UNECE WP 6 MARS meeting

Economic considerations on MS actions

In-house versus external testing

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Introduction

✓ **Adequate scale: what does it mean?**

- **765/2008 Art. 19 requirement**
- **Currently not clear what it means practically**

To consider that sampling costs are “the” limiting factor in MS actions

Introduction

Setting a cost function for “adequate scale”

Define cost function of market sampling

(system level sampling)

C = C1.nLR + C2.nMR + C3.nHR + C4.nSR

Where:

C = total cost of sampling and should be minimal.

LR: Low-acceptable Risk product
MR: Medium Risk
HR: High Risk
SR: Serious Risk
(from EC Risk Assessment Decision 2010/15/EC).

Economic considerations

- ✓ **Estimation of testing (assessments) costs**
  - **Using a Business Plan approach – optimal sampling**
  - **Calculations performed for small/medium large/large countries based on:**
    - **NCR = 15 %**
    - **Low risk equipment (e.g. specific type of household eq.)**

Economic considerations

- ✓ **Estimation of costs: comparison between external lab testing and combined in-house and external lab testing**
  - ✓ **3 essential requirements tested per sample**
  - ✓ **2 tests in-house, 1 test in lab**
  - ✓ **Average cost of sample = 70 EURO (incl. transport costs)**
  - ✓ **Cost of lab testing per test = 100 EURO**
  - ✓ **In-house test equipment cost = 40,000 EURO (depreciated over 10 years)**
  - ✓ **Cost of test technician per year = 50,000 EURO**

Economic considerations

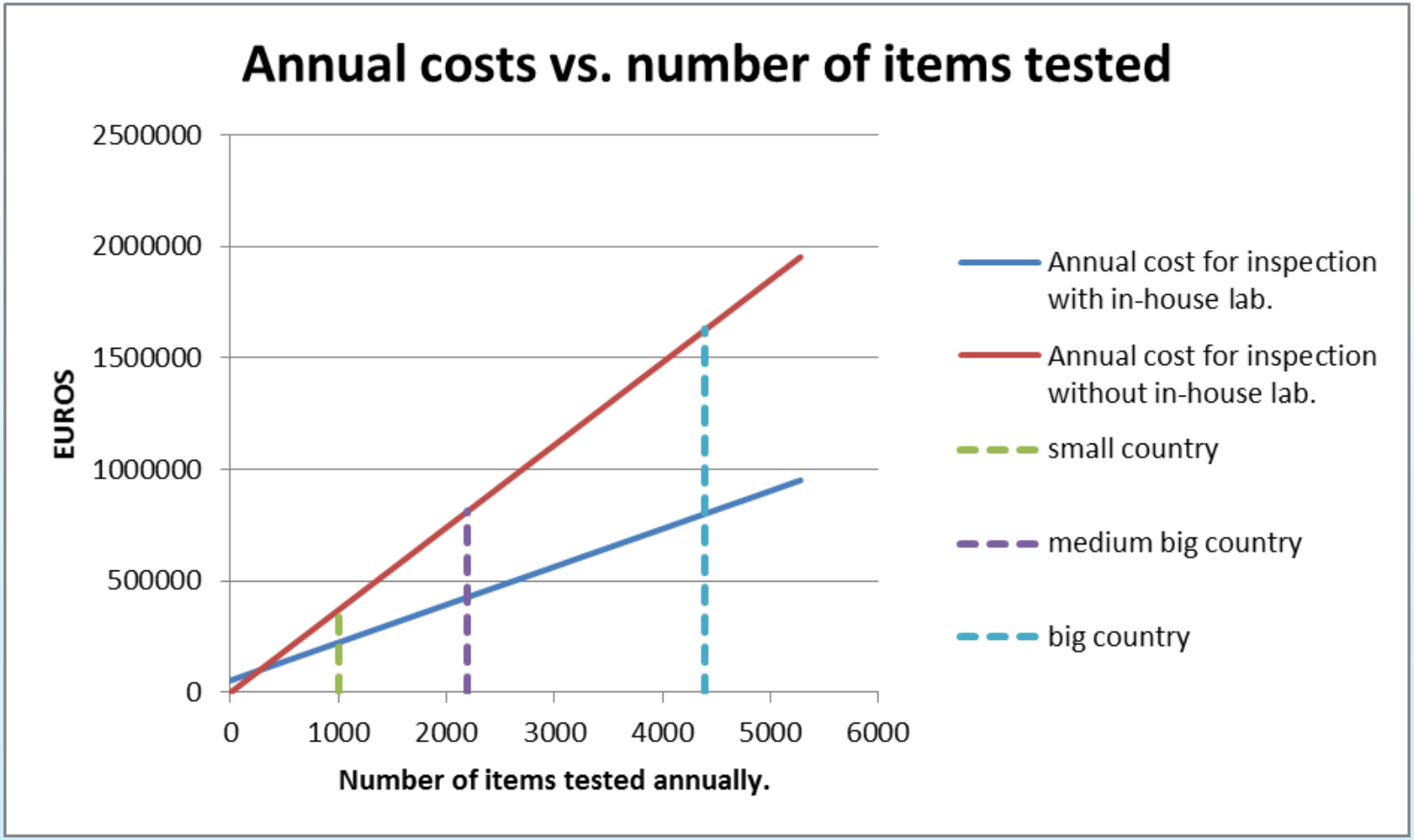
✓ Estimation of costs

Simulations performed using sample sizes as follows:

Size of the country	Number of items tested annually
small	1000
medium large	2200
large	4400

These are estimates if one considers a NCR of 15% and low risk equipment.

Economic considerations



Economic considerations

- ✓ **Estimation of costs: some conclusions**
  - ✓ **If there are performed min. number of annual test >= 270 (N_0) per year, then in-house testing is economically justified (apart from big advantage of building know-how!)**
  - ✓ **For large countries, this is even more important.**

Formula used: $$N > 0.15 \cdot \frac{c_{eq} + 10 \cdot c_{tec}}{c''_{nin\,h} - c_{in\,h} - c'_{nin\,h}} = N_0$$

Statistical justification

✓ Introduction

- ✓ **Part 1 gives the minimal number of items that should be tested annually in order to have in-house lab economically justified.**
- ✓ **In this part we will discuss, using an example, the statistical justification of having in-house lab.**
- ✓ **MATLAB simulation software was used for calculation of standard deviation (precision) of the inspection in 6 different cases**

Statistical justification

- ✓ **6 cases were simulated**

	Small country		Medium country		Big country	
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Number of items per product	1400 400 700 500 2000 1700 2300 1000		14000 4000 7000 5000 20000 17000 23000 10000		140000 40000 70000 50000 200000 170000 230000 100000	
Fraction tested external / in-house lab (%)	33 / 67	100 / 0	33 / 67	100 / 0	33 / 67	100 / 0
Cost: external / in-house lab (per item)	370 / 124		370 / 95		370 / 95	

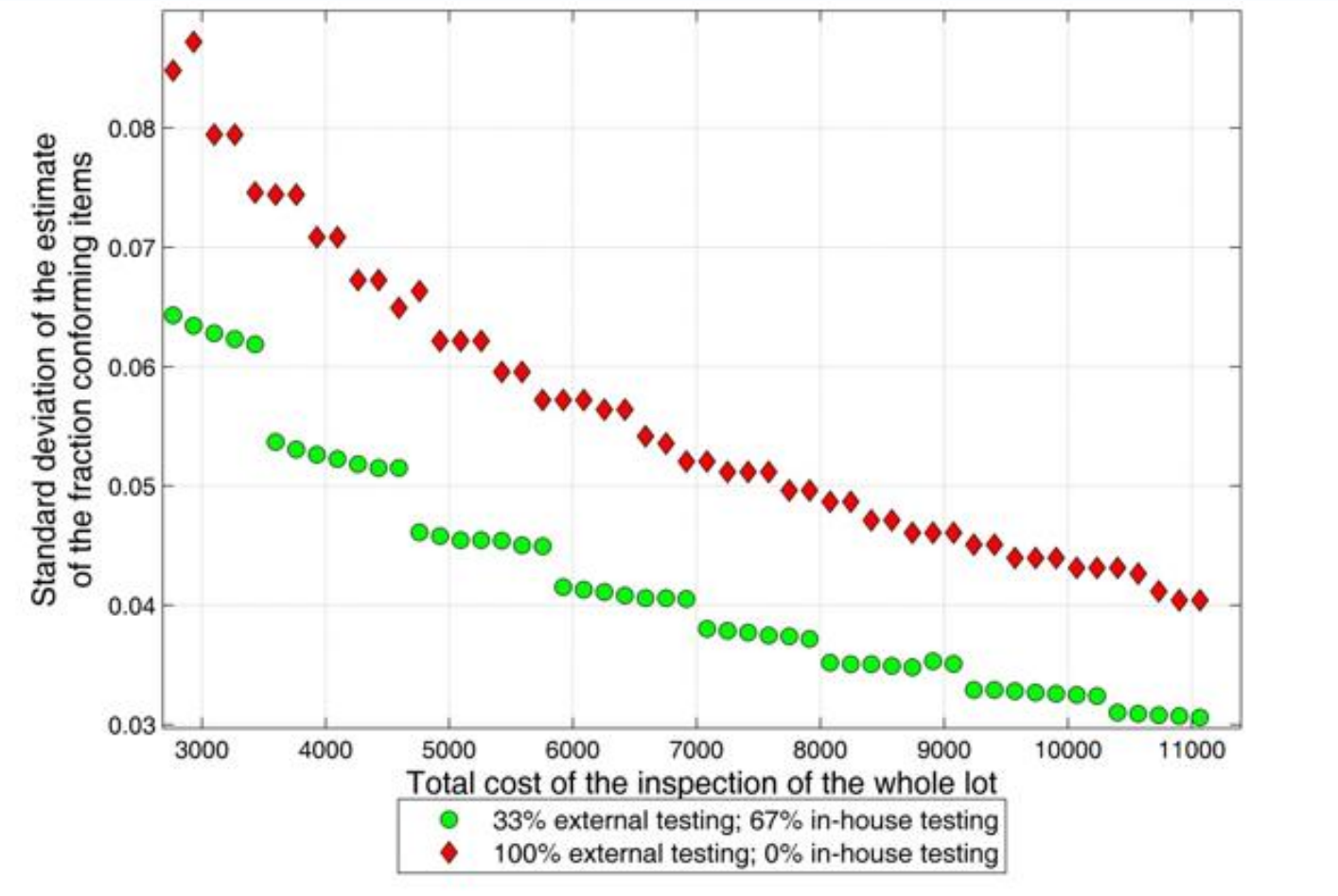
Statistical justification

✓ Common data for the 6 cases

- ✓ Number of different products on the market: 8
- ✓ Product risk of all products: Low
- ✓ Measurement error of the in-house lab: 10%
- ✓ Measurement error of the external lab: 5%
- ✓ Inspection by attributes is used.
- ✓ Estimate of the fraction of conforming items per product (known from previous inspections or by preliminary sampling):

Product No	Estimate
1	0.96
2	0.99
3	0.97
4	0.98
5	0.95
6	0.93
7	0.94
8	0.92

Statistical justification



Fixed cost example: inspection by attributes in a medium large country

Statistical justification

- ✓ **Estimation of costs: some conclusions**

  For fixed total costs of the inspection (on the x-axes), green markers lie below the red ones, i.e., standard deviation of the inspection if using in-house lab is smaller than using only external lab. This means that the precision of the inspection is higher when using combination of in-house and external testing.

Statistical justification

- ✓ **Estimation of costs: some conclusions**

Explanation: In-house testing is with higher measurement error, but it is cheaper. So, more items can be tested for the same budget, which finally brings lower standard deviation (error) of the inspection.

In-house testing: examples

- ✓ **In-house test facility - some example of test equipment**

Dielectric tester

Earth continuity tester

Test finger

In-house testing: examples

- ✓ **In-house test facility**
  - **Essential tests to be foreseen**
    - **LVD: earth continuity, HV-test, leakage current, isolation power supply (safety of the operator), temperature data recorder, test finger, etc.**
    - **EMCD: conducted emission test set-up, EFT (Electrical Fast Transient) test set-up, etc.**
    - **MD: Mechanical measuring equipment, ….**
  - **The IEC standard for lab testing (TC 64) shall be considered to protect MS staff during assessments.**

Preliminary Conclusions

Based on the requirements of the NLF “adequate scale” and performing simulations using system simulation software, we can state that:

- ✓ **Substantial cost savings are proved when performing a mix of in-house and external testing**
- ✓ **The importance of know-how building using in-house test facilities for the MSA, is a site-effect of performing in-house testing**
- ✓ **To protect MS staff during assessments.**