Introduction to Lean Product and Process Development

LeanPPD Consortium

www.leanppd.eu
• EU funded project
• 4 year (Feb 09 – Feb 13)
• 7,8 ML€ budget
• 12 European partners
• www.leanppd.eu
How to live (or survive)?

• Next Ricardo’s competitive advantages…

• Keynesian policies…

• Schumpeterian strategies…

• Lean approaches…
Lean? Where? When?

- Japan
  - 1945, economic post-war crisis
  - 1965, market liberalization
  - 1970ies, petroleum crisis & gas emission regulation
  - 1990ies, local financial crisis
  - 2008, global financial crisis
A proud history of improvements

Henry Ford (1863 – 1943)

Kiichiro Toyoda (1894 – 1952)

Taichi Ohno (1912 – 1990)

Shigeo Shingo (1909 – 1990)

Jeffrey K. Liker

James P. Womack & Daniel Jones

Source: www.takt.com & www.lean.org
Lean is...

- A mindset, or way of thinking, with a commitment to achieve a totally waste-free operation that’s focused on your customer’s success
- It is achieved by simplifying and continuously improving all processes and relationships in an environment of trust, respect and full employee involvement
- It is about people, simplicity, flow, visibility, partnerships and true value as perceived by the customer

Source: David Hogg, High Performance Solutions, 2008

Lean means economical, thin, more value with less work
But isn’t it about production?

- **Lean Production** cuts costs and inventories rapidly to free cash, which is critical in a slow economy.

- It also supports growth by improving productivity and quality, reducing lead times and freeing huge amounts of resources.

Source: Principles of Lean Thinking, 2004
Lean Enterprise

Source: xrtraining.com, 2009
While the world is changing...

MASS CUSTOMIZATION

REDUCED TIME TO MARKET

GLOBALIZATION
...maybe we are missing something?

- **Product is changed**
  - Customer and market demands for value creation incorporating sustainability, cultural aspects and customisation
  - Production of affordable & sustainable (social, economic, environment) products requires effective lean design and engineering

- **Product Design and Development (PD) is more and more complex**
  - Design stage impacts whole product lifecycle
  - 80% of manufacturing cost determined in design stage
  - Time available for PD is decreasing
  - Complex-design products not easy to make lean in production stage (causing waste & non-value added activities)

- **There is much more opportunities for competitive advantage in PD than anywhere else!**
The “time” variable

Today
40% 60%

Yesterday
15% 85%

Design and Development

Production

Reduced TTM

30 - 40%
The “time-space” variable
Then: Lean Thinking itself might be improved

Lean Thinking

Lean Manufacturing (Shopfloor)
- Definition exists
- Value Stream Mapping (VSM)
- Eliminates Waste
- Tools exist (e.g. JIT, Kaizen, Jidoka)
- Models available
- Technical & Engineering based

Lean Enterprise (management)
- Definition exists
- Value Stream Mapping (VSM)
- Eliminates Waste
- Creates Value
- Tools exist (e.g. 5’M)
- Models available
- Management based

Lean Product (and Process) Development
- New idea
- Dedicated tools not exist
- No VSM
- No full models available
- Engineering based
Lean Thinking in Product Design & Development

• Lean principles in Product Development
  – Lean objective is to identify **Value and Non-Value Added Activities** (VAA), in order to eliminate Non-Value Added (NVA)
  – VAA in Product Development is any activity that would **result in customer requirements being met** (or exceeded)
  – Engineering decisions in product development **must be based on proven knowledge** and experience
  – Failure to apply **proven knowledge and experience** could result in product and process redesign (NVA)
While manufacturing is a repetitive transactional-based activity, which might concretize the decision taken by others.

Product Design and Development is a recursive and reiterative intellectual activity, where designers and engineers might find solutions for given problems.

- Design and Development mean defining, analyzing, testing, comparing, choosing, specifying, documenting, etc.
Lean PD literature
Toyota Lean PD System
Toyota Lean PD System

5. Develop a Chief Engineer System to Integrate Development from Start to Finish
6. Organize to Balance Functional Expertise and Cross-functional Integration
7. Develop Towering Technical Competence in all Engineers
8. Fully Integrate Suppliers into the Product Development System
9. Build in Learning and Continuous Improvement
10. Build a Culture to Support Excellence and Relentless Improvement
11. Adapt Technology to Fit your People and Process
12. Align your Organization through Simple, Visual Communication
13. Use Powerful Tools for Standardization and Organizational Learning

1. Establish Customer-Defined Value to Separate Value-Added from Waste
2. Front-Load the PD Process to Explore Thoroughly Alternative Solutions while there is Maximum Design Space
3. Create a Leveled Product Development Process Flow
4. Utilize Rigorous Standardization to Reduce Variation, and Create Flexibility and Predictable Outcomes

Source: Morgan & Liker, 2006
P1: Establish customer-defined value to separate value-added from waste

- **Main objectives of Lean**
  - Remove Waste (cost reduction)
  - Maximise Value (meet/exceed customer requirements)

- **Waste**
  - Any activity that takes time and money but does not add value from the customer’s perspective

- **Value Added Activity**
  - Any activity that transforms or shapes raw material or information to meet customer requirements

- **Non-Value Added Activity**
  - Any activity that takes time, resources, or space but does not add value to the product itself
Value in Product Development

- Value Added
  - Design and testing
- Wasted time
  - Search for data
  - Waiting for data
  - Data translation
  - Wrong data
  - Data coding
- Non Value Added, but needed
  - Specification
  - Coordination

Source: PLM Alliance, 2007
Waste in manufacturing

• Seven types of waste
  – Over Production (without demand)
  – Waiting (for next step of production)
  – Transportation (un-required movement of products)
  – Inventory (components, WIP, finished product not being processed)
  – Motion (un-required movement of people/equipment)
  – Over Processing (creates extra activity as result of poor design)
  – Rework / Defects (inspecting, repairing, redesigning)
Waste in Product Development

- Two major types
  - Waste associated with the **process of Product Development** itself (e.g. knowledge, communication, and resource)
  - Waste created by **poor engineering** that results in low levels of product or process performance, then embodied in the same **product design** (e.g. complex design, poor manufacturing processes compatibility, and custom parts)
# Waste in Product Development

## Strategy Wastes

<table>
<thead>
<tr>
<th>Over Production</th>
<th>Too many products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Too many projects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Over / Inappropriate Processing</th>
<th>Inappropriate processing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrong projects</td>
</tr>
<tr>
<td></td>
<td>Failure to identify and manage design risk</td>
</tr>
<tr>
<td></td>
<td>Technology acquired but not used</td>
</tr>
<tr>
<td></td>
<td>Poor make versus buy decisions resulting in inability to deliver</td>
</tr>
<tr>
<td></td>
<td>Poor long-term understanding of customer needs</td>
</tr>
<tr>
<td></td>
<td>Lack of focus</td>
</tr>
</tbody>
</table>
## Waste in Product Development

### Organizational Wastes

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong organization structure</td>
<td>Poor process focus and visibility</td>
</tr>
<tr>
<td></td>
<td>Poor team arrangements (including geography)</td>
</tr>
<tr>
<td>Inappropriate individuals</td>
<td>Poor training and skills development</td>
</tr>
<tr>
<td>Lack of resources</td>
<td>Lack of appropriate number of correct human resources</td>
</tr>
<tr>
<td></td>
<td>Poor technology take up</td>
</tr>
<tr>
<td>Untapped human potential</td>
<td>Poor utilization of people</td>
</tr>
<tr>
<td></td>
<td>Poor representation of different function on Integrated Project Teams</td>
</tr>
<tr>
<td></td>
<td>Lack of continuity (of people)</td>
</tr>
<tr>
<td>Inappropriate processes</td>
<td>Poor process management</td>
</tr>
<tr>
<td></td>
<td>Lack of process knowledge capability</td>
</tr>
</tbody>
</table>
# Waste in Product Development

<table>
<thead>
<tr>
<th>Operational Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Over Engineering / Production</strong></td>
</tr>
<tr>
<td>Over specification - over designed</td>
</tr>
<tr>
<td>Failing to optimise design</td>
</tr>
<tr>
<td>Too much and wrong timing for detail</td>
</tr>
<tr>
<td>Too much detail and unnecessary info</td>
</tr>
<tr>
<td>Redundant development (re-use not practised)</td>
</tr>
<tr>
<td><strong>Waiting</strong></td>
</tr>
<tr>
<td>Information created too early</td>
</tr>
<tr>
<td>Late in delivery</td>
</tr>
<tr>
<td>Waiting to process information</td>
</tr>
<tr>
<td>Waiting for information (e.g. inability to deliver prototypes quickly and correctly)</td>
</tr>
<tr>
<td>Unavailable or of suspect quality</td>
</tr>
</tbody>
</table>
## Waste in Product Development

<table>
<thead>
<tr>
<th>Operational Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
</tr>
<tr>
<td>Multiple sources and transport needs</td>
</tr>
<tr>
<td>Communications failure and non-conformance</td>
</tr>
<tr>
<td>Lack of standardisation of processes</td>
</tr>
<tr>
<td>Lack of use of standard parts and / or lack of commonality</td>
</tr>
<tr>
<td>Lack of common prioritisation</td>
</tr>
<tr>
<td>Information formats - Lack of common/compatible standards</td>
</tr>
<tr>
<td>Information systems – Incompatibility, leading to manual transfer waste, and conversion waste</td>
</tr>
<tr>
<td>Poor interface control or management of design data among departments</td>
</tr>
</tbody>
</table>
# Waste in Product Development

## Operational Wastes

| Inventory | Unnecessary details and too much information  
|           | Incomplete content  
|           | Poor configuration management  
|           | Poor parts codification  
| Motion    | Information pushed to wrong people  
|           | Unnecessary manual intervention due to poor system connectivity  
|           | Too many data interfaces  

# Waste in Product Development

## Operational Wastes

<table>
<thead>
<tr>
<th>Over / Inappropriate Processing</th>
<th>Unnecessary development activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unnecessary serial processing</td>
</tr>
<tr>
<td></td>
<td>Out of sequence working (due to poor integration)</td>
</tr>
<tr>
<td></td>
<td>Inappropriate changes (changes not customer driven or not of benefit to business)</td>
</tr>
<tr>
<td></td>
<td>Re-work due to changing priorities or requirements</td>
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<tr>
<td></td>
<td>Excessive verification</td>
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<tr>
<td></td>
<td>Over authorisation</td>
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<tr>
<td></td>
<td>Poor/ bad decisions affecting future</td>
</tr>
<tr>
<td></td>
<td>Excess /custom processing</td>
</tr>
<tr>
<td></td>
<td>Too many or too little iterations / cycles</td>
</tr>
<tr>
<td></td>
<td>Working with wrong/incomplete information</td>
</tr>
<tr>
<td></td>
<td>Processing of defective information</td>
</tr>
<tr>
<td></td>
<td>Information created / passed too early/late</td>
</tr>
<tr>
<td></td>
<td>Data acquired then not used</td>
</tr>
<tr>
<td></td>
<td>Unnecessary data conversions</td>
</tr>
<tr>
<td></td>
<td>Poor parts re-use</td>
</tr>
<tr>
<td></td>
<td>Over or inappropriate tolerancing</td>
</tr>
<tr>
<td></td>
<td>Use of inappropriate technology</td>
</tr>
</tbody>
</table>
# Waste in Product Development

**Operational Wastes**

<table>
<thead>
<tr>
<th>Reworks / Defective</th>
<th>Quality lacking or suspect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conversion error</td>
</tr>
<tr>
<td></td>
<td>Wrong level</td>
</tr>
<tr>
<td></td>
<td>Incomplete, ambiguous, inaccurate design</td>
</tr>
<tr>
<td></td>
<td>Tolerance exceeded</td>
</tr>
<tr>
<td></td>
<td>Failure to understand and capture requirements</td>
</tr>
<tr>
<td></td>
<td>Poor design for X - manufacture, assembly, cost, reliability, and supply</td>
</tr>
<tr>
<td></td>
<td>Poor process outputs (poor specification, unclear requirements)</td>
</tr>
<tr>
<td></td>
<td>Poor configuration management</td>
</tr>
<tr>
<td></td>
<td>Poor planning</td>
</tr>
<tr>
<td></td>
<td>Poor supplier identification</td>
</tr>
<tr>
<td></td>
<td>Use of immature technology</td>
</tr>
<tr>
<td></td>
<td>Inappropriate use of tools</td>
</tr>
<tr>
<td></td>
<td>Lack of knowledge capture and reuse</td>
</tr>
</tbody>
</table>
P2: Front-load the PD process to explore alternatives thoroughly
Something that might be considered from the early stages...

Cumulated Incurred costs

Design  Production  Distribution & Use

Accrued costs
Something that might be considered from the early stages...

Opportunities incost reductions

Doing it better first is convenient!

Change costs

Concezione  Product Design and Development  Process Development  Production  Use
Concurrent Engineering

- **Integrated product development** approach
  - Emphasis on the response to customer expectations by producing better, cheaper and faster products
  - Multi-disciplinary teams
- Sharing and exchanging required knowledge and information in such manner that decision-making proceeds with emphasis on **simultaneous consideration during the design stage of all other product life cycle aspects**
  - As well as **performing parallel activities**
  - The individual team member is responsible throughout all the project for the product development
Concurrent Engineering

- Product Engineer
- Logistic
- Purchase
- Finance
- Customer
- Supplier
- Services Engineer
- Production
- Marketing
- Manufacturing Engineer
- Concurrent Product Development
Set Based Concurrent Engineering

- SBCE is the core of Toyota Product Development System (TPDS)
- Design participants practice SBCE by reasoning, developing, and communicating about sets of solutions in parallel and relatively independently
  - As the design progresses, they gradually narrow the sets of solutions based on additional information from development, testing, simulation, trade-off, customer and other participant sets until they agree on one solution
  - It is product development in a knowledge based environment
- Defined by Allen C. Ward (1960-2004)
Set Based Concurrent Engineering

(A) “Point-Based” Concurrent Engineering

- Selection
- Specification
- Prototyping
- Tests
- Final design

Re-Selection
Feed back
Set of Design

(B) “Set-Based” Concurrent Engineering

- Set of Design

Evaluate against trade-off curves
Eliminate infeasible solutions
Detail the design
Combine in different ways

Final Design
Main elements of SBCE

• Consider broad alternatives and gradually narrowing them, till the optimal choice and selection
• Chief Engineers
• Cross-functional team
• Team communication
• Working culture
• Knowledge generation and re-use
  - Selection of set of solutions and encouragement to perform several simulations, develop several prototypes and test them - leading to generation of valuable knowledge
  - This knowledge is captured formally for its re-use in future projects
SBCE Concept design level

Chief Engineer Vision: (vehicle concept design in a written document)

Body Eng    Chassis Eng    etc

Stylists Develop Around 12 Artistic Concepts in 2-D

Chief Engineer: Approve the New Vehicle Concept (sketch and specification) After considering requirements (e.g. passengers ergonomics, marketing, etc.).
SBCE System design level

Stylist: 6-10 Concepts and 1/5 Scale-Clay Prototypes

Planning Studies of:-
• Typical cross sections
• Joint definition
• Preliminary parts layout
• Wire harness
• Crash analysis
• Etc

Body Eng: Kentouzeu drawings

Narrow Set of Design to 2-3 Concepts for 1:1 Scale-Clay Prototypes

Body Eng: Kentouzeu drawings

One final design Concept

Body Structures Design Plan:
kozokeikaku (K4)

Toyota public event

Vehicle Development Units

Feedback & Approval
SBCE Detail design level

Body structures
design plan: (K4)

Detail design
(body panels & structural components)

Drawings sent to die Eng

Stamping Soft-Tool dies produced

Fit & function are adjusted

Hard-Tool dies produced into a screw Body

Full vehicle: Build & Test

Final design
ICT for SBCE

Collaborative Product Development and Management - CPDM

Authoring tools - CAx

EDM
PDM
PLM
Collaborative desktop

CAD 2D
CAD 3D
DMU
CAE
VR
RP/RM - CAM
CAPP
ICT for SBCE

'D70' '85' '95' '00
Drawing based Feature based Process based Knowledge based

Drawing based

CAD 3D

Feature based

CAD/CAM/CAPP
Integration
Virtual Prototypes

Process based

Knowledge based
digital knowledge

'00'
ICT for SBCE

Source: Adapted from an idea of the Kaemart Group
P3: Create a leveled product development process flow

- A Lean PD system is a **Knowledge Work Job Shop**, which a company can continuously improve by using adapted tools used in repetitive manufacturing processes to eliminate waste and synchronize cross-functional activities.
Value stream mapping

Value stream mapping in PD

Lead time = 30.1 days
Processing time = 11.6 hours

Source: Fiore, 2005
Value network analysis

- Value Network Diagram and Social Network Analysis
  - Ellipses represents roles
  - Colours of links indicate frequency of communication
  - Links are labelled and given a single arrow head to show nature and direction of the value transfer
  - Questions
    - Who do you communicate with? How often?
    - What do you send/share and to whom? What do you need and from whom?
Value network analysis

- Roles as agents of value creation / consumption
  - Flow Objects can be tangible or intangible and can include wisdom, knowledge, information and physical objects
  - Flow Objects may be customer deliverable either to next in value chain or ultimate end customer
  - Value can be created from intangibles and it may be negotiable through an exchange mechanism

- Assess health of network by subjective measure or by comparison with industry benchmarks
  - Coherent logic and reciprocity
  - Asset utilisation
  - Healthy balance of tangibles and intangibles
  - Are there dead-links, missing links?
  - Are exchanges fair?

Source: Allee, 2008
P4: Utilize rigorous standardization to reduce variation & create flexibility

- A Lean PD system creates higher-level system flexibility by standardizing lower-level tasks
  - **Design standardization**: common architecture, modularity, and reusable or shared components
  - **Process standardization**: standardize tasks and work instructions, from design till manufacturing processes
  - **Engineering skill set standardization**: the right staffing and program planning guarantee flexible and skilled engineers

- Adoption of **rules and methodologies**
Design methodologies and rules

- TRIZ e Problem solving techniques
- Quality Function Deployment
- Value Analysis and Engineering
- Design to Cost and Target Cost Management
- Design for X and Design to Cost
- Modular design e Platform design
- Design of Experiment, Robust Design, Process Capability
- Clustering and Group Technology
- Variery Reduction Program
- Risk analysis, FMEA e FMECA
- Lifecycle Analysis, Engineering and Assessment
Design for X

Source: Ulrich and Eppinger, 2006
P5: Develop a Chief Engineer system to integrate development

- Chief Engineer is responsible for and can tell you the exact status of any given project
  - The Chief Engineer is not just a project manager but a leader and technical systems integrators, he/she is the glue of the PD process
  - It is to this individual that difficult decisions are brought for resolution
P6: Organize to balance functional expertise and cross-functional integration

- Integrated traditional silos through the Chief Engineer
- Module development Teams
- Using obeya ("big room") system to enhance cross-functional integration
P7: Develop towering technical competence in all engineers

- Technical excellence
  - Rigorous hiring process
  - Career path for technical skills
- Principle of *genshi genbutsu* (actual part, actual place): get your hands dirty and go directly to see for yourself how the work is getting done and what the problems are
P8: Fully integrate suppliers into the PD System

- Involve suppliers from the earliest stages in concept development of a product
  - Presourcing arrangements
  - Guest engineers
- Suppliers are valued for their technical expertise in addition to their parts-making capability
P9: Build in learning and continuous improvement
P10: Build a culture to support excellence and relentless improvement
P11: Adapt technology to fit your people and process
P12: Align your organization through simple, visual communication
A3 sheets

**PROBLEM SITUATION**

<table>
<thead>
<tr>
<th>Problem Description</th>
<th>Count</th>
<th>Risk</th>
<th>Probability</th>
<th>Likelihood</th>
<th>Total Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of safety glasses</td>
<td>3</td>
<td>High</td>
<td>3</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Lack of safety shoes</td>
<td>2</td>
<td>High</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Lack of safety boots</td>
<td>1</td>
<td>High</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Lack of safety hats</td>
<td>2</td>
<td>High</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Lack of safety vests</td>
<td>1</td>
<td>High</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Lack of safety earplugs</td>
<td>3</td>
<td>High</td>
<td>3</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Lack of safety gloves</td>
<td>5</td>
<td>High</td>
<td>3</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

**Countermeasures**

- Clearly define and inform shop safety rules to shop employees and shop supervisors. Rules may need to be reworded and re enforced to reflect practical shop floor conditions.
- Reward system to be implemented as first step in lieu of increasing disciplinary action for failing to follow company safety rules.
- Raffle consisting of a cash prize (suggested value of at least $5,000) will be held at the end of the year.
- To maintain eligibility, shop floor members must:
  - Maintain a clean personal injury record
  - Not be caught failing to follow shop material handling and eye protection safety requirements
- Employees would be encouraged to inform and watch out for each other throughout the workday. Once or twice a week, a randomly selected member of the supervisory staff will perform a 'shop patrol' to look for employee non-conformances.
- Eliminated employees would be given the option to buy back into the raffle by making a minimum cash donation to a charity (to be determined).

**Implementation**

To be implemented as a company safety initiative in conjunction with Union Plant Safety Committee. Tracking is to begin for the abbreviated year, starting in March 2002.

<table>
<thead>
<tr>
<th>Action Req'd</th>
<th>Responsibility</th>
<th>Due By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project approval</td>
<td>President (Laverty)</td>
<td>Feb 8</td>
</tr>
<tr>
<td>Communicate A3 plan to Union Safety Committee for review, discussion, and feedback</td>
<td>HR Employee Relations (Eizerman)</td>
<td>Feb 18</td>
</tr>
<tr>
<td>Clarify shop safety rules</td>
<td>Goliat Union Safety Subcommittee</td>
<td>Feb 25</td>
</tr>
<tr>
<td>Roll out details to Goliat management and supervisors + shop employees (through team meetings)</td>
<td>Goliat Safety Representative (Garc)</td>
<td>Feb 28</td>
</tr>
</tbody>
</table>

**Verification and Follow up Activities**

- Progress to be tracked monthly during Quality Systems Team meetings and measurable tracking (compare 2002 progress vs. S91/02/01 YTD safety data)
- Informal survey of shop supervisory and managerial staff on a quarterly basis regarding shop safety requirements and compliance to shop safety rules

**Source**: Morgan & Liker, 2006
P13: Use powerful tools for standardization and organizational learning
LeanPPD Contributions

- Identify the **added value** activities in PD through surveying and analyzing industrial best practices
- Develop tools for PD **Value Mapping** and **Lean Assessment**
- Develop an approach for knowledge acquisition, re-use and creation to enable a **Knowledge Based Engineering (KBE)** system to enable a lean development process and lean product designs
- Propose a **route map** for the incorporation of the Lean PD into organizations
smart lean-T² readiness tool

increase value

readiness

measurement

reduce waste

diffusion

change management for lean-T²

Author: Myrna Flores (2009)
Graphic design: miscelaneo.net
The **lean-T²** Wheel of Change

### Goals
- Implement Lean Principles Successfully
- Improve the Product Development Process

### Goals Elements
- **Lean Strategy**
  - Focus on Customer Value & Value Stream
  - Industry-specific Key Success Factors
  - Change to Lean Paradigm
  - Cost Reduction & Efficiency Improvement
  - Long-term Philosophy with Continuous Improvement
  - Awareness & Understanding of Lean
  - Waste Elimination & Value Added Activities
  - Diff erentiation & Lower Cost

- **Multi-skilled People**
  - Strong Leader (Chief Engineer)
  - Level-out Workload
  - Empowered Teams
  - Integrated Partners/Suppliers
  - Top Management Buy-in
  - Learning & Struggle for Excellence
  - Cross-Functional Integration
  - Incentives v/s Reward for Lean Behaviour

- **Lean Catalysts**
  - Visual Communication
  - Captured & Re-used Knowledge
  - Performance Visibility
  - Visual Metrics for Lean Goals
  - Innovation vs Standardized Work
  - Integrated vs Mechatronic Systems
  - Set-Based Concurrent Engineering, Six Sigma, SS & Other
  - Adapted & Integrated Databases

- **Lean Tools & Technology**
  - Product Development Process
  - Information on Alternative vs Solutions
  - Expenditure in Information Technology
  - Lean Culture & Productivity
  - Firm-specific Core Competence
  - Horizontal Organization on Focus
  - Process Flow & Pull
  - Flexible & Dynamic Process

### Core Concepts
- Organizational Culture
- Home Country/Individual Culture
- External Environment
  - Government
  - Society
  - Economy
  - Green Supply Chain
  - Competitors Benchmarking

Author: Diaz, Flores, Tucci (2009)
LeanPPD Value Mapping
(Tool Under Construction)
LeanPPD Assessment

(Open Questionnaire)

Introduction

Aim:
The objectives of this questionnaire are: 1) to evaluate the progress of companies in highly innovative industries, implementing lean principles into their product development strategy, and 2) to assess how companies effectively measure their level of lean thinking implementation.

Confidentiality:
All information gathered during this study will remain strictly confidential; no names will be published.

Results:
All participating companies will get the results of this study by February 28th 2016.

Notes & Remarks:
A brief list of relevant terms used in this questionnaire is available in the section “Glossary.”

Please answer by giving your opinion rather than the company’s one. When you are not sure of an answer, just put what you think is appropriate, there is no wrong answer.

1. Company’s name: (please type)
2. Interviewer’s name: (please type)
3. Position in the company: (please type)
4. E-mail address: (please type)
5. Company’s sector:
   - Pharmaceutical
   - Medical devices
   - Medical product manufacturer
   - Homeopathic
   - Chemistry
   - Other: (please type)
6. Number of employees worldwide: (please type)
7. Number of employees at your workplace (or: at your location?): (please type)
LeanPPD Assessment
(Tool Under Construction)

Select Perspective
- Lean Strategy
- Multi-Skilled People
- Lean Tools & Technology
- Lean Catalyst
- Financial Perspective
- Learning Perspective
- Customer Perspective
- Process Perspective

Select Key Performance Indicators
1. Focus on Customer Value and Value Stream Mapping (VSM)
- Level of customer participation in the development of products
- Is value stream mapping technique used accurately in PD
- Percentage of products that used inputs from the customer
- Percent of Lead time reduction after using the VSM technique

Select Sub-Elements
1. Lean Strategy:
   - Focus on Customer Value and Value Stream Mapping (VSM)
   - Industry-specific Key Success Factors
   - Change in Lean Paradigm
   - Cost Reduction and Efficiency vs. Time
   - Long-term Philosophy with Continuous Improvement
   - Awareness and Understanding of Lean
   - Waste Elimination and Value Added Activities
   - Differentiation and Lower Cost

Fill Qualitative Key Performance Indicators
1. Level of customer participation in the development of products
   - No customer participation during the product development phase
   - Customers are consulted at Alpha and Beta Testing
   - Customers are consulted before starting the and at testing phase
   - Customers provide feedback in an informal way
   - Customers are involved in every step of the product development
LeanPPD KBE
(Tool To Be Developed)

Design session

Feedback area

Geometric representation area

Input area

Features

Information management applications

Engineering applications
Thanks for your attention!

The LeanPPD consortium
Any questions?

LeanPPD Consortium

www.leanppd.eu