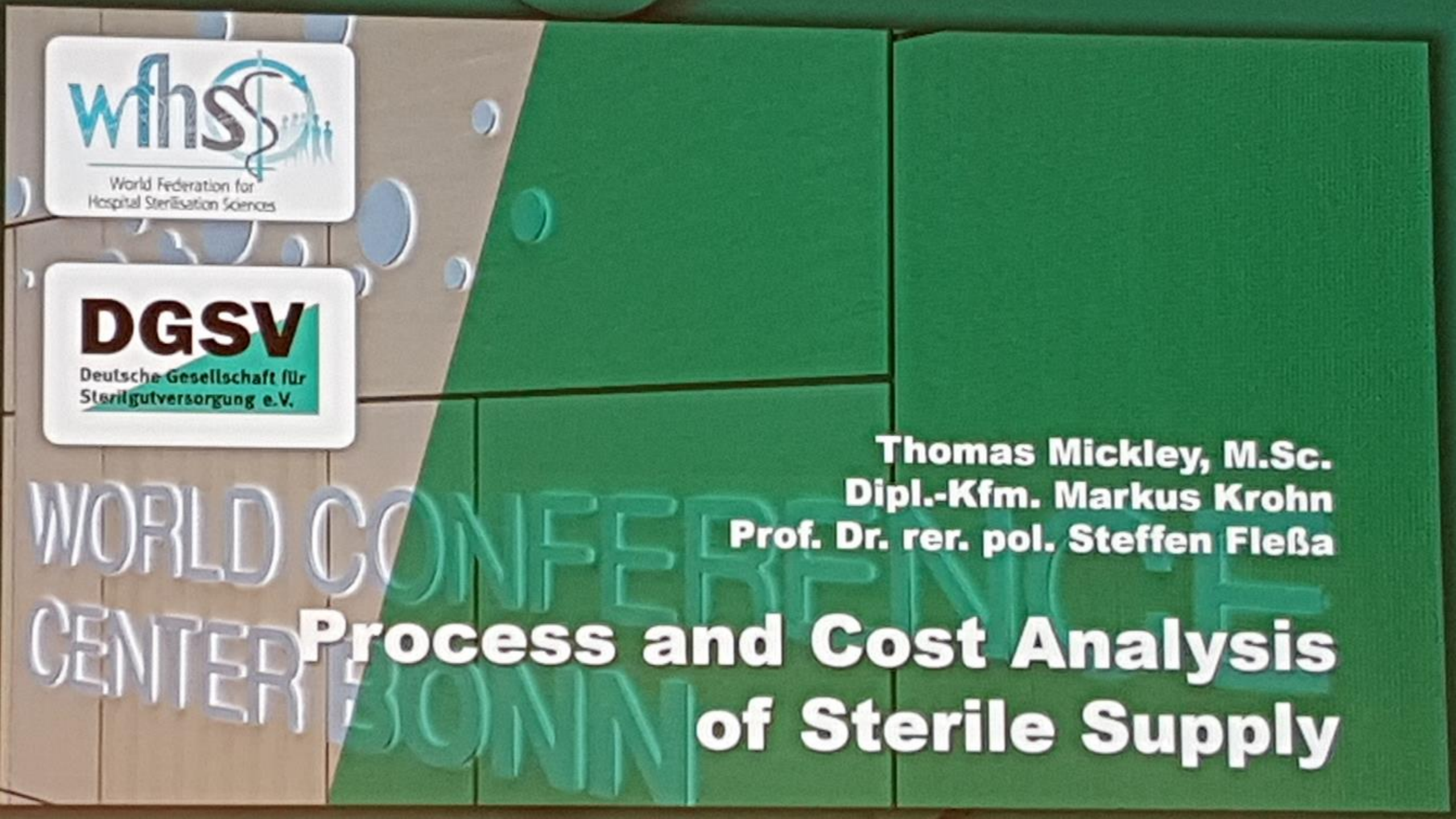


Thomas Mickley, M.Sc.
Dipl.-Kfm. Markus Krohn
Prof. Dr. rer. pol. Steffen Fleßa

Process and Cost Analysis of Sterile Supply

Agenda

1 Background

- comparative analysis by focusing on two fundamental methods: *Non-Woven Sterilization Wrap* vs. *Containers*

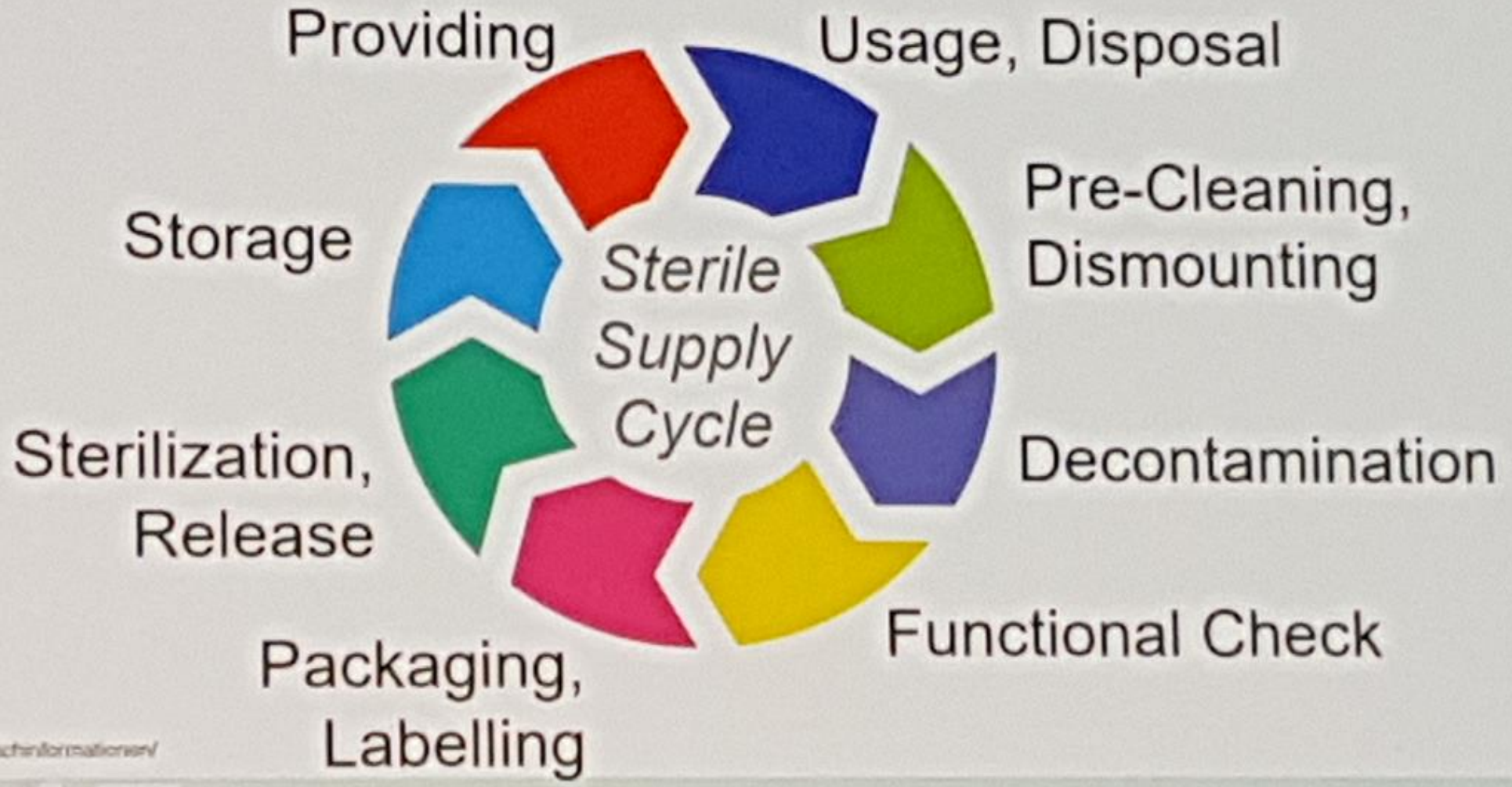
- entire sterile supply and disposal cycle

→ which option provides most economic advantages?

- especially personnel expenditures not scientifically evaluated

https://www.bbraun.de/content/dam/catalog/bbraun/bbraunProductCatalog/CW_DE/de-de/b1/xxl-endo-container1.jpeg
https://s3.amazonaws.com/keysurgical-site-assets/products/C3-2424.jpg

2 Methods of Process Analysis



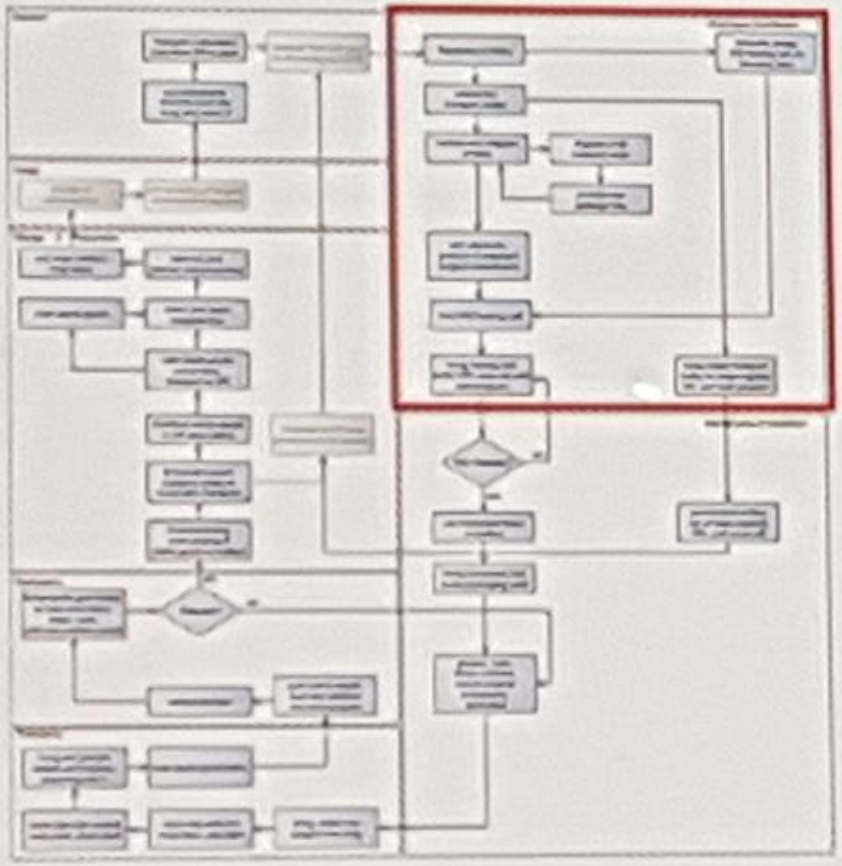
http://www.dgsv-ev.de/fachinformationen/

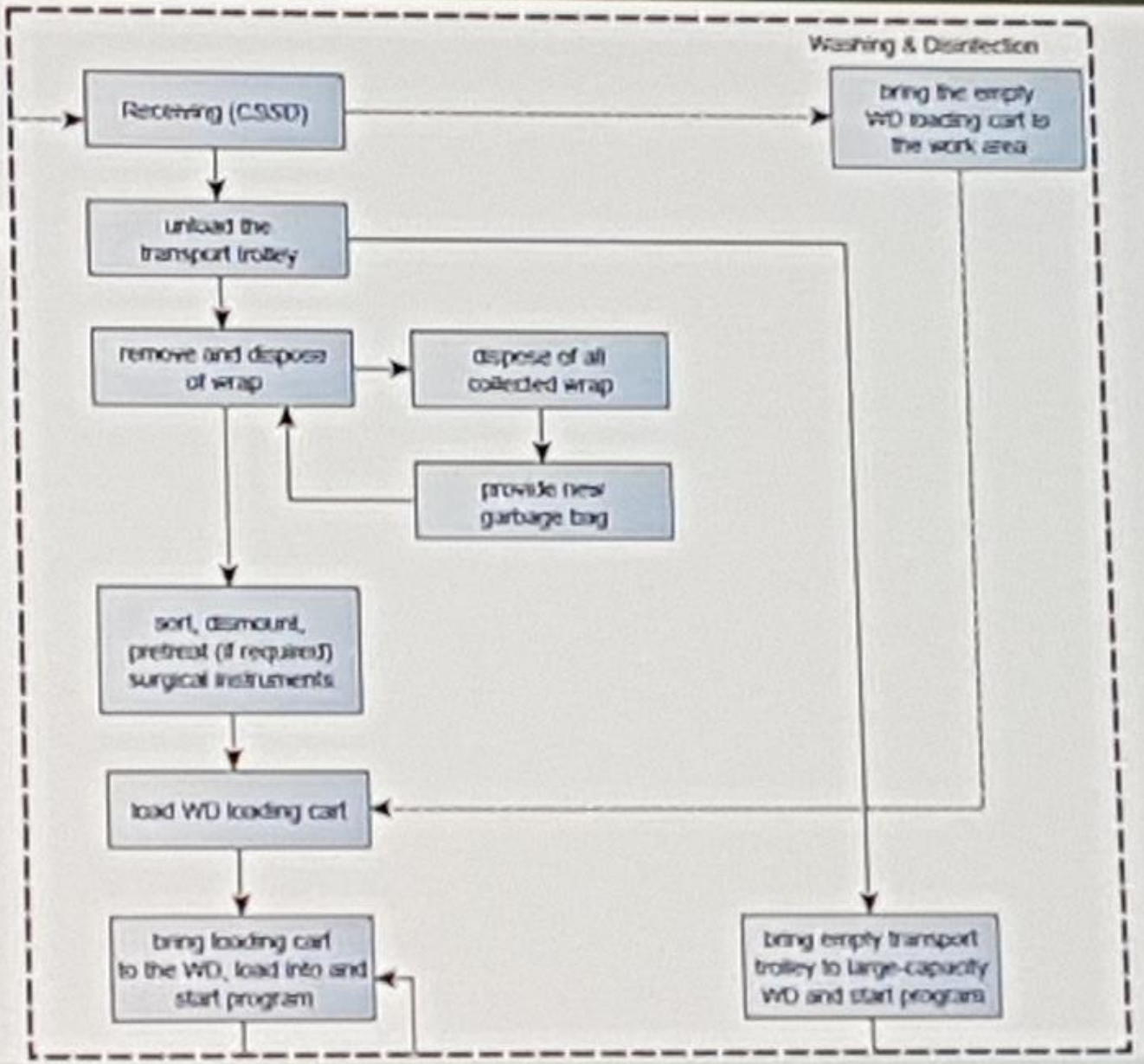
2 Methods of Process Analysis

	CSSD: Wrap	CSSD: Container
Data Collection	elapsed time measurement (stopwatch), data entry form	
Focus	✓ sterilization units (trays) × single packed, sealed, sterilized units	
Sub-Processes	31	44
Collected Data (times)	11,801 (process)	13,896 (process)
	27,823 (ster. unit)	31,508 (ster. unit)

2.1 Results:

Sterilization Wrap





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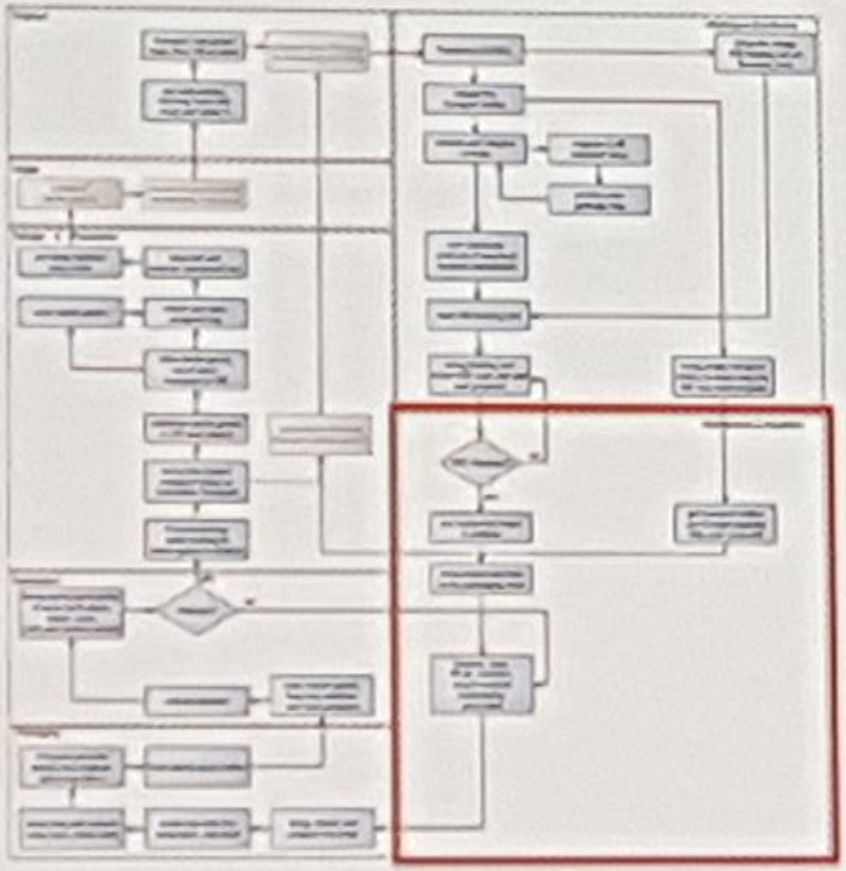

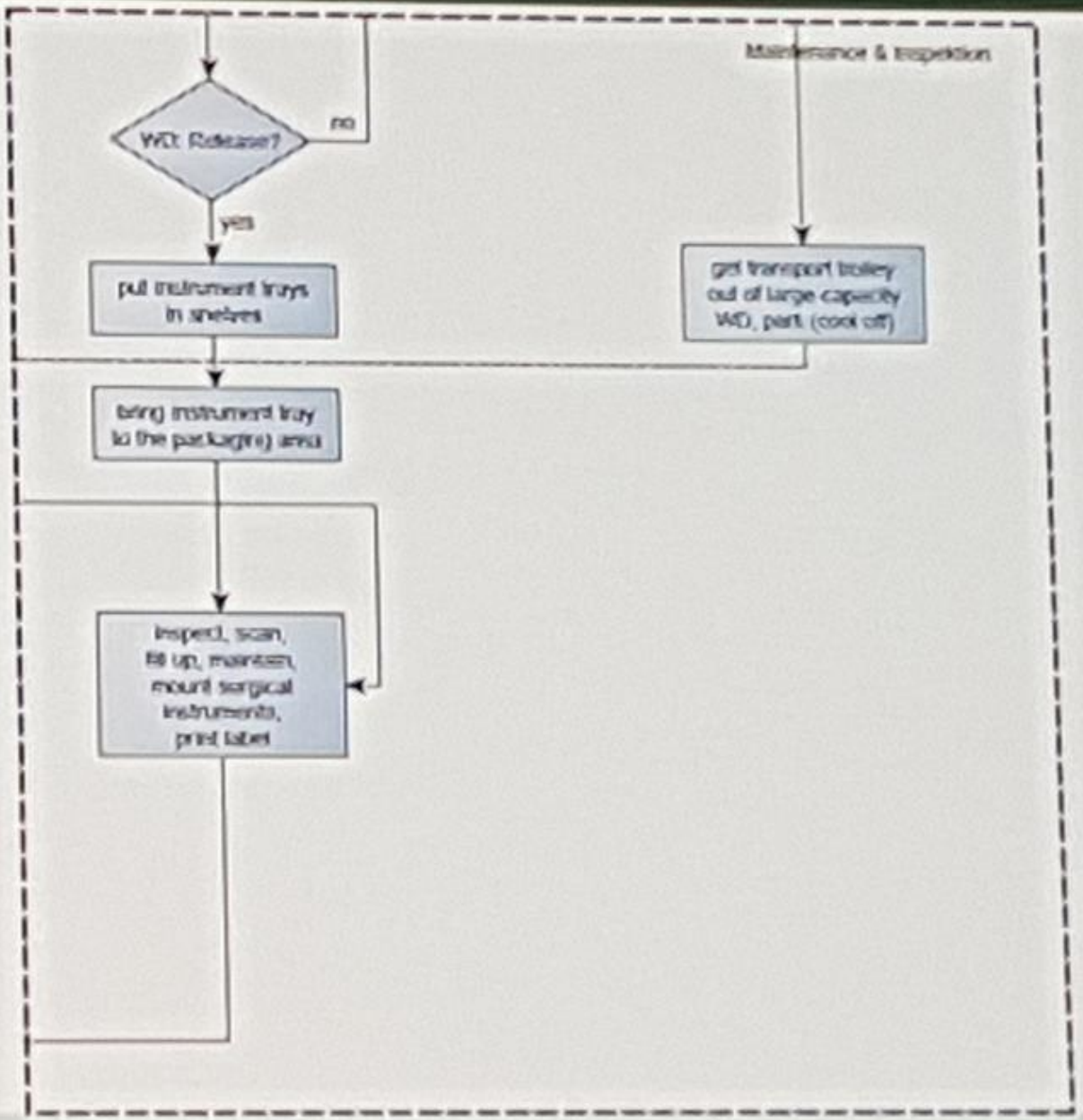

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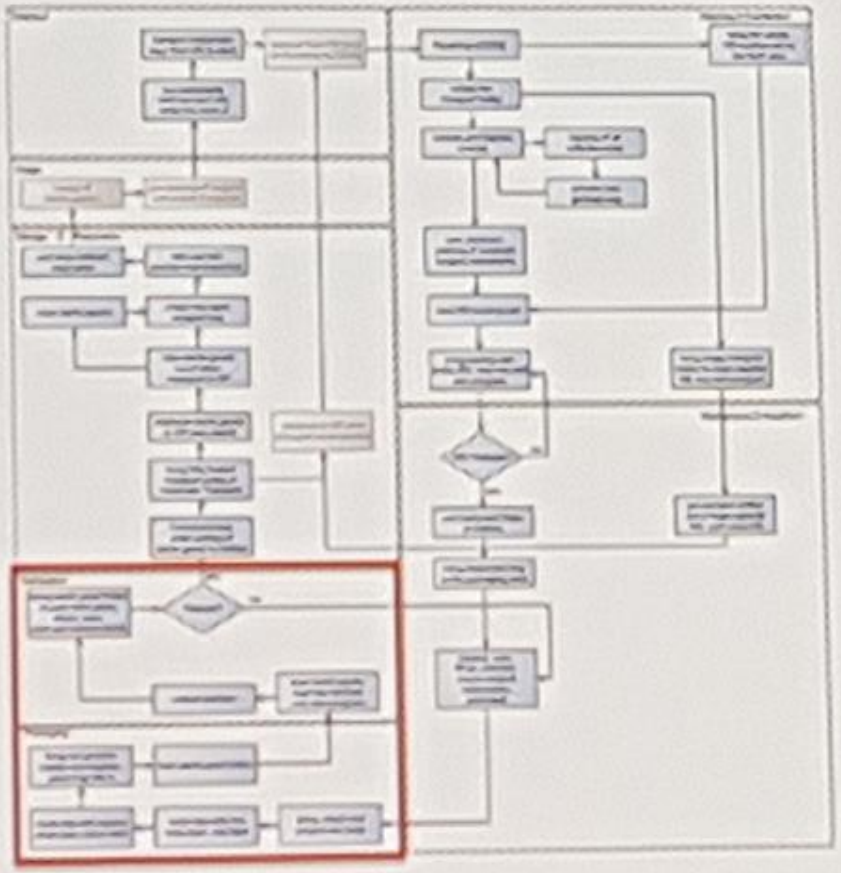
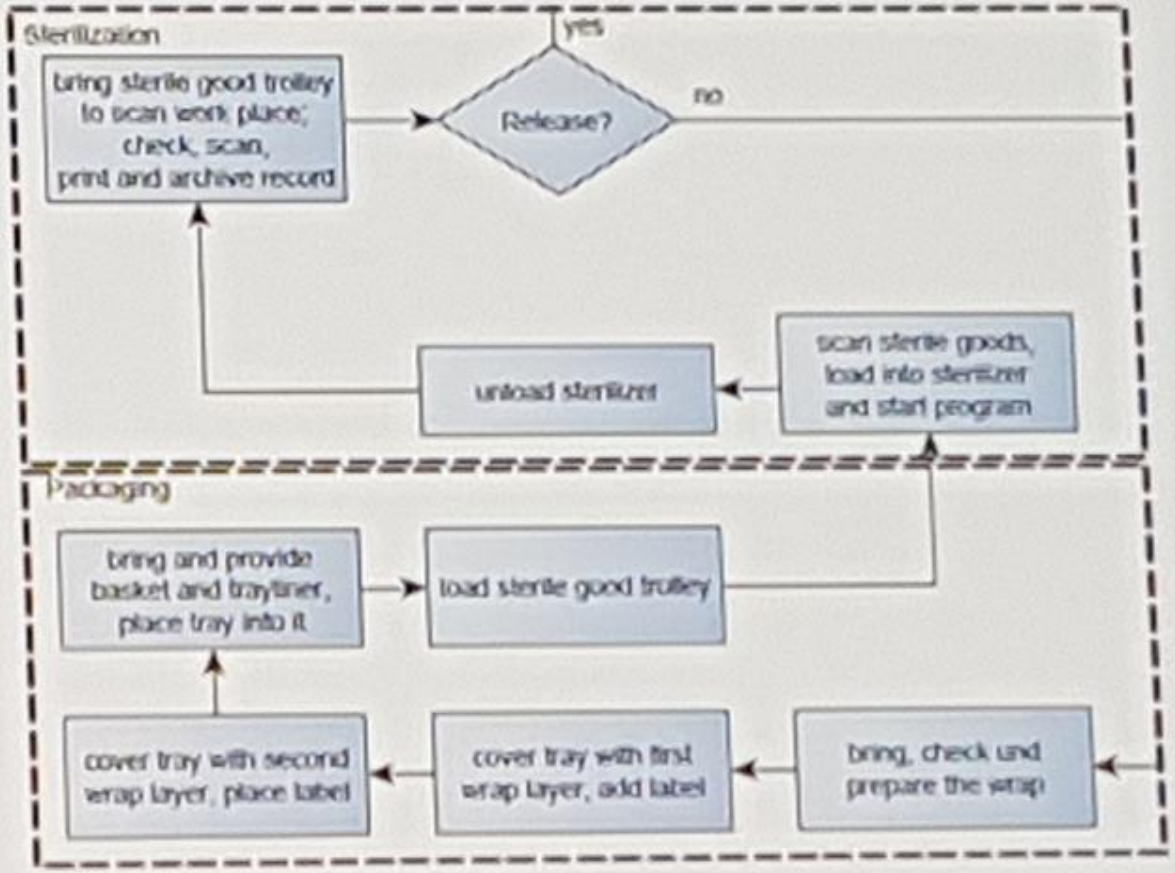
Sterilization Wrap





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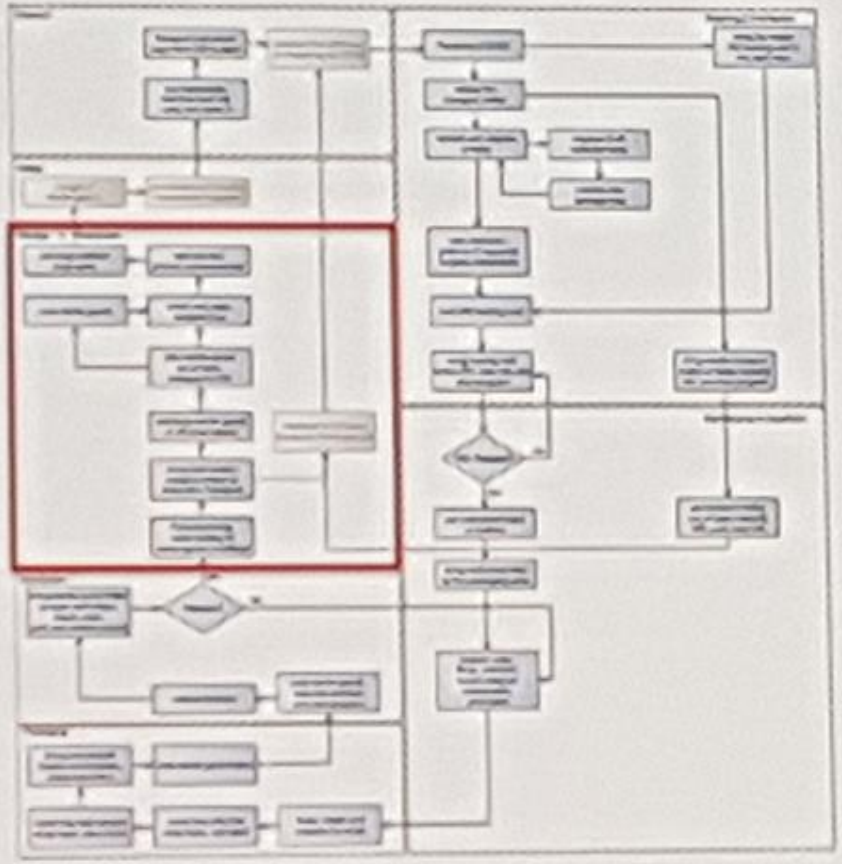

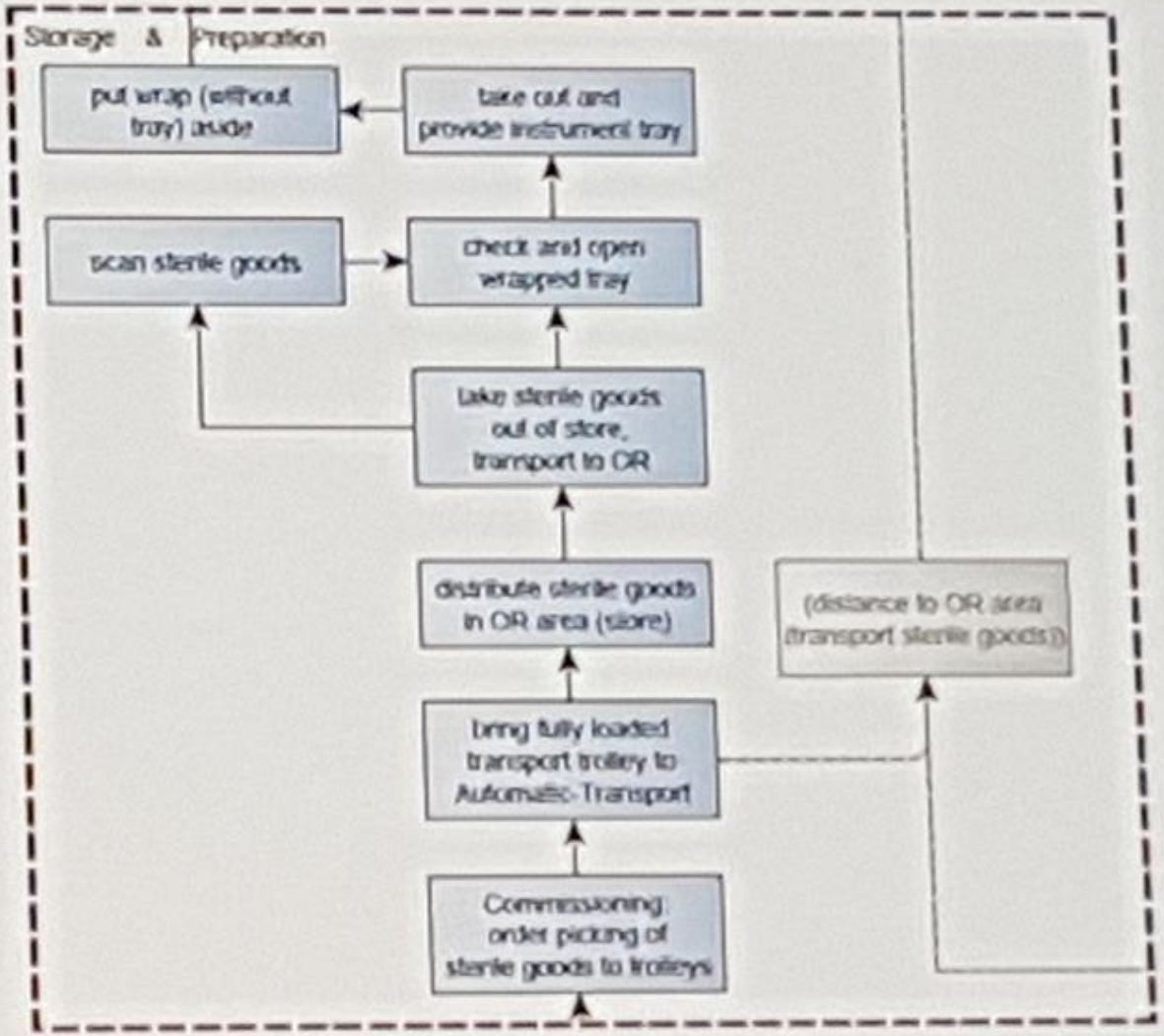

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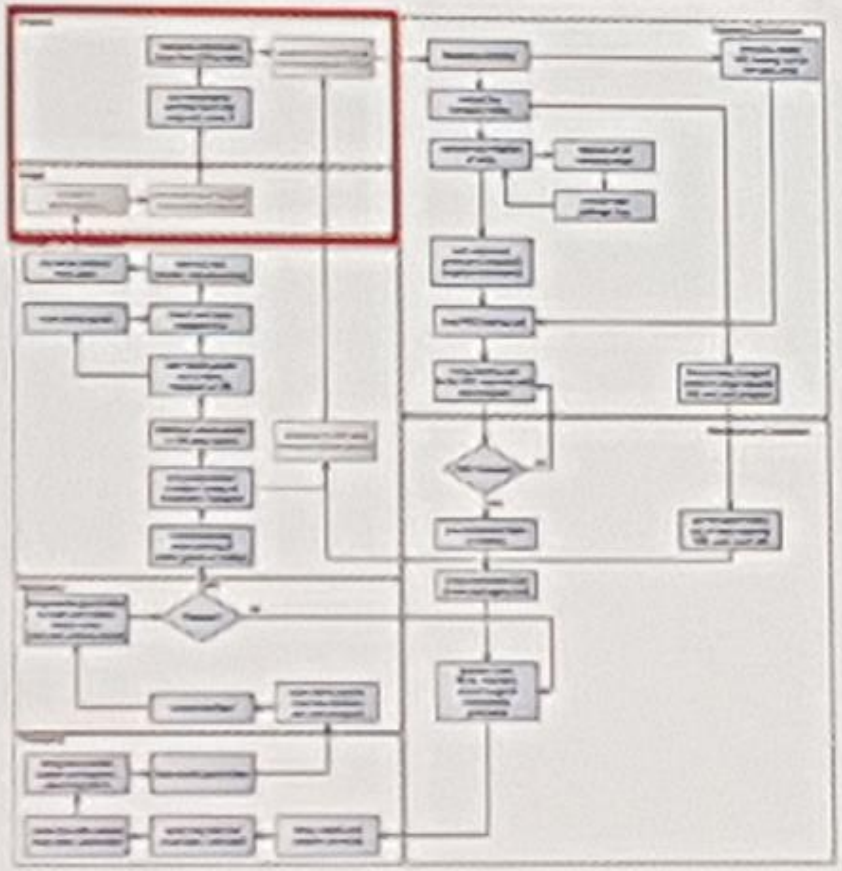
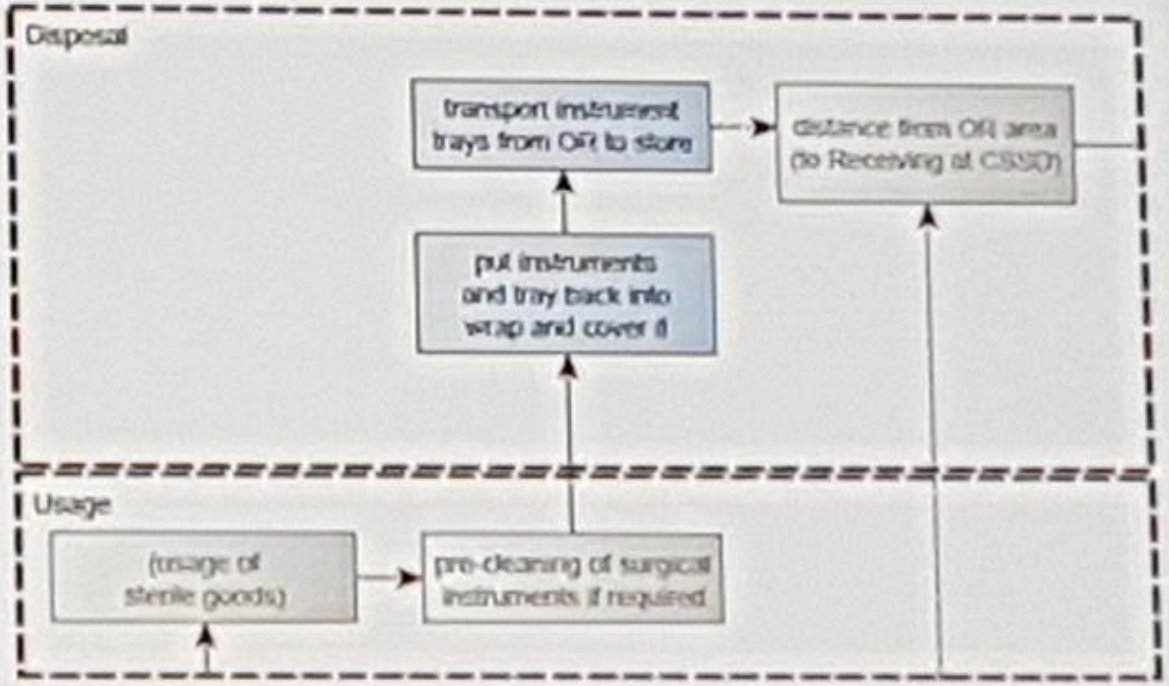
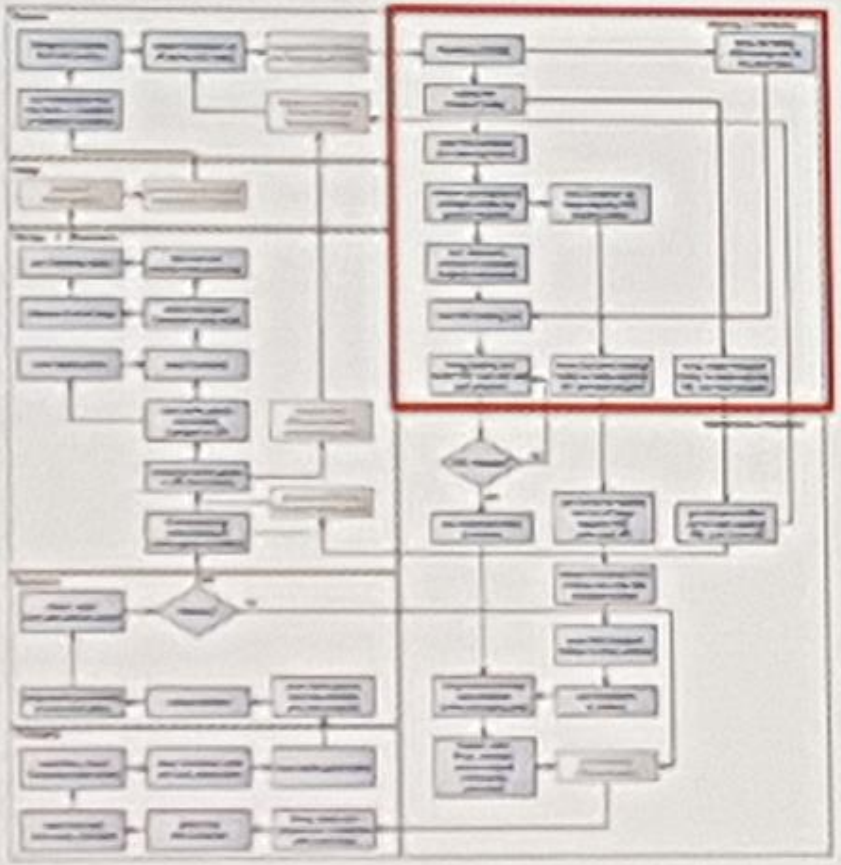
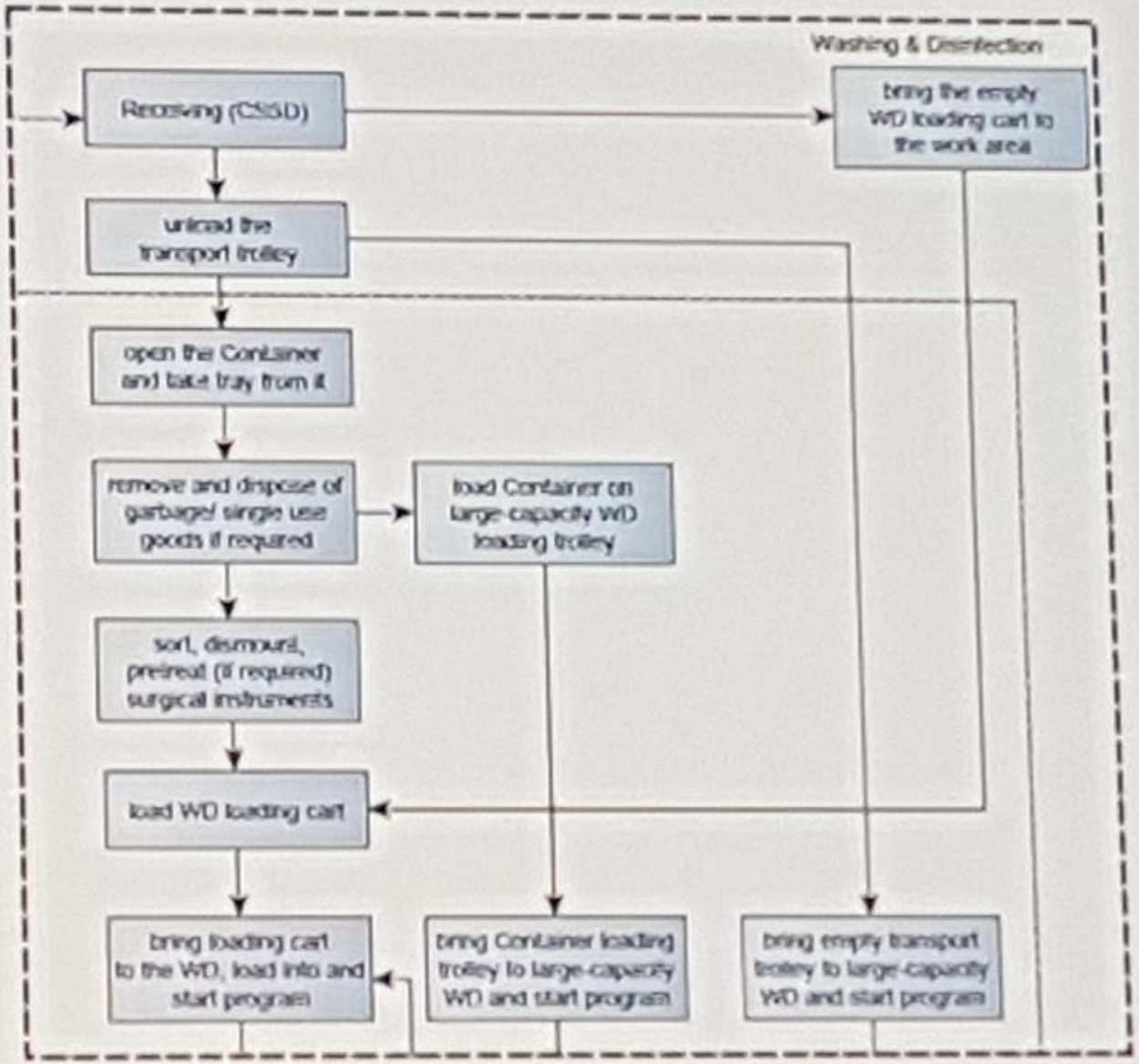
Sterilization Wrap





2.2 Results: Container





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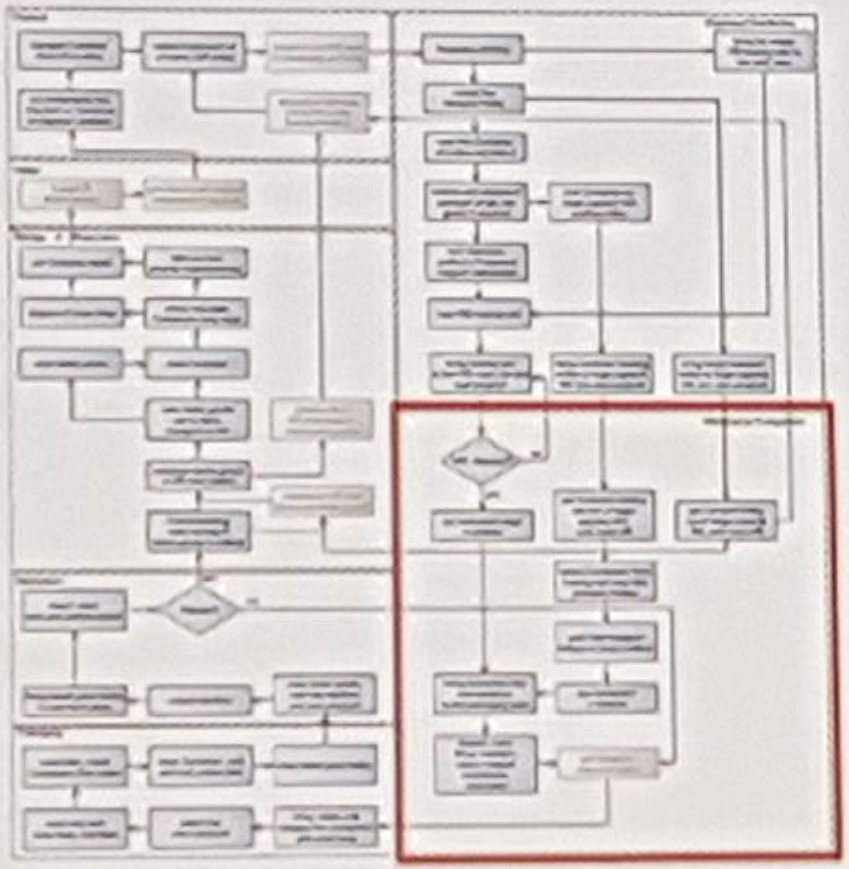

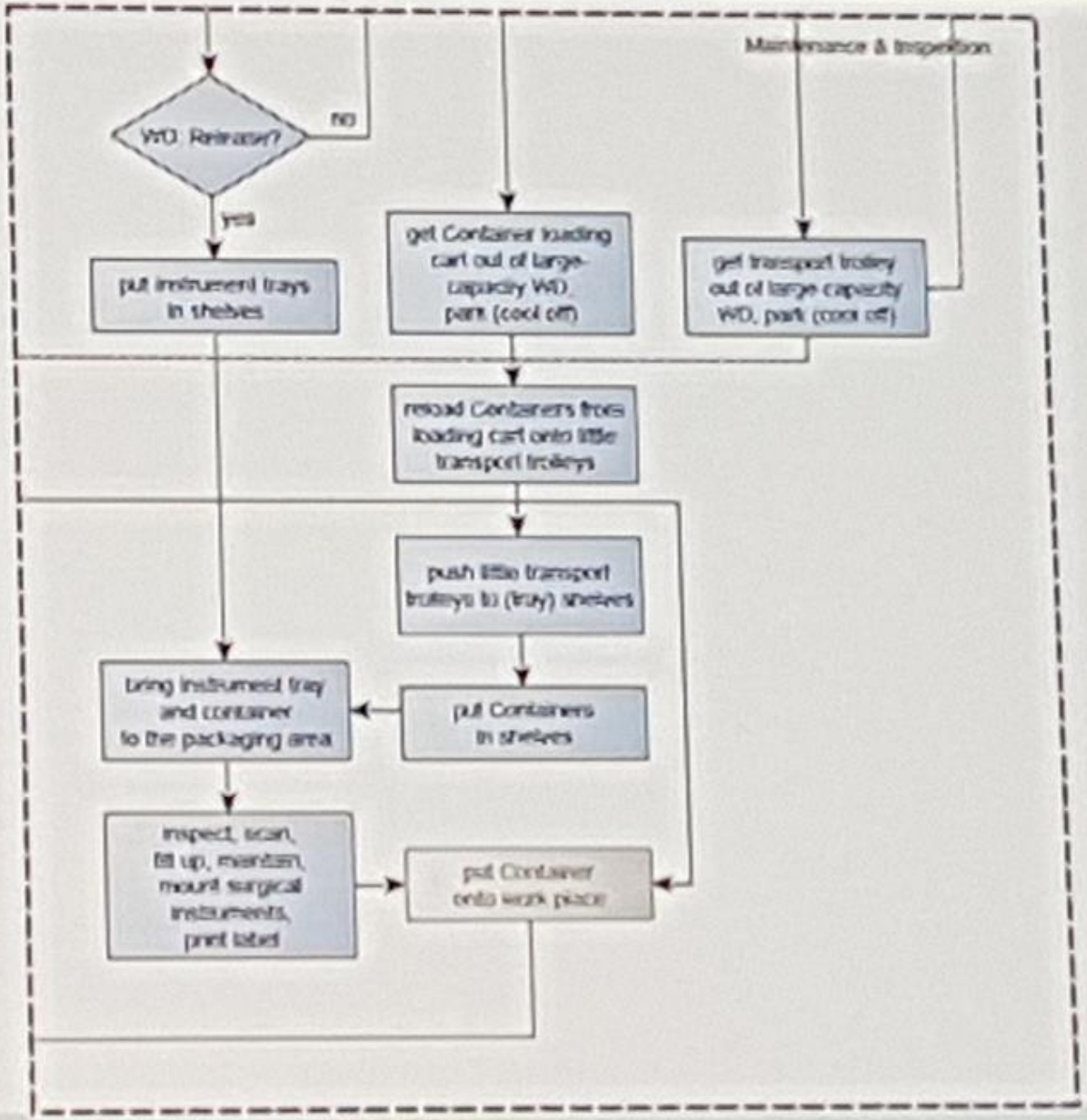

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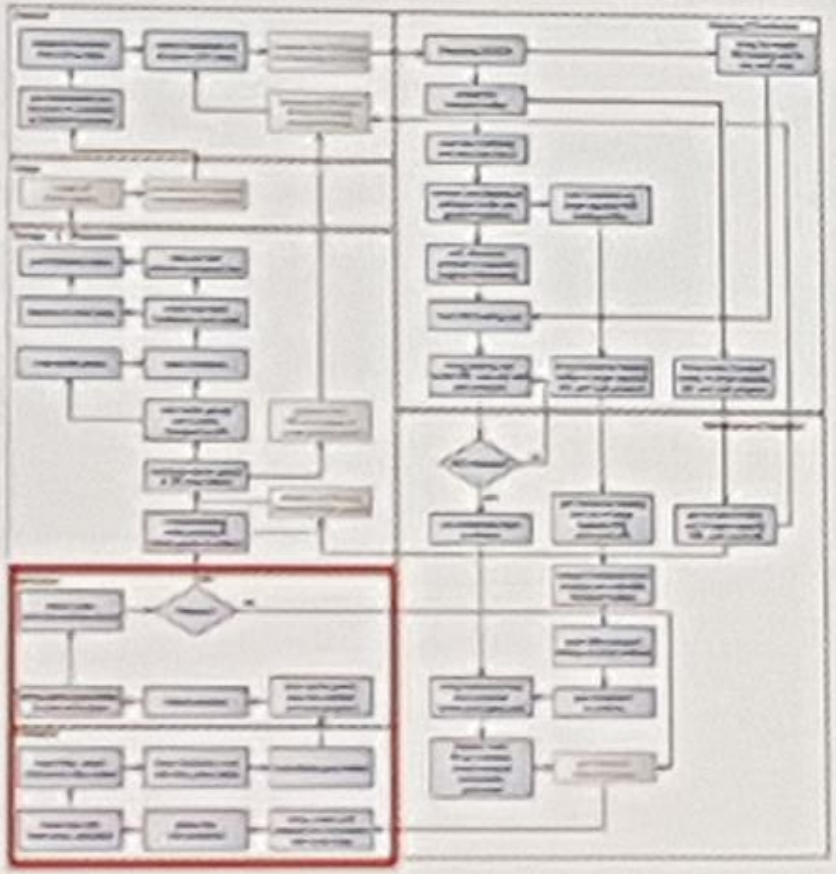

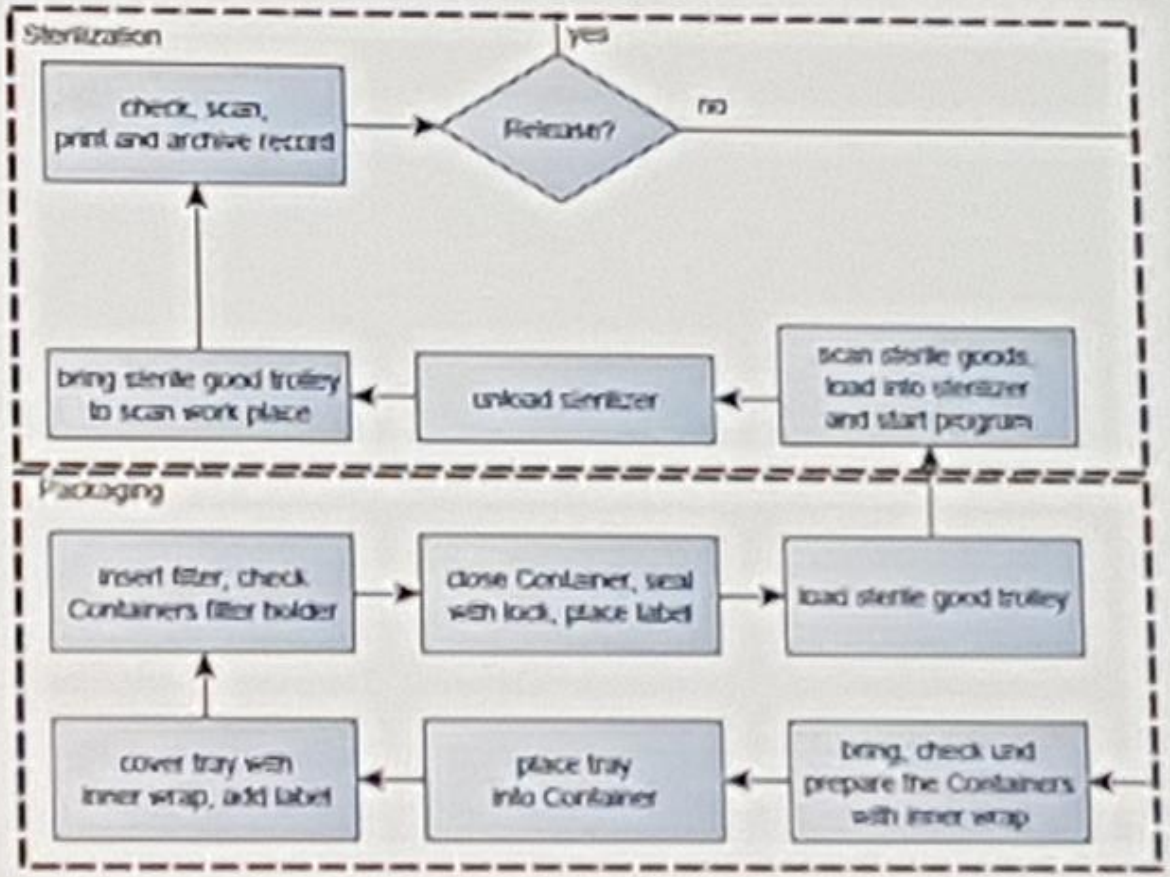

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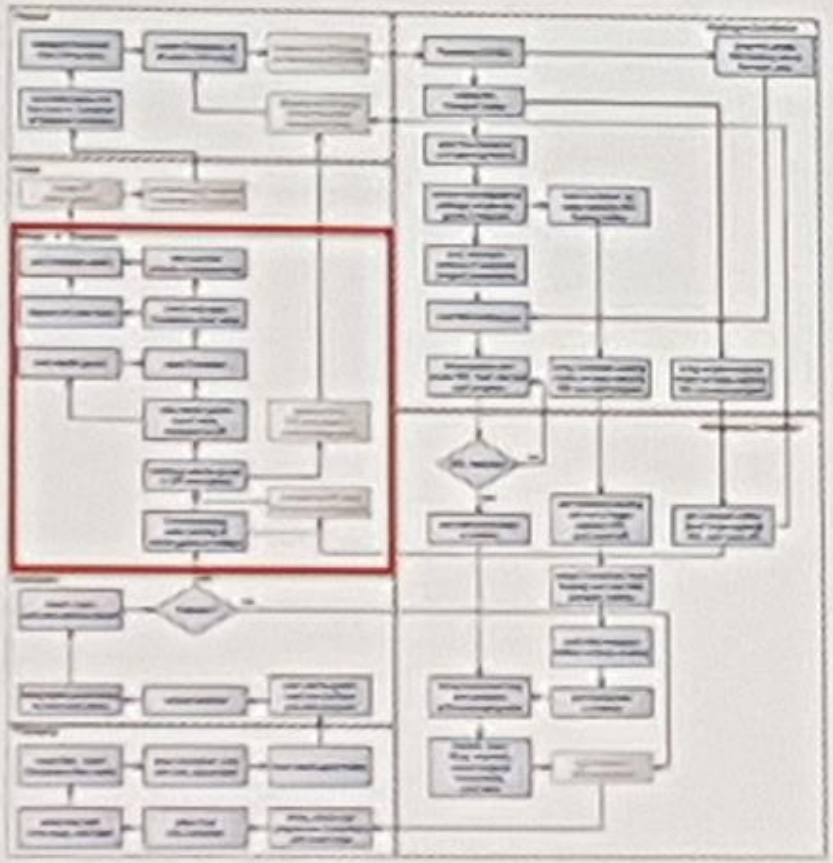

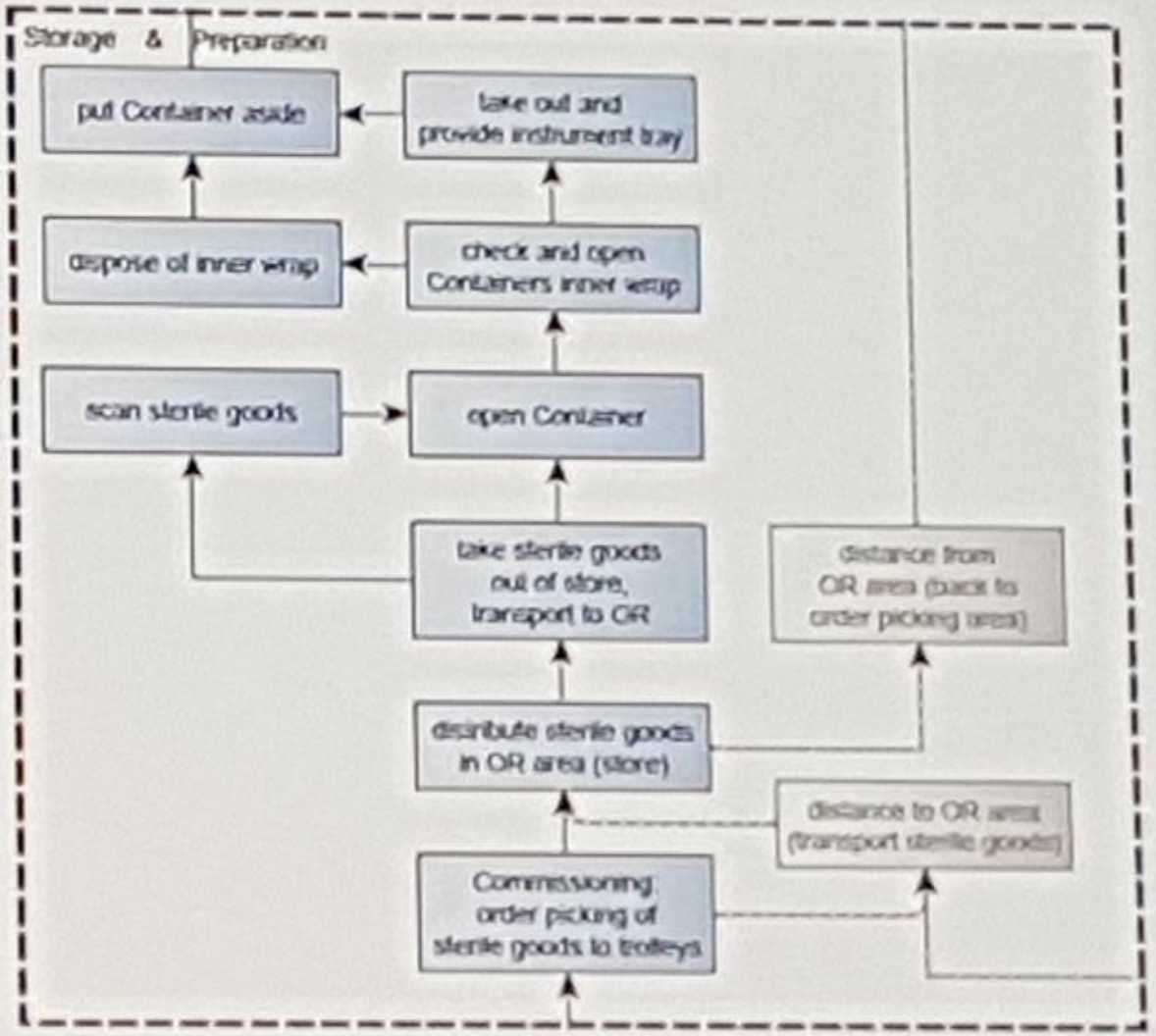

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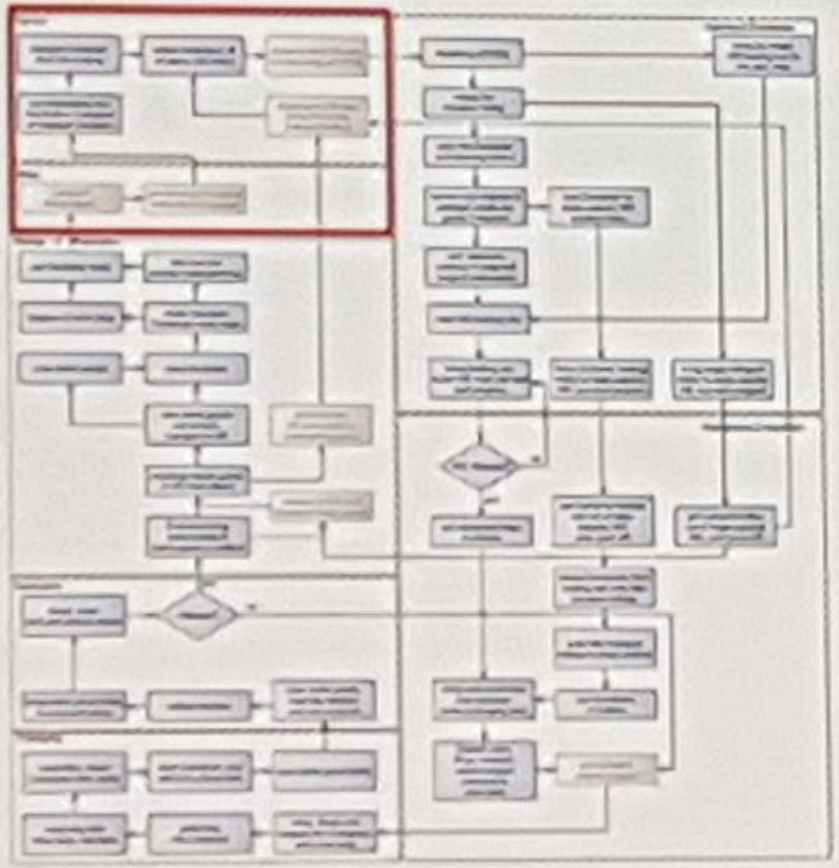
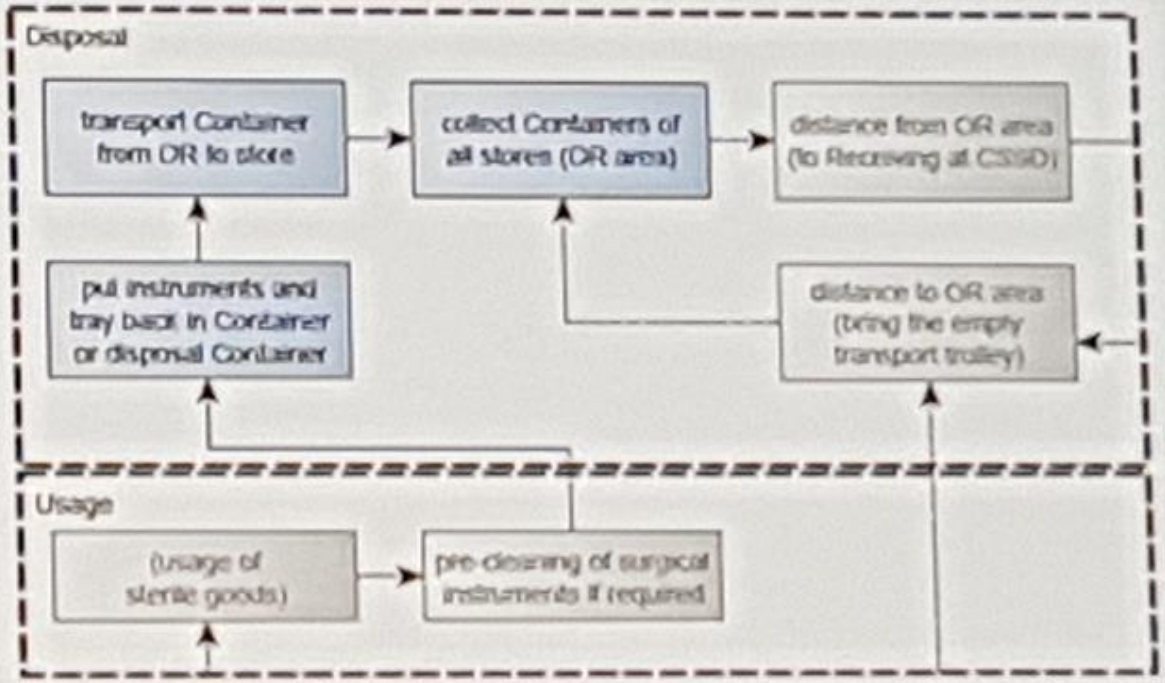




3 Cost Analysis

3.1 Calculation of Average Costs (Example)

3.2 Marginal Costs of Packaging/Labeling

Comparison of *„non-woven sterilization Wrap“ vs. Packaging „Container without inner wrap“*

3.1 Calculation of Average Costs (Example)

Assumptions:

- Set of produced goods is not equal in intensity of labor (time) and material costs
- „dependent" and „independent" processes have to be defined – Example:
  - DP = dependent processes:
    - **„sort, dismount, pretreat (if required) surgical instruments"** and
    - **„inspect, scan, fill up, maintain, mount surgical instruments, print label"**
  - IP = independent processes:
    - all others
- Fixed costs have to be respected (degression of fixed costs in case of increasing output)

Objective:

- **Calculation of average costs (with regard to the labor complexity of different output goods)**

3.1 Calculation of Average Costs (Example)

Result:

- Three produced goods: x, y, z
  - x – „less complex" good - labour intensity dependent processes (DPx) = 15 min – variable costs c_{var_x}: 0.83€
  - y – „normal complex" good - labour intensity dependent processes (DPy) = 25 min – variable costs c_{var_y}: 0.83€
  - z – „high complex" good - labour intensity dependent processes (DPz) = 45 min – variable costs c_{var_z}: 1.00€
  - labour intensity independent processes (IP) = 30 min
  - c_{flx} – CSSD fixed cost = 50,000€
  - n – number of employees = 20
  - g – gross employer wage per employee = 35,000€
- **Calculation formula for C_x (average costs of a „less complex" good X)**

$$C_x = \frac{c_{flx} + g \cdot n}{(x + y + z) \cdot IP + x \cdot DP_x + y \cdot DP_y + z \cdot DP_z} \cdot (IP + PD_x) + c_{var_x}$$

3.1 Calculation of Average Costs (Example)

Results:

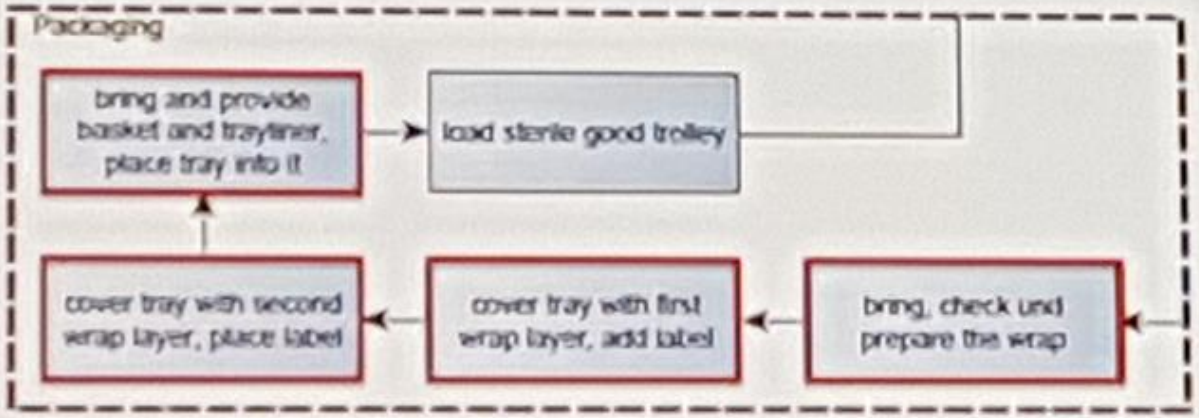
Scenario	Production output x	Production output y	Production output z	Average costs x	Average costs y	Average costs z
1	5,000	5,000	5,000	**39.40€**	**47.97€**	**65.29€**
2	10,000	5,000	5,000	**31.51€**	**38.33€**	**52.14€**
3	10,000	7,500	5,000	**28.10€**	**34.16€**	**46.45€**
4	15,000	7,500	7,500	**21.28€**	**25.83€**	**35.09€**
5	15,000	8,000	7,500	number of employees too low – set at least 21		

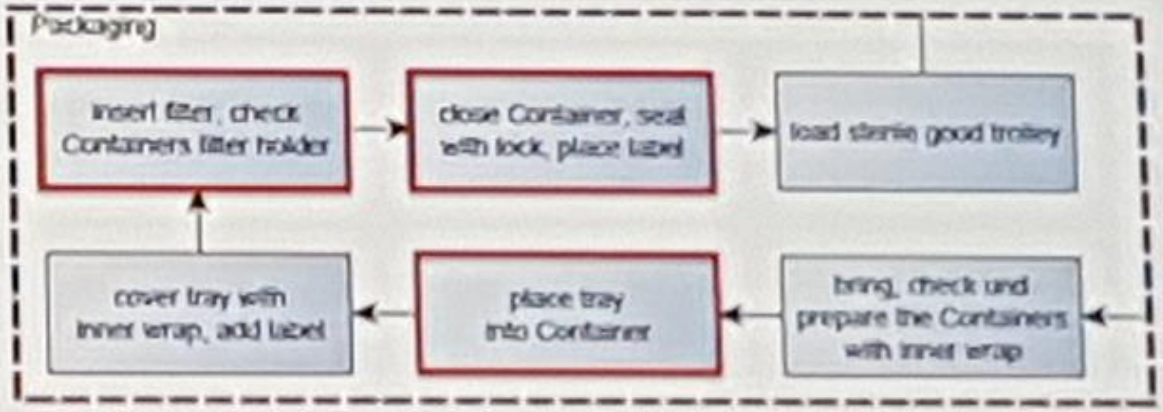
Discussion:

- Calculation formula can be extended to specific conditions, e.g. step-fixed costs for personnel, machines, extended set of output goods

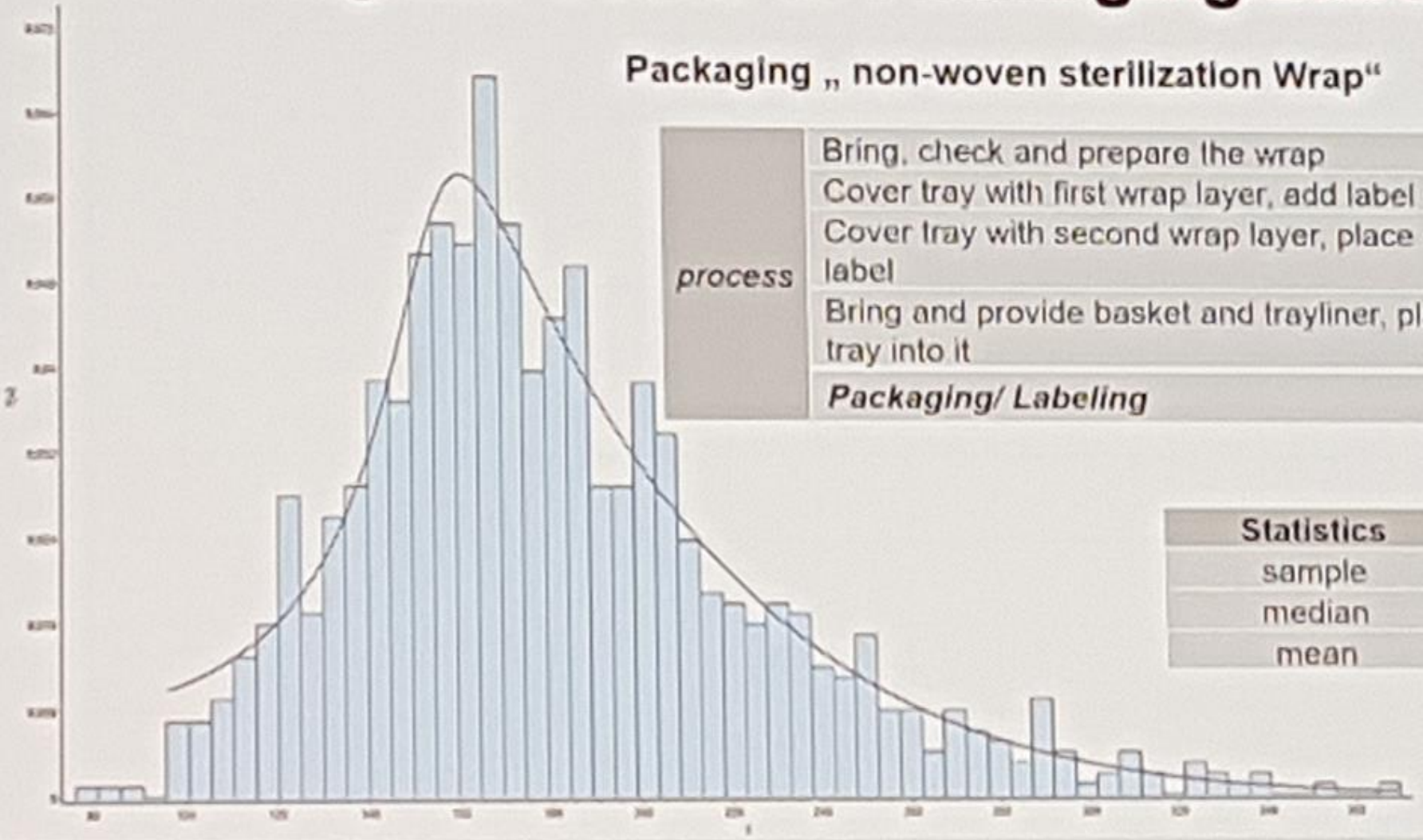
3.2 Marginal Costs of Packaging/Labeling

Packaging „non-woven sterilization Wrap“ *vs.* *Packaging „Container without inner wrap“*





3.2 Marginal Costs of Packaging/Labeling



Packaging „ non-woven sterilization Wrap“

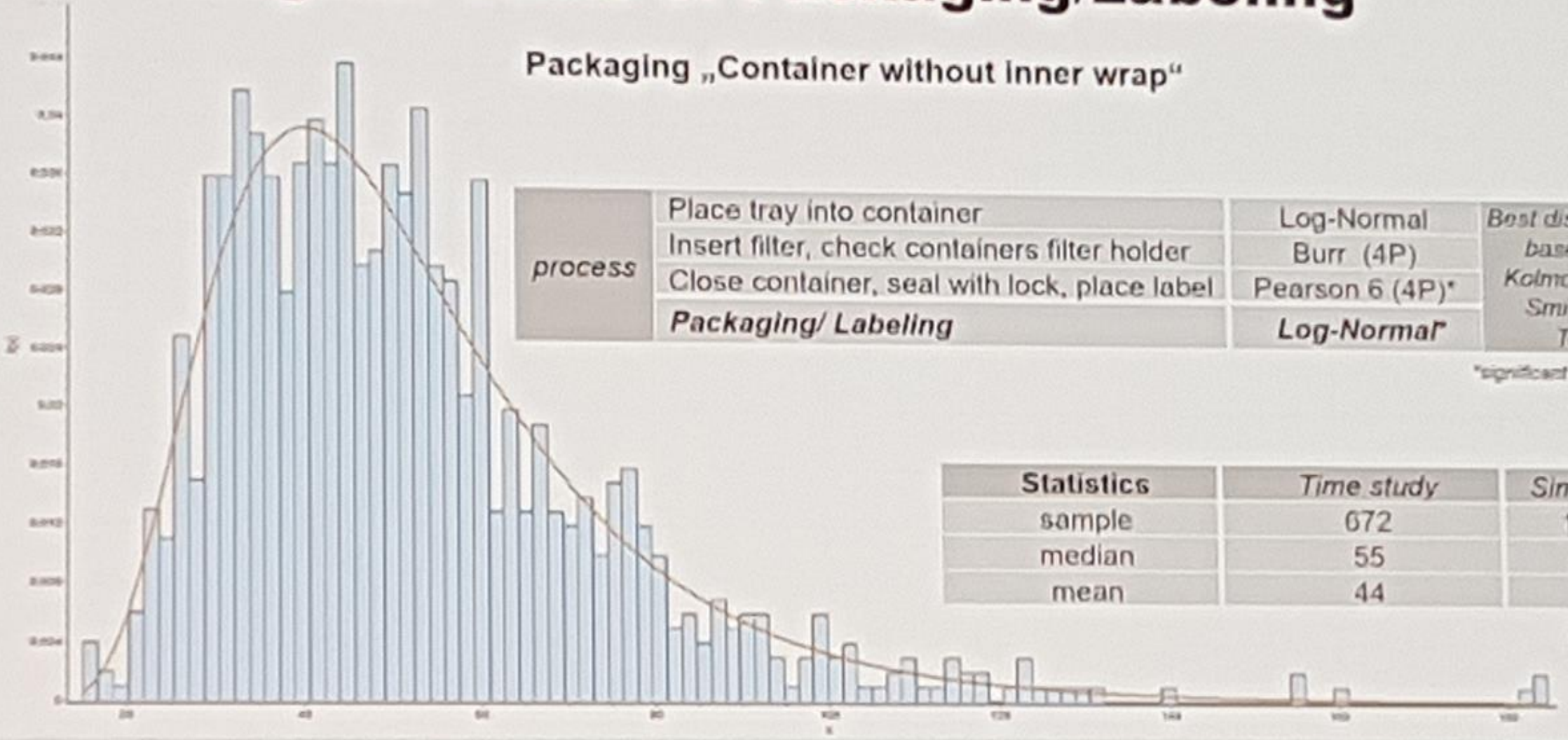
process	Bring, check and prepare the wrap	Burr (4P)*	*Best distribution based on Kolmogorow-Smirnow-Test*
	Cover tray with first wrap layer, add label	Log-Logistic*	
	Cover tray with second wrap layer, place label	Wakeby*	
	Bring and provide basket and trayliner, place tray into it	Wakeby*	
	Packaging/ Labeling	***Wakeby****	

*significant at α = 0.01

Statistics	*Time study*	*Simulation*
sample	424	1,000
median	172	173
mean	184	**181**

in seconds

3.2 Marginal Costs of Packaging/Labeling



Packaging „Container without inner wrap“

process	Place tray into container	Log-Normal	Best distribution based on Kolmogorow-Smirnow-Test
	Insert filter, check containers filter holder	Burr (4P)	
	Close container, seal with lock, place label	Pearson 6 (4P)*	
	Packaging/ Labeling	***Log-Normal***	

*significant at α = 0.01

Statistics	Time study	Simulation
sample	672	1,000
median	55	52
mean	44	**48**

in seconds

3.2 Marginal Cost of Packaging/Labeling

Cost Category	Wrap	Container without inner wrap
Personnel cost (0.3356€ per minute)	1.01€	0.27€
Container filter	-	0.05€
Container lock	-	0.07€
Labels	0.02€	0.02€
Sterilzation wrap (2x)	1.00€	-
Indicator labels and trayliner	0.10€	-
RESULT 1 (Marginal cost)	**2.13€**	**0.41€**
Depreciation container (per use)	-	0.60€
Repair and maintenance (per use)	-	0.01€
Depreciation transport basket (per use)	0.02€	-
Waste disposal (per 2x wrap)	0.27€	-
RESULT 2	**2.42€**	**1.02€**
Additional personnel cost for container cleaning	-	0.33€
Additional operating expenses using large capacity WD for container cleaning	-	0.08€
RESULT 3	**2.42€**	**1.43€**

Notes and Discussion:

- **Process option "Container without inner wrap" causes 0.99€ lower costs than using "non-woven wrap" – per use!**
- Results of process options „Container with inner wrap" would be between shown results
- Personnel and operational costs of identical processes in both options are not included
- Processes in operating theater are not included

Thank you for your attention!

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