

Forensic Laboratory Financial Management

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The National Institute of Justice's Office of Justice Programs has supported laboratories for the last several years with analysis of performance via Project FORESIGHT. Project FORESIGHT has collected data from the 2006 fiscal year, growing from a handful of laboratories to over 100 participating laboratories in the most recently completed fiscal year. There is ***no cost to participants***, and all forensic laboratories are invited to join the program. In return for data submissions, each laboratory receives a customized report comparing their performance in each forensic investigative area to the industry standards obtained from the project.

Project FORESIGHT is a business-guided self-evaluation of forensic science laboratories across the globe. The participating laboratories represent local, regional, state, and national agencies. A team of forensic science business experts provide assistance, guidance, and analysis. Laboratories participating in Project FORESIGHT have developed standardized definitions for metrics to evaluate work processes, linking financial information to work tasks, and functions. Laboratory managers can then assess resource allocations, efficiencies, and value of services—the mission of Project FORESIGHT is to measure, preserve what works, and change what does not.

Consider the summary statistics for several of the key performance indicators. Because of outliers in several of the investigative areas, the most meaningful comparisons might best be made with respect to the median as a representation of “typical” laboratory performance. To lend perspective to the spread of these metrics, each of the quartile metrics are reported.

As of this writing, one hundred three laboratories contributed data to the project in 2013-2014. For most areas of investigation, the submitted data offers a large enough sample to elicit good statistical properties. However for Evidence Screening & Processing, and Forensic Pathology, the number of reporting laboratories in these areas is too small to draw meaningful conclusions. As such, the metrics in these two areas of investigation offer limited inference.

Cost per Sample

The language used in Project FORESIGHT was developed over a one and a half year period by a voluntary group of seventeen laboratories. While each laboratory may have begun with its own internal definitions, the actual definitions used in Project FORESIGHT represent a consensus achieved by this group of laboratories. The project data collection tool, LabRAT, includes a glossary and counting examples for data reporting.

A **sample** refers to an item of evidence or a portion of an item of evidence that generates a reported result. The **cost** includes allocations for capital, wages & salary, benefits, overtime & temporary hires, chemicals, reagents, consumables, gases, travel, quality assurance and accreditation, subcontracting, service of instruments, advertisements, non-instrument repairs and maintenance, equipment leasing, utilities, telecommunications, overhead, and other expenses.

The sample offers a consistently applied metric across laboratories and suggests an average cost measure that is intuitively comparable in cross sectional commentary.

Table 1: Cost per Sample by Investigative Area

Cost per Sample	25th Percentile	Median	75th Percentile
Blood Alcohol	\$70	\$96	\$177
Crime Scene Investigation	\$6	\$71	\$1,642
Digital evidence - Audio & Video	\$575	\$705	\$2,656
DNA Casework	\$296	\$426	\$616
DNA Database	\$60	\$83	\$171
Document Examination	\$170	\$566	\$764
Drugs - Controlled Substances	\$90	\$119	\$196
Evidence Screening & Processing	\$56	\$110	\$310
Explosives	\$1,131	\$3,143	\$6,941
Fingerprints	\$73	\$129	\$319
Fire analysis	\$334	\$574	\$1,488
Firearms and Ballistics	\$230	\$386	\$553
Forensic Pathology	\$305	\$1,643	\$2,113
Gun Shot Residue (GSR)	\$214	\$615	\$1,668
Marks and Impressions	\$245	\$1,143	\$2,793
Serology/Biology	\$85	\$141	\$391
Toxicology ante mortem (excluding BAC)	\$277	\$327	\$749
Toxicology post mortem (excluding BAC)	\$221	\$344	\$518
Trace Evidence	\$345	\$1,267	\$3,215

Besides the average cost of a sample, the average cost per case, per item, per test, and per report are also presented in the project annual report. In addition, a breakdown of the components via an expansion of metrics is included.

The project also collects data on turnaround time (TAT) and backlogs over time by investigative area.

Table 2: Turnaround Time by Investigative Area

Turnaround Time (days) from First Item Received	25th Percentile	Median	75th Percentile
Blood Alcohol	\$4	\$8	\$35
Crime Scene Investigation	\$7	\$18	\$100
Digital evidence - Audio & Video	\$44	\$138	\$303
DNA Casework	\$39	\$90	\$163
DNA Database	\$11	\$51	\$239
Document Examination	\$31	\$59	\$105
Drugs - Controlled Substances	\$12	\$35	\$73
Evidence Screening & Processing	\$24	\$34	\$48
Explosives	\$26	\$77	\$118
Fingerprints	\$16	\$36	\$81
Fire analysis	\$18	\$45	\$112
Firearms and Ballistics	\$21	\$83	\$137
Forensic Pathology	\$41	\$96	\$172
Gun Shot Residue (GSR)	\$13	\$35	\$92
Marks and Impressions	\$25	\$67	\$159
Serology/Biology	\$23	\$58	\$100
Toxicology ante mortem (excluding BAC)	\$25	\$39	\$64
Toxicology post mortem (excluding BAC)	\$30	\$37	\$55
Trace Evidence	\$38	\$74	\$152

Note that turn-around time is offered in two forms. Presented in Table 2 is a measure that begins when the first item of evidence in an investigative area has been submitted to the laboratory. The second measure begins the turn-around time count with the submission of the last piece of evidence in an investigative area. Laboratories report the measure that is relevant to their jurisdiction. The metric has been slightly altered over the years to correspond to recommendations from Project FORESIGHT participants. The metric reflects the time from each request for analysis to issuance of a report. As such, a case in one investigative area may have multiple turn-around times that correspond to separate requests.

Table 2: Backlog Cases as a percentage of Total Caseload by Investigative Area

Backlog Cases/Annual Caseload	25th Percentile	Median	75th Percentile
Blood Alcohol	0.28%	0.83%	5.14%
Crime Scene Investigation	0.54%	8.89%	27.33%
Digital evidence - Audio & Video	8.45%	35.80%	132.35%
DNA Casework	6.42%	17.17%	32.74%
DNA Database	0.54%	14.02%	38.76%
Document Examination	7.24%	20.54%	31.90%
Drugs - Controlled Substances	2.14%	6.46%	21.01%
Evidence Screening & Processing	4.92%	16.75%	28.67%
Explosives	11.11%	25.81%	44.83%
Fingerprints	4.07%	8.82%	32.61%
Fire analysis	2.72%	7.74%	13.99%
Firearms and Ballistics	6.82%	22.22%	69.86%
Forensic Pathology	5.12%	11.15%	38.97%
Gun Shot Residue (GSR)	4.75%	13.35%	41.64%
Marks and Impressions	18.51%	42.56%	76.70%
Serology/Biology	3.84%	17.22%	36.80%
Toxicology ante mortem (excluding BAC)	2.22%	6.19%	11.54%
Toxicology post mortem (excluding BAC)	3.71%	5.77%	9.75%
Trace Evidence	14.17%	25.25%	43.09%

Another area of concern involves the increased demand for laboratory services and the level of backlog. For data collection purposes, the definition of backlog has been defined as open cases at the end of the fiscal year that have been open for more than thirty days. As a relative comparative measure, the ratio of open cases to total cases for the year is presented in the following table.

Current project research is linking TAT with backlog reduction efforts. Early results indicate that reduction in TAT is often met with an increased demand for services. As such, backlog reduction efforts may be affected by unanticipated reactions to their success; namely, increased backlog from the laboratory's successes.

Data in Perspective

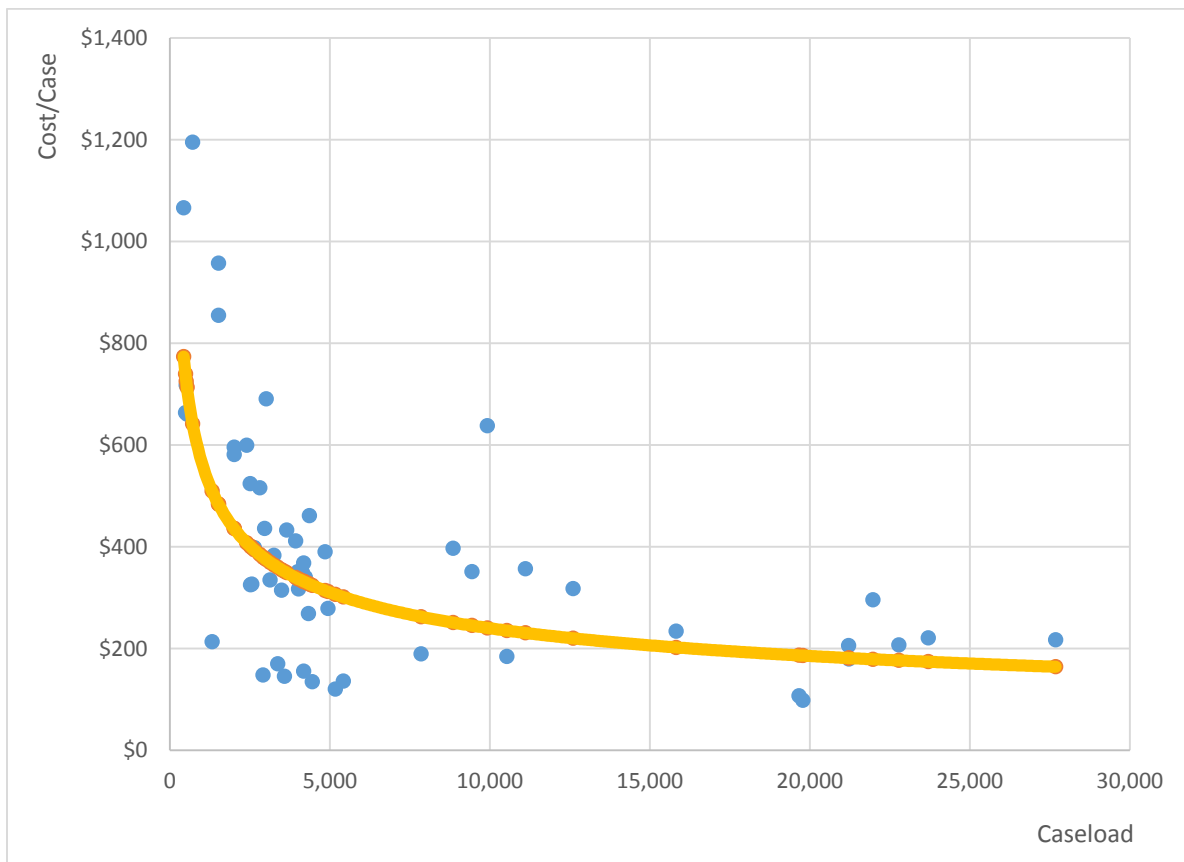
The summary statistics offer a one-dimensional view of performance. Project analysis is expanded through a consideration of cost effectiveness and efficiency. Economic behavior indicates that any industry, including forensic science laboratories, will have average costs (Cost/Sample) that decline as sampling is increased until reaching a point of perfect economies of scale. Thereafter, diseconomies of scale will be realized and average costs will rise as workload increases. This behavior is exemplified via U-shaped average cost curves.

In the project reports for each investigative area, the industry average total cost curve has been estimated by a series of statistical procedures. When a laboratory performs on or near the estimated curve, it is an indication of efficiency for the corresponding caseload. For an efficient performance that is near the bottom of the U-shaped curve, the laboratory exhibits cost effective performance as it approaches perfect economies of scale.

In addition to this cross-sectional comparison, average cost and productivity are illustrated for all past FORESIGHT submissions. Costs are adjusted for inflation and converted to the most recent year's price index.

The analysis is performed for each individual area of expertise. One area, drugs—Controlled Substances is illustrated.

Figure 1: Drugs—Controlled Substances Average Total Cost



For more information on Project FORESIGHT, including a downloadable LabRAT data collection tool, visit www.be.wvu.edu/forensic/foresight.htm. Questions regarding matters pertaining to Project FORESIGHT should be directed to the Principal Investigator Paul Speaker (paul.speaker@mail.wvu.edu). Remember that all forensic laboratories are invited to participate and there is no cost to the laboratory for participation and receipt of an individualized consultant's report on laboratory performance.

To read more about Project FORESIGHT and the project results, several publications are available.

Project FORESIGHT Publications

[FORESIGHT: A Business Approach to Improving Forensic Science Services](#), *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Max M. Houck, Richard A. Riley, Paul J. Speaker, & Tom S. Witt, pages 85-95

[Key Performance Indicators and Managerial Analysis for Forensic Laboratories](#), *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 1, 2009, Paul J. Speaker, pages 32-42.

[The Decomposition of Return on Investment for Forensic Laboratories](#), *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Paul J. Speaker, pages 96-102.

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[Forensic Science Staffing: Creating a Working Formula](#), *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 1, 2011, Joyce Thompson Heames & Jon Timothy Heames, pages 5-10.

[Managing Performance in the Forensic Sciences: Expectations in Light of Limited Budgets](#), *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 1, 2011, Hilton Kobus, Max Houck, Paul J. Speaker & Richard Riley, pages 36-43.

[Strategic Management of Forensic Laboratory Resources: From Project FORESIGHT Metrics to the Development of Action Plans](#), *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 4, 2011, Jonathan Newman, David Dawley, & Paul J. Speaker, pages 164-174.

[The Power of Information](#), *Forensic Magazine* April 10, 2012, Tom S. Witt & Paul J. Speaker

[Is Privatization Inevitable for Forensic Science Laboratories?](#), *Forensic Science Policy & Management: An International Journal* Volume 3, Issue 1, 2012, William McAndrew, pages 42-52'

[The Balanced Scorecard: Sustainable Performance Assessment for Forensic Laboratories](#), *Science and Justice* Volume 52, 2012, Max Houck, Paul J. Speaker, Richard Riley, & A. Scott Fleming, pages 209-216.

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[Forensic Science Service Provider Models: Data-Driven Support for Better Delivery Options](#), *Australian Journal of Forensic Sciences* Volume 45, Issue 2, 2013, Paul J. Speaker.

[Improving the Effectiveness of Forensic Service: Using the Foresight Project as a Platform for Quality](#), *Proceedings of the American Academy of Forensic Sciences*, Volume XIX, Max M. Houck, Jay W. Henry, and Paul J. Speaker, February 2013, p.21.

[Determinants of Turnover Intentions, Helping, and Knowledge Sharing in Crime Laboratories](#), *Proceedings of the American Academy of Forensic Sciences*, Volume XIX, David Dawley, February 2013, p.230.

[Are Forensic Science Services Club Goods? An Analysis of the Optimal Forensic Science Service Delivery Model](#), *Forensic Science Policy and Management: An International Journal* Volume 3, Issue 4, 2012, William P. McAndrew, pages 151 – 158.

[The Effects of Politics on Job Satisfaction in Crime Lab Employees](#), *Forensic Science Policy and Management: An International Journal* Volume 3, Issue 4, 2012, David Dawley & Timothy P. Munyun, pages 159 – 164.

[Expanding Budgets via Strategic Use of Leasing](#), *Forensic Science Policy and Management: An International Journal*, Volume 3, Issue 4, 2012, William P. McAndrew & Paul J. Speaker, pages 169 - 179.

[Developing New Business Models for Forensic Laboratories](#), Chapter 13 in *Forensic Science and the Administration of Justice*, Kevin J. Strom & Matthew J. Hickman editors, Max M. Houck & Paul J. Speaker, April 2014.

[A Novel Approach to Forensic Molecular Biology Education and Training: It's Impact on the Criminal Justice System](#), *Australian Journal of Forensic Sciences* DOI:10.1080/00450618.2014.925974, 2014, Khalid M. Lodhi, Robert L. Grier, and Paul J. Speaker

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