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Cost-effective public procurements of equipment for radiotherapy: starting point of patient's safety

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Public procurements of radiotherapy equipment

Radiotherapy equipment:

- Complex technology
- High initial costs and later maintenance costs
- High demands on up-time and performance during eq. lifetime

Public procurement committee:

- Involvement of senior professionals from the field:
 - Radiation oncologist
 - Medical physicist
 - Radiotherapy technologist
- Involvement of hospital management
- Team work of all committee members
- High integrity of every single team member



Medical Physics Experts

European Union Council Directive 2013/59/EURATOM, Article 83:

- *“Member States shall ensure that depending on the medical radiological practice, the medical physics expert takes responsibility for dosimetry, including physical measurements for evaluation of the dose delivered to the patient and other individuals subject to medical exposure, give advice on medical radiological equipment, and contribute in particular to the following:*
 - *...*
 - *(d) the preparation of technical specifications for medical radiological equipment and installation design;*
 - *...*

Official Journal of the European Union L 13

★ Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom

2013/59/Euratom
(published 17 January 2014)
Transposition by 6 February 2018
(16 years after 97/43/Euratom)

Directives that must be followed and transposed.
Legal obligations – **“shall”**



Purchase of medical radiological equipment

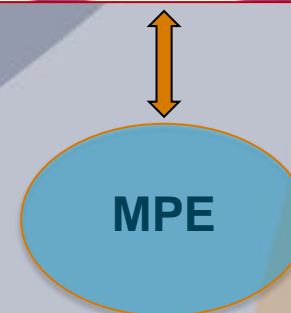
- “The preparation of **technical specifications** for medical radiological equipment and installation design.”

NOT ONLY THAT BUT ALSO

- Preparation of the **system** for the evaluation of offers

AND

- **Evaluation/scoring** of offers



Public tender documentation

- equipment and its functionality has to be clearly and unambiguously specified;
- it should reflect hospitals' needs;
- it should be structured in such a way to eliminate the possibility of unreasonably high prices of the equipment or post-warranty maintenance

THEREFORE

- It should contain a transparent, fair and easy understandable **system for the numerical evaluation - scoring** of offers



Post-warranty maintenance

- Tender documentation should contain a written sample of maintenance contract
- If agreed down-time would be exceeded – a clear system for penalties shall be presented to all bidders in advance;

HIGH UP-TIME (> 98%)



Post-warranty maintenance

- Tender documentation should contain a written sample of maintenance contract
- If agreed down-time would be exceeded – a clear system for penalties shall be presented to all bidders in advance;

LOW UP-TIME (< 98%)



Calculation of received points

NUMBER OF POINTS		
	NOT NORMALIZED	NORMALIZED
EQUIPMENT'S PRICE PART	$T_{A,i,1} = \frac{\sum_{k=1}^n P_k}{P_i \cdot n}$	$T_{A,i,2} = a \frac{T_{A,i,1}}{T_{A,max,1}} F(x_P)$
MAINTENANCE PART	$T_{B,i,1} = \frac{\sum_{k=1}^n \left(\frac{M}{P} \right)_k}{\left(\frac{M}{P} \right)_i \cdot n}$	$T_{B,i,2} = b \frac{T_{B,i,1}}{T_{B,max,1}} F(x_M)$
$\sum_i T$ for i -th offer		$T_{A,i,2} + T_{B,i,2}$



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$\sum_i T$ for i -th offer	$T_{A,i,2} + T_{B,i,2}$	

$T_{A,i,1}$: number of un-normalized points for i -th bidder

$T_{A,i,2}$: number of normalized points for i -th bidder

$T_{A,max,1}$: maximal number of un-normalized points for certain bidder

P_i : price of the equipment of i -th bidder

M : price of the post-warranty maintenance contract for 5 years

n : number of bids

a, b : constants chosen by the hospital

$$a + b = 100$$

a is the fraction which corresponds to the price of the equipment

b is the fraction which corresponds to the price of five years post-warranty maintenance contract

Range of selectable parameters a and b :

$$60 \leq a \leq 80 \text{ and } 20 \leq b \leq 40$$

Depends on the radiological equipment (CT, MRI, LINAC, PET CT, US, ...) and the type of the maintenance contract (full/not full)

COMPLEX?



„Penalty functions“ $F(x_P)$ and $F(x_M)$

$$F(x_P) = e^{-\frac{(x_P - a)^4}{4 \cdot \sigma^4}} \quad | \quad F(x_M) = e^{-\frac{(x_M - b)^4}{4 \cdot \sigma^4}}$$

Properties:

- Centered at the two selected parameters **a** and **b**
- Deviations from **a** and **b** result in lower number of received points for selected bid
- Functions are broad enough („broader gauss“) – penalties are modest/negligible, if the deviations are small



Conclusions

- Governing public procurements of expensive radiotherapy equipment is a demanding task for hospitals
- Fragile equilibrium between quality and price
- Optimized approach can save money while maintaining the quality of the radiological equipment
- Remaining resources can be invested in additional equipment raising the overall quality and safety of health care
- Quality and price of the post-warranty maintenance shall be considered as parameters which are of comparable importance as the price of the equipment itself

HOWEVER

**There is no perfect scoring system
for the evaluation of bids**



THANK YOU!

