Technical Paper

Backbone of the Lean Enterprise

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Enterprise, Lean, Backbone. These terms are from the title of the talk. However, there are many interpretations of each. The terms are listed in order in which a company should define them. The scope of the enterprise will determine the lean tools that apply most to them. The tools, in turn, set the specifications for the backbone needed to support their deployment. Here we consider "backbone" to include the processes, functions, and people required to implement and sustain a lean "operation." "Operation," in this case, includes one's own company and its supply chain partners.

What we Cover Here

Here are four propositions that characterize the current situation.

1. The "enterprise" universe is expanding. No longer is the "enterprise" the company and a few suppliers and customers. Globalization and competitive pressures make it necessary to look wider for supply chain partners and markets to serve.

2. Picking the "right" lean tool for the job at hand will be challenging. There are many lean tools. In fact, just about any cost reduction technique can be considered a tool. Increasingly, "lean" and "six sigma" disciplines are crossing paths with presenters at SME and other conferences describing how to combine them. Tools include analysis and deployment within the organization as well as engineering approaches. A management challenge, and a job for "backbone" functions, is matching the right tool with the needs of the enterprise.

3. A "backbone" infrastructure is required to implement lean in an expanding universe. The backbone must support ongoing efforts to make a company and its supply chain lean. Organizations like SME and the Supply-Chain Council provide help in defining elements of the backbone.

4. Structured project management is essential. These techniques provide a disciplined path from where we are to where we want to go. This is often lacking. The expanding enterprise universe makes project management all the more indispensable as the projects required become more complex.

The "Enterprise" & Lean Tools

The current version of the SME/CASA Wheel provides a model of the "enterprise." It is not repeated here because most readers are probably familiar with it. The Wheel extends from Level 1 at the hub of the wheel, *Customer*, at the center out to Level 6, *Manufacturing Infrastructure*. Level 4 contains processes. These include not just *Manufacturing* but also *Customer Support* and *Product/Process*. These are glued together by *Shared Knowledge* and *Systems*.

Processes listed in Level 4, Manufacturing, include Material Management, Assembly & Test, Component Fabrication, Operations Planning, and Resource Planning. Note that both planning (Operations Planning) and execution processes (Assembly & Test, Component Fabrication) are included.
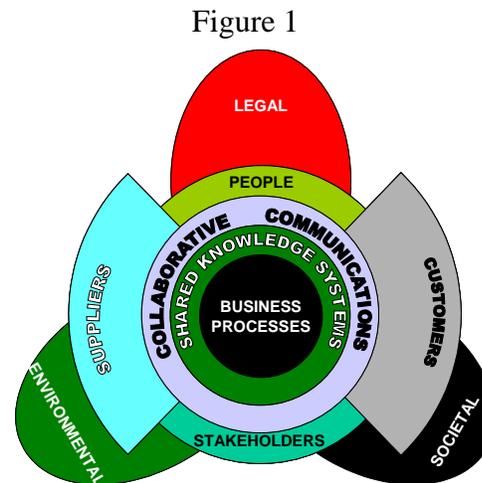
According to the 1993 introduction to the current version, this wheel is more externally oriented than the model it replaced. Elements include a customer-oriented mission, teams and networking, key process and their improvement, integration with the environment, and a lean organization. Despite this thinking, one must ask, "How many companies make the manufacturing engineer responsible for improving or maintaining all the processes in the Wheel?" Although this is a rhetorical question, the answer is probably, "Very few."

Figure 1 is a candidate Wheel to update the 1993 version.[1] It also takes an expanded view of the "enterprise" and is available at the SME Website (www.sme.org). In this Wheel, business processes are at the hub of the Wheel. Both Suppliers and Customers are prominently featured.

Processes presented in the detail that goes with the wheel are the following: SOURCE, PLAN, DEFINE, MAKE, MARKET, SELL, DELIVER, RETURN, SUPPORT.

Figure 1

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This list of processes is similar to that of the Supply-Chain Council's SCOR model, discussed next. The processes cover the product life cycle from design inception to after-sales support, including return items. This candidate Wheel also addresses systems for "collaborative communications" across multiple companies. Components of this collaboration include Applications, Content, and Infrastructure.

SCOR is a "Supply-Chain Operations Reference Model;" it is promulgated and maintained by the Supply-Chain Council. This is a non-profit organization consisting of

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[1] *Reinventing the Wheel Concept 1.ppt*, Manufacturing Enterprise Model, November 2003, William A. Estrem Ph.D., College of Business, University of St. Thomas.

companies, not individuals. The supply chain offers a good model for manufacturing engineers seeking to implement lean, particularly across company boundaries with suppliers and customers.

The Level 1 Execution processes in SCOR are SOURCE, MAKE, and DELIVER. Plan includes processes that match supply and demand. SCOR, at this time, doesn't include Design or Marketing & Sales.

SCOR recommends that the supply chain be considered end-to-end from raw materials to end-users. The model is hierarchical. The model consists of detailed process down two more levels to Level 3, Process Elements. These are considered generic to any supply chain. Level 4 and beyond processes are company specific.

The following points summarize these views of the enterprise from the SME and Supply-Chain Council.

- Broad range of processes covered

- Not just shop floor

- Includes information sharing

- Emphasizes collaborative relationships

These points fit with our proposition that the definition of "enterprise" is expanding. This expansion means the challenges of making that enterprise "lean" will also increase. For many companies, this involves a change in thinking. It may also require ME's to rethink their jobs and the skills they need. Certainly, technical skills will not be enough. The ability to work in teams, sell change, and implement will grow in importance.

Figure 2

This paper isn't intended to define all the tools associated with "lean." Figure 2 does list examples of lean concepts (or policies) and tools. The tools include analysis techniques commonly employed to assess opportunities for lean technology. The figure relates these to three companies in a supply chain and the Level 1 SCOR processes described above.
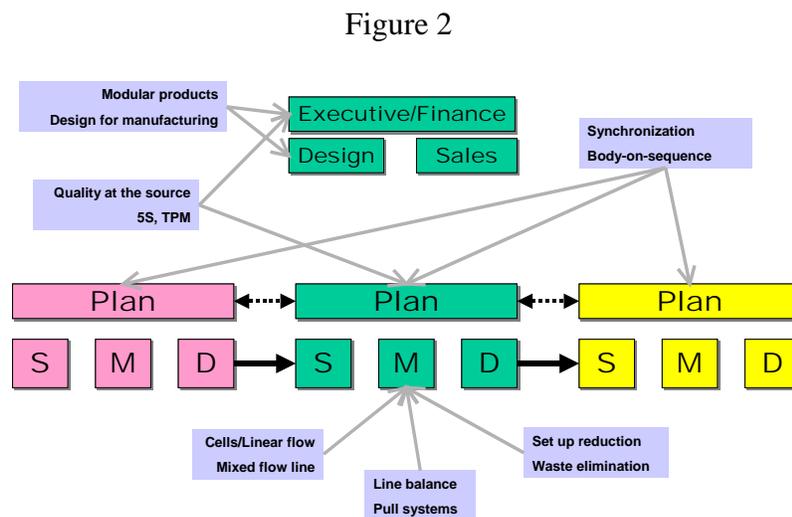
The tools fall across a broad range. Cells, 5S, and pull systems are commonly associated with lean efforts. Modular products involve other functions in the organization (design) and initiatives like synchronization require the cooperation of suppliers and customers.

The point is that lean techniques, to be successful, require collaboration with other departments inside the organization and other companies in the supply chain.

This leads to the subject of this presentation – the "backbone" required to implement and maintain a lean enterprise.

Backbone Requirements

Most problems in implementing change, including lean, can be traced to absence of one or more of these four backbone components:

1. Management mindset
2. Enable processes for continuity
3. Clear strategy that defines process requirements & performance metrics
4. Project & portfolio management

The first is "management mindset." This is the set of beliefs and attitudes toward lean and its role. Perhaps the most important component is management's view of the enterprise. A limited view, such as only including shop floor activity, will limit application of lean. There is a danger in a too-broad view also. The company may not be focused enough, diluting its effort, and failing to get anything done.

The second component consists of "enable processes." This term is also from SCOR that defines enable processes as those "that prepare, maintain, or manage information or relationships on which planning and execution processes rely." CGR's experience is that lack of enable processes is a principal obstacle to improvement. SCOR supply chain processes, described later, are a good beginning.

A strategy for competing is also needed for successful lean manufacturing. In fact, the strategy defines success. The strategy tells the lean implementation team what processes must be lean, what those processes must do in terms of serving customers, and the quality and cost that must be built into the process design. The strategy also enables the setting of priorities for process improvements.

Most lean projects do not occur in a vacuum. Other projects are ongoing while lean techniques are implemented. For example, in a larger organization new systems and products may be in the process of introduction. Separate process improvements will also compete with each other for scarce resources. Portfolio management must allocate resources among these initiatives. Another important function of project management, item #4, is to define the scope of lean projects. This task must strike a balance between the results sought, the time requirements, and the strategic contribution of the lean improvement effort.

The following sections provide examples of each of these four backbone components.

Management Mindset

There are two perspectives to consider when implementing lean and other improvements. The "top down" mindset covers the big issues assigned to the senior management team. This includes the CEO, COO, CFO, CIO, the marketing executive, the product

development executive, and others in key roles. The "bottom up" mindset encompasses issues of day-to-day process execution. It is the province of first line and middle management. It is no less important than the top down perspective; one mindset can't succeed without success in the other.

The table below contrasts the two mindsets.

Top-Down	Bottom-Up
Planning	Execution
Big picture	Local picture
Wide sphere of influence	Narrow sphere of influence
Supply chain perspective	Work center perspective
All enterprise costs	Local process costs
Portfolio focus	Project focus
Business skills	Technical skills
Linked improvements	Isolated improvements
Time frame: long	Time frame: short
Project role -- monitor	Project role -- execute

Getting the correct balance between top-down and bottom-up requires "management art" since there are no absolute formula solutions. Much will depend on the company's position in the supply chain, its products, and its markets. The weaker its role in the supply chain, the more competitive its market, and the more mature its products; the more likely the company will adopt a "bottom up" bias. Lean initiatives will emphasize cost reductions. A company with innovative products commanding high margins will favor a "top down" perspective. Lean initiatives will emphasize flexibility, lead-time reduction, and new product design.

Many companies are too bottom-up focused. This is the legacy of a narrow view of the ME role and an over-emphasis on shop floor cost reductions. Also, despite claims of success, too many lean projects are isolated and have little overall impact.

Enable Processes

SCOR, in addition to providing planning and execution process, does a valuable service in identifying the need for enable processes. It provides nine such processes for consideration. In practice, a company will use some of these and add others needed for their business. Enable processes are to the supply chain management what pavement is to highways. Without the pavement, the road is rough.

The nine enable processes from SCOR are the following:

1	Establish and manage rules	Policies used to make decisions in planning and execution processes.
2	Assess performance	Having measurable objectives and the means to track performance.
3	Manage data	Definition of and maintenance of supply chain related operational and planning data.
4	Manage inventory	Providing the physical capabilities to accommodate inventory.
5	Manage capital assets	Tracking of capital assets employed in the supply chain.
6	Manage transportation	Developing and providing transportation resources across the supply chain.
7	Manage supply chain configuration	Having standards for and maintaining documentation of supply chain components.
8	Manage regulatory compliance	Assuring that supply chain operations are compliant with government regulations
9 Plan	Align supply chain and financials	Assuring that financial goals and assumptions reflect supply chain realities.
9 Source	Manage supplier agreements	Establishing and maintaining sourcing or frame agreements with selected suppliers.

Any company embarking on an ambitious lean effort should examine whether these processes are in place and what other enable processes might be needed.

Strategy

Every company has a strategy. It emerges in company processes and improvement efforts. The strategy may not be the result of a conscious design, such as the one provided by a formal planning process. In Figure 3, the strategy product is called an "activity system" and is described in the referenced Blue Book from SME/CASA. Michael Porter, an academic leader in strategic planning, developed the technique. His methodology has particular merit for those looking for direction in using their supply chain operations to gain strategic advantages.

The input of the process is a series of choices, or themes, (large ovals in red) that anchor activities that implement the choice. Top management makes these choices.

The activities are the smaller ovals shown in different colors. These activities contain the processes that have to be created or modified to meet the intent of the strategy reflected in the themes. The four gray activities (upper left side) are those associated most closely with shop floor manufacturing and control.

The three green activities (in the middle on the right) support customer-facing themes for service and achieving more profitable service business. The two blue activities (on the lower left) address joint effort for product development.
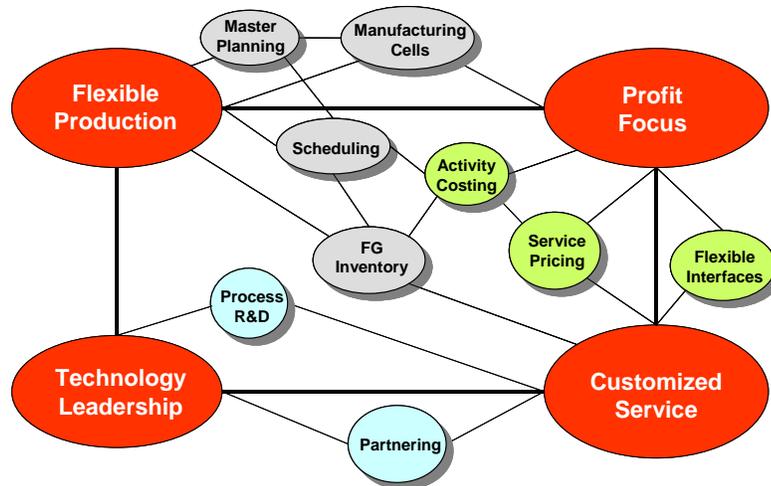
Figure 3

Those responsible for lean implementation should participate in developing the activity system. When implementing lean, the best opportunities might lie in the customer-facing processes, not the traditional shop floor territory. This could require a change in mindset that we discussed earlier where management views lean as a shop floor only event.

Project & Portfolio Management

The project management discipline has a lot to offer lean implementation efforts. In a larger organization, in particular, there are likely to be numerous projects or subprojects in implementing lean. Standardization of project management procedures, adapted to the needs of the company, will reduce the risk of these projects not being successful.

The table below shows the nine areas of project management knowledge. The PMBOK Guide - 2000 Edition from the Project Management Institute documents each of these. A book by the author of this paper describes the application of PMBOK in supply chain improvements.[2] These concepts apply to lean implementation as well.

The right hand column is an estimate of the importance of each knowledge area for lean implementation. The importance of the knowledge areas will vary from company to company and project to project. The table rates the potential importance of the knowledge area (high, medium, low) and the reason why supply chain projects might make it so.

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[2] Supply Chain Project Management: a Structured Collaborative and Measurable Approach, St. Lucie Press, 2004 by James B. Ayers

Knowledge Area	Priority for Lean
Integration Management	High, strategic, multi-company projects.
Scope Management	High, strategic, multi-company projects, deliverables measurement.
Time Management	Low, performed similarly to other projects.
Cost Management	Medium, can be a factor in incentive sharing between partners
Quality Management	Medium, strategic projects hard to measure.
Human Resources	High, requires training, multi-company.
Communications Management	Medium, many involved depending on scope.
Risk Management	High, but it varies by project. No risk, no gain applies.
Procurement Management	High, if purchases involved. Low if not so.

Practitioners should investigate these knowledge areas for applications to their business and whether their practices measure up to their needs.

Standard Methodology

One demonstration of project management ability is the presence of a standard methodology for each project. The one shown in Figure 4 is proven in its application to many projects. This process may be contained within a department of a company, cross department boundaries, or a multi-company process. The sequential improvements in performance, as shown in the small circles) can be part of a single project, or there can be a project for each move, as shown in the three small circles between the current situation and the destination.

Figure 4
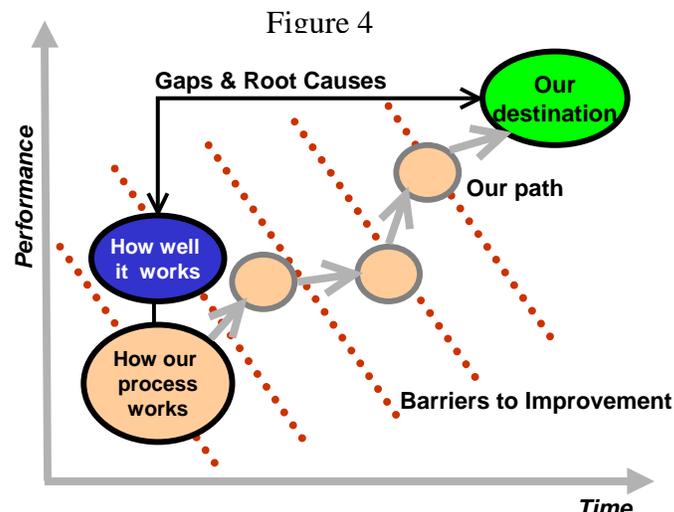
Barriers to improvement are particularly important; the project structure can go a long way toward avoiding these. CGR has identified the following as common barriers:

- No focus – we don't follow through
    - Executive disconnect
    - Little strategy or consensus
- Confusion – we don't understand
    - Definition of "enterprise" doesn't exist or is inconsistent
    - No cross-company accounting
    - Technology and its complexity
- Motivators – Objectives are fuzzy or wrong
    - Conflicting measures
    - Poor mission definition for manufacturing
- Boundaries – our influence is limited
    - "Pockets" of lean implementation
    - Going alone without partners in our chain
- Rigidity – we are slow
    - Poor implementation skills
    - Poor project management discipline
    - Lack of lean technical skills/tools

<u>Portfolio Management</u>

Another project management responsibility is oversight of all the projects in the improvement portfolio. This function involves new project initiation, discontinuing an ongoing project, and modifying the direction of an existing project.

Whatever the size of the company, this task is aided by a cost model to weigh the cost and benefits of a potential or existing project. See SME Technical Paper, "*Application of Computer-assisted Techniques to Indirect Cost Identification and Reduction*" on the SME website.

Summary

This paper proposes a number of ways to establish an enterprise backbone for lean implementation. The list below summarizes the recommendations and is a convenient tool for a company to use to take stock of their own "backbones." Question #3, addressing an important issue, refers to the "breadth" of the lean effort. This includes whether the current effort is covers processes that cross department or company boundaries and whether they extend past fabrication and assembly to administrative and technical processes.

Perhaps there are elements that aren't as important as others. The list allows for setting priorities for each item. "No" responses for high priority items are a good place to begin improvements.

		Yes/No	H/M/L
1	Do we have a common view of the enterprise?		
2	Do we have a common view of what "lean" means?		
3	How broad is our implementation of lean? Is it the right breadth?		
4	Does company strategy provide direction to our lean efforts?		
5	Are sufficient enabler processes in place?		
6	Have the lean projects we've completed been successful?		
7	Do we have a standard project management methodology?		
8	Do we have a way to manage our project portfolio?		
9	Do we understand where our costs are incurred and their drivers?		
10	Do manufacturing engineers play the role they should?		