

Lean Enterprise Transformation: Measuring and Accelerating the Transition to Lean

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Presentation Outline

- Research Objectives
- Strategic Value of the Lean Enterprise
- Multi-Stakeholder Value Optimization
- Lean Enterprise Self-Assessment Tool (LESAT)
- Leading and Lagging Indicators of Lean Enterprise Transformation
- Empirical Results in the Aerospace Industry
- Accelerating the Lean Transformation - Linking LESAT to Strategic Objectives
- Summary and Questions



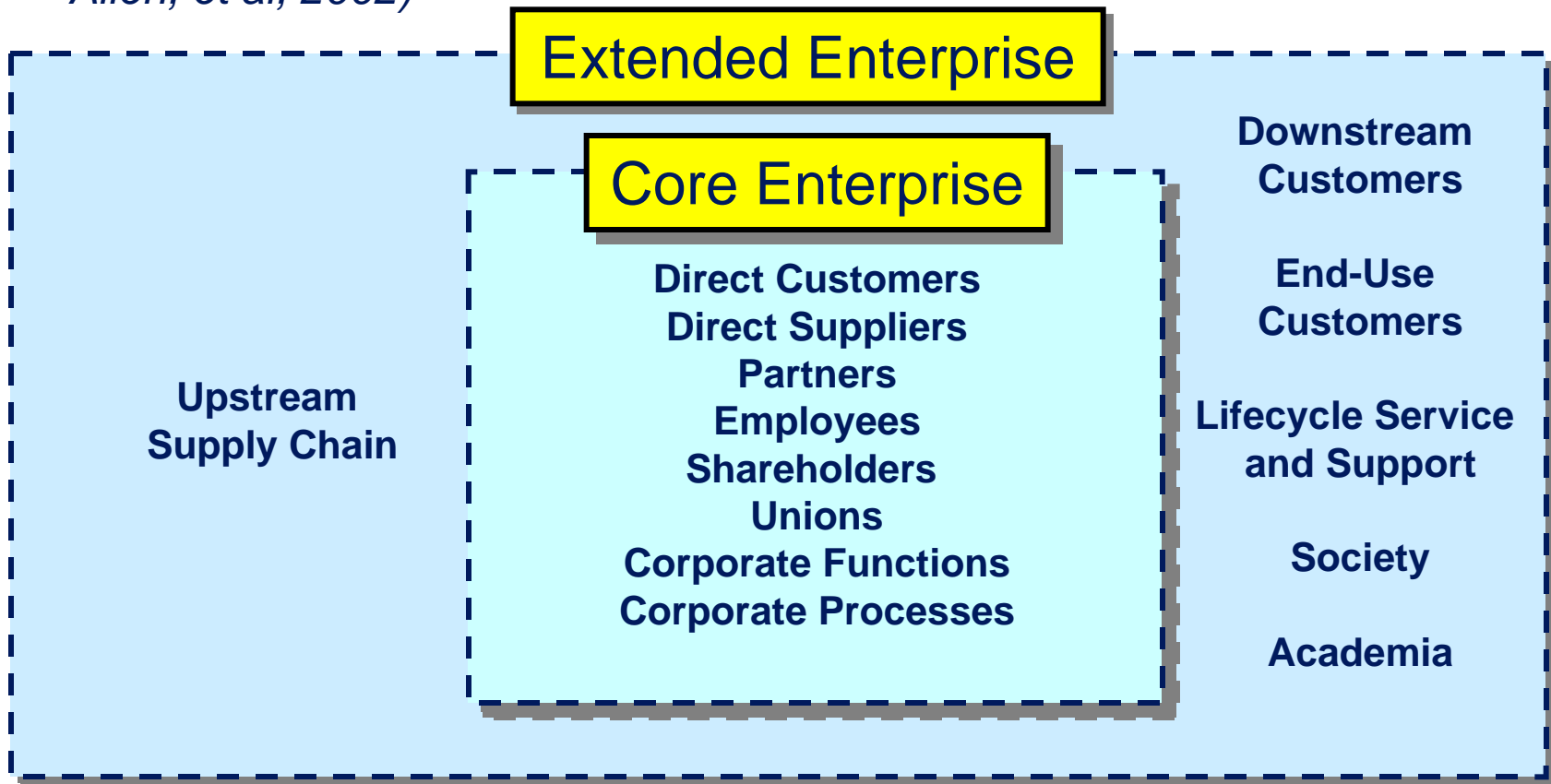
Research Objectives

- Develop the underlying logic of the strategic advantage of the lean enterprise
- Determine if there is an argument in support of the multi-stakeholder value perspective
- Establish the theoretical relation between leading and lagging indicators in lean enterprise transformation
- Utilize the Lean Enterprise Self-Assessment Tool (LESAT) to test hypotheses about lean enterprise transformation
- Propose empirically-based methodologies for accelerating Lean Enterprise Transformation
- Create a methodology for integrating Enterprise Strategic Objectives into a lean enterprise transformation methodology



The Lean Enterprise Defined

- A lean enterprise is an integrated entity that efficiently creates value for its multiple stakeholders by employing lean principles and practices (Murman, Allen, et al, 2002)*





The Strategic Value of the Lean Enterprise

- The Lean Enterprise is rooted in an operational strategy
- It must meet the needs of both corporate strategies and business strategies
- The operational strategy will be a driver of functional strategy and process strategies
- Competitive advantage arises from doing things differently than competitors, leading to higher value delivery under constant or improved resource utilization - this is what the lean enterprise aims to do by employing an operational strategy that results in performance gains over competitors.



The Lean Enterprise - a Source of Competitive Advantage

- There are Arguments against competing based on knowledge such as best practices, because of inappropriability and ease of transfer
- However, Lean is more than best practices, and while lean information is out there, it is difficult to create a lean enterprise for three reasons
 - Non-zero marginal cost of information acquisition
 - Absorptive capacity for understanding new knowledge
 - Organizational behavior at the heart of operating a lean enterprise
- Lean manufacturing has been difficult enough for many, now imagine extending the optimization problem throughout all functions, processes, and extended enterprise members!!!!
- Few, if any aerospace businesses have created a truly lean enterprise, thus the first to achieve the transformation will experience a period of sustained competitive advantage

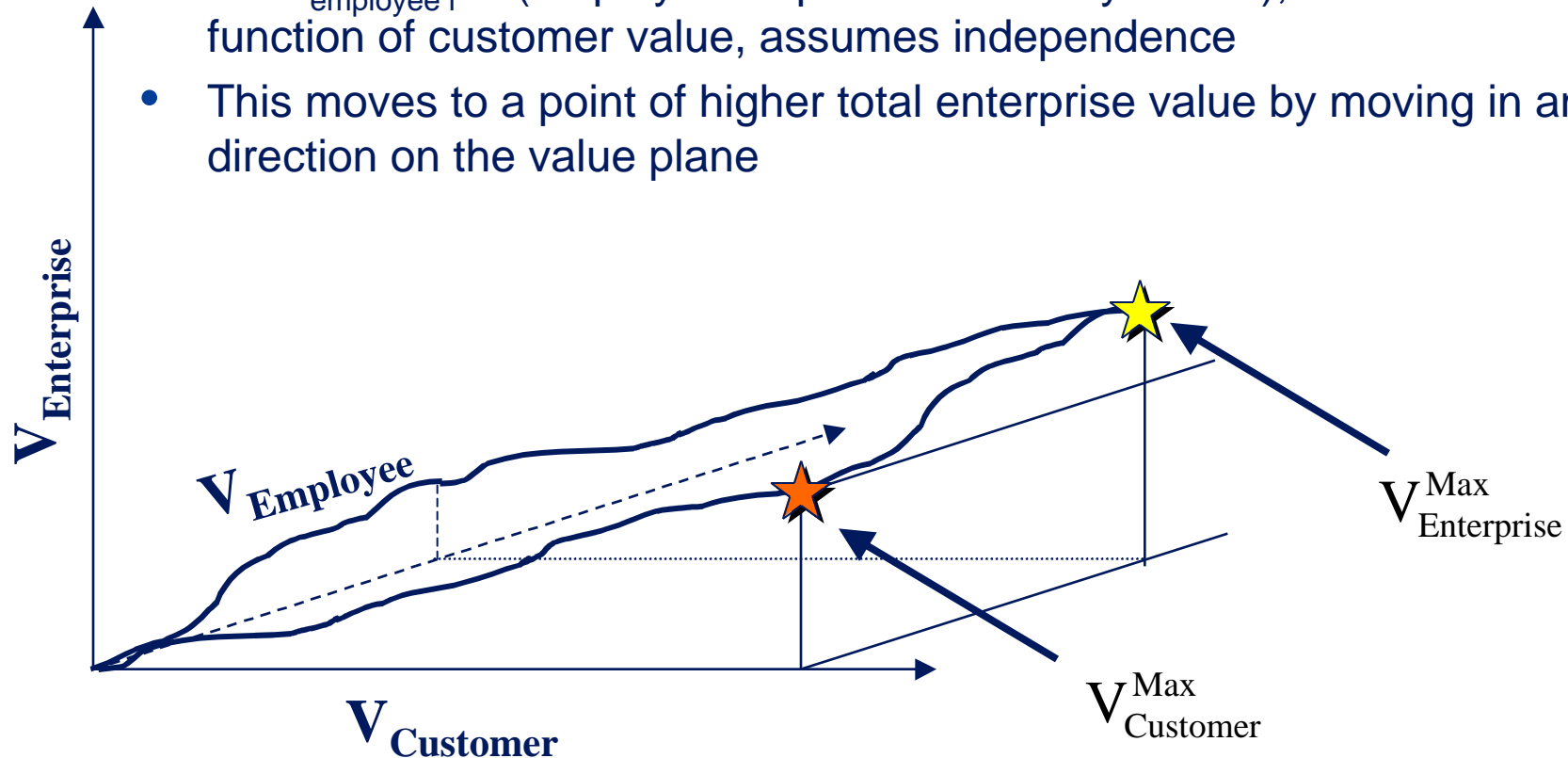


Multi-stakeholder Value Optimization - the Goal of the Lean Enterprise

- Some businesses focus solely on the customer, others on the shareholders - this may be a sub-optimal operating point
- The acknowledgement and consideration of all enterprise stakeholders may lead to greater enterprise value delivery
- Additionally, the interdependence of stakeholder value functions may lead to the discovery of win-win scenarios that increase total enterprise value delivery
- An enterprise that operates at a higher value delivery point would be expected to be more sustainable than competitors, all else being equal, as it creates more stakeholder value with an equal amount of inputs compared to competitors - *this is the lean enterprise.*

Multi-Stakeholder Value

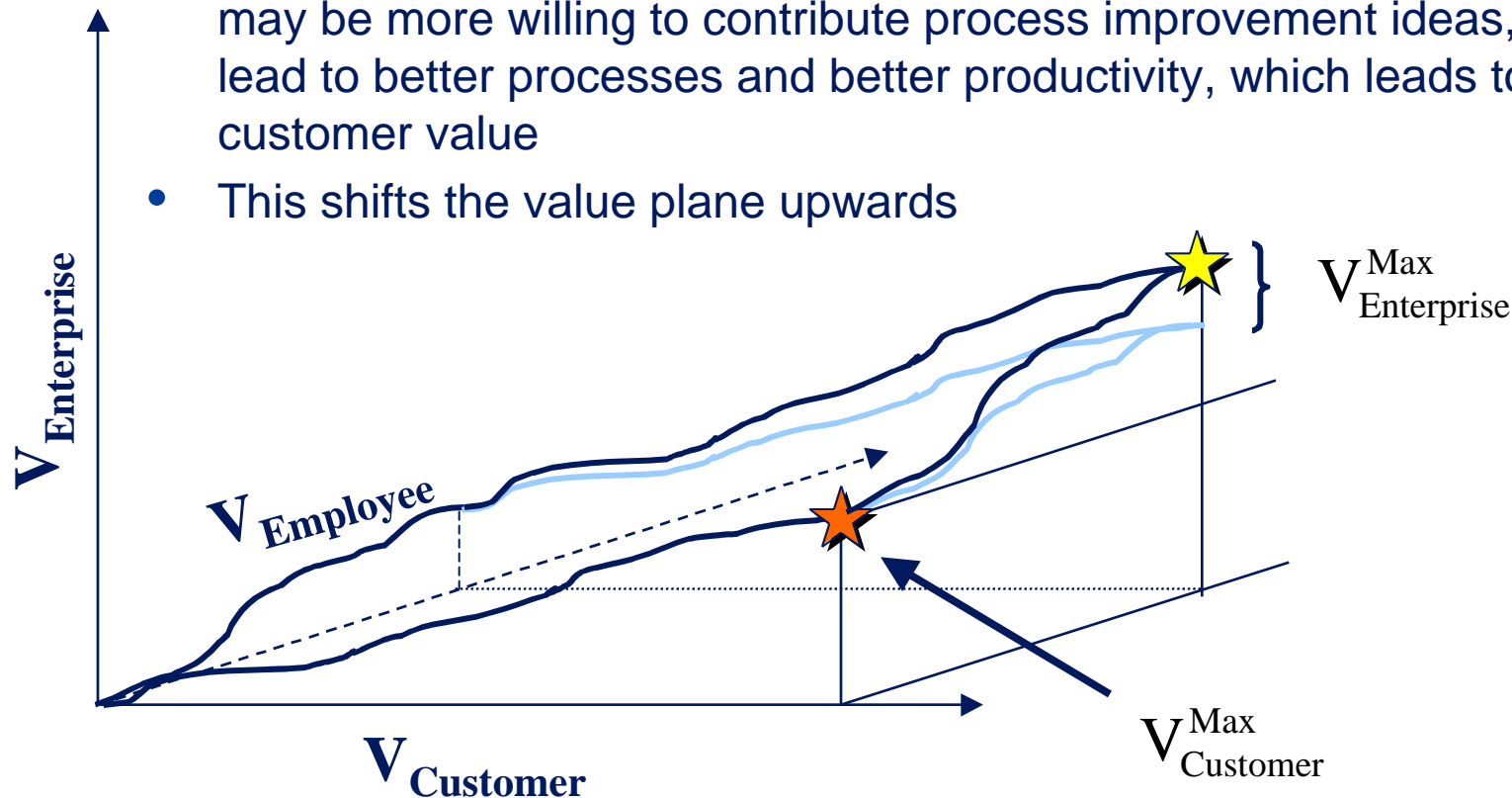
- If there exist stakeholder values that are not a function of customer value, then maximum enterprise value exists in a state that requires considering more than just customer value
- i.e. $V_{\text{employee } i} = f(\text{employee's opinion valued by others})$, which is not a function of customer value, assumes independence
- This moves to a point of higher total enterprise value by moving in another direction on the value plane





The Multi-Stakeholder Approach Need not be a Zero-Sum Game

- Furthermore, there may be stakeholder value function interdependencies, which could imply a non-zero sum game (i.e. productivity is dependent on the contribution of employees)
- If employees feel like their opinions are considered and valued, then they may be more willing to contribute process improvement ideas, which can lead to better processes and better productivity, which leads to better customer value
- This shifts the value plane upwards





**LEM
Principles & Practices**

**TTL
Roadmaps**

**LESAT
Self Assessment**



Tools Supporting Lean Enterprise Transformation - the LAI Tool Triad

Implementation Issue

What are the key lean principles and practices?

How do I transform my enterprise to lean?

How do I assess my progress?



Enterprise Tool

Lean Enterprise Model (LEM)

Enterprise Transition to Lean Roadmap (TTL)

Lean Enterprise Self Assessment Tool (LESAT)



Assessing Enterprise Transformation Progress

- Enterprise TTL application highlighted need for assessment tool
- Lean Enterprise Self-Assessment Tool (LESAT) developed by joint industry / government / MIT team in collaboration with UK LAI
- LESAT supports both
 - “As- Is” Analysis and the
 - “To-Be” Vision
- Targeted at Enterprise Leadership Team (enterprise leader and direct reports)



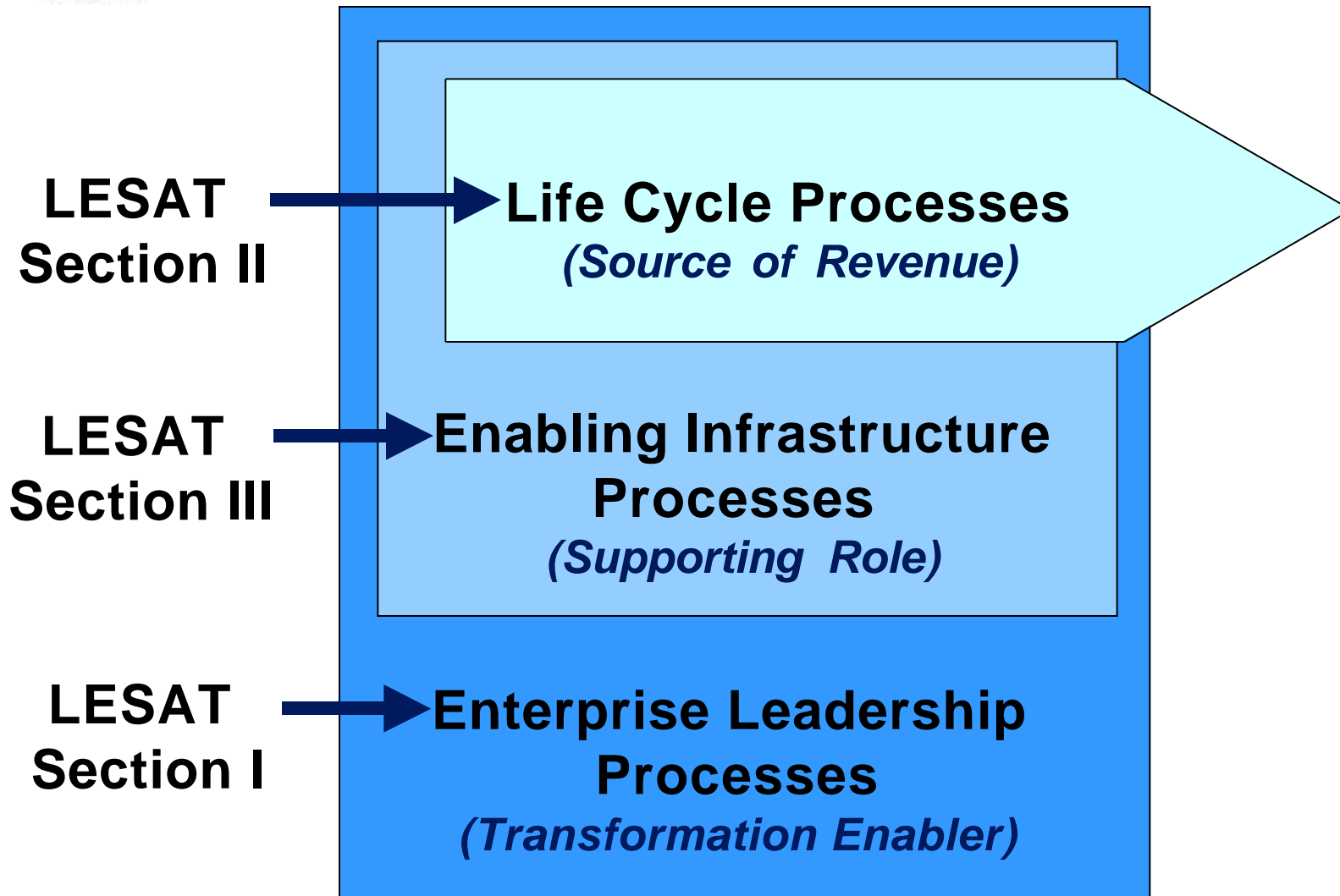
The Lean Enterprise Self-Assessment Tool (LESAT)



- A tool for self-assessing the present state of “leanness” of an enterprise and its readiness to change
- Comprised of capability maturity model for assessing
 - (1) Enterprise leadership
 - (2) Life cycle and enabling processes
 - (3) Enabling infrastructure
- Supporting materials: (Facilitator’s Guide, Glossary, etc.)



LESAT is Consistent with a Process Architecture View of the Lean Enterprise





Generic Capability Maturity Levels

(Facilitator's Guide, pp.13)

Level 5

Exceptional, well-defined, innovative approach is fully deployed across the extended enterprise (across internal and external value streams); recognized as best practice.

Level 4

On-going refinement and continuous improvement across the enterprise; improvement gains are sustained.

Level 3

A systematic approach/methodology deployed in varying stages across most areas; facilitated with metrics; good sustainment.

Level 2

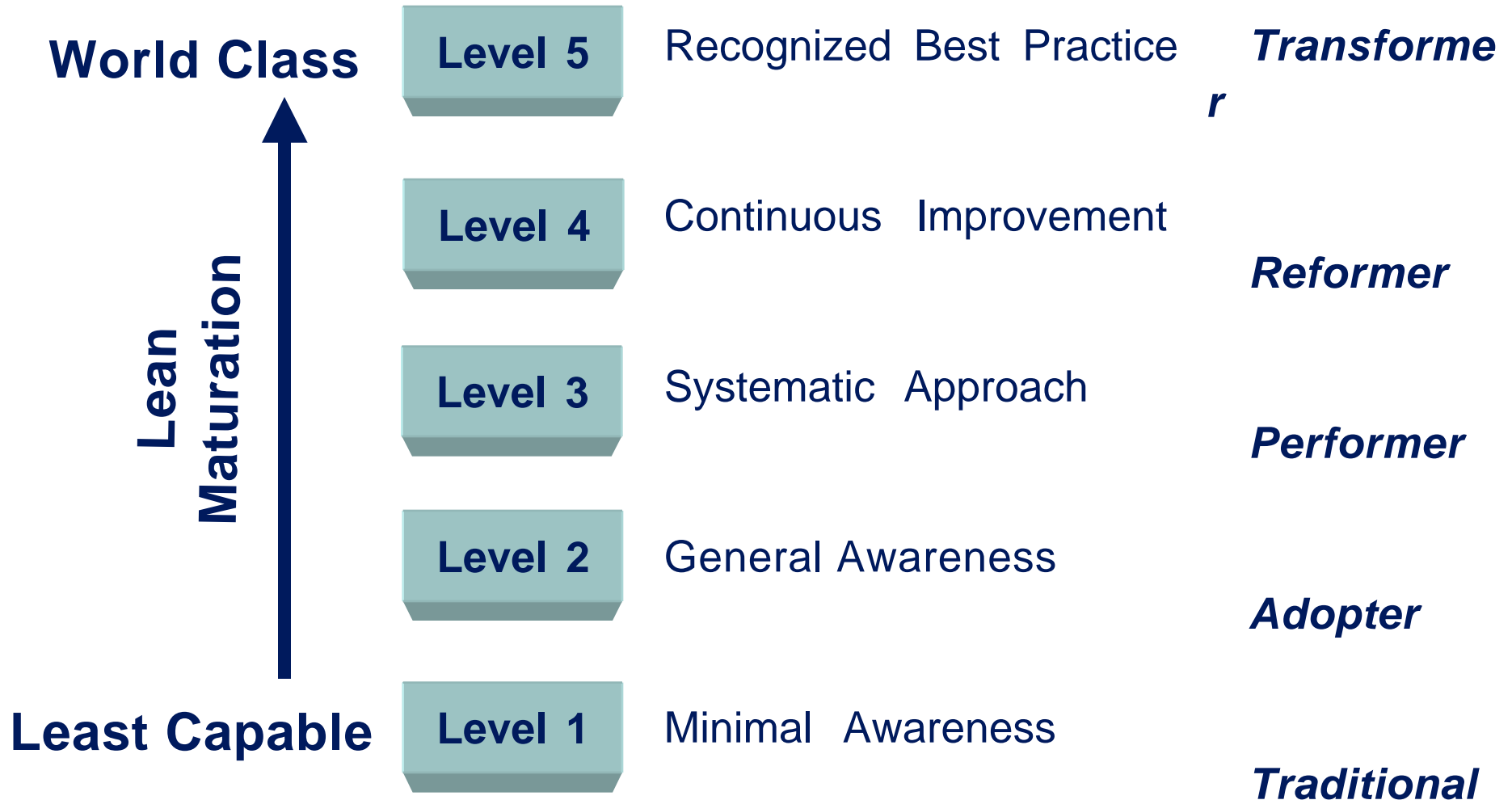
General awareness; informal approach deployed in a few areas with varying degrees of effectiveness and sustainment.

Level 1

Some awareness of this practice; sporadic improvement activities may be underway in a few areas.



Maturity Level Definitions Simplified





LESAT Subsections

LESAT Section I -Lean Transformation/Leadership

- I.A. Enterprise Strategic Planning
- I.B. Adopt Lean Paradigm
- I.C. Focus on the Value Stream
- I.D. Develop Lean Structure and Behavior
- I.E. Create & Refine Transformation Plan
- I.F. Implement Lean Initiatives
- I.G. Focus on Continuous Improvement

LESAT Section II - Lifecycle Processes

- II.A. Business Acquisition and Program Management
- II.B. Requirements Definition
- II.C. Develop Product and Process
- II.D. Manage Supply Chain
- II.E. Produce Product
- II.F. Distribute and Service Product

LESAT Section III - Enabling Infrastructure

- III.A. Lean Organizational Enablers
- III.B. Lean Process Enablers



LESAT Section I - 28 Lean Practices

I.A. Enterprise Strategic Planning

- I.A.1 Integration of Lean in strategic planning process
- I.A.2 Focus on customer value
- I.A.3 Leveraging the extended enterprise

I.B. Adopt Lean Paradigm

- I.B.1 Learning and education in “Lean” for enterprise leaders
- I.B.2 Senior management commitment
- I.B.3 Lean enterprise vision
- I.B.4 A sense of urgency

I.C. Focus on the Value Stream

- I.C.1 Understanding current value stream
- I.C.2 Enterprise flow
- I.C.3 Designing future value stream
- I.C.4 Performance measures

I.D Develop Lean Structure and Behavior

- I.D.1 Enterprise organizational orientation
- I.D.2 Relationships based on mutual trust
- I.D.3 Open and timely communications

- I.D.4 Employee empowerment
- I.D.5 Incentive alignment
- I.D.6 Innovation encouragement
- I.D.7 Lean change agents

I.E. Create & Refine Transformation Plan

- I.E.1 Enterprise-level Lean transformation plan
- I.E.2 Commit resources for Lean improvements
- I.E.3 Provide education and training

I.F. Implement Lean Initiatives

- I.F.1 Development of detailed plans based on enterprise plan
- I.F.2 Tracking detailed implementation

I.G. Focus on Continuous Improvement

- I.G.1 Structured continuous improvement processes
- I.G.2 Monitoring lean progress
- I.G.3 Nurturing the process
- I.G.4 Capturing lessons learned
- I.G.5 Impacting enterprise strategic planning



Example LESAT Practice - I.B Adopt Lean Paradigm -

I.B. Adopt Lean Paradigm - Transitioning to lean requires a significant modification to the business model of the enterprise. It is imperative that the enterprise leadership understands and buys into the lean paradigm since they will be required to create a vision for doing business, behaving and seeing value in fundamentally different ways.

Diagnostic Questions

- Do enterprise leaders and senior managers understand the lean paradigm at the enterprise level?
- Do all senior leaders and management enthusiastically support a transformation to lean?
- Has a common vision of lean been communicated throughout the enterprise and within the extended enterprise?
- Has a compelling case been developed for the Lean transformation?

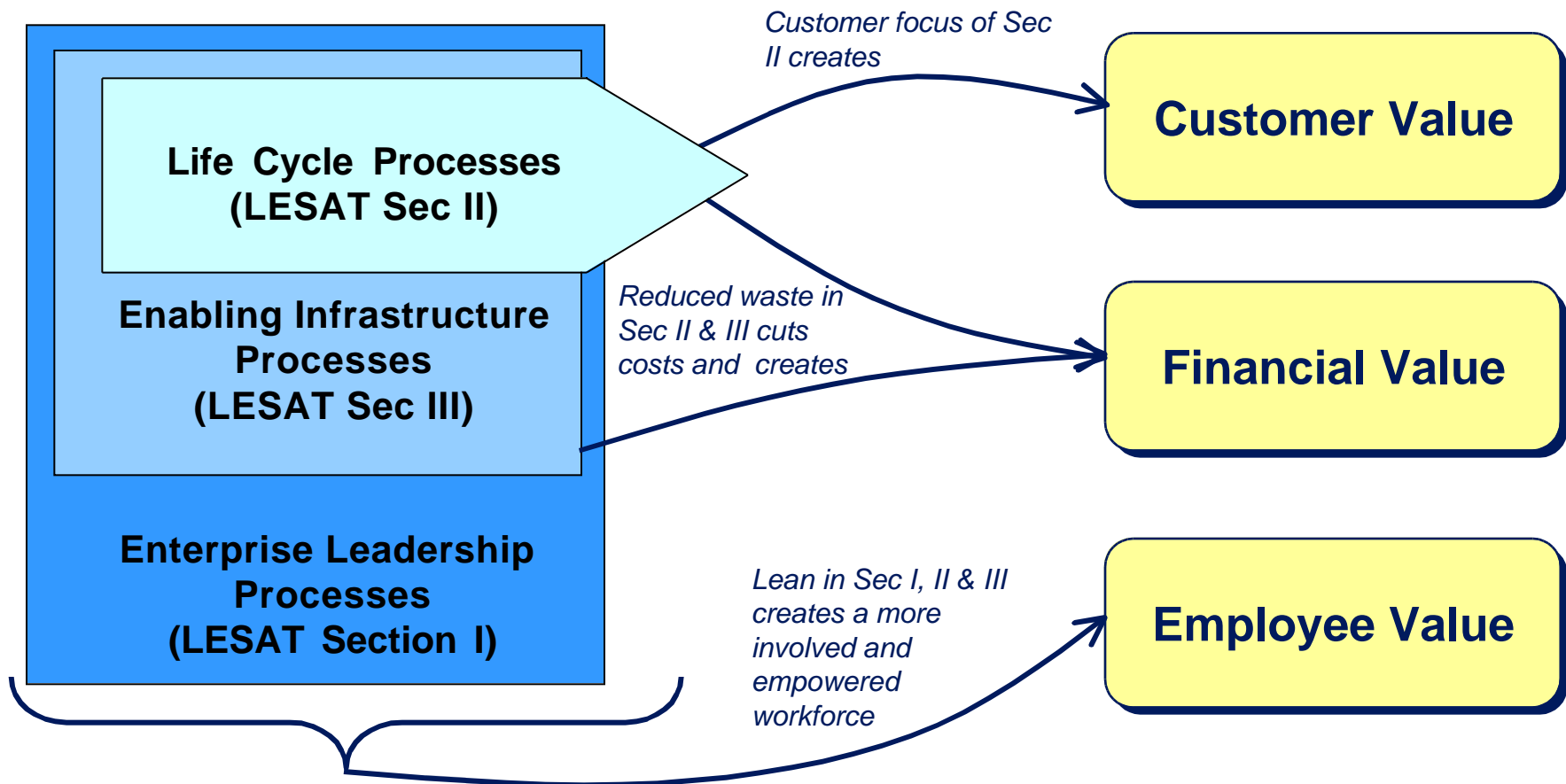
LP#	Lean Practices	Capability Levels				
		Level 1	Level 2	Level 3	Level 4	Level 5
I.B.3.	Lean Enterprise Vision <i>New mental model of the enterprise</i>	Senior leaders have varying vision of lean, from none to well-defined.	Senior leaders adopt common vision of lean.	Lean vision has been communicated and is understood by most employees.	Common vision of lean is shared by the extended enterprise.	Stakeholders have internalized the lean vision and are an active part of achieving it.
		C D	C D	C D	C D	C D
	Lean Indicators	<ul style="list-style-type: none"> •The role that lean plays in achieving the vision is clearly defined •The vision has been communicated to all levels and has extensive buy-in by most employees. •The vision incorporates a new mental model of how the company would act and behave according to lean principles and practices 				
	Evidence					
	Opportunities					



LESAT as a Leading Indicator of Improved Enterprise Value Delivery

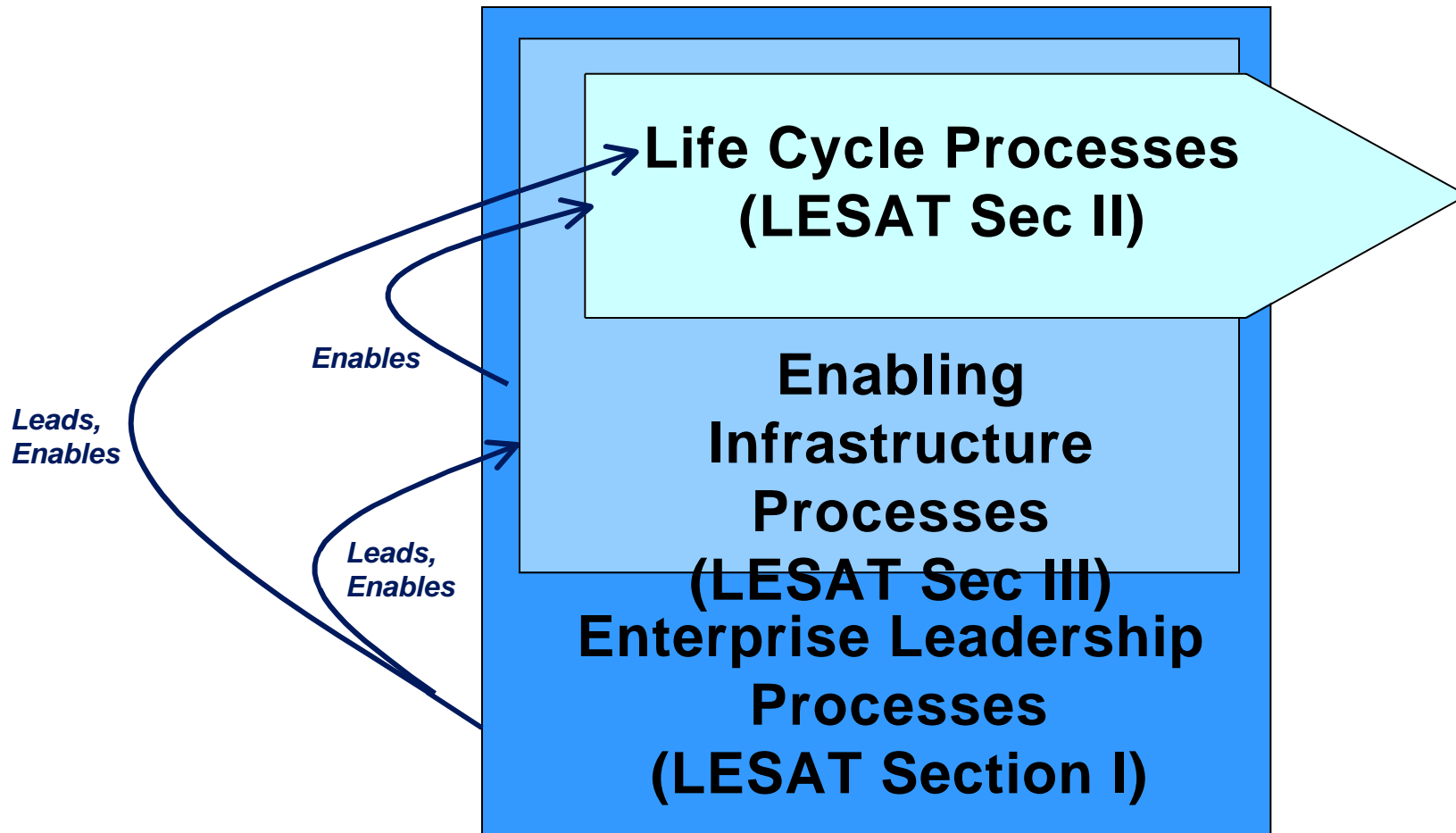
State of Enterprise Leanness
(LESAT - Leading Indicators)

Enterprise Performance Measures
(Lagging Indicators)





Proposed Causal Relations in Lean Enterprise Transformation





Hypotheses

- H1) Enterprises that exhibit a greater value of Enterprise Transformation and Leadership Process maturity will exhibit a greater value of Lifecycle Process maturity
- H2) Enterprises that exhibit a greater value of Enterprise Transformation and Leadership Process maturity will exhibit a greater value of Enabling Infrastructure Process maturity
- H3) Enterprises that exhibit a greater value of Enabling Infrastructure Process maturity will exhibit a greater value of Lifecycle Process maturity



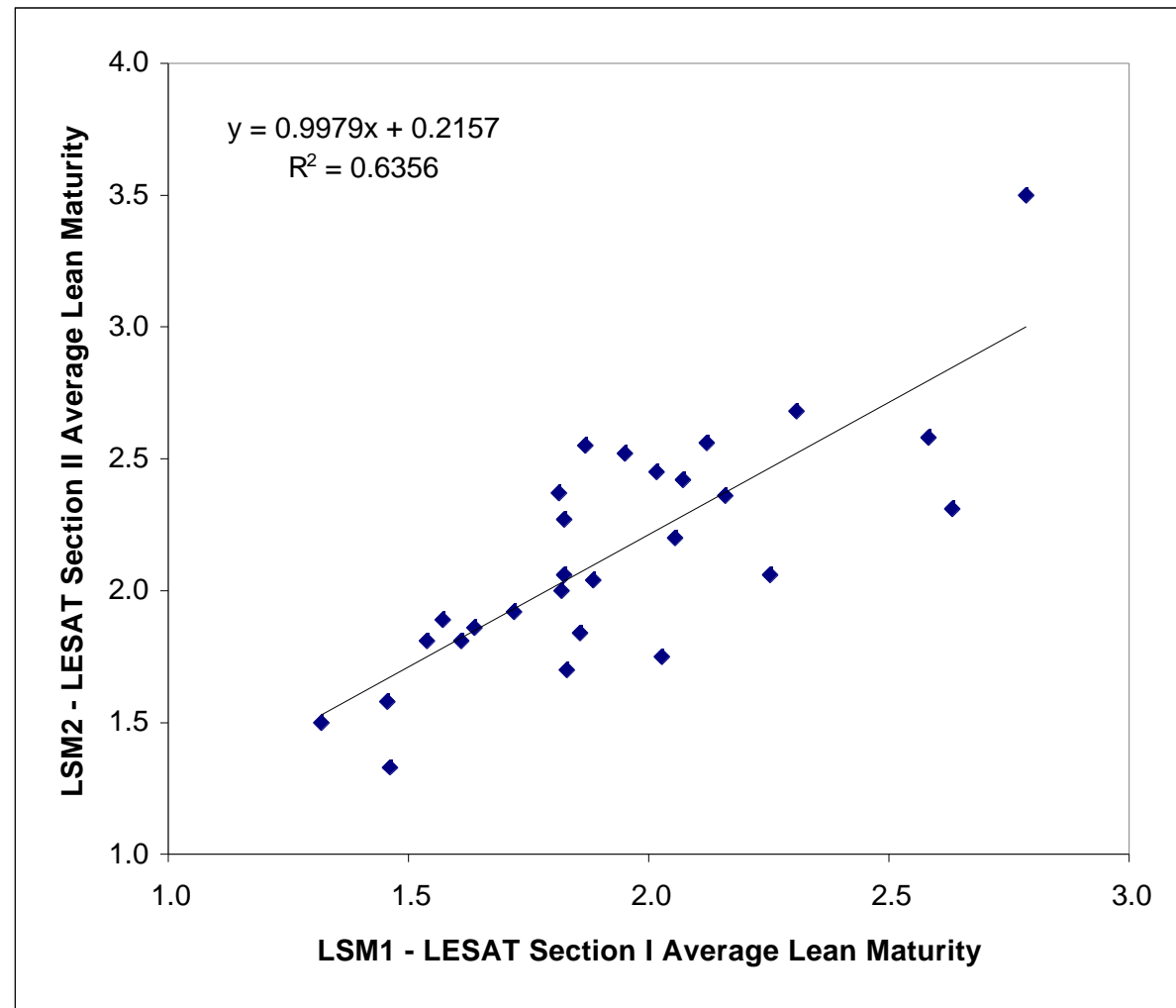
Experiment Sample

- 29 aerospace enterprises provided LESAT data (22 US, 7 UK)
- Average of 11 leadership participants per enterprise
- Assessments were conducted at the business unit level, business site level, and in one case the program level
- The sample includes both prime contractors and sub-contractors



Results of Primary Hypotheses

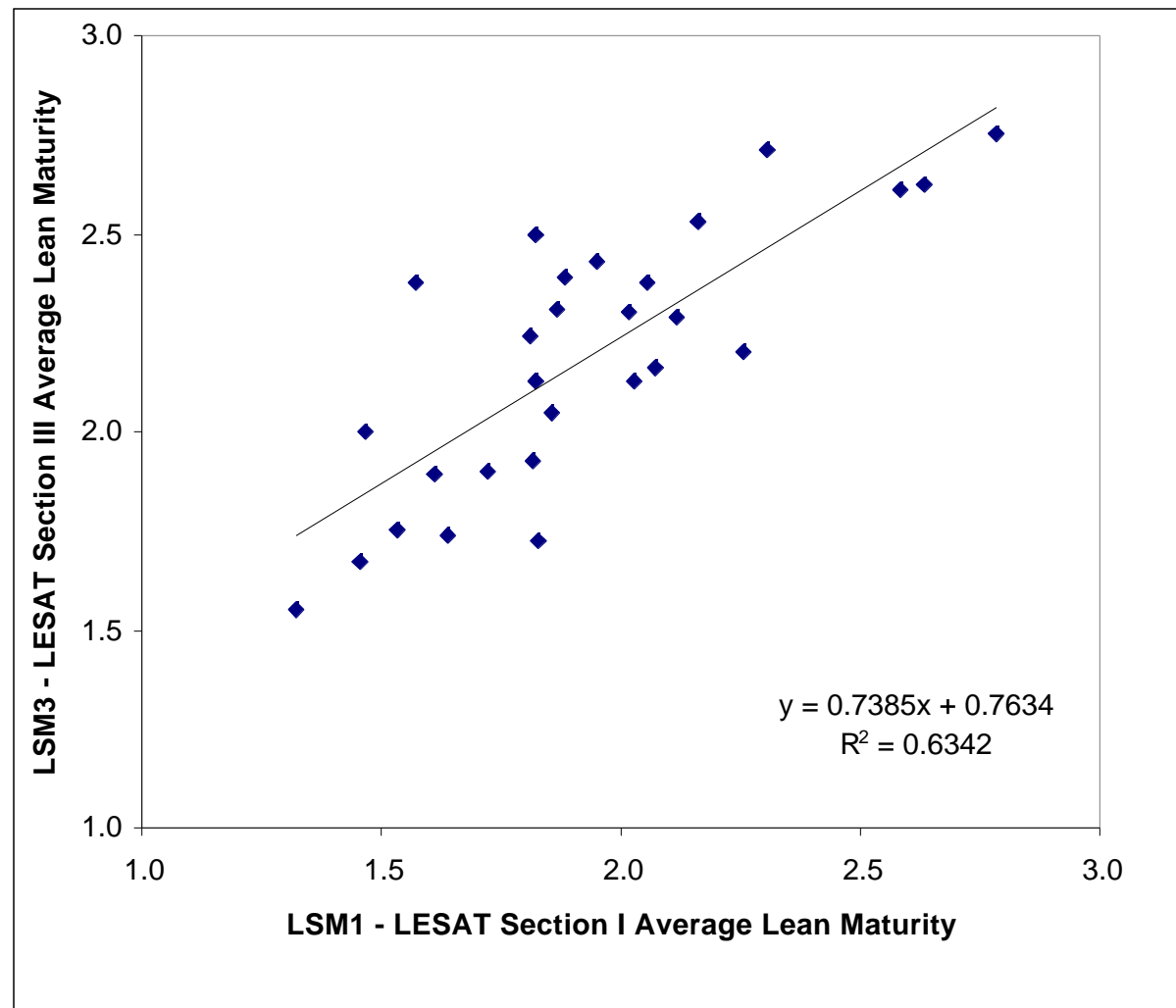
- $R=0.797$ ($n=28$)
- There is a strong indication that lean transformation leadership maturity (LSM1) is highly related to lean lifecycle process (LSM2) maturity, as measured by the LESAT





Results of Primary Hypotheses

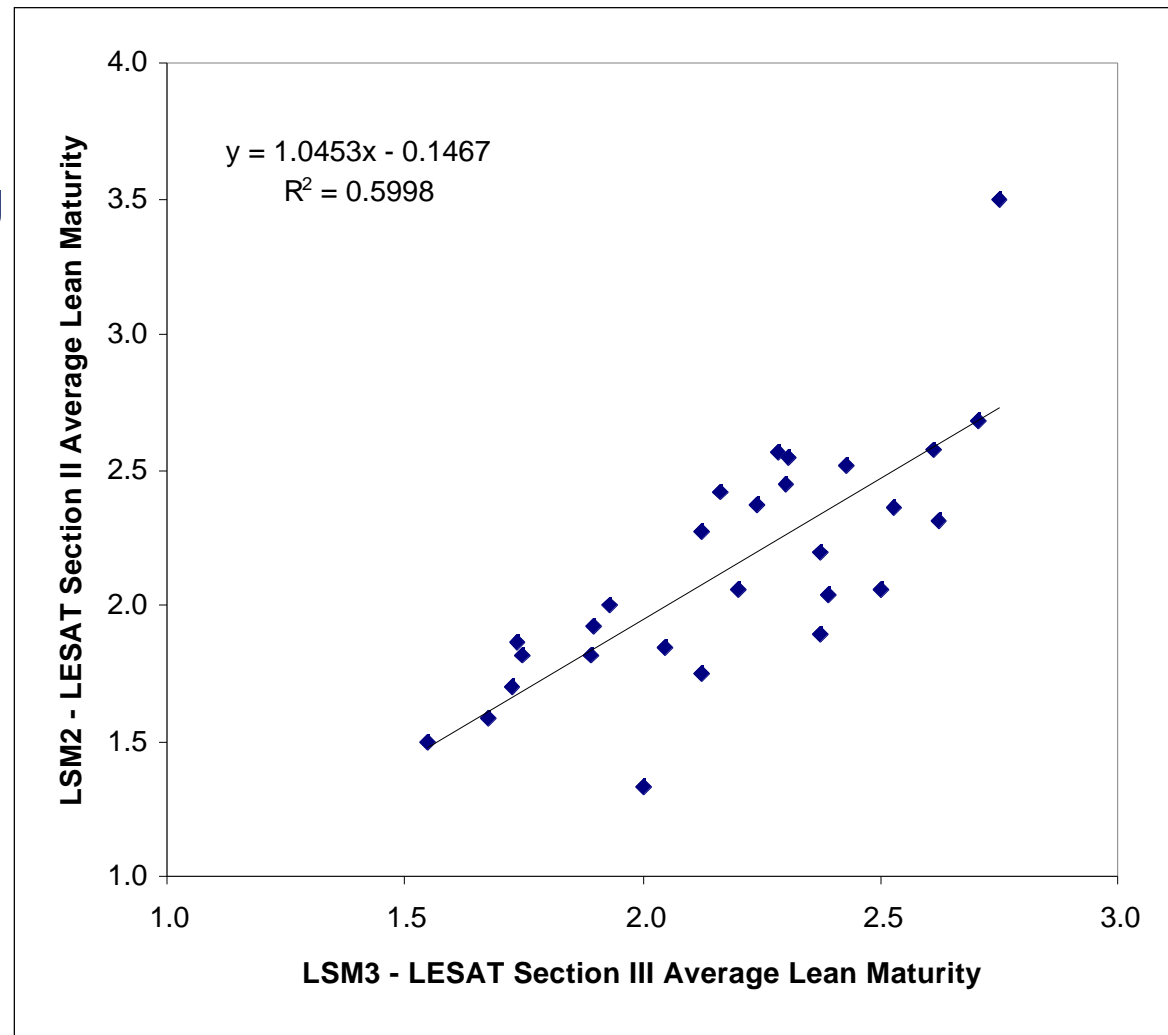
- $R=0.796$ ($n=28$)
- There is also a strong indication that lean transformation leadership maturity (LSM1) is highly related to enabling infrastructure process (LSM3) maturity, as measured by the LESAT





Results of Primary Hypotheses

- $R=0.774$ ($n=28$)
- There is a strong indication that enabling infrastructure process (LSM3) maturity is highly related to enabling infrastructure process (LSM2) maturity, as measured by the LESAT. Even controlling for LSM1, $R= 0.382$ (sig 0.025)

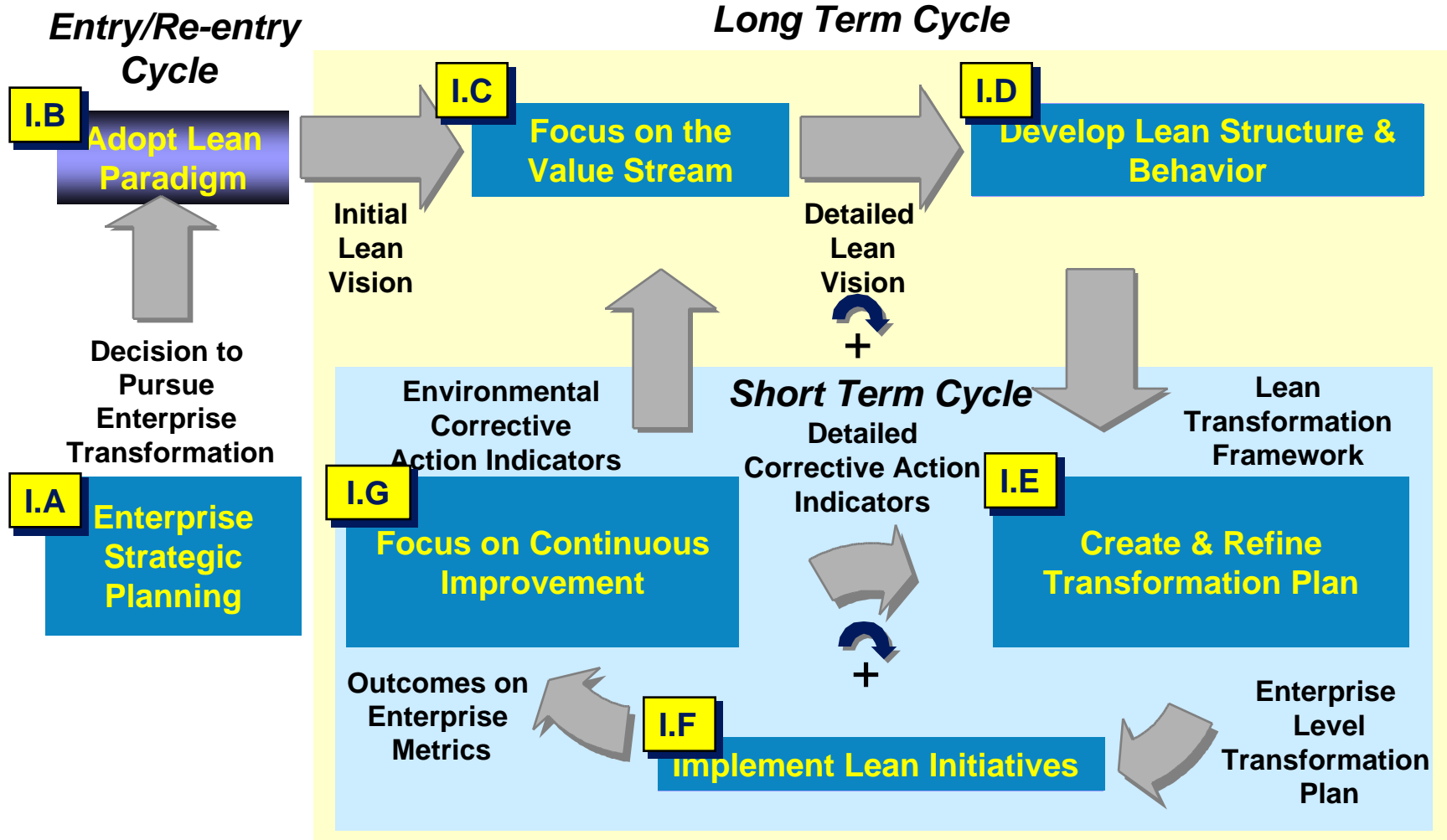




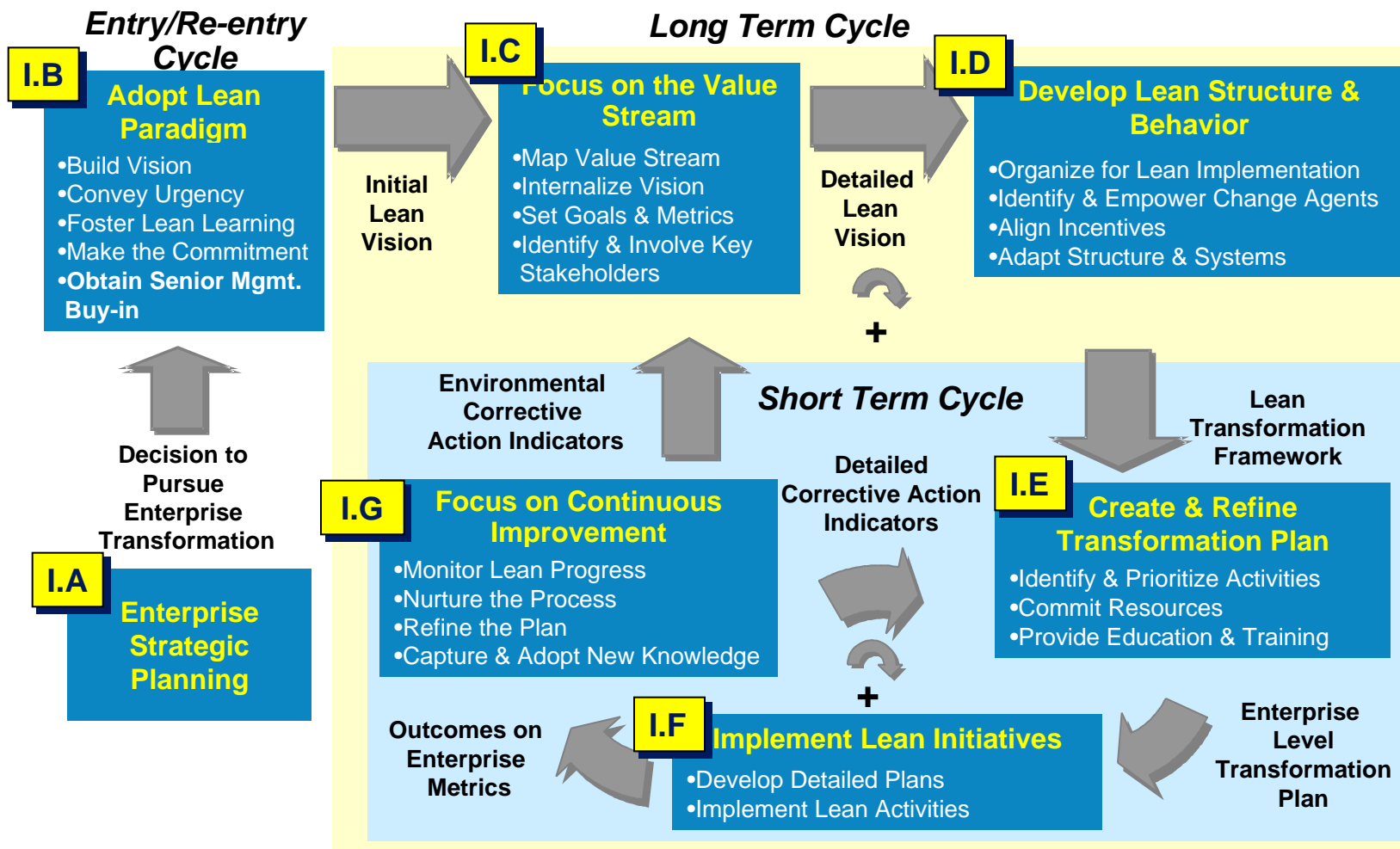
Results

- The three hypotheses hold, suggesting that there may be a causal link between setting the lean transformation/leadership environment as a precursor to lean enterprise maturity
- The Transition to Lean (TTL) Roadmap represents a proposed transformation activity sequencing, which can also be tested using the data,
- LESAT Section 1 maps directly to the TTL
- The existence of highly correlated data acts to disprove the null hypothesis that there is no inferred causality amongst the sequence of TTL elements

Enterprise Transition to Lean (TTL) Roadmap



Enterprise Transition to Lean (TTL) Roadmap





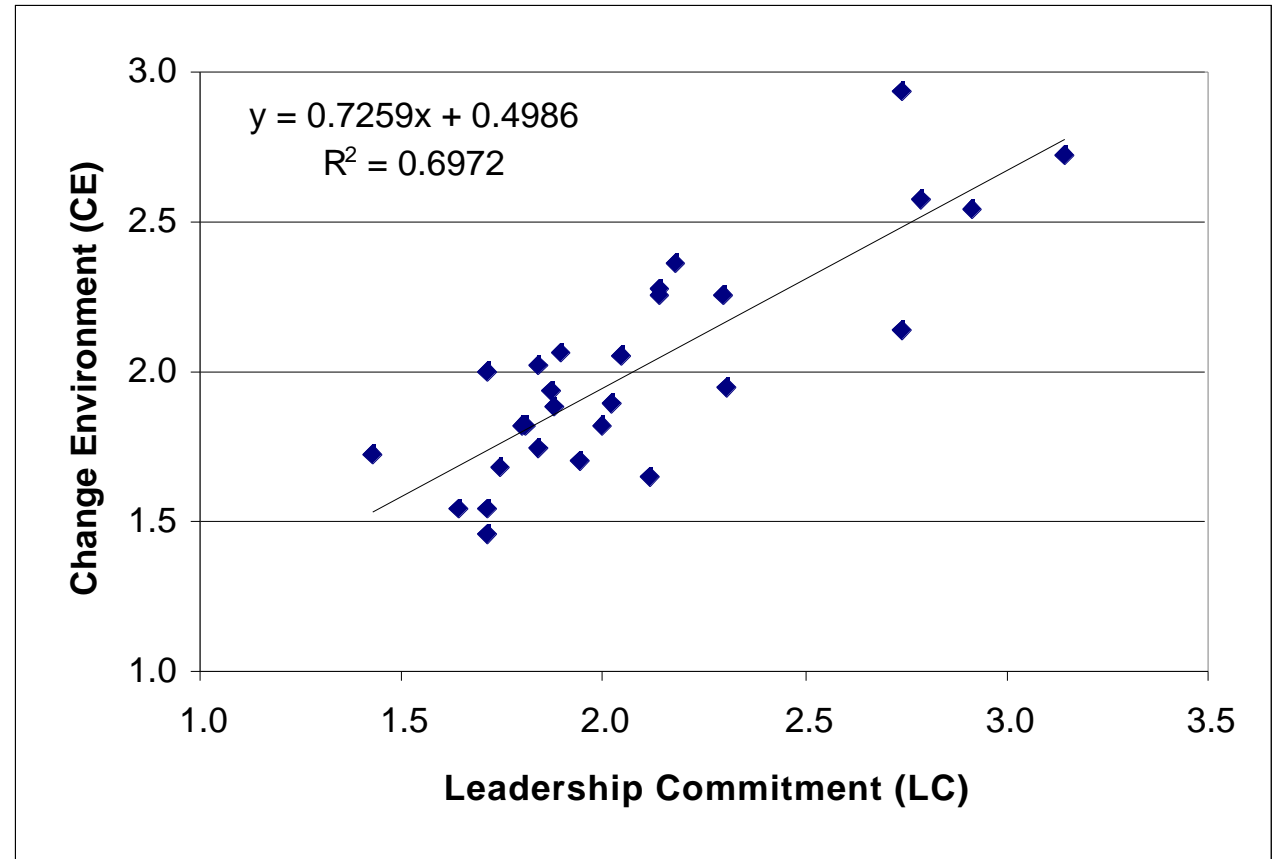
Testing Macro-Variables from the Transition to Lean Roadmap

- Define Leadership Commitment (LC) to transform to a lean enterprise as the average of LESAT practice I.A and I.B maturity
- Define the creation of the lean enterprise Change Environment (CE) as the long-term loop of the TTL, the average of the LESAT practice I.C and I.D maturity
- Define the lean enterprise Change in Practice (CP) as the short-term loop of the TTL, the average of the LESAT practices I.D, I.E, and I.F.
- If the logic of the TTL holds, then we would expect to see
 - A high correlation between LC and CE
 - A high correlation between CE and CP



Lean Change Environment as a Function of Leadership Commitment

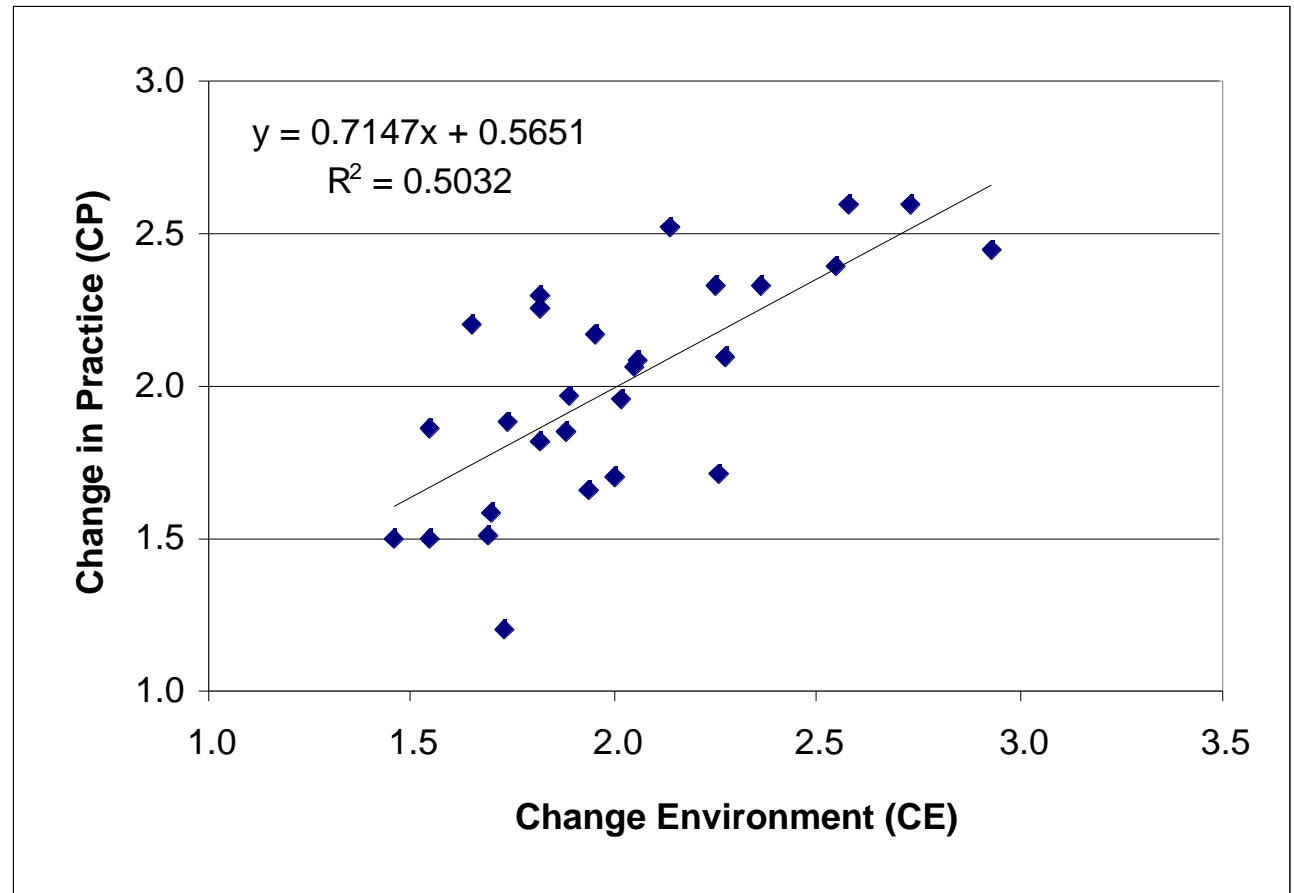
- $R=0.835$ ($n=28$)
- There is a strong indication that creating a mature lean Change Environment is highly related to mature lean enterprise Leadership Commitment (LC).





Lean Change in Practice as a Function of Lean Change Environment

- $R=0.709$ ($n=28$)
- There is also a strong indication that lean Change in Practice (CP) maturity is highly related to lean enterprise Change Environment (CE) maturity.



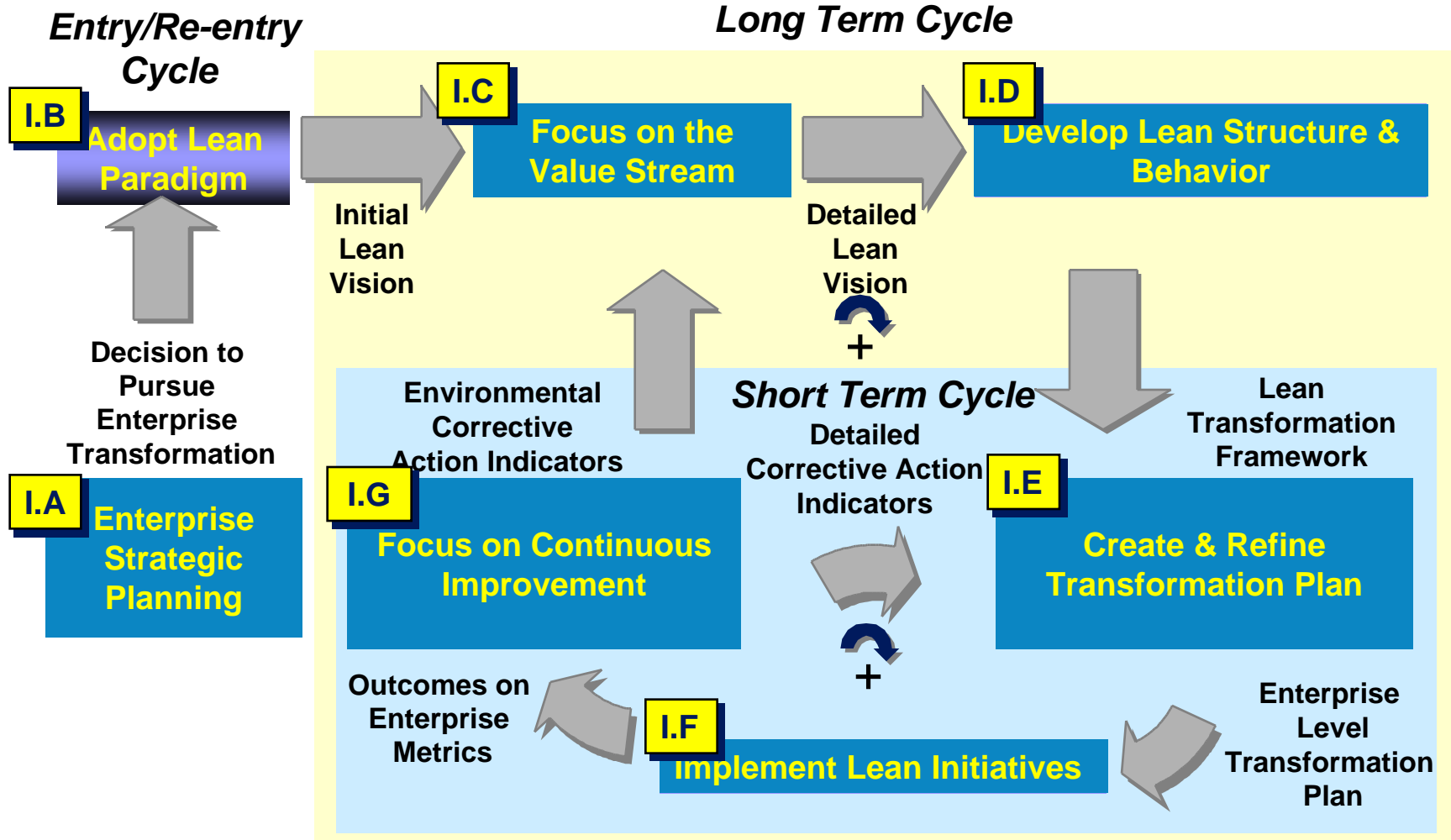


Results of TTL Structure Test

- If we test the TTL roadmap using the industry data, then the correlations between progressive steps can be used as a measure of the validity of the tool.
- As the table highlights, there is a moderate to strong correlation between each of the TTL steps, indicating that (to first order) the proposed sequencing of lean transformation steps appears valid

Bivariate	Correlation r_{ij}	r_{ij}^2	$r_{ij}^2 - r_{iBIA}^2$	r_{iCIB}

Enterprise Transition to Lean (TTL) Roadmap





LESAT Enabled Lean Enterprise Transformation - Case study results

- Enterprises are interpreting and acting on results in several manners
 - Improve lowest maturity practices
 - Come to consensus on highest variability areas
 - Address lowest maturity practices in Section I only in anticipation that they will lead to improvement in Sections II and III
 - Sequence the improvements in a manner consistent with the TTL (considers LESAT practice interdependencies)
 - Prioritizing improvements and change by cross-referencing improvement activities with strategic objectives
- Set future state 1-2 years out based on strategic needs of 5 year plan
- Observed 3 Categories of lean transformation management



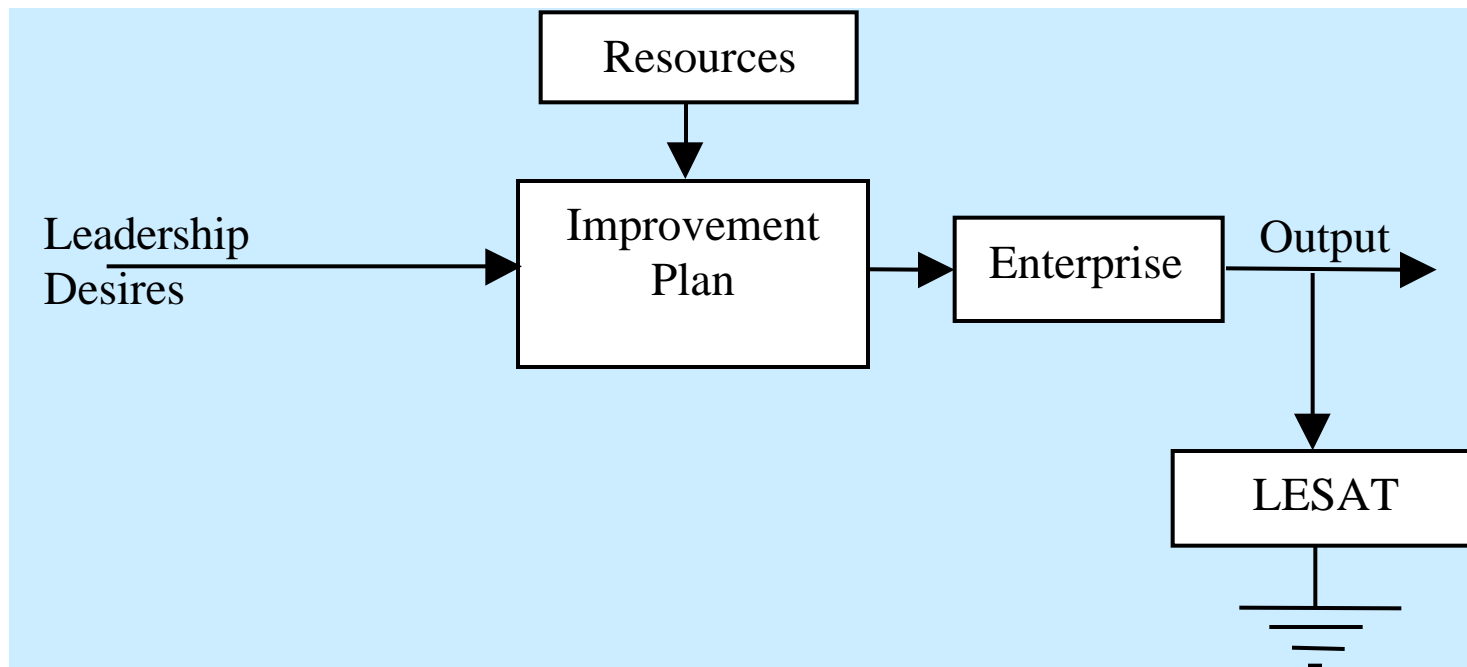
Observed Categories of Lean Transformation Management

- Category 1 - Open Loop Assessment
- Category 2 - Independent Closed-Loop Control
- Category 3 - Integrated Closed-Loop Control



Category 1 - Open Loop Assessment

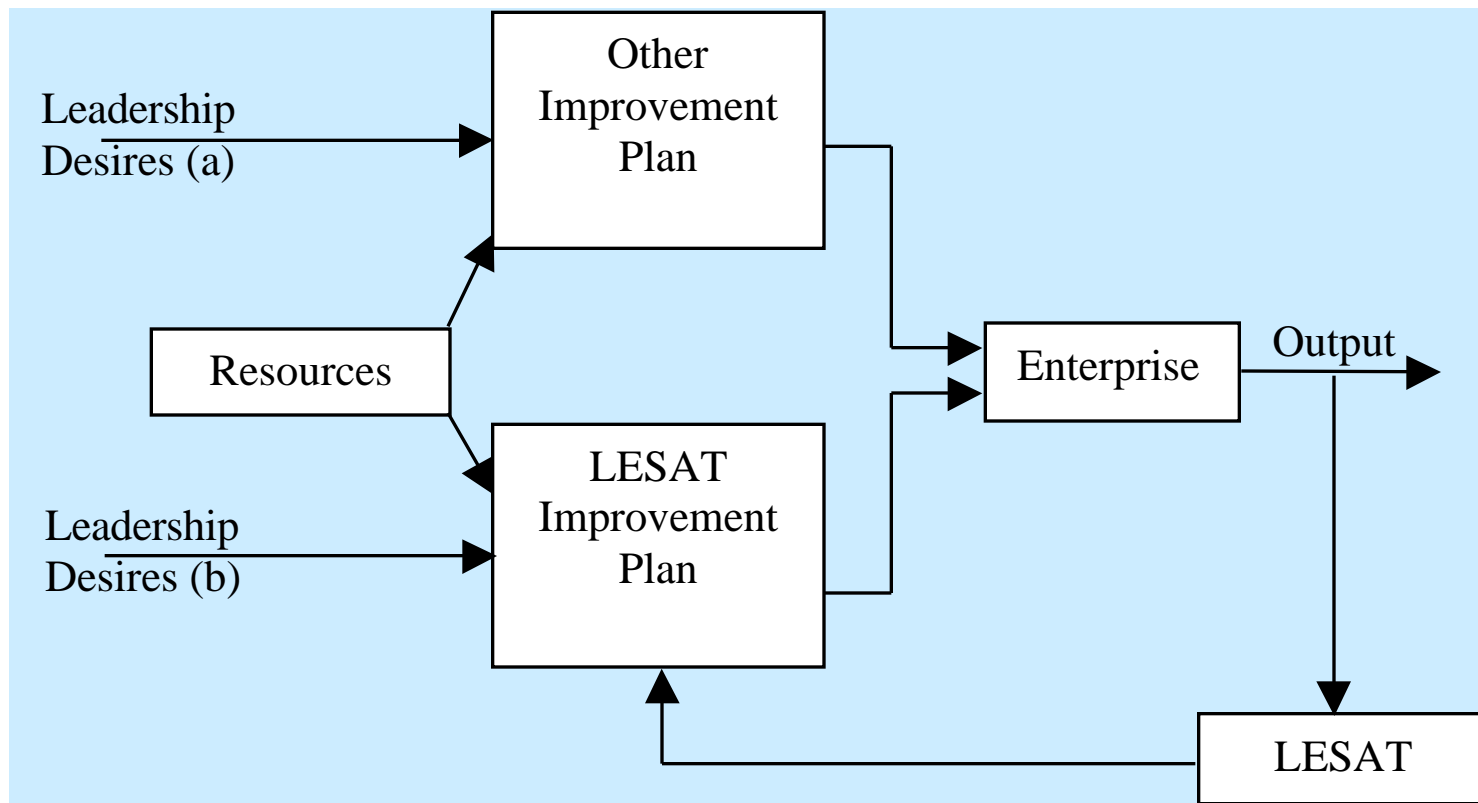
- Using LESAT
 - Will improve the lean enterprise vocabulary of the participants
 - Will have little or no direct effect on transformation





Category 2 - Independent Closed-Loop Control

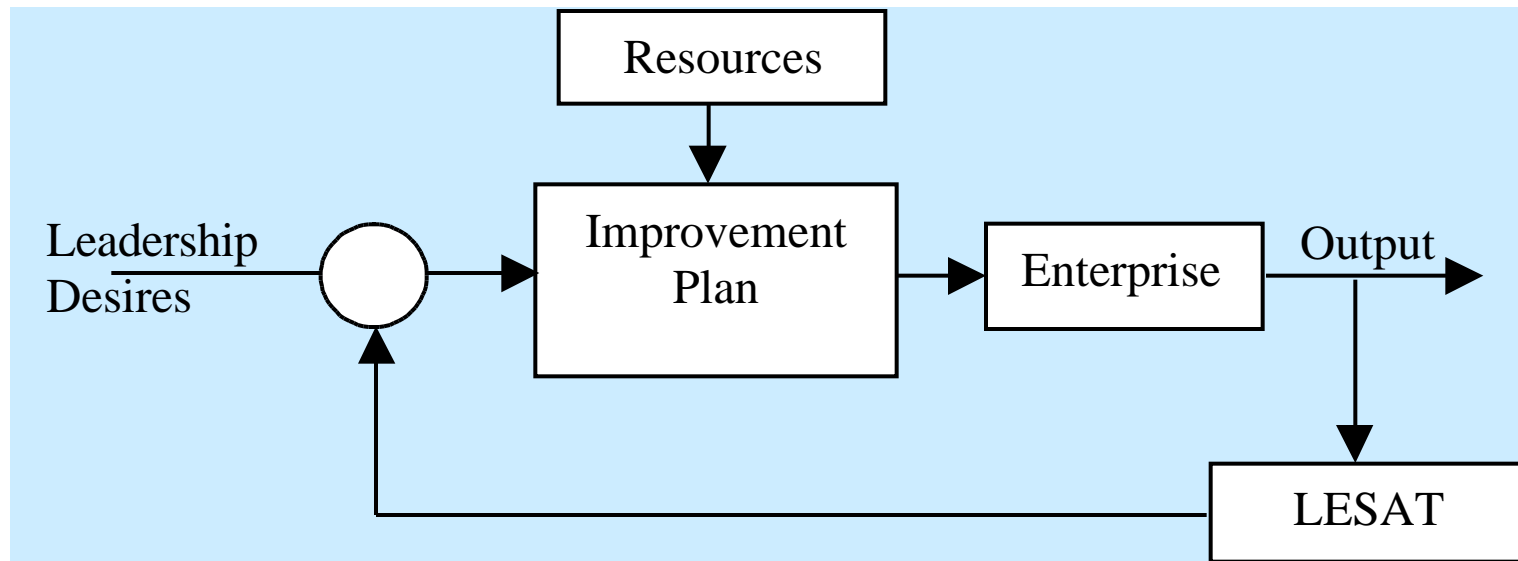
- Using LESAT
 - Will have impact on transformation and improvement activities, with uncertain outcome
 - Can result in competition of objectives (and for resources)





Category 3 - Integrated Closed-Loop Control

- Using LESAT
 - Will result in impact on enterprise transformation with much less uncertainty than first two models
 - Manages competing desires and resources to move the enterprise in an agreed-upon strategic direction





Perceived Cost/Benefit of LESAT in Industry

- Benefits
 - Assessment process as valuable as results
 - Increased executive communication
 - Creation of common vocabulary
 - Identify and support those who need education
 - Open identification of enterprise-level issues
 - Clear picture of maturity of enterprise
 - Next level of maturity obvious



Perceived Cost/Benefit of LESAT

- Costs
 - 4-6 hours for intro session, rating, and report-out
 - Additional resources to conduct the assessment and deal with logistics and data
 - Migration actions to next maturity level is unclear
 - Starting point of improvement efforts is unclear
 - Coordinating executives is difficult



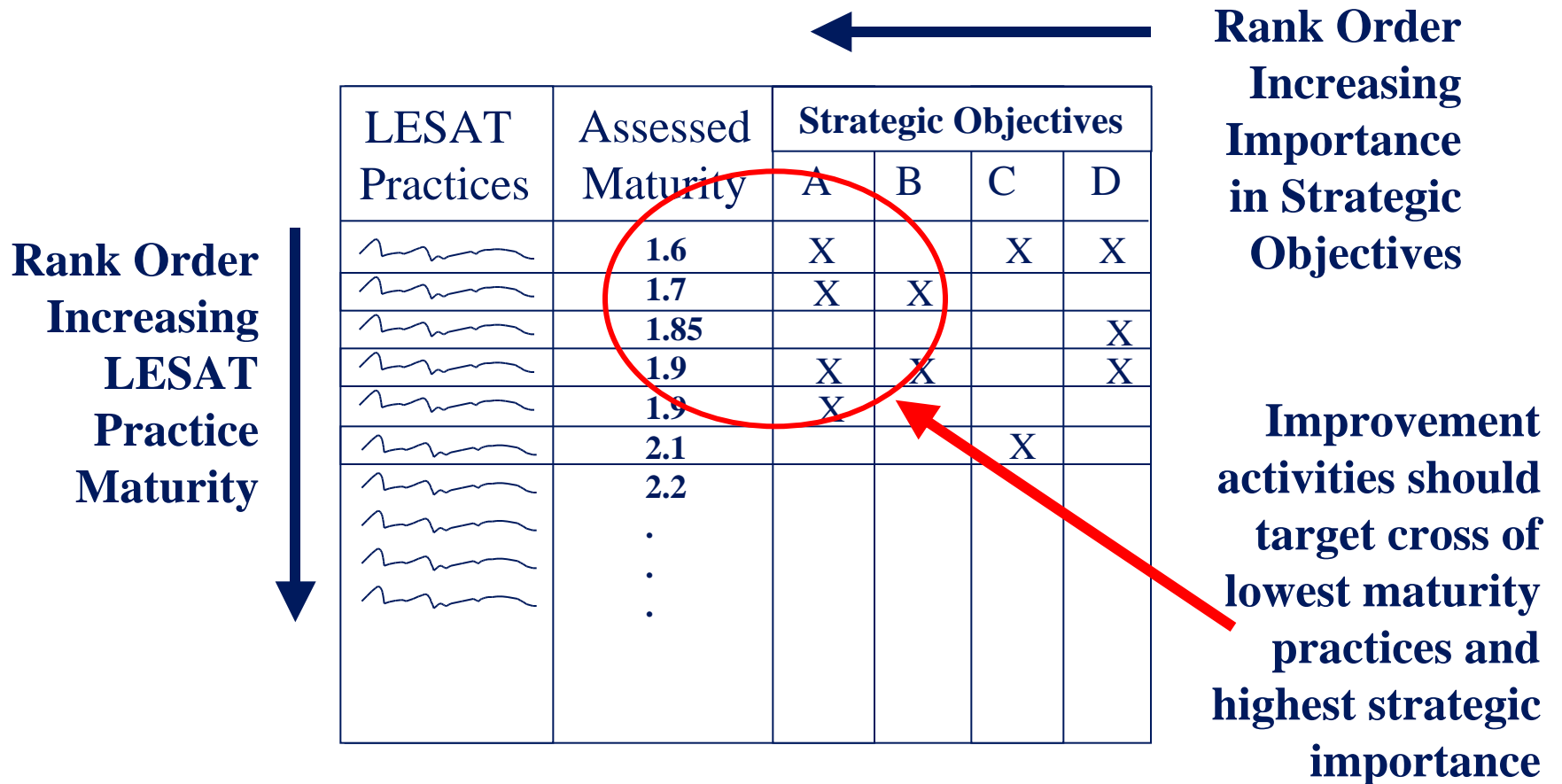
Major Observations on LESAT use to Date

- Transformation is a continuous process that takes years
- LESAT acts as a “sensor” for closed-loop lean enterprise management control
- LESAT users fall into 3 categories of enterprise management
 - 1 - Open Loop
 - 2 - Independent Closed-Loop
 - 3 - Integrated Closed-Loop
- Significant investment of time deemed worthwhile
- Increases understanding of the lean enterprise
- Sustainable transformation successes will likely be closely linked to Category 3 enterprises





Linking LESAT to Strategic Objectives - Completing the Management Control Loop





Thinking of 4-Space Enterprise Management

- In the context of this presentation, there are four major variables associated with prioritizing lean transformation, namely
 - Strategic Needs (SN)
 - Stakeholder Value (SV)
 - LESAT Practices Interdependencies (LPI)
 - Lean Maturity (LM) as measured by the LESAT
- Deciding where to focus transformation improvement efforts needs to consider decision making in a 4 dimensional space made up of these measures (SN,SV, LPI, LM), with the intention of improving the most important and least mature areas of the enterprise
- Coupled with the transformation progression of the TTL, considering these variables should lead to a more effective and accelerated lean enterprise transformation that improves total enterprise value delivery



Summary

- The Lean Enterprise is a source of competitive differentiation, and rests on creating value for all enterprise stakeholders
- There are no true lean enterprises in the aerospace industry yet (as measured by the LESAT)
- There is a strong correlation between Transformation/Leadership lean maturity and lean Lifecycle Process and Enabling Infrastructure maturity (the source of revenues and costs)
- The TTL tool is a guide for transitioning to a lean enterprise (empirical evidence supports the logic of the roadmap) - this can lead to transformation acceleration versus ad hoc improvement efforts that only address “low-hanging fruit”
- Linking enterprise-level maturity measures with strategic objectives helps create closed-loop transformation by prioritizing improvement activities that minimizes resource utilization and internal competition, while maximizing impact on transformation - this is a source of lean enterprise transformation acceleration.



Questions?

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