



# **Lean and Green Shipbuilding at Shipyard Brodotrogir**

Shipyard Brodotrogir, Trogir, Croatia  
M.Sc. Mario Rovin, project manager

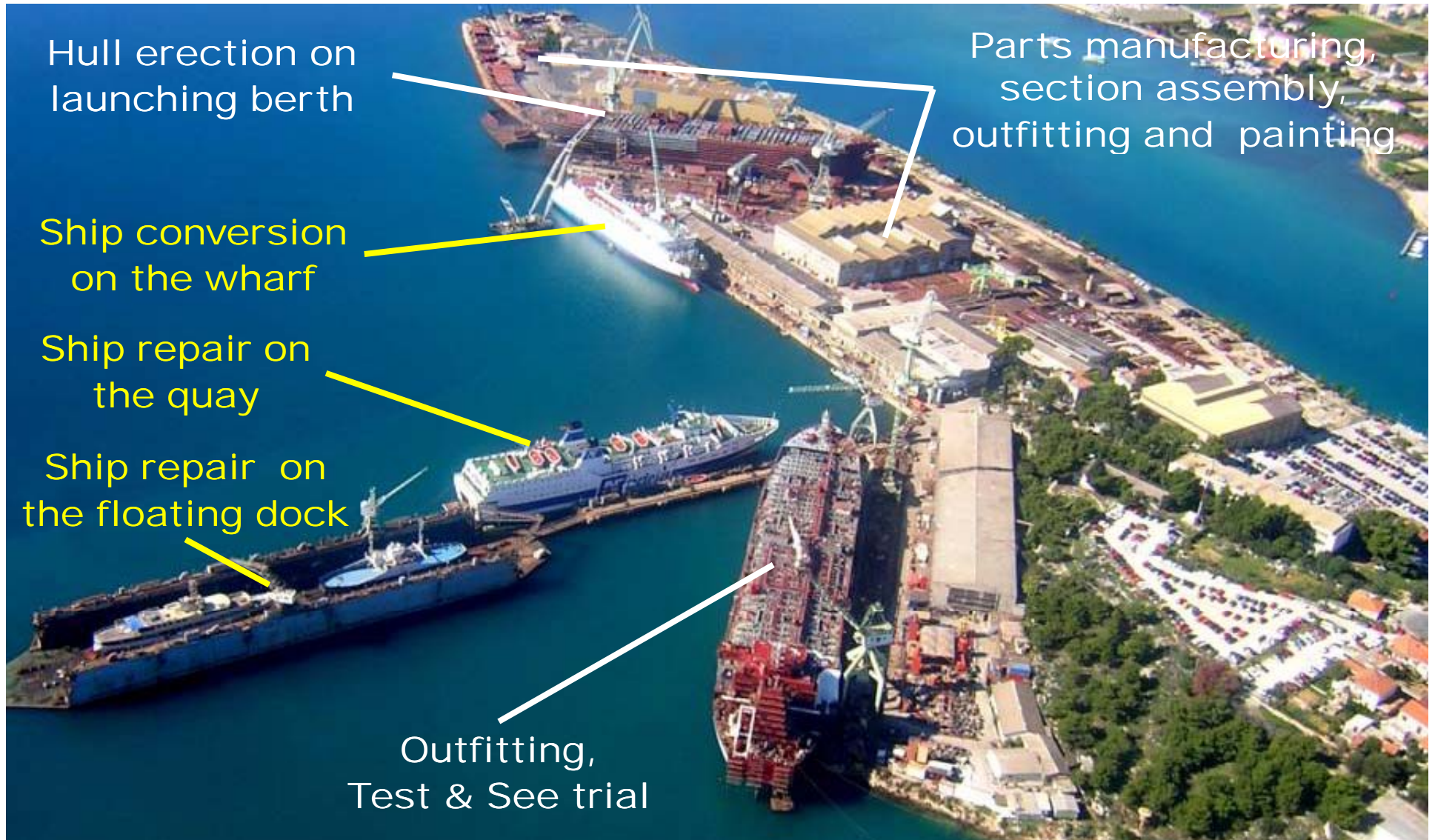
Aim 2013 Conference  
Split, September 21st 2013

# Outline

- Introduction to Shipyard Brodotrogir d.d.
- Characteristics of Shipbuilding
- Developing a Lean and Green Shipyard
- Conclusion

# Shipyard Brodotrogir d.d.

## Divisions: Shipbuilding & Shiprepair



Recently the Shipyard was the subject of new investments (from a private owner)



# Shipyard Brodotrogir d.d.

**Main product:** Chemical tanker 47.000 TDW (T-Design)



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# Characteristics of Shipbuilding

## Engineering to order vs Mass production

### Shipbuilding main characteristics:

- Customization to order
- Customization within certain constraints
- Product is partly designed and engineered to order
- Modular design where some modules are standardized and other are customized
- Low volume
- Complex, non-repetitive production
- 80% repetitive on process/product level – 20% is engineered and produced to order
- Production in loose networks
- Manual processes
- Handcraft
- Long through-put time

# Characteristics of Shipbuilding

## Business process: Streamline and Milestones

Based on the basic specifications provided by customer, Brodotrogir made a broad design to get a rough overall picture of the ship and subsequently offer a proposal to the customer. The bid proposal is a very important step of Brodotrogir's business since customers largely depend on this proposal to decide whether to place an order or not. Therefore, Brodotrogir try the best to show own full ability.

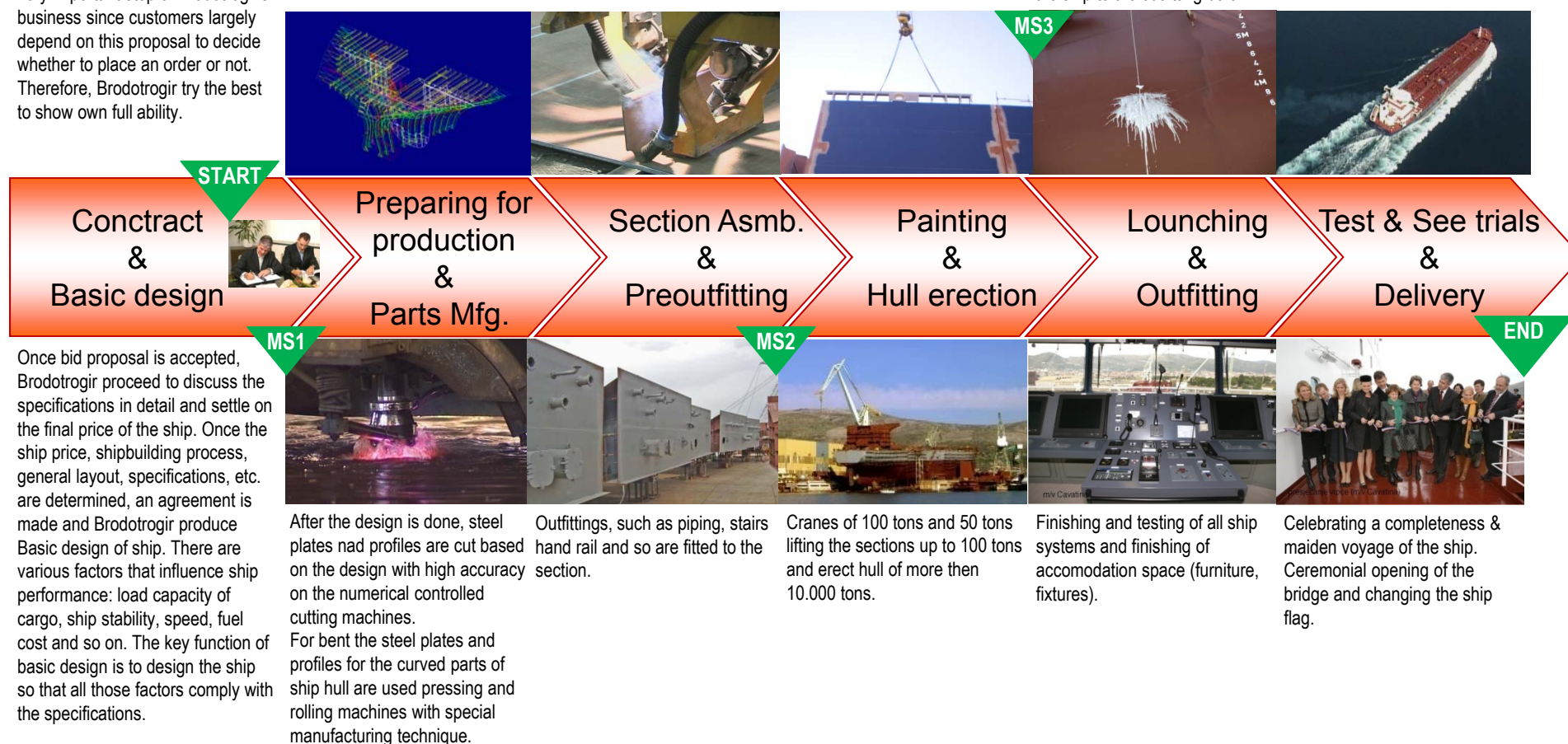
Use of various CAx technology for perfect planning sizes and shapes of all elements for building ship form and for perfect planning resources and technology of production.

Steel parts are assembled in form of mikro panels, panels, eggboxes and huge boxes – sections by high class of welding.

Not only for the estetic, but for the protection against the corrosion, is applied excellent painting to sustain severe conditions in the sea.

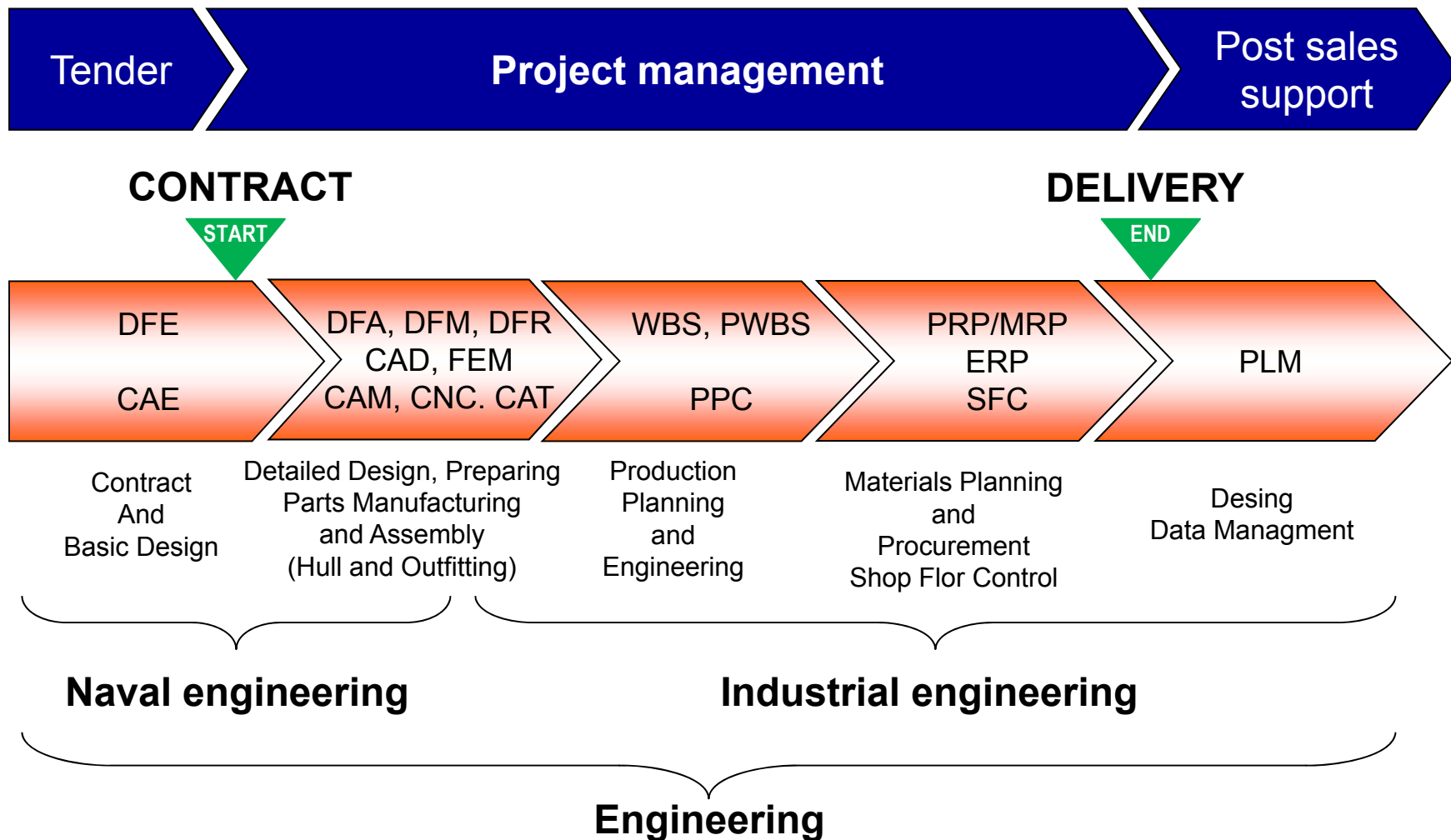
Celebration of ship completeness on slipway, Christening of ship by the owner, cutting the supporting rope with bottle of champagne for this celebration day, launching a ship in the seawater, and pulling the ship to the outfitting berth.

Confirming the function and performance of ship and of all equipment with the same condition of the voyage.



# Characteristics of Shipbuilding

Basic concepts in engineering: Project and Process Management - Streamline



***Shipbuilding Project management and Process Management***

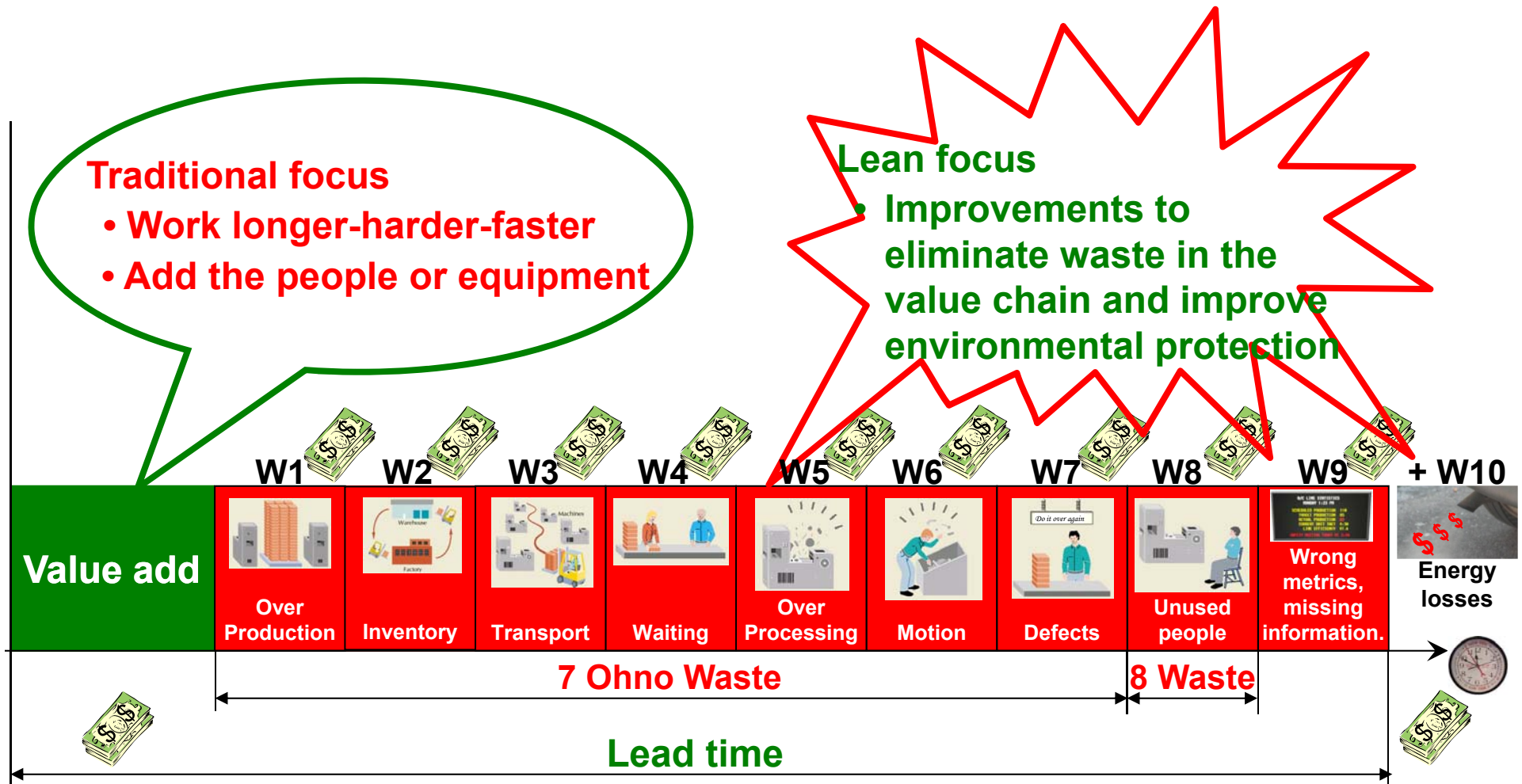


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# Developing a Lean and Green Shipyard

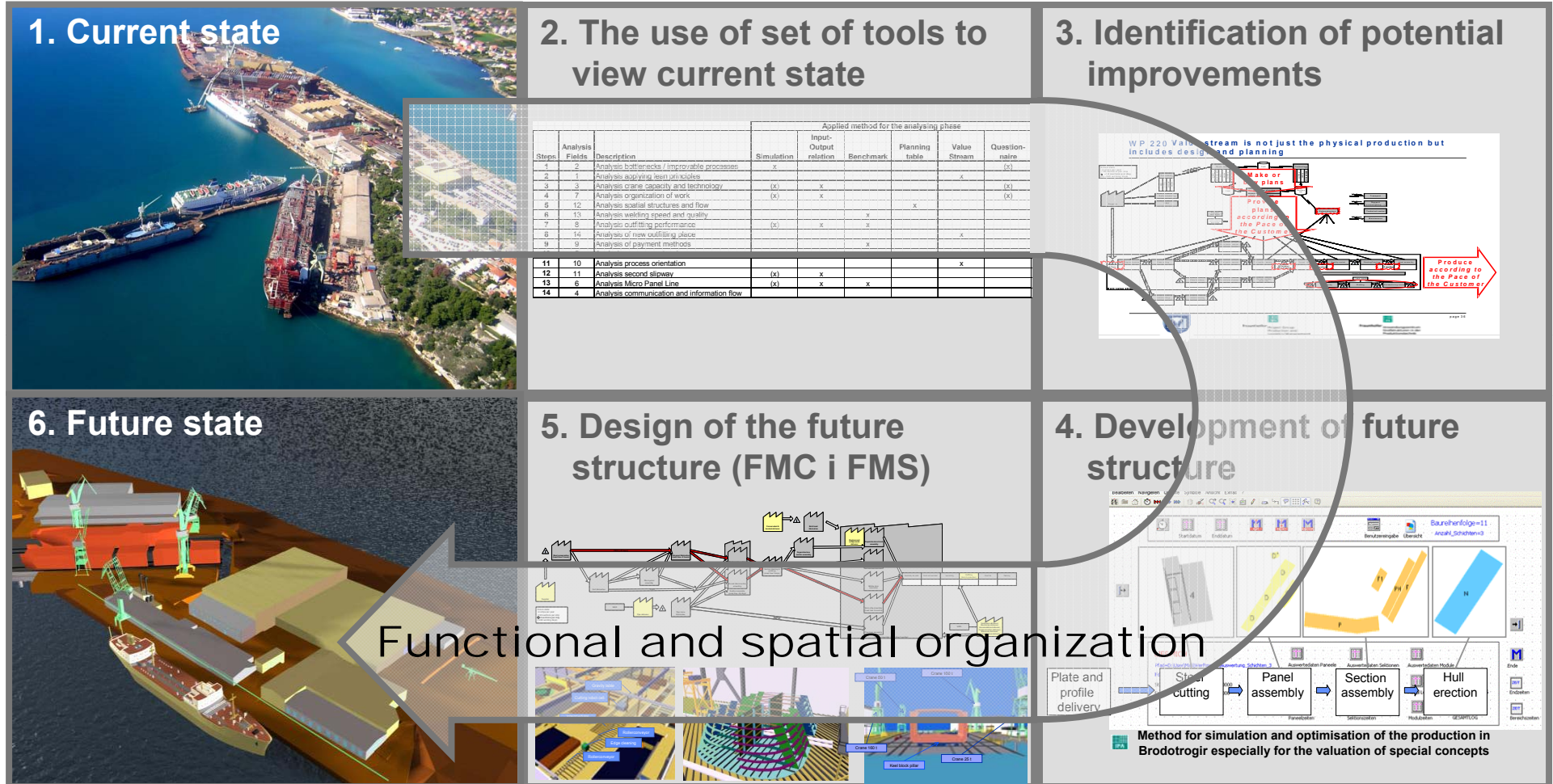
Main concept: **Do simply and green by removing the waste!**



Lean = eliminating waste

# Developing a Lean and Green Shipyard

## Systematic modeling of future state



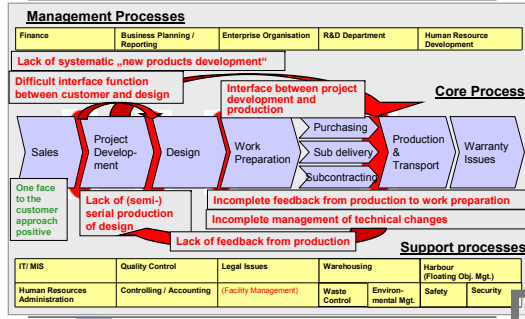
**To build a successful Lean companies is needed: energetically and fairly systematic presentation rated where the company is, where it should be, how it will get there by applying Lean principles and what are the benefits of it.**

# Developing a Lean and Green Shipyard

## Systematic modeling of future organization

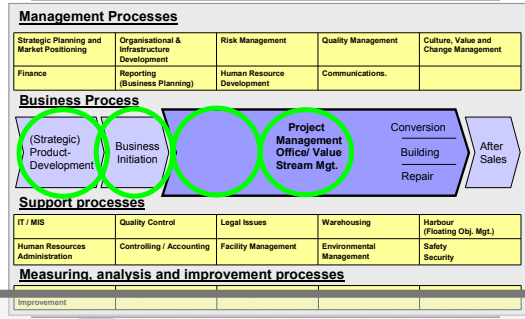
### 1. Identification of potential improvements

WP 210 Value stream analysis for the administrative processes  
Main Business Processes Map (1st level): Current State - Potential for Improvement



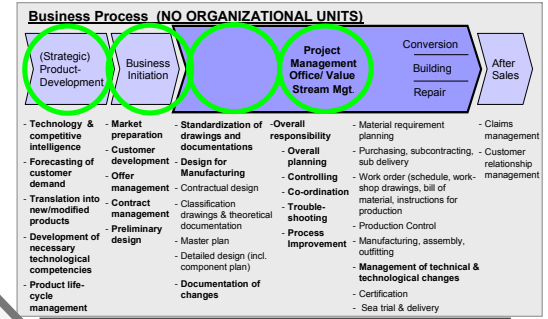
### 2. Development of process based organization

WP 210 Value stream analysis for the administrative processes  
Main Business Processes Map : Possible Target Processes



### 3. Implementing process based organization

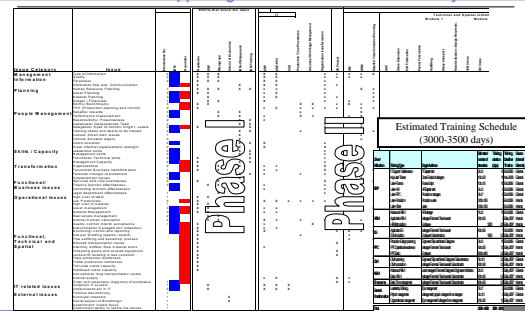
WP 210 Value stream analysis for the administrative processes  
Main Business Processes (Target State) – Overview of Tasks



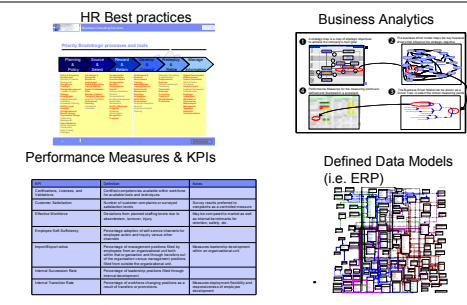
## Business process and Business Management

Further analysis identified several opportunities across Change Modules for operational improvement that could be initiated immediately

- BT needs to increase project management capacity (skills and number of resources) and lay down a foundation of the transformation project office—PM is BT core skill needed both for the transformation and for the production
- Current BT management will need to execute the transformation—the first step is to raise above day to day operations, transform yourself and your team; strong leadership skills will be needed both at the board level and in the top management echelon
- BT workers need to be better informed, more engaged and proactive in the transformation which calls for more interactive approach using available channels and opening of the new communication channels
- BT needs to advance its current HR management activities beyond HR admin—new performance/benefits as well as career/skills management capacities are essential elements of the transformation
- The shipyard needs to improve its quality control and asset management processes and establish entities independent from production processes to improve quality of interim products and therefore the end product quality as well to improve asset management capabilities



How do we do it—Combine the following ...



**Cjelovita izgradnja Lean tvrtke sadrži: Usklađenje i integriranje svih dijelova organizacije tvrtke i lanca dobave u procesno strukturiranoj Lean organizaciji samoprilagodljivog oblika i veličine sukladno promjenama koje zahtjeva kupac.**



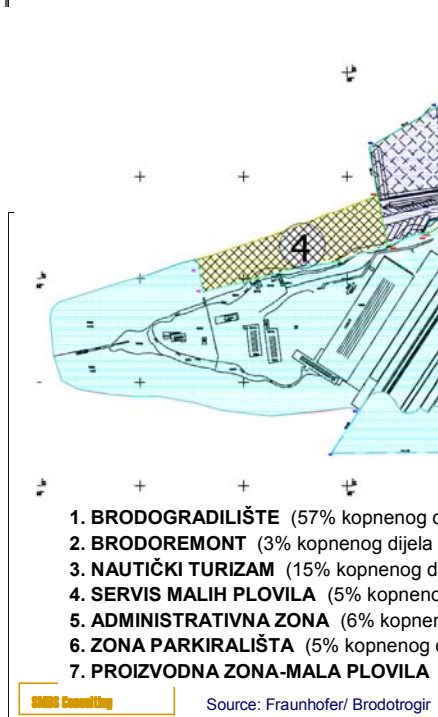
# Developing a Lean and Green shipyard

## Result of systematic modeling of Lean structure

*Example: Brodotrogir hired Fraunhofer, IBM, SMDS and others to help them with the transformation planning and implementation—extreme makeover: half the size, double the output, three more business models*



*The shipyard itself becomes a completely different animal—lean and mean profit machine and still building, repairing and/ or servicing ships*

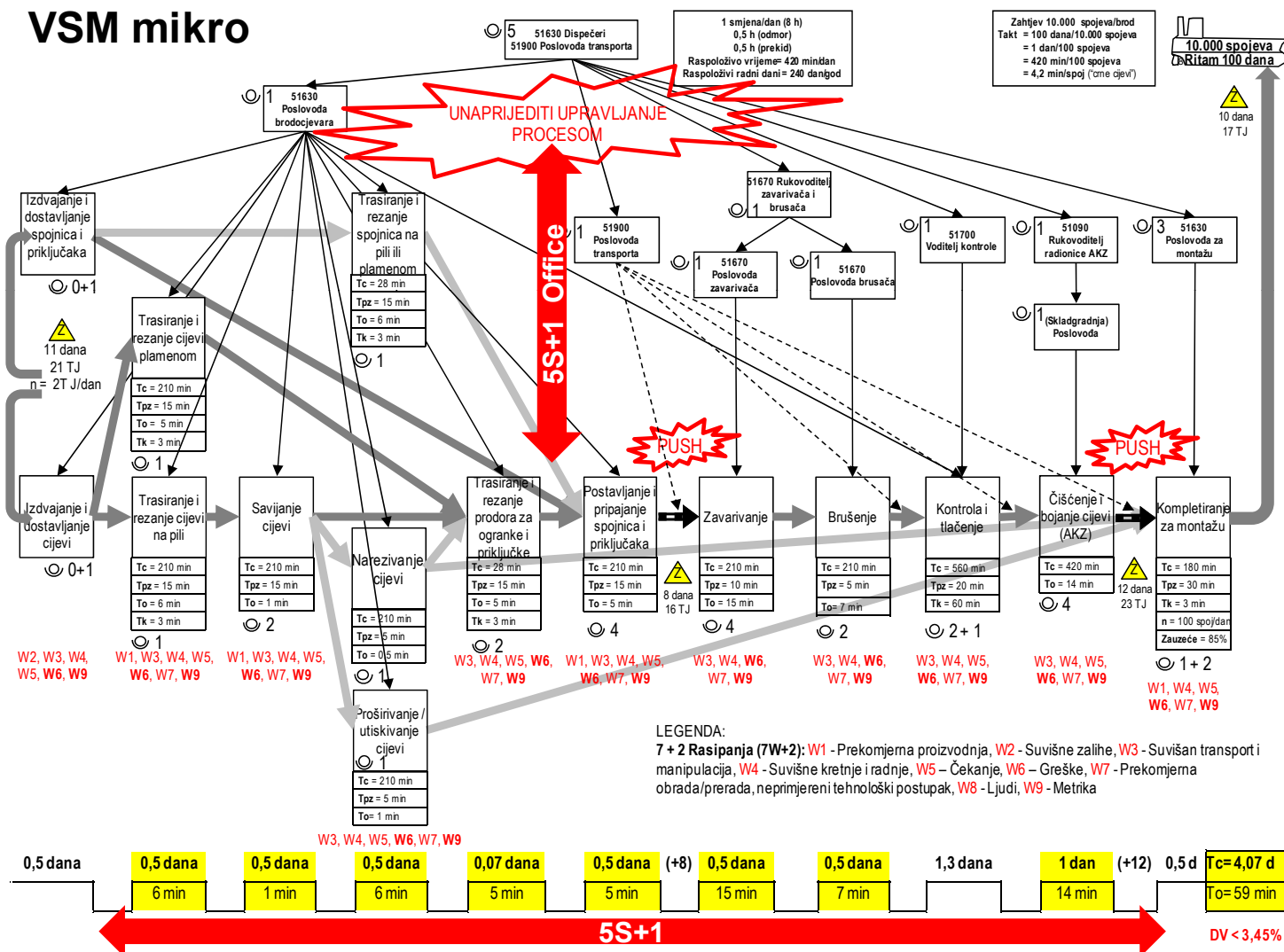


Main tool for implementation and for continuous change process  
(Becoming Lean): **5S+1 and 5S+1 Office**



# Developing a Lean and Green Shipyard

**Value stream mapping (Material and Information flow mapping):**  
Basic tool for identification improvements and manage 5S actions



# Developing a Lean and Green Shipyard

## Change management: Do it every day, planned, in small steps

LEAN PRODUCTION  
Implementacija 6S

*Rezultat pilot projekta 5S+1*  
Pipe & Locksmit Shop



Brodotrogir d.d. mr.sc. Mario Rovin, dipl.ing.

4



6S – Implementacija-Pipe & Locksmith Shop

27

LEAN PRODUCTION  
Implementacija 6S – S6 Zaštita okoliša

OSTVARENJE PLANA  
47 TJ. 19.-24.11.2012.

**S1 – nastavak: Ostvareno**



Brodotrogir d.d.

mr.sc. Mario Rovin, dipl.ing.

6

6S – Implementacija S6 – Zaštita svijeta oko nas

24.11.2012.



# Developing a Lean and Green Shipyard

## Measure improvements: Tangible and Intangible

LEAN PRODUCTION  
Implementacija 6S

POLAZNO STANJE  
Pipe & Locksmit Shop

### 1. Funkcijska organizacija za 6S – Samoocjena

1/5

#### 6S rutina – Audit

Tvrtka/Organizacijska jedinica: Brodotrogir d.d. / 21 samoocjenjivač

Naš cilj je uskladiti radno okruženje sa svjetskom razinom

Razred A: 150-136, Razred B: 135-116, Razred C: 115-90, Razred D: Ispod 90  
Samo vjerodostojan (dokazivi) razred A može se odlikovati izvršnošću 6S rutine

Ocjena postotka sukladnosti za svako mjerilo: 1 = 0%, 2 = 25%, 3 = 50%, 4 = 75%, 5 = 95% - 100%

SORTIRANJE: Osloboditi se nerada. Izdvojiti potrebno za rad.

1. Da li je radni okoliš uredan?
2. Da li su svi materijali i alati uredno odloženi?
3. Da li su kolet i dijelovi označeni i ispravno pohranjeni?
4. Da li je osigurano i dokumentirano obrazovanje zaposlenika za 6S?
5. Da li je osigurano i dokumentirano obrazovanje zaposlenika za 6S?

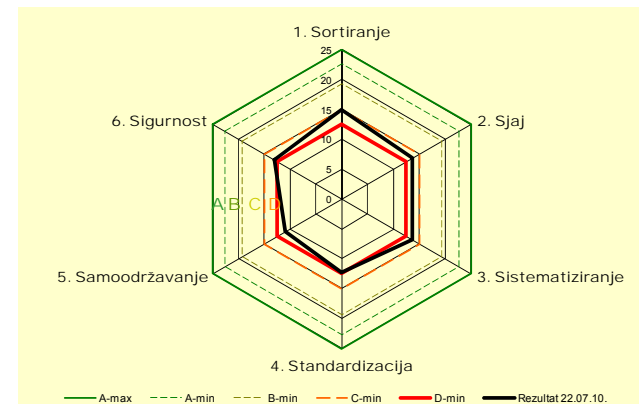
Samooocjena	0-25	25-50	50-75	75-95	Pregled	0-25	25-50	50-75	75-95
1	2	3	4	5	1	2	3	4	5
2	2	3	4	5	1	2	3	4	5
3	2	3	4	5	1	2	3	4	5
4	2	3	4	5	1	2	3	4	5
5	2	3	4	5	1	2	3	4	5

LEAN PRODUCTION  
Implementacija 6S

POLAZNO STANJE  
Pipe & Locksmit Shop

### 1. Funkcijska organizacija za 6S – Samoocjena

4/5



Prvi prioritet u akcijskom planu dobivaju najlošije ocjene

Brodotrogir d.d. mr.sc. Mario Rovani, dipl.ing. 5 6S – Implementacija-Pipe & Locksmith Shop 26-07-2010.

LEAN PRODUCTION  
Implementacija 6S – S6 Zaštita okoliša

Benefit?



Jednokomadni tok ("one piece flow system") umjesto guranja ("Push system")

OSTVARUJE SE UKLANJANJE SVIH 7+1+1 RASIPANJA I SMANJUJE EMISIJA  
PLINOVA U ATMOSFERU ZA PREKO 50%(W10)!!!



Brodotrogir d.d. mr.sc. Mario Rovani, dipl.ing. 6 6S – Implementacija

# Developing a Lean and Green Shipyard

**Don't forget people:** They are the most valuable asset that the company has

LEAN PRODUCTION  
Implementacija 6S – S6 Zaštita okoliša

OSTVARENJE  
PLANA  
29.11.2012.

**Radni tim koji je izdržao do kraja!**



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# Lean – Measurement of improvement

<b>(Scorecard)</b>	
<b>0</b>	Known best practice: Without implementation plan
<b>1</b>	Implementation plan: No ongoing activities
<b>2</b>	Ongoing activities on best practices
<b>3</b>	Best practice implemented in some manufacturing cells
<b>4</b>	Best practice implemented in all manufacturing cells
<b>5</b>	Model of Company for best practice

 **Brodotrogir is there!**

**The simplest measure is carried out by comparing their own productivity and business process management with best practices.**



# *Thanks four your attention!*

## *Questions?*



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