

SMS Cost Workshop

Cost Model for the Development,
Maintenance and Day-to-day
Operation of a SMS

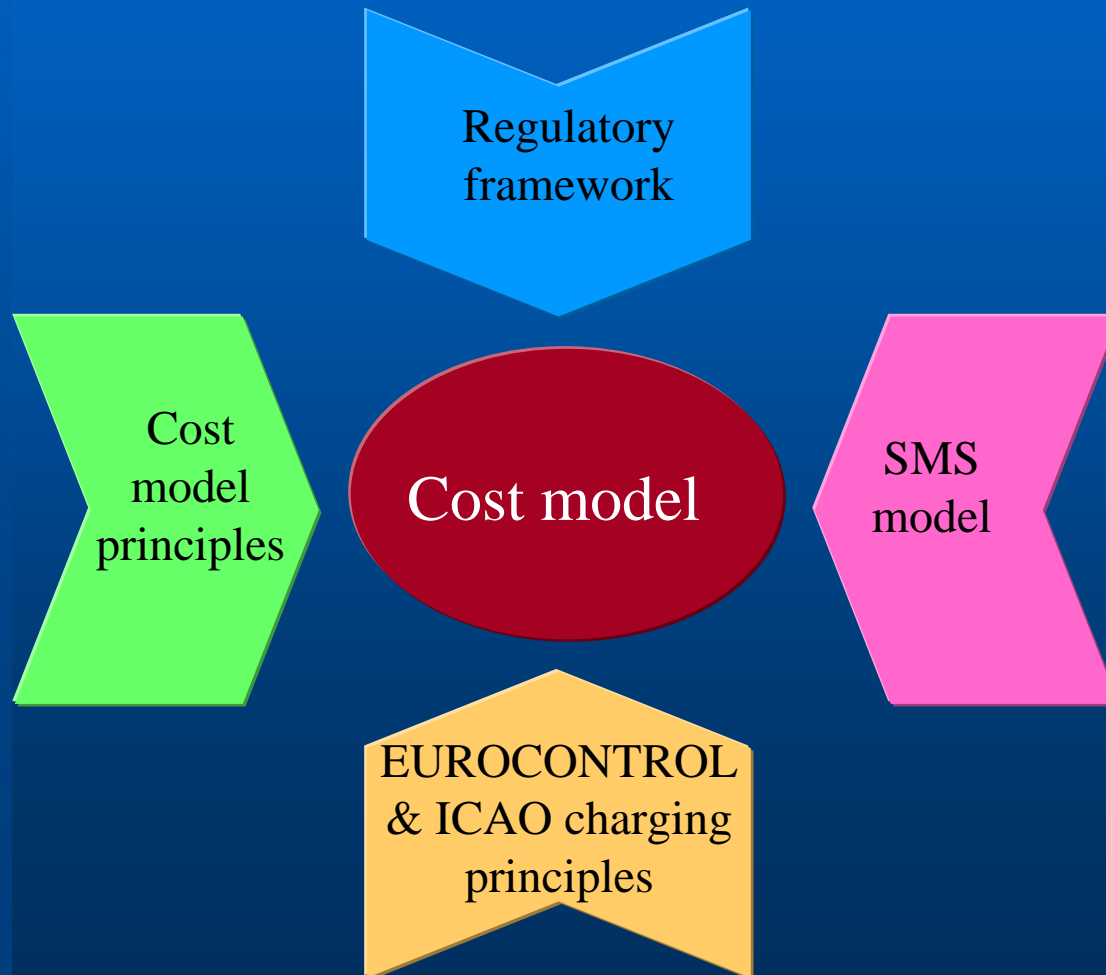
COMPASS IS ®
Vladimir Grigorov

Cost model

Cost Model Overview

Part I

Approach



Regulatory framework



- **EUROCONTROL ESARRs**
- **Commission Regulation 2096/2005**
- **Directive 2006/23/EC on a Community air traffic controller licence**
- **Directive 2003/42/EC on occurrence reporting in civil aviation**
- **Directive 94/56/EC establishing the fundamental principles governing the investigation of civil aviation accidents and incidents**
- **Commission Regulation 1315/2007 on safety oversight in ATM**
- **Commission Regulation 482/2008 on software safety assurance in ATM**

Best practices



- **EGSMM**
- **ESARRs' implementation guidance materials (SRC website)**
- **ICAO Doc 9859 – Safety Management Manual**

SMS model

- Scope of SMS
- Scope of SMS components
- Inventory of SMS cost elements



SMS scope – Safety planning

- SMS Development and Implementation Plan
- Organisation's Safety Policy
- Safety Targets and Safety Indicators



SMS scope – Safety organisation

- SMS Organisational Structure
- Safety Responsibilities and Accountabilities



SMS scope – Safety achievement

- SMS Documentation
- Competency Assurance
- Safety of External Services
- Mandatory Reporting System
- Voluntary Reporting System
- Investigation of Safety Occurrences
- Management of Safety Related Changes
- Risk Assessment and Mitigation
- Software Safety Assurance System



SMS scope – Safety assurance

- Safety Surveys
- Safety Monitoring
- Safety Records



SMS scope – Safety promotion

- **Safety improvement**
- **Lesson dissemination and safety awareness**



Scope of SMS components

- Definitions for cost of safety management and cost of safety
- Decomposition of the safety procedures in terms of:
 - Objective
 - Input (e.g. regulatory requirements)
 - Activities (tasks)
 - Type of resources used (e.g. OPS, ENG)
 - Infrastructure & equipment
 - Training needs, and
 - Products (output)

Example



Inventory of SMS cost elements (1)

- **Establish eligible costs in the ANSP cost base**
 - Staff costs
 - Other operating costs
 - Depreciation costs
 - Cost of capital
 - Exceptional (non-recurring costs)



Inventory of SMS cost elements (2)

- **Establish eligible SMS costs**
 - Investment costs (infrastructure & equipment)
 - Training costs
 - Human effort costs
 - Non-effort costs (e.g. publications, leaflets, production cost of manuals, etc.)



EUROCONTROL & ICAO charging principles

- ICAO Manual of Air Navigation Services Economics, Doc. 9082 and Doc. 9161
- EUROCONTROL Principles for Establishing the Cost-Base for En-route Charges and the Calculation of the Unit Rates
- EUROCONTROL Guidance on the Rules and Procedures of the En-route Charges System
- EC Regulation 550/2004 on the provision of air navigation services in the single European sky
- EC Regulation 1794/2006 on common charging scheme for air navigation services



Review

- Review of management system cost models
- Review of cost allocation principles in ANS provision

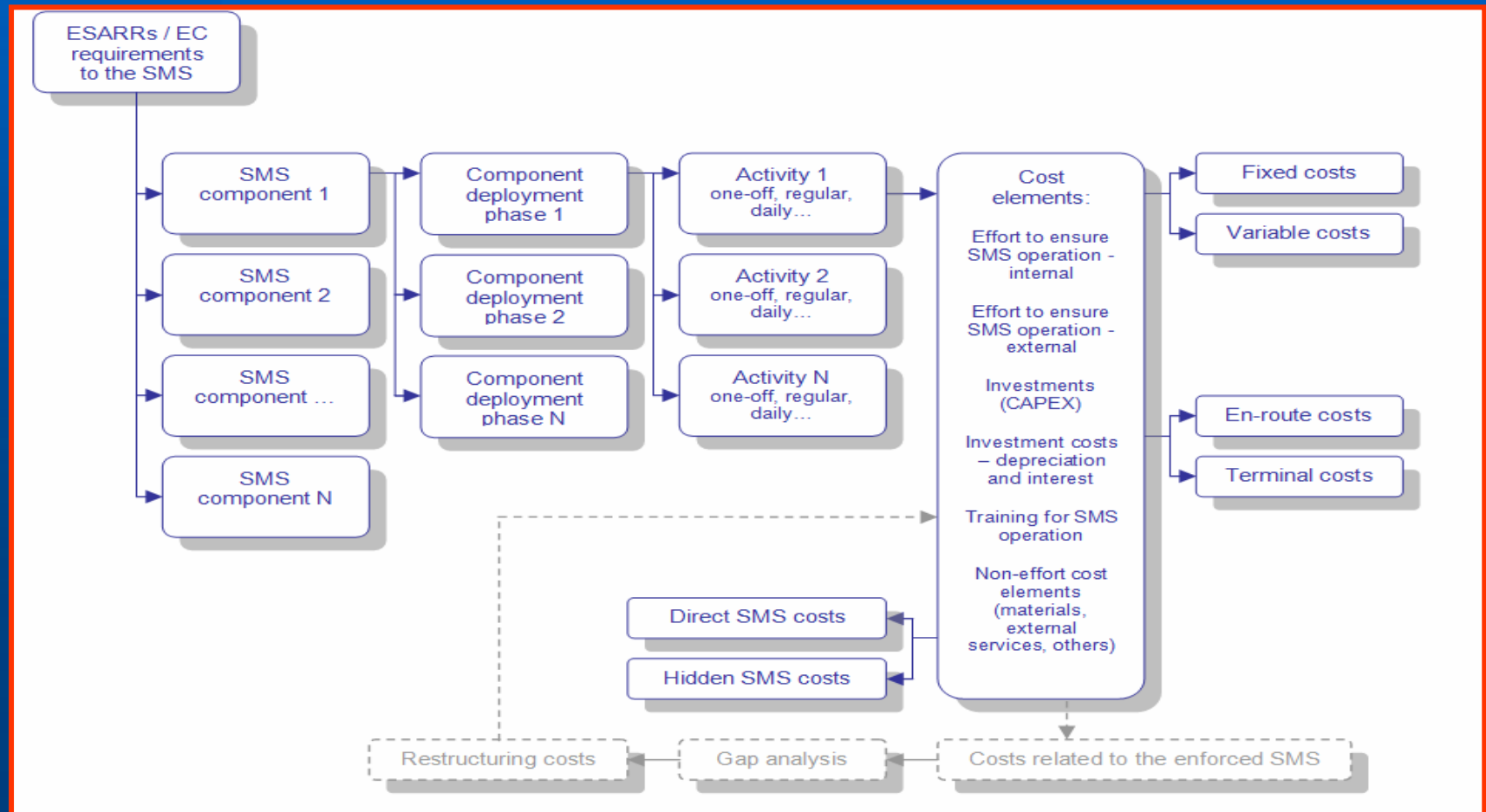


Cost model principles

- Standard cost model
- Activity based
- Quantitative methodology

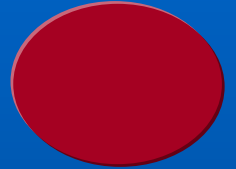


Outline model structure



SMS procedure cost components

- Human effort
- Training
- Infrastructure & equipment
- Non-effort elements



Criteria for cost efficient SMS

- National safety regulatory framework
- Organisational structure of ANSP
- Number of staff per competency category
- Human resources dedicated to safety
- Capital expenditure for safety-related equipment
- Training of safety skills

What you can do with the cost model?

- Identify implementation and operation costs per procedure or for whole SMS
- What will be the cost of a new procedure
- Different analyses of human effort distribution
- Costs of different elements of SMS
- Optimise costs

Demo

Cost model demonstrator (one procedure) Part II

How are we doing it?

- **Two cost cards per procedure:**
 - Implementation
 - Operation
- **Four cost components in each card**
- **Procedure broken down into steps**
- **Steps decomposed by activities**
- **Equipment cost calculated adhering to strict accounting principles**

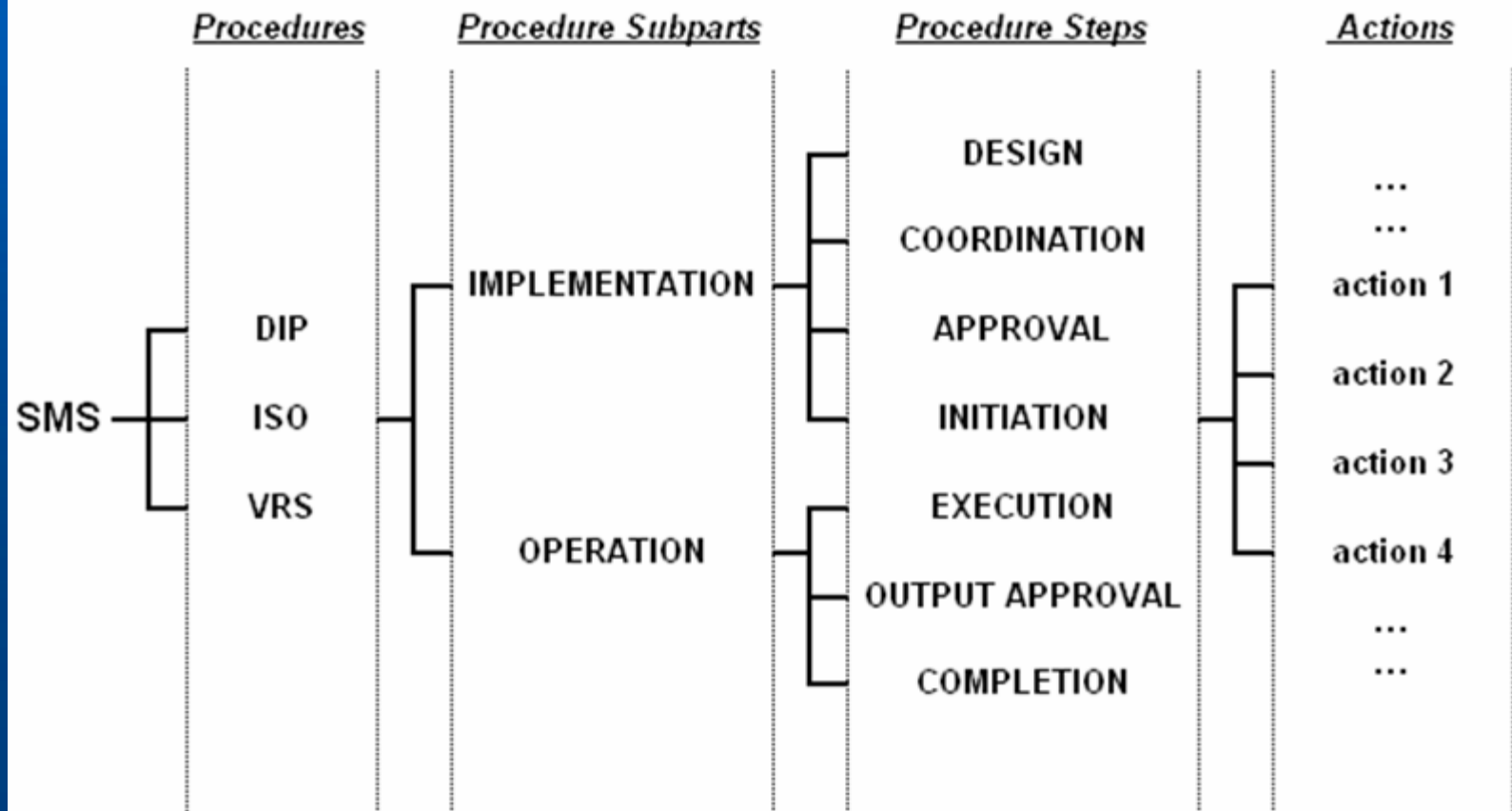
Human effort – Procedure Implementation

- Procedure Design
- Procedure Coordination
- Procedure Approval
- Procedure Initiation

Human effort – Procedure Operation

- Procedure Execution
- Procedure Output Approval
- Procedure Completion

Human effort structure



How are we doing it?

The model is actually a set of equations

BUT

It can be automated ...

Next demonstration of cost calculations of one SMS procedure

Demo – Model Input/Output

- **Model Input**
 - Global variables
 - Implementation cost card (ISO-I)
 - Operation cost card (ISO-O)
- **Model Output (results)**
 - Human effort
 - Training
 - Infrastructure & equipment
 - Non-effort elements
 - Summary
 - Charts
- **Help**

Demo – Global variables

- **Global variables**

- **Daily rates**

- SAF
- OPS, ENG
- MAN, ANC, ADM
- INT & EXT Trainers or support

- **Inflation**

- **Weighted average cost of capital**

- **Annual effort cost increase**

Demo – Human Matrix

Human effort assignment matrix					
SAF	OPS	ENG	MAN	ANC	ADM
[safety]	[operations]	[engineering]	[management]	[ancillary]	[administration]
Expert	Expert	Expert CNS	Top management (incl. directors)	MET	Procurement
Specialist	ATCO in OPS	COM	Line management	AIS	Accounting
	ATFM/ASM	NAV		SAR	HR
	Assistant	SUR		Instructor	
	OPS support (non-ATCOs)	IT			
	Trainee	Electro			
	Instructor	Instructor			

Demo – Global variables

Daily Rates

Role	Rate	Overhead Rate
SAF - daily rate	220.00 €	20.00%
OPS- daily rate	200.00 €	20.00%
ENG - daily rate	150.00 €	20.00%
MAN - daily rate	260.00 €	20.00%
ANC - daily rate	110.00 €	20.00%
ADM - daily rate	90.00 €	20.00%
Internal Trainer - daily rate	220.00 €	20.00%
External Trainer- daily rate	500.00 €	N/A
External Human Effort - daily rate	300.00 €	N/A

Global Variables

Variable	Value
Annual effort cost increase	3.50%
Inflation	3.00%
WACC - weighted average cost of capital	5.00%

SMS cost model - Human effort assignment matrix

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[safety]	[operations]	[engineering]	[management]	[ancillary]	[administration]
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Demo – Human effort

Human Effort

Procedure Design

Internal						External
SAF	OPS	ENG	MAN	ANC	ADM	
[mandays]	[mandays]	[mandays]	[mandays]	[mandays]	[mandays]	[mandays]
						[mandays]
						[amount]

1	Review applicable regulatory requirements	5	3
2	Review guidance material and available best practices	7	3
	Review existing in house		

Demo – Training

- **Input data**
 - Training courses
 - Training infrastructure and equipment e.g. SOE, venue
 - Training missions
 - Training non-effort elements e.g. training materials
- **Output**
 - Total training cost

Demo – Infrastructure & Equipment

- **Input data**
 - Gross balance value
 - Expecting operating life
 - % for SMS purposes
- **Output data**
 - Cost (depreciation and interest) for the whole operating life

Example 

Demo – Non effort elements

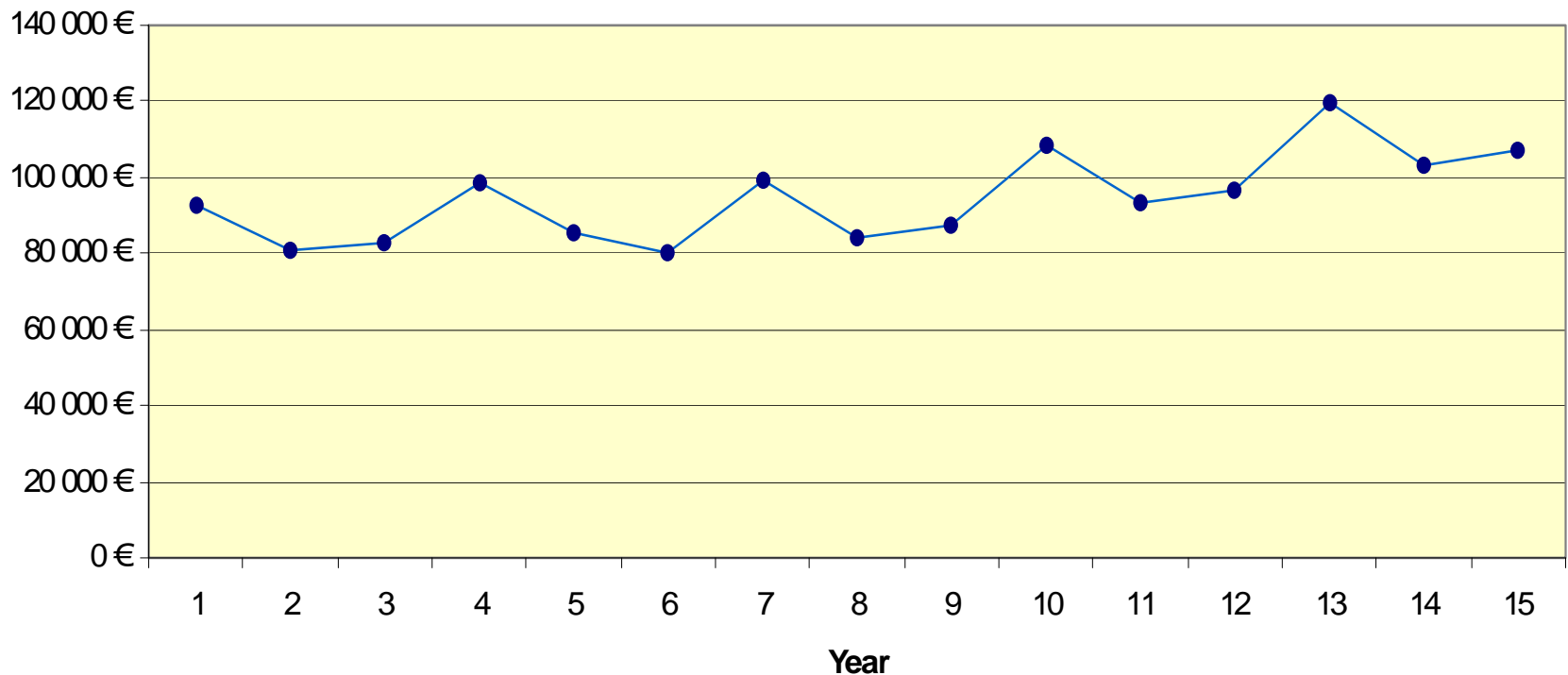
- **Input data**
 - Single prise
 - Quantity
 - Frequency per year
- **Output data**
 - Total cost

Questions & Answers

- What is the operation profile in some years?
- What is the total man effort per annum? How is this effort distributed?
- What are direct/hidden costs?

Operation profile - Example

Operation profile for 15 years



Man effort per implementation

Human Effort for Development and Implementation of SMS

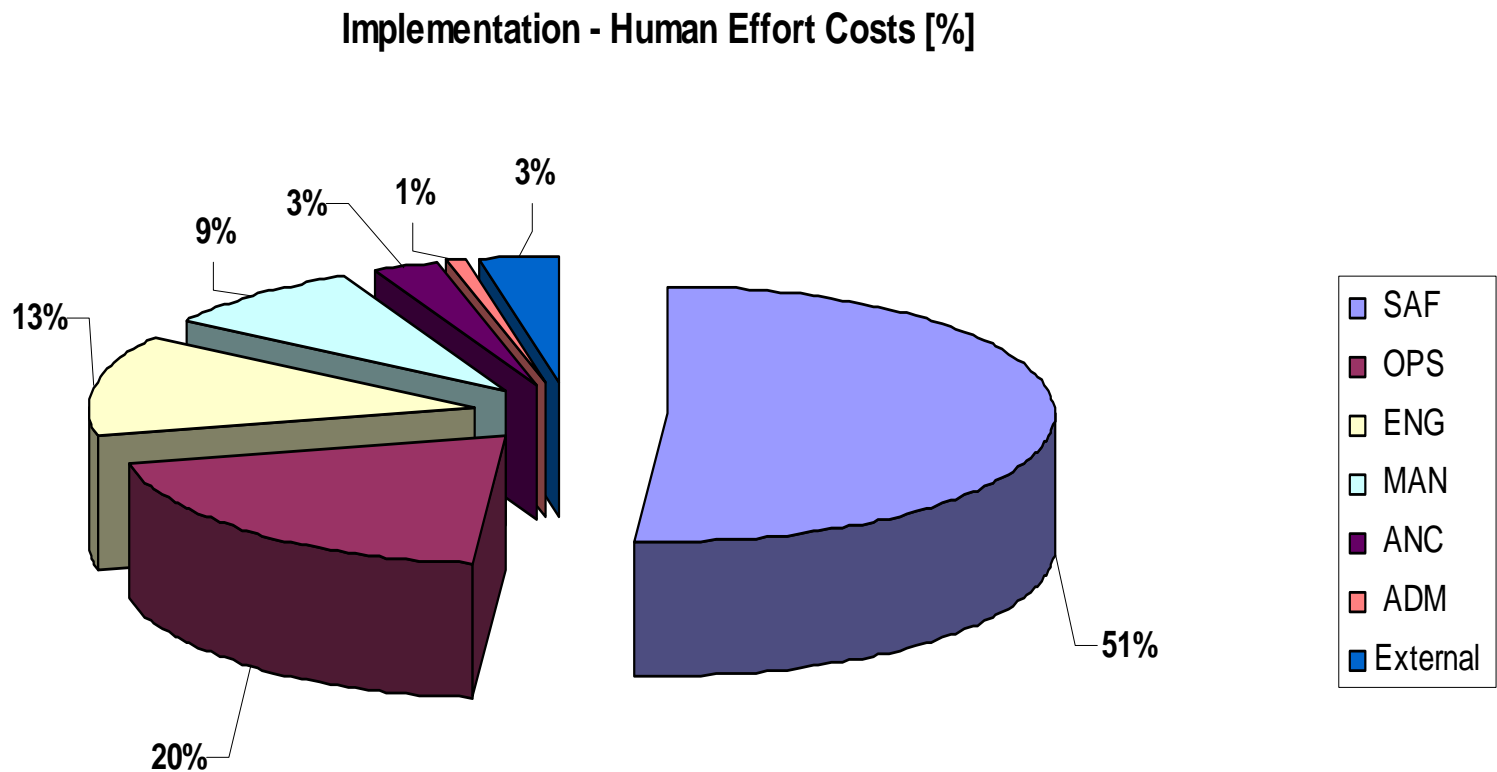
Procedure Action	Internal						External
	SAF	OPS	ENG	MAN	ANC	ADM	
	[total mandays]	[total mandays]	[totalmandays]	[total mandays]	[total mandays]	[total mandays]	[total amount]
1-Design	41	0	0	0	0	0	
2-Coordination	12	20	20	0	0	0	
3-Approval	2	0	0	1.25	0	0	
4-Initiation	39	20	20	12	10	5	
Grand Total Human Effort	94	40	40	13.25	10	5	
R-Average Rate [per day]	220 €	200 €	150 €	260 €	110 €	90 €	
OH-Overhead [%]	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	
<i>Rate for estimations</i>	264.00 €	240.00 €	180.00 €	312.00 €	132.00 €	108.00 €	
Total Human Effort Costs	24 816 €	9 600 €	7 200 €	4 134 €	1 320 €	540 €	1 800 €

Man effort for day-to-day operation

Human Effort for Maintenance and day-to-day Operation of SMS

Procedure Action	Internal						External
	SAF	OPS	ENG	MAN	ANC	ADM	
	[total mandays]	[total mandays]	[total mandays]	[total mandays]	[total mandays]	[total mandays]	
5-Execution	10.625	0.5	0.25	3	0.25	0	
6-Output approval	0	0	0	2	0	0	
7-Completion	1.5	2	2	1	1	1	
Grand Total Human Effort	121.25	25.00	22.50	60.00	12.50	10.00	
R-Average Rate [per day]	220 €	200 €	150 €	260 €	110 €	90 €	
OH-Overhead [%]	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	
<i>Rate for estimations</i>	264.00 €	240.00 €	180.00 €	312.00 €	132.00 €	108.00 €	
Total Human Effort Costs	32 010 €	6 000 €	4 050 €	18 720 €	1 650 €	1 080 €	0 €

Human effort distribution - Example

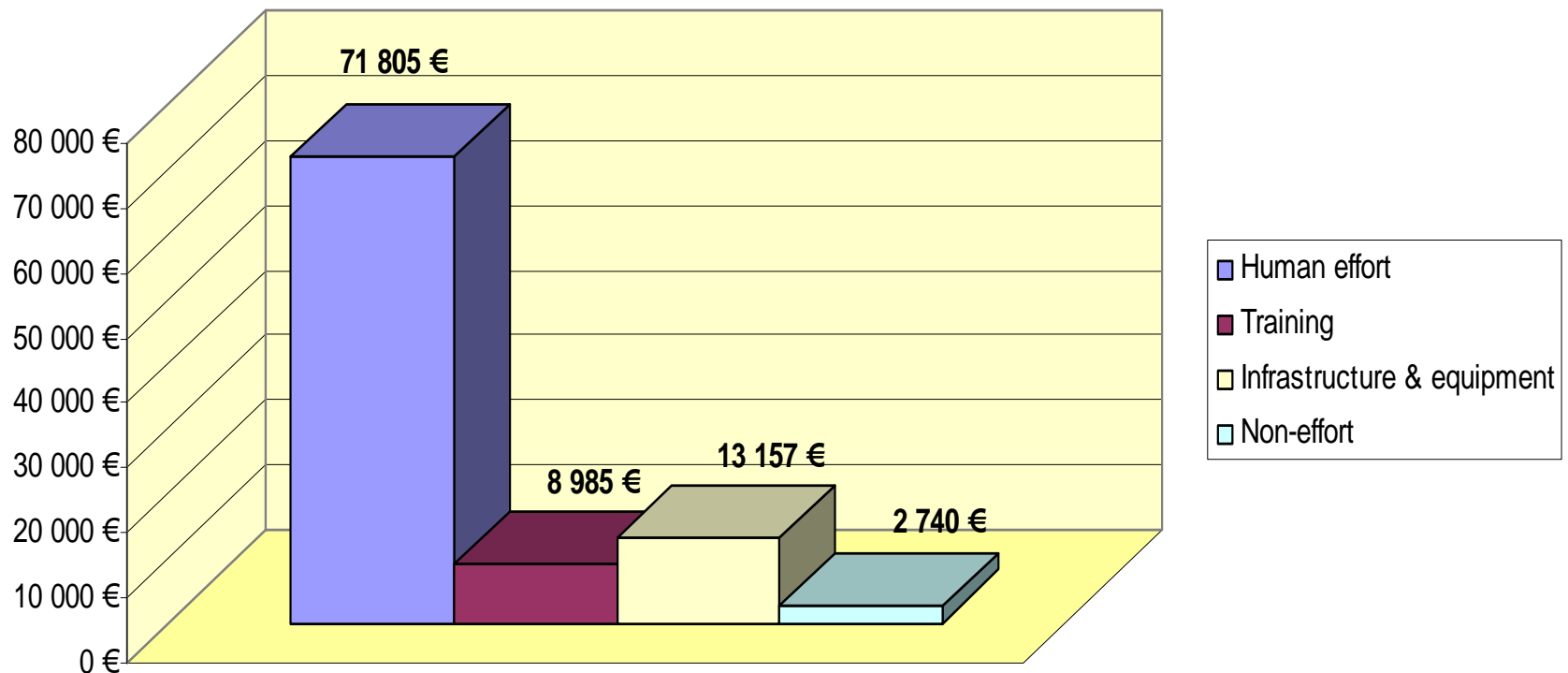


Direct/hidden/variable costs

- **Direct costs**
 - SAF effort
- **Hidden (indirect) costs**
 - Communication to and familiarisation of concerned staff
 - Involvement of OPS/ENG/ANC staff in SMS related activities
 - Venue costs
- **Variable costs**

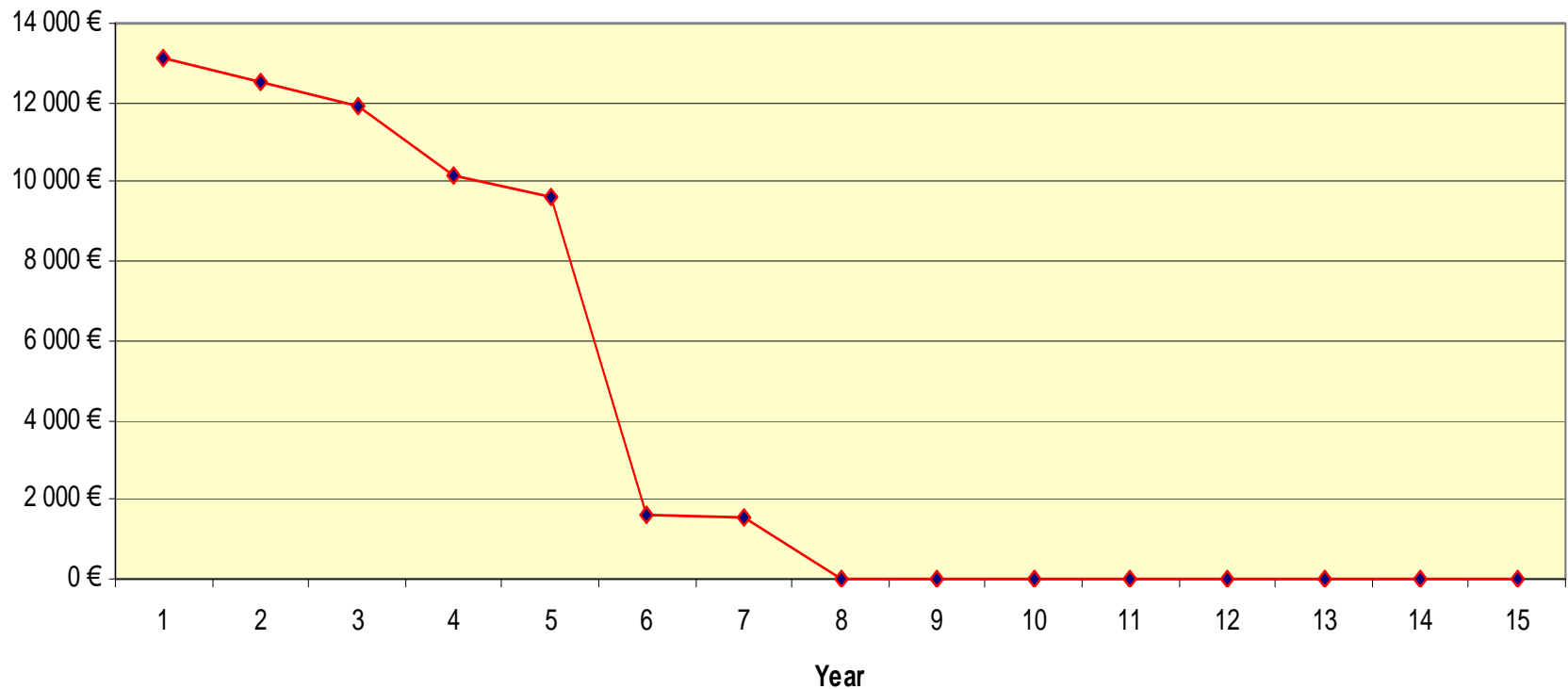
Distribution by elements - Example

Operation - Distribution by elements



Equipment profile - Example

Infrastructure and Equipment for 15 years



Financial crisis

- May I optimise SMS procedure in terms of effort/cost?
- Can I make a forecast 6 months ahead?
- May I plan my input for my SMS?
- How much does each particular activity cost me?

YES

Thank you!

