

# Lean CMMI-based process improvement

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# Content

- Objectives of the study
- Brief introduction to Lean
- Presentation of the results
- Conclusions and next steps



## Objectives for the study

Apply Lean principles and tools to CMMI-based process improvement to

- Meet the expectations of the companies for:
  - Comprehensive and usable processes
  - Efficient processes
  - Focussed on developing results that are useful for both the customers and the organization
- Demonstrate improvements quickly

# The three cases

## A. Beginner SPI organization

- Develops electronic systems
- Begins a process improvement program based on CMMI-DEV
- Needs lightweight processes because their “customers do not pay for internal and project management activities”

Develop what adds value to the customer

## B. Process reengineering organization

- Develops web applications
- Accredited CMMI-DEV ML2
- Finds the processes very bureaucratic
- A variety of practices are abandoned because of being of useless

Remove bureaucracy and other non value adding practices

## C. Towards ML4&5 organization

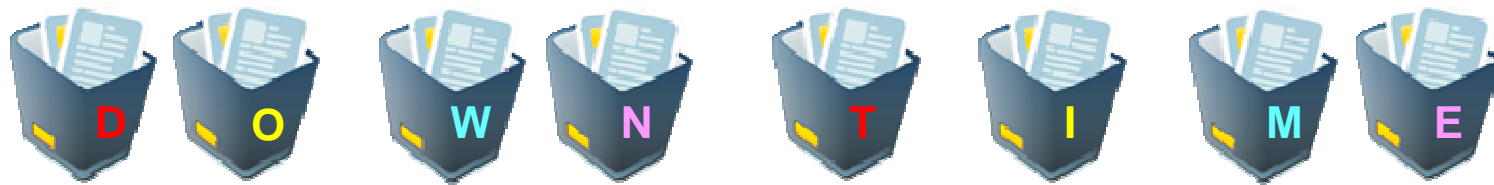
- A software factory with 7 Centres
- Accredited CMMI-DEV ML3
- Implementing CMMI ML4&5
- Particular interest in increasing the efficiency of the processes

Define efficient processes

# Lean Principles and Tools

Lean principles	Tools
Eliminate waste	Seeing waste
	Value stream mapping
Amplify learning	Feedback
	Iterations
	Synchronization
	Emergence
Decide as late as possible	Options thinking
	Defer commitment
	Set-based development
Deliver as fast as possible	Pull systems
	Queuing theory
	Cost of delay
Empower the team	Self determination
	Motivation
	Leadership
	Expertise
Build integrity in	Perceived integrity
	Conceptual integrity
	Refactoring
	Testing
Avoid sub-optimization	

# Waste Types



Defect

Over  
production

Waiting

Non value-  
adding  
processing

Transpor  
tation

Inventory  
excess

Motion  
excess

Employee  
knowledge  
unused

## Case A: Beginner SPI organization

- Approach
  - Define the first draft of the processes based on the current practices in the organization and CMMI-DEV
  - Use SIPOC\* to visualise the processes
  - Review the draft process description from two perspectives:
    - What that the customer pays for
    - What the organization needs for its internal purposes
- Lean principles and tools adequate for such type of context:
  - Eliminate waste
    - Seeing waste
    - Value stream mapping (simplified)
  - Amplify learning
    - Feedback

For the activities that do not meet any of these criteria, keep the simplest solution compliant to CMMI ML2.

\* SIPOC: Supplier Input Process Output Customer

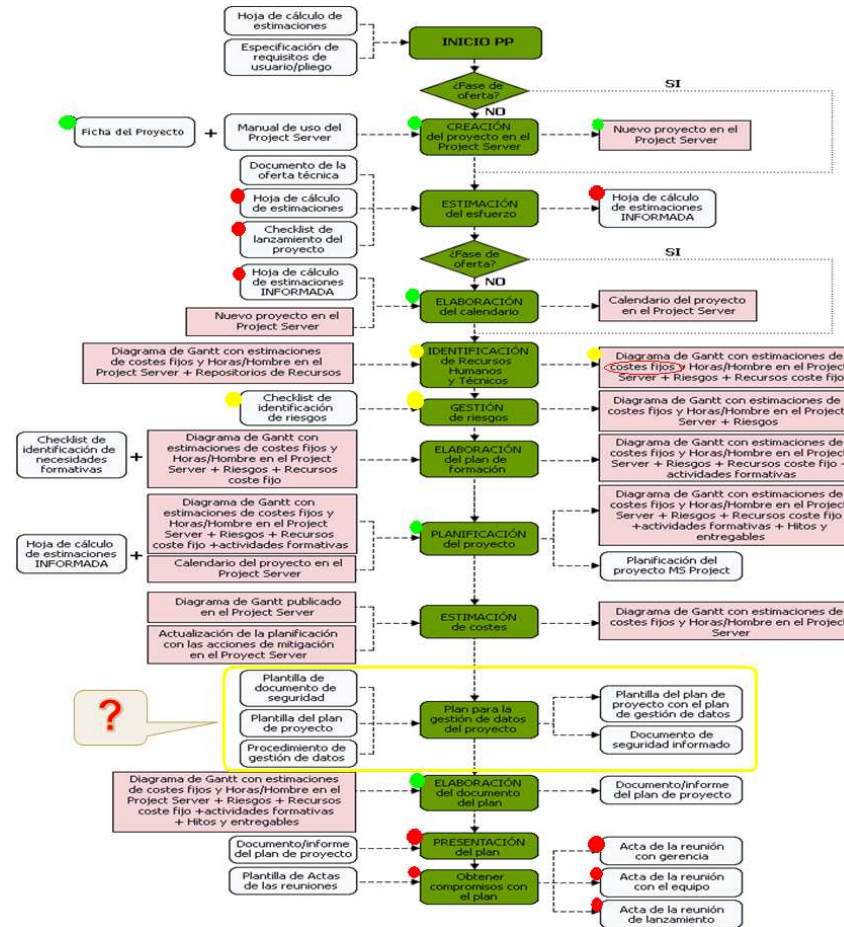
## Case B: Process reengineering organization

### Approach

- Use SIPOC to visualise the process flow
- Mark each activity as:
  - **Green**: Value-adding
  - **Red**: Non value-adding
  - **Yellow**: Non value-adding, but necessary
- Remove the **non value-adding** activities adjusting the process adequately
- For the **non value-adding, but necessary** activities
  - Look for an automated solution
  - Try to integrate the expected result development with other **value-adding** activities
  - Look for a lean solution
- Create a basic process data model
- Eliminate duplicated information
- Revise all manually performed activities and provide as automated as possible solutions
- Maintain compliance to CMMI-DEV



# Case B: Value stream mapping



# Case B: Process reengineering

Proceso	Actividad	Valor (1-3-9)	Tipo desperdicio	Ideas para mejoras	Comentarios
PP	Estimación	1	Non value-added processing	el método de estimación no vale, no lo creen y no se utiliza;	La checklist de lanzamiento del proyecto - no se pudo encontrar
PP	Gestión de riesgos	9		todo es muy variable y no ayudan a analizar los problemas que se han dado en los proyectos pasados y derivar la lista de riesgos relevantes	El checklist de los riesgos incluye riesgos que no se puede hacer nada con ellos
PP	Plan para la gestión de datos del proyecto	3	Motion excess	Esta parte se puede sacar como Tailoring guideline - a ver cómo lo podemos sacar de aquí	Se definió para los proyectos que deben tener en cuenta la LOPD
PP	Presentación del plan	3	Non value-added processing	Buscar cómo simplificar la recolección de evidencias, p.ej. Actas: se podría identificar a quién	no se presenta el plan a la Dirección, no se hacen reuniones de lanzamiento
PP	Creación del proyecto	1	Motion excess		La Ficha del proyecto duplica información del plan del proyecto v la oferta
PP	Plan de proyecto - Proyectos de mantenimiento	3	Defect	Definir un plan incremental	ver la plantilla de plan de proyecto de proyecto de mantenimiento
PMC	Reunión de seguimiento	3	Motion excess		A veces estas reuniones son obsoletas (cuando todo está bien en el proyecto) => reducir el nr
REQM	Calculo de impacto	1	Non value-added processing		El calculo se debe fijar
PPQA	Checklist de calidad	3	Non value-added processing	ver qué parte de estas auditorías se pueden hacer en remoto por los responsables de calidad	
PPQA	Informe de auditoría	1	Motion excess	el informe duplica lo que ya está en el checklist menos los participantes	
PPQA	Informe a gerencia	3	Motion excess	Se duplica la información en el informe de MA	

# Case B: Information organization and CMMI-compliance

## Process artefact check-sheet (information duplication)

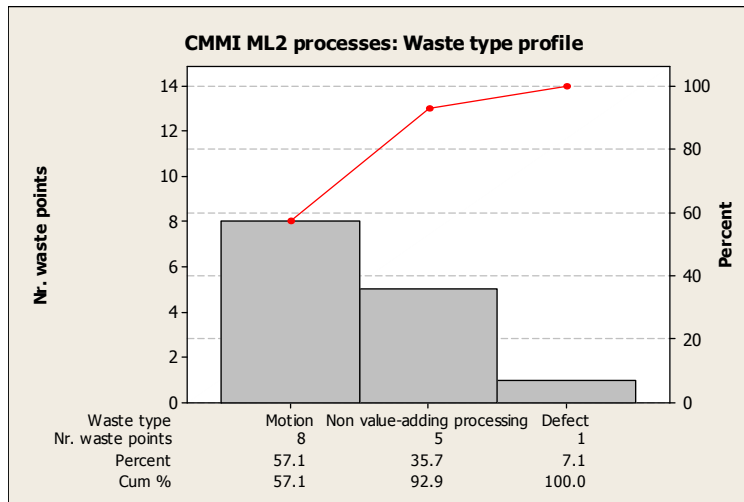
		Process artefact							
		Oferta	Plan de proyecto	Ficha de proyecto	Especif. de requisitos	Análisis funcional	Ficha de petición	Acta de reunión (doc)	Acta de reunión (PS)
Information item	Calendario	X	X	X					
	Presupuesto	X	X	X					
	Riesgos		X						
	Equipo del proyecto		X	X					
	Descripción de los requisitos				X	X			
	Descripción de petición de cambio						X		
	Resumen de una reunión							X	X

## CMMI-DEV compliance

	Development projects															Generic practices										Solution status		
	Specific practices																											
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.3	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	
REQM	Green	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Compliant to CMMI-DEV 1.3
PP	Red	Red	Red	Red	Red	Grey	Green	Red	Red	Green	Grey	Grey	Grey	Grey	Green	Green	Red	Green	Green	Yellow	Green	Green	Green	Green	Green	Red	Green	Under development
PMC	Green	Green	Red	Green	Green	Yellow	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Compliant to CMMI-DEV 1.3
SAM	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Compliant to CMMI-DEV 1.3
PPQA	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Compliant to CMMI-DEV 1.3
MA	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Compliant to CMMI-DEV 1.3
CM	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Compliant to CMMI-DEV 1.3

## Case B: Lean Perspective

- Process waste profile



- Lean principles and tools adequate for such type of context:
  - Eliminate waste
    - Seeing waste
    - Value stream mapping (simplified)
  - Empower team
    - Retrospective (as an early form of Self determination)
  - Build integrity in
    - Refactoring
  - Amplify learning
    - Feedback
    - Iterations

## Case C: Towards ML4&5 organization

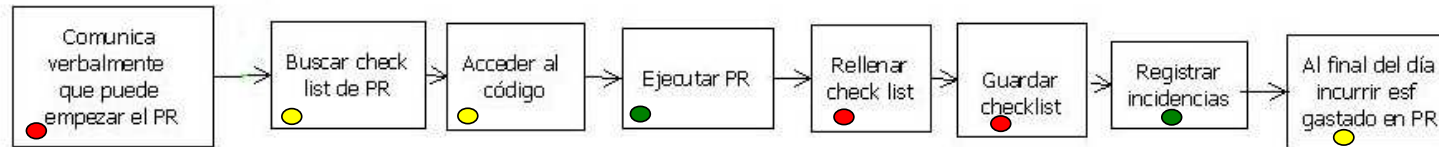
### Approach

- Apply Lean tools to the process which is managed quantitatively, Verification
- Classify each activity from this process flow as **value-adding**, **non value-adding**, or **non value-adding, but necessary**.
- Calculate the Total Cycle Time Efficiency based on
  - Estimates of Touch time
  - Activity start and end date (not hours) used to calculate Lead time
- Update the process as to
  - Remove the **non value-adding** activities
  - Suggest a more efficient solution for the **non value-adding, but necessary** activities
  - Maintain compliance to CMMI-DEV
- Apply the same techniques to other processes

# Case C: Value Stream Mapping

## Peer review of code

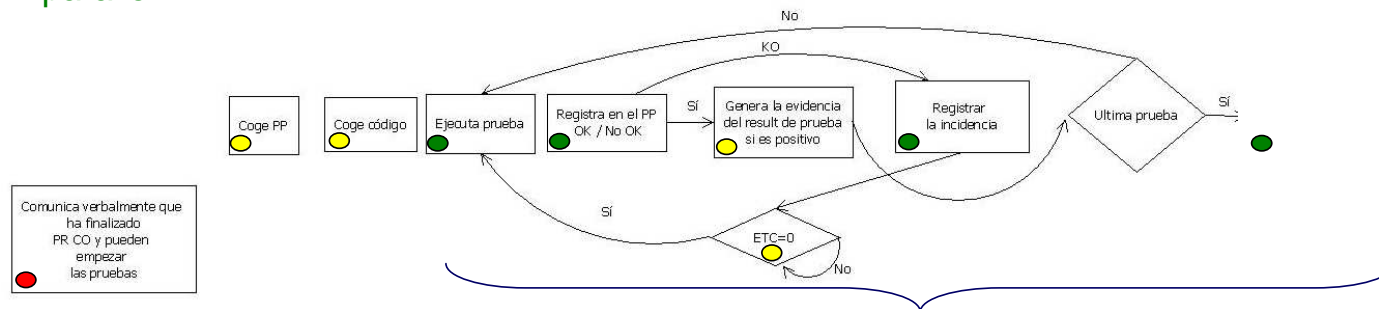
Cycle time efficiency  $\epsilon$  [88%, 95%]



Touch time	0.2 min	2.5 min	0.5 min	60-180 min	10 min	1 min	1 min/ incid	0.2 min
Lead time		95 - 130 min					20-35 incid	

## Testing testing in parallel

Cycle time efficiency  $\epsilon$  [120%, 133%] due to



Touch time	0.2 min	2.5 min	0.5 min	660 – 3480 min (11 - 58 horas)
Lead time	0.2 min	2.5 min	0.5 min	480 – 2880 min (1 – 6 días)

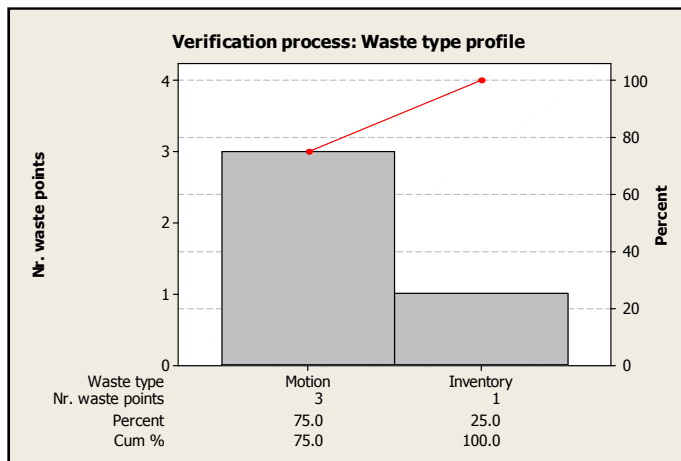
## Case C: Results and conclusions

### Applying Lean on a single process

- Does not result in a drastic improvement of its efficiency
- Affects the efficiency of the related processes
- Swim lane diagrams is a useful tool for analysing process flow
  
- Savings estimation:
  - Average task completion time: 300 min
  - Estimated task completion time reduction: 8-15 minutes
  - Tasks performed per centre per year: 1200 to 2200
  - Total productive time reduction per year: 20-60 days (1-3 person months)
  - Applied to the 7 centres of the company: 7-21 person months a year

# Case C: Lean Tools Applied

- Process waste profile



- Lean principles and tools adequate for such type of context:
  - Eliminate waste
    - Seeing waste
    - Value stream mapping
  - Empower team
    - Retrospective
    - Self determination
  - Deliver as fast as possible
    - Queuing theory
    - Cost of delay



# Integrating Lean and CMMI: Conclusions

# Lean Tools in CMMI-DEV implementations

Lean tools that have been identified as useful in the CMMI-DEV implementations projects of this study:

Organization type / Practice category	Beginner in PI	With some experience	High maturity
<b>Project/Process Management</b>	Seeing waste Value stream mapping (simplified)	Deffer commitment	Value stream mapping (based on data) Queuing theory Cost of delay
<b>Engineering</b>		Refactoring Iterations Testing	
<b>Training and stakeholder involvement</b>	Feedback	Expertise	Self determination

The rest of the Lean tools were not piloted in the projects, therefore they are not included in this table.

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