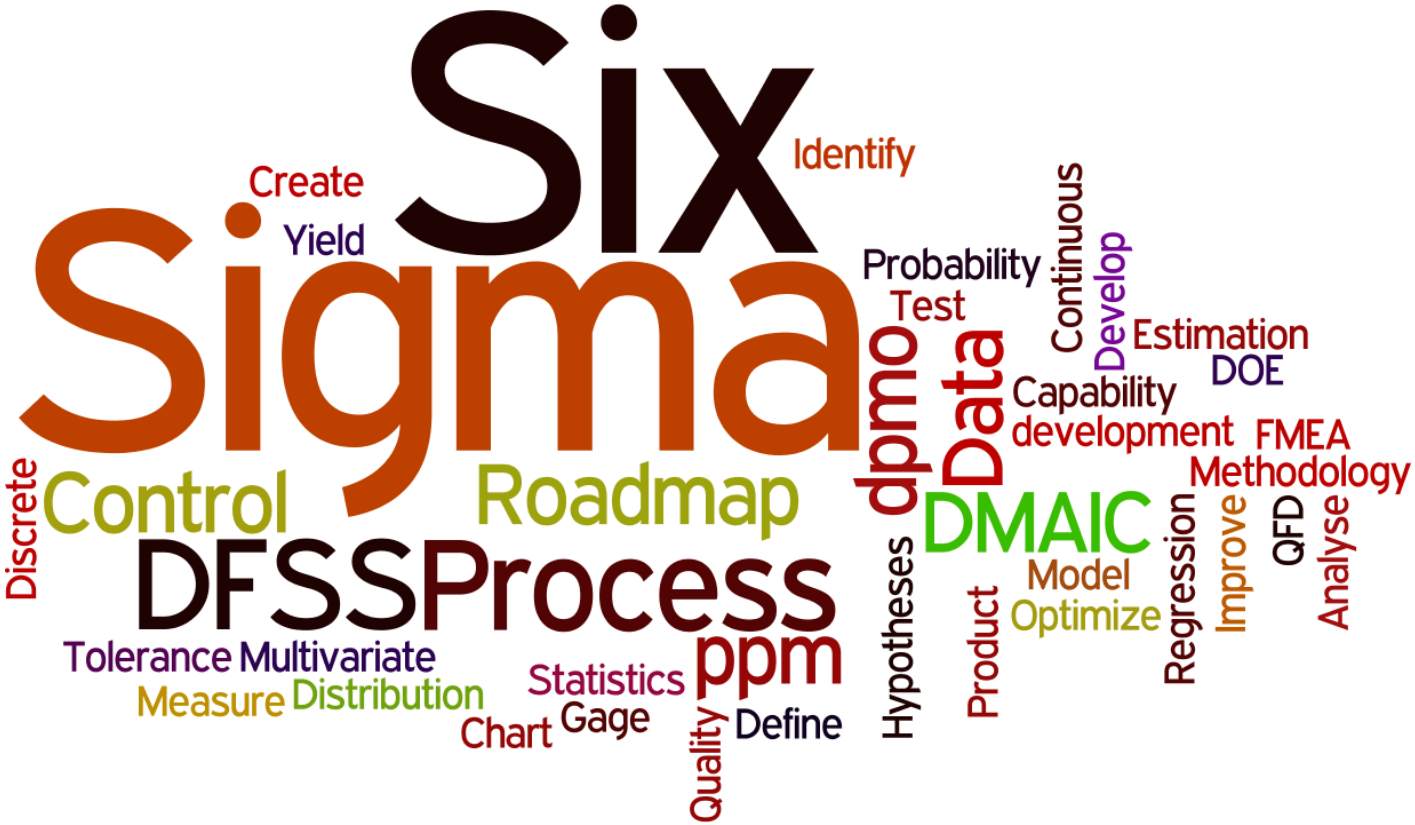
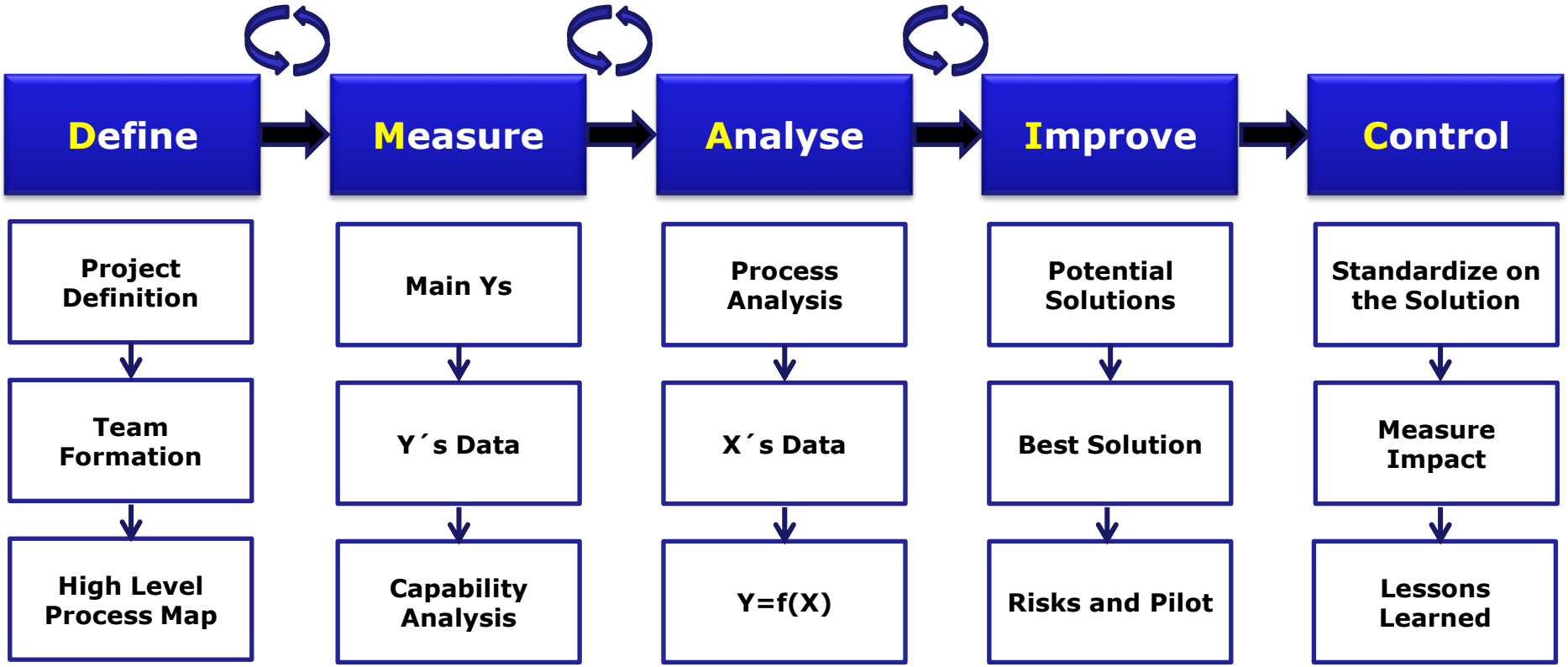


DMAIC- IMPROVE

Potential solutions / Best solution / Risks and pilot

Green Belts´s Training | Jun 2021

Roadmap Six Sigma – DMAIC
for improving products and processes



IMPROVE

Y=f(X)

Try Answering:

What are the different possible solutions?

What are the best solutions?

What are the risks associated with the solutions?

When, where, and how will the solution be implemented?

In the Improve phase, we try to develop and select solutions to the problem. The best solution is then implemented with a controlled risk. Try to justify how the fundamental Ys are at the end of the Improve phase.

Improve: Main Deliverable

Fundamental Requirements:

1. **Potential solutions to the problem (Parameters of a DOE, error-proof mechanism, best result of a simulation or regression …)**
2. **Selection of the best solution (AHP, Pairwise,…)**
3. **Risk analysis for the solution (FMEA, Pugh, etc …) and Pilot solution**

$$Y=f(X)+Z$$

Potential Solutions

After the correct understanding of the relationship Y = f (X) we try to generate potential solutions to optimize the Y's.
Some qualitative tools for generating potential solutions:

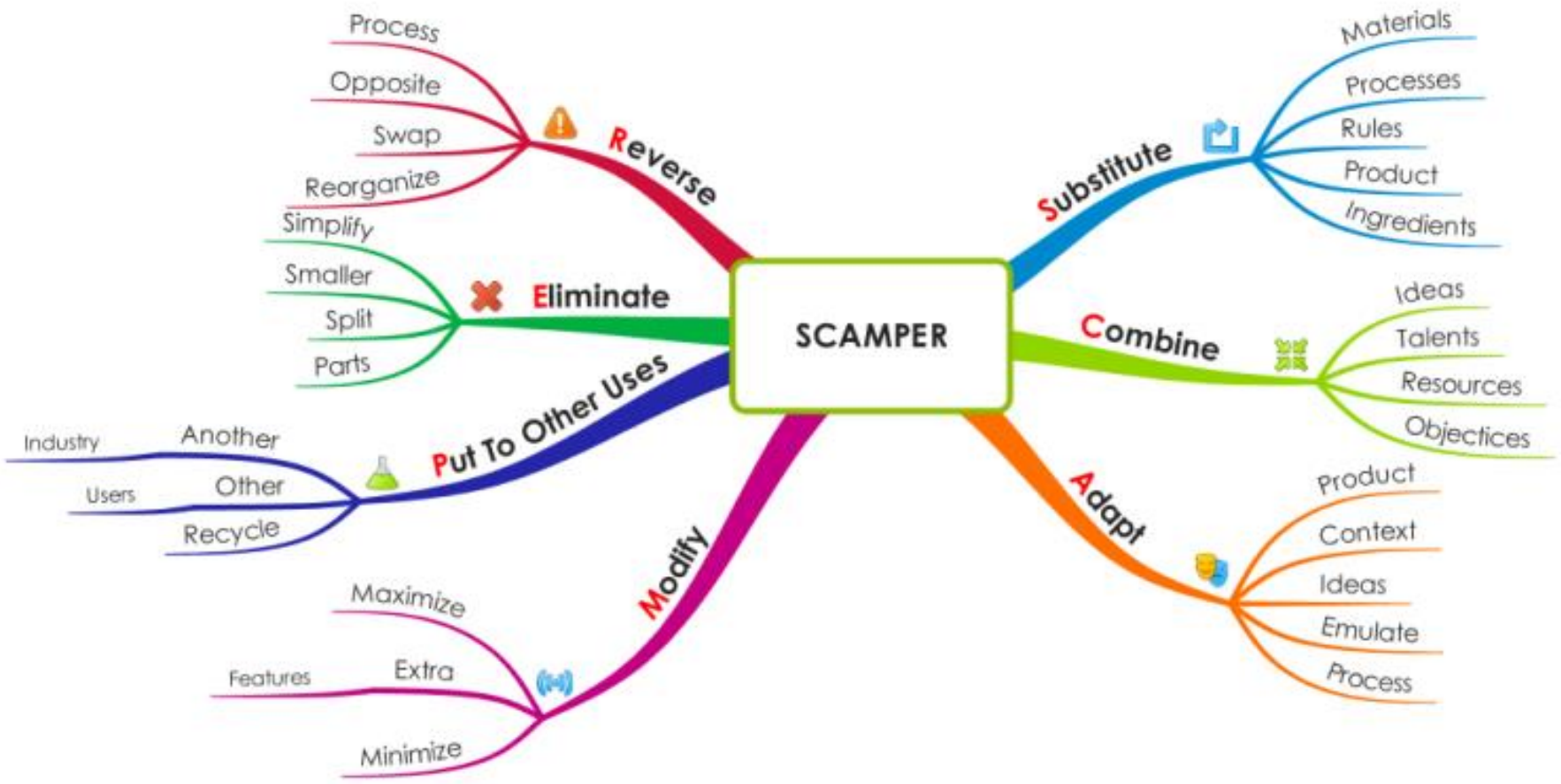
- Brainstorming and Negative Brainstorming
- Benchmarking
- 5Why's
- SCAMPER

Potential solutions are also:

- Setup of optimal parameters of DOEs;
- Implementation of better Simulations;
- Control of regression models;
- Recognized improvements in Process Mapping;
- Creating Error-Proofing Mechanisms
- Etc...

SCAMPER

SCAMPER is a brainstorming technique that helps spark creativity.

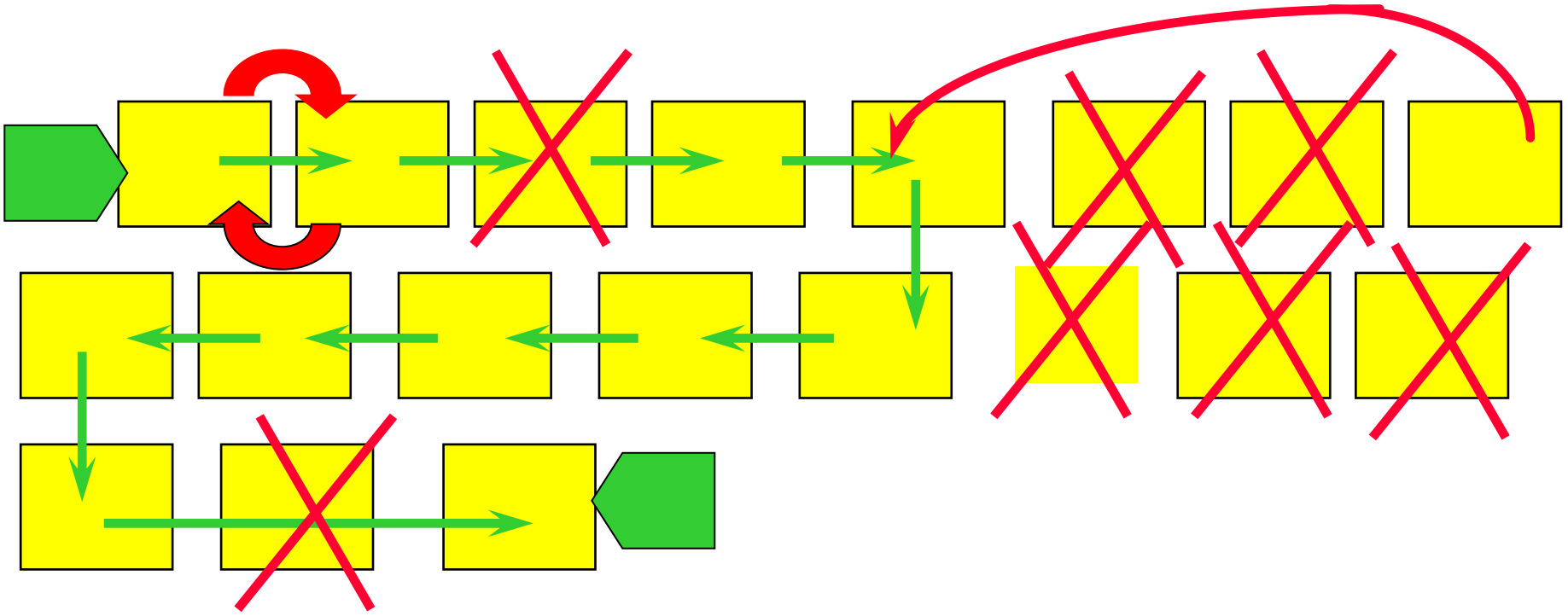


Benchmarking result as potential solution

- Central Idea: Follow the leader!
- Idealized by Xerox
- Do not reinvent the wheel!
- Best-in-class

What about a solution from the best in class?

New Process Mapping as potential solution



Best Solution

In this phase the best solution is selected among the potential solutions.

Tools like Pairwise, Matrix of Criteria, Pugh Matrix and AHP could help in choosing the best solution.

Pairwise

Options	A	B	C	D	E
A	-	B	A	D	A
B	-	-	B	B	B
C	-	-	-	C	E
D	-	-	-	-	D
E	-	-	-	-	-

A simple method of sorting solutions when data is little objective.

B	4	4/10 → 40%	1^{0}
A	2	2/10 → 20%	2^{0}
D	2	2/10 → 20%	2^{0}
C	1	3/10 → 10%	3rd
E	1	3/10 → 10%	3rd

From here the weight could come out

Matrix of Criteria

From here the order could come out

Criteria	Carlos	José	Maria	Pedro	João	Total	Weight
Can be implemented quickly	15	10	5	10	5	45	0,09
Solve the problem completely	40	60	35	50	55	240	0,48
Has a low cost	10	10	20	20	5	65	0,13
Impact the consumer directly	20	15	25	15	30	105	0,21
No environmental impact	15	5	15	5	5	45	0,09
	100	100	100	100	100	500	1

Pairwise with AHP

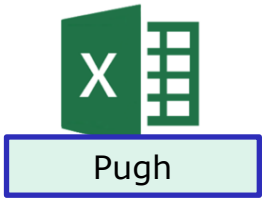
Analytic Hierarchy Process

A method for Sorting Solutions by making Paired Comparisons. (It's a Multicriteria approach)

The Fundamental Scale for Pairwise Comparisons

Intensity of Importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation

Intensities of 4, 6 and 8 can be used to express intermediate values.
Intensities of 1.1, 1.2, 13, etc. can be used for elements that are very close in importance.



Pugh Method: Example

	Solution 1	Solution 2	Solution 3	Solution 4
Requirement 1	+	-	+	-
Requirement 2	+	S	+	S
Requirement 3	-	+	-	-
Requirement 4	-	+	+	-
Requirement 5	+	-	+	-
Total +	3	2	4	0
Total S	0	1	0	1
Total -	2	2	1	4

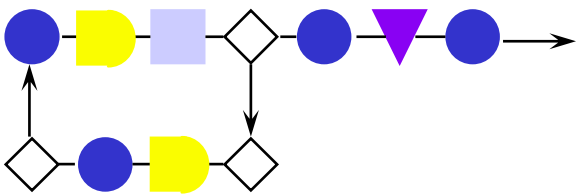
Use '+' for better than requirement
Use 'S' for meets the requirement
Use '-' for does not meet the requirement

Assign: excellent +, adequate 0 ou S, and poor -

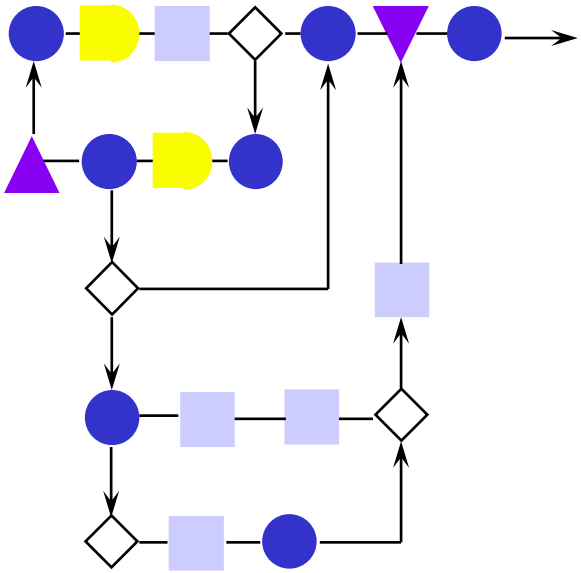
Risks and Pilot

As in most scientific studies the **pilot** solution is to confirm the results of a Six Sigma project.
The pilot solution should be representative of the actual solution and the data should be sufficient to obtain statistical conclusions.
After the success of the pilot solution, stakeholders must be sure to implement the final solution.

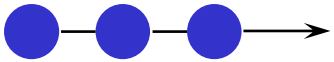
Pilot solution implementation



What do you think it is ...



What it really is ...



As you wish it were ...