The Business of Forensic Service Provision: A conceptual of operations, a business-analytic approach, and a case study of the UK Forensic Science Service

Dr. Max M. Houck, DC Department of Forensic Sciences
Dr. Paul Speaker, West Virginia University
Dr. Chris Maguire, DC Department of Forensic Sciences

Part 1: Conceptual

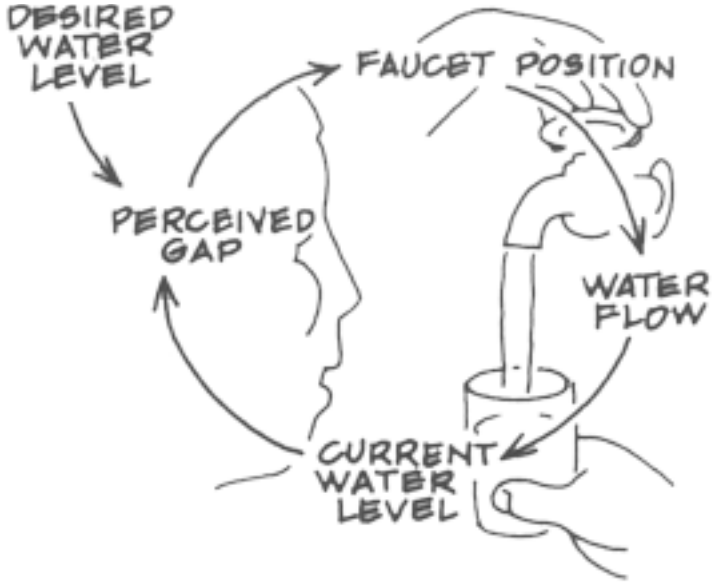
- Forensic science lacks an overarching, holistic framework for establishing and evaluating forensic service providers as systems. A proven three-part structure is that of:
  - a concept of operations (or CONOPS), a narrative that explains how the system operates to achieve the desired goals through stated methodologies,
  - an enterprise architecture, the fundamental organization of a complex program, and
  - a governance structure, setting forth management principles and decision making.
- Moreover, the forensic service provider is only one system in a system of systems that include law enforcement, the courts, and academic and political entities. Providing a framework for the forensic enterprise will allow lessons learned from benchmarking analytics and case studies to support and refine the effectiveness, efficiency, and value of the system.

A system

- A set of interacting or interdependent components forming an integrated whole.

- A system has:

1. Inputs and outputs
2. Processor
3. Control
4. Environment
5. Feedback
6. Boundaries and interfaces

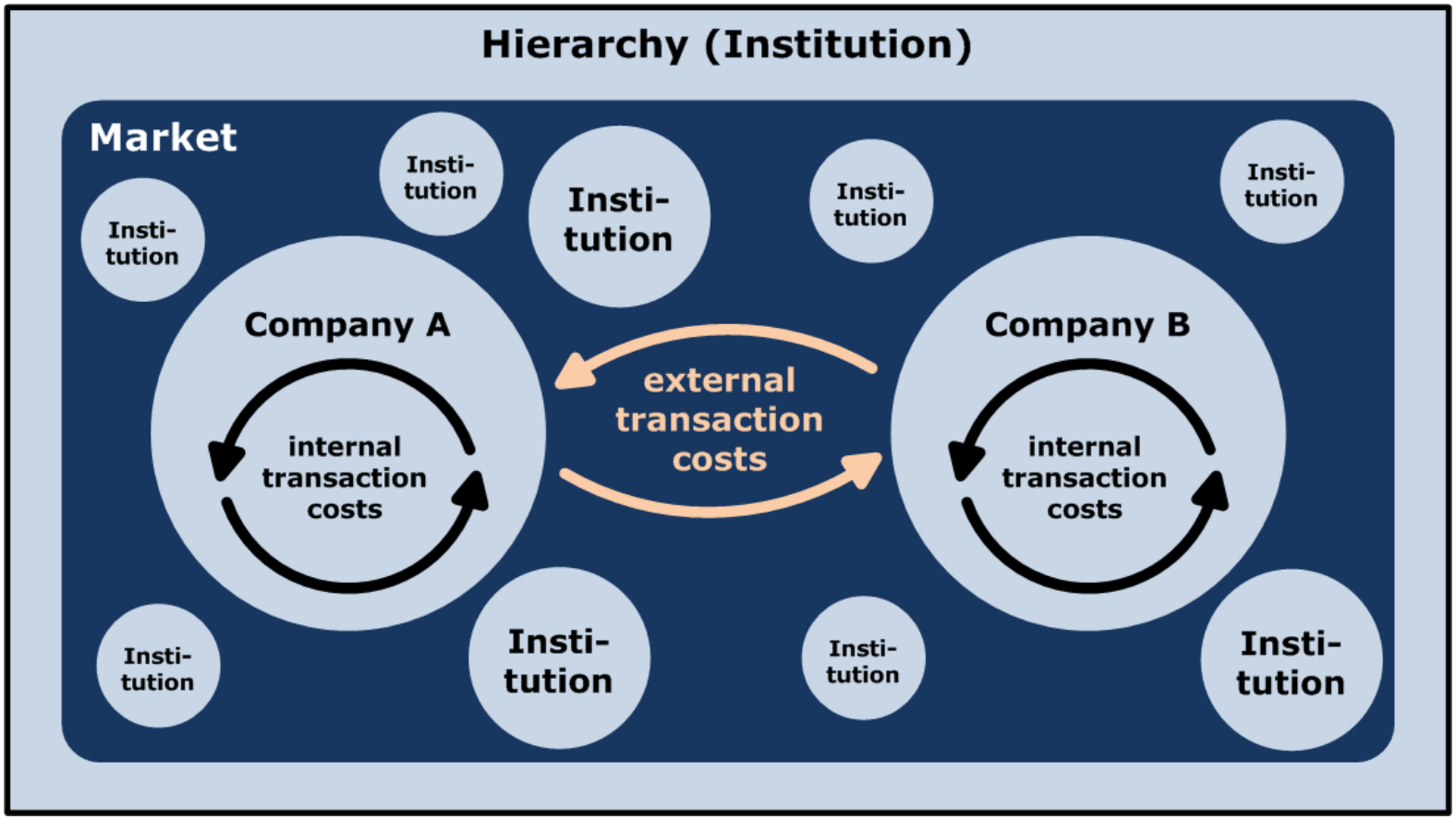


- A system's structure and behavior may be decomposed into subsystems to elementary parts or process steps.

A system of systems

- Moreover, the forensic service provider is only one system in a system of systems that include law enforcement, the courts, and academic and political entities.
- For financial and political reasons (which are also largely historic), many, if not most, forensic service providers are administratively part of law enforcement agencies.
- Being within a para-military organization sets the forensic service provider's relationships with their parent agency (formally hierarchical) and other related agencies (formally or informally hierarchical, such as medical examiners or prosecutors, for example).

A system of systems

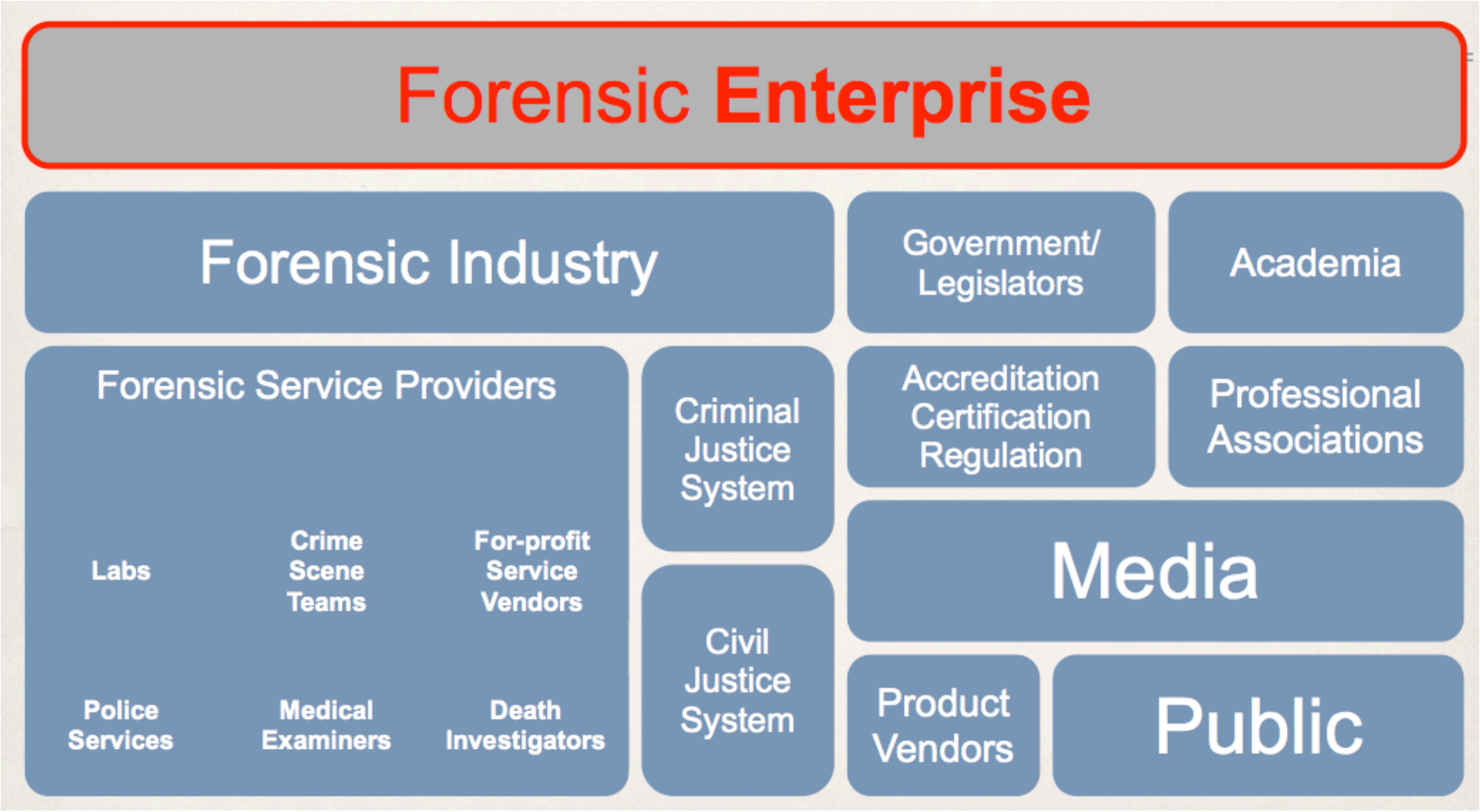


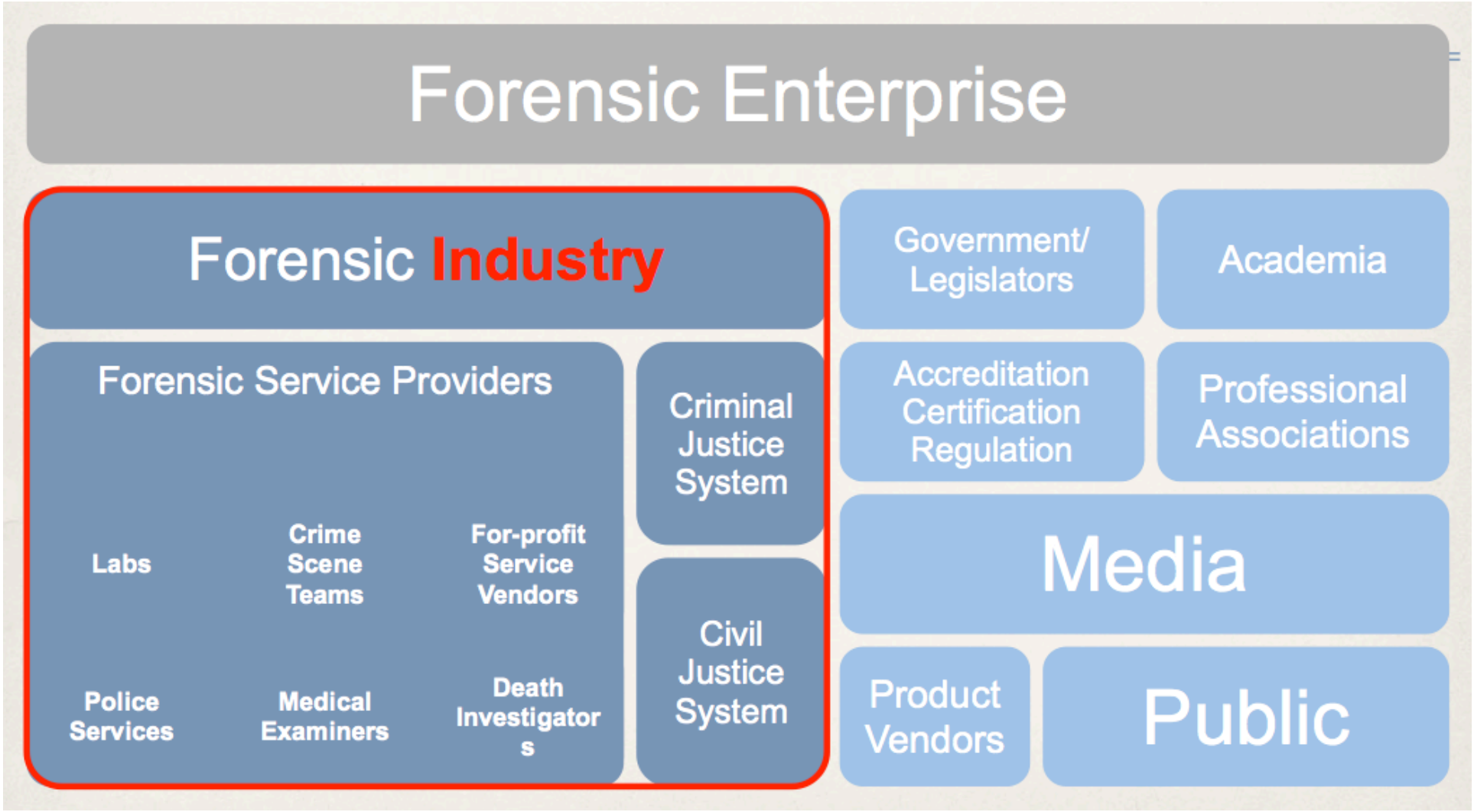
CONOPS

- A concept of operations is a narrative that explains how a system operates to achieve the desired goals through stated methodologies:
- Forensic service providers are, in essence, non-profit, production-oriented organizations staffed largely by knowledge workers.
  - Forensic scientists as knowledge workers take evidence and data and convert them into knowledge in the form of reports and testimony.
  - They specialize in these transactions and, therefore, simplify them for the benefit of the criminal justice system; the investigators or attorneys do not need to find numerous individuals to conduct the specific examinations required for a case.

Enterprise Architecture

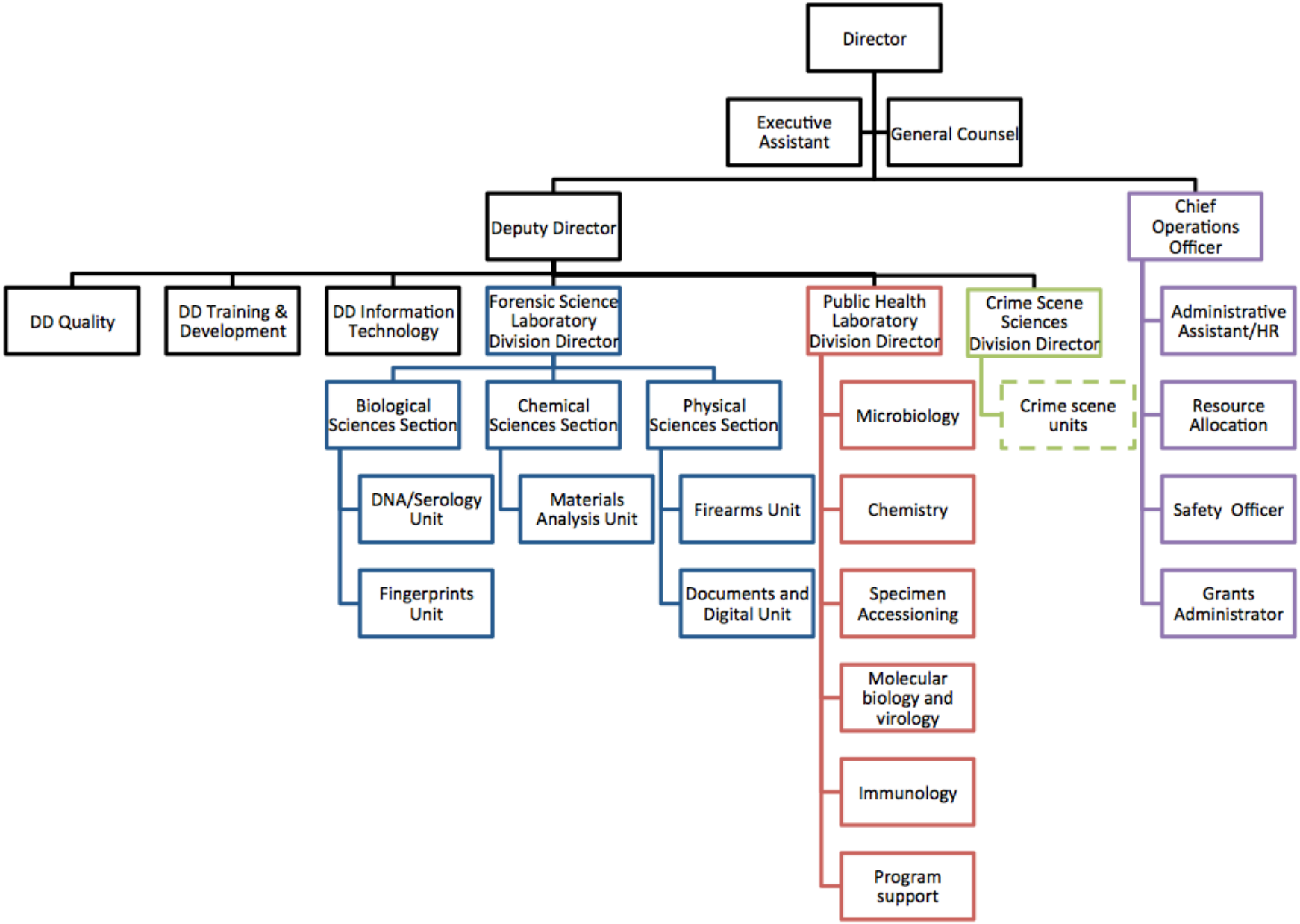
- The fundamental organization of a complex program; the organizing logic for business processes reflecting the integration and standardization requirements of the operating model.


Forensic Enterprise
Forensic Industry
Government/ Legislators
Academia
Forensic Service Providers
Labs
Crime Scene Teams
For-profit Service Vendors
Police Services
Medical Examiners
Death Investigators
Criminal Justice System
Civil Justice System
Accreditation Certification Regulation
Professional Associations
Media
Product Vendors
Public


Forensic Enterprise
Forensic Industry
Forensic Service Providers
Labs
Crime Scene Teams
For-profit Service Vendors
Police Services
Medical Examiners
Death Investigators
Criminal Justice System
Civil Justice System
Government/ Legislators
Academia
Accreditation Certification Regulation
Professional Associations
Media
Product Vendors
Public

Governance Structure

- Sets forth management principles and decision making


Director
Executive Assistant
General Counsel
Deputy Director
Chief Operations Officer
DD Quality
DD Training & Development
DD Information Technology
Forensic Science Laboratory Division Director
Public Health Laboratory Division Director
Crime Scene Sciences Division Director
Administrative Assistant/HR
Biological Sciences Section
Chemical Sciences Section
Physical Sciences Section
Microbiology
Crime scene units
Resource Allocation
DNA/Serology Unit
Materials Analysis Unit
Firearms Unit
Chemistry
Safety Officer
Fingerprints Unit
Documents and Digital Unit
Specimen Accessioning
Grants Administrator
Molecular biology and virology
Immunology
Program support

Framework for analytics

- Providing a framework for the forensic enterprise will allow lessons learned from benchmarking analytics and case studies to support and refine the effectiveness, efficiency, and value of the system.

Effectiveness vs Efficiency

- **Effectiveness**: The capability of producing an outcome, frequently a specific, desired effect
- **Efficacy**: The achievement of the effect, regardless of the resources expended
- **Efficiency**: Being efficacious in the most economical way: the least amount of input produces a minimum of, if not more than, the desired output.

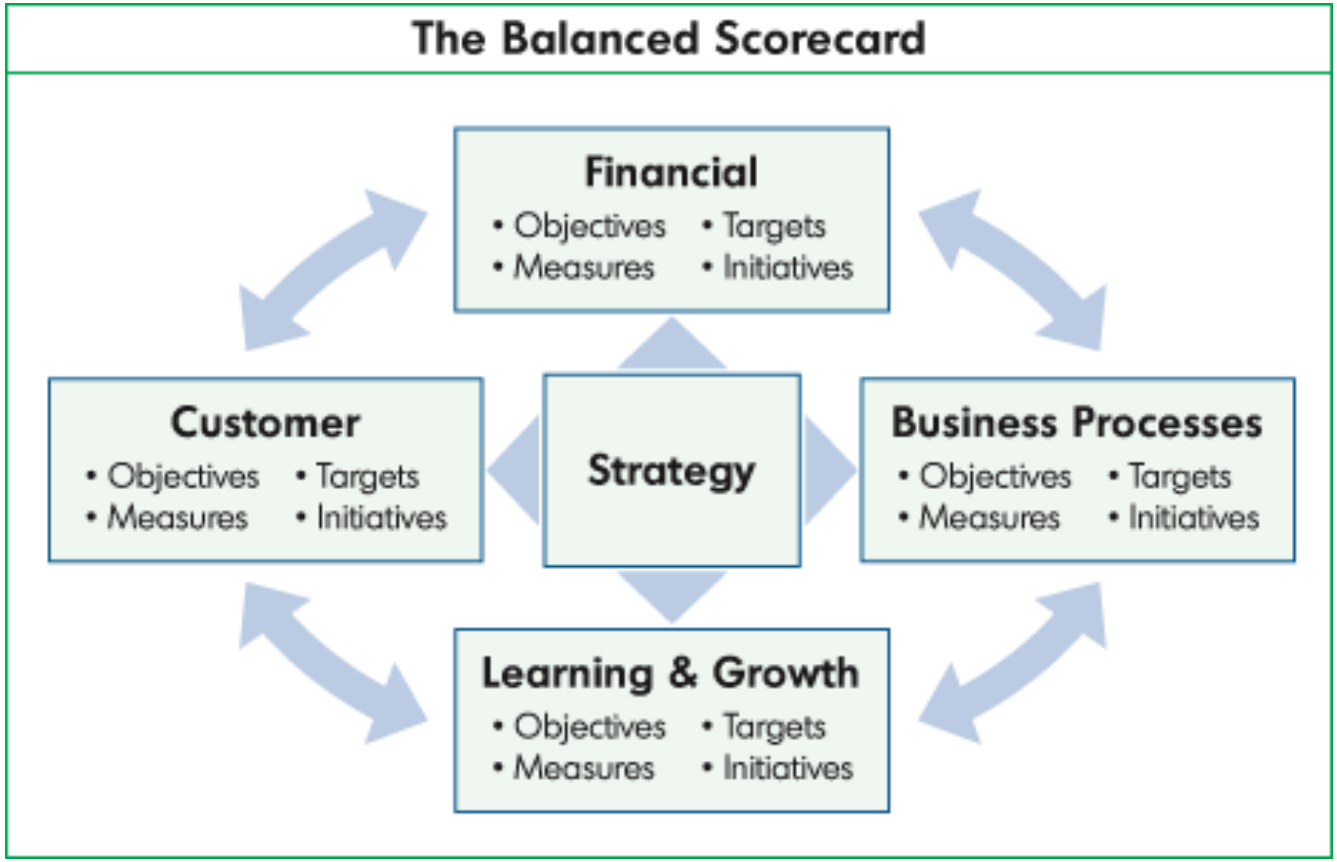
Example: A sports car

Thus, what is effective (it gets from point A to point B) is not necessarily efficacious (where do you put the groceries?), and what is efficacious (I don't buy much food) may not be necessarily efficient (sports cars are an expensive way to travel).

max.houck@dc.gov

“Informing the public through effective science”

A balanced scorecard approach



Better Practices

- Share the stories behind better practices
  - *Forensic Science Policy & Management: An International Journal*
- Customize individual laboratory reports
- Extend the analysis of the metrics
  - Industry issues
  - Change over time

Better Practices—Research Output

http://www.be.wvu.edu/forensic/publications.htm

The Business of Forensic Service Provision: A conceptual of operations, a business-analytic approach, and a case study of the UK Forensic Science Service

Dr. Max M. Houck, DC Department of Forensic Sciences
Dr. Paul Speaker, West Virginia University
Dr. Chris Maguire, DC Department of Forensic Sciences

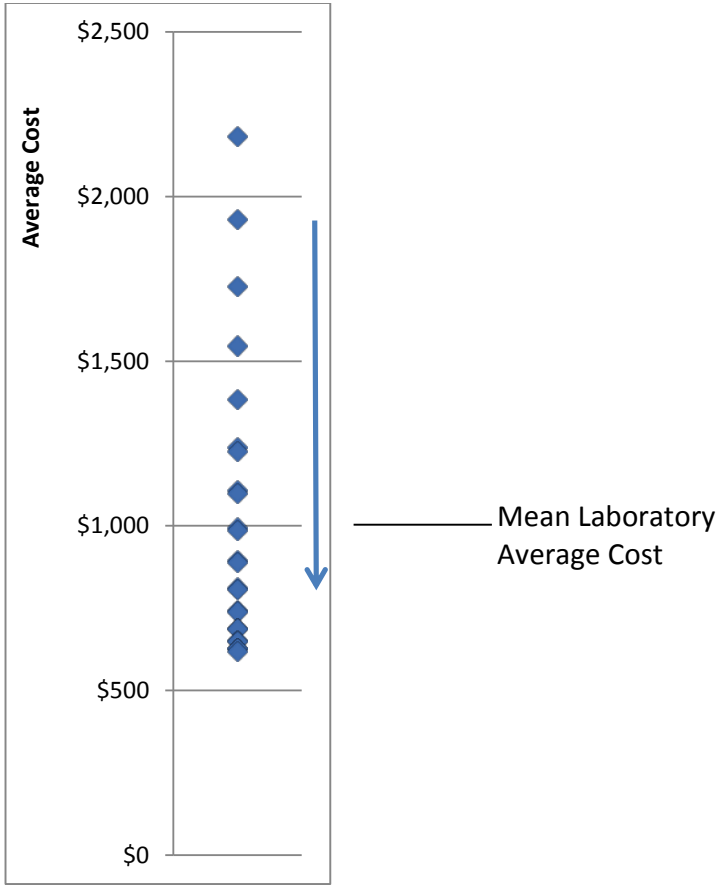
The Decomposition of Return on Investment for Forensic Laboratories

- ROI and DuPont Expansions
- Easily monitored metrics
- Comparisons across industry, across time, and across personnel

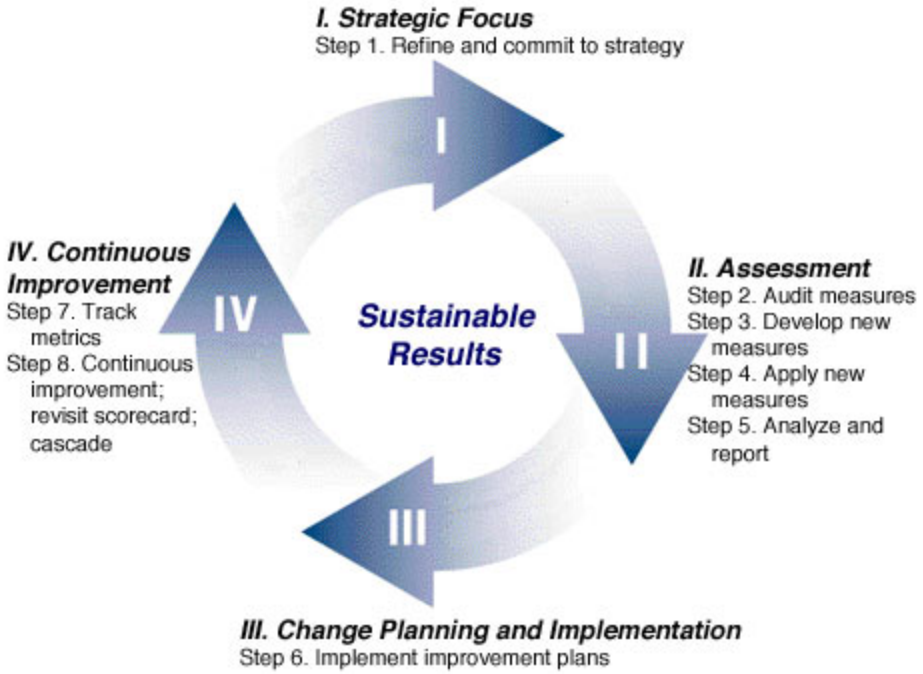
The Decomposition of Return on Investment for Forensic Laboratories

$$\text{Average Cost (Per Case)} = \frac{\text{Average Comp} \times \text{Testing Intensity}}{\text{Productivity} \times \text{Personnel Expense Ratio}}$$

The Decomposition of Return on Investment for Forensic Laboratories



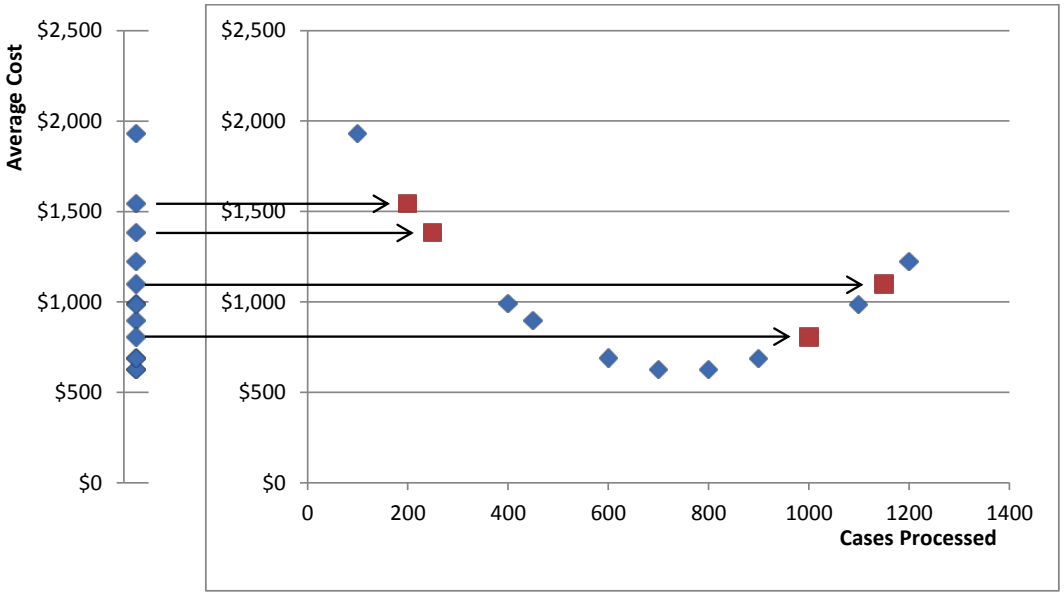
The Balanced Scorecard: Sustainable Performance Assessment for Forensic Laboratories



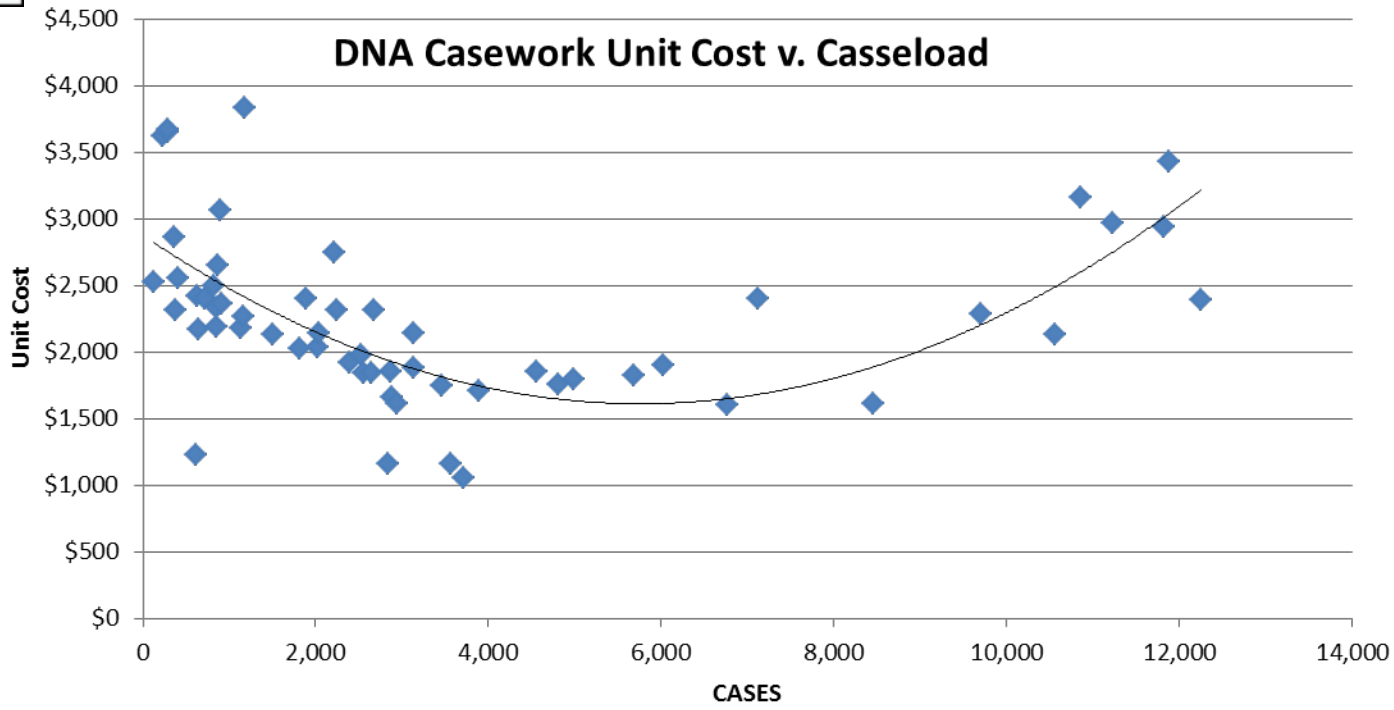
Efficiency and the Cost Effective Delivery of Forensic Science Services: In-Sourcing, Out-Sourcing, and Privatization

- Laws in Economics
  - Law of Demand
  - Low of Diminishing Marginal Returns
- Accounting Cost and Economic Cost
- Efficiency
- Cost Effectiveness
- Educated work force
- FORESIGHT data

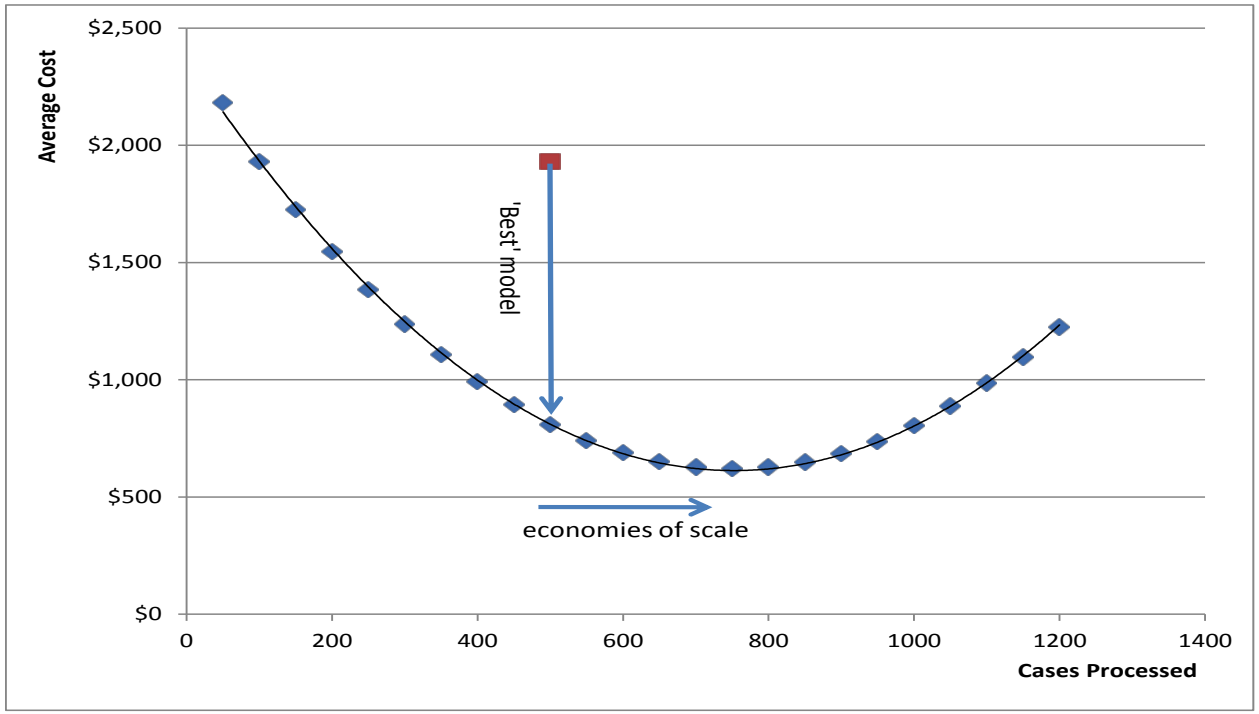
Efficiency and the Cost Effective Delivery of Forensic Science Services: In-Sourcing, Out-Sourcing, and Privatization



Efficiency and the Cost Effective Delivery of Forensic Science Services: In-Sourcing, Out-Sourcing, and Privatization



Efficiency and the Cost Effective Delivery of Forensic Science Services: In-Sourcing, Out-Sourcing, and Privatization



Forensic Science Service Provider Models: Data-Driven Support for Better Delivery Options

- Is there a ‘best’ option for the delivery of forensic science services?
- New Zealand’s ESR considered
- Efficiency, Cost Effectiveness, Crime rates, and Population
- Market-based caseload versus Jurisdiction-based caseload

Project FORESIGHT

Paul.speaker@mail.wvu.edu

http://www.be.wvu.edu/forensic/foresight.htm

WestVirginiaUniversity.
College of Business and Economics

National Institute of Justice
The Research, Development, and Evaluation
Agency of the U.S. Department of Justice

The Business of Forensic Service Provision: A conceptual of operations, a business-analytic approach, and a case study of the UK Forensic Science Service

Dr. Max M. Houck, DC Department of Forensic Sciences
Dr. Paul Speaker, West Virginia University
Dr. Chris Maguire, DC Department of Forensic Sciences

Questions for the Audience

How many of you work in the public sector?

How many of you work in labs with ‘backlogs’?

How many of you are too busy too much of the time?

Why is this?

Is it the same in the private sector?

Definitions

- **Private sector**: That portion of the economy that is run by individuals or groups as a means of enterprise for profit and which is not controlled by the state.

- Fee for Service

Definitions

- **Public sector**: That portion of the government that provides goods and services by and for the government or its citizens, whether federal, state, or local level.
- Budget driven

Classic Economic Problem

- Allocation of scarce resources
  - Multiple jurisdictions
  - Wide variety of services
  - Decreasing budgets
  - Increasing demand

- Not all demands can be pursued simultaneously; trade-offs are necessary but not sufficient

- Is there a “best” way?

Classic Economic Problem

- What is the best way to provision forensic services?
  - Public sector – 'free at the point of use'? – or abuse
  - Private – fee for service?
  - Mixed? (What's this?)

- How do you measure success?
  - More cases out in a given time?
  - Lower costs?
  - Fewer quality failures?
  - Reduced Turnaround times?

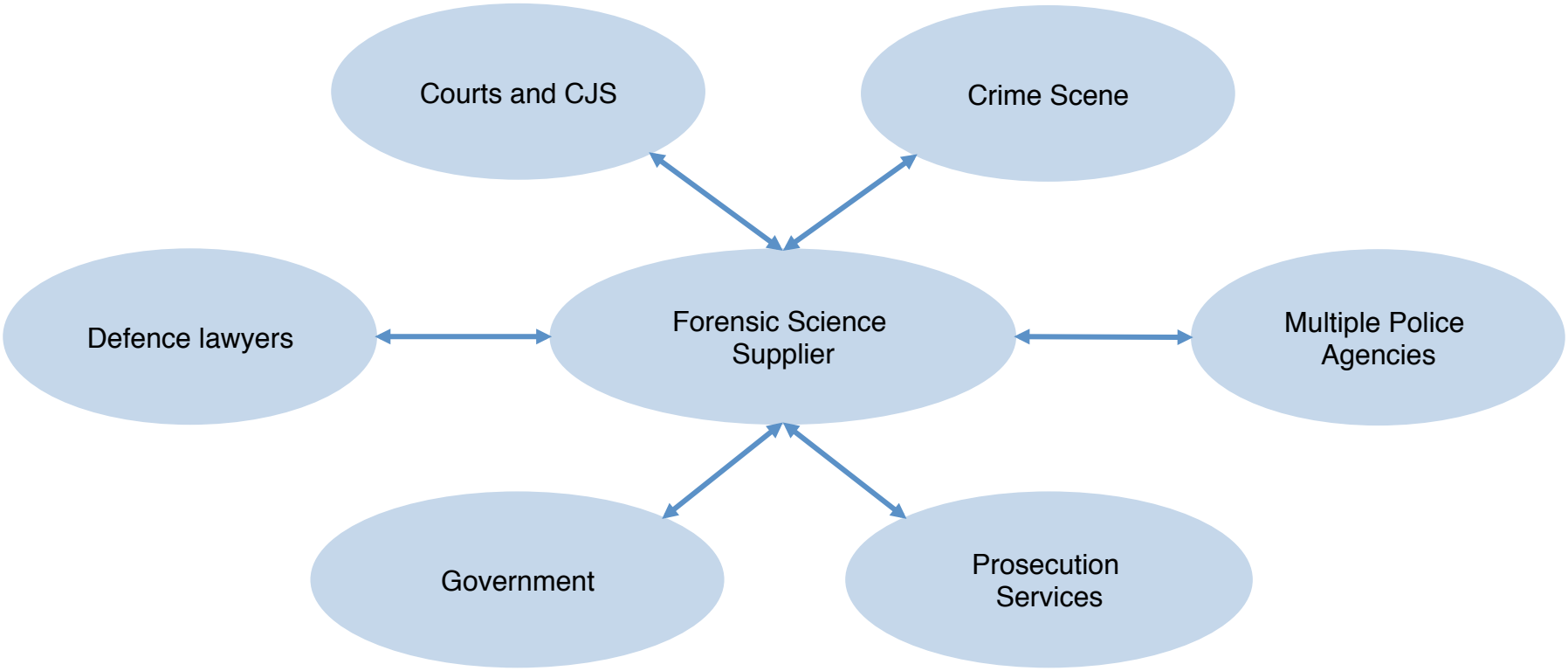
- These measures compete for resources (internal and external)

Value for Money?

- The best return on investment?
- The lowest cost/case, sample, test?
- The most public good for a fixed budget?

- **What** do you choose? **How** do you choose?
- How do you define '**Value**'

Public Sector Forensic Science Services



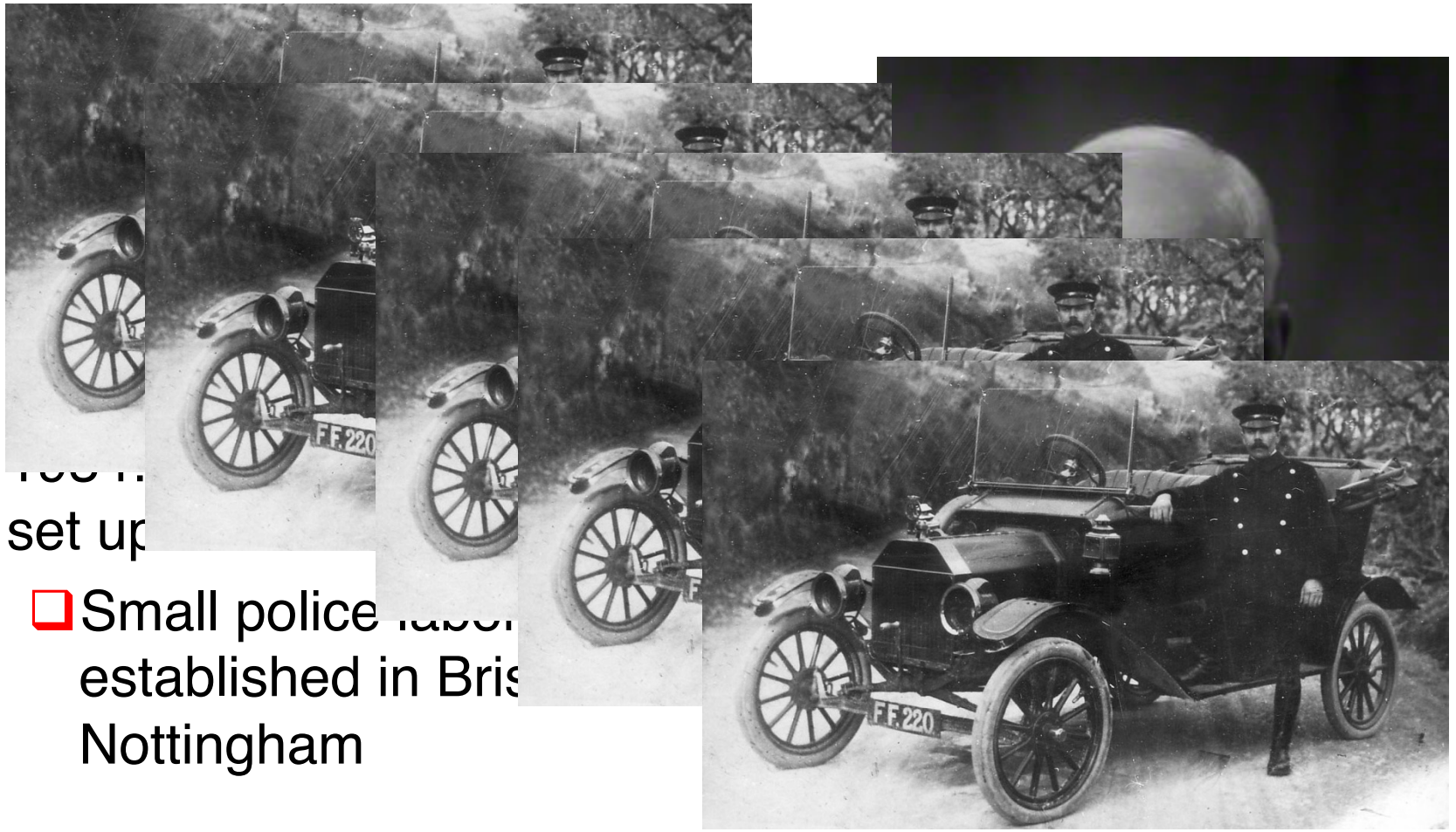
- **Who is your client? To whom are you providing forensic services?**

Forensic Science Service (UK)

A case example …

Forensic Science Service (UK)

-
- set up
  - Small police
    established in Bris
    Nottingham

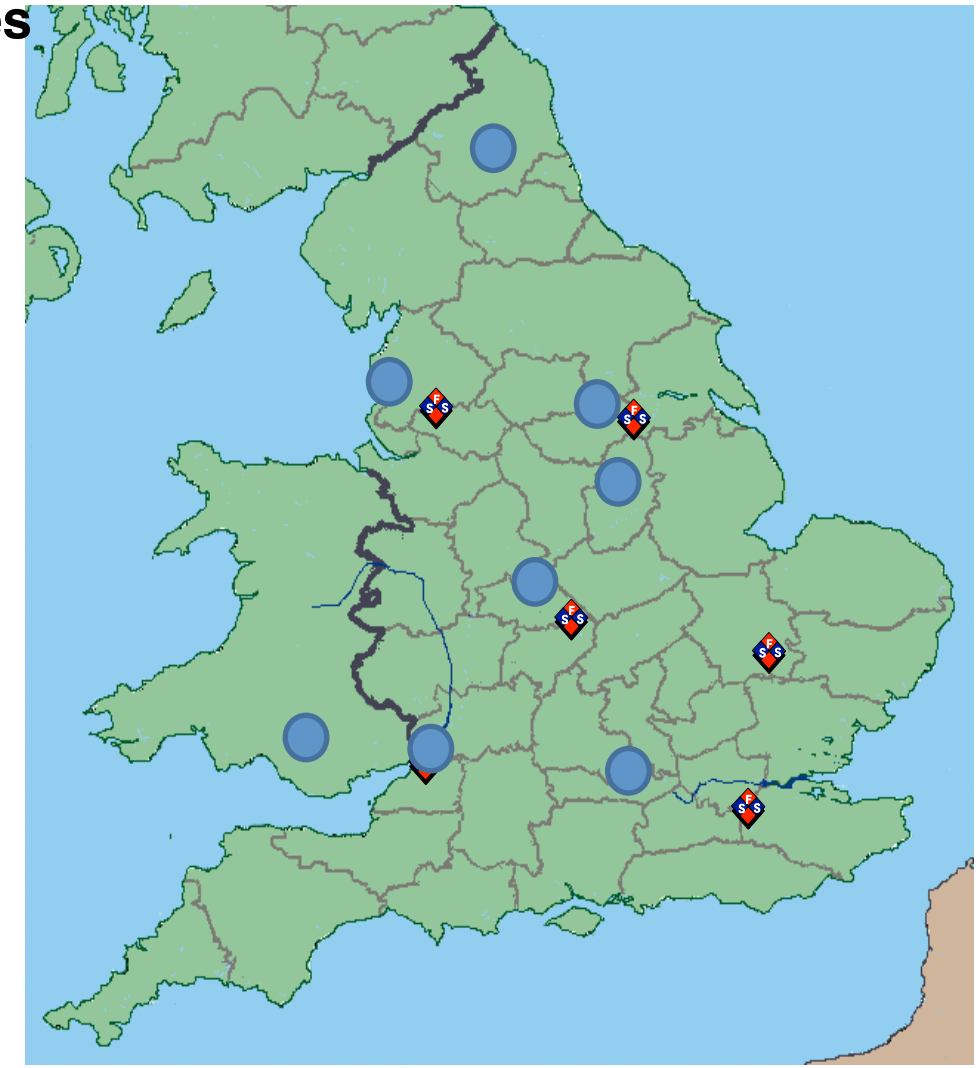


Forensic Science Service

- **Network of small laboratories replaced by purpose-built, Regional Forensic Science Laboratories and a Research Centre**

- **1970s Home Office FSLs**
  - **Aldermaston**
  - **Birmingham**
  - **Chepstow**
  - **Chorley**
  - **Huntingdon**
  - **Wetherby**

Metropolitan police, London



Managing a Scarce resource?

- **1950 – 1990 Govt. Grant and Common Police Services Fund**
- **1987 Touche Ross Report**
  - *"**An effective method for regulating the demand and supply of a service is for a customer to pay the supplier for the amount of service used ...** The level of demand would then be regulated by the relative benefits which the forces derived from forensic science, compared with other expenditure on aids to the detection of crime"*
- **1989 – 1990 Development of charging model**
- **1991 Executive Agency – fee for service by product /time charge**
- **1996 Met Police lab merged with FSS**

Managing a Scarce resource?

- **1999 Trading Fund Status - FSS is still part of the Home Office**
  - **Retains income from Operating Activities**
  - **Finance CAPEX from Government loans**
  - **Accumulate Cash Resources (Profit)**

- **Required to Achieve agreed financial targets**
  - **Recovery of Full Economic Costs**
  - **A cash Unit cost of £81.33**

Managing a Scarce resource successfully?

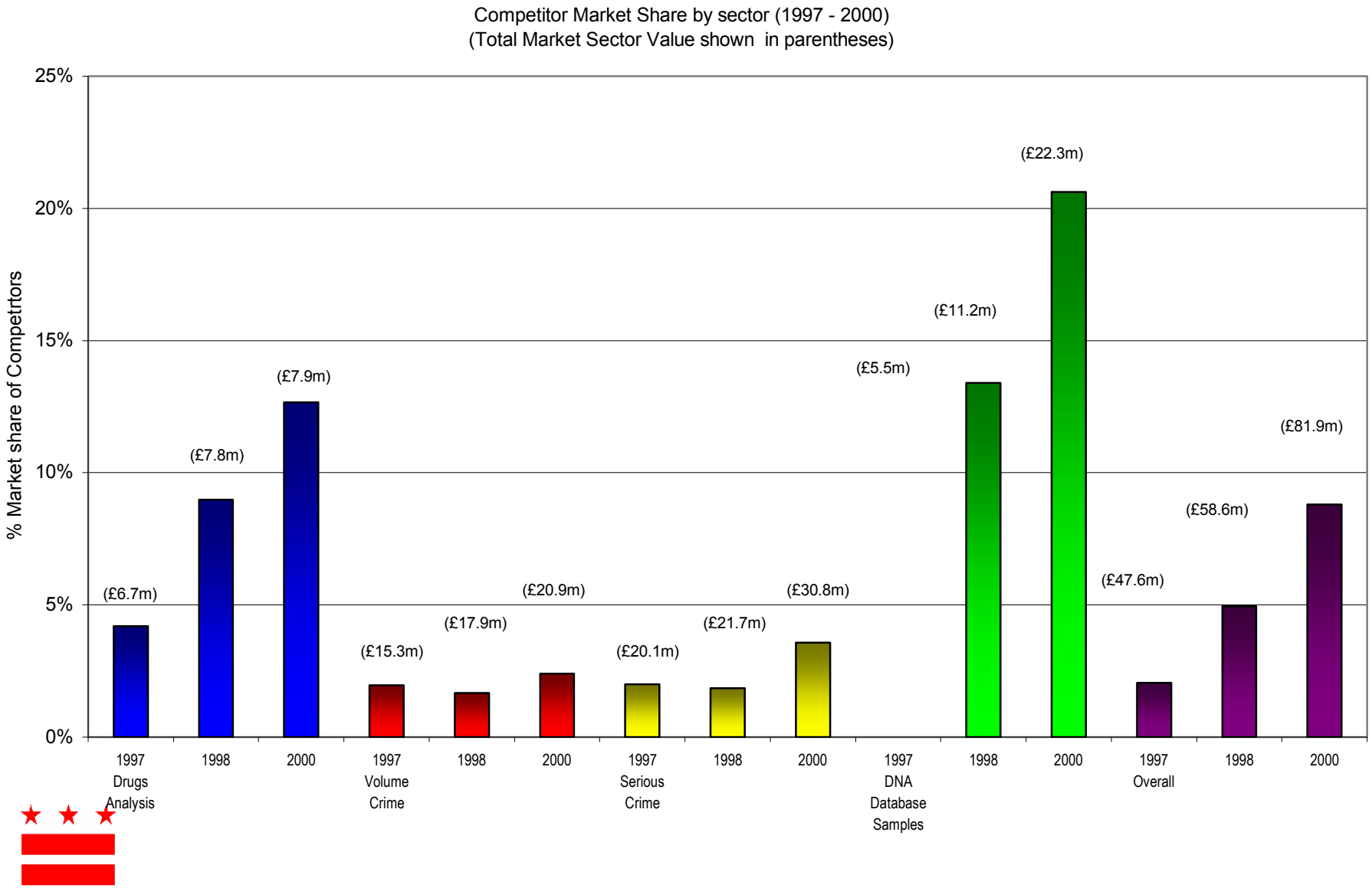
Financial year end (31st March)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
	£'000s	**£'000s**	**£'000s**	**£'000s**	**£'000s**	**£'000s**
Income from activities	**£76,505**	**£102,917**	**£128,097**	**£140,954**	**£148,851**	**£150,386**
Expenditure	**£75,578**	**£98,329**	**£122,172**	**£128,317**	**£134,653**	**£138,196**
Staff Costs	£47,256	£55,893	£68,958	£77,123	£85,433	£84,106
Staff cost/total cost %	**62.53%**	**56.84%**	**56.44%**	**60.10%**	**63.45%**	**60.86%**
Gross Profit	**£927**	**£4,588**	**£5,925**	**£12,637**	**£14,198**	**£12,190**
Staff Numbers						
Casework and specialists	1,221	1,419	1,677	1,692	1,706	1,770
Management and Support staff	539	623	736	829	873	761
Agency staff				208	118	111
Total No. Staff	**1,760**	**2,042**	**2,413**	**2,729**	**2,697**	**2,642**
No. Cases	**103,166**	**114,757**	**130,294**	**147,644**	**131,933**	**125,289**
DNA database (CJ) samples	**177,987**	**347,197**	**395,050**	**363,499**	**350,962**	**400,651**

Managing a Scarce resource successfully?

	2000		2005
Turnover	£ 76millions		£150 millions
Gross Profit	£ 1 million		£12 millions
Staff	1760		2640
Cases	103,000		125,000
DNA Samples	178,000		400,000

Government Funding – DNA Database Expansion £248 millions

Development of Commercial Market?



McFarland Review (2003)

- FSS was being burdened by overhead costs and an inability to meet clients' needs—"change resistant"
  - Review commissioned as FSS continues to lose work

- Recommended Government Company ("GovCo") Status as a short precursor to Public-Private Partnership

  - *"By becoming private sector classified, the FSS would acquire the private sector flexibilities it desires and the Government would be relieved of the responsibility for a commercial operation, as well as partly realising its investment"*

Development of Commercial Market?

- Commoditisation of forensic science
- Scientific Support Manager Staffordshire:
  - *"... Like CJ samples FSS is £1.50 or £2 more expensive than LGC. Now it doesn't sound much, but if I am sending 10,000 samples per year as a moderately sized force would do,* ***that's £20,000 I could save just by redirecting (the work) without any effort on my side whatever"***
- Rationale for switching to FSS competitor for a purely commercial advantage.

NPIA National Forensic Framework Agreement 2007

NPIA Procurement Contract

Designed to involve other
forensic science suppliers
& giving the police a choice

FSP's can bid for individual lots
& no longer need to be
full service laboratories

Niche players enter market;
FSS loses work with every contract

Lot 1 DNA PACE
Lot 2 DNA Crime Scene Stains
Lot 3 Drugs
Lot 4 Fire Investigations
Lot 5 Footwear Marks
Lot 6 Casework - Gun Crime (A)
Lot 7 Homicide and Violent Crime (A)
Lot 8 Casework - Sexual offences
Lot 9 Casework - Volume Crime
Lot 10 Questioned Documents
Lot 11 Road Traffic Investigation
Lot 12 Toxicology
Lot 13 Casework - Gun Crime (B)
Lot 14 Homicide and Violent Crime (B)

Structure of the forensic science market

- **Product differentiation** – NPIA National Forensic Procurement Project 2007
- **Barriers to entry**
- **Buyer concentration** - effect of NPIA National Forensic Framework Agreement,
- **Barriers to exit**

Conduct of the forensic science market

- The analysis of the 'Conduct' of a market means understanding what firms do to compete with each other. It can include factors such as:
  - pricing,
  - advertising,
  - the level of investment in customer-focussed research and development,
  - product specification and ranges,
  - customer service offers and
  - merger and acquisition activities.

- 'Conduct' could also include issues of seller activities including collusion and price manipulation; whether tacit or overt.

Performance of the forensic science market

- **The 'Performance'** of an industry or firm in a competitive market is often measured by profitability or other wealth-maximising criteria such as share price.

- The analyst has to determine whether the managerial actions or decisions have improved the performance of the firm or have resulted in a decline in any particular metric.

Sustainability of the forensic science market

- **McKinsey Review, in 2008,** contracted by FSS, stated:

1. The [forensic] market remained immature, was underperforming and had not delivered the benefits expected of a competitive market.

2. The vision was for a thriving competitive market in which the FSS had a significantly reduced share but the governance, policy and regulation were well established.

3. Without urgent market reform, the forensic market faces decline and significant threats to the quality of service.

4. The FSS was facing a financial emergency and the **costs of restructuring** FSS would be significant. Other suppliers would have to consider whether to stay in the market .

Performance of the FSS 2006 - 2010

Forensic Science Service as a Government-owned Company (GovCo)

Financial year end (31st March)	***Oct 05-2007**	**2008**	**2009**	**2010**
	£'000s	**£'000s**	**£'000s**	**£'000s**
Income from activities	**£210,449**	**£138,001**	**£125,794**	**£112,951**
Expenditure				
Cost of sales	£120,744	£82,965	£80,421	£75,298
Other Operating charges	£83,510	£51,461	£50,257	£50,331
Total Operational Expenditure	**£204,254**	**£134,426**	**£130,678**	**£125,629**
Gross Profit (Loss)	**£6,195**	**£3,575**	**£4,884**	**£12,678**
Restructuring costs	£7,100	£4,600	£12,034	£37,902
Operational Loss	**£905**	**£1,025**	**£16,918**	**£50,580**

Performance of the FSS 2006 - 2010

	2006		2010
Turnover	£210 millions		£112 millions
Gross Profit (Loss)	£6 millions		£12 millions
Restructuring Costs	£7 millions		£37 millions
Operational loss	£1 million		£50 millions
DNA Samples	178,000		400,000

Government Funding – NIL

Performance of the forensic science market

LGC Ltd.

	Turnover(£000)	Profit (Loss) (£000)	Operating Profit (%)	Staff #	Ops/Admin (%)
2007	53,586	889	1.66%	675	82.96%
2008	65,952	5,007	7.59%	927	78.86%
2009	79,097	4,930	6.23%	916	79.80%
2010	83,348	-1,021	-1.22%	1,032	81.78%

Orchid Cellmark Ltd.

	Turnover(£000)	Profit (Loss) (£000)	Operating Profit (%)	Staff #	Ops/Admin (%)
2007	14,994	1,324	8.83%	188	73%
2008	14,296	-280	-1.96%	196	74%
2009	18,841	978	5.19%	238	79%
2010	25,901	4,504	17.39%	327	81%

Key Forensic Services Ltd – 2 Auditors Warnings

Sustainability of the forensic science market

- Under the conditions of:
  - Low profitability
  - Increasing commoditisation – National Forensic Framework Agreement II
  - Collapsing accessible market volumes – expected to be £110m by 2014/5
  - Police budget cuts of 20% and ‘back office’ activities taking the brunt of this
  - Increased police insourcing & police building & running forensic laboratories
- Is this market sustainable?

FSS closure – ‘financial decision’

- Planned re-organisation of FSS to National model – ‘right-sizing’
  - Closure of three laboratories; Chepstow, Chorley, Birmingham
  - 700 scientists & support staff made redundant
  - Insufficient savings

- 10th December 2010 - James Brokenshire announces FSS closure citing financial losses as the only reason

- April – July 2011 HoC Science & Technology Committee Report; highly critical of decision

FSS closure – House of Commons

http://www.publications.parliament.uk/pa/cm201012/cmselect/cmsctech/855/855.pdf

House of Commons Science & Technology Committee

100 written submissions, oral evidence from 15 witnesses

Lack of information on financial analysis behind decision

Impact of procurement policy on complex cases

Lack of Consultation

Future of research – Brain drain

Archive

Initial Ministerial response:

"It mis-states a number of very significant points. Our focus remains on providing continued high quality forensic services to the justice system now and in the future. We remain confident that our plans for winding down the FSS will deliver this."

Formal Government response delayed

FSS closure – ‘Commentary’

J… …sure 15th December 2010

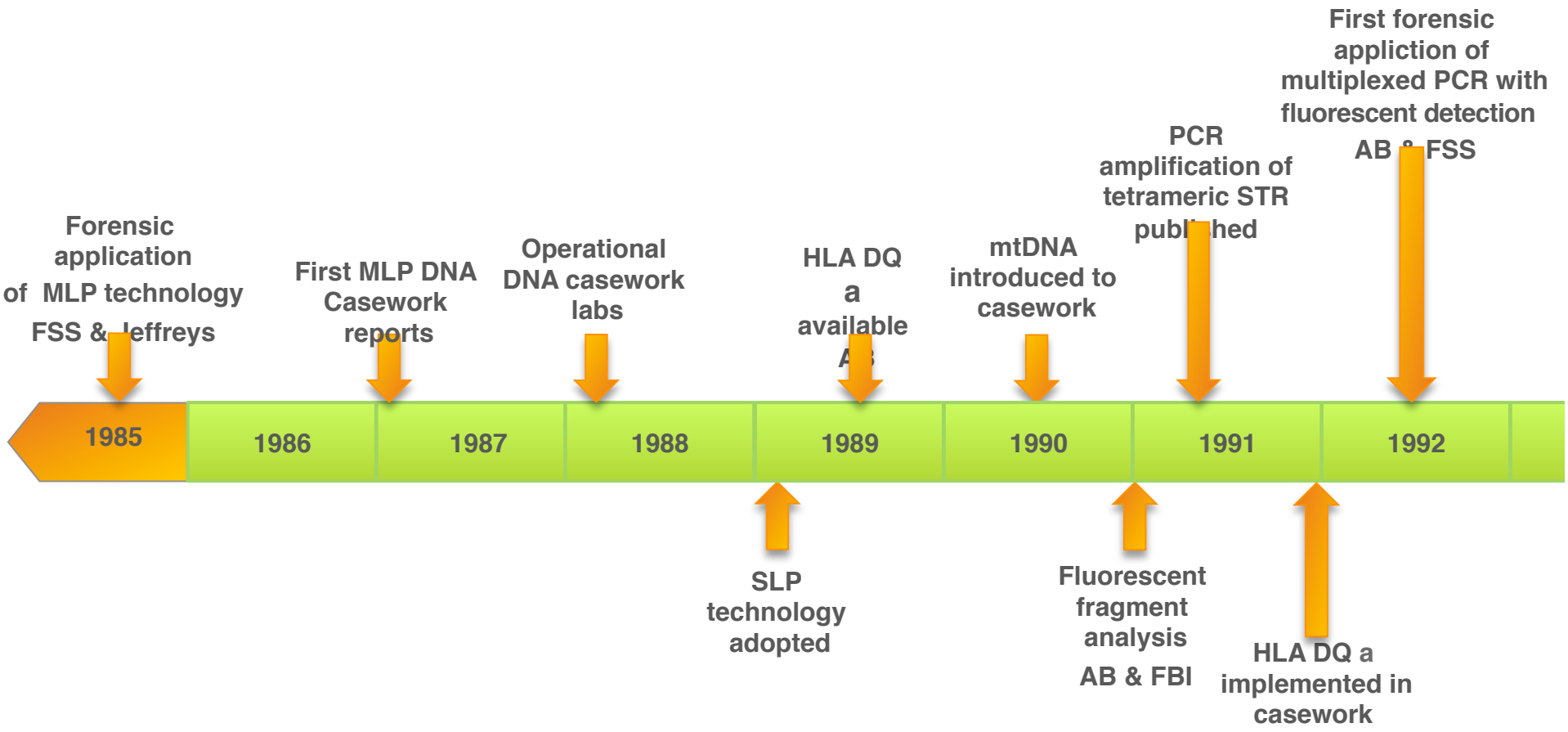
Speed of forensic science cuts ‘harms the quality of evidence’ – 1st July 2011

The Home Secretary overlooked the interests of justice to save money when she ordered the closure of the Forensic Science Service (FSS) last year, a highly critical report from MPs has found.

…if the UK government does not heed the concerns, we then urge other countries to review what is happening there and to use it as a model case to avoid the unfortunate loss of public forensic services with all its negative national and international consequences.

Budowle et al., Investigative Genetics 2011, 2:4

FSS closure – Impact on scientific research



FSS closure – Impact on Society

- **Delivery of Justice – Private vendors to pick up 65% work in 1 year?**
- **Impact on quality, miscarriages of justice**
- **Cold Case Reviews – some work suspended**
- **CCRC – part of Appeals process – work hampered**
- **Innovative intelligence tools – Familial Searching??**
- **Resilience – major terrorist event; Olympics 2012**
- **Quality – police labs given until 2015 to meet ISO17025 in DNA and fingerprints**

So how much did it cost to close FSS?

£100 million Rt Hon William Hague MP, Foreign Sec State to European Commission 07/12/2011

- **Liquidation costs:- Home Office**
  - Operational support £30m
  - Staff exit costs £55m
  - Liabilities £32m

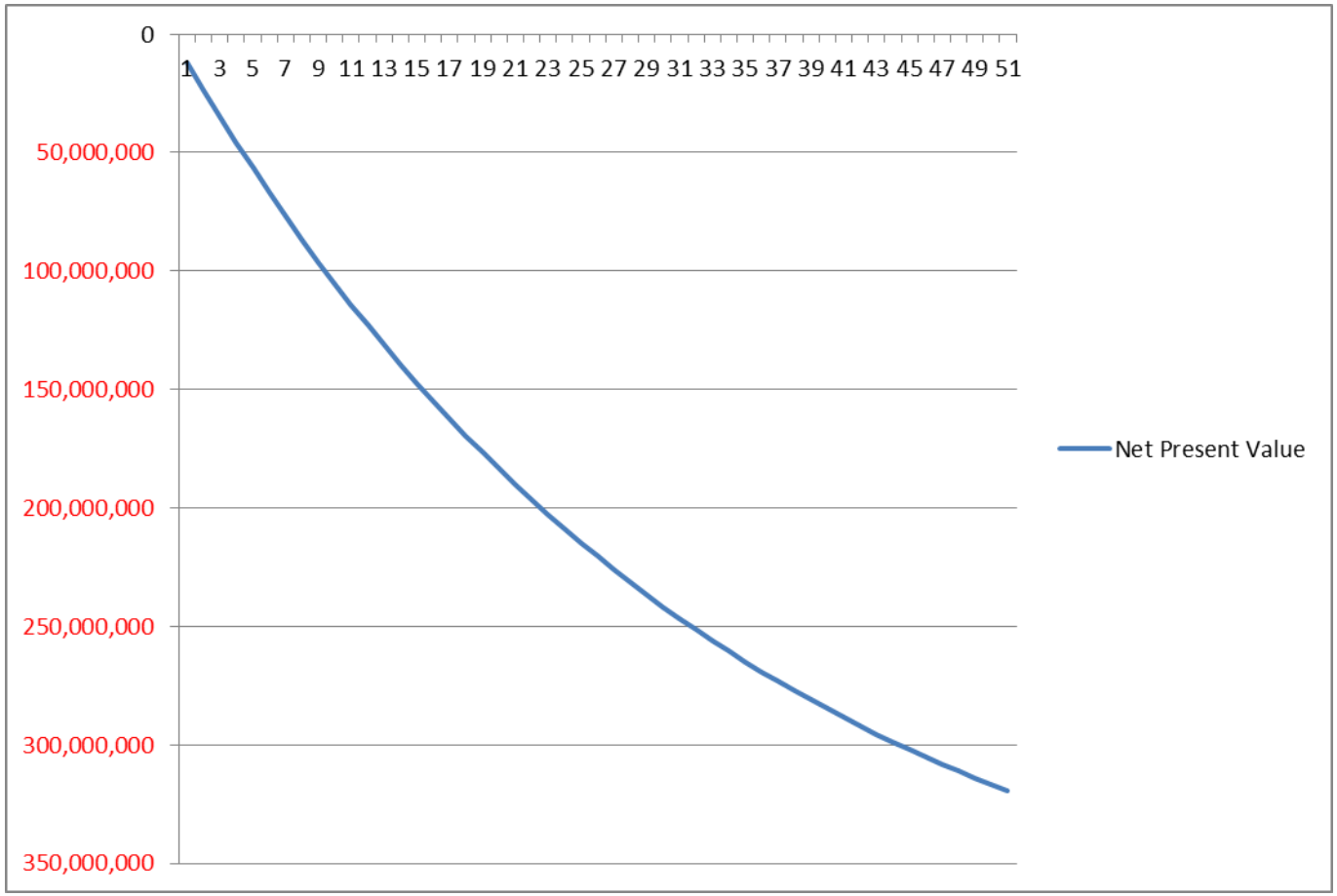
- **Other Costs** – undeterminable but estimated …

- MPS - estimate £2m per annum plus £4m pa for staff (£60m/10 yrs)
- Police lab for Northeast forces (West Yorkshire) £21m
- Pension shortfall provision £20m (actual shortfall £111)
- Operation of National Forensic Archive estimated £2 pa (£20m/10yrs)
- Accreditation costs - £45,000 per police force (£2 million)

- **Personal Estimate - £290-330million (end September 2012)**

So how much did it cost to close FSS?

Net Present Value calculation (UK Gilt 30yr return rate 3.02%)



Is there a stable forensic science market?

- **Contestable Market:- ACPO/FSP's estimate**
  - £78-80million (previous estimate £110 m by 2014/5)
- **Low profitability**
- **Large value contracts moving between FSP's**
- **National Forensic Framework Agreement 2**
  - **Contracts for 5 +2 years**
  - **Barrier to entry for potential suppliers**
- **Will current suppliers wish to remain in the market?**
- **What happens if a company fails or withdraws**
- **House of Commons Science & Technology Committee – Round 2**