 6, process to test and develop PSs [34]. The team identifies small steps to accomplish collectively and conducts experiments at the gemba to test the hypothesis (stated as a Physical Solution) through empirical observation. For example, the team sought to improve the system (FR11) by reducing nip roll pressure, a change to the White Sheet standard work, without impacting part quality (FR6). After several Kata cycles, the team was able to reduce the nip roll pressure by 50%, which resulted in less Teflon tape usage and nip roller wear. In other words, a change to the Physical Solution resulted in bottom-line improvement on the Plain English Financial Statement (FR11m). Using the five Kata questions as a framework to develop next steps and finalize best practices for standard work enables the team to reinforce behaviors that align with CSD functional requirements and physical solutions defined by the team.

![Five Questions for Coaching Kata](image)

**Figure 6. Use of Coaching Kata to Establish the Physical Solutions of the Collective System Design**

Once a best practice is established through the Coaching Kata, standard work can be developed to maintain the baseline work. Standard work is documented and trained through Job Instruction by the company. The standard work is checked by binary (yes or no) measures, which serve as a check regarding whether the standard work is being done and is being improved on a regular basis. The established CSD functional requirements (FRs) and physical solutions (PSs) can be evaluated periodically utilizing Value Stream Mapping and by identifying future opportunities for improvement. Value Stream Mapping is used to implement the physical design to achieve the logical design relationships expressed by the Collective System Design (CSD) Map, see Figure 5 [35].

![Extruder Value Stream Map](image)

**Figure 7: Extruder Value Stream Map**

In summary, the Company has replaced the Oji Intertech Production system “tool box” approach with Oji Intertech Collective System Design, which provides the framework to unify Oji Intertech, Inc.’s internal programs and fulfill the objectives of the value stream stated through functional requirements. The hypotheses to achieve the Functional Requirements are stated as Physical Solutions. Measures on the PS re-enforce that the work is being done according to plan (these are verification measures); while measures on the FRs, determine whether desired value stream FRs are being met, which serve as validation measures. These measures on FRs are then transferred into a Box-Score sheet, (see Figure 8). The CSD Box Score is described in Section 5.0.
Lean accounting should re-enforce lean as a consequence of effective Enterprise Design and Engineering, a process where one or multiple value streams flow products or services with the least time in system and waste. Effective management accounting should help the management team decide on what to improve. Standard costing is inflexible and does not facilitate the development of value streams. Instead, its use creates an environment of ambiguity, at best, and more typically detracts from working on the real work that must be done to achieve the value stream objectives (FRs) of the enterprise [36, 37].

For example, imagine reduces inventory as a result of lean manufacturing improvements. The manufacturing team has success and achieves an inventory reduction for the month of $234,890. Encouraged by their successful efforts to improve, the team attends the month-end financial review meeting expecting good news. In the meeting, the team members are surprised when the CPA informs them that they have missed their profitability target of 16% and only achieve a profit of 4%. The manufacturing team had reviewed all of their internal numbers, i.e., machine efficiencies, scrap, labor, etc., prior to the meeting. They explain to the CPA that they were confident that all of manufacturing costs were at or below budget. They ask the CPA if there could be some mistake in his profit projection of only 4% and are assured by the CPA that the projection of 4% profit is correct. Confused and deflated, the manufacturing team goes back to work wondering what had happened that caused such low profits and whether or not lean is really the way forward. The following paragraphs provide some insight into how a standard cost financial statement can confuse and lead organizations away from lean manufacturing.

This section compares the Standard Cost Income Statement versus a lean “Plain English Statement” [38]. As one can see from the example shown in Figure 9, the Standard Cost Income Statement is vertical and top down. The statement details Gross Sales in the aggregate (A), Cost of Goods Sold in the aggregate (B), a large inventory adjustment is hidden in the overhead adjustment (C), and that the organization realized a profit of 4% (D). As the previous anecdote demonstrated, with the Standard Cost Income Statement it is difficult for non-financial personnel to understand what actually happened within the operation during the evaluating period. Employees are left to wonder, how were the costs distributed? What exactly goes into all the variance accounts? Why did the organization achieve only 4% income?
In contrast, the Lean “Plain English” Statement is horizontal in nature. The “Plain English” Statement details the income that was generated from each of the different value streams (A). The direct costs are allocated to the individual value streams, with the support costs detailed separately (B). The large inventory adjustment is detailed separately (C). One can see clearly that the operation generated return on sales of 16%, but the large inventory adjustment (C) was the reason for profit of 4% (D).

The “Plain English” Statement allows the financial team to assist in the value stream design and improvement efforts by providing easy-to-understand statements. In this case, the team can see that the operation returned 16% on sales and their efforts to reduce inventory is the reason for the unexpectedly low profit of 4%. Upper management, mid management, and the associates can all see that the operation performed well and that the reduced profits are short term and a positive development (reduction of inventory equates to increased cash flow for the organization).

The Box Score is one way to reinforce a system implementation. [39]. The Box Score developed from CSD (see Figure 9) allows the financial team to communicate weekly performance in a relevant, reliable, and understandable format. The Box Score is aligned to the FRs of the extruder value stream at Oji Intertech. The Oji Intertech, Inc. Box Score enables the financial team to tailor the individual line items within the three categories (Operational, Capacity, & Financial) to assist the manufacturing team in developing and tracking the impact of value stream design and improvement activities. The CSD Box Score ensures that lean activities (PSs of the value stream design) are on-track and provide timely feedback so that course corrections can be made.

The old adage, “you get what you measure… even if it is wrong,” holds true. The human outcomes related to improving performance based on a given performance measure are to: “1. Improve the system, 2. Distort the system or 3. Distort the data” [40]. Unfortunately, individuals may be forced to focus their efforts on approaches 2 and 3 when we obviously want them to focus on number 1. “Improve the system.” For these reasons collective agreement about the FRs and proposed PSs is critical to being able to sustain any system or value stream design. The alignment of a PS to an FR is necessary, but not sufficient. The enterprise performance measures FRs must align with the FRs, and also re-enforce the achievement of the FRs.

6.0 Conclusions
We have looked at Oji Intertech, Inc.’s path to develop a new “Plain English” Statement and a new CSD Box Score that aligns with the FRs determined by the extruder Value Stream team. The tone of the leadership team is making this project successful. Their tone is facilitating Collective Agreement about the FRs for the value streams. The management team is not dictating these. The team is choosing the FRs and the direction of where to go in terms of...
PSs. Second, the leadership is putting in place an organization structure to ensure the development and improvement of the standard work as the means (PSs) to achieve the value stream FRs. Coaching Kata is providing guidance on how to ask questions. PDCA improvements are sustained through standard work and the CSD Map defining the logical design of the value stream and are used in conjunction with the Value Stream Map that defines flow.

Finally, and most importantly, the President of the company is facilitating long-term sustainability by no longer using standard costing to make investment and operating decisions and is using measures derived from the CSD Box Score. This change in conjunction with the Plain English Financial Statements gives the leadership team the right information and views necessary to run the business effectively.

Sustainability of a system requires more than just a language for design and lean tools. It requires people to move their feet and to become engaged about what must be done to enact change. This is Peter Senge’s term, that we enact something, rather than simply mechanistically transforming it... through a lean transformation [41]. Respect for people requires leaders and designers to see people in systems in a different way. Not as objects to manipulate or as units of labor productivity or as heads that we can go cut or not cut. The people in an enterprise are the asset.

Toyota describes this principle as respect for the worker [42]. But how do we get people engaged to change something? Calling it Lean X isn’t working... at least for the long-term. CSD is meant to be a solution to the question of, “how do we sustain a system?”

References

12. Kreafle, K., 2001, D. Cochran’s MIT 2.812 Class Presentation (April) and Private Conversations, former VP of Quality, TMMK.