Implementing Lean Principles

"Lean" is a customer-centric organizational approach primarily focused on reduction of waste and continuous improvement of process efficiency. It is based on a thought process consisting of identification and mapping of value for the customer, creation of proper program and processes flow, designing for change, team education and empowerment, and building-in quality for the customer.

For Systems Engineers, Lean can be summarized by seven key principles:
1. Eliminate waste
2. Sustain knowledge
3. Plan for change
4. Deliver fast
5. Empower the team
6. Build in quality from the start
7. Optimize the Whole

1. The Challenge of Lean for Suppliers

As the implementation of Lean has expanded, its principles have been tailored and adapted to the process of outsourcing, but therein have been mainly focused on procurement and supply-chain management processes implemented on the customer side. In particular it is assumed that the customer, acting as the outsourcing party, expects or requires implementation of Lean by its supplier and includes the Lean aspects in the outsourcing contract. The Lean outsourcing model emphasizes the need for management commitment and support, robust communication, vendor education and training, employee empowerment, vendor performance measurement, benchmarking and continuous improvement, as well as realistic cost assessment and control. A successful outsourcing relationship also emphasizes the need for alignment between the goals and objectives of the customer and the supplier, a clear understanding of both parties' policies and organizational culture, and a realistic assessment of the risks involved in the outsourcing process and their appropriate mitigation. This alignment is required throughout the entire program, from the early negotiation stages, through its completion, and in most cases continuing well after into the sustainment and support stage. The concept of

team work and a close and positive relationship between the customer and the supplier are therefore essential for a successful Lean-based outsourcing program.

But what about the case when the outsourced engineering firm practices Lean but the customer does not, or when the supplier has a significantly different approach to Lean implementation?

This represents a notable challenge since the important tenant of Lean implementation as an organizational commitment conflicts with the business requirement for the supplier to seamlessly work with the customer.

Should an outsourced engineering firm stand firm on its Lean principles when those processes cause the customer to have to change its operations in order to work with them?

The answer is, of course not. As a supplier, you must always figure out the best way to serve the Customer's needs without sacrificing the quality standards of your own brand. And it falls on your shoulders to create efficient ways to offer the benefits of Lean delivery without detracting from the overall value proposition by straining the relationship.

The Real Time Group (RTG), as an ISO9001 & ISO13485 design firm, implements Lean Thinking in all Project Management and Systems Engineering processes. In general, RTG's customers implement and support Lean as well, enabling the alignment between the two parties. Nevertheless, on numerous occasions, RTG had to de-conflict the above problem, without losing its internal Lean commitment. But most importantly, RTG had to find the appropriate way to provide the benefits of Lean to the Customer, without letting RTG's implementation get in the way or create a negative experience.

This white paper is based on RTG's accumulated experience applying Lean in its work with both types of customers. It summarizes the guiding principles from the point of view of the supplier along with specific examples of application of Lean while working in cooperative and non-cooperative circumstances.

2. Tailoring Lean for the Customer's Needs

Implementing Lean internally and working with all types of customers requires a high degree of adaptability as well as the sensibility to choose the appropriate level of formal implementation suitable to the customer.

2.1 Formal Lean Customer

For a formally Lean customer the supplier must quickly learn the key implementation practices, management and organizational policies and, when applicable, the cultural differences between the two organizations. In most of the cases the customer will probably have a well-evolved Lean supply management organization. Based on this the supplier has to adapt quickly to the customer environment as applicable to the outsourced project level. In particular, the supplier must quickly learn and implement the critical Lean savings elements already adopted by the customer. For instance the supplier may apply simplified reporting methods, practical implementation of design reviews, or streamlined signoff steps, etc., similarly to those already applied by the customer. These may or may not require additional tailoring of the supplier's own Lean procedures; they are however necessary for assuring alignment between the customer and the supplier at the project level.

Usually, the formally Lean customer expects to train suppliers, and is equipped with specific tools for the purpose. In those cases, RTG usually finds that the customer's processes are very close to our own, and so adaptation is relatively straightforward. They key idea for RTG in this case is to "let simple be simple" – a good Lean implementation is easy to adapt for a Lean company even the details are different.

2.2 Non-Formal Lean Customer

To support customer who doesn't formally implement Lean, the supplier should focus his/her process tailoring at the applicable business interfaces. There are several of these to consider, but a few of the most important ones are order placement (contract initiation), identification of requirements, status reporting, delivery of customer-furnished equipment, material purchasing

authorization, scope management and change notification management, formal design reviews,

Examples of practicing Lean at the business interface may include for instance: agreement on a reduced number of program reviews; reviews conducted by phone or video conference instead of travel; performing certain highly expensive or destructive environmental tests by similarity, or limit them only to the first article; etc. It is noted however that while intended to reduce waste and streamline processes, these steps can only be implemented if agreed in all details with the customer and formalized in the outsourcing contract.

It's also very important to avoid socializing Lean within the customer's organization or attempting to implement Lean at the customer's facility. This does not mean relaxing or abandoning the supplier's internal Lean processes – on the contrary, a good set of processes will facilitate recognition of objectives, practices and desires of the customer. However, whenever process tailoring or de-confliction becomes necessary, it's important to minimize the impact to the customer's efforts. And wherever your own process tailoring cannot be directly related to improved value of deliverable item, you've got to consider whether the original process is necessary in the first place.

3. Things to Watch For

Below we address a number of major issues to be considered when implementing Lean in an outsourcing program. Some of these issues may be only customer or supplier driven, while others result from the need for team-work and interaction between the two parties.

3.1 Supplier-Imposed Processes

Supplier-imposed processes can either enhance or hinder Lean when working with the customer. The following are some of such examples:

- *Project Start-up and Resourcing Delays* – Lean purchasing organizations rigorously pursue absolute minimum lead-times throughout their supply chain, and a Lean-minded engineering services provider should understand the equivalent of lead-time for their

deliverables in the very same way. It's important not to lose sight of the fact that on-time delivery begins with on-time project start-up, which depends upon your ability to get the promised resources in place quickly.

- *Change Order processes* – applied properly, an expedited streamlined change approval process, may decrease significantly the approval time, thus minimizing wasted team-time. A complicated approval process, including several design change order boards and highly formalized documentation, may cause significant delays and additional costs. It's important to always keep the purpose of change order processes in mind: to maintain a mutual understanding of the up-to-date contracted scope of delivery. Wherever streamlining can be done without risk to this principle, you should.

- *Supplier's Purchase Authorization processes* – One of the most common areas that can create queueing or interface delays are major purchases, when made by the supplier to support program execution. This problem originates from the business need to manage cash risk at the supplier level, but can sometimes create unnecessary waste due to purchase authorization processes. Often problems occur when a long-lead or unique item is not recognized early-on during program planning, and require expediting. A predefined, cost-based, staggered authorization purchasing system may highly expedite the purchasing process.

  However, it's more important to be able to react to purchasing surprises that occur due to typical development project uncertainties. When a significant unforeseen purchase occurs, the supplier most often delays until they can get customer confirmation that the purchase will be covered under the contract. This is a necessary business delay, but the Lean outsourced engineering firm should always be prepared to provide a "fast-track" authorization path for valued and trusted customers, and not allow their own processes to dictate responsiveness.

- *Supplier QA/QC process* – Including QA/QC considerations as early as possible, preferably already at the contract phase, may significantly reduce issues in the design, testing and qualification phases. Also, it may avoid later manufacturability and sustainability issues. On the other hand, if not applied judiciously, this may add an additional layer of verification and approval, resulting in a complex burdensome process. Outsourced engineering firms must always be prepared to evaluate whether their QA/QC processes are in the Customer's best interest, versus whether they are "what we've always done". The suppliers Project Managers should also provision for those in their delivery schedule as well, so that the Customer knows what "just in time" means for him, and doesn't waste time waiting.

- *Supplier's Configuration Management* – Establishing the controlled configuration baselines as late as possible may reduce the number of change orders requests (engineering or manufacturing). However failing to establish the baselines on time (e.g. at the design reviews) may cause ambiguity, loss of design data, and consequently significant waste.

  A judicious analysis of the supplier-imposed Lean principles in the early project definition and negotiations phase, agreed as much as just possible with the customer, will help establish a clear project implementation structure.

3.2 Robust Contract Structure

One of the characteristics of any outsourced engineering/design project is its inherent risk to achieve the projected performance, schedule, and cost. Mitigating or avoiding risk is possible by various means; some may imply additional costs (e.g. concurrent development) while others avoid risk simply by applying proper contractual constraints. Establishing a robust contract structure which allows for change, while at the same time providing cost containment for the customer, is a major tool in mitigating risk.

Under a robust contract the project supports phase containment by including approval gates for major phases of the project. In practical terms this means that the Statement of Work and

Master Schedule establish well defined development phases and exit criterion with stated performance, schedule and allocated budget for each phase. At the completion of each phase, progress and completion are evaluated in a streamlined but informative way. If accepted by the customer, the gate to the next phase is opened and the project advances to the next phase. If issues are reported, the project or the applicable requirement is reevaluated and, if justified, the contract is modified to include possible changes. In this way the performance, schedule and cost are closely monitored thus minimizing overall risk.

The robust contract structure should also provide for change management. This means that both parties feel comfortable with the ability to make project and delivery changes without having to completely re-negotiate the contract at every turn. The robust contract provides clear thresholds and criterion that balance the need for necessary project learning against the supplier's need to manage risk.

3.3 Supplier's Cash Management

A critical requirement for assuring continuous program flow, i.e. avoiding wasted time and resources, is to establish a well-designed program plan and schedule, timely supported by the necessary resources. Ideally, applying Lean principles, these resources will become available just in time and will feature the required performance and quality. When properly planned this should assure a project featuring a balanced or positive cash flow, with savings and elimination of waste.

To achieve this, the supplier must establish at the beginning of the project the requirements for material purchasing, staff, labs and other facilities, as well as any related test or support equipment. Of special importance is to make sure that the supplier can handle advanced purchases and personnel ramp-ups immediately at the start of the project. The cost aspects of these requirements must be reflected in the supplier's budgeting and cash flow plan.

In any case the supplier should never allow a slowdown of the customer's project due to its own cash management concerns. Proper cash flow planning in the contract negotiation phase

and continuous monitoring throughout the project span should avoid cash flow discrepancies and their potential impact on the project flow.

4. Modifications to the Lean Mindset for Outsourced Design

Ideally, applying Lean at the project level implies continuous alignment between the objectives and goals of the customer and those of the supplier throughout the entire span of the project. However, in real life the needs of the customer occasionally may differ temporarily or permanently from those of the supplier applying Lean.

In practical terms the customer may need the supplier to act "Counter-Lean" in order to optimize the performance on his end. Here are a few examples of such situations:

4.1 Learning and retaining knowledge

The supplier, as an organization, may be required to learn and retain knowledge regarding the customer's project. It is important to note that when outsourcing the engineering project the customer considers the supplier as an expert in the subject matter; hence learning cannot be at the expense of the customer. However costs for retaining knowledge may be different, if this implies special preservation services. In any case when handling or retaining customer's data the supplier is responsible for protecting the customer's IP. Therefore while the supplier cannot use knowledge derived from the customer's IP unless agreed by the customer, he remains in charge of this knowledge and its preservation, possibly implying "waste" under the Lean concept.

4.2 Retaining resources

In certain cases the customer may require the supplier to keep the key resources dedicated to his project for a certain period of time and sometimes indefinitely. Should the requirement be in absolute terms, meaning that those resources cannot be used for any other purpose or that the resources must be available upon immediate or very short notice, this may immobilize useful resources which according to Lean enhances "waste".

4.3 Holding-off deliveries

In some cases the customer may require the supplier to hold-off on a delivery helping in managing his own resources. This obviously conflicts with the Lean requirement that the supplier should perform deliveries as soon as possible.

Lean Systems Principle	What it Means For Outsourced Engineering
Eliminate waste	• Be responsible for your own overhead, and expect customer to do the same • Mirror the customer's deliverable cycles • Avoid "working ahead" after an early delivery • NEVER let resources ride a customer's P.O. without clear direction toward relevant work
Plan for change	• Establish robust contract structures that minimize change orders • Allow for a phase-contained contract structure
Deliver fast	• Make reliable commitments • Understand and minimize "engineering services lead-time" • Drive the customer's job to completion • Manage scope pro-actively
Empower the team	• Minimize approval processes for project management that must run outside of the customer's prevue • Establish project material purchasing plans that minimize your own authorization • Never put the customer's program in the position to slow down due to your own cash management issues
Learn and retain knowledge	• Engineering Suppliers must come to the table as experts – never charge your customer to learn unless it's for unique purposes • Protect the customer's IP
Build in Quality	• Understand the customer's true objectives and delivery standards *at the beginning of the project* • Come to the table with a set of quality processes for your own deliverables • Know how to deliberately tailor those processes for the customer's needs (don't be reactive in tailoring)
Optimize the whole	• Must be able to modulate resources to match project needs. Leverage your matrixed organization to optimize value to the customer.

In all the above cases the supplier must adapt to the customer's requests in an apparent deviation from Lean. In some of such cases the supplier could be financially compensated for the related costs incurred at his end; nevertheless, from the point of view of pure Lean all these deviations represent waste.

5. Summary of Lean Principles for Outsourced Engineering

The following is a summary of Lean principles for suppliers based on RTG's experience with outsourced engineering.

6. References

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