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# Curriculum Development of Master's Degree Program in Industrial Engineering for Thailand Sustainable Smart Industry

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## **Project Management for Industry 4.0**

Pilot course report (11/09/2020 – 30/10/2020, 8w)

Rui M. Lima (UMinho)



Curriculum Development  
of Master's Degree Program in  
Industrial Engineering for Thailand Sustainable Smart Industry

## Module 1: Management of Industry 4.0 Projects

- Introduction to Project Management in a new era of digitalization
- Industry 4.0 maturity models (Acatech and PWC models)
- Project Management Processes of initiating and planning a project for evaluating I4.0 maturity levels
- Agile project management for fast adaptation in the era of the fourth industrial revolution
- Project Management execution - time management and project indicators for assessing projects related to I4.0 maturity levels

## Module 2: Project Team Management for Industry 4.0

- Project communication management in a new era of digitalization
- Project Management monitoring and control – time compression and team project indicators
- Project team management in a new era of digitalization. Team formation and development of distributed and multicultural teams in Industry 4.0 environments
- Software tools for project management in a new era of digitalization
- Decisions under high uncertainty in the context of fast changing environments of the of the fourth industrial revolution



# Project Management for Industry 4.0 Pilot at UMinho

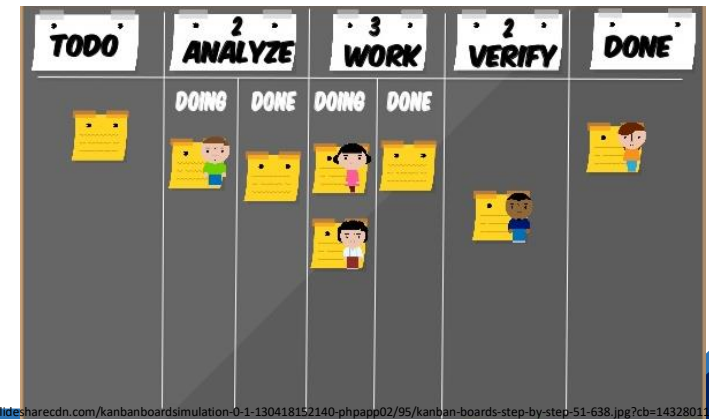
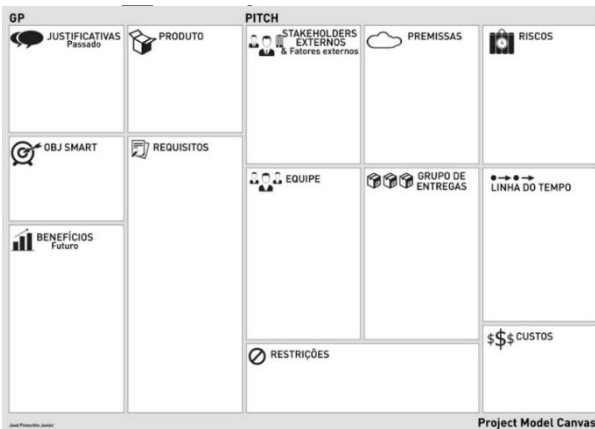


- [UMinho][Gestão de Projetos e Equipas Lean]
  - Lean/Agile Project (Team) Management
  - Project Team Management
- 4 Teachers
  - Rui M. Lima
  - André Luiz Aquere
  - Cristiano de Jesus
  - Diana Mesquita
- 37 Students
  - G3 – I4.0 MATURITY MODEL SURVEY (5 st.)
  - G4 – I4.0 MATURITY MODEL SURVEY (3 st.)
  - G5 – I4.0 MATURITY MODEL SURVEY (4 st.)
  - G9 – BIM+ - Distributed teams master st. (3 st.)



- Educational approach
  - Classes of 4 hours
  - Mainly inductive methods
  - Some (short) lectures
  - Activities
  - Discussions
  - Presentations

- Project plan and project execution and monitoring
  - Select and define a project to be executed
  - Create the project plan
  - Write a journal entry each week
  - Develop the monitoring process
  - Execute the project
  - Make a final presentation



GPEL	Date	Hours	Prof.	Tópicos
1	11/09/2019	4	RML	[RML] Course topics and team dynamics. [CJ] Industry 4.0 and Acatech maturity model
2	18/09/2019	4	ALA	[ALA] PMBOK Groups of Processes and Knowledge Areas – processes overview. Project Initiation – Project Charter
3	25/09/2019	4	RML	[RML] Visual Planning – PM CANVAS. [RML] SCRUM – Lego4Scrum
4	02/10/2019	4	ALA	[RML] Project Schedule Management. Critical Path, Pert, ... [ALA] PMBOK – Project Execution, Monitoring and Control. KPIs.
5	09/10/2019	4	RML	[RML] Project Resources Management. Teams of success. [RML] Teams Stages of development. Individual team Belbin profile.
6	16/10/2019	4	DM	[DM] Project Resources Management. Coaching for Project Management. [DM] Team coaching. Myers-Biggs Personality Test.
7	23/10/2019	4	RML	[RML] Project Communication Management. Communication systems. [RML] Communication facilitators. Individual communication profile.
8	30/10/2019	4	ALA	[RML] Projects presentations

## The challenge is simple:

In 18 minutes, build the tallest free-standing structure out of 20 sticks of spaghetti, 3 feet of tape, 3 feet of string, and one marshmallow. The marshmallow must be on top.



<https://www.blueskypersonnel.com/wp-content/uploads/2015/11/Marshmallow-Challenge1.png>

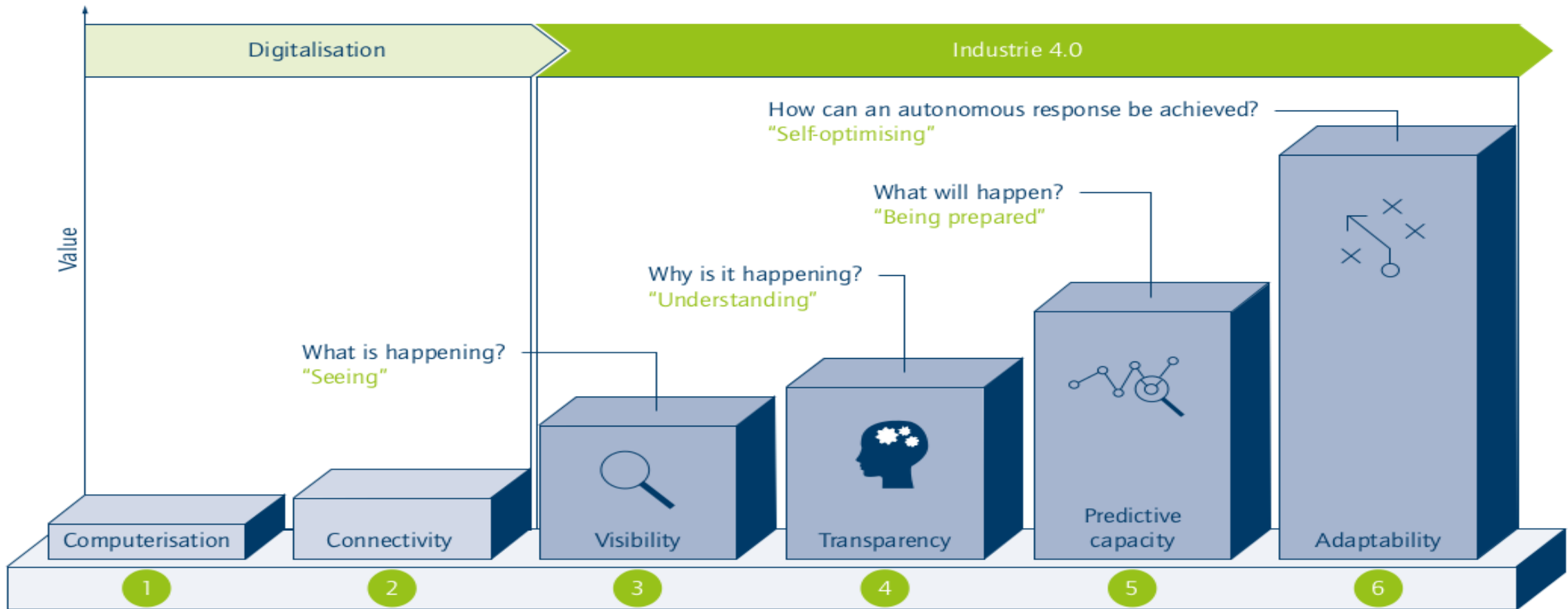


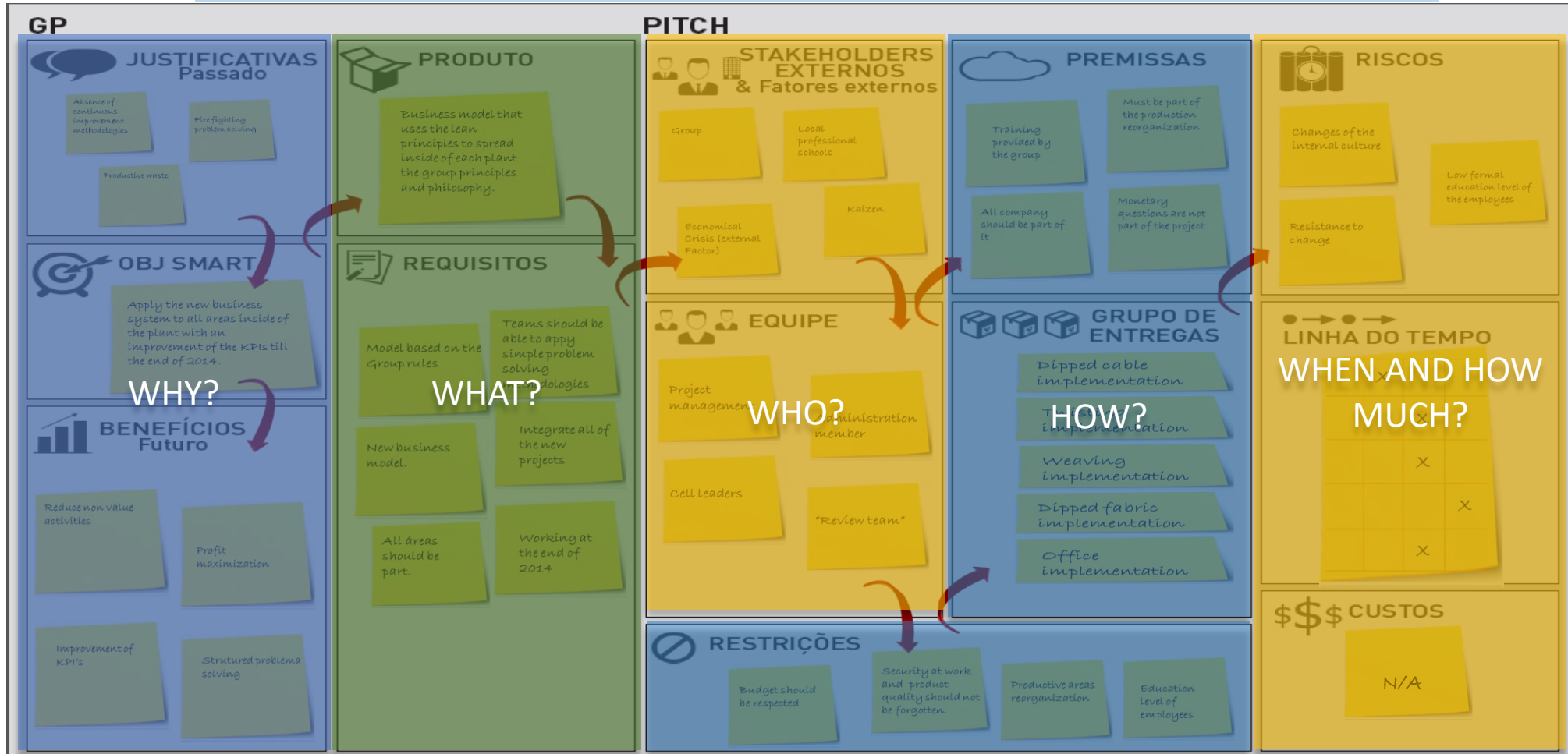
Figure 5: Stages in the Industrie 4.0 development path (source: FIR e. V. at RWTH Aachen University)

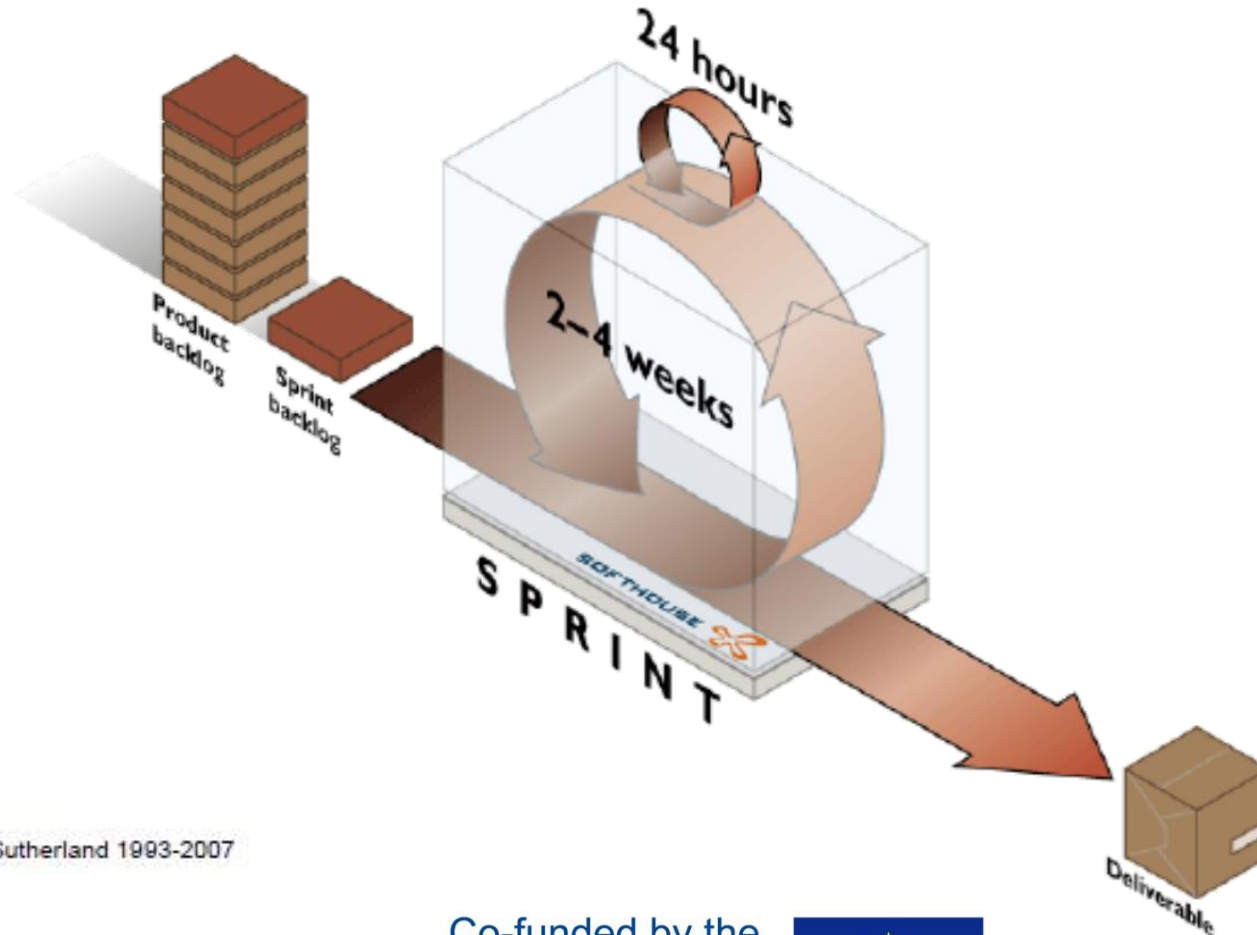


# [ALA] PMBOK Groups of Processes and Knowledge Areas – processes overview





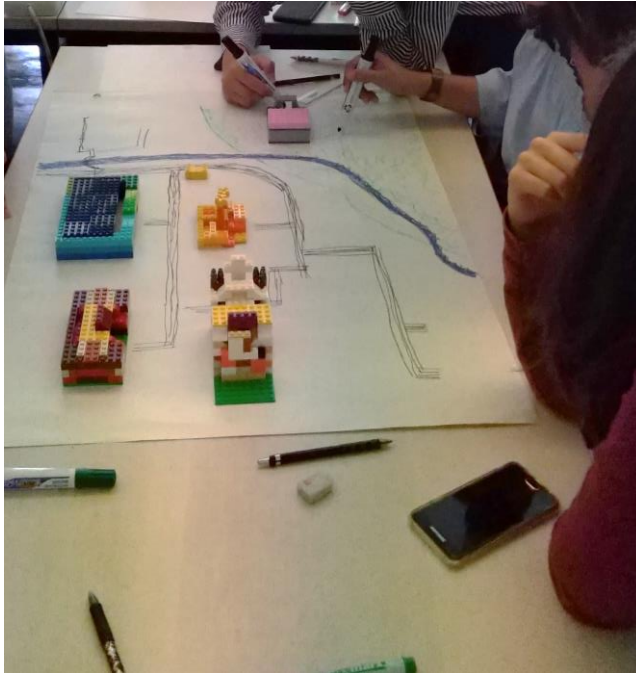




Scrum –  
inspect and  
adapt  
framework

© Jeff Sutherland 1993-2007

- Lego 4 Scrum - Alexey Krivitsky
- <https://www.lego4scrum.com/>



## Work Breakdown Structure - templates

Task ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names
91	Establish discipline governing code requirements	2 days	Tue 22/08/00	Wed 23/08/00	66	Discipline Engineer
92	Review and finalize discipline standards and specifications	5 days	Tue 19/09/00	Tue 26/09/00	73;91;72;77	Discipline Engineer
93	Start Discipline Design	55 days	Tue 26/09/00	Tue 12/12/00		
94	Start architectural design	25 days	Tue 26/09/00	Tue 31/10/00	92	Discipline Engineer;T
95	Start civil design	30 days	Tue 03/10/00	Tue 14/11/00	94SS+5 days	Discipline Engineer;T
96	Start mechanical design	30 days	Tue 10/10/00	Tue 21/11/00	95SS+5 days	Discipline Engineer;T
97	Start piping design	30 days	Tue 17/10/00	Tue 28/11/00	96SS+5 days	Discipline Engineer;T
98	Start structural design	30 days	Tue 03/10/00	Tue 14/11/00	94SS+5 days	Discipline Engineer;T
99	Start electrical design	30 days	Tue 24/10/00	Tue 05/12/00	97SS+5 days	Discipline Engineer;T
100	Start instrumentation de	30 days	Tue 31/10/00	Tue 12/12/00	99SS+5 days	Discipline Engineer;T
101	Implement first quality review	5 days	Fri 01/12/00	Fri 08/12/00	94SS+75%;95S	Discipline Engineer
102	Vendor drawing review (all disciplines)	60 days	Tue 21/11/00	Tue 13/02/01	80SS+25%;70S	Discipline Engineer
103	Vendor drawing certification (all disciplines)	5 days	Tue 13/02/01	Tue 20/02/01	102	Discipline Engineer;F
104	Cross discipline engineering review	5 days	Fri 01/12/00	Fri 08/12/00	94SS+75%;95S	Discipline Engineer;T
105	Complete equipment list	90 days	Tue 03/10/00	Mon 05/02/01	85	Discipline Engineer;F
106	Complete PIDs	80 days	Fri 20/10/00	Thu 08/02/01	86	Discipline Engineer;T
107	Complete GAs/site plan	80 days	Fri 20/10/00	Thu 08/02/01	87	Discipline Engineer;T
108	Complete Discipline Design	80 days	Fri 08/12/00	Fri 30/03/01		

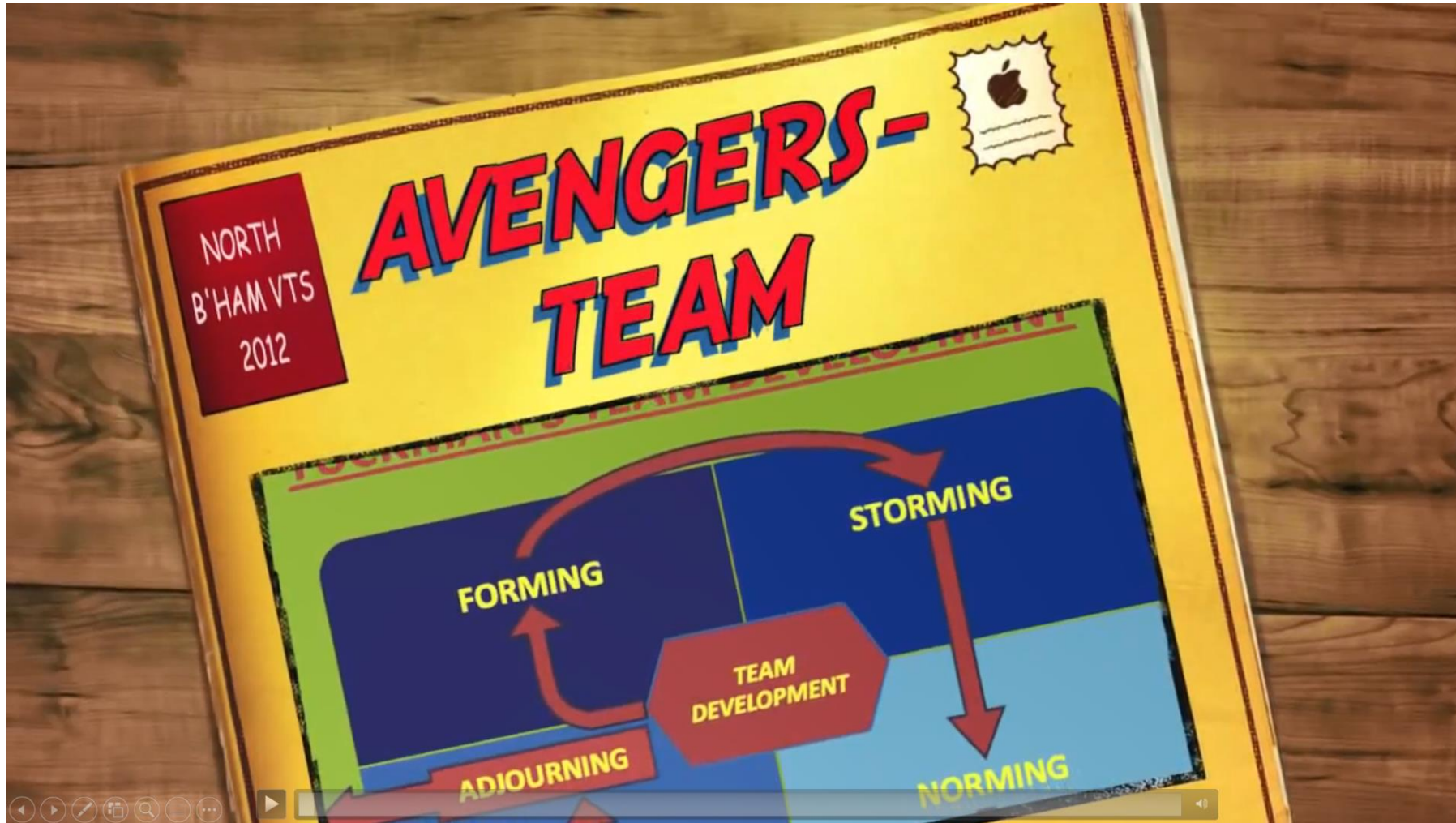
  

Task ID	Task Name	Duration	Start
0	PMI Process	17 days?	#####
1	Read this note to understand the context and numbers	1 day?	Mon 14/0/
2	Process Groups and Knowledge Areas	1 day?	Mon 14/0/
3	Initiation Processes	5 days?	Tue 15/0/
4	Review Inputs to Initiation	4 days?	Tue 15/0/
5	Review Contract	1 day?	Tue 15/0/
6	Review Project Statement of Work	1 day?	Wed 16/0/
7	Review Enterprise Environmental Factors	1 day?	Thu 17/0/
8	Review Organizational Process Assets	1 day?	Fri 18/0/
9	Produce Outputs from Initiation	1 day?	Mon 21/0/
10	Develop Project Charter (3.2.1.1)	1 day?	Mon 21/0/
11	Develop Preliminary Project Scope Statement (3.	1 day?	Mon 21/0/
12	Initiation Processes COMPLETE	0 days	Mon 21/0/
13	Planning Processes (3.2.2.1)	9 days?	Tue 22/0/
14	Scope Management Processes	3 days?	Tue 22/0/
15	Perform Scope Planning (3.2.2.2)	1 day?	Tue 22/0/
16	Complete Scope Definition (3.2.2.3)	1 day?	Wed 23/0/
17	Create WBS to level of Work Packages (3.2.2.4)	1 day?	Thu 24/0/
18	Activity Planning	1 days?	Fri 25/0/
19	Define Activities (3.2.	1 day?	Fri 25/0/
20	Determine Activity Se	1 day?	Mon 28/0/
21	Define Activity Resou	1 day?	Tue 29/0/
22	Define Activity Durati	1 day?	Tue 29/0/
23	Cost Planning	1 days?	Wed 30/0/
24	Develop cost estimates (3.2.2.10)	1 day?	Wed 30/0/
25	Develop cost budget (3.2.2.11)	1 day?	Thu 31/0/
26	Complete Quality Plan (3.2.2.12)	1 day?	Tue 22/0/
27	Complete Human Resource Plan (3.2.2.13)	2 days	Wed 30/0/

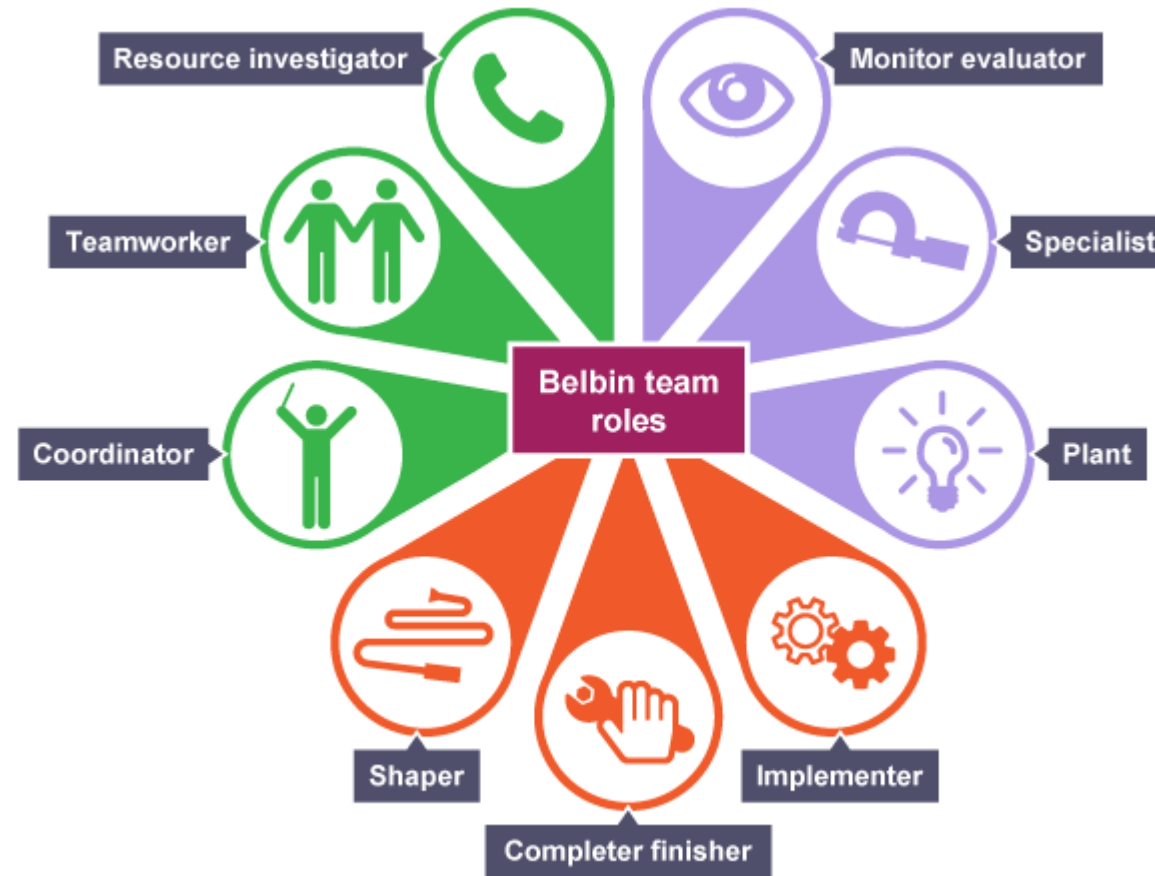


# [RML] Project Resources Management

## Tuckman team development phases



# [RML] Project Resources Management – Belbin team roles



Thinking      Action      People

<https://dotnetsharing.files.wordpress.com/2017/09/team-roles.png>

# [RML] Project Resources Management – Collaborative Distributed Teams

	Zoho Projects	Asana	LiquidPlanner	Podio	Slack	LeanKit	Airtable	Basecamp	Glip by RingCentral	Wrike
Lowest Price	SEE IT	SEE IT	SEE IT		SEE IT	SEE IT	SEE IT	SEE IT	SEE IT	SEE IT
Editors' Rating	●●●●● EDITORS' CHOICE	●●●●● EDITORS' CHOICE	●●●●● EDITORS' CHOICE	●●●●● EDITORS' CHOICE	●●●●● EDITORS' CHOICE	●●●●○ EDITORS' CHOICE	●●●●○	●●●●○	●●●●○	●●●●○
Best For	Project Management	Workflow Management	Project Management	Work Hub	Team Chat	Lean Kanban				

techradar pro

BEST ONLINE COLLABORATION TOOLS

1. Slack
2. Asana
3. Podio
4. Ryver
5. Trello
6. Flock

Google

Docs

Sheets

Slides

Forms

coggle

Collaborative Software



### The 11 Best Online Whiteboards

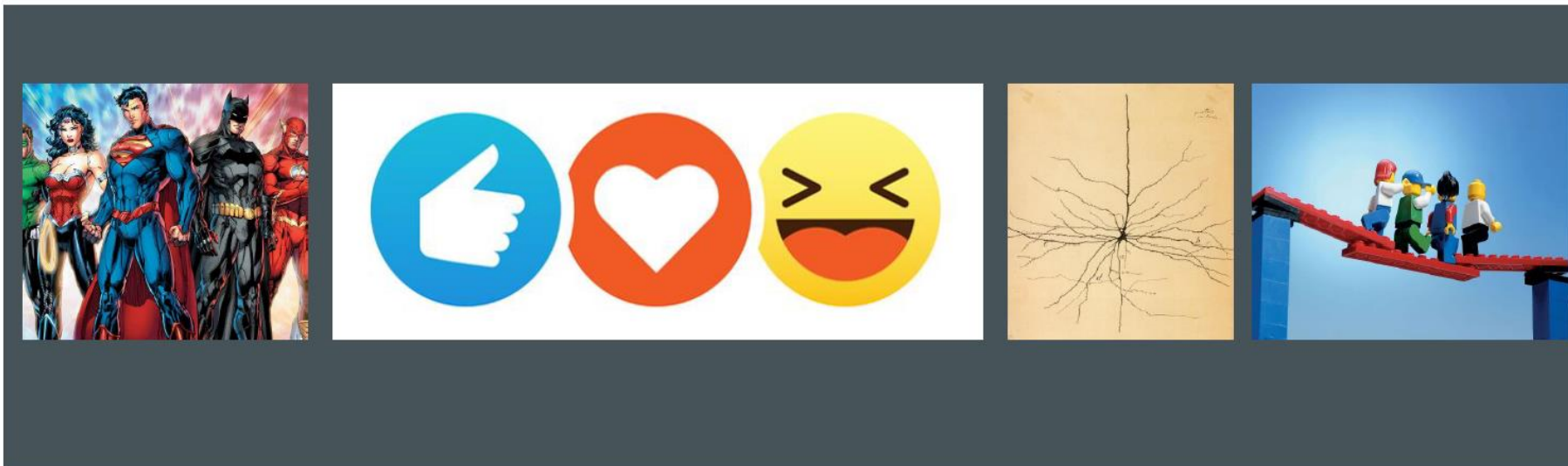
- IPEVO Annotator (macOS, iOS, Windows, Android) for annotating presentations
- Limnu (Web, Android, iOS) for a realistic whiteboard experience
- InVision Freehand (Web, Android, iOS) for annotating design files with a team
- Stormboard (Web) for creating multiple whiteboards in a single brainstorming session
- AWW (Web) for embedding a live whiteboard on a web page
- RealtimeBoard (Web, Mac, Windows, iOS, Android) for formal presentation of your whiteboard
- Sketchboard (Web) for saving and organizing multiple, unrelated whiteboards
- Conceptboard (Web) for large, complex whiteboards
- Explain Everything (Web, iOS, Android, ChromeOS) for creating whiteboard videos
- Whiteboard Fox (Web) for quick, informal whiteboard sessions
- MURAL (Web) for remote, multi-member team meetings



## COACHING É COACHING.

DIANA MESQUITA

Universidade do Minho  
Escola de Engenharia





## What's Your Personality Type?

Use the questions on the outside of the chart to determine the four letters of your Myers-Briggs type.  
For each pair of letters, choose the side that seems most natural to you, even if you don't agree with every description.

### 1. Are you outwardly or inwardly focused? If you:

- Could be described as talkative, outgoing
- Like to be in a fast-paced environment
- Tend to work out ideas with others, think out loud
- Enjoy being the center of attention

then you prefer  
**E**  
Extraversion

- Could be described as reserved, private
- Prefer a slower pace with time for contemplation
- Tend to think things through inside your head
- Would rather observe than be the center of attention

then you prefer  
**I**  
Introversion

### 2. How do you prefer to take in information? If you:

- Focus on the reality of how things are
- Pay attention to concrete facts and details
- Prefer ideas that have practical applications
- Like to describe things in a specific, literal way

then you prefer  
**S**  
Sensing

- Imagine the possibilities of how things could be
- Notice the big picture, see how everything connects
- Enjoy ideas and concepts for their own sake
- Like to describe things in a figurative, poetic way

then you prefer  
**N**  
Intuition

**ISTJ**  
Responsible, sincere, analytical, reserved, realistic, systematic. Hardworking and trustworthy with sound practical judgment.

**ISFJ**  
Warm, considerate, gentle, responsible, pragmatic, thorough. Devoted caretakers who enjoy being helpful to others.

**INFJ**  
Idealistic, organized, insightful, dependable, compassionate, gentle. Seek harmony and cooperation, enjoy intellectual stimulation.

**INTJ**  
Innovative, independent, strategic, logical, reserved, insightful. Driven by their own original ideas to achieve improvements.

**ISTP**  
Action-oriented, logical, analytical, spontaneous, reserved, independent. Enjoy adventure, skilled at understanding how mechanical things work.

**ISFP**  
Gentle, sensitive, nurturing, helpful, flexible, realistic. Seek to create a personal environment that is both beautiful and practical.

**INFP**  
Sensitive, creative, idealistic, perceptive, caring, loyal. Value inner harmony and personal growth, focus on dreams and possibilities.

**INTP**  
Intellectual, logical, precise, reserved, flexible, imaginative. Original thinkers who enjoy speculation and creative problem solving.

**ESTP**  
Outgoing, realistic, action-oriented, curious, versatile, spontaneous. Pragmatic problem solvers and skillful negotiators.

**ESFP**  
Playful, enthusiastic, friendly, spontaneous, tactful, flexible. Have strong common sense, enjoy helping people in tangible ways.

**ENFP**  
Enthusiastic, creative, spontaneous, optimistic, supportive, playful. Value inspiration, enjoy starting new projects, see potential in others.

**ENTP**  
Inventive, enthusiastic, strategic, enterprising, inquisitive, versatile. Enjoy new ideas and challenges, value inspiration.

**ESTJ**  
Efficient, outgoing, analytical, systematic, dependable, realistic. Like to run the show and get things done in an orderly fashion.

**ESFJ**  
Friendly, outgoing, reliable, conscientious, organized, practical. Seek to be helpful and please others, enjoy being active and productive.

**ENFJ**  
Caring, enthusiastic, idealistic, organized, diplomatic, responsible. Skilled communicators who value connection with people.

**ENTJ**  
Strategic, logical, efficient, outgoing, ambitious, independent. Effective organizers of people and long-range planners.

### 3. How do you prefer to make decisions? If you:

- Make decisions in an impersonal way, using logical reasoning
- Value justice, fairness
- Enjoy finding the flaws in an argument
- Could be described as reasonable, level-headed

then you prefer  
**T**  
Thinking

- Base your decisions on personal values and how your actions affect others
- Value harmony, forgiveness
- Like to please others and point out the best in people
- Could be described as warm, empathetic

then you prefer  
**F**  
Feeling

### 4. How do you prefer to live your outer life? If you:

- Prefer to have matters settled
- Think rules and deadlines should be respected
- Prefer to have detailed, step-by-step instructions
- Make plans, want to know what you're getting into

then you prefer  
**J**  
Judging

- Prefer to leave your options open
- See rules and deadlines as flexible
- Like to improvise and make things up as you go
- Are spontaneous, enjoy surprises and new situations

then you prefer  
**P**  
Perceiving

## THE 4 COMMUNICATION STYLES

PASSIVE



AGGRESSIVE



PASSIVE-AGGRESSIVE



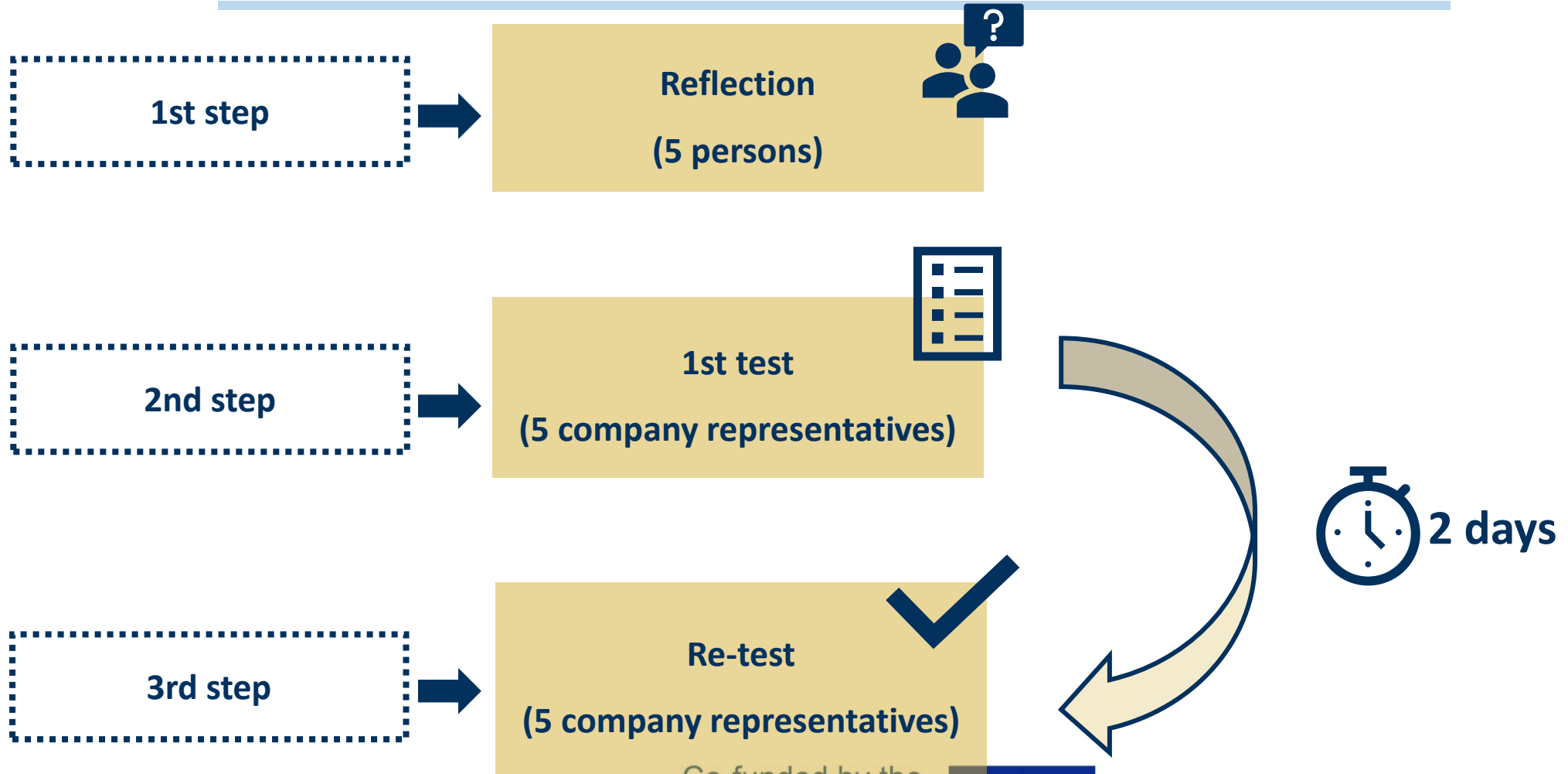
ASSERTIVE



+Manipulation

- G1 – REFOOD – OFFICE LEAN
- G2 - PIEGI\_A – TUTORING FOUR PROJECT TEAMS
- **G3 – I4.0 MATURITY MODEL SURVEY (5 st.)**
- **G4 – I4.0 MATURITY MODEL SURVEY (3 st.)**
- **G5 – I4.0 MATURITY MODEL SURVEY (4 st.)**
- G6 - AGILE – STUDY COMPANIES' MODELS
- G7 – DPE – OFFICE LEAN
- G8 - PIEGI\_B – TUTORING FOUR PROJECT TEAMS
- **G9 – BIM+ - Distributed teams master st. (3 st.)**

# Example of methodology applied by one group



5 RESPOSTAS DE DIFERENTES EMPRESAS



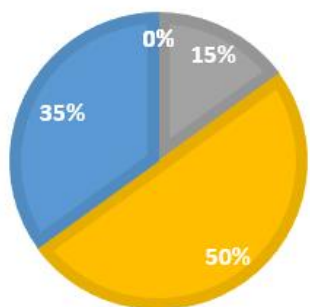
RESULTADO	2,06	2,95	4,21	4,80	1,66
NÍVEL	NÍVEL	NÍVEL	NÍVEL	NÍVEL	NÍVEL
	2	3	4	5	2



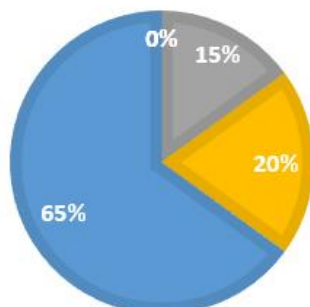
# G4 – INDUSTRY 4.0 MATURITY MODEL SURVEY (3 st.)



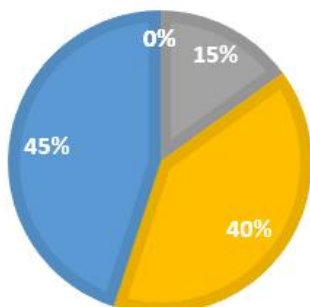
1º DIA- PESSOA A



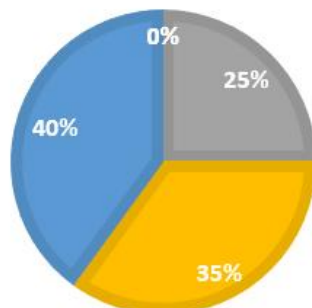
2º DIA- PESSOA A



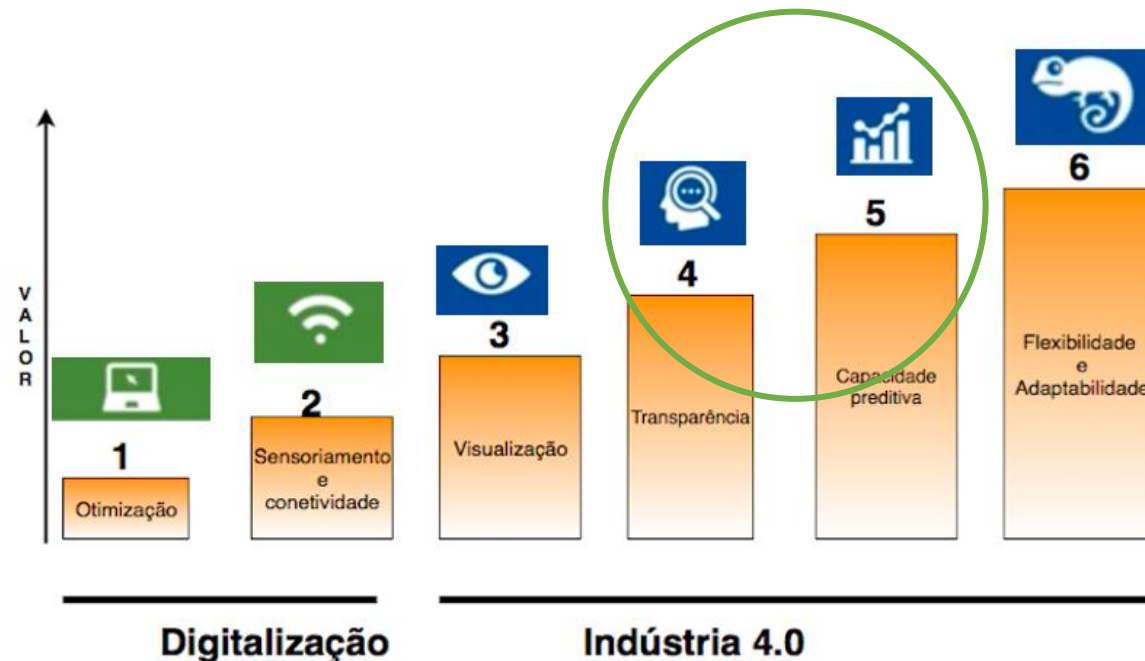
1º DIA - PESSOA B



2º DIA PESSOA B

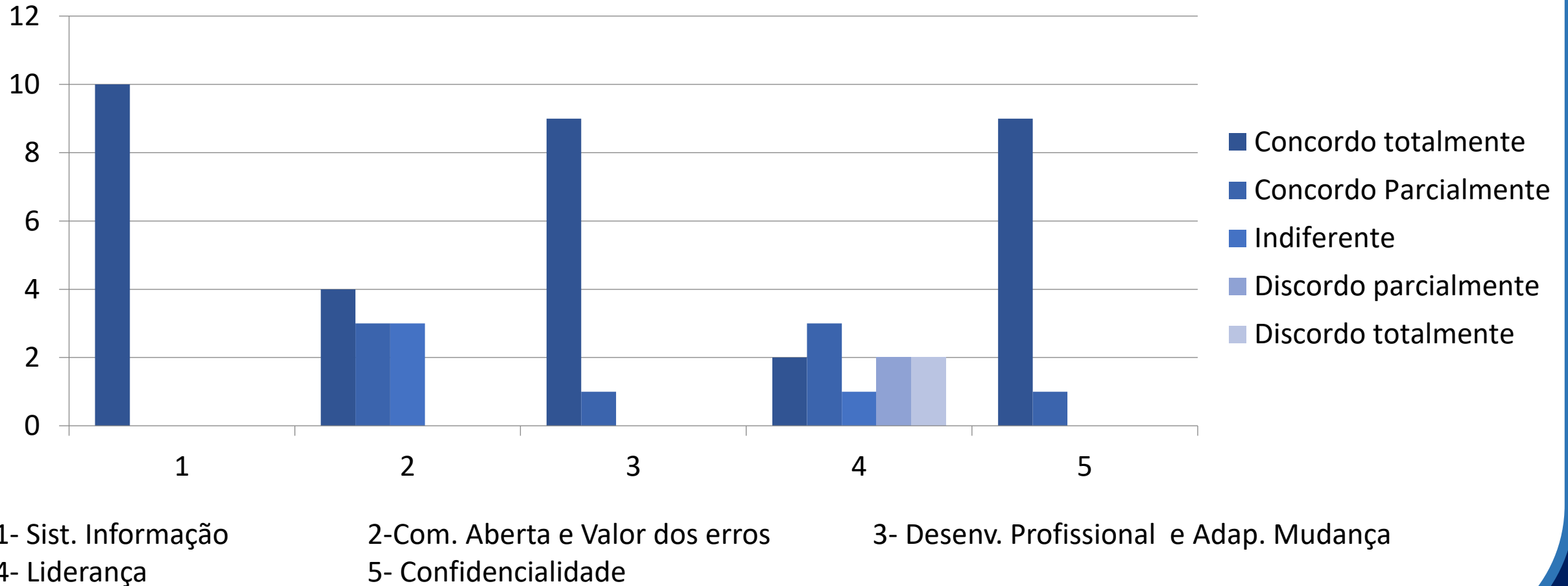


- Discordo totalmente
- Discordo
- Não concordo nem discordo
- Concordo
- Concordo totalmente





# G5 – INDUSTRY 4.0 MATURITY MODEL SURVEY (4 st.)





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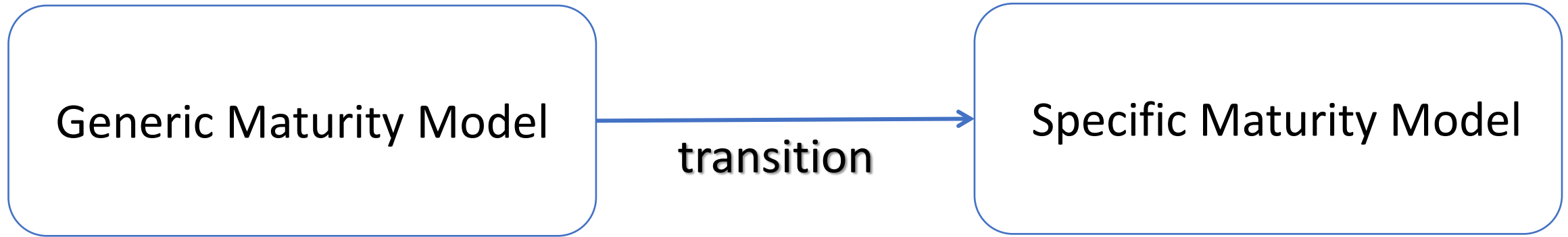
# Thank You



Curriculum Development  
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- Finocchio Junior, José (2013) Project Model Canvas - Gerenciamento de Projetos Sem Burocracia. Elsevier – Campus. ISBN: 978-85-352-7456-1
  - <http://www.livrariasaraiva.com.br/produto/4967937/project-model-canvas-gerenciamento-de-projetos-sem-burocracia/>
- Oehmen, J. (Ed.). (2012). *The Guide to Lean Enablers for Managing Engineering Programs, Version 1.0*. Cambridge, MA: Joint MIT PMI INCOSE Community of Practice on Lean in Program Management.
  - <http://dspace.mit.edu/bitstream/handle/1721.1/70495/Oehmen%20et%20al%202012%20-%20The%20Guide%20to%20Lean%20Enablers%20for%20Managing%20Engineering%20Programs.pdf>
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## Workshop Sessions: Project supervision sessions

- Team formation and team dynamics
- Project selection – development of instruments for assessing the Industry 4.0 maturity level
- Exploring the dimensions of the Industry 4.0 maturity model
- Visual planning of the project for I4.0 maturity model self-diagnosis
- Developing the methodology for maturity level self-diagnosis
- Creating and validating the I4.0 maturity self-diagnosis model
- Applying the I4.0 maturity self-diagnosis model
- Creating and validating the I4.0 maturity self-diagnosis model

# PMBOK 6: The 10 Knowledge Areas & 49



	Project Management Process Groups				
Knowledge Area Processes	Initiating	Planning	Execution	Monitoring and Controlling	Closing
Project Integration Management	Project Charter	Develop project management plan.	Direct and Manage Project Work; Manage Project Knowledge.	Monitor and control project work; Perform Integrated Change Control.	Close Project or Phase.
Project Scope Management		Plan Scope Management; Collect Requirements; Define Scope; Create Work Breakdown Structure.		Validate Scope; Control Scope.	
Project Time Management		Plan Schedule Management; Define Activities; Sequence Activities; Estimate Activity Resources; Estimate Activity Durations; Develop Schedule.		Control Schedule.	
Project Cost Management		Plan Cost Management; Estimate Costs; Determine Budgets.		Control Costs.	
Project Quality Management		Plan Quality Management.	Manage Quality	Control Quality.	
Project Resource Management		Plan Human Resource Management; Estimate Activity Resources.	Acquire Resources; Develop Team; Manage Team.	Control Resources	
Project Communications Management		Plan Communications Management.	Manage Communications.	Monitor Communications.	
Project Risk Management		Plan Risk Management; Identify Risks; Perform Qualitative Risk Analysis; Plan Risks Responses.	Implement Risk Responses	Monitor Risks.	
Project Procurement Management		Plan Procurement Management.	Conduct Procurements.	Control Procurements.	Close Procurements.
Project Stakeholder Management	Identify Stakeholders	Plan Stakeholder Engagement.	Manage Stakeholder Engagement.	Monitor Stakeholder Engagement.	

