A Feasible and Sustainable Model for Forensic Service Delivery in Canada

By

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The views expressed herein are those of the authors and do not necessarily reflect those of Public Safety Canada.

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Project Team

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The NUCFS team was pleased to have the support of **Dr James R. Mitchell**; a founding partner of the Ottawa-based policy consulting firm Sussex Circle.

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Our thanks also go to all of the police officers, Crown and Defence Counsel who gave their time and expertise to inform the qualitative data collection exercise.

[1] The academic position of Reader in the UK is equivalent to Senior Associate Professor in North America

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1.0 Executive Summary

The present study is designed to determine what particular models of forensic service delivery are both feasible and sustainable in the Canadian political, constitutional, legislative, and regulatory context. This report considers the current provision of forensic science in Canada, including public sector and private sector forensic science suppliers, their governance, the disposition of laboratories, and the services supplied. Other forensic service delivery models in use in foreign jurisdictions are examined in detail, evaluated, and reviewed for their applicability in Canada.

Data collection methodologies

The qualitative data collection, which concerned client needs and expectations of a forensic science provider and their perception of the current service level offered, used a direct interview methodology. This instrument covered broad topics but also provided opportunities for respondents to raise issues and for interviewers to follow-up on them.

Quantitative data were collected using standardized metrics to benchmark performance with the goal of recognizing, understanding, and integrating better practices. The standard used came from a global project that assesses forensic laboratory performance - project FORESIGHT, which provides the basis for broad yet deep comparisons between forensic laboratories using robust measures. The FORESIGHT process is agnostic to laboratory size or location, recording functional and process data that then is collated and compared to produce analyses and laboratory-specific reports. These quantitative data, which have been collected and validated from a global group of 64 laboratories, have been used in the econometric analysis presented in this report.

Canadian Service Providers

Canada's federal police force, the Royal Canadian Mounted Police (RCMP), has the responsibility of policing eight provinces and three territories and more than 200 municipalities, providing local, provincial, and national policing services across Canada. Three provinces (Ontario, Québec, and Newfoundland and Labrador) operate independent provincial police forces. The responsibility for policing services in Ontario falls to the Ontario Provincial Police (OPP) or in the larger municipal communities, to municipal police forces. In Quebec, the Sûreté du Québec (SQ) provides provincial policing services and some local services outside major urban areas. The Royal Newfoundland Constabulary provides policing services in the larger urban areas of Newfoundland and Labrador (e.g. the North East Avalon peninsula, Corner Brook, and St John's).

The compilation of a forensic attrition model for policing in Canada is suggested to better understand the current and potential for forensic interventions. A United Kingdom-based forensic effectiveness project, the Scientific Work Improvement Model (SWIM), undertaken by the Police Standards Agency in 2007, yielded useful results. This model indicated that increased tasking levels at scenes of crime, and targeted examinations for fingerprint and DNA evidence, resulted in a greater level of crime detection. Given the results of this project, any consideration of alternative forensic service delivery models in Canada must take into account laboratory and field service relationships.

Forensic Markets – Public, Private, or Partnership

In many jurisdictions, the delivery of forensic science is achieved through the police or other public sector organizations whether this is sponsored by a national government, state or provincial legislature, sheriff's office, or municipal authority. In some instances, notably in England & Wales, forensic science is delivered entirely by private companies with the work being tendered by the police under competitive contract arrangements. In many states in the United States of America (USA), elements of the forensic science examination (largely DNA profiling analysis) are sub-contracted by public sector laboratories to private sector organizations. In Canada, the Royal Canadian Mounted Police Forensic Science and Identification Services (RCMP FS&IS) has such a contractual agreement with Maxxam Analytics Inc. for the provision of DNA profiling services. This Standing Offer Agreement enables the RCMP FS&IS to manage backlogs of DNA work.

Whilst a viable, privatized, full-service forensic market in Canada may seem attractive to Government, many obstacles must be overcome before such a market could become established. These include a political and legislative environment that encourages the growth of private sector forensic science providers, and having police and Criminal Justice authorities who understand the costs and value of forensic science to the investigation and prosecution of crime. The Government should also understand that the development of a sustainable and competitive forensic science market, which needs to be protected by strong regulation, is likely to take up to ten years to develop fully.

Forensic service provision models from the United Kingdom (UK), New Zealand (NZ), and the USA provide reference points for evaluation and discussion of the challenges that Canada faces.

Many of the senior police officers interviewed indicated that they had used the private sector forensic science suppliers to support their investigative needs and commented particularly on the high levels of customer service they had received. However, since the federal and provincial forensic science laboratories do not charge for their services, the client support provided by the private forensic science companies, funded from operational budgets, is perceived by some officers to be expensive.

Public sector provision nevertheless also has its costs. Extending private sector practices to the public sector, particularly in forensic science, requires attention to key performance indicators (KPIs). These KPIs are related to the mission and strategies of public sector entities, which are generally to achieve as much 'public good' as possible with the resources at their disposal. Business ratios provide robust KPIs that compare easily across disparate operational entities and over time. In this project, a variant of *DuPont expansions*, a standard business method, is employed to good effect. For the forensic industry, the Return on Investment (ROI) and its inverse, the Cost per Case, can be explained by a combination of key measures which include: Cases processed per Full-time Equivalent employee(Cases/FTE); Testing Intensity (Tests per Case); Average Compensation; Labour Productivity; and the Ratio of Personnel Expense to Total Expense.

The summary statistics[2] are the foundation for simulation and scenario analyses. An analysis of the economies of scale, for example, identifies the volume of an investigative service required to provide that service at a minimum Cost per Case. From the analyses presented in this report, it is clear that the RCMP FS&IS operating at a less than a desirable cost per case.

Whilst the level of capital investment within the RCMP FS&IS laboratory services is a positive measure, it is also accompanied by extremely high costs for labour, consumables, and other expenditures. Consumables cost per case is generally higher than the global medians, which suggests over-testing. Labour expenditures per case and other costs per case generally exceed the global medians, often by a wide margin, suggesting a high potential for efficiency gains. Based on this analysis the results suggest that if the efficiency by which RCMP FS&IS delivers forensic science services could be improved to that of the Canadian mean for these KPIs, substantial financial benefits could be realized.

Exploration of models and solutions

A number of issues must be addressed to inform any decisions about changing the model of forensic science delivery in Canada. The political and jurisdictional issues are complex, the costs of doing business in Canada are higher than in other jurisdictions, and there are limited, if any, current opportunities for sharing resources among the public sector forensic science suppliers. All of these issues impact upon the feasibility and sustainability of any chosen forensic science delivery model.

One of the options the Project Team was asked to consider is that of a fully privatised forensic science market. Is it feasible that a market for a wide range of forensic services could be established in a reasonable timescale and in a culture where forensic science has always been considered to be 'free' to its users? This would be a significant challenge to government.

Currently, the three private forensic suppliers in Canada provide only DNA profiling services to their clients. There is the potential for one of the private suppliers to extend another line of business (toxicological analysis) if such work was available from the police. The Project Team is not aware of any of the other forensic investigative areas being offered as a service by the current forensic suppliers. On the basis of the UK experience, a commercial market in forensic science will take at least 10 years to develop. Moreover, it would rely on the government to generate the opportunities for such a market to grow and to maintain the stable and regulated conditions under which forensic science suppliers could thrive and make a reasonable profit. This is not a short term option.

The Project Team also looked at different options for the organizational status of the RCMP FS&IS. At present, the RCMP FS&IS is simply a part of the Royal Canadian Mounted Police. Whilst it would be possible to designate it as a 'Special Operating Agency' within the RCMP, it is not apparent that such a change in organizational status would, in itself, do a great deal to reduce costs or improve efficiency. It might, however, make it easier for this function to charge for its services and retain revenues.

[2] The Project Team undertook other data analysis that, although not included in this report, are relevant to and influence the findings of this report.

Another option would be to pass legislation to transform the RCMP FS&IS into a legally separate organization (a 'Separate Operating Agency'), with a statutory mandate and appropriate powers to run itself in a more business-like way. However, this option would not by itself reduce the cost of services or increase the efficiency of operations. Similar considerations would necessarily apply to the idea of legislating RCMP FS&IS as a Crown Corporation.

Turning the RCMP FS&IS into a pan-Canadian agency covering the delivery of forensic science to the whole of Canada is unlikely given provincial responsibilities for policing and the complex relationships between the federal and provincial governments. Other questions, such as how such a national agency would be funded or allocate its forensic resources, would also arise. National services, such as the National DNA Data Bank (NDDB) and research and development, also offer specific challenges of resourcing, legality, and privacy under any model in which the RCMP FS&IS was not part of the RCMP.

Finally, the option of simply devolving the RCMP FS&IS laboratories to the provinces is considered but quickly discarded for a number of reasons. First, it is not clear that each province would wish to accept this responsibility. Moreover, current services are organized on a 'national' basis; they would have to be realigned on provincial lines before they could be turned over to provinces. Finally, arrangements would have to be made for cooperation among the provinces to ensure the requisite services were available. For all these reasons, the idea of transferring the RCMP FS&IS function to the provinces is considered neither feasible nor advisable.

Having carried out an analysis of both RCMP FS&IS and the broader environment for forensic science in Canada and abroad, the following conclusions and recommendations are offered.

Conclusions and Recommendations

Conclusion and Recommendation 1

The Senior Management Team of the RCMP FS&IS has undertaken an aggressive change programme (Forensic Investigative Process) that was introduced in the Maritime region in 2009 and which completed its roll-out in British Columbia in June 2011. This programme of work has ensured that police clients are now receiving a significantly improved service, with standard turnaround times of 40-60 days rather than the previously quoted 180 days. The Project Team has been informed that this improvement is welcomed by many of the police clients.

The RCMP FS&IS change programme (Forensic Investigative Process) should be continued and further inefficiencies driven out of the system. As an example, the Project Team has been informed that, within the 40 day process in Biology casework, there is a significant proportion of time in which an exhibit is awaiting an examination or analytical results are awaiting interpretation. Further process improvements should be sought to drive down this dead time to improve the operational service to the RCMP FS&IS clients.

Conclusion and Recommendation 2

The quantitative data analysis using the FORESIGHT methodology leads to the conclusion that, in many investigative areas, the RCMP FS&IS costs per case are high. This is evident whether the comparison is made against the other public sector laboratories in Canada or against a global group of forensic science laboratories.

The Criminal Code of Canada is the same across the country and the public sector laboratories are held to the same legal requirements. The Project Team accepts that there are some extra costs associated with delivering forensic science in Canada but recommends that RCMP FS&IS look to the examination protocols and quality assurance requirements for each of the investigative areas to drive out inefficiencies caused by excessive testing.

Conclusion and Recommendation 3

Part of Section 8 and Appendix G examine the operational requirements placed on the RCMP FS&IS and question whether the service could not be delivered from fewer laboratory sites. The rationale for this suggestion is that the services being delivered from the Regina laboratory (Firearms and remote Biology Case Reporting) and from the Winnipeg laboratory (Toxicology only) are each currently delivered from two other sites.

The Project Team recommends that further consideration be given to the consolidation of the RCMP FS&IS operational base from six laboratory sites to either four or three sites, with the closure of the Regina, Winnipeg and possibly the Halifax laboratories.

Two options have been considered in detail in this report:.

1. Consolidating the staff and operational delivery in four sites with the closure of the Regina and Winnipeg laboratories. The analysis indicates that this option could lead to an estimated upper limit for annual fixed cost saving of **between $4.5 and $7.5 million;**

2. Consolidating the staff and operational delivery in three sites with the closure of the Regina, Winnipeg, and Halifax laboratories. Under this scenario the Project Team estimates the upper limit for annual fixed cost savings would be **between $6.0 and $9.4 million.**

The estimates of potential savings made by the consolidation of laboratory sites are **annual savings**. These savings would have to be offset by one-off costs of about $40,000 for each member of the operational staff who transferred to another site.

Note: There would be additional savings made in Recommendation 3 if managerial, administrative and maintenance staff positions are made redundant as laboratory sites are closed. At this time the Project Team has made the assumption that operational posts, whether in analytical or scientific areas, would be retained. There is a risk in such a major re-organization, in that the RCMP FS&IS could lose very experienced staff if they chose to resign rather than move. If RCMP FS&IS undertakes such a laboratory closure programme, it might be prudent to consider the consequences for the organization if 50% of the staff in the affected laboratories elected to resign.

Conclusion and Recommendation 4

The Project Team has considered the option for moving forensic service delivery to an alternate service delivery model through a Special Operating Agency, a Service Agency, or a Crown Corporation.

Unless there is a government exigency of which the Project Team is unaware, it is recommended that no further consideration be given to the delivery of forensic science through a Special Operating Agency, a Service Agency, or a Crown Corporation. The case is argued in detail in section 8 of this report.

Conclusion and Recommendation 5

There is a small but developing forensic market in Canada, almost exclusively in DNA profiling services. It is clear that the private sector can supply police and Criminal Justice System (CJS) clients with services that RCMP FS&IS do not provide (e.g. Y-STR analysis and mitochondrial DNA sequencing), and can provide routine DNA analyses in extremely short timescales to meet the particular needs of specific investigations. One of these suppliers, Maxxam Analytics Inc., currently has a contractual relationship with RCMP FS&IS.

The options for privatisation of forensic science are set out in Section 8.

The Project Team recommends that RCMP FS&IS explore further the option for outsourcing DNA profiling analysis to the private sector. The private sector suppliers are willing to take on a greater proportion of the analytical processing and suggest that a greater volume of submissions should result in lower costs of analysis and faster analytical processing. This, in turn, should improve service delivery for police clients and ensure the transfer of lessons from private sector practice to the RCMP FS&IS.

Conclusion and Recommendation 6

One of the aims of Budget 2010 is to "*increase research and development in forensic science".* The RCMP FS&IS, the Centre of Forensic Sciences (CFS) and the Laboratoire de sciences judiciaires et de médecine légale (LSJML) currently meet as part of the Canadian Scientific Working Group on DNA Analysis Methods to share ideas and the results of research programmes. The Project Team see significant advantages in extending this programme of inter-laboratory co-operation to other investigative areas. The Canadian Scientific Working Groups thus created would:

- Oversee the development of forensic examination and analytical processes;
- Agree on quality assurance protocols across all three Canadian public sector suppliers;
- Agree on the processes by which new forensic techniques would be introduced into the Criminal Justice System with the support of appropriate Federal and Provincial representatives.

Note: If such pan-Canadian Scientific Working Groups can be established, the lead scientist in each area could act as a Specialist Advisor to provincial and federal Departments of Public Safety, ministers, and legislators or parliamentary committees as required.

The Project Team recommends that the programme of inter-laboratory Scientific Working Groups is extended to include all investigative processes.

Conclusion and Recommendation 7

In the UK, the Police Standards Unit conducted an exercise to examine the impact on crime detection by increasing the rate of scene attendance and targeting the evidential potential of DNA and fingerprints for volume crime. This work was published as the Scientific Work Improvement Model (SWIM) in 2007[3]. This UK-based research suggests that, in considering any alternative forensic service delivery models in Canada, the relationship between the police-based Forensic Investigation Support Service teams and the forensic science provider will be critical.

The Project Team recommends that research is undertaken in Canada to develop a forensic attrition model to further the understanding of the potential 'hidden-demand' for forensic support in the investigation of crime, i.e. the proportion of reported offences for which forensic science support is not currently invoked but the investigation of which might benefit from a scientific intervention.

Concluding Comments

The members of the Project Team have engaged with the RCMP FS&IS and other public and private sector forensic science suppliers and their federal, provincial and municipal clients. The Project Team has realised a set of recommendations for consideration. While these recommendations may be in some respects challenging, the Project Team believes they offer the possibility of significant cost savings for the RCMP FS&IS and the federal government in the short to medium term.

Organizational change

With respect to organizational options and alternate service delivery modes, the first question the Project Team asked was:

> *Is there any advantage to be gained in terms of the delivery of forensic laboratory services through the conversion of FS&IS (or just the six laboratories) to a Special Operating Agency, a Service Agency or a Crown Corporation?*

Section 8 of this report examines this issue in detail; setting out the pros and cons for each of the organizational models. The Project Team observes that:

- *Organizational change per se is almost never <u>the</u> solution to a problem; rather, it should be seen as one tool, perhaps among many, that can enable a solution*. Once the programmatic goals are identified, the organisational model that best supports them can be sought.

- *Organizational change is costly in both financial and human term and it requires time to take effect*. If what is desired is a change in organizational culture and performance, simply changing the legal status or business model of an organization will not deliver instant results.

[3] Summary Report of the Scientific Work Improvement (SWIM) Package, Home Office, 2007

Additional complex issues would need to be addressed if the government chose to convert RCMP FS&IS to a separate organization outside the RCMP (i.e., either a service agency or a Crown corporation). These include:

- *How to accommodate the National DNA Data Bank, which is currently located in and managed by RCMP FS&IS;*
- *How to accommodate the research function if RCMP FS&IS was a separate government organization; and*
- *How to fund a new government organization for forensic laboratory services.*

Experiences from England & Wales and New Zealand indicate that forensic science can be successfully delivered from a government agency or from a Crown Corporation but it is in this type of organizational change that Government faces real choices in terms of organizational profile and independence. What is clear, however, is that experience to date does not show any significant cost savings from the simple conversion of a departmental function to an SOA, Service Agency, or Crown Corporation. Other potential advantages to be gained in terms of more effective management to moving to another organizational structure may exist.

The costs of conversion in terms of time, legislation, dislocation of personnel, additional corporate overhead to be developed, additional reporting requirements, and the development and management of new relationships with clients would not be justified in terms of more effective management or lower costs. As noted, there is no evidence that costs would be lower under these alternative organizational forms.

The decision as to whether to change the organizational status of the RCMP FS&IS depends on the policies and exigencies of government. Prior to making any such change, decisions will need to be made as to what type of organizational structure is required for program purposes and is feasible under the circumstances. These decisions will include how the changed organization would relate to the police and CJS clients and whether the organization would be funded by appropriation or on a cost-recovery basis. If a cost-recovery regime were selected, then a clear understanding of costs, benefits, and value to concerned jurisdictions would have to be communicated to the clients. From the experience of England & Wales and New Zealand, developing a solid costing model and shared understanding of those costs would likely take at least two years (see Appendices A- D).

2.0 Introduction

The Government of Canada indicated in Budget 2010[4] the intention to review the delivery of forensic science services to Canadian law enforcement agencies, stating:

> *"In order to improve the effective processing of forensic materials and help law enforcement more efficiently tackle crime, the Government will explore options for different delivery models, including potential privatization of the RCMP Forensic Laboratory Services. A new approach should improve the timeliness of processing samples; ensure sound financial administration and increase research and development in forensic science".*

To meet this imperative, Public Safety Canada issued a Request for Proposal entitled, 'A Feasible and Sustainable Model for the Delivery of Forensic Service in Canada' (Solicitation Number 201102991) on the 9th of November 2010.

2.1 Project Aims

The objective of the present study is to determine what particular models of forensic service delivery are both feasible and sustainable in the Canadian political, constitutional, legislative, and regulatory context. This requires an examination of the current provision of forensic science in Canada, including a description of the forensic science suppliers, their governance, the disposition of the laboratories, and the services supplied. In addition, the study includes a review of forensic service delivery models in use in foreign jurisdictions and their applicability in Canada.

2.2 Project Team

The Northumbria University Centre of Forensic Sciences (NUCFS) Project Team selected to undertake the research and prepare the reports for this project includes:

- **Dr Christopher Maguire** - Reader[5] in Forensic Science, NUCFS, was, until October 2010, a Senior Forensic Consultant with the Forensic Science Service Ltd. (UK). Dr Maguire has almost 30 years' experience as a practicing forensic scientist and laboratory manager.

- **Dr Max Houck** – formerly of West Virginia University (WVU) has experience of research and quantitative analysis in relation to the 'business' of forensic science;

- **Dr Paul Speaker** is a Professor of Finance at WVU and has expertise in econometric modelling of forensic science service delivery through the development of the FORESIGHT business modelling tool;

- **Professor Robin Williams** (NUCFS) has experience in qualitative research into the utilization of forensic science in the Criminal Justice System;

The NUCFS team was pleased to have the support of **Dr James R. Mitchell**, a founding partner of the Ottawa-based, policy consulting firm Sussex Circle. Dr Mitchell has many years of experience in the analysis and resolution of complex public policy issues, and was formerly Assistant Secretary of Cabinet (Machinery of Government) and was a principal advisor on the 1993 reorganization of the federal government.

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[4] James M Flaherty, Minister for Finance, Budget 2010 'Leading the Way on Jobs and Growth' p. 127

[5] The academic position of Reader in the UK is equivalent to Senior Associate Professor in North America

3.0 Canada – Context and focus

Canada consists of ten provinces and three territories, each with its own provincial/territorial government and legislature. It is the world's second largest country by total area, having a land mass of approximately 10 million square kilometres. Statistics Canada estimates the current population to be 34.6 million, which is approximately half that of the UK.

3.1 Crime and Criminality in Canada

The crime figures recorded by the Canadian police reflect the population density of the provinces and major cities, Ottawa, Vancouver, Edmonton, Toronto, Montreal, and Québec. The majority of the recorded violent crimes, property crimes, and impaired driving cases occur in Ontario, Québec, British Columbia, and Alberta (see Appendix F).

3.2 Crime trends[6] in Canada

In 2010, police-reported crime continued a downward trend. There were 77,000 fewer police-reported crimes in 2010 than in 2009 with decreases in the numbers of property crimes accounting for most of this declining trend; the falling crime rate could impact on the use of forensic science by the police, as has happened in England & Wales.

Statistics Canada also calculates a **Crime Severity Index,** which takes into account the volume of offences and the seriousness of the crime; each offence is assigned a weight derived from the average sentences handed down by the criminal courts.

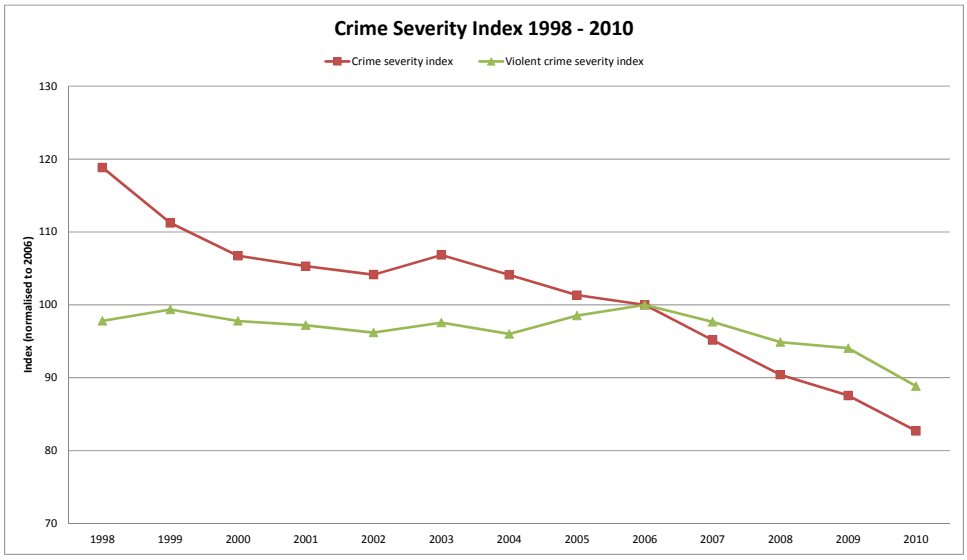

Figure 1 - Crime Severity Index for Canada 1998 - 2010

Figure 1[7] shows a continuing decline in the Crime Severity Index for Total Crime and Violent Crime in Canada from 1998 to 2010. The data is normalized such that 2006 equals a value of 100.

[6] Brennan, S., Dauvergne, M. *Juristat* article (July 2011) Police-reported Crime Statistics in Canada, 2010
[7] Statistics Canada from CANSIM table 252-0052

Highlights from the *Juristat article*, 'Police-reported Crime Statistics in Canada 2010' (published July 2011) include:

- The 2010 crime rate reached its lowest level since the early 1970s;
- In 2010 the homicide rate dropped 10% and reached its lowest since the mid-1960s;
- Police reported decreases in attempted murder, robbery, and assault cases;
- Most of Canada's census metropolitan areas reported decreases in the Crime Severity Index; and
- Canada's Violent Crime Severity Index fell by 6%, the fourth consecutive annual decline.

3.3 Policing Canada

Policing in Canada is complex and is regulated by the federal and provincial/territorial governments. *The Constitution Act, 1867*, sub section 91 (27)[8] confers authority on the federal Parliament to legislate in relation to criminal law and procedure. **Note:** All of the provinces and territories are covered by the same *Criminal Code of Canada (1985)*[9]. The various police forces in Canada have the mandate to deliver the following core functions:

- ***Law enforcement*** - investigating crime and participating in the prosecution of criminals;
- ***Crime prevention*** - promoting attitudes and behaviours to create and maintain safe communities;
- ***Maintenance of public order*** - preventing breaches of the peace and promoting a sense of security in communities;
- ***Emergency response*** - to stabilize and control public order emergencies and natural or other disasters; and
- ***Assisting victims of crime*** - providing support, timely information, and appropriate referrals to victims of crime.

Within the context of their core policing functions, the police powers in Canada are separated as follows:

- ***Federal*** - The RCMP enforces federal statutes and laws made by, or under the authority of, the Canadian Parliament;
- ***Provincial*** - Provincial police forces enforce the *Criminal Code* and provincial statutes within each province, or areas not served by a municipal police force;
- ***Municipal*** - Municipal police forces enforce the *Criminal Code*, provincial statutes, and municipal by-laws within the specific boundaries of a municipality, or within several adjoining municipalities, which make up a region.

Note: The mandates of the various levels of policing are becoming increasingly inter-dependent in response to changes in the nature of crime. Integration of police services is essential to combat serious and organized crime, which can cross provincial, territorial, and international boundaries.

[8] http://laws.justice.gc.ca/eng/Const/Page-5.html accessed 28th September 2011
[9] Criminal Code, RSC 1985, c C-46, http://canlii.ca/s/amtp retrieved on 2011/09/28

3.4 Royal Canadian Mounted Police – Federal, Provincial and Municipal policing mandate

The Royal Canadian Mounted Police (RCMP) is Canada's federal police force and it has diverse responsibilities, including the policing of eight provinces and three territories and more than 200 municipalities[10]. Three of the Canadian provinces (Ontario, Québec, and Newfoundland and Labrador) operate independent provincial police forces.

Contract policing is a long established police services model. It is considered to be a strategic advantage for the RCMP to tackle crime at the federal, provincial/territorial, and municipal levels. More than 60% of the RCMP sworn members provide support under contract policing agreements. The RCMP also provides federal policing services across Canada, including to the provinces of Ontario and Quebec, focusing on organized crime, economic integrity, border enforcement, and matters of national security.

The Police Service Agreements are bi-lateral contracts between the federal government and provincial, territorial, and municipal contract jurisdictions. The individual agreements address administrative issues such as authorities and responsibilities and guidelines for deployments, and determine the policing priorities and budgets. The RCMP is not a signatory to these Agreements but works with the provincial, territorial, or municipal authorities to establish the level of policing, the policing priorities, and the budget.

The Police Service Agreements are 'fee-for-service' agreements based on a cost share arrangement between the federal government and contracting authority. The cost share basis is shown in Table 1:

Contracting Authority (CA)	CA contribution	Federal Govt. contribution
Province or Territory	70%	30%
Small Municipality (Population <15,000)	70%	30%
Larger Municipality (Population >15,000)	90%	10%
Municipality (First time request)	100%	-

Table 1 - Cost share arrangements for RCMP Contract Policing Agreements

The RCMP is responsible for collecting these revenues. In 2010/11 the costs of contract policing was estimated to be $2.2 billion of which the federal government contributed approximately $600 million.

The current contract policing agreements between the federal government and the provincial/territorial governments are due to expire on 31st March 2012. Negotiations to renew these agreements for a further twenty years have resulted in agreements in principle or signed agreements for all parties[11] [12].

[10] Under the auspices of section 20 of the RCMP Act (1985

[11] http://www.prairiepost.com/news/sw-alberta-news/rcmpaccidentscrimestoppers/3200-alberta-and-canada-sign-new-20-year-contract-for-rcmp-as-provincial-police-service.html

[12] http://news.gc.ca/web/article-eng.do?nid=621019 – accessed 30th September 2011

The RCMP Contract Policing model is perceived to generate a number of benefits for the contracting authorities. These include:

- Adaptable policing model sharing national/provincial/municipal policing priorities;
- Coordination of local and national intelligence to combat serious and organized crime and national security threats;
- An RCMP officer in a contract policing jurisdiction who is able to enforce both provincial and federal statutes, a particular advantage in remote areas of Canada;
- Ability to deploy contract police officers across Canada to respond to major policing events;
- Enables national focus on policing programmes such as Crime Reduction Strategy, Family Violence, and Youth Justice; and
- Economies of Scale – sharing common services, training and information systems.

3.5 Policing Ontario and Quebec

The responsibility[13] for policing services in Ontario falls to the **Ontario Provincial Police (OPP)** or in the larger municipal communities, to municipal police forces. The OPP provides contract policing services to 141 of Ontario's municipalities whist a further 172 municipalities receive OPP non-contract policing services.

In Quebec, the **Sûreté du Québec (SQ)** provides policing services in complex cases, organised crime investigations, inter-provincial (or cross-border) investigations, and police support services to the province. The Ministry of Public Security, Quebec, has signed agreements with 80 County Regional Municipalities under which the Surêté du Québec (SQ) provides policing services to over 1,200 municipalities. The level of policing provision supplied by Municipal Police Forces (CPM) is defined by the size of the municipal population[14].

First Nations Police forces[15] [16]: First Nations communities in Canada are covered by First Nations Police forces or by the RCMP, OPP, or SQ.

The RCMP provides federal policing services across Canada including to the provinces of Ontario and Quebec supporting the Ontario Provincial Police, the Surêté du Québec, and other municipal police forces as required.

[13] http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90p15_e.htm#BK5 - accessed 2nd October 2011
[14] Police Act, RSQ, cP-13.1 June 2011 http://www.canlii.org/en/qc/laws/stat/rsq-c-p-13.1/latest/rsq-c-p-13.1.html
[15] OPP Annual report 2101 http://www.opp.ca/ecms/files/250258838.6.pdf - accessed 2nd October 2011
[16] Created under sections 90 to 102 of the Police Act (1990) and tripartite agreements between a band council, the Government of Québec and the Government of Canada.

3.6 Initial Crime Scene Examination – Police Forensic Investigation Support Services Teams

The RCMP, the Ontario Provincial Police, the Surêté du Québec, and some of the larger Municipal Police forces maintain Forensic Identification Support Services teams. These specialists, who are sworn officers, are trained in techniques of evidence identification and recovery, and attend scenes of major and serious crimes to recover and preserve trace evidence. They may subsequently offer expert opinion testimony on the relevance of that evidence at the scene. The tasks performed by officers of the Forensic Investigation Support Service include:

- Collection of samples for potential DNA analysis;
- Fingerprint comparisons and identification;
- Forensic photography and digital imaging;
- Crime scene videos and forensic video analysis;
- Locating and preserving trace evidence; and
- Blood Pattern Analysis.

In some of the larger police forces and RCMP detachments, separate teams of civilian Scenes of Crime Officers undertake similar duties at property crime scenes involving Breaking & Entering (burglary) and Vehicle Crime.

3.7 Police use of forensic science

The police use of forensic science has a number of dependencies as described in Figure 2 below. Any changes to the mechanism by which forensic science is delivered in Canada will have to take account of these dependencies.

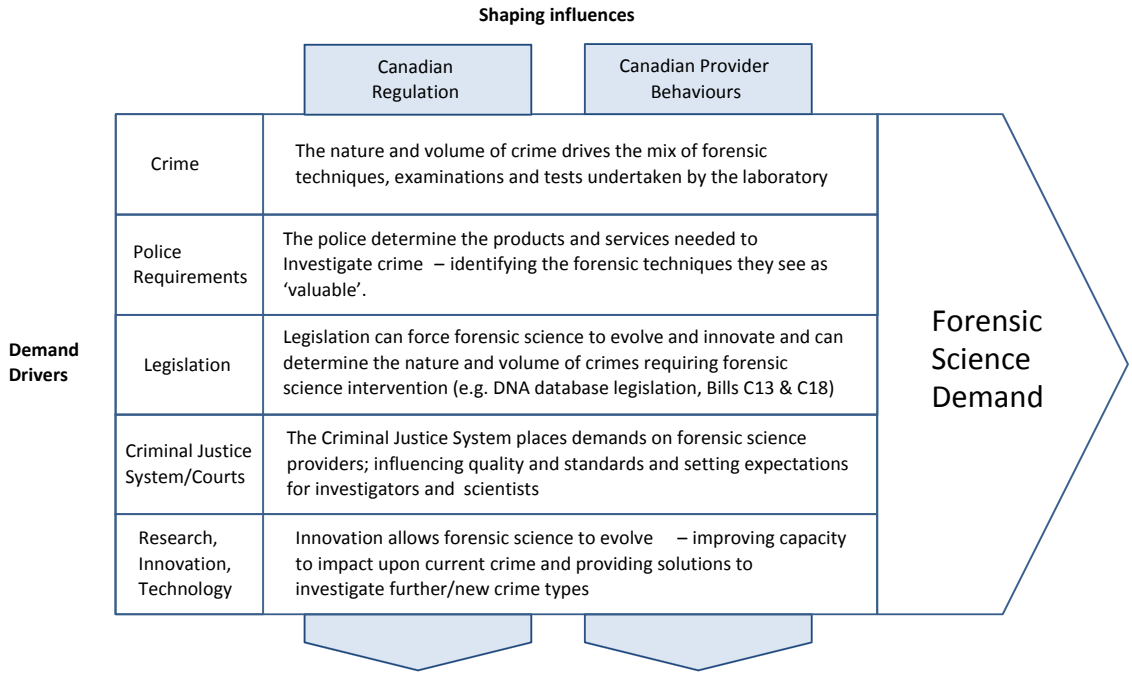

Figure 2 - Drivers on demand for forensic science support

The demands placed on the forensic science suppliers in Canada, as in other jurisdictions, are being driven by the changing nature of crime, policing priorities moving from purely evidential (or post-charge) corroborative work to investigative (or case-building) activities which require faster forensic turnaround times, legislative and regulatory changes, and the evolution of forensic technologies. In addition, the regulatory context in which the forensic laboratories operate and the behaviours of the forensic science providers (including their relationships with police and CJS client groups; any mechanisms for limiting submissions; quality assurance programmes; attitudes to research and innovation; training provision, etc.) also act upon the demand drivers.

The police and crown counsel respondents to the qualitative interviews all commented positively on the value and utility of forensic science support to the investigation, or to the development of a prosecution case and trial process. Defence counsel referred to the phenomenon known as the 'CSI effect' , suggesting that juries expect to hear of forensic evidence in cases presented to them in court, and that the lack of forensic evidence weakened the *perception* of a prosecution case.

The Project Team found that there is little current information as to the potential 'hidden-demand' for forensic support, i.e. the proportion of reported offences for which forensic science support is not invoked, but the investigation of which might benefit from a scientific intervention. An understanding of the level of this hidden demand and potential for forensic interventions to impact upon crime investigation can be improved by the use of a forensic attrition model.

In the UK, the Police Standards Unit conducted such an exercise for volume crime. This work was published as the Scientific Work Improvement Model (SWIM) in 2007[17]. This work included:

- Recording the number and type of scenes attended by crime scene examiners;
- Estimating the scenes attended as proportion of the police reported crimes;
- Recording the number of forensic materials (DNA and fingerprints) recovered; and
- Recording the number of detections or interventions made by each evidence type.

The results of this study led to the refocusing of scene of crime activities and increases in crime scene attendance in a number of police forces. The SWIM model indicates that resourcing, training, and tasking the Forensic Investigation Support Service teams appropriately will result in an increase in forensic submissions, and increased crime detections. This UK-based research suggests that the utilization and potential value of forensic evidence is *not* confined to the laboratory processes and results; it is substantially dependent on the identification and collection of evidence, which is the remit of the Forensic Identification Support Service teams.

The work of a forensic science provider may only be a small part of a 'value chain' that stretches from the reporting of a crime, through the police investigation and prosecution case building, to court disposal. Forensic science has the potential to impact at several points in this value chain but defining 'value' in the context of a police investigation or in the criminal justice system may be very difficult.

[17] Summary Report of the Scientific Work Improvement (SWIM) Package, Home Office, 2007

4.0 Data Collection Methodologies – Qualitative, Quantitative and Canada specific

4.1 Analysis of Client needs – qualitative analysis

The methodology used for the collection of primary data concerning client views on their needs and expectations of a forensic science provider and their perception of the service level offered by their current provider is the semi-structured, direct interview. Researchers worked with an interview protocol (see Appendix E) with a list of broad topics, which also allowed sufficient opportunities for respondents to raise issues not in the guide, and for interviewers to add additional or follow-up questions. This interview methodology allowed the researchers to compare the responses of different respondents to specific topics, yet allowed the respondents to raise issues not already considered.

4.2 Analysis of laboratory performance – quantitative analysis

To collect annual performance data from the RCMP FS&IS, the Centre of Forensic Sciences (Toronto), the Laboratoire de sciences judiciaires et de médecine légale (Montréal), and the other contributing laboratories, the Project Team used the LabRAT self-evaluation tool developed by Professor Speaker and Dr Houck at West Virginia University. The LabRAT tool was developed for the FORESIGHT programme, of which the RCMP FS&IS is a founding participant. FORESIGHT is:

> *"... a business-guided self-evaluation of forensic science laboratories across North America. The participating laboratories represent local, regional, state, and federal agencies. ... Standardized definitions for metrics evaluate work processes, linking financial information to work tasks and functions. Laboratory managers can use these functions to assess resource allocations, efficiencies, and value of services - the mission is to measure, preserve what works, and change what does not"*[18].

The FORESIGHT respondent group includes laboratories in North America, Europe, Australasia, and Asia. The data were collected to measure, assess, and benchmark performance for improving efficiencies, quality, and service in forensic service providers. Benchmarking is improving performance by recognizing, understanding, and integrating better practices. A standard of comparison is necessary for benchmarking and, until the FORESIGHT Project no such standard existed in forensic science. QUADRUPOL and its successor, project FORESIGHT, created the standard methods to collect management data, and these provide the basis for broad, yet deep, comparisons between forensic laboratories using robust measures.

The FORESIGHT Project involves standardizing definitions for metrics to evaluate work processes, and linking financial information to work tasks and functions. The data are collected through the Laboratory Reporting and Analysis Tool (LabRAT). Costs are reported in adjusted native currencies (Pounds, Euros, US or Canadian Dollars, etc.) for ease of internal evaluation; costs can easily be compared using recorded exchange rates[19]. The data collected from LabRAT is collated and compared to produce analyses and reports (see Appendices H – K).

[18] FORESIGHT Overview, West Virginia University

[19] For the purposes of this project all of the global data was converted to 2010 Canadian dollar values.

FORESIGHT uses **cross-sectional laboratory data comparisons** to identify and examine processes, strategies, resources, and allocations at a detailed level. The goals are to improve the efficiency of the science offered to the criminal justice system from a business perspective, whilst also maintaining quality. In FORESIGHT, the intent is to distinguish between "know that" (data or information) and "know how" (putting "know that" to use), facilitating the latter through standardization, collaboration and analysis, whilst retaining innovation to solve complex problems.[20]

Laboratory managers in the FORESIGHT group use these reports to assess their resource allocations, efficiencies, and value of service; sharing experiences with, and learning from, others in the group.

4.3 Econometric modelling

The cross-sectional data provided by the FORESIGHT respondent laboratories was analysed using an econometric modelling methodology developed and published by Professor Speaker.[21,22] The cross-sectional econometric model provides the means to compare feasible and sustainable models for cost effectiveness. The dependent variable developed for each area of investigation is the Cost per Case, which allows the development of a model to explain cost minimization according to microeconomic theory. Business finance tools include the use of **DuPont expansions** to show the relationship between metrics. For the forensic industry, the return on investment and its inverse, the cost per case, can be explained by a combination of several of these key measures.

The model begins with a foundation in economic theory regarding the optimal size of operation as average cost is minimized with respect to the level of output. Microeconomic theory indicates that producers of goods or services will gravitate towards the efficiency related to operating facilities of a size to achieve perfect economies of scale. When the data for RCMP FS&IS for the financial year 2010-2011 are placed into the estimated model, a baseline is obtained from which to compare the alternative model frameworks.

These empirical, cross-laboratory, data include a verified global sample of 64 laboratories and represent the world's most extensive dataset on forensic laboratory budget, personnel, and casework.

[20] Brown, J., & P. Duguid. 2002. *The social life of information*. Boston: Harvard Business School Press.
[21] Speaker, P., (2009b) The Decomposition of Return on Investment for Forensic Laboratories Forensic Science Policy and Management, 1: 96–102.
[22] Speaker, P., (2009a) Key Performance Indicators and Managerial Analysis for Forensic Laboratories, Forensic Science Policy and Management, 1: 32–42.

Quantitative data collected using the LabRAT form, created for the FORESIGHT project, were used to populate the econometric models. The quantitative data include:

- Types of casework (by investigative area) and number and types of items examined per case;
- Turnaround times (or cycle times);
- Number of cases/exhibits in processing units (work loading);
- Type and Number of Cases in 'backlog' (i.e. cases not worked for more than 30 days since receipt);
- Staffing levels and work patterns, levels of staff utilization and down time (non-operational);
- Capital expenditure, Salary, and Running costs (consumables, utilities, etc.);
- Costs/case, costs/test, cost/item.

4.3.1 Limitations to the current modelling

The Centre of Forensic Sciences (CFS) has provided data for comparative purposes and the Laboratoire de sciences judiciaires et de médecine légale (LSJML), Montréal, has compiled its data into the FORESIGHT format for the first time.

The Project Team was able to cross-compare the data received from CFS and LSJML with that received from the RCMP FS&IS in order to assess the relative performances of the Canadian laboratories. From the data submitted by the Canadian public sector laboratories measures were derived to represent Canadian laboratory mean and minimum values. In addition, the performance of the RCMP FS&IS was compared with the performance of a global group of laboratories using the metrics of the LabRAT tool.

The econometric modelling tool developed by Professor Speaker included the addition of variables to:

- Allow for the combination of effects from input costs, cultural demands, and judicial mandates that might be unique to the Canadian experience;
- Recognize the special mandates of the national laboratory (e.g. post-blast explosives investigation);
- Allow for the cost structure of a multi-laboratory system, recognising it might differ from the cost structure of a single site laboratory.

One important specification could not be included. Among the list of unique characteristics of the RCMP FS&IS mandate in some investigative area were legislated duties that require significant time outside of casework. A prime example of this is the requirement to deliver Breath Testing Training from the Blood Alcohol area. To account for this, a variable CASEWORK% (defined to be the percentage of total hours devoted to casework) was calculated from the LabRAT submissions for the global comparison group. The RCMP FS&IS was not able to submit the hours in casework for the financial year 2010-2011 and the variable could not be included. No other available measure has been suggested to proxy for this effect. Where this issue appears to affects the RCMP performance adversely appropriate comments have been made in this text.

5.0 Canadian Public Service Forensic Service Providers

5.1 RCMP Forensic Science and Identification Services (RCMP FS&IS)

The RCMP Forensic Science and Identification Services is an integral part of Policing Support Services under the leadership of an Assistant Commissioner. FS&IS has a mandate to provide quality investigative support services to police and the Criminal Justice System across Canada and to international policing partners. These services and programmes include:

- **Forensic Science Laboratory Services** – with laboratories located in Halifax, Ottawa, Winnipeg, Regina, Edmonton, and Vancouver;
- **Integrated Forensic Investigation Support services** – National Policy Centre supporting Forensic Investigation Support Services teams across Canada; Disaster Victim Identification, CBRNE crime scene examination, national forensic imaging services, and regional automated fingerprint identification system;
- **Canadian Criminal Real Time Identification Services** – national repository for fingerprints and criminal record information; and
- **National Services and Research** – National DNA Data Bank operations and forensic science research programmes.

The RCMP FS&IS maintains six forensic science laboratories across Canada and forensic examinations and analyses are conducted in the following areas:

- **Biology/Serology** - location and identification of body fluids and hairs and the recovery of these biological materials for DNA profiling;
- **DNA Profiling** – extraction of DNA from body fluid stains and preparation of DNA profiles;
- **Toxicology** – analysis of body tissues and fluids, tablets, powders or liquids for alcohol, drugs or poisons in cases of impaired driving, sexual assault, fire death, homicide, or crimes involving drugs;
- **Trace Evidence** – examination and analysis of materials including paint and glass, fibres, fire debris;
- **Explosives analysis** – examination of materials recovered from post-blast explosive scenes and the identification of potential explosives
- **Firearms and ballistics** – identifying weapons, relating a bullet or cartridge to a particular weapon, determination of mechanical condition of a weapon, and weapon classification;
- **Document Analysis**
    - Documents – authenticity, alterations, identification of inks, indented writing etc;
    - Counterfeiting – examination and identification of counterfeit money & documents ;

The service delivery streams for each programme in each of the RCMP FS&IS laboratories are shown in Table 2.

	Halifax	Ottawa	Winnipeg	Regina	Edmonton	Vancouver
Site Management & Support	✓	✓	✓	✓	✓	✓
Evidence Management	✓	✓	✓	✓	✓	✓
Biology - Search		✓			✓	✓
Biology - DNA Analysis		✓			✓	✓
Biology – Case Reporting	✓	✓		✓	✓	✓
Toxicology - Analysis	✓		✓			✓
Toxicology – Case Reporting	✓		✓			✓
Firearms/Ballistics - Examination	✓			✓		✓
Firearms/Ballistics – Case Reporting	✓			✓		✓
Firearms/Ballistics - GSR		✓				
Trace Evidence - Search					✓	
Trace Evidence - Analysis					✓	
Trace Evidence – Case Reporting					✓	
Document Analysis - Alterations		✓				
Document Analysis - Counterfeiting		✓				
Document Analysis – Case Reporting		✓				
Explosives - Analysis		✓				
Explosives – Case Reporting		✓				

Table 2 - Disposition of operational services in RCMP FS&IS laboratories

None of these laboratories provides a 'full-service' programme; although RCMP FS&IS can be described as a full-service forensic science provider which operates from multiple sites.

5.1.1 RCMP FS&IS Forensic Science Laboratory Services – reviews and current developments

The RCMP forensic laboratory service has been subject to a series of audits and reviews over the last 20 years and the theme of consolidation or rationalisation of laboratory sites is not a new issue. Following a report of the Office of the Auditor General (OAG) in April 2000[23] the House of Commons Standing Committee on Public Accounts[24] recommended that the RCMP develop a strategy to rationalize its forensic laboratory facilities and use data generated by performance measurement to redirect resources.

In a separate exercise, Budget 2005 recommended the closure of the Edmonton site since, at the time, the Edmonton laboratory site was a leased building and the lease was up for renewal. The potential savings were calculated as $4.5million over four years[25]

RCMP FS&IS acted upon each of these recommendations. Following the OAG report of 2000, there were plans to close the laboratories in Regina and Winnipeg but these plans were reconsidered under pressure to retain skilled jobs in Saskatchewan and Manitoba. Again, following the 2005/06 Budget Expenditure Review, the RCMP purchased the Edmonton laboratory building and the planned closure did not take place.

The Report of the Auditor General 2007[26] recommended that RCMP should develop measures of service efficiency and effectiveness in consultation with their clients, design mechanisms for identifying bottlenecks in the process, and should determine the systems, procedures, and resources required to eliminate a backlog in biology services.

Following the OAG 2007 report, the RCMP FS&IS contracted Forensic Science Service Ltd. to review the organization, processes and resourcing of the Biology Services Division. The outcome of this review was known as the *'iforensic'* report (2008)[27]. RCMP FS&IS acted on the outcomes of this review to streamline the organization, and eliminated the backlog in the biology service line.

With the publication of the *iforensic* report in 2008, the RCMP FS&IS started an aggressive transformation programme, known as the Forensic Investigation Process (FIP), with the objectives to:

- Maximise the service delivery resource within the available budget;
- Develop a new Forensic Investigation Process;
- Embed process improvements across the delivery sites;
- Explore solutions for funding and capacity issues;
- Review FS&IS Governance structures;
- Ensure long term sustainability.

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[23] Report for the Auditor General, Chapter 7, Services for Canada's Law Enforcement Community, April 2000
[24] Report of the House of Commons Standing Committee on Public Accounts, October 2000
[25] http://www.expenditurereview-examendesdepenses.gc.ca/tab/ds-em-eng.asp
[26] Report of the Auditor General, Chapter 7, Management of Forensic laboratory Services – RCMP, May 2007 http://www.oag-bvg.gc.ca/internet/docs/20070507ce.pdf
[27] http://www.rcmp-grc.gc.ca/fsis-ssji/report-rapport/final-eng.htm

The Forensic Investigation Process was piloted in the Atlantic region in September 2009 and was extended to include all of the clients and operational laboratories by June 2011. RCMP FS&IS continues to improve this process in conjunction with its clients and a further round of change is currently being implemented.

One major outcome of this FIP programme for the RCMP FS&IS clients is the introduction of the Forensic Assessment Centre (FAC). This acts as the central point for case submissions and specific discussions between the RCMP FS&IS and the investigating police officers and prosecuting counsel. The FAC provides a triage and screening service to ensure that only forensic examinations relevant to the investigators' issues are undertaken. In addition, working cooperatively with police officers to determine the samples pertinent for examination has reduced the number of samples submitted for complex cases, and has allowed RCMP FS&IS to eliminate DNA sample 'quotas'. The effect of this change has been to reduce the case turnaround times and enhance productivity. In many disciplines the quoted diary date is now 40 - 60 days, rather than the 120 - 180 days previously offered to the police. Many clients commented to the Project Team that this was a significant improvement in RCMP FS&IS service.

The RCMP FS&IS records the number of cases in which the police submissions are declined. The numbers of declined cases for the fiscal years 2008 to 2010 are shown in Table 3 below:

Fiscal year	No. of new[28] cases received	No. cases declined	% cases declined
2008/09	8909	366	4.1%
2009/10	9475	662	7.0%
2010/11	9473	625	6.6%

Table 3 – Number of cases where the submission was declined (by fiscal year)

A case might be rejected by the RCMP FS&IS if the examination requested would not resolve the issue in question or move the investigation forward. For example, in a sexual assault case where consent is the only issue, there may be no forensic reason to examine and test the intimate samples contained within the Sexual Assault kit. If these are the only exhibits to be submitted, then the case might be declined following a discussion with the Investigating Officer. It can be seen that the number of cases rejected by RCMP FS&IS is a small percentage of the total cases received.

[28] RCMP FS&IS defines new cases as those that received a particular file number for the first time

The governance of the RCMP FS&IS also underwent a change as part of this FIP project and is now led by two senior management boards, one representing the Forensic Services branch and the other representing the Information and Identification Services branch. Within the Forensic Services branch additional governance is provided by the Forensic Integrated Operations Board (FIOB) and the Policy Programme Support Board (PPSB). The RCMP FS&IS management structure is shown in Figure 3 below:

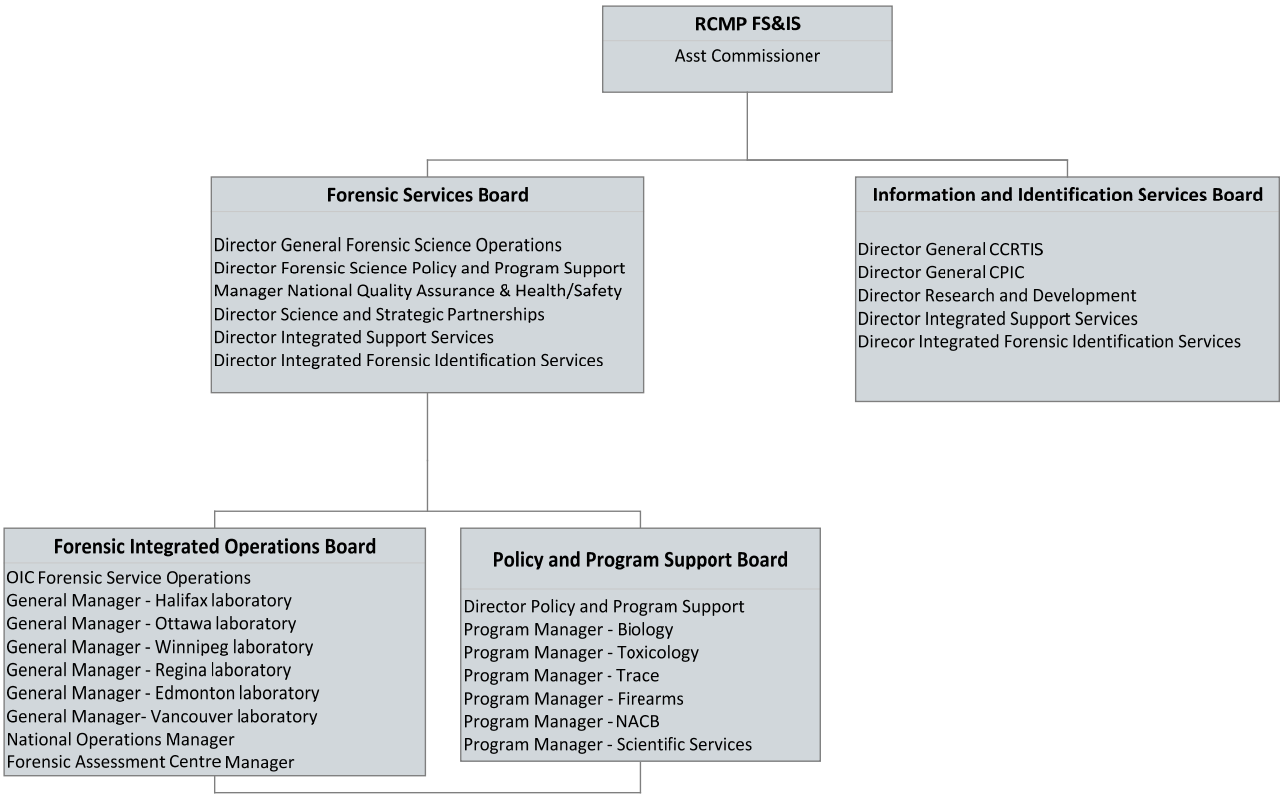

Figure 3 - RCMP FS&IS Management structure

This appears to be a complex management structure but it has been developed over several years to manage the operational processes covering six forensic science laboratories and the multiple dependencies between operational delivery, policy and quality management, research and innovation, and police information and identification services (including fingerprints, criminal records, IT services and the National DNA Data Bank).

Tables 4 – 8 show the changing number of completed service requests in each of the major RCMP FS&IS programme areas; Biology, Firearms, National Anti-counterfeiting Bureau, Toxicology, and Trace evidence[29].

Program	**Biology**		
Year	**2008/09**	**2009/10**	**2010/11**
Offence Type			
Homicide/Att Murder	781	949	885
Sexual Offences	1141	1335	1512
Other offences against the person	696	1025	1261
Breaking & Entering and other Property Crimes	1195	1702	2395
Total Crime Submissions	**3813**	**5011**	**6053**

Table 4 – Service requests Biology 2008/9 – 2010/11

There is a significant annual increase in the Biology programme loading, largely driven by increasing submissions in Property Crime (DNA Profiling). This change is due to an increase in the numbers of secondary offences being eligible for submission to the NDDB and the removal of the DNA sample quota under the Forensic Investigation Process.

Program	**Nat. Anti-Counterfeiting Bureau**		
Year	**2008/09**	**2009/10**	**2010/11**
Offence Type			
Homicide/Att Murder	12	10	12
Sexual Offences	3	0	4
Other offences against the person	18	17	32
Breaking & Entering and other Property Crimes	228	256	368
Total Crime Submissions	**261**	**283**	**416**

Table 5 – Service Requests NACB 2008/9 - 2010/11

There is also a large increase in submissions of service requests to the National Anti-Counterfeiting Bureau, again driven by examinations involving property crime offences.

[29] RCMP data JTRAC # SBI-648 created 28/10/2011

Program	Toxicology		
Year	**2008/09**	**2009/10**	**2010/11**
Offence Type			
Homicide/Att Murder	313	259	225
Sexual Offences	178	209	183
Other offences against the person	1583	1861	2415
Breaking & Entering and other Property Crimes	53	37	33
Total Crime Submissions	**2127**	**2366**	**2856**

Table 6 - Case Submissions Toxicology 2008/9 - 2010/11

The work of the Toxicology programme has increased over the last three years with rising submissions of service requests in Other Offences against the Person, which include assault. Toxicology submissions in relation to sexual offences, homicide, and other property crime categories appear to be flat or falling.

Note: The requirement for the RCMP FS&IS to provide training courses for police officers responsible for evidential breath testing is having an impact on the RCMP FS&IS in those provinces where RCMP is responsible for policing. A significant proportion of the Reporting Scientists' time is currently spent in supporting this training and, as the RCMP FS&IS does not record the time spent in casework, this training also adversely affects the apparent COST/CASE value for Blood Alcohol Analysis.

Program	Firearms		
Year	**2008/09**	**2009/10**	**2010/11**
Offence Type			
Homicide/Att Murder	289	213	218
Sexual Offences	4	4	1
Other offences against the person	236	243	257
Breaking & Entering and other Property Crimes	927	1015	1037
Total Crime Submissions	**1456**	**1475**	**1513**

Table 7 - Case Submissions Firearms 2008/9 - 2010/11

The work in the firearms programme shows a slow growth in service requests from 2008/9 to 2010/11.

Program	Trace Evidence		
Year	**2008/09**	**2009/10**	**2010/11**
Offence Type			
Homicide/Att Murder	94	113	75
Sexual Offences	15	9	12
Other offences against the person	112	99	103
Breaking & Entering and other Property Crimes	249	193	204
Total Crime Submissions	**470**	**414**	**394**

Table 8 - Case Submissions Trace Evidence 2008/9 - 2010/11

The submissions of cases involving the examination of Trace Evidence (paint, glass, gunshot residues, hairs, fibres etc.) are declining. This could be due to the clients' perception of the evidential value of some evidence types (e.g. Glass), compared with the level of individualization offered by body fluid evidence and DNA profiling analysis.

Note: A deeper analysis of the forensic effectiveness of trace evidence is required to determine whether RCMP FS&IS should continue to recover and analyse these types of evidential materials or consider contracting with another forensic provider (Centre of Forensic Sciences, Toronto, or Laboratoire de sciences judiciaires et de médecine légale , Montreal) to undertake this work.

5.1.2 Outline of the RCMP FS&IS process

The RCMP FS&IS case process from crime report to court disposal is outlined below:

- The police receive notification of the commission of a crime and investigate accordingly;
- Crime Scene Examiners from the Forensic Identification Support Service unit attend to identify and collect relevant evidential materials;
- The Investigating Officer outlines the details of the case and the required examination using a C414 laboratory submission form and forwards the form by email, fax, or post to the Forensic Assessment Centre (FAC) in the Ottawa laboratory;
- A case is allocated to a member of the Forensic Assessment Centre who becomes the Case Manager[30] and primary point of contact for the Investigating Officer. The most complex cases are allocated to a Forensic Strategist; less serious cases will be allocated to a Case Advisor;
- The case requirements are checked and agreed between FAC and the Investigating officer, and the case is then allocated to a laboratory team with the facilities and capacity to undertake the work. The officer is informed to which laboratory the case is to be submitted. This may involve the transfer of exhibits across Canada using a secure courier service;
- The loading and capacity of the operational delivery teams is monitored on a daily basis by the National Operations Manager who informs FAC if there are any delivery issues;
- The work is received by the nominated laboratory and processed as agreed. The results of evidential examinations and analytical service sections (Toxicology, Trace Evidence, and DNA profiling) are sent to the appropriate Reporting Scientist. In the Serology/Biology area, the Reporting Scientists often work remotely from the Evidence Recovery and DNA Analysis units and the results of the examinations are sent to them electronically;
- The Reporting Scientist completes the laboratory report and, after the appropriate quality assurance and administrative checks, the laboratory report is sent to the Investigating Officer;
- The laboratory reports are a factual statement of the examination undertaken and the results obtained;
- In conjunction with police and other witnesses, the forensic scientist will attend court, if required, to give evidence as an expert witness;
- To improve the performance of the scientists and to inform the RCMP FS&IS court training, Crown and Defence Counsel are invited to comment on the performance of the scientist in court by use of a specific feedback mechanism[31].

[30] FAC Directive11/21/11 – changed the term 'Case Owner' to 'Case Manager' for all FAC documentation
[31] Quality of Service Questionnaire – Court Testimony Form

5.1.3 Forensic Science Research

RCMP FS&IS also maintains an active Research Directorate the mandate of which is to:

- Enable the current and future application of forensic science within the FS&IS by active engagement in research and participation and/or collaborations nationally and internationally;

- Develop a documented and sustainable strategy for research and development in FS&IS.

The FS&IS Research Directorate has seven staff whose work is directed to the enhancement of operational casework delivery. This typically includes the validation of new equipment, the development and validation of new processes, or the development of a reference or comparison database (e.g. paint chips, AFIS). Other projects involve the development of sample preparation processes to prevent contamination issues and the development of protocols for dealing with samples from CBRN incidents.

In 2010/11 the FS&IS Research Directorate:

- Received internal, operational funding of $42,000;
- Conducted more than $430,000 in research through in-kind contribution, collaborations, and independent research grants;
- Supported operational delivery by assisting with troubleshooting exercises, problem solving and technical support;
- Delivering improved methods that will have a major impact on Biology and DNA operations – including Dual Quant DNA Quantitation, Y-STRS and Sperm Hy-liter projects;
- Supported the development of FS&IS staff through small research project work.

The RCMP FS&IS, the Centre of Forensic Sciences (CFS) and the Laboratoire de sciences judiciaires et de médecine légale (LSJML) currently meet as part of the Canadian Scientific Working Group on DNA Analysis Methods to share ideas and the results of research programmes. It would be advantageous to the delivery of forensic science in Canada if this programme could be extended to include all casework processes.

Note: One of the aims of Budget 2010 is to "*increase research and development in forensic science".* The RCMP FS&IS, the Centre of Forensic Sciences (CFS), and the Laboratoire de sciences judiciaires et de médecine légale (LSJML) currently meet as part of the Canadian Scientific Working Group on DNA Analysis Methods to share ideas and the results of research programmes. The Project Team sees significant advantages in extending this programme of co-operation to other investigative areas. If such pan-Canadian Scientific Working Groups can be established they could:

- Oversee the development of forensic examination and analytical processes;
- Agree on quality assurance protocols across all three Canadian public sector suppliers;
- Agree on the processes by which new forensic techniques would be introduced into the Criminal Justice System with the support of appropriate Federal and Provincial representatives.

5.2 RCMP FS&IS – Strengths, Weaknesses, Opportunities & Threats Analysis

The Project Team was asked specifically to consider a SWOT analysis for the RCMP FS&IS as a forensic provider to the Canadian police and criminal justice system. The following analysis reflects the views of the Project Team and it is presented from Organizational, Process and Resource perspectives.

5.2.1 STRENGTHS

Organization

RCMP FS&IS provides forensic science support to Federal, Provincial & Municipal clients[32]

Strong & dynamic strategic leadership[33]

RCMP FS&IS is closely associated with its clients in Operational Policing Programmes and Criminal Justice System

Organization strives for continuous improvements in operational outcomes[34] - see FIP

Embrace challenges – see 'iforensic' Biology Services Programme and current Forensic Investigative Process

Multi-site laboratory structure - ability to move work between sites to maximise efficiency & minimise turnaround times based on daily discussions between sites and National Ops Manager[35]

Multi-site laboratory structure – element of local delivery where demand is greatest[36]

Governance structures include senior scientific staff – there is a science focus

Engaged with FORESIGHT Programme - understanding business metrics to inform decision making

Strong communication lines from Board-level Senior Managers to staff

Process

Major change programme – Forensic Investigation Process being rolled out across the business

Forensic Assessment Centre – a success from client perspective - single point of contact and case owner[37]

Process changes influenced by scientific staff – aiming for consistency across business

Strong quality culture within the RCMP FS&IS - across laboratories and within work streams

Scientific research supports process change

Resources (People & Technology)

Large organization – a significant resource available in many operational areas

Research Directorate underpinning operational improvements (see page 23 for examples of operational improvements assisted by Research Directorate) and technology ever-greening

Significant organizational spend on modernizing technology – contributing to operational efficiency

Support from government for Laboratory improvements – updating laboratory infrastructure[38]

Staff commitment - working in a challenging scientific environment

Staff have strong public sector ethos[39]

Very positive client feedback about staff Reporting Scientists performance in court – professionalism, demeanour, even-handedness, clarity, respect of court process

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[32] Canada context – Contract Policing Agreements
[33] Staff & Client interviews
[34] RCMP FS& IS Strategic roadmap
[35] See RCMP FS&IS Organization Charts – role of National Coordination Manager
[36] Proportion of cases submitted to RCMP FS&IS by province – location of laboratories
[37] Client interviews
[38] Modernising Federal Laboratories Initiative http://www.rcmp-grc.gc.ca/fsis-ssji/mfli-mimlf-eng.htm
[39] Staff interviews

5.2.2 WEAKNESSES

Organization

Complex organizational governance with Forensic Services Board, Forensic Investigation Operations Board, and Policy & Programme Support Board

Complex interaction between Operations and Policy sides – much time spent in meetings

Significant number of staff involved in non-operational management or support roles[40]

Organization is very risk averse – exacting Quality Assurance programmes impact on operational delivery

Staff see information stream as top-down and do not feel that they have any influence

RCMP FS&IS forensic services are more costly than other forensic providers in the global FORESIGHT group [41]

Forensic science delivered by police organization – risk of perceived prosecution bias

Multi-site operational delivery – staff may be required to travel long distances to court with associated travel and lost opportunity costs

Client dissatisfaction with availability of RCMP FS&IS services –7 day opening and extended working days to maximise asset utilisation is seen as necessary by some interview respondents

Process

Forensic Investigation Process seen as being built around Biology Services – may not suit other disciplines[42]

Forensic Assessment Centre – removes responsibility for case ownership from Reporting Scientist

Risk-averse quality assurance programme militates against development of efficient operational processes

Processes for implementation of research-driven scientific improvements are unclear - impacting on efficiency of operational delivery

Court attendance processes may be inefficient given distances involved in Canada; Crown Counsel is requested to support the use of video-conferencing for testimony whenever possible; but often the lawyer prefers the scientist to attend in person for the greater impact on a jury[43].

Resources (People & Technology)

Large organization – overstaffed in some areas given the workloads

Significant organizational spend on modernizing technology but underutilization of assets undermine potential gains in efficiency.

Little interaction between staff and clients, or analysts and reporting staff through case examination, analysis and reporting processes

Biology Reporting Scientists currently divorced from casework examination and DNA Analysis

Constant change is undermining the morale of some staff

Staff members have little understanding of the business imperative – How much 'public good' can be achieved for the given budget?

5.2.3 OPPORTUNITIES

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[40] FORESIGHT data
[41] FORESIGHT data
[42] Interview transcripts
[43] Point confirmed by interviews with Crown and Defence Counsel across Canada

Organization
Review and streamline Corporate Governance structures to reduce complexity and cost

Consider alternate organization – can the service be delivered more efficiently and cost effectively through a Special Operating Agency or other corporate structure (e.g. Public Private Partnership)

Review delivery of specific operational programmes – can these be effectively shared with other public sector laboratories (e.g. Document Examination and Counterfeiting delivered from RCMP FS&IS Ottawa could be amalgamated with the Document Analysis team in the Border Agency laboratory in Ottawa)

Create 'Centres of Specialty' for specific case examinations where maintaining such units across Canada is not cost effective (e.g. glass examination could be undertaken by CFS, Toronto)

Review Operations and Policy side structures to reduce numbers of non-operationally focused staff

Change laboratory opening hours to reflect client needs (7 day working or extended opening hours) to encourage case submissions, to increase efficiencies and asset utilisation in the forensic process and to increase client satisfaction

Process
Reporting Scientists to be responsible for case ownership, creating, and maintaining forensic strategy

Reporting scientists to be closely associated with operational casework teams

Review submissions protocols and revise FAC processes appropriately - 7-day receipt of cases

Encourage interactions between Investigating Officers and Reporting Scientists to improve understanding and client satisfaction

Review all QA processes and implement only that which is required to ensure appropriate quality standards

Standardise level of risk (Quality Assurance standards) acceptable to Canadian Criminal Justice Programme (same systems in place across Canada)

Rapid implementation of research-led improvements to maximise efficiency

Introduce concept of contextualising casework statements – Casework, Assessment and Interpretation model – if this would be acceptable in the Canadian context

Create processes such that work can easily be moved between RCMP FS&IS labs, CFS, Toronto and LSJML, Montreal to maximise throughput and minimize case backlogs for the benefit of the Criminal Justice System, Canada

Resources (People & Technology)

Improve focus on operational activity by maximizing number of staff involved in operational delivery

Maximise asset utilization of instrumentation or other equipment

Review staff requirements by operational programmes and sites to reflect operational need

5.2.4 THREATS

Organization

Potential for political interference in executive decision making (lab closures in politically sensitive provinces)

Change in FS&IS leadership through internal RCMP reorganization could derail current change programme

Consolidation of laboratory sites could cause a critical loss of expertise if staff resign rather than move

Critical quality failure leads to loss of confidence by police or CJS clients

Pressure to reduce RCMP FS&IS internal costs

Federal and Provincial police see other investigative techniques as more cost effective than forensic science leading to fall in demand

DNA database legislation passed fully without additional funding being granted. Demand for DNA profiling rises rapidly without appropriate expansion in capacity in NDDB team and Criminal Records Team and RCMP responds by cutting other areas.

Research team deemed not critical and ever greening research abandoned

Failure of FS&IS to maintain services leading to rise in use of private firms that offer quicker & cheaper services

Process

Lack of staff engagement derails current Forensic Investigative Process

Quality improvement programmes not implemented – leads to quality failures and crisis in police and CJS confidence

If Research Directorate distanced from operational delivery then focus lost

Research-led technology improvements not implemented in a timely manner leads to fall in operational performance

Resources (People & Technology)

Assuming RCMP FS&IS consolidation option accepted - staff resign rather than move to retained laboratory sites – loss of expertise or staff relocate to retained laboratory sites under protest – increase in resentment leading to lower operational output

Staff refuse to consider alternate working practices - Underutilization of assets undermines operational output

Insufficient resource spent on Capital Equipment budget (maintaining and improving technology) results in asset downtime, increased repair bills and fall in productivity

Lack of staff experience – most staff less than 6 years' experience

Canadian Social programme – Maternity/Paternity leave reducing some units to critical staffing levels – financial provision must be made to retain/develop staff to cover parental leave absences

5.3 Centre of Forensic Sciences, Toronto

Ontario has a population of about 13.2 million persons and the highest rate recorded crimes in Canada. However, the crime rate has been falling for the last four years, mirroring that of Canada as a whole, as evidenced by the number of police-recorded violent crime shown in Figure 4 below.

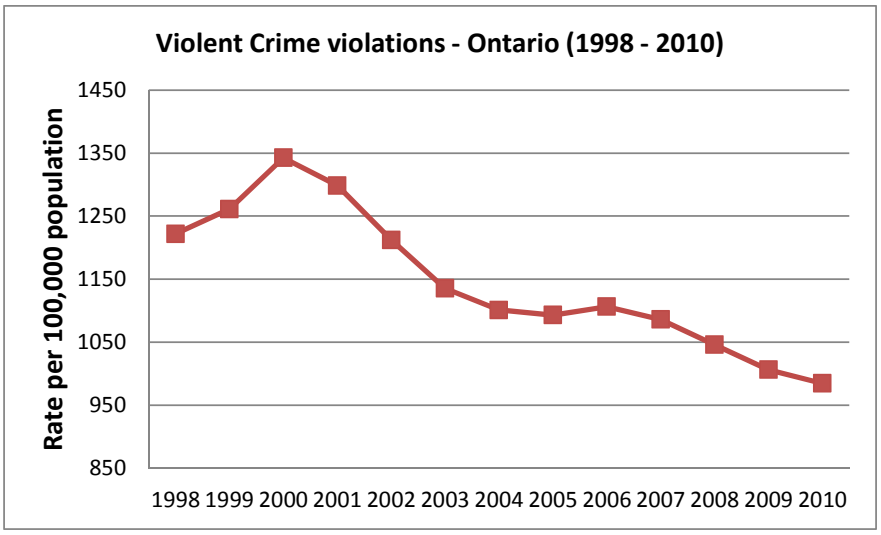

Figure 4 - Violent Crime per 100,000 population in Ontario (1998 – 2010)

The Centre of Forensic Sciences (CFS) is the forensic science provider for the province of Ontario. CFS is a part of the Ministry of Community Safety and Correctional Services and the CFS Director reports to the Assistant Deputy Minister, Public Safety Division, Ministry of Community Safety and Correctional Services.

CFS has two laboratory sites, one in Toronto and the second in Sault Saint Marie (Northern Regional Laboratory).

The two laboratories conduct scientific investigations in cases submitted by the Ontario Provincial Police or other municipal police forces, or by the Coroner's office with which the CFS has a very close working relationship.

The organizational and operational management structure of CFS is straightforward, consisting of the Director and Deputy Directors and Heads of Function for each laboratory area. It is this group, which decides the strategic direction of CFS and makes the day-to-day operational decisions.

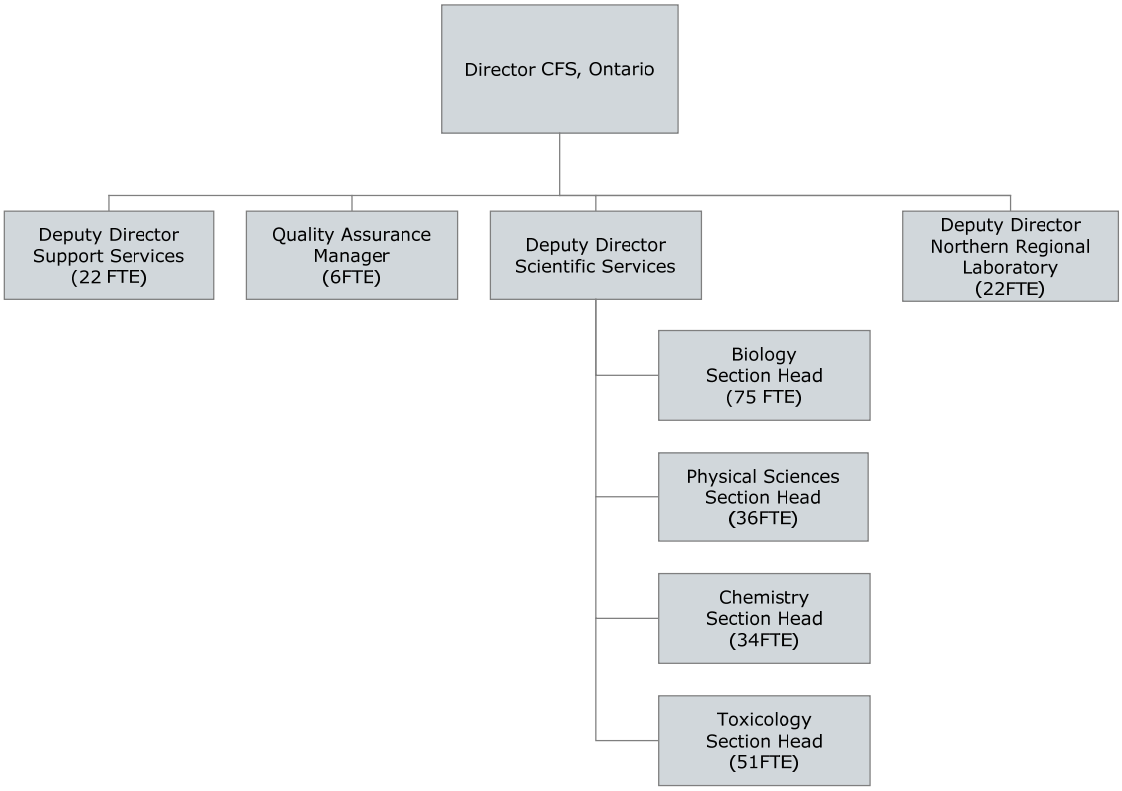

Figure 5 - Management Structure; Centre of Forensic Sciences, Ontario

CFS has an Advisory Committee which is made up of representatives of the CFS and their clients, including the police, Crown Counsel and the Defence community, the Coroner's Office, Ontario Forensic Pathology Service, the judiciary and the government of Ontario. In addition, there are representatives from other Canadian forensic science suppliers and other internationally recognized scientists. CFS heads of function and other individuals can be invited to attend the meetings of the Advisory Committee as required.

The Ontario Provincial Government is funding the building of a new laboratory complex for forensic science and pathology in Toronto, which will house the CFS, the Office of the Chief Coroner, and the Forensic Ontario Pathology Service. The new laboratory is expected to be completed in 2013.

All of the evidential items submitted to CFS for examination are taken in by the Centre Receiving Office (CRO), which is responsible for screening incoming items from investigative agencies throughout Ontario. The CRO ensures that guidelines for submission have been met, proper packaging has been employed, and proper continuity or chain of custody has been maintained. In this way, the CRO acts like the RCMP FS&IS' Forensic Assessment Centre. The exhibits are then made available to the operational teams and scientists for examination and analysis.

Forensic examination and analysis are conducted in the following areas:

- **Biology** - identification of body fluids, blood pattern analysis and DNA profiling;
- **Chemistry** – trace evidence including paint and glass, hairs and fibres, fire debris, gunshot residues, explosives;
- **Physical Sciences**
    - Documents – authenticity, alterations;
    - Electronics – digital evidence from computers, cell phones, PDA's, audio analysis;
- **Forensic Engineering** - component failure, tyre examination, vehicle collision analysis;
- **Firearms and tool marks** – identifying weapons, relating a bullet or cartridge to a particular weapon, determination of mechanical condition of a weapon, weapon classification, tool mark examination;
- **Toxicology** – analysis of body tissues and fluids, tablets, powders or liquids for alcohol, drugs or poisons in cases of impaired driving, sexual assault, fire death, homicide, or crimes involving drugs.

The case submissions for each area, as supplied by CFS, are shown in Table 9 below. The level of work has remained steady for the last two years. The data for 2011/12 is a projection based on submitted data for April – October 2011.

	Toronto			Northern Regional Laboratory		
	2009/10	2010/11	2011/12 (projected)	2009/10	2010/11	2011/12 (projected)
Biology	3648	3671	3984	377	275	245
Chemistry	880	876	909	66	86	73
Documents	154	135	103			
Electronics	37	39	38			
Firearms & Tool marks	1046	1047	1060	79	119	75
Toxicology	5099	5010	5030	1013	1212	1385
Photo analysis				25	11	
Total	**10864**	**10778**	**11124**	**1560**	**1703**	**1778**

Table 9 - Case Submissions by section for CFS Toronto and Northern Regional Laboratory

The Northern Regional Laboratory (NRL) in Sault Sainte Marie processes approximately 12% of the total case submissions to the Centre of Forensic Sciences, Ontario. The Project Team was informed that the submissions to the NRL might differ substantially from those accepted by the Toronto laboratory, reflecting the policing issues in northern Ontario. Approximately 50% of the total service requests to the Centre of Forensic Sciences are for toxicological analysis.

Over the last three years the CFS management has amended the operational structure and service delivery as a result in changing customer demand. The following services have been introduced or curtailed as described below.

Biology Section - DNA Analysis

As of April 2011, CFS divided the DNA analytical operations into two service lines:

- High Volume Service (HVS): DNA analyses conducted in support of the investigation of volume crimes such as Break & Enter; Theft; Drug and Weapon offences;
- DNA analyses conducted in support of the investigation of violent crimes such as Homicide and Attempt Homicide; Sexual Assault and Robbery.

The DNA High Volume Service uses a high throughput, automated DNA testing process and the CFS will no longer limit the number of items submitted if the case submission meets the designation criteria for Volume Crime. This service line is supported through federal funding through the Biology Casework Analysis Contribution Program under which, the federal government provides funding of $3.45million per annum to support the provision of forensic sciences in Ontario, and to ensure the analysis and upload of casework DNA profiles to the Crime Scene Index (CSI) of the NDDB.

Ontario and Quebec are responsible for entering more than 60% of the profiles contained in the CSI. The remaining provinces/territories use the RCMP laboratories.

The Biology Casework Analysis Contribution Program is in effect until 31st March 2015, as a mechanism to *"foster the effectiveness of the National DNA Data Bank as a mutual objective"*[44], by encouraging the analysis of DNA samples collected from crime scenes to further populate the Crime Scene Index.

Chemistry Section – elemental analysis of glass

The Chemistry Section has recently added elemental analysis as a technique for the examination of glass. This new technique provides a much higher level of discrimination for glass sources and the instrumentation makes the CFS the most advanced Canadian forensic sciences laboratory in this type of analysis.

There are on-going discussions between RCMP FS&IS and CFS to look at ways these laboratories could share services.

[44] http://www.publicsafety.gc.ca/abt/dpr/eval/dna-dg-eng.aspx#a23 accessed 30th September 2010

Physical Sciences

Due to declining customer demand and consequent increasing costs, the Physical Sciences section has discontinued operational services for:

- Digital evidence (video enhancements etc.);
- Marks and impressions (footwear and tire marks);
- Physical comparisons involving garbage bags.

Toxicology

The toxicology section scientists have been involved in the delivery of training course to police officers who will be using a new breath testing instrument in police stations. Formerly these courses were presented by two scientists and were of two weeks duration. Lately these courses have been reduced from two weeks to one week in response to requests from several police services to deliver this training in a more efficient and cost effective manner.

Note: A similar issue is being experienced by the RCMP FS&IS which provides training courses for police officers responsible for evidential breath testing in those jurisdictions where RCMP is responsible for policing. A significant proportion of the Reporting Scientists' time is currently spent in supporting this training and, as the RCMP FS&IS does not record the time spent in casework, this training also adversely affects the apparent COST/CASE value for Blood Alcohol Analysis.

5.4 Laboratoire de sciences judiciaires et de médecine légale, Montréal

Quebec has a population of approximately eight million persons and has the second highest provincial crime rate in Canada. Whilst the overall crime rate and the rate of property crime are falling the profile of violent crime has remained flat over the last four years.

Figure 6 - Violent Crime violations per 100,000 population - Quebec (1998 - 2010)

The Laboratoire de sciences judiciaires et de médecine légale (LSJML) in Montreal is, by comparison with CFS, Ontario, and the RCMP FS&IS, a simple, traditional forensic sciences laboratory. The LSJML is part of the Department of Public Security, Quebec.

The LSJML is the forensic science supplier for the Surêté du Québec (SQ) and Municipal Police Forces (CPM) in the province of Quebec. LSJML differs from both the RCMP FS&IS and the Centre of Forensic Sciences in that it provides pathology services (autopsy and consultation services) and has the responsibility for the testing and certification of gaming machines in Quebec.

The range of scientific expertise provided by the LSJML includes:

- **Pathology**
  - Autopsy and other examinations and consultation services;
- **Toxicology;**
- **Biology and DNA profiling;**
- **Chemistry, Fire and explosion investigations;**
- **Documents;**
- **Imaging;**
- **Gaming Machines**
  - Certification testing;
  - Verification (for use in casinos);
  - Audit – video lottery equipment.

The laboratory workload by section[45] is shown in Table 10 below:

Scientific Section	2007/8	2008/9	2009/10	2010/11[1]
Pathology				
Autopsy and other examinations	690	749	744	750
Consultations	110	178	100	100
Toxicology	2712	2336	2789	2700
Biology/DNA	3596	4958	4004	4000
Firearms and Ballistics	1434	1814	1708	1800
Chemistry, Fires and explosions	671	743	770	850
Documents	230[2]	147	119	150
Imaging (photo & video analysis)	220[3]	57[4]	43	50
Gaming Machines				
Certification testing	123	199	212	235
Verification for Casino use	8394	7832	9818	6300
Audits - lottery equipment	11	12	11	11

Table 10 - Submissions to LSJML by work stream 2007/8 to 2010/11

Notes

1. Projected targets 2010/11
2. Reduction in staff from 5 – 3.5 FTE
3. Includes both internal and external client requests
4. Only external client requests taken since 2008/9

The LSJML is funded by a combination of Provincial Government allocations, fee-for-service (Gaming Machines), and a federal government allocation of $3.45 million per annum through the Biology Casework Analysis Contribution Program.

The LSJML budget for 2010/11 was $14.5 million and the staffing allocation set at 125 FTE. The budget includes about $900,000 which represents revenue generated from the provision of services to the gaming industry. This element of revenue generation is unique to the LSJML.

[45] LSJML Annual Report 2009/10

Management and Governance

The management and governance of the LSJML is simple. The Management Board[46] consists of a Director and Deputy Directors and Heads of Function for each laboratory area. It is this group, which decides the strategic direction of LSJML and makes the day-to-day operational decisions. The situation is further simplified as the Deputy Director, Administration, is also the current Head of Section for both Biology and Gaming Machines.

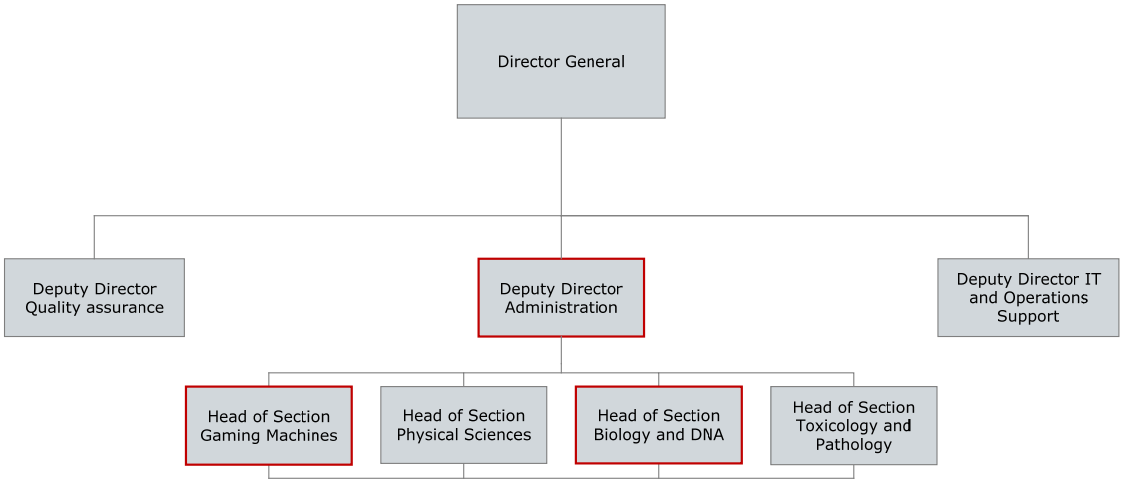

Figure 7 - Management and Governance Structure for LSJML

Based on their first FORESIGHT returns, the LSJML is the most cost effective public sector laboratory in Canada. However the data shown in Table 11 above indicates that the laboratory workload has been static in most of the work streams over the last three years. There is a significant backlog of biology cases[47]. Together these results indicate that this laboratory is cash (budget) limited and more could be accomplished with an increased budget provision and an increase in staffing in Biology services.

Note – All of the public sector laboratories are now involved in the FORESIGHT programme.

It might be beneficial if a high level working group involving representatives from RCMP FS&IS, CFS and LSJML could be created to look at the development of forensic examination and analytical processes, and to agree the minimum requirements for quality assurance protocols.

[46] http://www.securitepublique.gouv.qc.ca/lsjml/a-propos/organigramme-laboratoire.html
[47] Interview respondent

5.5 Health Canada

Health Canada's Drug Analysis Service (DAS) operates laboratories across Canada to analyze suspected illegal drugs seized by Canadian police forces and the Canada Border Services Agency.

The DAS laboratories receive over 110,000 samples per year, confirming the identity and, in some cases, the purity of the controlled substances seized by the police, for subsequent use as evidence in the Courts.

Additionally, DAS provides the following services to agencies involved in the control of illicit drugs, controlled substances, and precursor chemicals:

- Investigation and dismantling of clandestine laboratories that make illicit drugs;
- Advice and training to police[48] for sampling illicit drug seizures and on health and safety issues related to shutting down clandestine laboratories;
- Distribution of dog training kits for police and customs canine divisions; and
- Monitoring of controlled substances and precursor chemicals used in the production of illegal drugs.

5.6 Canada Border Services Agency - Coordination and Laboratory Services[49]

The Science and Engineering Directorate is the CBSA's authority for border science and engineering. The range of services provided by the Directorate includes:

- Advanced scientific analysis of suspected counterfeit and contraband, such as commodities, alcohol, tobacco, drugs and documents, to support investigations and criminal or civil prosecutions;
- Scientific analysis of imported or exported commodities, to determine the composition and origin of materials so that the materials have appropriate tariffs, excise taxes and/or duties applied to them;
- Research, testing and advice in the CBSA's selection and use of detection technologies;
- Systems design, implementation, and operational advice for the CBSA's radiation detection network and other high-potential, non-intrusive inspection technologies;
- Research, evaluation, and advice in the selection of biometric technologies; and
- Research and application of video surveillance/analytics technology and tools.

The work undertaken by the Canada Border Services Agency in examining and analyzing suspected counterfeit or altered documents parallels that undertaken by the RCMP FS&IS National Anti-Counterfeiting Bureau programme. There may be some benefits in considering the rationalisation of these services, moving the staff and casework from RCMP FS&IS to the Canada Border Services Agency, providing the appropriate accreditations and quality assurance programmes are in place.

[48] http://www.hc-sc.gc.ca/hc-ps/substancontrol/analys-drugs-drogues/manual-guide-eng.php
[49] http://www.cbsa-asfc.gc.ca/security-securite/detect/03-eng.html

5.7 Other Public Sector organizations with links to forensic capability

RCMP FS&IS is at the heart of a Forensic Cluster of public sector services and university-based teams undertaking research in forensic science related topics. Much of this research concerns issues relating to Chemical, Biological, Radiological and Nuclear (CBRN) analysis and monitoring, but the public sector organizations and the laboratory services involved could be considered as alternative providers of forensic science analysis.

The following is not an exhaustive list of public sector laboratories but includes:

- **Canadian Food Inspection Agency** (biological and microbiological testing);
- **Defence Research and Development Canada;**
- **Environment Canada** (explosives – analysis and composition);
- **National Microbiological Laboratory;**
- **Canada Security Intelligence Service;**
- **Public Works and Government Services, Canada;**
- **National Research Council, Canada.**

5.8 Private Forensic suppliers in Canada

There are three private companies providing forensic biology and DNA analysis services to law enforcement agencies in Canada:

- Wyndham Forensic Group Inc., Guelph, Ontario;[50]
- Warnex PRO-DNA services, Laval, Quebec, and Thunder Bay Ontario;
- Maxxam Analytic Inc., Mississauga and Guelph, Ontario.

5.8.1 Maxxam Analytics Inc. was formed in 1996 and since 2008 has been owned by the Ontario Municipal Employees Retirement System (OMERS) which has $53 billion in net assets. Maxxam Analytics Inc. is one of Canada's largest privately held analytical services companies with interests in environmental sciences (48% sales), petroleum services (30% sales) , food safety and food sciences (15% sales), and pharmaceuticals and forensic analysis (7% sales) which includes equine and workplace drugs testing, DNA-based relationship analysis, and forensic biology and DNA profiling services. Maxxam Analytics Inc.[51] has laboratories in twelve Canadian cities and employs over 1200 staff. Maxxam offers services in forensic biology and DNA analysis to Canadian law enforcement agencies from laboratories in Mississauga and Guelph, Ontario. They employ a team of seven staff, which includes four DNA technicians and three experienced forensic scientists.

[50] www.wyndhamforensic.ca
[51] www.maxxam.ca

Like the other private companies undertaking work for law enforcement agencies in Canada, Maxxam Analytics Inc. is accredited by the Standards Council of Canada to Canada to CAN-P-1578 and CAN-P-4E (ISO/IEC 17025: 2005). In addition, Maxxam is accredited by Forensic Quality Services – International (FQS-I) for compliance to the national quality assurance standards for DNA profiling as issued by the FBI.

Maxxam's principal forensic science activities appear to be the examination of evidential items for biological materials – blood, semen, saliva and hairs, the identification of these biological materials, the extraction and analysis of DNA and the comparison of DNA profiles generated from these biological materials. In addition, Maxxam Analytics Inc. offers DNA testing services[52] for Immigration, Paternity and other relationship analyses using a combination of autosomal STR and Y-STR tests.

For their forensic casework Maxxam Analytics Inc. claim that their turnaround time is routinely three weeks but the analytical (DNA profiling) work can be completed in three or five (business) days by agreement. An additional charge is levied for these premium services.

The RCMP FS&IS have a Standing Offer Agreement with Maxxam Analytics Inc. for the provision of DNA profiling services to manage backlogs of DNA work. This contract was renewed in February 2011 for a period of two years with the option to extend the contract for a further year.

As part of this contract, Maxxam Analytics Inc. has processed approximately 270 cases (750 casework items) submitted by RCMP between mid-October 2011 and February 2012. The contracted turnaround time for these examinations is 40 days but Maxxam claim to have managed an average turnaround time of 27 days in this period.

Maxxam's interview respondents expressed one concern with this contract in that the supply of work is irregular; they have to maintain a fully accredited forensic DNA analysis team during those periods that work is not forthcoming from RCMP FS&IS. There appears to be a significant degree of volatility in this process and Maxxam perceive all of the risk to lie with them. However, Maxxam Analytics expressed an interest to the Project Team in working more closely with the public sector laboratories to deliver a much higher proportion of DNA profiling services. Maxxam would like to be considered an extension of the RCMP FS&IS DNA analysis unit. Their challenge is that, given a continuous stream of work with a sufficiently high throughput of samples, they could create an operational team that could meet any required turnaround time at a cost lower than that of any of the public sector laboratories. This is an option RCMP FS&IS should explore.

There is a perception amongst the police users of Maxxam's services that this company is expensive. Countering this, the Maxxam respondents claimed that 70% of their invoices were less than $3000. However, they did concede that the prices could rise sharply if a client had a number of exhibits or samples that required a very rapid turnaround time. It was also conceded that court preparation and court attendance was an additional charge.

[52] www.thednalab.com

5.8.2 Warnex[53] is a company providing Quality Assurance Services and contract Research and Development to the Pharmaceutical and Bio-technology industries, Medical Screening tests to the Health Industry and DNA Services for law enforcement and private clients. In 2009 Warnex acquired Molecular World Inc., a laboratory specializing in human DNA identification including forensic DNA testing, and changed its name to Warnex PRO-DNA Services. Recently (December 2011) Warnex was acquired by Gamma-Dynacare Medical Laboratories[54] a major Canadian medical diagnostics company. In its press release Gamma-Dynacare stressed the importance of Warnex's medical diagnostic capabilities:

> *"Warnex Medical Laboratories brings to Gamma-Dynacare expanded capabilities in molecular medicine, oncology and companion diagnostics that will enhance our growth in the field of personalized medicine. In addition, the assay development expertise of Warnex Medical Laboratories will accelerate our ability to bring new, value-added laboratory tests to the Canadian marketplace."*

The operational capability to conduct DNA profiling services is contained within a single sentence in this press release.

Warnex PRO-DNA Services is based at two laboratory sites in Laval, Quebec and Thunder Bay, Ontario. This company undertakes forensic DNA testing using a variety of techniques including autosomal STR analysis, mini-STR analysis, Y-STR analysis, and mitochondrial DNA sequencing. Warnex is accredited by the Standards Council of Canada to CAN-P-1578 and CAN-P-4E (ISO/IEC 17025:2005). Warnex PRO-DNA Services is also accredited by the American Society of Crime Lab Directors/Laboratory Accreditation Board (ASCLAD/LAB) for forensic analysis.

Warnex PRO-DNA Services will undertake Low Template (or 'touch') DNA analysis where there may be a limited amount of DNA present in the sample, such as from fingerprints or degraded human remains. Warnex also offers to undertake cold case reviews, and to provide an independent review of case files for Defence lawyers. The Warnex business model is to position itself as a provider of niche DNA services, Low Template DNA analysis, Y-STR analysis, and mitochondrial DNA sequencing. These are specialist services not routinely offered by the other private suppliers. The standard turnaround time offered by Warnex is quoted as ten days for routine DNA analysis and thirty days for mitochondrial sequencing though they do offer to meet shorter deadlines if required.

Note: A company called LabCorps is a significant shareholder in Gamma-Dynacare medical Laboratories. LabCorps is a major provider of DNA paternity testing services in the USA. LabCorps also recently (December 2011) completed the acquisition of Orchid Cellmark, a major provider of *forensic* DNA analysis to State laboratories in the USA and a provider of forensic science services in the UK.

[53] www.warnex.ca
[54] http://www.gamma-dynacare.com/Content/Media/News.aspx

5.8.3 Wyndham Forensic Group Inc. is a small company which has been created by two former members of the Centre of Forensic Sciences in Toronto. This company is accredited by the Standards Council of Canada to CAN-P-1578 and CAN-P-4E (ISO/IEC 17025: 2005) for forensic biology and DNA profiling only. Wyndham Forensic Group Inc. offer the following services to the police, Crown and Defence Counsel and other law enforcement agencies:

- **Examination of evidential items for biological materials** – body fluid stains, hairs, DNA;
- **Identification of body fluid stains** – blood, semen, saliva;
- **Comparison of biological materials** to determine possible associations between items and places or people (including relationship analysis), DNA Analysis using autosomal STR analysis (standard DNA profiling analysis);
- **Cold Case Reviews**;
- **Independent Review** of Results and Opinion (service for Defence Lawyers);
- **Consulting Services**
    - Training and Professional Development;
    - Laboratory management and QA Consultation;
    - Laboratory Audit.

Wyndham Forensic Group Inc. claim to be able to meet any turnaround time the client requires.

In interview with the Project Team, Wyndham Forensic Group Inc. indicated that they were awaiting a laboratory appraisal from the RCMP FS&IS as part of their accreditation programme which would allow them to upload DNA profiles to the NDDB.

5.8.4 Relationships between the public and private sector laboratories in relation to upload of DNA profiles to the NDDB

The National DNA Data Bank of Canada (NDDB) is based on the Combined DNA index System (CODIS) database software which was created by the Federal Bureau of Investigation (FBI) for storing and comparing convicted offender DNA profiles to DNA recovered from crime scenes.

The protocols for uploading DNA profiles to the NDDB were agreed between the FBI and the U.S. Department of Justice and the RCMP and are governed by the *DNA Identification Act* and the *Privacy Act*. As a result, DNA profiles must be up-loaded to the NDDB by an authorised public sector laboratory, (RCMP FS&IS, CFS or LSJML).

Due to casework capacity issues, in the past the RCMP issued a National Standing Offer for the outsourcing of DNA casework to an accredited private laboratory. Maxxam Analytics Inc. won the contract and, under the Standing Offer Agreement, the RCMP FS&IS undertook a technical audit of Maxxam facilities and laboratory processes, and has to review all of the crime scene DNA profiles submitted for upload to the NDDB by Maxxam.

In practice; any DNA profiles generated by Maxxam Analytics under the Standing Offer Agreement with RCMP FS&IS, or DNA profiles generated from casework submitted to Maxxam Analytics directly,

have to be submitted to RCMP FS&IS for review and up-load to the NDDB. RCMP FS&IS makes no separate charge for this NDDB DNA profile up-load service.

Other private laboratories have demonstrated interest to be allowed to upload of DNA profiles recovered from crime scene exhibits to the NDDB. CFS and LSJML have declined consideration to upload the public laboratories generated crime scene profiles. Consequently, the issue was brought to the attention of the NDDB Advisory Committee.

The NDDB Advisory Committee reviewed the issue of DNA profile uploads from private laboratories[55]. Representatives of the three Canadian private laboratories (Wyndham, Maxxam and Warnex) and the three Canadian publicly funded forensic laboratories provided feedback on this issue. The Advisory Committee recognized that the private sector has been an important contributor to forensic DNA testing in Canada. However, given the agreement between the RCMP and the FBI governing the use of CODIS, private laboratories are not allowed direct access to the NDDB and any profile generated by a private laboratory must be reviewed and uploaded by a CODIS participating public laboratory.

The Advisory Committee provided the following advice on this issue:

1. Processing exhibits through a private laboratory may be a fiscal challenge to many police departments. Maintaining the integrity and future continuity of evidence and the DNA results, as well as privacy issues and court testimony could be problematic if a private laboratory closed its operations;

2. The scientific, administrative, technical and financial challenges necessary to allow uploading DNA profiles from private laboratories on a routine basis would be onerous, inefficient and costly;

3. Private laboratories may be contracted to generate DNA profiles from crime scene evidence if the public laboratories face exceptional circumstances. However, these private forensic laboratories would be required to be accredited and subject to external technical and administrative review by a public forensic laboratory. In addition, processes would need to be established between public and private forensic laboratories to notify the NDDB on the action taken following a match as well as a clearly defined process for removing CSI DNA profiles that do not comply with the enabling legislation; and

4. The Committee also recommended that police clients using private forensic laboratory services make prior arrangements, preferably though a legal written agreement, with a public laboratory for the acceptance of any DNA profiles that could be eligible for upload to the Crime SceneIndex of the NDDB.

[55] NDDB Advisory Committee meeting January 2011

The RCMP FS&IS agreed with these recommendations accepting that the failure to upload private laboratory crime scene DNA profiles could preclude valuable matches between unsolved crimes as well as matches between crime scenes and convicted offenders, which could subsequently have an impact on ongoing police investigations.

RCMP FS&IS has implemented a pilot project that will allow the three Canadian private laboratories to contribute crime scene DNA profiles for evaluation and upload to CODIS from casework originating from RCMP FS&IS client agencies. For this pilot project, the Canadian private laboratories are required to meet the following technical criteria established by RCMP FS&IS:

- Must have valid accreditation status under ISO 17025 and CAN-P-1578 or equivalent;
- Must use the DNA profiling protocols that staff at RCMP FS&IS has been trained and are accredited to review[56]; and
- Must successfully pass a technical audit of the private laboratory facilities and processes completed by RCMP FS&IS personnel.

Currently, only Maxxam Analytics Inc. meet the requirements of the pilot study. Technological changes being implemented in RCMP FS&IS will result in staff being trained in the use of additional STR chemistries. At this time the RCMP FS&IS will be able to review the data currently produced by the other private labs and will allow them to participate in the pilot study.

It is recognized that RCMP FS&IS acceptance of DNA profiles from the private laboratories will have an additional impact on resources as both technical audits and DNA profile reviews will be required. Currently, the costs of this service are borne by the RCMP FS&IS.

[56] AmpF/STR® Profiler Plus ® kit to test for nine loci plus the amelogenin locus OR use using AmpF/STR® Profiler Plus ® kit and the AmpF/STR® COfiler® kit to test for thirteen STR loci, with the minimum threshold for DNA amplification set at 250 picograms

6.0 Analysis of Performance of the public sector forensic sciences laboratories

6.1 Qualitative Analysis - Users and Providers: Convergent and Divergent Perspectives

Between April 2011 and February 2012, the Principal Investigator undertook interviews with more than eighty respondents including forensic scientists and managers of the RCMP FS&IS, the CFS, Toronto and the LSJML, Montreal; with police clients of each of these laboratories, and with Crown Counsel and Defence Counsel across Canada.

Potential interview respondents were identified in consultation with members of the Project Steering Board and approached as individuals expected to have knowledge and experience, which would enable detailed exploration of the research objectives, in particular the effort to determine what service and organizational issues are significant to the users and providers of forensic science in Canada.

The purposive sample of clients included police officers, crown prosecutors and defence counsel, all of whom had considerable experience of forensic science provision and knowledge of recent changes in that provision[57]. Interviews with these clients provided information about their needs, expectations, and experiences of the quality of the current service as well as their views of areas for improvement.

RCMP FS&IS officeholders interviewed included those with policy and operational responsibilities across several scientific disciplines and within several laboratories that comprise contemporary forensic science in this jurisdiction. These interviews informed the Project Team's understanding of the complex legal and organizational arrangements which shape the current pattern of forensic science provision by the RCMP FS&IS in Canada. Both clients and providers were invited to comment on a range of matters including the economic and operational value of forensic science, the question of provider charges for services and the advantages and disadvantages of alternative models of forensic science provision.

Since selection was non-random, no statistical inferences about the wider population of Canadian forensic science and criminal justice post-holders can be made from data obtained from this purposive sample of interviewees. Each respondent was treated as a separate 'case'[58]. The data gathered from the interviews provided vivid depictions of what respondents – as accountable actors – regarded as significant (and occasionally problematic) features of contemporary Canadian forensic science provision. Sometimes these remarks included assertions of the representativeness of what was said – that they were trans-individual – but the accuracy of these assertions is impossible to test. As expected, there is some variation in the broadly positive client views of the quality of forensic science services currently provided by RCMP. Several issues were aired in the course of most interviews and these are outlined below.

Forensic scientists are held in high regard by the Police and by both Prosecution and Defence Counsel. They are seen as independent, court-oriented experts able to communicate complex scientific principles to a lay audience.

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[57] For a description of the logic of purpose sampling in qualitative research, see Shakkori & Teddlie (eds) (2003) *The Handbook of Mixed Methods in Social and Behavioural Research*. London: Sage.
[58] Hamel, J., Dufour, S. & Fortin, D. (1993) *Case Study Methods*. London: Sage

This response was uniformly presented in each of the jurisdictions visited. The CJS clients (Police, Prosecution Service, and Defence Lawyers) were highly complementary of the gravitas and independence of the scientists when they gave evidence in court. The skill with which they communicated complex scientific principles to the court, and to lay juries, was particularly praised. Despite such plaudits, many clients commented on the strict report writing guidelines and standard operating procedures that structure the nature of these documents. A feature of Canadian reports seems to be the avoidance of the interpretation of findings in a way that relates them to a presumed or candidate context. The reports give no indication of the degree of support lent by the results to one or another version of the events in question, though scientists are perfectly free to make such comments in court, and will often have pre-trial discussions with Crown Counsel (and occasionally Defence Counsel) to define the limits of their commentary. The adoption of other models of report-writing (e.g. that used in the FSS Case Assessment and Interpretation approach) may allow for more robust management of this process.

Many officers felt that these reports were clear and unambiguous, though some respondents expressed the contrary view that the scientific reports were difficult to understand. Some of the respondents from the Forensic Investigation Support Services related instances where they would 'translate' scientific reports for their less conversant colleagues, often converting the scientific texts to tables to show potential links between individuals and crime scenes. Whilst there is a mechanism to allow such commentary or criticism to be passed to the RCMP FS&IS it was not clear if officers used this routinely.

The change from the previous PROOF system of case authorization to the current Forensic Assessment Centre processes is seen as a significant improvement though there are still client issues.

Formerly the RCMP FS&IS controlled the submission of cases to the laboratories using a set of rules which were known as the PROOF system. This offered two levels of service, 25 days turnaround time for priority cases and 180 days for routine cases. Not surprisingly, submitting officers tried hard to justify their cases as 'urgent' and there was often a significant level of negotiation, often involving senior laboratory managers, on or subsequent to a case arriving at the laboratory. In addition, the number of evidential items was limited to eight per submission.

Authorization for the submission of forensic samples to relevant RCMP laboratories is now granted by Forensic Assessment Centre (FAC) staff. The operation of the FAC is generally commended by police clients but there was some commentary about the knowledge of the Case Advisors and Forensic Strategists about the investigative process. There was a general frustration that the FAC staff were arbitrarily requiring officers to review submissions in order to reduce the number of exhibits requiring examination. The view expressed by many officers was that they were aware of the laboratory requirements but were submitting only those exhibits crucial to the resolution of their cases. More enlightened officers understood that the laboratory was concerned with selecting the correct exhibits to answer the immediate investigative questions. These officers realised that a conversation with the FAC could often resolve an apparent issue. Throughout this project the perception of the value of the FAC appears to have been changing as the police become more understanding of the changed process, and the scientists become more experienced at dealing with the police problems.

Forensic science case turnaround times are improving in many areas but are still not good enough – the laboratory should routinely manage much shorter timescales and in urgent cases clients have indicated that that they would like RCMP FS&IS to provide services in under 10 days.

Police, prosecutors, and forensic science providers all commented on improvements that were being made to the turnaround times for the receipt of the results of forensic science analysis. Yet despite these commendations, there remain cases in which investigators seek shorter times. Whilst it might always and everywhere be true that criminal investigators want the evidence they submitted to be analysed and interpreted more quickly, there are clearly circumstances in which there is a genuine necessity for urgency. Under agreed circumstances the RCMP FS&IS can meet very short turnaround times for critically urgent forensic examinations and will always give such a priority case a 15-day diary date. In some instances the police require a much faster turnaround time and, under time critical conditions, may approach one of the private laboratories requiring an extremely rapid examination and DNA analysis. One senior investigating officer summarised the issue as, "the turnaround time for the laboratory analysis should be limited only by the science, not by human resource considerations".

The police like the 'personal' contacts possible with scientists at a 'local' laboratory and prefer those to the centralization of 'customer services' in Ottawa and the distribution of submissions to 'remote' laboratories.

Police officers recognized that the strategic routing of exhibits to laboratories at some distance from their own locations contributed to a smoother flow of work to those laboratories, and contributed to the improvement of turn-around times. However, they also saw the geographical and temporal distances involved as problematic. It is obvious that the practicalities of resource provision and geographical scale in the Canadian context make it impossible for such localized services to be available to all clients, but many of them believe in the value of on-going personal contact. This could be addressed by making the Reporting Scientist the case owner and giving them the responsibility for defining and acting on an agreed forensic strategy.

The customer service focus of 'private' forensic science suppliers was excellent and much better than any of the RCMP labs but the private laboratory services are seen to be expensive.

Senior Investigating Officers interviewed cited specific cases in which considerable sums of money – up to $40,000 – have been paid to Maxxam Analytics to ensure three to five day turnaround times for the examination of exhibits and the subsequent DNA profiling analysis, deemed critical to major investigations. The officers commented that the impact of the receipt of rapid DNA intelligence more than outweighed the high initial investment.

The police representatives and Crown counsel interviewed for this project were very positive about the quality of customer service offered by the private laboratories but, as paying for forensic science is not normally within the experience of RCMP FS&IS clients, they considered the services of the private companies to be expensive.

6.2 Quantitative Analysis Methodology

The quantitative analysis undertaken in the project was conducted using the FORESIGHT Project methodology. The FORESIGHT Project is a volunteer, business-guided self-evaluation of forensic science laboratories. Its goals are to measure, assess, and benchmark performance for improving efficiencies, quality, and service in forensic service providers. An agency's strategic value is a function of the benefits it delivers to its clients, and managers frequently will focus on the costs and other financial measures.[59]

- Benchmarking is improving performance by recognizing, understanding, and integrating better practices. The FORESIGHT Project created the standard methods to collect management data and these provide the basis for broad, yet deep, comparisons between forensic laboratories using robust measures;

- Standardization of terminology is critical to successful comparison and benchmarking, as is standardization of recording. The data are collected through the Laboratory Reporting and Analysis Tool (LabRAT). LabRAT is a condensed, active, data collection tool that allows for easy entry of information;

- FORESIGHT uses cross-laboratory data comparisons to identify and examine processes, strategies, resources, and allocations at a detailed level. The goals are to improve the efficiency of the science offered to the criminal justice system from a business perspective whilst also maintaining quality.

In the FORESIGHT project, the intent was to distinguish between "know that" (data or information) and "know how" (putting "know that" to use); facilitating the latter through standardization, collaboration and analysis while retaining innovation to solve complex problems[60]. Prior to the FORESIGHT Programme there were no standard definitions for key components such as a case, sample, item, test, turnaround time, or backlog; consequently, inter-laboratory comparisons of performance could be meaningless.

The RCMP FS&IS and the Centre of Forensic Sciences, Toronto, were amongst the first group of laboratories to participate in the FORESIGHT programme; they have been involved in the development of the programme since 2006/07.

The Laboratoire de sciences judiciaires et de médecine légale (LSJML), Montreal, made its first submission to the FORESIGHT programme in November 2011, as part of the current project.

Note: See Sections 17 - 19 **Appendix H - K** for a description of the FORESIGHT project; the definitions of each investigative area, and the glossary, which provides the basis under which all FORESIGHT submissions, including those of the three Canadian laboratories, were completed.

FORESIGHT is based on the plan-do-check-act cycle, an iterative four-step process to solve problems and improve processes[61]:

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[59] Campbell, A., J. Whitehead,, S. Finkelstein. 2009. Why good leaders make bad decisions. *Harvard Bus. Rev.* (Feb): 60–66.
[60] Brown, J., & P. Duguid. 2002. *The social life of information*. Boston: Harvard Business School Press.
[61] Shewhart, W. (1939) *Statistical method from the viewpoint of quality control* New York: Dover, and

Plan: Establish objectives processes necessary to achieve the stated output.

Do: Implement the processes.

Check: Measure the new processes and compare them against previous and expected results evaluating any variances.

Act: Analyse any differences or variances to determine cause.

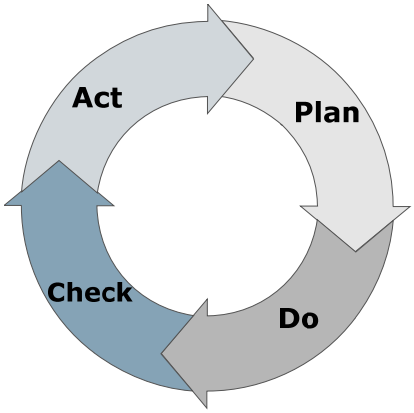

Figure 8 – Plan, Do, Check, Act cycle

A single pass through this cycle rarely solves the problem and the cycle continues until the expected output is achieved. FORESIGHT is predicated on facilitating the Plan, Check, and Act steps of the cycle, leaving the "Do" step to the individual laboratories to implement the improvements.

The 'Plan, Do, Check, Act' cycle is based upon the scientific method and so should be readily understandable by scientific laboratory managers.

Deming, W. E. (1986) *Out of the crisis* Boston: MIT Center for Advanced Engineering Study

6.2.1 Key Performance Indicators

When economists evaluate an organization in a for-profit industry, the optimization problem is relatively simple. The decisions of the business are guided by a wealth-maximization criterion, and actions become relatively easy to judge based upon that standard. Although the highest attainable level of wealth is unknown, decision-makers can determine whether managerial actions have improved the performance of the business or resulted in decline of a particular performance metric. That is, either an action served to increase stock price (or some other appropriate measure of wealth such as profits) or it did not.

Extending these business practices to the public sector, particularly the forensic sciences, requires the attention to key performance indicators (KPI) that are related to the mission and strategies of public sector entities. When it comes to the not-for-profit or government entity, the goals are a little more disparate. Each not-for-profit organization has a goal that is targeted towards some sense of "greater good" that for-profit market solutions do not adequately address. Generally speaking, the not-for-profit organization tries to achieve as much of the "public good" as it can with the resources at its disposal.

Managerial decisions in this environment differ from that of the not-for-profit manager in that funding/resources/revenues are predetermined by some extra-organizational (e.g. fiscal or legislative) process and the manager is left with an exogenous budget constraint. Given a budget for funding, the optimization problem for management becomes one of getting the most output from the limited funds. However, the other side of this coin is that managers, by maximizing output for a given budget, are minimizing the cost per unit of output.

While laboratories may have similar missions, there are differences between them. They serve different populations, and have different geographic and jurisdictional coverage, legislative mandates, and cultural considerations, breadth of investigative areas, and staffing and existing facilities that make direct comparisons of productivity across laboratories difficult.

To find meaningful metrics across the range of forensic laboratories, it is helpful to make adjustments for the level of resources and responsibilities through the creation of accounting and economics ratios.

Ratios provide **relative measures** that make for easier comparisons across disparate operational entities. Ratios permit a laboratory to measure its performance over time, against other specific laboratory operations and against industry averages or other acceptable standards. The ability of a laboratory to assess performance over time permits management to relate performance to changes in scientific advancement, managerial prowess, or alternative delivery models.

6.2.2 Which Metrics to Use?

There is a seemingly endless array of potential metrics that might be devised from the data in any forensic laboratory. Ultimately, the questions to be answered come down to the overall performance of the forensic laboratory.

- How does the laboratory compare to its peers?
- Is the forensic laboratory taking sufficient care of the funds provided by its stakeholders?
- Does management have the laboratory on a path of continuous improvement?

Managerial accounting practices include the creation of common size financial statements to transform the "financial statements" of individual laboratories into size-adjusted analytical tools that can be easily compared against peer labs and industry standards. Business finance practices demonstrate that transforming absolute dollar performance measures into size-adjusted ratios permits an evaluation of the allocation of resources into measures of efficiency, quality/risk management, analytical process choices, market conditions, and return on investment.

Following a recent study[62], the goal of maximizing cases processed for a given budget, or minimizing the cost per case processed, leads to a series of metrics to explain how individual laboratories meet that goal and how to compare their performance over time or across all laboratories.

6.2.3 Decomposition of Return on Investment (ROI)

To evaluate the appropriate ROI measure and decompose it into explanatory ratios, it is imperative to understand which performance metrics are critical to the forensic science industry. The KPI below reflect the key considerations recognized by forensic scientists across Europe, Australasia, and North America. These studies demonstrate that, for public forensic laboratories, whatever is used to represent the return on investment is dependent upon the quality required, and the level of risk an organization can tolerate; the efficiency of the analytical process and the local economic market conditions.

The output or service unit of measurement is a **processed case** within an investigative area of the forensic laboratory. Thus FORESIGHT uses a description of ROI as

$$\boldsymbol{ROI = \frac{CASES\ PROCESSED}{TOTAL\ EXPENDITURES}} \tag{1}$$

[62] Speaker, P., (2009a) Key Performance Indicators and Managerial Analysis for Forensic Laboratories, Forensic Science Policy and Management, 1: 32–42.

Amongst the ratios that proxy for **quality or risk** is the average number of tests performed per case. The more tests performed, the higher the presumed quality of the case determination and the lower the risk of the laboratory (or scientist) being open to criticism.

For **efficiency metric**, a labour productivity ratio i.e. the average number of tests performed per full time equivalent employee is appropriate.

Since a decision to make long term investment in capital equipment may incur a current period cost of fewer cases processed, the analytical processing decisions are represented by the **ratio of labour expense to total expenditures.**

Finally, local market conditions affect comparisons across the industry. For instance, metropolitan areas generally require higher salaries than more rural laboratories as the forensic laboratories compete for employees with skills that translate across industries. **Average compensation** is used to proxy market conditions.

Business Finance tools include the use of **DuPont expansions** to show the relationship between metrics. For the forensic industry, the return on investment and its inverse, the cost per case, can be explained by a combination of several of these key measures.

The corresponding DuPont expansion for public forensic laboratories is shown by a series of ratios that show the relationships that increase the return of investment (numerator terms) and those relationships that reduce the return (denominator terms)[63].

Specifically

$$\boldsymbol{ROI = \frac{Labour\ Productivity\ x\ Labour\ Expense\ Ratio}{Average\ Compensation\ x\ Testing\ Intensity}} \tag{2}$$

Maximizing the ROI is the same as minimizing the cost per case. Thus, the inverse of ROI is interesting in its own right.

$$\boldsymbol{\frac{Cost}{Case} = \frac{Average\ Compensation\ x\ Testing\ Intensity}{Labour\ Productivity\ x\ Labour\ Expense\ Ratio}} \tag{3}$$

[63] Speaker, P., (2009b) The Decomposition of Return on Investment for Forensic Laboratories Forensic Science Policy and Management, 1: 96–102.

The resulting ratio relationship makes sense and is easy to interpret. The cost per case rises as workers must be paid more or if more tests are performed on the average case. Likewise, the cost is reduced when the average employee is more productive or when the budget is diverted from long-term capital expenditures in favour of more immediate period output via more worker hours for immediate casework[64].

This decomposition of the average cost into four components is developed in the academic literature. This decomposition technique may be applied to the performance metrics to enable alternative breakdowns. In the case of the FS&IS, some questions arose with respect to the measurement of tests[65] and whether that measurement was comparable to laboratories in a global sample or to a comparison group of Canadian laboratories. To avoid errors with the interpretation of the measure TEST, a second decomposition was developed for this study. In this decomposition, the Testing Intensity and Labour Productivity measures are combined through the measurement of CASES/FTE, which offers a comparable measure of productivity given and imbedded policy for testing. Making that substitution, the cost per case relationship of expression (3) is replaced by:

$$\frac{\boldsymbol{Cost}}{\boldsymbol{Case}} = \frac{\boldsymbol{Average\ Compensation}}{\boldsymbol{Case\ Productivity\ x\ Labour\ Expense\ Ratio}} \qquad (3')$$

Where Case Productivity (CASES/FTE) is equal to

$$\frac{\boldsymbol{Case}}{\boldsymbol{FTE}} = \frac{\boldsymbol{Labour\ Productivity}}{\boldsymbol{Testing\ Intensity}} \qquad (4)$$

The FORESIGHT benchmark ratios for each of the following measures are shown in Appendix H:

- Cost per Case
- Average Compensation
- Labour Case Productivity (Cases per Full Time Equivalent (FTE))
- Ratio of Personnel Expense to Total Expense

These benchmarks offer a useful standard by which to compare the performance of other laboratories. Additionally, the summary statistics serve as a basis for simulation and scenario analyses, where alternative laboratory models may be evaluated with respect to the expected outcome.

7.0 Analysis of the Performance of the RCMP FS&IS laboratory services

[64] The Labour Expense Ratio (Personnel Expenditures/Total Expenditures) serves as a proxy for the inter-temporal impact from long-term investment in capital equipment. For each investigative area, there is a strong negative relationship demonstrated by the correlation between the Labour Expense Ratio and the Capital Expense Ratio (Capital Expenditures/Total Expenditures).

[65] The appendix includes the definition of all of the components in equation (2) and offers examples from the FORESIGHT study on the interpretation of measures for items, samples, and tests.

The LabRAT template[66] was submitted by the RCMP FS&IS and from a global group of sixty-three laboratories including the Laboratoire de sciences judiciaires et de médecine légale (LSJML) in Montreal, and the Centre of Forensic Sciences in Ontario. The research team has used data from the RCMP FS&IS for comparison with validated data submitted by this global sample of laboratories[67] which has provided a benchmark for each investigative area.

The first set of tables is a comparison of the decomposition metrics including the Cost per Case, Cases per FTE, Average Compensation and ratio of Personnel Expense to Total Expense.

Note: All of the figures presented have been adjusted to 2010 Canadian dollars.

	Cost per Case		
Investigative Area	**FS&IS**	**Global Sample Mean**	**Canadian Minimum[68]**
Blood Alcohol	$2,204.74	$210.92	$665.08
DNA Casework	$3,070.04	$2,241.63	$1,236.64
Document Examination (including handwriting)	$2,861.82	$2,752.99	$2,861.82
Explosives	$54,352.46	$7,557.11	$1,898.05
Fire analysis	$5,141.77	$2,401.55	$811.02
Firearms and Ballistics	$1,991.18	$1,133.69	$693.94
Gun Shot Residue (GSR)	$6,650.07	$1,985.82	$5,769.89
Serology/Biology	$952.50	$656.77	$952.50
Toxicology ante mortem (excluding BAC)	$5,200.48	$543.48	$1,143.40
Toxicology post mortem (excluding BAC)	$5,331.17	$721.01	$1,144.38
Trace Evidence (includes Hairs &Fibres, Paint & Glass)	$10,924.58	$5,407.48	$2,534.38

Table 11-Comparison of Cost per Case between RCMP FS&IS, Canadian laboratories, and a global sample of forensic science laboratories

In every investigative area except document examination, the RCMP FS&IS average cost to process a case is higher than the global average, but for document examination and serology/biology the RCMP FS&IS average cost is the lowest amongst the Canadian laboratories. For Blood Alcohol,

[66] The LabRAT tool is a data collection instrument created in the FORESIGHT project. It provides uniform definitions for a variety of forensic laboratory metrics, including data on casework, personnel, and budgets.

[67] **Note.** Laboratories in the global sample have met recognized standards for quality (e.g., ISO/IEC 17025, ASCLD/LAB accreditation). Data was self-submitted by each laboratory with external verification of budget allocations. Data failing to conform to the standards outlined in project FORESIGHT have been excluded from the comparison sample. Within this benchmark data set (see Appendix J) two measures of central tendency, mean and median, are reported because of outliers in several of the investigative areas.

[68] The Canadian Minimum is highlighted as an indication of the possible cost per case that may be experienced given input prices unique to Canadian laboratories and the political, constitutional, legislative, regulatory, and law enforcement environments in Canada.

Explosives, Fire Analysis, Gunshot residue analysis (GSR), Toxicology ante-mortem, Toxicology post-mortem, and Trace Evidence, case processing is more than twice as expensive as the average laboratory in the global sample.

From the **decomposition of Cost per Case** we can begin to identify some of the factors that help to explain the differences in average cost for each investigative area. The first component is a productivity measure, Cases/FTE.

	Cases per FTE		
Investigative Area	**FS&IS**	**Global Sample Mean**	**Canadian Maximum[69]**
Blood Alcohol	55.49	1,021.70	261.41
DNA Casework	40.53	78.74	106.59
Document Examination (including handwriting)	39.26	61.28	39.26
Explosives	2.88	25.41	65.76
Fire analysis	21.64	94.71	124.50
Firearms and Ballistics	75.86	171.24	158.04
Gun Shot Residue (GSR)	16.66	114.24	19.32
Serology/Biology†[70]	107.08	232.15	107.08
Toxicology ante mortem (excluding BAC)	26.08	316.08	97.77
Toxicology post mortem (excluding BAC)	26.08	236.21	97.69
Trace Evidence (includes Hairs &Fibres, Paint & Glass)	10.38	37.69	52.40

Table 12- Comparison of Case per FTE productivity measure between RCMP FS&IS, Canadian laboratories and a global sample of forensic science laboratories

Productivity measures (Table 12) suggest that in every investigative area the RCMP FS&IS is less productive than the Global Sample mean, and in Blood Alcohol, Explosives, Fire Analysis, Firearms and Ballistics, GSR, Toxicology ante mortem, Toxicology post mortem, and Trace Evidence, the average laboratory from the global samples processes more than twice the number of cases as the RCMP FS&IS laboratory.

Several factors may explain these differences seen in tables 11 and 12 above; including (but not limited to): the volume of casework as a reflection of crime rates and/or submissions to the laboratory; productivity; regional economic factors; analytical processes; the mandate of a national

[69] **Note:** The Canadian Maximum is highlighted as an indication of the possible productivity that may be experienced given the political, constitutional, legislative, regulatory, and law enforcement environments in Canada.

[70] **Note:** A Biology case may be a combination of submissions recorded as Serology; involving the primary examination of the submitted exhibits, and the location and identification of potential body fluids; and the subsequent analysis of these body fluids using DNA profiling analysis. See Appendix E for examples on the counting of casework across multiple areas of investigation.

versus a provincial, regional, or metropolitan laboratory; the Canadian political, constitutional, legislative and regulatory context; and the particular organizational framework that has been adopted for the provision of these services.

The cost associated with the RCMP FS&IS Blood Alcohol investigative area may be skewed by the way RCMP collects these data. There are a number of non-casework activities undertaken by the scientific staff involved in Blood Alcohol Analysis, including a significant investment in the provision of training of police officers to use the breath testing instruments. As the RCMP does not capture casework hours it is impossible to account for these additional activities.

	Average Compensation		
Investigative Area	**FS&IS**	**Global Sample Mean**	**Canadian Minimum[71]**
Blood Alcohol	$89,503	$83,248	$83,513
DNA Casework	$92,320	$98,705	$64,821
Document Examination (including handwriting)	$75,542	$75,846	$75,542
Explosives	$95,763	$106,067	$80,052
Fire analysis	$77,533	$111,364	$41,622
Firearms and Ballistics	$91,844	$101,250	$56,464
Gun Shot Residue (GSR)	$86,206	$104,638	$71,548
Serology/Biology	$90,688	$105,884	$89,638
Toxicology ante mortem (excluding BAC)	$82,777	$84,529	$82,777
Toxicology post mortem (excluding BAC)	$85,162	$92,094	$54,089
Trace Evidence (includes Hairs &Fibres, Paint & Glass)	$88,570	$92,071	$54,089

Table 13-Comparison of Average Compensation between RCMP FS&IS, Canadian laboratories and a global sample of forensic science laboratories

An inspection of Average Compensation (Table 13 above) suggests that market conditions are not a factor in the higher average cost to process cases, as the RCMP average compensation is very near, and often below, the global mean in all investigative areas. However, compared to other Canadian laboratories, RCMP FS&IS offers higher compensation in many areas of investigation.

Personnel Expense/Total Expense

[71] **Note:** The Canadian Minimum is highlighted as an indication of the possible market compensation that may be experienced given the political, constitutional, legislative, regulatory, and law enforcement environments in Canada.

Investigative Area	FS&IS	Global Sample Mean	Canadian Maximum[72]
Blood Alcohol	73.16%	71.78%	73.16%
DNA Casework	74.19%	62.00%	74.19%
Document Examination (including handwriting)	85.24%	77.88%	85.24%
Explosives	49.57%	73.68%	65.67%
Fire analysis	82.53%	75.86%	82.53%
Firearms and Ballistics	57.07%	81.13%	81.46%
Gun Shot Residue (GSR)	81.83%	76.81%	81.83%
Serology/Biology	81.16%	76.95%	81.16%
Toxicology ante mortem (excluding BAC)	62.80%	66.96%	62.80%
Toxicology post mortem (excluding BAC)	63.71%	67.35%	73.31%
Trace Evidence (includes Hairs &Fibres, Paint & Glass)	78.68%	71.40%	78.68%

Table 14- Comparison of the proportion of Personnel Expense as a proportion of Total Expense

Under the Decomposition of Return on Investment model[73] used, the ratio of Personnel Expense to Total Expense serves as a proxy to capture the effect of investment in future periods that would be evidenced through the ratio of Capital Expenditure to Total Expenditure. These factors are highly negatively correlated[74]. A high Personnel Expense/Total Expense ratio indicates that a process tends to have a high manual component whilst a low Personnel/Total Expense ratio suggests the process is highly automated.

These data suggests there is a long term investment in capital equipment. The higher percentage of capital investment is a positive sign; higher investment levels today yield greater gains in future years.

The 2010-2011 expenditures, personnel allocation, and casework processing by the RCMP FS&IS are shown in Table 15 below. The data is drawn, with permission, from the RCMP FS&IS LabRAT submission to the FORESIGHT Project:

Investigation area	Expenditures Total	FTE	Cases

[72] **Note:** The Canadian Maximum is highlighted as an indication of the possible analytical mix of inputs that may be chosen given the political, constitutional, legislative, regulatory, and law enforcement environments in Canada.

[73] Speaker, P., (2009) The Decomposition of Return on Investment for Forensic Laboratories, *Forensic Science Policy and Management*, 1: 96–102.

[74] The proxy ratio of Labour Expense to Total Expense is used in place of Capital Expense to Total Expense to preserve parsimony in the Decomposition of Average Cost. The direct use of Capital Expense to Total Expense dramatically increases the number of ratios within the decomposition without adding significant value to the expression.

Blood Alcohol	$2,418,597	19.77	1,097
Counterfeits	$2,036,951	16.97	860
DNA Casework	$15,466,863	124.30	5,038
Document Examination	$340,557	3.03	119
Explosives	$1,195,754	7.64	22
Fire analysis	$925,518	8.32	180
Firearms and Ballistics	$6,292,142	41.66	3,160
Gun Shot Residue (GSR)	$625,106	5.64	94
Serology/Biology	$6,633,216	65.03	6,964
Toxicology - Opinion Letters	$1,185,659	11.11	1,258
Toxicology ante mortem (excluding BAC)	$3,858,753	28.45	742
Toxicology post mortem (excluding BAC)	$1,348,785	9.70	253
Trace Evidence	$1,431,120	12.62	131
Total	**$43,759,022**	**354.25**	**19,918**

Table 15-The RCMP FS&IS 2010 expenditures, personnel allocation and casework submissions

Using the Decomposition of Return on Investment, as described above, as an econometric modelling tool, the RCMP FS&IS data can be used to develop an understanding of the organizational performance against a number of parameters.

Note: There is a concern that differences in scientific methodologies and analytical processes between the Canadian laboratories might account for some of the differences in costs. For example, the work content of a toxicology case submitted to CFS in Toronto under the Coroner's Act may differ from that of a sex offence case submitted by the police to an RCMP FS&IS laboratory. Each case might require a battery of analytical screening and confirmatory tests for the presence of drugs and the production of a Laboratory Report containing the scientific results. However, for each Coroners Act case received by CFS, Toronto, a scientist has to meet with the Pathologist and the Coroner to discuss the case circumstances prior to undertaking the laboratory analysis.

Again, using Toxicology as an example, it was noted during the researchers' visits to the RCMP FS&IS laboratories that the analytical equipment varied between the Toxicology Units. This means that the RCMP FS&IS cannot standardise their toxicology processes, and maintaining such variation inevitably increases cost.

In addition, the laboratory Quality Assurance programmes might demand a different level of testing for similar analytical processes.

These differences in cost, and/or productivity, are captured in the decomposition and economies of scale analyses.

7.1 Economies of Scale and Scope

An examination of the optimal forensic services model includes a consideration of the size of the operations in any investigative area and a consideration of the mixture of services across

investigative areas. The former issue involves the determination of optimal **economies of scale** within an investigative area, while the latter involves **economies of scope**.

Economies of scale exist when an increase in provision of a good or service results in a drop in the average cost of that good or service. Diseconomies of scale are said to exist when higher output increases the average cost. It is a well-known result in cost theory that the average cost curve for the provision of any good or service is a U-shaped curve with the minimum indicating perfect economies of scale. For a given investigative area of the laboratory, Figure 9 illustrates the theoretical concept of economies of scale. Notice the relationship between the average cost curve and the total cost. The U-shaped average cost curve may be typified by a 2nd degree polynomial. The corresponding total cost curve is an S-shaped curved (typified by a 3rd degree polynomial) and either representation is related to the perfect economies of scale. For the U-shaped average cost, perfect economies are shown directly as the case level that results in the minimum average cost. That same case level is associated with the point on the S-shaped total cost curve where the average cost is represented by a ray from the origin and tangent to the total cost curve.[75]

The average cost curve is a reflection of the ideal size laboratory system for a given volume of casework. It is a reflection of the most cost effective mix of personnel, capital, and other inputs to provide that level of casework in a single laboratory. As such, a laboratory system can determine the most cost effective number of laboratories as it attempts to "right size" its facilities towards perfect economies of scale.

There is another implication from the relationship between Average Cost and Caseload depicted in Figure 9 below. For laboratories operating a single facility for a case volume below the level of perfect economies of scale, a new perspective may be reached when reviewing the performance data in the previous section. That is, a relatively high average cost might merely be a reflection of a low crime rate, and therefore a low utilisation of a given test, and not indicate any lack of efficiency on the part of the laboratory.

[75] This point of tangency represents where the marginal cost and average cost are equal. Beyond that level of casework, average cost is rising as marginal cost exceeds average cost.

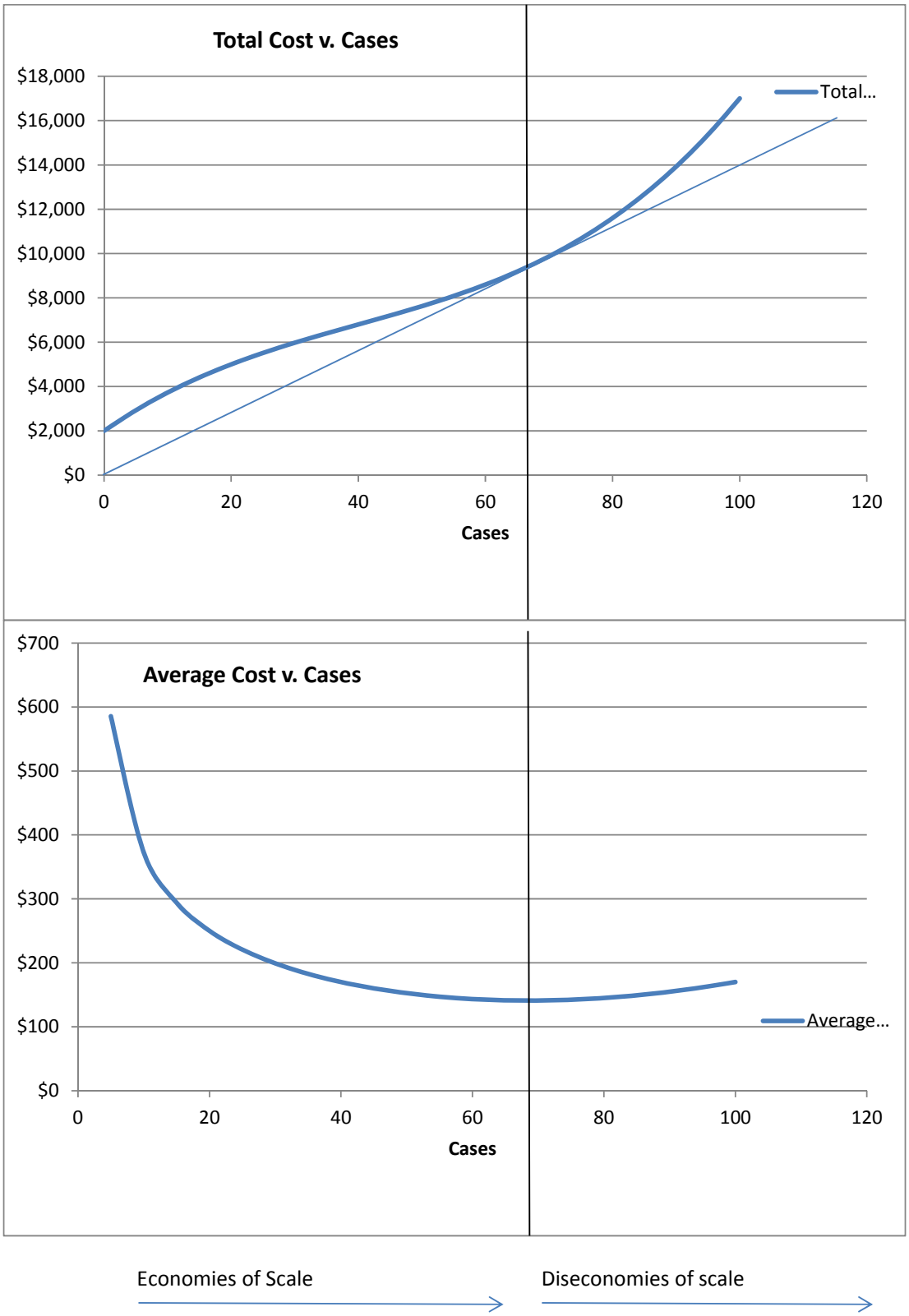

Figure 9 - Economies and Diseconomies of Scale

As noted above, an average cost curve as shown in Figure 9 above, as with other U-shaped curves, is represented by a second degree polynomial equation and the total cost curve is represented by a third degree polynomial. To determine the level of output associated with perfect economies of scale for each investigative area, the process begins with a regression estimate of the relationship between the Cost and the variable Cases as represented in these functional forms. That is, the following relationship is estimated using multiple least squares:

$$Total\ Cost = \beta_0 + \beta_1\ Cases + \beta_2\ Cases^2 + \beta_3\ Cases^3$$

From the resulting estimation, Average Cost may be calculated after dividing the estimated equation by Cases. Figure 10 illustrates the estimation for a hypothetical investigative area. For this example the data suggests that perfect economies of scale are achieved at 3,692 cases.[76] Notice that a large number of observations are clustered at the lower end of the case spectrum. This is typical of each investigative area in the forensic sciences; many laboratories maintain an expertise in an investigative area even with a low volume of cases in that area.

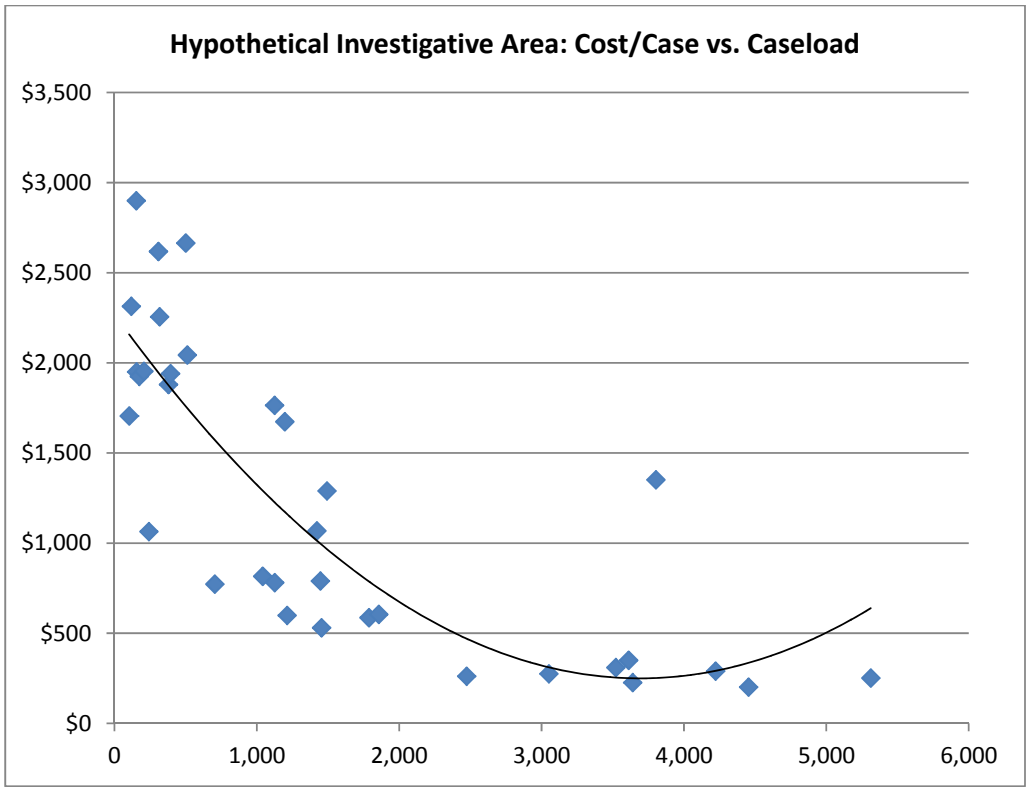

Figure 10 - Estimated Average Cost Curve for Hypothetical Example

The size of the comparative global laboratory group (sixty-three laboratories) lends itself to good statistical properties in these estimates. The assumptions of linear regression include the

[76] The perfect economies of scale volume of casework is found by taking the partial derivative of the estimated equation with respect to Cases, setting the result equal to average cost, and solving for the number of cases.

assumption of normality in the distribution of the error terms. With the sample size of the global laboratory group, the central limit theorem may be invoked to argue that the distribution of errors is normally distributed with constant variance across case volumes.

The concept of **economies of scope** addresses the bundles of services that are offered. Economies of scope are realized when the laboratory demonstrates synergies from the offering of multiple areas of investigation that permit the lowering of costs in combination from what they would have been if offered individually. Examination of this issue involves the estimation of the cost curves for each individual investigative service with a comparison to the costs from joint provision of those services. While economies of scope represent another interesting question regarding the makeup of the ideal laboratory, it does not appear that the data offers sufficient observations to make such an estimate worthwhile.

7.2 Foundations of the RCMP FS&IS Cost Structure

The analysis from the prior two sections provides the foundation for an explanation of the performance by the RCMP FS&IS. To demonstrate, consider a hypothetical investigative area in which the Cost/Case for RCMP FS&IS is $2,750.00 while the average Global sample Cost/Case is $2,000.00. The volume of casework processed by RCMP FS&IS is first compared to that which constitutes a perfect economy of scale. Figure 11 illustrates.

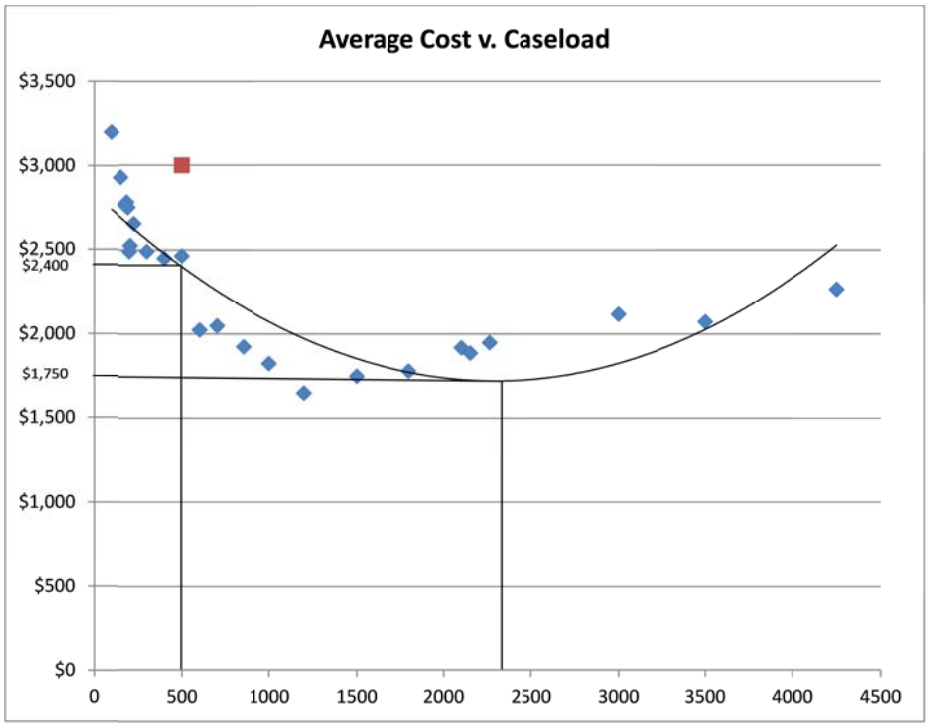

Figure 11- Economies of Scale for a hypothetical investigative area

This graph illustrates that the Cost per case is optimized at 2,350 cases at an average cost of $1,750.00. Suppose that the RCMP FS&IS processes 500 cases at an average cost of $3,000.00. Part of the explanation for the higher cost experienced by the RCMP FS&IS is that the number of cases entered into the system is insufficient to realize the gains from scale of operations. When we fit the

RCMP FS&IS case volume into the economies of scale cost/case curve we find that $650.00 (that is $2,400.00 cost/case for 500 cases minus the $1,750.00 minimum) of the cost/case difference is explained by the lower case volume in their jurisdiction. Potential gains from a new model of delivery might come via a consolidation of activity within the organization, or with other jurisdictions, to reach an optimal volume.

Part of the difference in Cost/Case may be related to the Canadian context, e.g. some of the consumables might be more expensive in Canada than in Europe or the USA. In addition, the Quality Assurance regimes required to meet the Canadian legal standards might require different laboratory protocols. Using the minimum cost/case Canadian laboratory to illustrate these differences, we offer an explanation for another portion of the differences as shown in Figure 12 below:

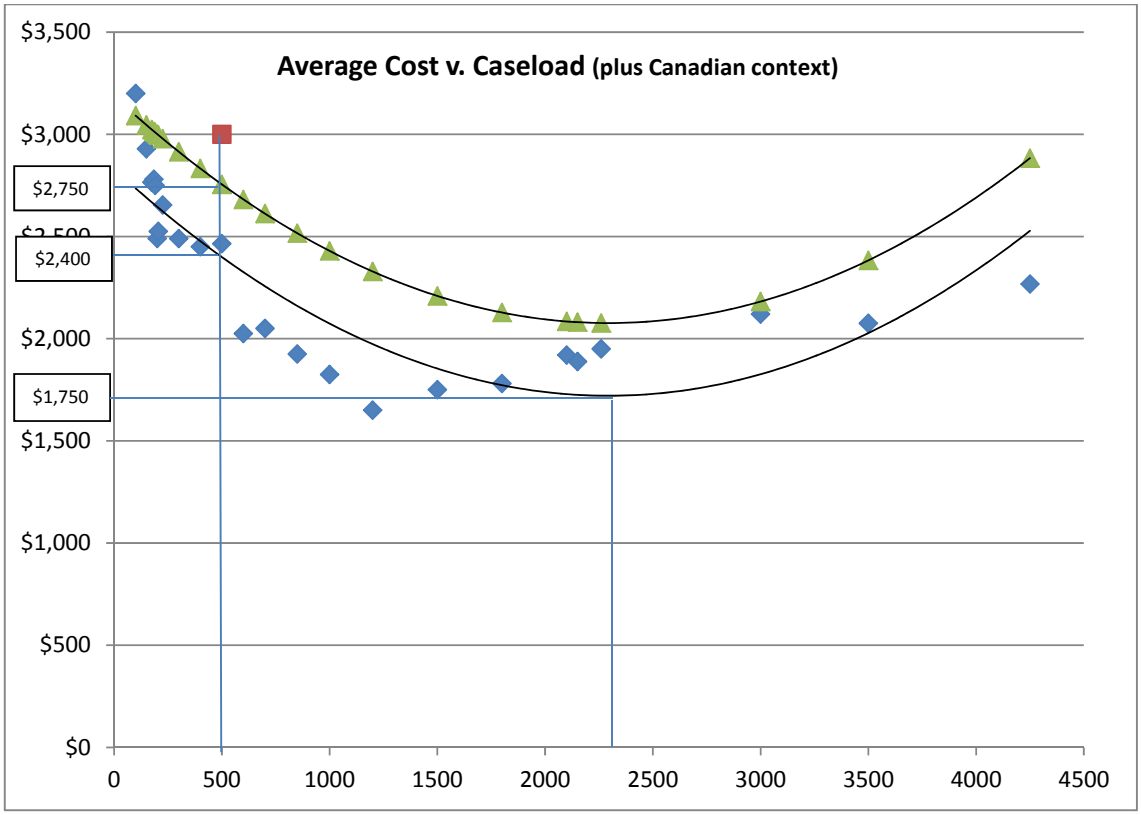

Figure 12- Economies of Scale for a hypothetical investigative area for the Canadian Context

When the average cost curve is adjusted upward by the additional cost/case for the Canadian context, the average cost curve shifts upwards by $350.00 at every level of case processing. Of the $1,250.00 higher cost per case, economies of scale explains $650.00 of the difference, and the Canadian context explains $350.00. The remaining $250.00 represents a difference in this hypothetical case, which might need to be explained.

A third consideration involves the mandate of the national laboratory. This may reflect the greater responsibilities in covering a wider geographical area and a larger number of police jurisdictions than

the average laboratory. It may also reflect the broader responsibilities for national safety and security. One example of this is in the provision of a national service for the examination of post-blast explosives cases. Maintaining an RCMP FS&IS explosives team and the equipment and laboratory processes to support the examination of only 22 cases per annum, makes the cost of each case over $50,000. This might reflect the cost of maintaining the expertise to fulfil the national mandate of the RCMP FS&IS to support the investigation of such cases. The decomposition model highlights such outliers for further scrutiny. To reflect the greater cost from the broader responsibility, Figure 12 can be amended to include the cost structure of national laboratories and multi-facility laboratory systems. Figure 13 illustrates that inclusion.

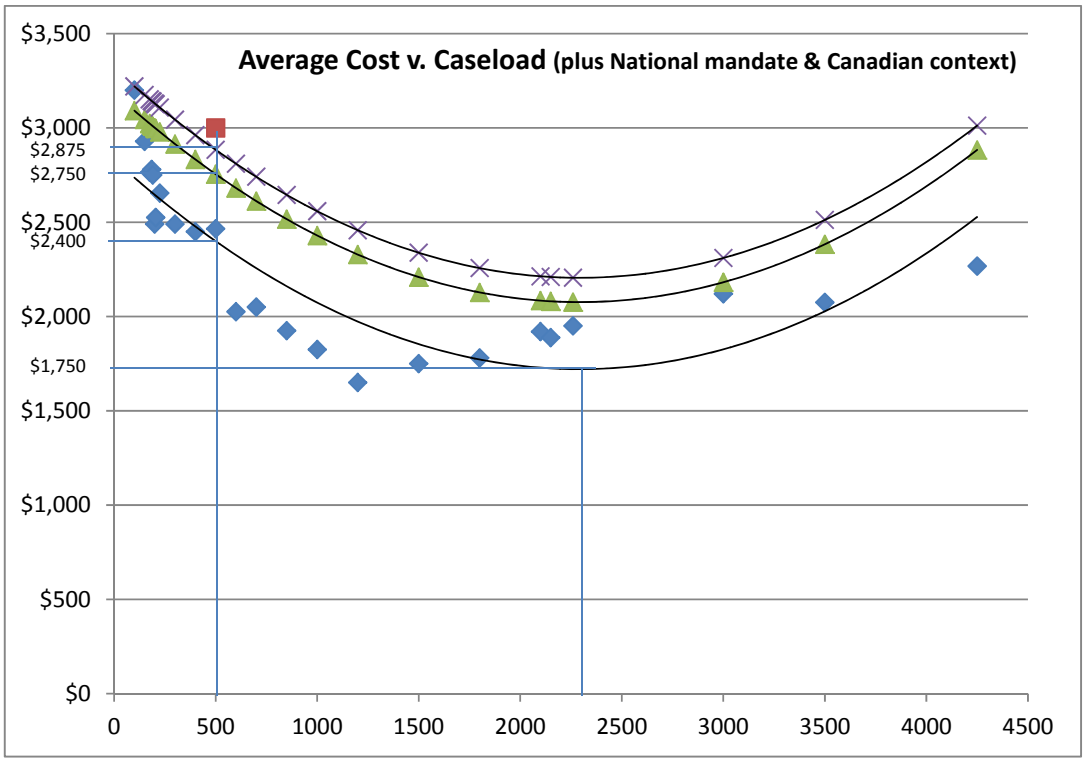

Figure 13 - Economies of Scale for a hypothetical investigative area for the Canadian Context and National mandate

Another $125.00 is explained by additional responsibilities. That leaves $3,000.00 minus $2,875.00 to be explained. This remaining difference may be revealed via examination of the other cost components and the KPIs highlighted in Section 6 above. These cost components may include non-casework activities (such as Breath Test Instrument training within the Blood Alcohol investigative area), and could be captured if the distribution of personnel hours had been recorded.

7.3 Econometric Model of the Cost Effective Provision of Forensic Science Services

From the foundations presented in the preceding section, the econometric model for the cost effective provision of forensic science services is developed. The cross-sectional econometric model provides the means to compare feasible and sustainable models for cost effectiveness via a model to explain cost minimization, according to microeconomic theory. When the data for RCMP FS&IS

2010-2011 financial year are placed into the estimated model, the baseline is obtained from which to compare the alternative model frameworks.

From the previous discussion, it is postulated that:

Cost = *f* (Caseload, Laboratory Facilities, Market Economic Conditions, Analytical Process, Productivity, Risk Management, Time in Casework, Jurisdiction, Country)

As noted in section 7.1, the average cost curve when mapped against caseload will be typified by a parabolic curve with the minimum point indicating the volume of casework associated with perfect economies of scale. If the scatter plot of Average Cost versus Caseload resembles a U-shaped curve, then a polynomial regression is appropriate. However, if the U-shaped curve does not appear in the scatter plot, then alternative representations would include logarithmic relationships, exponential relationships, or multiplicative relationships. The logarithmic relationship might best describe the downward-sloped portion of a U-shaped average cost curve while the exponential relationship might best describe the upward-sloped portion of the U-shaped cost curve. The multiplicative relationship will best be estimated with a double logarithmic regression.

Consider the model that represents this relationship between Total Cost and Caseload. For a linear regression estimate of this non-linear relationship three variables CASES, CASES SQUARED (defined as CASES x CASES), and CASES CUBED (defined as CASES x CASES x CASES) are introduced to the model. These variables are used to capture economies of scale.

Beyond the economies of scale explanation for laboratory expenses, there are other unique circumstances that may be captured. As described in section 7.2 these include the other arguments in the functional relationship suggested above. To capture market conditions, the average compensation (COMP) in each laboratory is used to reflect this influence. Laboratories must compete for their personnel and offer compensation that is indicative of both the skill required for the position and the demands of the local economy.

Cost theory teaches us that for any volume of production, there are a number of different combinations of labour, capital, and other inputs to achieve that level of production. The most cost effective analytical process will anticipate the general level of casework and choose a process appropriate for that level of activity, one that minimizes the cost. Several variables might be used to capture this effect including the percentage of capital expenditures to total expenditures, the percentage of personnel expenditures to total expenditures, and the ratio of personnel expenditure to consumables expenditures.

Given the quality variation in depreciation rules across laboratories and detail of reporting, the capital expenditure ratio was abandoned in favour of the ratio of **Personnel Expenditures to Consumable Expenditures** (LABOUR).

To capture productivity, the decomposition of average cost (Speaker, 2009b) indicates that the **ratio of tests per FTE** will be an appropriate measure. Although the LabRAT tool provides a series of examples to count the measure of Test, some concerns emerged when the RCMP FS&IS Test levels were compared to the global sample. While it is possible that policies and procedures for the RCMP FS&IS laboratories call for a high number of tests relative to other laboratories, the review team was suspicious of the consistency of this measure with the comparison sample. As such, alternative productivity measures, **Items per FTE** and **Samples per FTE (PRODUCTIVITY**) were considered.

A few additional variables appear in the equations (1) and (2) below. These represent (0,1) dummy variables to capture effects solicited in the Statement of Work or to address issues raised through the interviews highlighted in the previous sections.

These dummy variables include CA to capture the Canadian political, constitutional, legislative, and regulatory context and to recognize input prices that may be unique to Canadian laboratories.

Another dummy variable MULTI, representing laboratory systems with multiple facilities (MULTI = 1 if the observation represents a multi-laboratory system and 0 otherwise), is included to capture any unique expenses of the multi-laboratory system. MULTI is expected to address those laboratories with a caseload beyond the level for perfect economies of scale for which an additional facility divides the workload for a more efficient response.

Finally, NAT is a (0, 1) dummy with a value of 1 assigned to any laboratory with a national mandate and 0 assigned otherwise.

Equation (1) leads to a U-shaped scatter plot of the relationship between average cost and caseload from the S-shaped relationship between Total Cost and caseload. The use of CASES, CASES SQUARED, and CASES CUBED takes the hypothesized non-linear relationship and transforms it into a linearity that may be estimated by linear regression.

$$\text{COST} = \beta_0 + \beta_1 * \text{CASES} + \beta_2 * \text{CASES SQUARED} + \beta_3 * \text{CASES CUBED} + \beta_4 * \text{CA} + \beta_5 * \text{PRODUCTIVITY} + \beta_6 * \text{LABOUR} + \beta 7_6 * \text{MULTI} + \beta_7 * \text{NAT} + \beta_8 * \text{COMP} \quad (1)$$

7.4 Cost of providing the RCMP FS&IS forensic laboratory services

RCMP FS&IS laboratory services are currently delivered from six laboratories located in major cities across Canada. Biology and DNA analysis, Toxicology and Firearms and Ballistics analysis are delivered from multiple sites, whilst Trace Evidence, Gunshot Residue Analysis, Document Analysis and Explosives Analysis are delivered from special units at single sites (see Table 3).

RCMP FS&IS has a staff complement of 387.4 of whom 311 are directly involved in the delivery of operational casework. The remaining 76.4 staff have managerial, administrative, programme support and operational support duties. The costs of running the individual RCMP FS&IS laboratories for 2010/11 is shown below.

	FORESIGHT	Halifax	Ottawa	Winnipeg	Regina	Edmonton	Vancouver
	2010/11	**2010/11**	**2010/11**	**2010/11**	**2010/11**	**2010/11**	**2010/11**
FTE	387.4	36.5	73	26.5	27	58	90
Salaries(OT included)	$28,778,523	$2,819,413	$4,962,473	$1,764,816	$1,967,321	$3,811,874	$6,060,313
O&M							
Travel		$31,169	$105,769	$29,557	$48,681	$119,543	$60,559
Freight/Postage		$35,116	$62,496	$30,863	$20,184	$30,111	$33,313
Telecommunications	$276,237	$22,272	$5,330	$28,947	$29,693	$12,953	$8,557
Publication services		$1,320	$0	$383	$184	($140)	$112
Contracted services real Property		$625,374	$8,120	$505,341	$21,901	$167,270	$148,052
Corps of Commissionaire		$30,175			$19,392	$53,371	$51,651
Professional services		$21,900	$52,100	$6,770	$7,812	$11,334	$56,687
Rentals		$7,623	$9,249	$9,027	$3,178	$2,450	$8,085
Building repairs		$23,078	$36,571	$488	$2,419	$4,535	$17,208
Instrument repairs	$1,426,331	$40,824	$280,089	$58,341	$967	$70,128	$150,099
Misc repairs		$1,765	$0	$8,099	$1,964	$2,151	$2,041
lab supplies		$141,929	$821,966	$168,765	$7,297	$518,333	$872,371
Fuel(Freight related)			$43,931				
Utility services/heating	$486,627				$333,544	$148,313	$4,770
Utilities&Materials		$32,382	$38,754	$49,079	$28,517	$64,900	$109,046
Minor Capital		$370,830	$330,794	$472,415	$7,128	$67,006	$494,297
PILT		$94,619	$724,750	$186,144	$155,756	$158,299	$31,750
Other		$162	$324	$770	$164	$721	$644
	$16,515,916	$1,480,538	$2,520,243	$1,554,989	$688,781	$1,431,278	$2,049,242
Capital							
Building work		$726,047	$798,986	$3,377,040	$2,286,409	$122,390	$28,463
Vehicules		$0		$0	$0	$18,607	
	$4,245,244	$726,047	$798,986	$3,377,040	$2,286,409	$140,997	$28,463
TOTAL	**$49,539,683**	**$5,025,998**	**$8,281,702**	**$6,696,845**	**$4,942,511**	**$5,384,149**	**$8,138,018**

Table 16 – Costs of running the RCMP FS&IS laboratories by site[77]

From data supplied for fiscal year 2010/2011, the overall costs of running the RCMP FS&IS forensic laboratory services was approximately $49.5 million, of which $36.9 million supported operational delivery and $12.6 million was managerial, administrative and support overheads. The entries in Table 16 only indicate the expenditure levels for one year. While a single year's O&M budget may be indicative of typical expenses for succeeding years, caution should be used in extending annual expenditures for capital expenses. For example, the entries in Table 16 include some one-time costs

[77] These data do not include the staff or administrative costs of management, programme support, or operational support.

for capital expenditures ($400,000 for Regina, $500,000 for Winnipeg, and $600,000 for Halifax). Appendix G, Table 27 highlights the point as it modifies the single year's potential fixed cost savings to reflect the average capital expenditure over the three years of data provided.

8.0 Organizational Options

The analysis contained in Section 7 above exposes a number of organizational and process issues which suggest that RCMP FS&IS laboratory services may be more expensive (or less productive) than they could be.

The present section examines organizational options for the delivery of RCMP FS&IS laboratory services, ranging from different ways of organizing the delivery of forensic science services within government to outright privatization. This section:

- **Firstly, describes different organizational models for the delivery of services;**
- **Then, addresses a number of issues arising in connection with a change in organizational status; and**
- **Finally, concludes with an assessment of the viable options for the delivery of FS&IS laboratory services, including options for cost recovery.**

This treatment of organizational options is informed by a detailed comparison of the international experience with the delivery of forensic laboratory services. This is shown in Appendices A and B.

8.1 Alternative Service Delivery Models

Forensic science is delivered under different business models in jurisdictions around the world. The nature of the laboratory organization, whether as a national, state/provincial provider, or local/municipal provider, impacts on the structure, conduct and governance that organization might be required to establish. In addition, the needs of a particular jurisdiction might require a single laboratory, or the forensic science services might be more appropriately delivered from multiple laboratory sites. The characteristics of a multi-site forensic organization often depend on the geographic area the jurisdiction occupies.

The ***nature*** of the forensic services offered will also vary, being dependent on the mandate under which the forensic laboratory is established. Services offered by laboratories with a national or international remit will differ from those with just a local or municipal remit. In the former, the forensic provider might be expected to offer a full range of forensic techniques to support routine police investigations, and maintain specialist staff and equipment to cover the requirements of anti-terrorism or national security investigations. The local laboratory or police forensic investigation support unit, by contrast, might only be required to support the initial examination of a crime scene or casework items, outsourcing analytical testing to another organization. The responsibilities of the differing forensic science facilities are shown in Figure 14 below.

'WORLD LEADING' FORENSIC SCIENCE SUPPLIER
Purpose: National/International/Global lead in Forensic science. Aim is to develop and provide solutions to national and international policing problems.
Development and supply of advanced technologies. Invests heavily in advanced R&D and involved in major international research collaborations
Developing and maintaining forensic databases to provide advanced intelligence services
Provides lead for development of international forensic policy and international practice. May have international responsibilities and oversight (CODIS database – design, delivery & maintenance)
International influence in the development of forensic science concepts and techniques providing support to other, leading forensic science suppliers. Staff considered to be 'world leaders' in their appropriate fields
Examples include – Federal Bureau of Investigation, USA; FSS (UK) pre-2010

NATIONAL FORENSIC SERVICES SUPPLIER
Purpose: National forensic science supplier – provides solutions to provincial and federal policing issues Maintains forensic databases to provide intelligence services and has access to advanced technology. May have some R & D capability.
Influences (or sets) national forensic policies and impacts on legislation and has national/federal responsibilities and oversight. May influence local/provincial/state forensic science policy
Interacts with national and international professional bodies; G8, ENFSI, Interpol, Europol
Accreditation to ISO 17025 and all required national standards
Examples include: RCMP FS&IS; ESR (NZ); Netherlands Forensics Institute; BKA (Germany)

FORENSIC SCIENCE LABORATORY
Purpose: Provision of a range of laboratory services for local, municipal or provincial police – primary examination of exhibits and determination of presence/absence of forensically significant samples. Recovery, identification and analysis of such samples – body fluids & DNA profiling, Toxicology and Alcohol, Firearms, Explosives, Trace evidence and particulates.
Evaluation and Interpretation of evidence and provision of expert opinion to the CJS and courts
Limited R&D capability, if any
Accreditation to ISO 17025 and all required national standards
Most forensic science laboratories fit into this category – LSJML, CFS, LGC (UK), Orchid Forensics (UK)

FORENSIC TESTING LABORATORY
Purpose: limited to forensic 'testing' – DNA profiling services, workplace or equine drug testing etc
Limited or no interpretation of results; Court attendance as required
Accreditation to appropriate ISO 17025 and other required national standards
e.g. Maxxam Analytics, Warnex Pro-DNA, Wyndhams Forensic Group

LOCAL POLICE FORENSIC IDENTIFICATION UNIT
Purpose: limited to local police investigations and crime scene examination – court reporting as required
Development of fingerprints and other marks; use of enhancement techniques when necessary
Management of exhibits from scene of crime
Examination of scenes of crime for items relevant to investigations – Volume and Serious Crime
Limited, if any, accreditation – ISO 9001 (Management) and internal staff training and competency

Figure 14 - roles and responsibilities of forensic facilities

The ***governance structures*** under which forensic laboratories operate also vary widely across international jurisdictions. Many laboratory services are provided by national policing or investigative services such as the Federal Bureau of Investigation in the USA, or the RCMP FS&IS. Others are supported by law enforcement agencies at state or provincial level, as in the cases of the California Department of Justice, the Florida Department of Law Enforcement, or the Ontario Ministry of Public Safety and Correctional Services. Still others operate as Crown or Special Operating Agencies associated with governmental ministries. The Forensic Science Service in England & Wales (1991 - 2005), and New Zealand's Environmental Science and Research Ltd (ESR) are examples of such agencies.

Finally, some suppliers of particular forensic services operate as fully commercial organizations, providing forensic science expertise on a fee-for-service basis. From 2005, forensic science services have been delivered to the police and criminal justice system in England & Wales by a number of commercial suppliers, through a competitive tendering process. In Canada, there are three commercial suppliers of DNA profiling services, and a number of commercial companies in the USA offer high-throughput DNA profiling services to State and local laboratories. It should be noted that, in North America, none of the commercial suppliers provide a full range of forensic services, whereas in England & Wales the major commercial organizations are full-service suppliers.

8.1.1 Other Models

In this section the current status of forensic science provision by the RCMP FS&IS and the potential for alternate models of service delivery is reviewed. This range of alternative models includes:

1. **Consolidation of RCMP FS&IS laboratory services** – reducing the number of laboratory sites from the current six;
2. Delivery of forensic science through a **new government organization** (a Special Operating Agency, Service Agency or Crown Corporation);
3. **Privatizing** some or all of the RCMP FS&IS laboratory services.

These alternate forensic science delivery models are exemplified by reference to appropriate forensic science provision in non-Canadian jurisdictions.

A fourth major option for the delivery of forensic laboratory services would be to transfer the RCMP FS&IS laboratories, personnel and associated financial resources to the provinces, on the grounds that these services are almost entirely in support of an area, or areas, of provincial jurisdiction, namely the enforcement of the criminal law. This option, whilst it might appear possible in theory, is in fact not realistic in practice. Nevertheless, for the sake of completeness it is addressed in Section 8.6.

8.2 Model One: Consolidation of RCMP FS&IS Laboratories

RCMP FS&IS laboratory services are currently delivered from six laboratories located in major cities across Canada. Much of the service delivery is duplicated at multiple sites (see Table 3) and the analysis shown in Section 7 above demonstrates that there is an underutilization of staff and other resources within the RCMP FS&IS laboratory service. Using a strategy to take advantage of greater economies of scale, one obvious option would be to rationalize the number of laboratories from which RCMP FS&IS delivers its laboratory services.

To determine where the FS&IS should locate its laboratories so as to optimise geographic coverage and customer support, it is instructive to consider the proportion of cases submitted to the RCMP FS&IS by province and territory. This is summarised in Table 17 below. The full data are shown in Appendix G.

	Submissions
Alberta	24.46%
British Columbia	31.49%
Manitoba	14.69%
New Brunswick	3.96%
Newfoundland and Labrador	2.50%
Nova Scotia	8.02%
Northwest Territories	0.85%
Nunavut	0.66%
Ontario	2.76%
Prince Edward Island	0.74%
Quebec	1.13%
Saskatchewan	8.20%
Yukon Territory	0.55%
Total	**100.01%**

Table 17 – Case submissions (%) to the RCMP FS&IS by province and territory

It may seem surprising that the RCMP FS&IS receive work from Ontario and Quebec. However, these provinces may require RCMP FS&IS support for those cases that involve international, federal, or cross-border crime.

Mapping the geographic origin of the case submissions against the location and operational service delivery work streams of the current RCMP FS&IS laboratories suggests two rationalisation strategies involving the closure of either two or three laboratories.

Scenario 1 – retaining laboratories in: Vancouver, Edmonton, Ottawa and Halifax

Scenario 2 – retaining laboratories in: Vancouver, Edmonton, and Ottawa[78].

The costs of running the RCMP FS&IS operational laboratories are shown in Table 27 (Appendix G) below. Consolidating the number of laboratory sites from which the RCMP FS&IS laboratory services

[78] Scenario 2 would require **all** of the laboratories to undertake full service delivery while retaining the specialist services in Counterfeiting and Document examination and Explosives analysis in Ottawa.

are delivered and eliminating the redundant fixed costs would reduce the cost of forensic science delivery. Table 27 offers a demonstration of the types of savings that may be made from the elimination of some fixed cost components (e.g., capital expenditures, utilities, maintenance, Payments in Lieu of Taxes) prior to consideration of other jurisdictional and law enforcement considerations that could affect the manner in which forensic laboratory services are delivered.

Note: this analysis demonstrates the potential savings from elimination of the laboratory sites. Whilst it is accepted that this option will make some managerial, administrative and maintenance staff positions redundant neither of these current costs, nor the costs of transferring people or equipment from one laboratory to another, have been included in the analysis. It is assumed, however, that the operational staff positions will be transferred to the remaining sites.

An analysis of the data presented in Table 27 provides a range for the upper limit of potential fixed cost savings of between $4.5 and $9.4 million, depending on which laboratories were closed and which retained.

- **Scenario 1:** Consolidating the staff and operational delivery in **four laboratories** by closing the Winnipeg and Regina sites could lead to an estimated annual fixed cost saving **of between $4.5 and $7.5 million.**

  The rationale for this suggestion is that the services being delivered from the Regina laboratory (Firearms and remote Biology Case Reporting) and from the Winnipeg laboratory (Toxicology only) are each currently delivered from two other sites (see Table 3).

- **Scenario 2:** Consolidating operational delivery at three laboratory sites by closing Winnipeg, Regina, and Halifax could lead to estimated fixed cost annual savings of **between $6.0 and $9.4million.**

  This is likely to be a much more difficult scenario to achieve from an operational perspective, as the capabilities of the three remaining laboratories would have to be extended to incorporate additional toxicology and firearms sections.

There may be additional savings made in both of the scenarios presented above as managerial, administrative and maintenance staff positions are released as laboratory sites close. The projected savings made by the closure of laboratory sites are **annual savings**. It is noted that these savings would have to be offset by **one-off costs** of about $40,000 for each member of the operational staff transferred to another site.

Note: There is a risk in such a major re-organization in that the RCMP FS&IS could lose very experienced staff if they choose to resign rather than move. If RCMP FS&IS undertakes such a laboratory closure programme, it might be prudent to consider the consequences for the organization if 50% of the staff in the affected laboratories elect to resign. A fuller analysis of this issue is shown in Appendix G. This analysis will, of course, inform any decision about the retention or closure of any particular RCMP FS&IS laboratory.

Summary

The RCMP FS&IS laboratory services are currently delivered from six laboratories located in major cities across Canada. Much of the service delivery is duplicated at multiple sites (see Table 3). The analysis shown in Section 7 above demonstrates that there is considerable underutilization of staff and other resources.

The estimated annual fixed cost savings generated by the closure of the Winnipeg and Regina sites could be between $4.5 and $7.5 million. Closing these two sites, each of which have a very limited range of services, is the easiest operational option for the RCMP FS&IS.

By closing three laboratory sites (Winnipeg, Regina, and Halifax) the potential cost savings rise, estimated to be between $6.0 and $9.4 million, but the development of the remaining facilities into full service laboratories would be much more of an operational challenge and could incur considerable cost.

8.3 Model Two: Delivery through a New Government Organization

The second model for delivering forensic services would be to transform FS&IS laboratory services into a separate government organization; either as a distinct agency *within* the RCMP, or a legally separate organization serving the RCMP and other police services in Canada.

As noted above, there are three ways to do this[79]:

a) Convert RCMP FS&IS laboratory services from a regular element of the RCMP into what is called a **Special Operating Agency** *within* the RCMP (this would be done by Treasury Board decision)[80];

b) Transform RCMP FS&IS laboratory services into a '**Service Agency'** like Canada Revenue Agency (CRA), Parks Canada or the Canada Food Inspection Agency (CFIA). This could be done initially by Order in Council but would require legislation to follow;

c) Create RCMP FS&IS laboratory services as a **Crown Corporation**. This would also require legislation.

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[79] There is another category of agency not discussed in this section, namely agencies that are simply parts of the Public Service that are designated by Order in Council as a 'department' for the purposes of the *Financial Administration Act* and other administrative statutes. These organizations are legally freestanding and administratively managed as if they were a regular department of government. The head of the organization has the status and all the authorities of a deputy head. Examples in this category include everything from the Privy Council Office to the Canadian International Development Agency. Because there would appear to be little to be gained in terms of commercial-type efficiency from simply designating RCMP FS&IS as a 'department' like this, this category of organization is not considered further in this paper.

[80] It should be noted that a decision would have to be made on whether the organization to be converted into something separate is simply the six RCMP FS&IS laboratories, or whether we consider the RCMP FS&IS as a whole. The distinction is important – FS&IS includes a number of functional units quite separate from the forensic laboratories that are the subject of the present study. It may be, however, that if the goal were to change the status of the laboratories, the best way to do this might be to include the entire FS&IS.

This section examines the pros and cons of these different models. As we consider these organizational options, we should bear in mind that:

- *Organizational change per se is almost never the solution to a problem. Rather, it should be seen as one tool, perhaps among many, that can enable a solution*. The first thing you need to know is what you are trying to achieve in program terms; then you can look for the organizational model that best supports those program objectives.

- *Organizational change is costly in both financial and human terms, and it requires time to take effect*. If what is desired is a change in organizational culture and performance, simply changing the legal status or business model of an organization will not deliver instant results.

8.3.1 Special Operating Agencies (SOAs)

The UK concept of the 'executive agency'[81] was one of the inspirations for a similar organizational innovation in Canada in the 1980s, where this type of governmental body was called a 'Special Operating Agency' (SOA).

As in the UK, this form of organization was seen as an effective way of delivering government services in a way that was:

- More aligned to client needs; and
- More business-like in operations and in the costing of services.

Although inspired by the UK executive agency concept, there are some important differences between the UK model and what emerged in the Canadian model. Notably, many more agencies were created in the UK (some 133 agencies by the year2000) and the UK executive agencies are in some respects more like Canadian 'Service Agencies'[82].

The first group of Canadian SOAs was announced by the President of the Treasury Board in December 1989. Since then, some 16 Special Operating Agencies have been created in Canada, the most recent being the Canadian Coast Guard (2003) and Industry Canada's Industrial Technologies Office (2007).

[81] See Appendix A

[82] For example, although the head of a UK Executive Agency reports to the Permanent Secretary of the department, it operates at greater distance from the department and with a much different management and employment regime.

The Treasury Board Secretariat defines **Special Operating Agencies** as,

> *"Units within a department or agency that have a separate or distinct identity and that serve a particular operational function, or provide a particular service. They are considered part of the host department, and not as separate legal entities."*

Special Operating Agencies deliver *services* as distinct from providing policy advice to Ministers. The relationships and accountabilities between the SOA and the home department are defined by a Framework Agreement and Corporate Plan. The SOA is required to meet defined performance targets and to assess its service delivery and financial performance against those targets in an Annual Report.

A key aim of establishing an SOA (as was the case with similar organizations in the UK and New Zealand) is to give the opportunity, scope and freedom to the SOA to serve its clients (which means, in some cases, the Canadian public) more effectively.

Key Features

Key features of the SOA model that should be borne in mind for the purposes of this report are:

- The head of the SOA reports to the deputy head of the department in which the SOA is located (i.e., if the FS&IS were an SOA in the RCMP, this would be the Commissioner).
- Unless special financial authorities are arranged for the SOA, it operates with the same authorities and management regime as the department in which it is located.
- Special authorities such as revenue raising and retention would have to be negotiated as part of the original agreement under which the SOA was created.
- Unless specifically mandated by the Treasury Board,[83] the terms of employment in the SOA remain unchanged by the SOA designation. Among other things this means that (a) pay and benefits remain the same and (b) relationships with bargaining units and the employees' access to work elsewhere in the Public Service are unaffected.
- The SOA is subject to all of the standard planning and reporting requirements of a regular department of government.

Comments

This organizational form has largely fallen out of favour since the 1990s, in part because most of the obvious candidates for SOA status have been taken up and, perhaps more importantly, because the anticipated advantages of SOA status (notably the goal of achieving commercial-type efficiencies and revenues) have proven difficult to realize in practice. There are many reasons for this, including reluctance by the Treasury Board to give these entities the operating freedom they would require to be successful in a more business-like form.

[83] http://www.tbs-sct.gc.ca/Pubs_pol/opepubs/TB_B4/SOA-eng.asp

It is important to note that Special Operating Agencies are not driven entirely by the need to generate revenue. Indeed, many are largely dependent on the home department for funding and most exist on mixed sources of funding. *The key criterion for considering a function for SOA status is that it be entirely operational in nature and that it be amenable to operating, at least in some ways, as a commercial business.*

In assessing whether a service such as the provision of forensic science is suitable for delivery through a Special Operating Agency, a number of factors would have to be considered. These include:

- The benefits that could be achieved for the clients (police and CJS) and the Canadian public;
- The economic impact of this change in status (e.g. political decisions about location of jobs);
- The potential gains in efficiency of programme delivery;
- The potential for overall cost savings;
- The likelihood that the private sector could deliver all or part of the service (outsourcing);
- The impact on employees, (e.g. changes to conditions of service, relocation or redundancy);
- The degree of authority the government needs to maintain over the service delivered. (Is this a service that can easily be delivered in a more business-like or commercial way, or is it something that is inherently close to government and that should therefore be kept under tighter control?)

8.3.2 Service Agencies

This model would involve converting RCMP FS&IS laboratory services[84] into a legally separate organization within the Public Safety portfolio with a mandate to deliver forensic laboratory services. The new organization would be given a specially-tailored management regime and authorities appropriate for this purpose.

The Treasury Board Secretariat defines **Service Agencies** as

> *"a specialized form of departmental corporation established **through tailored legislation** to perform a highly operational function or service for which there is usually no private sector competition. Service agencies are financed through parliamentary appropriations and user fees. Their governing management boards and individual organizational arrangements and responsibilities are specified in the legislation; therefore, each entity's degree of autonomy varies."*

Key Features

Most Service Agencies have corporate form (in that usually they have an Executive Board) but they are otherwise managed as if they were departments of government and each is responsible to a Minister. Examples include operational agencies created over the last 10-15 years such as Canada Revenue Agency, Parks Canada, the Canada Border Services Agency and the Canadian Food Inspection Agency. Most of these enjoy special management authorities of some sort, whether financial or in terms of personnel management.

[84] Again, we note that it would have to be decided whether the organization to be converted was just the RCMP FS&IS laboratories or the entire FS&IS.

Comments

Although Service Agencies were originally touted as a significant innovation in service delivery to Canadians, most people would say that experience over the past ten years has not borne out the initial hopes.

- One organization, the **Canada Revenue Agency (CRA)**, has had considerable success with its Management Board, which has come to play a significant role in overseeing the management of the agency. CRA is also a 'separate entity' for employment purposes, which means that it has greater freedom than a regular department in designing and operating its human resources management regime. The CRA's compensation arrangements, however, are all ultimately controlled by the Treasury Board.

- The **Canada Border Services Agency (CBSA)**, by contrast, is a departmental corporation without a Board. Its employment regime is the same as that of the regular Public Service and it operates as a regular department of government. The only difference from other departments is that it does not have its own Minister.

- Still yet another variant is exemplified by the **Canadian Food Inspection Agency (CFIA)** that is a departmental corporation and a separate employer, but it functions without a Board like a regular department of government.

Note: all of the Service Agencies created to date are orders of magnitude larger than RCMP FS&IS. Moreover, all are involved in serving the public across the country. Whether it would be worth converting RCMP FS&IS to this free-standing, near-departmental status, with all the costs that would be involved in terms of legislation, administrative infrastructure, new reporting regime and other management functions, would be a question for Ministers to consider.

8.3.3 Crown Corporations

Crown Corporations are defined by the Treasury Board Secretariat as

> *"Government organizations that operate following a private sector model, but usually have a mixture of commercial and public policy objectives"*[85].

Some, like the **Export Development Corporation** or the **Business Development Bank** operate in the commercial sphere while also fulfilling a governmental purpose. Others, such as the **Canada Council for the Arts** or the **International Development Research Centre** have no commercial purpose (not even as revenue-raising entities) but were created as Crown Corporations because it was felt their purposes would best be achieved if they operated at arm's length from Ministers. In all cases, however, the Board and CEO of a Crown Corporation are appointed by the Governor in Council. Crown Corporations are given significant management and operational freedom to deliver their mandate and their employees are not appointed under the *Public Service Employment Act* – they are employees of the Crown Corporation.

[85] http://www.tbs-sct.gc.ca/reports-rapports/cc-se/2007/cc-se03-eng.asp

The *Financial Administration Act*[86] governs the financial administration of Crown Corporations.

Key Features

Key features of the Crown Corporation model that should be borne in mind for RCMP FS&IS laboratory services are:

- Every Crown Corporation has a responsible Minister to whom it reports, and every one must submit an annual Corporate Plan to the Minister and through the Minister to the Treasury Board for approval.

- In all but a few cases, the Minister has the power to provide direction to the corporation. Through the Corporate Plan the Minister is in a position to set strategic objectives for the organization.

- A Crown Corporation must publish an annual report each year. Its senior executives and responsible Minister can be examined on the Corporation's performance and financial management by the appropriate Parliamentary committees.

- Although formal direction is seldom given, the 'power of the purse' means the government is always in a position to require the Crown Corporation to do what it wishes.

Comments

The Crown Corporation model is suitable for government organizations that should be run more or less at arm's-length from Ministers and, in most cases, those that operate in a commercial environment. The first of these characteristics would certainly apply to the forensic services function, and the second could well be applied as it has been in the UK and New Zealand. Indeed, whether or not forensic services can be put on a more business-like, or even commercial, footing is one of the issues at stake in the present study.

This said, similar considerations would apply in this model as in the case of the Service Agency model; would it be worth the time, trouble and continuing cost to legislate RCMP FS&IS as a Crown Corporation given its rather small size and rather narrow mandate? Would the potential gains outweigh the benefits?

[86] http://laws-lois.justice.gc.ca/eng/acts/F-11/index.html

8.4 Issues re RCMP FS&IS Laboratory Services as a Separate Government Organization

There are a number of issues to be considered before making a decision to move the delivery of forensic science to a new organizational status; whether a Special Operating Agency, a Service Agency or a Crown Corporation. Some of these have to do with issues of cost, management regime, optimal efficiency, and cost recovery. Others have to do with the complexity of federal-provincial relations, or with the politics of taking what has been a purely policing function from inside the RCMP and moving it to a new status.

These issues include:

1) Is there an option for forensic science to be delivered from the private sector?

In the current environment, the private forensic science providers in Canada are able to deliver DNA profiling services in the form of contractual arrangements of a Standing Offer Agreement between RCMP FS&IS and Maxxam Analytics Inc. and individual cases requiring specialised DNA analysis as provided by Warnex Pro-DNA Services.

Maxxam Analytics have expressed an interest to the Project Team in working more closely with the public sector laboratories to deliver a much higher proportion of DNA profiling services. Maxxam would like to be considered an extension of the RCMP FS&IS DNA analysis unit. Their challenge is that, if given a continuous stream of work with a sufficiently high throughput of samples, they could create an operational team that could meet any required turnaround time at a cost lower than that of any of the public sector laboratories. There may be some benefit for RCMP FS&IS, CFS, and particularly LSJML in working with Maxxam Analytics Inc. to explore this option.

As far as the Project Team can establish, **none** of the other forensic service lines (e.g., firearms, toxicology, or trace evidence) are being delivered in Canada by private companies at this time.

2) Can forensic casework be delivered from another government agency?

If issues of jurisdiction, funding, and the pull of other responsibilities can be overcome, there may be a possibility of consolidating some forensic service lines between some of the public sector forensic science suppliers. For example, this is what is being currently considered for glass analysis by the RCMP FS&IS and the CFS, Toronto.

There also may be options to consolidate some forensic services between RCMP FS&IS and other government agencies. The Canada Border Services Agency has a high quality Documents Analysis Laboratory in Ottawa, which, with the appropriate accreditations, could be considered as an alternative location for the RCMP National Anti-Counterfeiting Bureau.

3) Can we consider forensic science to be a pan-Canadian issue and design a new organization to cover the delivery of forensic science to the whole of Canada?

Though designing an optimal forensic service delivery system to service the whole of Canada may seem like an attractive idea, it is a highly unlikely to be a scenario that would work in practice. The RCMP's FS&IS has a mandate to support policing services in eight provinces and three territories, while the provincial forensic sciences laboratories (CFS and LSJML) are charged with these responsibilities in Ontario and Quebec. Whatever the potential cost savings from a

single national provider, these advantages would be outweighed by traditional jurisdictional responsibilities and established relationships between the provincial laboratories and police services inside the two largest provinces.

4) Can we consider the delivery of forensic laboratory services by the RCMP FS&IS as a potential candidate to become a Special Operating Agency, Service Agency or Crown Corporation?

While it is certainly possible to imagine using one of these new organizational forms for the delivery of forensic lab services in the jurisdictions served by the RCMP FS&IS (i.e., excluding Ontario and Quebec), there are a number of jurisdictional, operational and financial issues that would have to be resolved first. These would include:

- How the relationship with (or within) the RCMP would be managed;
- How forensic science research is to be funded and managed;
- How scarce forensic resources are to be shared among the different provincial, territorial, and municipal police services that use them;
- How a transparent charging mechanism is to be defined and agreed, etc.

This question is addressed in detail in Section 8.7 below.

5) How would national services such as the National DNA Data Bank, which are currently delivered by RCMP FS&IS, fit into such an SOA/Service Agency/Crown Corporation?

The National DNA Data Bank could not readily fit into a new forensic organization that was legally separate from the RCMP (i.e., a Service Agency or Crown Corporation) because the mandate for delivery of the NDDB sits with the RCMP under the *DNA Identification Act (1998)*[87]. Changing this would require a legislative amendment. Moreover, the DNA profiling function is inextricably linked with RCMP Identification and Information Services through fingerprints, Criminal Records, and the requirements of the *Privacy Act (1985)*[88]. Thus, even with an amendment to the *DNA Identification Act (1998)*, care would have to be taken to ensure a close working relationship between the RCMP and a new organization.

6) Could the research function be accommodated if RCMP FS&IS was a separate government organization?

This is an interesting question. While it is entirely possible for a research function to be maintained in a separate service delivery organization (as it is in a NZ Crown Research Institute or was in the UK Executive Agency), there is inevitably a tension between the research function and operational delivery because clients usually do not want to pay for the costs of research.

To get around this, there are a number of options:

- If a fee-for-service model were chosen, the costs of research could be built into the model as an overhead. However this will only work if the client sees the value of such research and is willing to pay for it as a 'tithe' on the costs of operational services[89].
- Alternatively, the research function could be supported by a specific government allocation, though this kind of funding can be vulnerable in a period of fiscal restraint.[90]

[87] http://laws-lois.justice.gc.ca/eng/acts/D-3.8/
[88] http://laws-lois.justice.gc.ca/eng/acts/P-21/index.html
[89] In England & Wales, the FSS had to include an overhead for research, which then made it more expensive than its competitors. This contributed to the successive loss of business to the other private sector forensic science suppliers.

The foregoing considerations would apply whether the new organization were an SOA inside the RCMP or a legally separate entity such as a Service Agency or a Crown Corporation.

7) How would a new government organization for Forensic laboratory services be funded?

Options for funding a new forensic laboratory services organization would depend on the organizational model chosen.

If the new organization were an SOA (i.e., a distinct organization within the RCMP) then it could be funded in several ways:

- As it is today, it could be 100% funded as part of the RCMP's annual appropriation, and it could be directed to tailor its programming and management in ways that maximize efficiency and reduced costs[91];
- Or, it could receive *base funding* as part of the RCMP appropriation and at the same time implement a *cost recovery* regime for its clients, including the RCMP and the other police services in Canada that rely on its services, the Criminal Justice System and the Courts. This cost recovery regime would not be intended to cover the entire cost of the operation, but rather the marginal costs of specific services (and not necessarily all services).

If the new organization were legally separate from the RCMP (i.e., a Service Agency or a Crown Corporation), then similar options would apply:

- It could be funded entirely from appropriations as a separate agency in the Public Safety portfolio (like the RCMP, CSIS or CSC), or;
- It could receive some funding from appropriations and be authorized to implement a cost recovery regime that would cover the remainder of its costs.

What would **not** be feasible would be for the new organization to be 100% self-funding because most external clients would say they had already paid for forensic services as part of the their BCAA agreements with the RCMP, and federal clients would see forensic laboratory services as an essential service. The most that could be achieved, in our view, would be 100% recovery of the costs of specific forensic laboratory services provided, with the federal government covering base costs.

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[90] In New Zealand this is an issue for ESR; the police supported operational research projects to the value of $300,000 per annum for a number of years. However the funding has been stopped in the light of pressure on police budgets.

[91] As noted in section 5.5.1 the RCMP FS&IS has been engaged in a process of organizational renewal that has produced some dramatic improvements in operational efficiency. This process should be reinforced and continued.

8) How could cost recovery work?

a) Cost Recovery via Service Agreements

On this option the new organization would deliver forensic laboratory services on a partial cost recovery basis via **Service Agreements** with its various clients, both RCMP and non-RCMP. The new entity would agree to provide forensic services for clients for a negotiated set fee, the proceeds of which would cover the agreed costs.

In effect, this is the arrangement that exists today under the BCAA. The most recent agreements with jurisdictions for which RCMP provides policing on a contractual basis (i.e., all except Ontario and Quebec) covering the period to March 31, 2013. These jurisdictions pay a **combined total** of $3.8M per year to the federal government. Amending the agreements to charge individual police services would be difficult, however, because of the need to sign agreements with dozens of different policing agencies, most of which had to date been receiving these services for what they perceive as 'free of charge'.

Second, as noted, most RCMP forensic work is in done under the BCAA under which the provinces pay a set fee to cover all the biology services for that jurisdiction. The provinces might not wish to reopen those agreements, or to sign additional ones for the provision of specific forensic services.

b) Fee-For Service Model

An alternative is a fee-for-service model based on a transparent charging regime. Under this model, individual police services, whether RCMP divisions or detachments, or non-RCMP police forces, would be charged a specific fee for a specific forensic service.

However attractive this may appear, this too would be difficult to implement in practice. Experience in the UK and New Zealand has shown that understanding the cost base and generating a transparent product or service-based charging regime is likely to take about two years to complete. Moreover, and as noted above, paying for forensic services would be a foreign concept to Canadian police forces and the Canadian criminal justice system. There would have to be a significant involvement of client agencies in the definition of the charging model to convince them of its suitability and value.

Any change of this magnitude would certainly require political support at the provincial and local levels, and perhaps changes in regulatory regimes governing the client agencies to enable them to pay for forensic services.

One advantage of giving the client agencies the budgets to allow them to pay for forensic science services is that they then have a choice: to use forensic science or another investigative or corroborative technique or process to advance a case, and the option to choose the RCMP FS&IS or another, commercial forensic science supplier to meet the investigative needs.

Some police forces are choosing to spend monies from an operational budget, to purchase DNA profiling services from Maxxam Analytics or Warnex Pro-DNA if the RCMP FS&IS cannot deliver the required service, or meet the required turnaround time.

The concept of fee-for-service is not unknown to some RCMP detachments and municipal police forces in British Columbia. The Victoria Police Department offers a service in video analysis and the investigation of digital crime from a specialist forensic unit. The cost of these services is recovered on a fee-for-service model from the requesting police force.

8.5 Model Three: Privatization of forensic science delivery in Canada

8.5.1 The development of a private forensic market in Canada

As noted, in Canada there are three private forensic science suppliers; Wyndham Forensic Group Inc., Warnex Pro DNA Services Inc., and Maxxam Analytics Inc.; that specialize in the delivery of DNA profiling services. While these laboratories have the facilities and staff to carry out the primary examination of items to identify biological materials of evidential significance, their primary business is DNA profiling analysis. The three companies differ in size; two (Warnex and Maxxam) are relatively large with major, corporate financial backing, whilst Wyndham Forensics Group is a small, privately funded company.

The routine turnaround times from these companies are claimed to be of the order of 10-15 days but they offer enhanced, or premium, services for police forces requiring shorter turnaround times. These services come at an additional cost.

In many of the interviews conducted, police officers investigating major crime indicated that they have authorised payments to Maxxam Analytics to enable a very rapid turnaround of DNA profiling analyses. In more than one of the interviews Senior Investigating Officers have cited specific cases in which considerable sums of money – up to $40,000 – have been paid to Maxxam Analytics to ensure three to five day turnaround times for the examination of exhibits, and the subsequent DNA profiling analysis, deemed critical to major investigations. The officers commented that the impact of the receipt of rapid DNA intelligence more than outweighed the high initial investment. The police representatives and Crown counsel interviewed for this project were very positive about the quality of customer service offered by the private laboratories but, as paying for forensic science is not normally within the experience of RCMP FS&IS clients, they considered the services of the private companies to be expensive.

Note: There appears to be no significant activity in the private forensic market in Canada other than in DNA analysis, nor is it obvious that there would be good reason for private suppliers to develop capacity in areas such as toxicology where RCMP FS&IS already has ample capacity, or in trace evidence where there is a relatively low annual demand in Canada.

8.5.2 Lessons from Other Jurisdictions

Appendices B - D describes experience with the privatization of forensic services in other jurisdictions – England & Wales, New Zealand, the U.S., and Scotland. As noted therein, the key lessons to be drawn from that international experience are that the creation of a viable privatized full-service, forensic market in Canada requires:

- A political environment and economy where competition is encouraged and well regulated;
- A government committed both to the provision of forensic services by the private sector and to funding police forces to pay for those services;
- The police to have an understanding of the full economic costs of forensic science; and
- The police to have a full understanding of the value that forensic science brings to an investigation, so that informed decisions can be made on the relative cost/benefits of forensic science versus other investigative tools.

International experience suggests that it is likely to take five to ten years for a private market to develop fully while the development of a viable and acceptable costing model alone might take two years.

Clearly, it is difficult to find a jurisdiction that compares precisely to Canada. The United States is vastly larger and more complex in terms of its thousands of police jurisdictions and the enormously greater resources devoted to policing; the UK is of comparable size but experience there is of limited relevance to Canada. The Scottish situation is evolving too rapidly for comparative purposes, and the situation in England & Wales is in such an uncertain state that it is difficult to see it as being sustainable. Essentially, the UK government has closed its 'national' forensic service provider (Forensic Science Service Ltd.) on the premise that the private sector can fill the gap. Commercial service providers are now providing all of the forensic science services and, in addition, some police forces are developing their own forensic science capability. As an example, the Metropolitan Police, which is by far the largest police force in the UK, has begun to re-create its own in-house services to replace those formerly provided by FSS. In December 2011 the FSS supported the transfer of more than 100 forensic biologists working in the areas of Homicide and Violent Crime to the Metropolitan Police Forensic Directorate.

8.5.3 Options for privatisation of forensic services in Canada

In light of these experiences, and given that there is a small but emerging private sector capacity in Canada for DNA testing services, what are the options for private sector delivery of services currently offered by RCMP FS&IS?

There are several possibilities, all of which, as noted above, would be contingent on several factors:

1. A policy decision to have police forces pay for forensic services, and a consequential policy decision, at both the federal, provincial and municipal levels, to provide appropriate resources to the relevant police forces for this purpose;
2. The development of costing models for forensic services for which there is not already an established market in the private sector;
3. A mechanism for overseeing/regulating the marketplace to ensure that costs are reasonable for the police and CJS clients and sufficient profit can be made by the service providers to ensure sustainability of service provision;
4. Agreement on how to cost and pay for services for which there is no private sector supplier;
5. Agreement on how to cost and pay for research in forensic science.

Option One: Privatization of Individual Services

The first option under the privatization heading would be simply a policy decision by the federal government to look to the private sector for as much in the way of forensic services as is available, provided those services are cost-effective and meet the quality standards of the client police forces.

In effect, this would mean 'privatizing' as many of RCMP FS&IS's routine forensic laboratory services as the private sector is able to provide, with RCMP FS&IS maintaining a capacity for quality control, research and, perhaps, backstopping what the private sector is unable to do in these areas. Other, more specialized or higher cost services, where there is no private sector supplier, would continue to be provided by FS&IS.

It should be noted that some delivery streams (e.g., firearms, trace evidence) would be difficult if not impossible to treat in this manner because the potential demand from RCMP FS&IS would never be sufficient to make it attractive for a private sector supplier to develop the capacity to serve this limited market. The revenue potential is simply not there.

This option would move Canada's forensic environment several significant steps further towards public sector engagement. The three current private sector companies would see an opportunity to expand their business, and new enterprises might well be formed to take advantage of this opportunity, provided they were confident that this was the government's direction for the long term.

This approach would have to be carefully developed and articulated, and implemented in close consultation with the existing and potential service providers. As noted above, it would take some time to develop credible costing models. It might also take considerable time to obtain the agreement of the contract policing jurisdictions to pay for services from the private sector that hitherto they had received, at least in large part, from RCMP FS&IS.

Option Two: Privatization of RCMP FS&IS

A second option under this heading would be to privatize RCMP FS&IS by turning it into a carefully-regulated private sector supplier of forensic services to the Canadian market, either to supplement the services provided by the existing three private companies that provide DNA analytical services, or to compete with them.

The purpose behind this more dramatic step would be to obtain (at least for the eight provinces and three territories currently served by the RCMP FS&IS) the efficiencies of private sector operations whilst retaining a single national supplier of specialized services such as post-blast explosives analysis, firearms and ballistics, toxicology and trace evidence – all the services not available from the existing private sector suppliers.

Here, the experience of New Zealand with a monopoly/monopsony model is instructive. New Zealand set up a single service provider (Environmental Science and Research) as a Crown Research Institute operating as a for-profit business owned by the national government. Working with New Zealand's national police service, ESR developed a credible costing model and the arrangement seems to be working well today.

As noted in Appendix B, whether or not this model could be created in Canada would depend very much on whether one could obtain buy-in from the contracting provinces and the many other police services that currently use FS&IS on a no-cost basis for the provision of forensic laboratory services. The magnitude of this task should not be underestimated. The impact of such a change on the organization of the public sector laboratories in Ontario and Quebec is unknown. It should be noted that there are many different forms that a "privatized" RCMP FS&IS could take, ranging from a genuinely publicly-traded corporation like Canada National (CN) to something more along the lines of NAVCAN[92], the federal air navigation service that was turned into a self-sustaining not-for-profit, monopoly provider of air navigation services, with significant stakeholder involvement in both creation and governance.

Experience has shown that moving in this direction requires a compelling policy rationale and strong determination by government to carry through on the initiative. It also takes time and, at least at the outset, some initial investment[93].

8.6 Model Four: Devolution to the Provinces

This fourth approach is not so much an "organizational model" but, there is the option for the federal government of Canada to devolve the delivery of forensic science to the provinces. There are a number of precedents for the transfer from the federal government to the provinces of programs or services that are agreed to be better delivered by provincial governments. The most significant one in recent years was EI Part II employment programs, which were seen to be more matters of provincial interest and responsibility and which were therefore transferred in the 1990s and early 2000s by a series of bilateral agreements from the federal government to individual provinces. Each agreement involved the transfer of financial resources and personnel. In the case of FS&IS laboratory services, the starting point is not dissimilar – i.e., the provision by the federal government of a service that supports a function (i.e., criminal justice) under provincial jurisdiction. What is different about RCMP FS&IS laboratory services is that:

- The six (or fewer) laboratories are currently organized to support a *national* forensic services program; they would have to be dramatically reconfigured to provide full-service support to individual provinces;
- There are fewer laboratories than contract jurisdictions;
- There is no evidence that the contract policing provinces and territories would wish to take on this kind of function (indeed, the territories simply do not have the resources or the caseload to make this worthwhile);
- Provinces receiving a lab would have to be paired to provide services to other provinces or territories;
- The same arrangements with respect to an agreed costing model would have to be worked out in order to make the arrangement viable as an inter-provincial function;
- This might be seen as a retrograde step as RCMP FS&IS laboratory services were previously aligned on a regional/provincial basis.

[92] http://www.navcanada.ca/NavCanada.asp?Language=en&Content=ContentDefinitionFiles/default.xml

[93] In the case of the privatization of CN, the government wrote off debts of some $2 billion in exchange for non-railroad assets of approximately the same value.

8.7 Options for RCMP FS&IS Laboratory Services

Transfer to the provinces of all or some of the RCMP FS&IS laboratories would be a difficult, and politically unacceptable, task. In practical terms, then, the more realistic options are:

a) **Consolidation:** reducing the number of laboratories from six to three or four, and continuing to look for efficiencies in forensic processes;

PLUS:

b) **Organizational Change:** possibly putting the FS&IS labs on a different organizational footing (including, perhaps, privatization) with a view to enabling a more business-like operation and cost recovery regime;

AND:

c) **Cost Recovery:** possibly developing an agreed costing model with the clients of RCMP FS&IS and implementing a cost recovery regime.

As can be seen from the foregoing discussion, there is a strong case to be made for Option (a) the consolidation of the RCMP FS&IS to fewer laboratory sites. The only consideration here is to sustain operational delivery. Reducing the number of operational sites from six to four by closing Winnipeg and Regina would have the least impact on staff or on the delivery of services. Reducing the operational delivery to three sites by closing Winnipeg, Regina, and Halifax would require considerable investment in infrastructure to bring the remaining laboratories to 'full-service' status, and have a much greater impact on the operational and managerial staff.

It is in regard to Options (b) and (c) that the Government faces some real choices. In weighing those choices, the following considerations should be borne in mind:

- The federal interest in the maintenance of an effective criminal justice system in Canada, particularly in regard to needs and capacities of the smaller provinces and territories;
- The federal stake in the continued development and increasing utility of the national DNA Databank which is currently fed by no-cost submission of samples from FS&IS clients;
- The fact that experience to date does not show any significant cost savings from the simple conversion of a departmental function to an SOA or Service Agency. This is not to say that there are no other potential advantages to be gained in terms of more effective management.

Beyond these essentially federal considerations are a number of factors reflecting the provincial interest in forensic laboratory services, notably:

- Whether the provinces and police services currently served by RCMP FS&IS would be prepared to move toward a cost recovery regime;
- Whether an agreed costing model could be worked out that would satisfy both sides of the equation;
- How the territories would be resourced to pay for services which to date they have received at no cost.

8.7.1 The Organizational Question

The advantages of consolidation are set out above. There is a compelling argument for consolidation from six laboratories to four, or possibly three, sites. With respect to organizational options, and assuming all of the above considerations could be satisfactorily addressed, the first question is,

> *Is there any advantage to be gained in terms of the delivery of forensic laboratory services through the conversion of FS&IS (or just the six laboratories) to either an SOA or a Service Agency?*

Experience shows that management often finds the new management regime (i.e., SOA or Service Agency) to be preferable to that of a traditional department-like body such as the RCMP FS&IS. The costs of conversion in terms of time, legislation, dislocation of personnel, additional corporate overhead to be developed, additional reporting requirements, and the development and management of new relationships with clients, would not be justified in terms of more effective management or lower costs. As noted, there is no evidence that costs would be lower under these alternative organizational forms.

The second question is,

> *Is there any advantage to be gained through privatization, whether of particular services or the entire FS&IS laboratory function*?

As noted, privatizing particular services would essentially mean looking to the private sector for the delivery of all (or virtually all) DNA analysis. This could certainly be done under a long-term arrangement with external suppliers, though the current service providers see themselves as filling a supplementary niche rather than serving as the complete providers of those DNA services. However, Maxxam Analytics has challenged the status quo, expressing an interest to the Project Team in working more closely with the public sector laboratories to deliver a much higher proportion of DNA profiling services. Maxxam would like to be considered an extension of the RCMP FS&IS DNA analysis unit. Their challenge is that; given a continuous stream of work with a sufficiently high throughput of samples, they could create an operational team that could meet any required turnaround time at a cost lower than that of any of the public sector laboratories.

Privatizing the entire RCMP FS&IS laboratory services function would be a different matter and would require the development of a business case, not simply with respect to fairly straightforward services such as DNA analysis but also for the more costly, less frequently used services such as post-blast explosive analysis, firearms, toxicology and trace evidence. Whether such services could be made "profitable" is an open question. Moreover, whether the current private sector suppliers would welcome the addition of a new competitor, or whether any of them would be prepared to bid to acquire RCMP FS&IS laboratory services s is unknown. The latter is unlikely, unless this were done on terms that would be hard to justify in terms of cost to the federal government.

Devolution of six or fewer labs to the provinces does not appear to be a likely possibility, not only because the eight provinces and three territories are unlikely all to accept such an arrangement, but because coming up with a workable interprovincial arrangement would be extremely difficult. At a

minimum, the federal government would be likely to have to buy its way to a solution, something that would carry unpredictable costs into the longer term.

8.8 Cost Recovery

The issues of implementation of a cost recovery regime are outlined in Section 8.4 above. Whilst those jurisdictions that contract their policing from the RCMP pay some monies towards the costs of forensic science (amounting to an annual payment of $3.8 million), this is a fraction of the true cost of the delivery of forensic services from the RCMP FS&IS.

Most of the police officers interviewed as part of this project had no idea of the cost of any particular service line, or analytical technique, provided by the public sector laboratories. In effect, they considered forensic services to be 'free'. This is a problem for any change management programme that the government might consider following the publication of this report. There is a huge cultural barrier to be overcome with the police and CJS users of forensic science.

However, the picture is not entirely bleak. Some of the more experienced police officers, interviewed in jurisdictions across Canada, do understand that forensic science has a cost, and these officers are making choices about the nature, cost and value of investigative interventions, and they are choosing to use the current private suppliers if the circumstances of a particular case so dictates.

The key to creating a fee-for-service cost recovery model is to convince the users of forensic science services that the charges are fair and reasonable. This requires the forensic science provider to have a detailed understanding of **cost** and to be able to demonstrate that it is using the most cost effective work processes. Undertaking unnecessary testing under the guise of 'quality assurance', or allowing the development of unnecessarily large corporate overheads becomes very transparent to the users.

The international experience as demonstrated in England & Wales, and in New Zealand, shows that business-like charging regimes can be developed and can be successfully implemented. Representatives of the forensic client groups need to be engaged in the development of the charging model, and need to see where the costs are falling. In addition, it is imperative that in a public service culture such as that pertaining in Canada; the public sector forensic science provider is not seen to be making a huge profit. However, it is incumbent on the forensic service provider to ensure that they make a reasonable margin, agreed with government. This ensures that there are monies available to maintain and develop the service provision, and to ensure the business is sustainable. This type of regime works extremely well in New Zealand where there is a single supplier of forensic science, Environmental Science and Research Ltd, and a single user of forensic science services, the New Zealand National Police.

However attractive this model may appear, it would be difficult to implement in practice. Experience in the UK and New Zealand has shown that understanding the cost base and generating a transparent product or service-based charging regime, which is acceptable to the police and CJS clients, is likely to take about two years to complete. Moreover, and as noted above, paying for forensic services would be a foreign concept to most Canadian police forces and the Canadian

criminal justice system. There would have to be a significant involvement of client agencies in the definition of the charging model to convince them of its suitability and value.

If the Government chose to move to a new organization structure, forensic laboratory services could be delivered on a partial cost recovery basis via **Service Agreements** with its various clients, both RCMP and non-RCMP. The new entity would agree to provide forensic services for clients for a negotiated set fee, the proceeds of which would cover the agreed costs.

9.0 Summary and Recommendations

The objective of the present study was to determine what particular models of forensic service delivery are both feasible and sustainable in the Canadian political, constitutional, legislative, and regulatory context.

The study has involved an examination of the current provision of forensic science in Canada. This report includes a description of the forensic science suppliers, their governance, the disposition of the laboratories, and the services supplied. In addition, the study includes a review of forensic service delivery models in use in foreign jurisdictions and a review of their applicability in Canada.

The qualitative data concerning client needs and expectations of a forensic science provider and their perception of the current service level offered used a direct interview instrument and involved a significant number of interviews with forensic scientists, forensic science managers, and police and Criminal Justice System respondents across Canada. This instrument covered broad topics but also provided opportunities for respondents to raise issues and for interviewers to follow-up on them.

Standardized quantitative metrics were collected using the FORESIGHT LabRAT tool to benchmark performance with the goal of recognizing, understanding, and integrating better practices. This process is agnostic as to laboratory, and records functional and process data, which is then collated and compared to produce analyses and laboratory-specific reports.

Forensic service provision models from the UK, New Zealand, and the US provide foundations for evaluation and discussion of the challenges Canada faces.

Issues relating to the current disposition of forensic science providers and forensic service delivery are exposed and potential solutions, including the consolidation of laboratory services, the creation of a Special Operating Agency or Crown Corporation or the privatization of services, are discussed.

It is inevitable that a number of issues must be addressed in discussing the potential for changing the way forensic science is delivered, particularly within the political, constitutional, jurisdictional, federal, and provincial complexities in Canada. A number of recommendations have been made which include options for continuous improvement in processing, organizational learning from public sector laboratories across Canada, and from the FOREIGHT respondent group. The

recommendations also cover the consolidation of the number of laboratory sites, and issues of alternate service delivery and privatisation.

Recommendation 1
The RCMP FS&IS Forensic Investigative Process should be continued and further inefficiencies driven out of the system. The Project Team has been informed that, within the 40 day process in Biology casework, there is a significant proportion of time in which an exhibit is awaiting an examination or analytical results are awaiting interpretation. Further process improvements should be sought to drive down this dead time to improve the operational service to the RCMP FS&IS clients.

Recommendation 2
The Project Team accepts that there are some extra costs associated with delivering forensic science in Canada but recommends that RCMP FS&IS look to the examination protocols and quality assurance requirements for each of the investigative areas, comparing these with the protocols in use in the other public sector laboratories. The Criminal Code is the same across Canada, and therefore the protocols for each of the laboratories should be broadly similar. Any excess testing should be driven out of the RCMP FS&IS laboratory processes.

Recommendation 3
The Project Team recommends that consideration be given to the consolidation of RCMP FS&IS operational base from six laboratory sites to either four or three sites, with the closure of Regina, Winnipeg and possibly Halifax laboratories.

Two options have been considered in detail.

1. Consolidating the staff and operational delivery in four sites with the closure of the Regina and Winnipeg laboratories. The analysis indicates that this option could lead to an estimated annual fixed cost saving of **between $4.5 and $7.5 million.**

2. Consolidating the staff and operational delivery in three sites with the closure of the Regina, Winnipeg, and Halifax laboratories. Under this scenario the Project Team estimate the savings in annual fixed costs would be **between $6.0 and $9.4 million.**

The projected savings made by the consolidation of laboratory sites are **annual savings**. These savings would have to be offset by one-off costs of about $40,000 for each member of the operational staff who transferred to another site.

Note: The projected savings made by the closure of laboratory sites are **annual savings**. These savings would have to be offset by one-off costs of about $40,000 for each member of the operational staff who transferred to another site.

There is a risk in such a major re-organization, in that the RCMP FS&IS could lose very experienced staff if they chose to resign rather than move. If RCMP FS&IS undertakes such a laboratory closure

programme, it might be prudent to consider the consequences for the organization if 50% of the staff in the affected laboratories elected to resign.

There will be additional savings as managerial, administrative and maintenance staff positions will be surplus to RCMP FS&IS as laboratory sites are closed. At this time the Project Team has made the assumption that operational posts, whether in analytical or scientific areas will be retained.

Recommendation 4
The Project Team has considered the option for moving forensic service delivery to an alternate service delivery model through a Special Operating Agency, a Service Agency, or a Crown Corporation. The case is argued in detail in section 8 of this report.

Unless there is a government exigency of which the Project Team is unaware, it is recommended that no further consideration be given to the delivery of forensic science through a Special Operating Agency, a Service Agency, or a Crown Corporation.

Recommendation 5
There is a small but developing forensic market in Canada, almost exclusively in DNA profiling services. It is clear that the private sector can supply police and CJS clients with services that RCMP FS&IS do not provide (e.g. Y-STR analysis and mitochondrial DNA sequencing), and can provide routine DNA analyses in extremely short timescales to meet the particular needs of specific investigations. The options for privatisation of forensic science are set out in Section 8.

The Project Team recommends that RCMP FS&IS explore further the option for outsourcing DNA profiling analysis to the private sector. Encouraging the private sector to take on a greater proportion of the analytical processing should result in lower costs of analysis and faster analytical processes, which in turn should improve service delivery for police clients and ensure the transfer of lessons from private sector practice to the RCMP FS&IS.

Recommendation 6
One of the aims of Budget 2010 is to "*increase research and development in forensic science".* The RCMP FS&IS, the Centre of Forensic Sciences (CFS) and the Laboratoire de sciences judiciaires et de médecine légale (LSJML) currently meet as part of the Canadian Scientific Working Group on DNA Analysis Methods to share ideas and the results of research programmes.

The Project Team recommends that this programme is extended to include all investigative processes. The Scientific Working Groups thus created would:

- Oversee the development of forensic examination and analytical processes;
- Agree quality assurance protocols across all three Canadian public sector suppliers and;
- Agree the processes by which new forensic techniques are introduced into the Criminal Justice System with the support of appropriate Federal and Provincial representatives.

The lead research scientist in each area could act a Specialist Advisor to provincial and federal Departments of Public Safety, ministers, and legislators or parliamentary committees as required.

Recommendation 7

The Project Team recommends that research is undertaken in Canada to develop a forensic attrition model to further the understanding of the 'hidden-demand' for forensic support, i.e. the proportion of reported offences for which forensic science support is not invoked, but the investigation of which might benefit from a scientific intervention.

In the UK, the Police Standards Unit conducted such an exercise for volume crime. This work was published as the Scientific Work Improvement Model (SWIM) in 2007[94]. This UK-based research suggests that, in considering any alternative forensic service delivery models in Canada, the relationship between the forensic science provider and the police-based Forensic Investigation Support Service teams will be critical.

Concluding Comments

The members of the Project Team have engaged with the RCMP FS&IS and other public and private sector forensic science suppliers and their federal, provincial and municipal clients. We have realised a set of recommendations which we present to Public Safety Canada for consideration. While these recommendations may be in some respects challenging, the Project Team believe they offer the possibility of significant cost savings for the RCMP FS&IS and the federal government in the short to medium term.

The decision as to whether to change the organizational status of the RCMP FS&IS depends on the policies and exigencies of government. Prior to making any such change, decisions will need to be made as to what type of organizational structure is required for program purposes and is feasible under the circumstances. These decisions will include how the changed organization would relate to the police and CJS clients and whether the organization would be funded by appropriation or on a cost-recovery basis. If a cost-recovery regime were selected, then a clear understanding of costs, benefits, and value to concerned jurisdictions would have to be communicated with the clients. From the experience of England & Wales and New Zealand, developing a solid costing model and shared understanding of those costs would likely take at least two years.

[94] Summary Report of the Scientific Work Improvement (SWIM) Package, Home Office, 2007

10.0 Appendix A – International Experience with Governmental Agencies

10.1 Development of Executive Agencies in the UK

In 1988 the UK government Efficiency Unit published a document entitled*, Improving Management in Government: The Next Steps - A Report for the Prime Minister*[95]. One of the major recommendations of this paper was that:

> *'Agencies should be established to carry out the executive functions of government within a policy and resources framework set by a department'.*

This paper envisioned "Next Steps" Executive Agencies as discrete business units within central government departments that would deliver services directly to citizens or business, or to other public sector organizations. The agencies were to be located within Ministries (ultimately reporting to the responsible Minister) but were to be given freedom to manage their activities, with the aim of improving efficiency and the quality of service delivery. Executive Agencies operated as delegated authorities under responsible Ministers, which meant that legislation was not required for their creation.

The Chief Executives of the Executive Agencies were appointed by the responsible Minister and given managerial and budgetary control to deliver the services for which they were responsible. Agency responsibilities and service targets were set out in a Framework Document and the CEO was responsible to the departmental Minister for the performance of the agency.

Advantages

The purpose of an Executive Agency was to give the CEO and Executive Board much greater freedom and flexibility to organise and manage the work of the agency in a way that most effectively and efficiently met client and business needs. It was seen as a mechanism to split operational service delivery from the policy-making arms of government and to allow market testing of services with a view to:

- Moving the service to a commercial (private) supplier;
- Improving the efficiency of service delivery; or,
- Closing down the service if the client needs had changed.

The Next Steps programme (1988) was also the blueprint for the development of Crown Agencies in New Zealand and an important source of inspiration for Special Operating Agencies in Canada.

[95] Efficiency Unit (1988) *Improving Management in Government: The Next Steps,* London, HMSO

10.1.1 The Forensic Science Service (FSS)

In 1991 the Forensic Science Service became an **Executive Agency** of the Home Office and, at the same time, introduced a 'product based' fee-for-service model as a way of rationing scarce forensic resources. From this time FSS funding was based solely on the monies that could be earned from operating activities. All of the FSS costs had to be supported by earned revenue but, as an Executive Agency, the FSS was a non-profit making organization.

In 1999 the legal position of the FSS changed from that of Executive Agency to the status of a **Trading Fund**. The FSS remained part of the Home Office, its parent government department, but the advantage of this new legal status was that FSS could retain the income (profit) from its operating activities, using this to meet its expenditure requirements.

In 2002 the Government announced a further review of FSS's status. The McFarland Review explored a number of potential options for the reorganization of FSS and regeneration of the forensic market, one that would be "best suited to deliver responsive, efficient, and quality forensic services".

The McFarland Review (2003) concluded that, the best route for the FSS was for it to become a fully commercial company, with the Government retaining a stake in the company for the protection of the Criminal Justice System. It was recommended that the FSS be transformed into a **Government-owned company (GovCo)** as a precursor to evolution into a private sector classified Public Private Partnership. This transitional phase was expected to last no more than 12-18 months.

In October 2005 the legal position of FSS changed to that of a Government-owned Company. The Forensic Science Service Trading Fund (Revocation) Order[96] was approved and FSS Ltd. established as a GovCo on 5th December 2005.

In 2008 the National Policing Improvement Agency (NPIA) introduced a National Forensic Framework Agreement (NFFA) policy to provide advice to police forces on the procurement of forensic services. Under the NFFA operational forensic science was divided into a series of work packages and, for each work package, a standard user specification was created encompassing the services to be delivered, the quality standards to be met, and the turnaround times required.

In 2008/9 FSS introduced a radical programme of reform to convert the organization from regional laboratories supplying local police forces to a corporate business providing national services in line with the NFFA. As part of the restructuring exercise, FSS closed three laboratories; Chepstow (Dec 2010) and Chorley and Priory House, Birmingham (March 2011) with the loss of 500 operational scientists and support staff. However, FSS Ltd. simply became unprofitable as a company and, added to this, the costs of the restructuring exercise were considerable.

On 10th December 2010, Mr James Brokenshire, a junior minister at the Home Office, announced the Government's decision to close FSS with effect from March 2012.

10.2 Executive Agencies in New Zealand

There were significant public sector reforms in New Zealand through the 1980's which followed the England & Wales *Next Steps* programme and which culminated in the *Crown Research Institutes Act*

[96] Forensic Science Service Trading Fund (Revocation) Order 2005 – Seventh Standing Committee on Delegated Legislation

(1992). Under this *Act*, the New Zealand government created eight Crown entities from elements of the Department of Scientific and Industrial Research (DSIR) to deliver scientific research on behalf of the New Zealand taxpayer. The purpose of a Crown Research Institute (CRI) was to carry out research, according to a set of operating principles that included such things as public interest, excellence, results orientation, and social responsibility.

The Crown Research Institutes are **government-owned, not-for-profit companies** charged with delivering their operational responsibilities in a financially viable and sustainable manner. This obligates the CRI to provide an agreed 'adequate rate of return' on the funds provided to the Institute by the government. This is currently about 8%.

10.2.1 The Institute of Environmental Science & Research Limited (ESR)

Environmental Science and Research Limited (ESR) is a Crown Research Institute charged with delivering forensic science to the New Zealand Police, and ESR has developed a close and mature relationship with its police client. The charging model is seen as transparent and has the approval of the client, enabling an agile response to NZ police needs. The police recognise the need for research to underpin scientific developments and improvements in operational techniques, and have provided funds to support such operational research.

ESR has a number of functions, undertaking service delivery and scientific research in forensic science, food safety, water science, human health, and pharmaceuticals. ESR is the sole provider of forensic science services to the New Zealand Police; other clients include the Ministry of Health, the New Zealand Food Safety Authority and the Ministry of Research, Science and Technology.

ESR has a complement of approximately 350 staff, 140 of whom are involved in the delivery of forensic services.

ESR maintains three Forensic Service Centres (which equate to the Canadian police Forensic Investigation Support Services) which are the base for scene examination and evidence recovery specialists (scientific and technical staff). These staff members attend scenes of major crimes to support the police and to identify and collect potential evidential materials and undertake specialist examinations including blood spatter interpretation. The Forensic Service Centre staff members are also the first point of contact for the police and can be case managers for major investigations.

The NZ Police retain the responsibility for fingerprint services, document examination and for a computer forensics laboratory.

ESR delivers a full range of forensic science services from two centres: toxicology, breath alcohol calibration, and blood alcohol testing are delivered from laboratories in Wellington; biology and DNA profiling, physical evidence, drugs analysis, and clandestine laboratory investigations are delivered from a laboratory in Auckland. ESR has approximately 14,000 case submissions from the police and other agencies per annum.

11.0 Appendix B – Developing a Commercial Market Model: International Experience

11.1 Experiences in England & Wales

In England & Wales forensic science services are delivered to the Criminal Justice System by two distinct agencies, the police and private organizations or firms with the appropriate scientific competencies[97].

11.1.1 Police forensic science activities

The 43 police services of England & Wales maintain Scenes of Crime departments that routinely examine and record scenes of volume and violent crimes, collecting materials of potential evidential value. The police Fingerprint Bureaus have responsibility for the collection, storage, enhancement, and comparison of finger and palm prints from scenes of crime and from arrestees, victims, witnesses and other persons of interest in criminal investigations. Many police forces have specialist Imaging Services to provide photography and video services at scenes of crime[98]. These units are roughly equivalent to the Forensic Investigation Support Service units that are part of many of the RCMP detachments, or provincial and municipal police forces in Canada.

Some police forces, notably the Metropolitan Police Service (MPS), have created their own forensic science laboratories in which 'Evidence Recovery Units' undertake the primary examination of evidential items, including blood pattern analysis, fibre recovery, examination for potential body fluids, and DNA sampling. Reporting Scientists assist the police in creating the initial forensic strategy and report the casework findings for court purposes. The police are now crossing the boundaries into work traditionally done by the forensic science suppliers. This trend is set to continue with the closure of the Forensic Science Service in March 2012, and as the police perceive this to be a more cost effective model, one that gives them greater control over their budget. By contrast, some groups, including members of the legal profession, see this as a retrograde step as it introduces the potential for claims of **prosecution bias** in the delivery of forensic science[99].

11.1.2 Forensic Science Providers

Forensic Science Providers (FSPs) are traditionally laboratory-based and receive items of evidential significance from submitting police forces. The FSPs are geared to examine these items to identify blood and body fluids; paint, glass, particulates, and shoe and tool marks; alcohol, drugs, and other materials of toxicological interest; firearms, ammunition and other components. The forensic scientist compares these evidential materials with reference materials from suspects or scenes of crime and reports their scientific findings and opinions as expert evidence to the Courts.

All FSPs working in the criminal justice system in England & Wales are required to be accredited to the international standard ISO 17025 for testing and calibration laboratories and are required to have a documented Quality Management System. Those FSPs supplying DNA profiles for loading to the National DNA Database are also required to be accredited by the NDNAD Custodian.

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[97] Scotland and Northern Ireland have separate legislatures, police forces, and forensic science suppliers

[98] In Canada the equivalent service is provided by the police Forensic Investigation Support Services units.

[99] In the current environment the police service forensic laboratories will not be required to meet the ISO 17025 standards until 2015.

11.1.3 The development of a private market in the UK

In the UK, the first inroads of private companies into analytical forensic science were in simple drug testing or in DNA profiling analysis for the National DNA database. This was exemplified by the development of LGC Forensics from an analytical testing house to the potential market leader in forensic science in England & Wales:

- **LGC Forensics**, created in 2002, was an analytical testing company specializing in drugs and toxicology. In 2003[100] it expanded into the DNA testing market (where there was significant government funding);

- **Forensic Access**, established in 1986, undertook case reviews on behalf of defence lawyers. In 1997, Forensic Access together with the National Physical Laboratory and Cellmark Diagnostics created **Forensic Alliance Ltd**. (FAL) – the UK's first full-service private forensic laboratory;

- In September 2005[101] LGC Forensics acquired FAL to create the UK's largest private full-service forensic service that, on the closure of the FSS, will be the largest player in the UK market.

These competitors initially targeted those areas of business, simple drug identification, and DNA profiling which had low barriers to entry (highly automated, low cost analysis) and which had significant margins, as shown in figure 16 below.

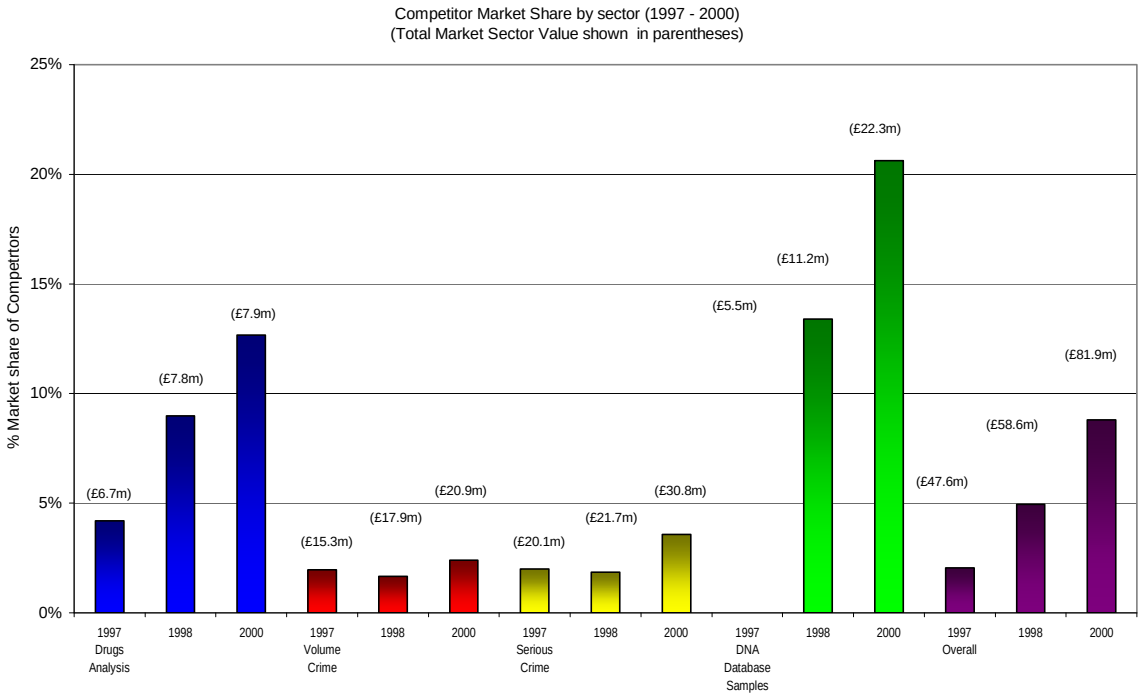

Figure 15 - Competitor activity by market sector 1997 – 2000

[100] http://www.lgc.co.uk/about_lgc/history/milestones/09-12-03_lgc_f__labs_in_run.aspx
[101] http://www.lgc.co.uk/about_lgc/history/milestones/16_sep_2005__lgc_acq_of__fal.aspx

Between 1997 and 2000 these companies took 13 % and 21% share of the drugs and DNA market sectors respectively. These were the 'commodity' market sectors of forensic science where the police were buying 'tests' rather than 'services' and were highly price sensitive.

Note: *A similar position now pertains in Canada. Three commercial companies provide DNA profiling services to the police and to other CJS clients. In addition Maxxam Analytics Inc. is providing workplace and equine drug testing services; just a short step from potentially providing toxicological analysis to the police.*

By 2008 there were four firms offering 'full-service' laboratory services to the police and criminal justice system: Forensic Science Service Ltd., LGC Forensics Ltd., Orchid Forensics Ltd., and Key Forensic Ltd.

Note: *Establishing a viable full-service forensic market in the UK took about eight to ten years, with the initial stimulus for the market development coming from a £240 million injection of government monies to support the expansion of the National DNA Database*[102].

11.1.4 Current Situation in England & Wales

The forensic market in England & Wales is currently undergoing a major 'shake-out' with the announcement of the closure of FSS Ltd. by March 2012. The government and Association of Chief Police Officers (ACPO) expect that other forensic science suppliers (FSPs) will take up the contracts vacated by FSS Ltd.

The government has also indicated that it intends to cut police budgets by 20% over the next four years, and is allowing the police to in-source the provision of forensic services. The Home Office expects the value of the 'accessible market' (monies spent on purchasing forensic services from organizations outside the police service) to fall from £170 million to £110 million by 2014.

The buyer power is increasing through the standardisation of products and services under the NPIA's National Forensic Framework Agreements and through the police tendering as regional consortia. The seller concentration is also increasing and there is a degree of growth in the turnover of Orchid Cellmark Ltd and LGC Ltd, though only the former is showing a growth in profitability. Key Forensics continues to trade in an increasingly untenable position.

The market environment in England & Wales is fragile, threatening the continuing provision of forensic science services to the police and Criminal Justice System. The House of Commons Science and Technology Committee recognised the need for a strictly regulated environment[103] and the urgency of stabilising the market such that forensic science providers are allowed to make a modest profit to incentivise growth and innovation.

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[102] http://www.parliament.uk/documents/post/postpn258.pdf

[103] House of Commons Science and Technology Committee – The Forensic Science Service
Seventh Report of Session 2010-2012, 22nd June 2011
See: http://www.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/inquiries/forensic-science-service/

All forensic services are open to the police from the remaining commercial providers from crime scene attendance to court testimony. The total capacity in forensic science in the UK has been reduced with the closure of FSS and it remains to be seen whether the remaining capacity will be sufficient for policing needs, be able to cope with changing demand or with an emergency. The statements of ACPO to the House of Commons Science and Technology Committee suggest that the police are content with the current situation.

11.1.5 Applicability of the UK (England & Wales) model to Canada

Experience with forensic services in England & Wales over the past decade has been marked by a steady turn toward ever greater sourcing of those services from the private sector. This appears to have been driven largely by the belief at the national (i.e., Home Office) level that this was the only way to reduce costs. Today, police services in England & Wales must look to a limited set of private sector service providers for the provision of the services formerly provided by the Forensic Science Service (FSS). The private sector suppliers provide all the services traditionally required for effective police work. In addition, the Metropolitan Police and some other police forces have begun to develop their own forensic capacity because they believes it can provide in-house services more cheaply,. In effect, the organizational wheel has turned full circle.

What conclusions can be drawn to date from this experience? We would offer the following:

- It takes approximately two years to develop an effective costing model for forensic services;
- The development of a fully viable private market could take ten years to develop;
- Private sector firms are capable of providing good quality forensic services, particularly in areas where modern technology, high throughput, and low case-cost efficiencies can be applied.
- The private sector suppliers can provide forensic services in all technical areas and from crime scene examination to court testimony
- Left to their own devices, large police services will tend to want to develop their own internal forensic capability because internal services are seen as most responsive to their needs. They may also be seen as cheaper than using external service providers (though there is no data yet to demonstrate this.)

Nothing in the UK (England & Wales) experience suggests Canada could replace its current RCMP FS&IS capability with private sector suppliers. Moreover, experience in the UK would lead one to believe that Canada's largest police force (i.e., the RCMP) would be inclined to re-create the FS&IS if that service were to be initially privatized.

11.2 New Zealand – Monopoly/Monopsony model

New Zealand has a single national police force – the New Zealand Police – which has an establishment of approximately 11,000[104]. The New Zealand Police has the responsibility for policing a population of 4.4 million individuals, investigating crime and initiating prosecutions. The NZ Police records approximately 400 - 450,000 crimes per annum. The level of recorded crime has been static over the last five years though there has been a fall in the rate of theft of, and from, vehicles. This is counterbalanced by increases in the rates of crimes of violence and sexual offences[105] . The NZ Police recorded crime statistics for 2008 – 2010 are shown in Table 19 below:

New Zealand Police - Recorded Crime Statistics 2008 - 2010

Offence Categories	**2008**	**2009**	**2010**
Murder, Att. Murder and manslaughter	102	127	97
Assault	42,035	45,375	44,515
Sexual Assault & related offences	2,795	2,912	3,016
Threatening behaviour	12,719	14,473	14,157
Robery & related offences	2,826	2,828	2,641
Burglary	59,326	61,405	59,323
Theft	140,858	144,780	136,932
Fraud & related offences	14,606	13,314	9,726
Illicit drugs offences	20,631	24,924	22,995
Regulated weapons & explosives offences	7,291	7,763	7,074
Damage to property & related offences	61,759	62,636	58,483
Public Order offences	42,981	46,945	46,105
	409,937	**429,491**	**407,074**

Table 18 - Recorded Crime, New Zealand Police 2008 – 2010

11.2.1 Environmental Science and Research Ltd (ESR)

ESR has a number of functions, undertaking service delivery and scientific research in forensic science, food safety, water science, human health, and pharmaceuticals. ESR is the sole provider of forensic science services to the New Zealand Police; other clients include the Ministry of Health, the New Zealand Food Safety Authority and the Ministry of Research, Science and Technology.

ESR has a complement of approximately 350 staff, 140 of whom are involved in the delivery of forensic services.

ESR maintains three Forensic Service Centres (which equate to the Canadian police Forensic Intelligence Services) which are the base for scene examination and evidence recovery specialists (scientific and technical staff). These staff members attend scenes of major crimes to support the police and to identify and collect potential evidential materials and undertake specialist examinations including blood spatter interpretation. The Forensic Service Centre staff members are the first point of contact for the police and can be case managers for major investigations.

[104] The effective strength of the police as at 30 June 2009 was 8,776 sworn members and 3,105 support staff
[105] New Zealand Crime Statistics 2010

The New Zealand Police also employ Scenes of Crime Officers who attend property crime and other less serious crime scenes to identify and collect potential evidential materials. The NZ Police retain the responsibility for fingerprint services, document examination and for a computer forensics laboratory.

ESR delivers a full range of forensic science services from two centres: toxicology, breath alcohol calibration, and blood alcohol testing are delivered from laboratories in Wellington; biology and DNA profiling, physical evidence, drugs analysis, and clandestine laboratory investigations are delivered from a laboratory in Auckland. ESR has approximately 14,000 case submissions from the police and other agencies per annum.

11.2.2 ESR management and governance

The Chief Executive Officer of the Crown Research Institute has the responsibility for the strategic direction and operational management of ESR. The ESR Mission Statement (2010 Annual Report) is:

> *"ESR will be the leading provider of specialist solutions contributing to innovation in New Zealand and to the protection of people and their environment in the Asia-Pacific Region".*

Each operating area has a General Manager who is accountable for the financial performance of his area and reports directly to the CEO. This direct reporting structure simplifies the decision making processes and management decisions can be made quickly without reference to external government bodies or the Treasury.

The Governance of ESR is the responsibility of an independent Board of Directors, which is appointed by government and the responsible minister. The Board members are selected for their business acumen and knowledge of the subject areas.

The Strategic Leadership Team, led by the CEO is responsible for developing the strategic plans and achieving the strategic goals and business objectives. The Strategic Leadership team includes the senior managers of the Forensic Science, Environmental Health, and Integrative Research for Sustainability Business Groups and the managers of the Business Service, Business Development and Marketing, Science and Research, Human Resources and Information Management.

The Treasury monitors CRI financial performance and the Ministry of Science and Innovation is responsible for the oversight of the scientific direction and performance.

11.2.3 The New Zealand Forensic Science Service Delivery Model

As a Crown Research Institute, ESR is responsible for recovering the cost of its services. ESR charges the New Zealand Police for the services delivered and the NZ Police recognise ESR as the 'sole supplier' of forensic services through a five-year Service Level Agreement.

This commercial relationship had difficult beginnings. The police were critical of the changed operating environment. They saw the requirement to purchase forensic science services from an external provider as 'expensive' and those services being delivered in-house (fingerprints) as essentially 'free'.

Following an independent audit of the commercial basis for the charging model[106] the police began to understand the basis for the charging regime. In New Zealand, as in the UK, the development of the charging model and the acceptance of it by the New Zealand Police took about two years.

The relationship between ESR and the NZ Police has matured and the market value of the relationship is approximately NZ$20-24 million per annum. This relationship is unusual and it represents a true monopoly/monopsony (single supplier/single purchaser) model.

Under the ESR business model (like that in England & Wales) the delivery of forensic science is broken down into products and services. Every product or service has an individual price, whether it is a scene attendance, a DNA profiling test, a physical sciences screening procedure or a drug analysis. The pricing model is based on unit prices for products and time-based (an hourly rate charge) pricing for other services.

For ESR the transparency of the charging model to the police makes activities requiring internal investment, including the development and implementation of scientific techniques, operational research, and the professional development of the staff, the subject of more explicit decision-making. Having clarity and understanding the forensic charging model allows the police to forecast their forensic budget more accurately. The financial data from ESR's forensic operations is shown in Table 19 below[107]:

	$NZ (millions)			
	2007/8	**2008/9**	**2009/10**	**2011/11**
Police Revenue	20.145	22.628	20.477	21.652
Other Revenue	0.745	0.743	1.019	0.742
Total	20.89	23.371	21.496	22.394
Expenditure	18.614	19.877	18.992	19.764
Surplus	2.276	3.494	2.504	2.63

Table 19 - ESR Forensic Group Financial Performance 2007 - 2010

In Table 20 above the 'Other Revenue' relates to services delivered to the Customs, Ministry of Justice for court attendance and the Military Police in New Zealand and a small amount of international work in Australia and the Pacific Islands.

[106] Business and Economic Research Ltd. (1998), Sustainable Forensics for New Zealand
[107] Data supplied by Dr Keith Bedford, General Manager Forensic science, ESR

Expenditure is all-inclusive. Each programme is fully costed on a pseudo-commercial model with charging for infrastructure costs (e.g. IT, information services, and building occupancy) and corporate overheads.

The ESR Forensic Group budget for 2011/12 is broadly similar to that of 2010/11 as police budgets are subject to government constraints.

ESR is measured on financial performance at Earnings before Interest and Tax (EBIT) and Return on Equity (RoE) since the government is the "shareholder". The target RoE is negotiated between the ESR Management Board and government and is normally around 8%. The government is not currently requiring ESR to return a dividend, so the surplus generated is retained and reinvested into the business.

ESR is a successful, viable company with forensic science operations accounting for about 40% of its business. Other business areas include; Environmental Health (Food Safety, Water Management, Public Health Surveillance, Communicable Disease and Human Biosecurity), Pharmaceuticals and Workplace Drug Testing.

11.2.4 Operational relationships between ESR and the NZ Police

Prior to any scientific work being undertaken in a case, the ESR scientist has to agree the work content and obtain approval from the NZ police. This requires close liaison between the officer in charge and the ESR case manager on the likely benefits of undertaking particular analyses. This drives a "cost/benefit" approach to casework decisions and there is a healthy tension around decisions concerning the submission of items and the commissioning of work. ESR does <u>not</u> have a 'triaging' system (such as the RCMP Forensic Assessment Centre) to prioritise work. NZ Police have internal checks to ensure that work requested is justified.

This 'client-driven' approach works in New Zealand because there is a single police customer; issues of case prioritisation at the laboratory can be managed through the internal police submissions process.

One consequence of the ESR's Crown Research Institute status is that there is no direct government support for forensic science infrastructure such as the National DNA Data Bank. ESR has to recover the costs of the National DNA Data Bank operations and the development of new services by an additional levy on every sample submitted for DNA testing. For example the cost of generating a DNA profile from a reference sample is less than half the price charged to Police. The rest goes on Databank administration and reporting, infrastructure costs and 'added-value' DNA Databank intelligence functions.

11.2.5 Funding research in the New Zealand monopoly/monopsony model

ESR has a strong culture in valuing 'science excellence', a fundamental part of which is undertaking both operational and 'blue skies' research. There is an understanding of the importance of science and research underpinning forensic science service delivery but ESR has been less than successful in winning grants in the competitive science and research funding environment in New Zealand.

The NZ government has made a Capability Fund available through the Crown Research Institute system and ESR has been successful in this arena, winning research funding of approximately NZ$2 million per year. This equates to about 10 per cent of the revenue generated through forensic service delivery. ESR has discretion in how this research funding is invested within the business. The allocation process tends to favour capacity building with a view to generating new revenue, rather than operational research or improvements in scientific technique.

In recent years the NZ police have been assisting ESR to support operational research with funding of approximately NZ$300,000 for mutually-agreed operational research projects, which are directly, related to casework issues or technique improvements. This was a significant step in partnership-building but the provision is currently suspended due to police budgetary constraints.

11.2.6 Applicability of the New Zealand model to Canada

The monopoly/monopsony model that has developed in New Zealand has led both ESR and the New Zealand Police to focus on the 'value' forensic science can bring to a police investigation and an understanding that under certain circumstances the costs of science can outweigh the resulting benefits.

The New Zealand experience demonstrates that with careful development of a suitable charging model and with a mature supplier/client relationship, the provision of forensic science can be managed in a sustainable and financially viable manner provided the "single purchaser" aspect of the New Zealand model could be replicated in Canada. This may, of course, prove difficult, in that the FS&IS serves not only the RCMP but all police services in Canada except those in Ontario and Québec.

11.3 USA – a plethora of service delivery models

The jurisdictional patchwork of the US criminal justice system creates enormous inefficiencies in the provision of forensic services. Over 18,000 federal, state, and local law enforcement agencies exist in the US[108] with control focused at the local level. By comparison, the UK, which is one quarter the size of the US, has only 43 police forces.

These myriad organizational structures, roles and responsibilities have created a fragmented, decentralized system. The effect of this fragmentation is a plethora of forensic services delivery systems, some of which overlap significantly either in the services provided, geographic coverage, or both.

In a 2005 US Bureau of Justice Statistics report, 254 public forensic laboratories were recognized[109], while a 2009 survey identified an additional 300 forensic service providers[110]. This creates an environment of 'extreme disaggregation'[111]. As an example, consider the Dallas-Fort Worth metro area, encompassing 12 counties with a 2010 population of nearly 6.4 million people.

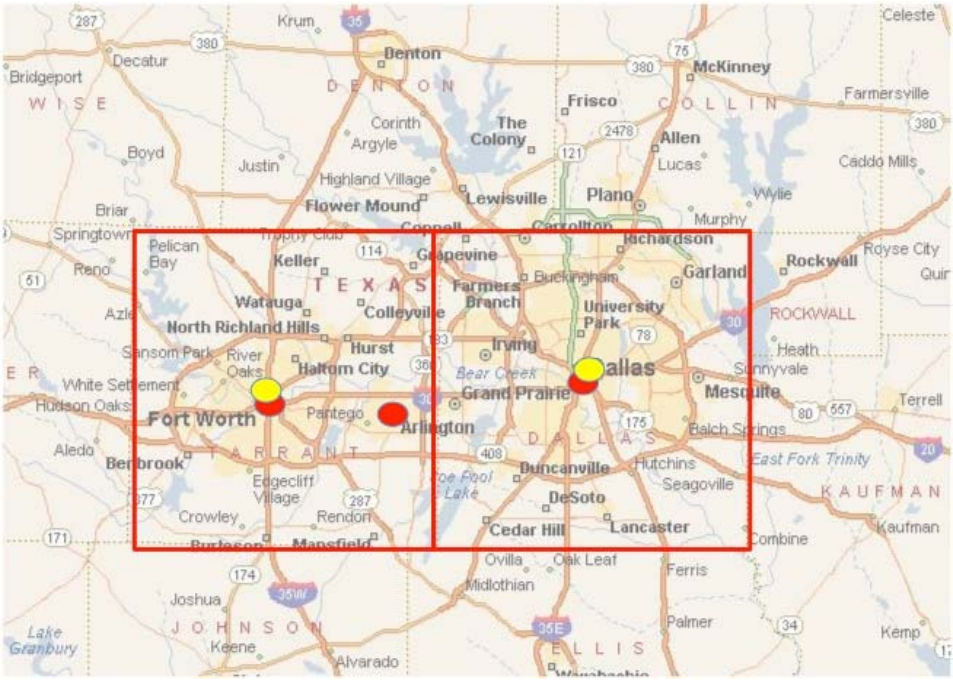

Figure 16 - The Dallas-Fort Worth area

In Figure 16 above, the red dots indicate police department laboratories; yellow dots indicate medical examiner laboratories.

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[108] Walker, S. and Katz, C. *The Police in America*, 4th edition. McGraw-Hill: New York. 2002.
[109] *Census of Publicly Funded Crime Labs*, US Bureau of Justice Statistics, 2008.
[110] Childs, R., Witt, T., and Nur-Tegin, K. "Survey of Forensic Service Providers", *Forensic Science Policy and Management*, 1(1): 49-56.
[111] National Academies of Science National Research Council, *Strengthening Forensic Science in the US: A Path Forward*, 2009.

The City of Fort Worth has a police department forensic laboratory; the surrounding county (Tarrant) has a medical examiner's office that also has a full-service forensic laboratory. Likewise, the City of Dallas police department offers forensic services, as does the Dallas county medical examiner's office. In between theses jurisdictions, the city of Arlington police department has forensic service provision for its citizens.

Overlaid on all of this is the state-wide Texas Department of Public Safety's Forensic Laboratories, in addition to numerous private forensic laboratories. The various law enforcement agencies (city, county, state) throughout the metropolis have numerous opportunities for forensic service provision, some of which are contractual.

Moreover, federal agencies have forensic service capabilities in the area (e.g. Drug Enforcement Administration laboratory in the Dallas area) which may offer assistance to local agencies *pro bono*. The forensic landscape is complicated, to say the least.

11.3.1 Provision of forensic science research funding in the USA

Funding for competitive research grants in forensic science is scarce when compared with other sciences. For example, in 2007, the entirety of available research funding ($6.2 million) from the US National Institute of Justice, the agency that provides the largest amount of that type of funding, represented just a fraction of the funding available for any other science (Figure 17 below).

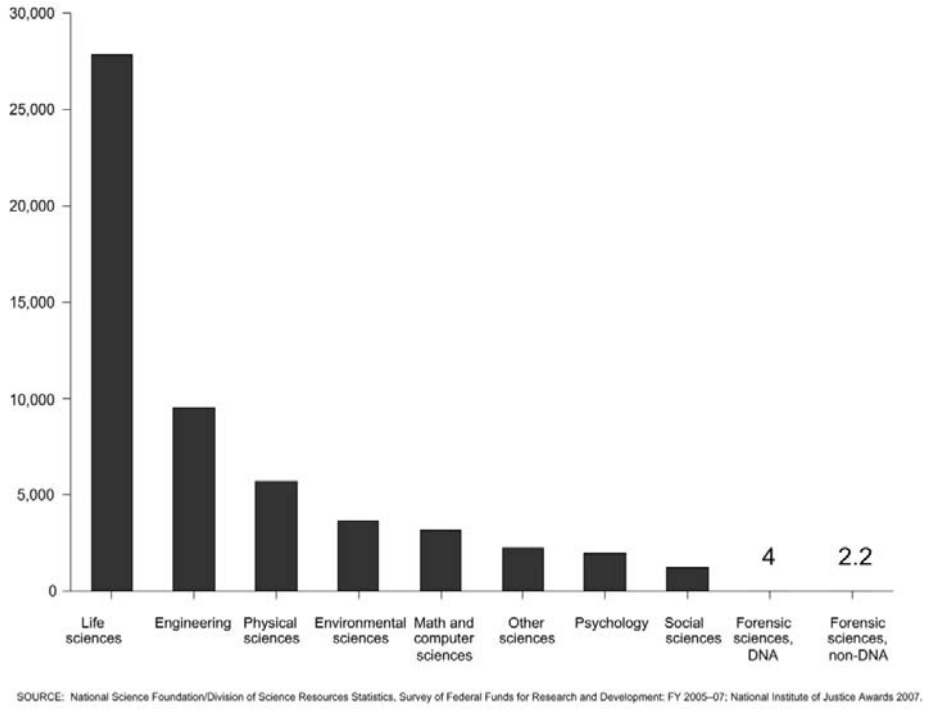

Figure 17 - Federal obligations for research, by field of science and engineering and agency FY2007, projected and awarded (NIJ) in millions of dollars

In 2010, despite a marked increase in NIJ research, development, and evaluation funding, those numbers are barely any better in the scope of overall science research funding where forensic science represents a barely measurable effort (Table 20 below).

Funding Body	US $ Billions
National Institutes of Health	$30.7
National Science Foundation	$6.8
Department of Energy	$4.9
National Institute of Justice (overall)	$0.072
NIJ Forensic Science	$0.0265

Table 20 - Research dollars in FY2010/11 by agency, in billions of US dollars

Despite numerous and frequent calls for more research in forensic science even at the highest levels, such as the National Academies of Science National Research Council's 2009 report[112], little progress seems to have been made.

11.3.2 Applicability of the U.S. model to Canada

The differences between Canada and the US in terms of jurisdictional complexity, numbers of police services, approach to criminal justice and resources devoted to policing all would suggest that the US model of many different suppliers of forensic services is neither advisable nor affordable in the Canadian context. Indeed, if one were designing a system from scratch, one would certainly not aim to produce something with this level of redundancy and inefficiency.

[112] National Academies of Science National Research Council, *Strengthening Forensic Science in the US: A Path Forward*, 2009.

11.4 Forensic Science in Scotland

The provision of forensic services in Scotland underwent a major change in April 2007 with the creation of the Scottish Police Services Authority (SPSA). Under the *Police, Public Order and Criminal Justice (Scotland) Act 2006*, SPSA gained the responsibility of the national provision of forensic services in Scotland. The implementation of SPSA Forensic Services (SPSA FS) removed the operational delivery of forensic science from police organizations, resulting in a single-provider, multiple-customer environment. The purpose of SPSA FS was to integrate services that were operating in numerous locations across Scotland into one national service. The introduction of SPSA FS[113] has resulted in the amalgamation of all the scenes of crimes units, forensic science laboratories, and fingerprint bureaux under one umbrella organization.

SPSA FS is made up of four forensic laboratories and fingerprint bureaux, and eight scenes of crime examination units. Each individual SPSA FS unit retained responsibility for the provision of some forensic services (e.g. scene examination, fingerprint examination) to the surrounding police forces. More specialist services (e.g. toxicology, firearms) are restricted to specific laboratories providing a national service for specialised forensic evidence examinations. Table 21 below illustrates how the four main SPAS FS units provide services for the eight police forces in Scotland.

SPSA FS location	Local forces provided	Specialist national services
Glasgow	Strathclyde Police Dumfries & Galloway Constabulary	Document & Handwriting Comparisons Firearm & Gun Shot Residue (GSR) Analysis
Edinburgh	Lothian & Borders	Toxicology
Dundee	Tayside Police Fife Constabulary Central Scotland	DNA (database, criminal paternity and human remains identification)
Aberdeen	Grampian Police Northern Constabulary	Drugs Analysis Hair and fibre

Table 21 - National provision of forensic science in Scotland

None of the private forensic science suppliers operating in England & Wales has any presence in Scotland.

[113] http://www.spsa.police.uk/services/forensic_services

The Scottish DNA Database remains a distinct entity, but it exports and uploads suspect (criminal justice or CJ) DNA profiles and crime scene DNA profiles to the National DNA Database[114]. Approximately 8,000 general biology cases are received by SPSA FS per annum, of which approximately 75% involve the export and upload of DNA profiles to the National DNA Database (i.e. approximately 500 cases per month)[115].

In September 2011 the SPSA announced the intention to amalgamate the Scottish Police forces into a single national police force for Scotland[116]. A major review of the Scottish Fingerprint Services has recently concluded with very significant criticisms of the Scottish systems. This review has raised fundamental issues for the way in which fingerprint evidence is collected, handled, compared, and reported[117].

11.4.1 Applicability of the Scottish model to Canada

The research team has attempted to contact the Director of the SPSA Forensic Science Service in relation to this project on a number of occasions without success.

Given the impending changes outlined above and the considerable constitutional, geographic and population differences between Scotland and Canada, the Scottish model will not be considered further.

[114] http://www.spsa.police.uk/services/forensic_services/dna/dna_database
[115] Quarterly Customer Reports 2009-2011, www.spsa.police.uk/admin/pages/edit_section/about/our_corporate_publications/quarterly_performance_reports
[116] http://www.scotland.gov.uk/News/Releases/2011/09/08142643
[117] http://www.thefingerprintinquiryscotland.org.uk/inquiry/3127.html

12.0 Appendix C – The forensic market in England & Wales

12.1 The Structure of the forensic market in England & Wales

The overall spend by the police in all aspects of forensic science is approximately £450 million per year[118]. Of this, the Police Sector is worth approximately £275 million and the remaining £175 million is available to the 'external' FSP's (termed the 'Accessible Market').

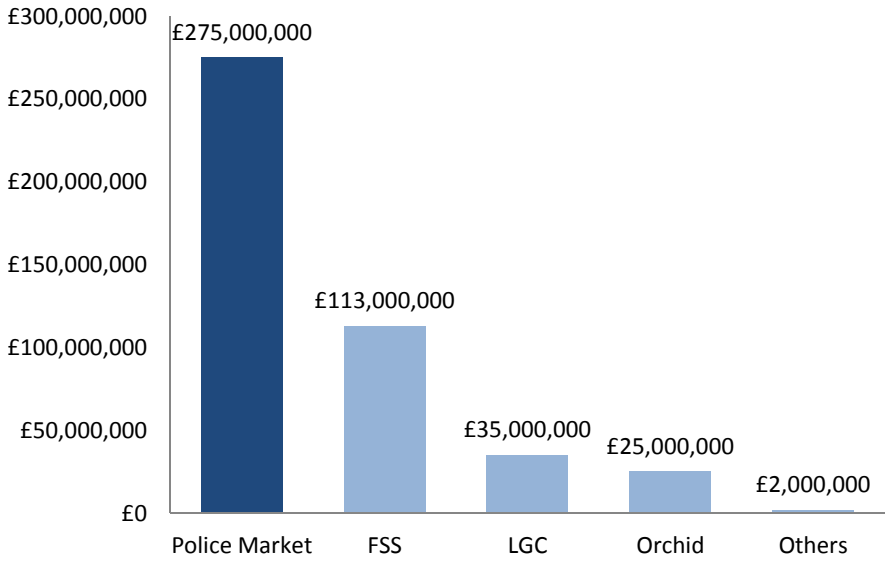

Figure 18 - Forensic Market in the UK

A predicted fall in market value

It is anticipated that the 'Accessible Market' is set to shrink rapidly with the overall value estimated to fall to £110 million. This market change is predicted for a number of reasons:

- Falling crime rates resulting in a fall in forensic submissions
- Government decision to cut police budgets by 20%
- Increasing police in-sourcing of forensic science

The timescales for this change are unclear; ACPO estimated 2014 but others predict this will happen much earlier; perhaps by 2011/12. This is a significant issue for those forensic suppliers, which the Government expect, will pick up the 60 – 65% market share that will become available as FSS Ltd. is closed. Is it good business sense for a profit-based, commercial FSP to take on the liabilities for staff and capital equipment in a market that is set to fall in value by 35% in the next 2 – 3 years?

[118] House of Commons Science & Technology Committee Report (2011)

12.1.1 Seller concentration

The 'accessible' market is dominated by three firms; FSS Ltd., LGC Forensics and Orchid Forensics. These firms are all considered to be 'full service' suppliers; providing scene and laboratory services encompassing a range of evidence types. Together these firms account for 98.8%[119] of the accessible market volume. In 2009/10 the market was dominated by FSS Ltd., which had a market share of 64.6%.

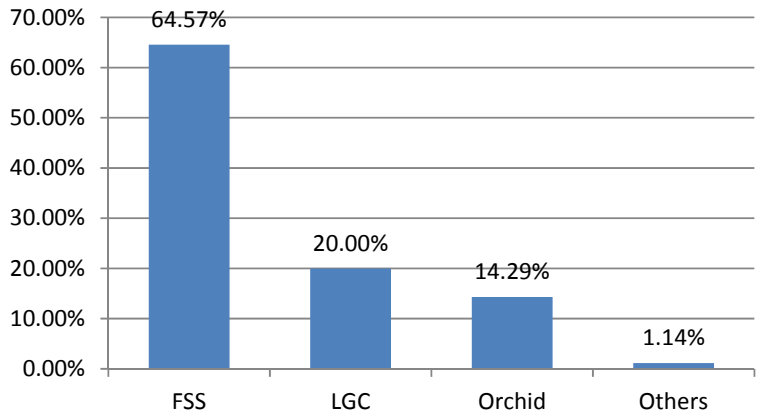

Figure 19 - Seller concentration in the UK forensic market

The FSPs can be divided into 'full-service' firms; those considered to be provide a full range of forensic services; and 'niche' forensic science suppliers supplying laboratory-based, analytical or consultancy services within a limited scope.

The full-service forensic science suppliers include:

	Turnover 2009/10 (£m)	Staff
Forensic Science Service Ltd	£113	1945
LGC Forensics[120]	£ 35	600
Orchid Cellmark Ltd.	£ 25	327
Key Forensics[121]	£ 2	90

All of the 'niche' FSPs have been accredited as forensic suppliers under the NFFA. These firms include:

- **First Forensics** – Digital Analysis (mobile phones, cell site analysis, computers);
- **Napier Associates** – Consultancy (Footwear only);
- **Manlove Forensics** – Biology, Scene examinations, Anthropology;
- **Forensic Access** – Consultancy;
- **Randox Forensics** – Toxicology;
- **ROAR Forensics** – Toxicology.

[119] Company Annual reports (2009/10)
[120] ENFSI Membership data (2008) http://www.enfsi.eu/page.php?uid=150
[121] ENFSI membership data (2009) http://www.enfsi.eu/page.php?uid=219

There have been two major events in the market that affect the seller concentration. In December 2010 the government announced the closure of the FSS with effect from 31st March 2012. There is an expectation from the government, the police, ACPO and the National Policing Improvement Agency that the remaining suppliers will be willing to expand their operations to take up the service delivery contracts currently offered by FSS Ltd. Some contracts have already been let; the major proportion of which have fallen to LGC Ltd. and Orchid Forensics[122] - see Figure 20 below:

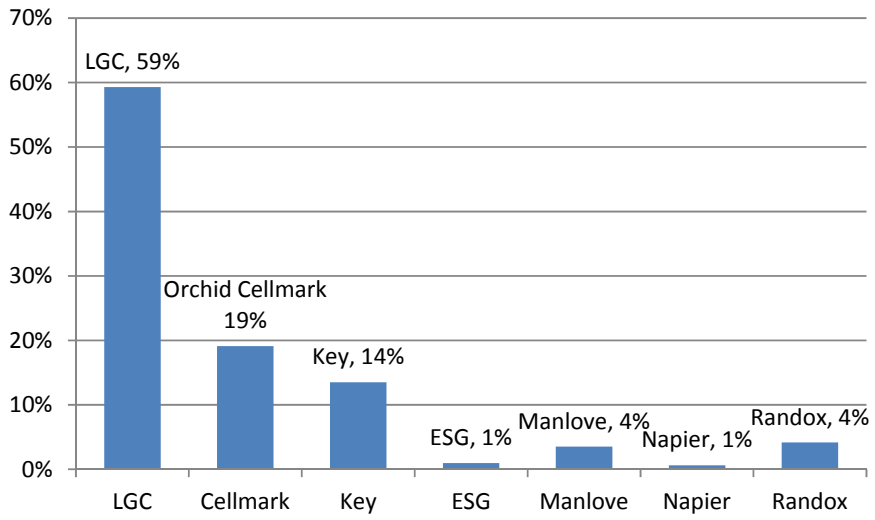

Figure 20 - Operation slingshot – reallocated FSS contract awards 2011

The second is that major police forces; including the Metropolitan Police (MPS), West Midlands Police and West Yorkshire Police are planning to in-source significant proportions of their forensic science provision. In this way the police will become 'suppliers' as well as 'purchasers' and be acting as competitors to the traditional FSP's. In addition, if the Metropolitan Police Service takes a significant proportion of their current £35-40 million 'external' spend away from the 'accessible' market by in-sourcing their forensic activities; the number of forensic suppliers is likely to fall further as firms become less profitable, and either leave the market or become subject to acquisition and merger activities.

Note: Approximately 100 staff from the FSS Homicide and Violent Crime team transferred to the Metropolitan Police Forensic Science Directorate in December 2011. These staff will undertake scene examinations and undertake forensic casework removing a further tranche of work from the commercial market.

With the closure of FSS Ltd., LGC Forensics Ltd. is likely to become the new 'monopoly' player as the 'accessible' market becomes more concentrated. The US-based parent company of Orchid Cellmark Ltd. (Orchid Cellmark Inc.) is currently under threat of acquisition by another major US company LabCorps[123]. The impact of such an acquisition in the England & Wales forensic market is not known at this time.

[122] FOI request from NPIA
[123] LabCorps Press Release (Aug 15, 2011)
http://phx.corporate-ir.net/phoenix.zhtml?c=84636&p=irol-newsArticle&ID=1596399&highlight=

12.1.2 Product differentiation

In the years 1997 – 2007 the forensic science providers were able to compete for work from police forces on a number of terms; service volumes, turn-round times, added-value services, research and innovation and price. Individual police forces let contracts to FSPs under Service Level Agreements, usually of three years duration.

The National Policing Improvement Agency (NPIA) established the National Forensic Procurement Project in 2007 to:

> *"... formulate a strategy for future procurement of forensic analysis, to develop a standardized User Requirement, Specifications and Terms and Conditions and to subsequently undertake an EU procurement to select suppliers under a national (forensic) framework agreement (NFFA)".*

Note - the term *'forensic analysis'*, indicating the desire to commoditize forensic science into a series of 'tests' which can be purchased at the lowest price. This removed the concept of a 'service' provider; downplayed the professionalism of the forensic scientist and minimised the 'value' or contribution the external FSP's could make to the CJS. The police forces were to *"run mini-competitions within the framework on a regional basis"* with the NPIA supporting the procurement process; defining the product to be delivered, the product volumes, the expected turnaround times and the quality standards to be met[124]. There was no value placed on Research and Development or innovation or client/service provider partnerships. Under this procurement process the only parameter on which the FSPs could compete was price and setting the National Forensic Framework Agreement (NFFA) under a regional basis meant that significant revenues could change hands as contracts were won and lost by FSPs.

An initial tender exercise was carried out by the NPIA in order to register FSP's as accredited suppliers, such that when forces or regions wanted to procure forensic science support, very little additional work would be required on behalf of the tendering authority or the FSPs. FSS Ltd. commented to the Parliamentary Home Affairs Committee (2011):

> *"In reality, the majority of the tenders that have taken place have selectively utilized parts of the framework, but have also introduced other bespoke elements, meaning each tender is a lengthy and relatively complicated process (and therefore also expensive) for all involved".*

And:

> *"Police take-up of innovation has ground to a halt and it seems that opportunities to introduce innovative solutions to criminal justice issues are not developed".*

However, the police realized significant savings in the commoditized product areas, as the competitive tendering model drove down the market price for these tests. For example, in 2005 the price of a DNA database analysis was about £40; by 2010 this had fallen to less than £20.

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[124] FSS Response to Parliamentary Home Affairs Committee – The New Landscape of Policing (June 2011) http://www.publications.parliament.uk/pa/cm201012/cmselect/cmhaff/writev/939/nlp15.htm

12.1.3 Barriers to entry

Prior to 2007 there were limited barriers to entry to this market. FSPs had to demonstrate that they were accredited to the ISO 17025 standard and those companies wishing to bid for DNA database or DNA casework analysis; the results of which might have had to be loaded to the National DNA Database, also had to be accredited by the NDNAD Custodian.

The introduction or the NPIA National Forensic Framework Agreement in 2007/08 created a significant barrier to new entrants. FSPs had to respond to an initial tender exercise to be registered a suppliers under the NFFA procurement. Without this accreditation a firm wishing to enter the market cannot compete for police business. It is not clear how a firm wishing to enter the forensic market can now obtain such accreditation.

In its response to the Parliamentary Home Affairs Committee (2011)[125] FSS Ltd. noted;

> *"Rather than establishing and cementing a truly competitive, healthy market, the NFFA has contributed to its destabilization, introducing significant uncertainty for existing FSPs, and introducing barriers for new entrants".*

It is clear that the stability of the forensic market is now crucial to the Criminal Justice System of England & Wales. The market needs government regulation and supervision such the remaining forensic science suppliers can adequately recover their costs, compete to meet the changing market conditions and be incentivised to invest in research and development.

12.1.4 Buyer concentration - effect of NPIA National Forensic Framework Agreement

Between 1997 and 2007 FSP's competed with each other to win work from individual police forces. In that period the FSP's could compete on a number of terms; service volumes, turn-round times, added-value services, research and innovation and price; or a combination of these factors. However, once the police started to tender for forensic science support as a consortium (e.g. under a North West/South West agreement thirteen forces submitted a single request for tender), the buyer concentration increased.

The advent of the NPIA National Forensic Framework Agreement led to more rapid market concentration. Instead of 43 individual clients forces there are now only eight or nine regional police customers purchasing 'external' forensic science support. Under these conditions the 'Buyers' are in a powerful position as they

- Purchase a significant proportion of the output of the independent FSPs
- There is an increasing concentration of buyers
- The service and product specifications become more standardised (under the NFFA)
- There is a credible threat of 'backward integration' as police in-source services

[125] See 63 above

12.1.5 Barriers to exit

If a firm elects to exit this market due to falling profits or unsustainable losses there are two barriers to exit:

- Costs of closure – including redundancy pay, staff pensions etc.
- Reputational damage due to failure to support current clients and the needs of the Criminal Justice System

12.2 The Conduct of the forensic market in England & Wales

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.

Prior to 2007/8 the FSPs were free to compete for police business and to respond to tenders using a full range of service or product definitions. The FSP could agree service volumes, develop customer specific 'added-value' services, offer reduced turnaround times and develop innovative solutions to customer issues, or include the client in their Research and Development programme. The NPIA National Forensic Framework Agreement processes have removed many of these competitive opportunities. The service requirements are closely defined, though in many instances police forces require significantly customised services, and the FSPs can only compete on price.

In response, the FSPs have created the Association of Forensic Science Providers[126] to strengthen their representation with key stakeholders; Home Office and Parliament, the Forensic Regulator, the Police, Crown Prosecution Service and other lawyers and the Judiciary. The members of the Association of Forensic Science Providers (AFSP) include; FSS Ltd., LGC Ltd., Orchid Forensics; Scottish Police Services Authority (SPSA), Forensic Science Northern Ireland (FSNI) and the Eolaíocht Fhóiréinseach Éireann (Ireland) was constituted on 1 July 2010 with the following mission and vision statements:

> ***Mission***
> *To represent the common views of the providers of independent (i.e. non-police) forensic science within the United Kingdom and Ireland with regard to the maintenance and development of quality and best practice in forensic science and expert opinion in support of the justice system, from scene to court.*
>
> ***Vision***
> *To be the unified, objective, informed voice of practical forensic science provision in order to best support the interests of the criminal justice system through a partnership approach.*

[126] http://www.afsp.org.uk/homepage

12.3 The Performance of the forensic science market in England & Wales

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 a particular metric. In a 'for-profit' industry or organization the metrics are easily measured. Gross Profit is calculated as the revenue generated from operating activities minus the costs of undertaking those activities. The revenue generated is a combination of volume of product or services delivered and the price per unit achieved. Profitability can also be affected by a firm's ability to react to changes in the market environment; fluctuations in demand, regulatory or legislative changes or competitor activity.

The major financial measures of the full-service FSP's for the years 2007 to 2010; FSS Ltd, LGC Ltd, Orchid Cellmark Ltd. and Key Forensics are shown below:

FSS Ltd

	Turnover(£000)	Profit (Loss) (£000)	Operating Profit (%)	Staff #	Ops/Admin (%)
2007	210,449	6,195	2.94%	2,431	69.60%
2008	138,001	3,575	2.59%	2,086	75.41%
2009	125,794	-4,884	-3.88%	1,972	72.52%
2010	112,951	-12,678	-11.22%	1,945	71.57%

Note – the 2007 figure of £210m is for a period of Oct 2005 to March 2007 – the first full operating period for FSS as a GovCo. And it represents an annual turnover of approximately £140 million

Note - Exceptional costs of £37 million for restructuring the business pushed the losses of FSS Ltd to £50 million for 2009/10[127]. The 2010/11 Annual Report has been submitted to the Home Office; showing a loss of over £100 million due to redundancy costs for 500 scientific and other staff[128].

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%

LGC Ltd. has four Divisions; LGC Forensics, LGC Genomics, LGC Science & Technology, and LGC Standard that operate in diverse, but related, market sectors. The company presents a group account so it is difficult to understand the position of each Division in their respective market sector. However, Dr Steve Allen (CEO) in his evidence to the House of Commons Science & Technology Committee (2011) the turnover of the Forensics Division was about £35 million; therefore contributing approximately 42% of the company turnover[129]. The Forensics Division has about 600 staff[130] (2008); which indicates that approximately 65% of the staff is engaged in forensic science.

[127] FSS Annual Report and Accounts 2009/10
See http://www.forensic.gov.uk/userfiles/FSS%20Annual%20Report%202009-10.pdf
[128] Personal communication to cnm
[129] Steve Allen (CEO) – evidence to House of Commons Science & Technology Committee (2011)
[130] ENFSI Membership data http://www.enfsi.eu/page.php?uid=150

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%

This company has increasing its turnover and profitability and is becoming more operationally focussed; growing the proportion of operational to managerial and administrative staff. With the demise of FSS Ltd., Orchid Cellmark Ltd. will become the second largest independent FSP. Orchid Cellmark Ltd. undertakes work for the police in the forensics market in England & Wales but also has contracts for DNA Profiling with the Child Maintenance and Enforcement Commission and the UK Border Agency (Immigration Dept.). In addition they undertake animal DNA testing for identification, relationship testing and disease susceptibility.

Key Forensics

Key Forensics is the smallest of the full-service forensic science providers and one that has struggled to survive in the forensic science market in England & Wales. The company files short form, or abbreviated accounts[131] and is not obliged to disclose details of turnover, EBIT, or profitability data. Key Forensics does not disclose its total staffing levels, nor does the company declare the proportion of operational to managerial staff.

In 2009 the Key Forensics abbreviated accounts contained a 'Going-concern' warning stating that:

> *"The company is heavily reliant upon revenue received from contract work for national crime prevention agencies ... Until the outcome of these contract awards is known, the company continue to be supported by its major shareholders... The directors have concluded that the combination of these circumstances represent a material uncertainty that casts a significant doubt upon the company's ability to continue as a going concern and therefore the company may be unable to realise their assets and discharge their liabilities in the normal course of business",*

The only material data that gives an indication of company performance is the Shareholder Funds, which fell from a £331,000 surplus in 2007 to a £2.6 million deficit in 2010 demonstrating the deepening crisis in this company. Unless there is a significant change in profitability or the company is the subject of an acquisition (or merger with another player in the market) it seems the company might find it difficult to continue trading.

Note: it appears that LGC Ltd. is outsourcing some of the forensic casework it won in the latest round of tendering, to Key Forensics.

[131] Section 444 (3), Companies Act (2006)

13.0 Appendix D - House of Commons Review of Forensic Market in England & Wales

The House of Commons Science and Technology Committee undertook a review of the Government's decision to close the Forensic Science Service Ltd. between January and June 2011.

The Committee's report, published on the 1st July 2011 was highly critical of the Government's decision and the review process.[132] There were 49 conclusions and recommendations including the following:

The forensics market in England & Wales

1. Given that the Government expected private forensic science providers (FSPs) to pick up the FSS's 60% share of the external forensics market, it is disappointing that the Government does not appear to have gathered any market intelligence on the capacity and commercial willingness of private forensic science providers to take on the FSS's work. (Paragraph 42)

5. Given the marked decrease in the external forensics market in 2010-11, it is reasonable to expect that the market may shrink to £110 million or less before 2015, particularly given that spending cuts have yet to bite on police budgets. While we agree with the Minister that it would be wrong to speculate, we recommend that the Government re-evaluates the future of the forensics market in light of the cuts to police budgets and planned withdrawal of the FSS from the market. (Paragraph 52)

National Forensic Framework Agreement

6. It is our understanding that some areas of forensic science provision, particularly complex, interpretive analyses, are not profitable under the current procurement strategy, although this does not make them less important to criminal justice. In considering the proposed closure of the FSS and development of a future procurement strategy, the Government must recognise and address this issue. (Paragraph 62)

Financial position of the FSS

9. The Government announcement that the FSS was losing £2 million a month was not the full story. It should have been made clear that (i) the figure did not take into account the savings expected to be delivered by the transformation programme; (ii) it did not account for potential further declines in business; and (iii) while some monthly losses may have been £2 million, the average monthly loss over the past year was lower. As a result, evaluation of the proposal to close the FSS from the taxpayer's perspective was difficult. (Paragraph 80)

11. If the Government wants a competitive market in forensic services it must ensure that the market is not distorted by the police customer increasingly becoming the competitor. Otherwise the ambition for a truly competitive market is fundamentally undermined. We consider that the Government's ambitions for fully privatised forensic science provision are jeopardised by its complacent attitude towards police forensic expenditure. (Paragraph 91)

Quality standards and impartiality

[132] http://www.publications.parliament.uk/pa/cm201012/cmselect/cmsctech/855/85502.htm

13. In the transition period to 2012, the Government must ensure that none of the FSS's work is transferred to a private forensic science provider that has not achieved accreditation to ISO 17025. (Paragraph 100)

14. We have serious concerns about the potential transfer of the FSS's work to non-accredited police laboratories. We agree with the FSR that the transfer of work from the FSS to a non-accredited police environment would be highly undesirable, as this would pose significant and unacceptable risks to criminal justice. If a sufficient match in quality standards cannot be met elsewhere, the Government should, at the least, reconsider the 2012 closure deadline. The needs of criminal justice must come before considerations of financial convenience. (Paragraph 109)

The Forensic Science Regulator

19. The Forensic Science Regulator (FSR) has a crucial role in ensuring high quality standards are maintained, and this role will become more important during the transition period. It is time for the Forensic Science Regulator to have statutory powers to enforce compliance with the quality standards and Codes of Conduct that he has developed through what appears to be a robust process. The Government should bring forward proposals to provide the FSR with statutory powers immediately. (Paragraph 129)

20. It is unacceptable that the Home Office failed to consult with the Forensic Science Regulator when considering the future of the FSS, as he was a key stakeholder who could have offered a useful, independent perspective. (Paragraph 131)

Forensic science research and development

26. We are concerned that no formal assessment was made of the impact of closing down the FSS on forensic science R&D before the decision was made and announced. We have not seen any evidence of an informal assessment. We are very concerned and disappointed that the Chief Scientific Adviser to the Home Office was not consulted prior to the decision to wind down the FSS. (Paragraph 175)

29. Although private FSPs invest in R&D, it is probably unreasonable to expect private companies to increase their investment in some areas of forensic science research, particularly in fundamental research, at a time of market uncertainty. Private companies do, however, have a key role to play in development and application of research and on-going validation of methods. (Paragraph 194)

30. Although we are hesitant to call for increased research funding in the current economic climate, the case for increased public funding specifically for forensic science research is compelling. We consider that the Home Office and Research Councils have an interest in the health of the forensic science research base and should develop a new national research budget for forensic science. The views of the forensic science community should be sought when determining the size and scope of the budget and details of its administration. (Paragraph 195)

Final conclusions

43. There are many factors to take into consideration when determining what has caused the dire financial position of the FSS. We consider the most significant factor to be the shrinking forensics

market, driven by increasing police in-sourcing of forensic science and a forensic procurement framework that drove down prices and did not adequately recognise the value of complex forensic services. (Paragraph 239)

44. The stabilisation of the external forensics market is now of crucial importance. For this to be achieved, the Government must do two things. First, further police in-sourcing of forensic science must be curbed. Second, the National Forensic Framework Agreement, and any successor framework, must be revised to reflect that some forensic science services cannot be commoditised easily into products and ensure that the true costs of forensic services are reimbursed to providers. Without stability through regulation, a properly competitive market cannot be realised. A shrinking market provides no incentive for further investment or growth from any forensic science provider. The success of forensic science providers and their willingness to invest further in forensic science will be threatened if action is not taken to stabilise the market. (Paragraph 240)

The Government's response[133] to the Seventh Report from the House of Commons Science and Technology Committee – the Forensic science Service, was published on the 31st October 2011.

Mr Andrew Miller MP, the Chairman of the House of Commons Science and Technology Committee is reported to have commented that national forensic science service would have to be 'reinvented' due to the likelihood of failed prosecutions when the current system closes in March (2012)"

The report in the Telegraph broadsheet newspaper of 26th December 2011[134] quotes Mr Miller as commenting,

"We will have prosecutions that will fail because a good solicitor will be able to throw doubts on the integrity of the way things have been handled … I can easily see that happening and smart solicitors getting bad guys off the hook, and equally, I can see victims of rape remaining totally unsatisfied with the outcome of the investigation because the forensic science was inadequate … Within a few years, the FSS will be reinvented in some form or another. In the meantime, the great risk is that the interests of justice will not be served.

This is not an issue that is a one-sided one. It's in the interests of justice. I think the Government has got to slow down this process, solve some of the problems and if there's a case for finally closing the FSS, to do so at a pace that answers these difficult questions."

There are significant lessons for Canada in the England & Wales experience. Forensic Science can be delivered to good effect from an Agency or by a fully commercial market but, if either of these routes are chosen, then the Government has to be fully committed to the concept. If a viable commercial market is to be established, then Government has to create a highly regulated environment where the range and volume and continuity of forensic provision is guaranteed for the police and CJS, and where the forensic science providers are allowed to make a profit in order to sustain and grow their businesses.

[133] http://www.official-documents.gov.uk/document/cm82/8215/8215.pdf
[134] http://www.telegraph.co.uk/news/uknews/crime/8961169/Fresh-fears-over-future-of-forensic-science-in-criminal-cases.html

14.0 – Appendix E - Qualitative Methodology and data collection

14.1 Qualitative Methodology and example questions for police and CJS respondents

Research Aim
The aim of the interview process is to elucidate the respondent's role in the investigative or criminal process and the nature and level of their interaction with the forensic science provider.

The interview process also explored the expectations the participant may have of 'perfect' forensic science provision and perceptions they have of the performance of their current provider.

Methodology
The methodology proposed for the collection of primary data concerning client views on their needs and expectations of a forensic science provider and their perception of the service level offered by their current provider was the semi-structured, direct interview. The research team worked with an interview protocol with a list of broad topics that allowed sufficient opportunities for respondents to raise issues not in the guide and for interviewers to add additional or follow-up questions. This interview strategy combined a concern with comparability between respondents whilst allowing them to raise issues not already considered.

The semi-structured interview with individual officers was chosen as a data collection methodology to eliminate the potential for hierarchical, or peer, pressure influencing the outcomes of the research. For this reason the use of focus groups was rejected as a data collection tool.

The choice of this analytical strategy was informed by a commitment to 'Grounded Theory' in which 'themes' or 'implied causal relationships' can be identified as present in the interview data. Of particular interest in this study are the themes that are present amongst the variety of understandings, expectations, views, and behaviours of the variety of stakeholders interviewed about their experience of forensic science provision in the current Canadian context. The interviews were used to discuss perceptions of alternate models of forensic science provision and to explore the respondents' attitudes to issues such as charging, service provision, commodity testing, and 'value'.

Interview subjects were drawn from a purposive sample of laboratory staff, federal, provincial, and municipal police officers, crown prosecutors and defence counsel who have specific roles and who might have different expectations of, or responsibilities for, forensic science. Respondents were chosen because they have knowledge and experience that allowed a detailed exploration of the research objectives. No statistical inferences can be derived from such a sample since individuals was not selected at random. This sample was made up of individuals who were expected to be able to provide information-rich data to allow the identification of the dominant (and some less dominant) issues that matter most to the users of forensic science in Canada.
The following categories of individuals were approached to supply these data[135]:

[135] For a description of the logic of purpose sampling in qualitative research, see Shakkori & Teddlie (eds) 2003. *The Handbook of Mixed Methods in Social and Behavioural Research*. London: Sage.

- Criminal Operations Officer (responsible for the crime portfolio at senior level)
- Deputy Commissioner for Policing (Head of CID)
- Lead Investigator for Major Crimes (SIO)
- Director of Forensic Investigation Support Services (RCMP, Provincial and municipal)
- Investigating Officer
- Forensic Identification Specialist
- Public Prosecution Services of Canada
- Provincial Crown Prosecutor
- Defence Lawyers

Interview Protocols

Interviews lasted between about 75 and 90 minutes. The interviews were recorded with the express permission of the participants. When the respondents declined to be recorded, notes were taken by the interviewer. Interviews were anonymised before being transcribed for later analysis.

The interview transcripts were coded (using NVivo 9 software) in order to distil interview responses into 'categories' or 'emerging themes '. In this way the analysis was used to identify those issues that were most important to the users of forensic science and also to elucidate the variety of client perceptions of the performance of the current forensic science providers.

Informed consent

Potential interview candidates were contacted and informed of the purpose of the research at least 24 hours prior to the interview taking place. At this time the interviewee was sent a description of the research aims and methodology, an outline of the type of questions to be covered and a consent form.

Interviewee were asked for their permission to record the interview and informed of the anonymisation procedure and that any necessary identifying details would be stored securely and separately from the interview data. Finally, they were informed that they had the right to withdraw from the data collection exercise and to have their remarks destroyed.

14.1.1 Examples of lines of questioning for the police and CJS participants

1. Describe the type of work you do and your role in the forensic process.
2. Which laboratories do you consider to be your forensic science provider (FSP)?
3. How often have you had contact with 'your' FSP in the last year and who are your main contacts at the laboratory?
4. What type of forensic casework or examinations are you normally concerned with?
5. Are you involved with forensic decision making and if so to what purpose -strategic, operational, charge/no charge, investigative?
6. Does the laboratory provide a scientist to assist in the creation of a forensic strategy?
7. Does the scientist communicate significant findings in an appropriate timescale?
8. What do you think of the frequency and appropriateness of the communication between you and the scientist?
9. What do you think of the reports or statements produced by the scientist – are they written in a clear and unambiguous language that a jury or lay-person could understand?
10. Are the services provided by your FSP consistent (regardless of which scientist is involved) and do they meet the needs of the investigation? (Fit for Purpose)
11. Is the scientific advice you receive impartial and objective? Is it always presented in a professional manner?
12. How do the forensic scientists you meet perform in Court – do they always respond to the lawyers questions in an impartial, objective, professional and confident manner?
13. Is the forensic provision available to the Prosecution and Defence equitable?
14. Where does a Defence lawyer obtain forensic advice and or testing?
15. Have you ever had cause to complain about the service you have received from your FSP or about the performance of an individual scientist? If so how did the FSP deal with your complaint?
16. In your view have you had sufficient training in forensic science? Who provides forensic training in your area?
17. Do you understand what forensic science can do for you in a casework situation?
18. Can you give me any examples where a forensic examination was crucial to an investigation?
19. How did you measure the value of forensic science to that investigation/case?
20. Is there an objective measure of **value** of forensic science? How do you judge value?
21. Does the laboratory charge for its services and if so, on what basis?
22. If the FSP does not charge for its services, is the forensic science provision rationed in another way; for example by limiting the number of submissions per case?
23. Do you measure/monitor the cost of forensic science in your area?
24. Does the turnaround time offered by the FSP always meet your needs?
25. Does the laboratory have a casework backlog and if so, does this cause you any issues?
26. If you had a perfect forensic science supplier what would their service look like?
27. Is forensic science important to you?

14.1.2 Areas for exploration with Forensic Science Providers

Business Processes

1. Can you define a case/sample?
2. How is a sample/case managed through the unit?
3. Which people interact with that sample/case during its progression through the unit?
4. What information is entered into LIMS while the sample/case is in the unit?
5. What happens if the LIMS data needs to be changed or corrected?
6. How is this LIMS data used during the life of the service request?
7. Who defines the priority of samples and cases within the unit – can this be changed?
8. In a complex case, how are the multiple elements brought together across the disciplines?
9. How has the Biology Services change programme gone – what were the issues?

(FORESIGHT Programme)

Technical Process

10. What technical processes happen to a sample/case in the unit?
11. On what basis are decisions made that effect the route a sample/case will take through the laboratory?
12. When does a Reporting Officer get involved?
13. What is the case review & admin review process?
14. How well is the lab & office space utilised?
15. How well is the equipment utilised?
16. Are any considerations being planned to change their technical process?

Turnaround times

17. What is the unit's definition of a 'job', case, or Service Request?
18. How long does it take the unit to complete a 'job', case, Service Request?
19. How is a 'backlog' defined – does the unit have a backlog
20. How many 'jobs', cases, Service Requests does the unit complete per week/month/year?

(FORESIGHT will require 3 years data)

Quality

21. Define quality?
22. Who is responsible for the quality standards within the unit?
23. What quality assurance processes takes place in the unit?
24. Does the unit submit to external audit?
25. How often are audits carried out?
26. What QC samples are used within the process – purchased tests, or samples prepared in-house?
27. What happens when areas of non-compliance/quality failures are found?
28. Who is responsible for completing any quality actions found during an audit?
29. How is quality ensured across units/teams at different sites?

Training

30. Define operational roles?
31. What are the training/mentoring requirements in the unit per role?
32. How long, on average, does it take to train/mentor each role within the unit?
33. How much does it cost to train for a given role?
34. Define the competency (proficiency testing) programmes?
35. Who has responsibility for signing off scientists as competent?
36. Does the LIMS retain competency information
37. Who is responsible for ensuring all training/mentoring is carried out on time & to the required quality?
38. What is the financial impact of training/mentoring on the team?
39. What is the abstraction rate from Operations for training/mentoring?
40. What is the structure of training/mentoring, per role, in the team?

Team

41. What is the expected role of the team/unit
42. What is the organizational structure of the unit?
43. What are the responsibilities of each member of the team?
44. Does each role have a role description?
45. What is the escalation process within the unit?
46. How many people are in the team – span of control issues?
47. Do the staff feel empowered and responsible for the job they are performing?
48. Is there any feedback on the outcome of the case that a team/scientist has worked on?
49. Is the team aware of the RCMP FS&IS strategic direction (Manager)?
50. How does the team manage the routine casework/priority
51. How much overtime, on average, is each staff member doing?
52. How many vacancies are there in the team currently?
53. When do they expect these to be filled?
54. How do the unit feel they perform?
55. How is poor staff performance managed in the team?
56. What development opportunities does the staff have? Are these focussed on operational output?
57. What are the expected operational staff utilisation rates – and the actual utilisation rate?
58. Are there any other activities besides casework and training that the team get involved with?
59. How much time is allocated to these activities?

Communication

60. What is the communication like between unit management and the team?
61. How is communication between the same units at different sites maintained?
62. How well is Corporate and local management information cascaded across all sites?

Performance metrics (FORESIGHT programme)

63. What are the performance metrics the unit and individuals are measured on, i.e. how is productivity measured?
64. Equipment utilisation?
65. What reports are produced for Management and how often?

Support functions

66. What role do Ops support functions play within the unit?
67. What specific stages in the process do the unit interact with Ops Support and why?
68. What percentage of time does that interaction with Ops support equate to?

Research

69. What is the purpose of the research team – blue skies; operational development or both
70. Does the Research function include operational staff – if so why?
71. To what extent is the Research function funded

Introduction of new techniques

72. How do the R&D and Ops functions interact in the implementation of new techniques?
73. Does the operational staff have the opportunity to be involved in any special projects?
74. How are new techniques implemented into the unit?
75. Are there any difficulties with this process?
76. How is the training for new techniques achieved?

Financials (FORESIGHT Programme)

77. Are there clear definitions for operational parameters; item/exhibit/case, TRT, backlog etc.?
78. Do all the units operate to the same definitions?
79. Are the same definitions applied to operational performance and operating costs?
80. How is the Unit/team budget managed?
81. What financial management processes are in place?
82. Can the cost/item, cost/test, cost/case be clearly shown?
83. What is the split between staff costs, consumables, equipment maintenance and so on?
84. Financial impact of overtime?

Customer focus

85. Does the staff view the Police and Courts as 'customers' or 'clients'?
86. Is the staff aware of their client requirements – in general or for a particular case?
87. How is the interaction between the Senior Investigating Officer (of police case officer), the scientist, and the Prosecuting Authority managed?
88. Do the staff know what the police/courts think of the RCMP forensic 'performance'?
89. Do the RCMP labs have regular forums or meetings with Police or Prosecuting Authorities?
90. What is the position of Defence Lawyers – where do they get forensic advice and/or testing carried out?
91. How are issues aired with the RCMP clients – police, lawyers?
92. Is the RCMP engaged in training or informing the operational police officers, CSI and submissions units about new techniques etc.?
93. Is such information conveyed to the Defence community and if so, how?

Other questions

94. Are there any areas the unit would like to see improved – if so how would they do it?
95. Do the staff feel that they have a part of a wider CJS
96. How is morale?
97. How do the staff feel about working for RCMP?
98. How do they feel about change?
99. Is there any realisation that change is needed to improve the overall performance of the system?

15.0 Appendix F – Police-recorded Crime and Crime Trends in Canada

15.1 Recorded crime and Crime Trends in Canada

Tables 22 and 23 below show the recorded crime figures for Canada for 2010 for Violent Crime including: Homicide, Attempted Murder, Serious Assault, Robbery, Sexual Offences, and Firearms Offences. The recorded crime figures for Property Crime include Break and Enter and Theft of, and from Motor Vehicles. Reported cases of Impaired Driving are included in these tables as this type of crime is investigated by the RCMP FS&IS, the Centre of Forensic Sciences (CFS), Toronto, and the Laboratoire de sciences judiciaires et de médecine légale (LSJML), Montréal.

Province and territory	Homicide	Att. Murder	Serious Assault (levels 2 & 3)	Robbery	Sexual Assault (levels 1, 2 & 3)	Firearms offences	Violent Crime
Ontario	189	251	15,684	12,210	7,693	570	131,437
Quebec	84	220	11,491	6,759	4,342	348	85,099
British Columbia	83	76	9,154	4,952	2,932	259	74,208
Alberta	77	46	7,408	3,706	2,523	300	55,793
Manitoba	45	26	4,523	2,417	1,417	125	26,303
Saskatchewan	34	30	4,211	1,235	1,139	150	25,834
Nova Scotia	21	24	1,638	584	683	61	15,516
New Brunswick	9	14	1,151	197	585	62	11,551
Newfoundland & Labrador	4	2	702	115	360	36	7,622
Prince Edward Island	0	0	117	19	59	3	1,781
Northwest Territories	1	0	435	13	176	15	3,730
Yukon	1	0	177	9	69	10	1,399
Nunavut	6	4	409	23	202	13	3,011
Canada	**554**	**693**	**57,100**	**32,239**	**22,180**	**1,952**	**443,284**

Table 22 - Recorded crime figures for Violent Crime by province (2010)

Province and territory	Break and Enter	Motor Vehicle theft	Property Crime	Impaired Driving
Ontario	54,687	22,611	388,688	17,191
Quebec	53,733	24,410	248,350	16,424
British Columbia	31,346	15,957	231,362	16,067
Alberta	22,533	15,298	182,611	14,865
Manitoba	10,116	5,596	77,767	3,040
Saskatchewan	9,806	4,988	71,910	6,566
Nova Scotia	5,259	1,282	40,848	3,426
New Brunswick	3,633	1,239	24,688	2,628
Newfoundland & Labrador	3,399	603	21,035	2,119
Prince Edward Island	732	113	6,165	727
Northwest Territories	713	222	9,769	740
Yukon	248	160	3,103	408
Nunavut	676	204	5,595	196
Canada	**196,881**	**92,683**	**1,311,891**	**84,397**

Table 23 - Recorded crime figures - Property Crime and Impaired Driving by province (2010)

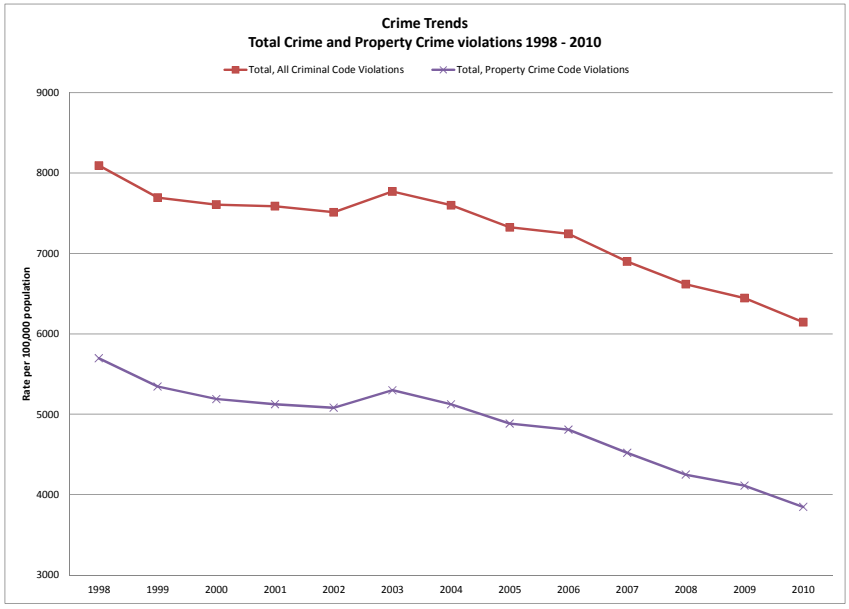

Figure 21 - Total Crime and Property Crime violations in Canada 1998 – 2010

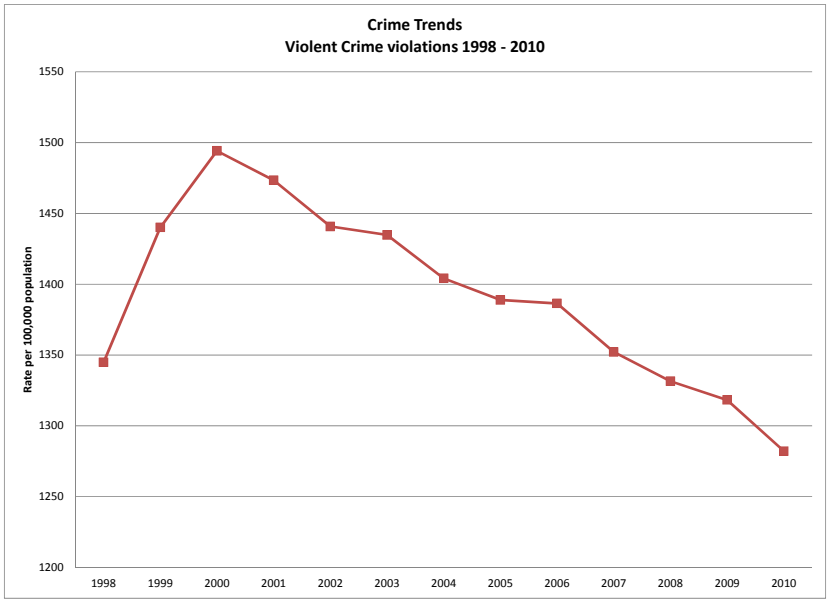

Figure 22 - Violent Crime violations in Canada 1998 - 2010

Figures 21 and 22[136] demonstrate the trends for Total Crime violations, Property Crime violations and Violent Crime violations in Canada from 1998 to 2010. These data are presented as crime rate per 100,000 persons in the population

[136] Statistics Canada from CANSIM table 252-0051

15.2 Recorded Crime and Crime Trends in Ontario

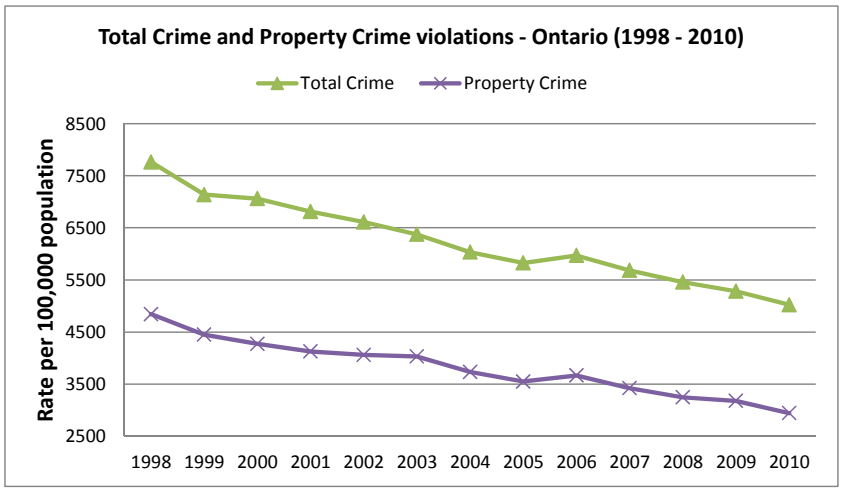

Figure 23 - Total Crime and Property Crime per 100,000 population in Ontario (1998 – 2010)

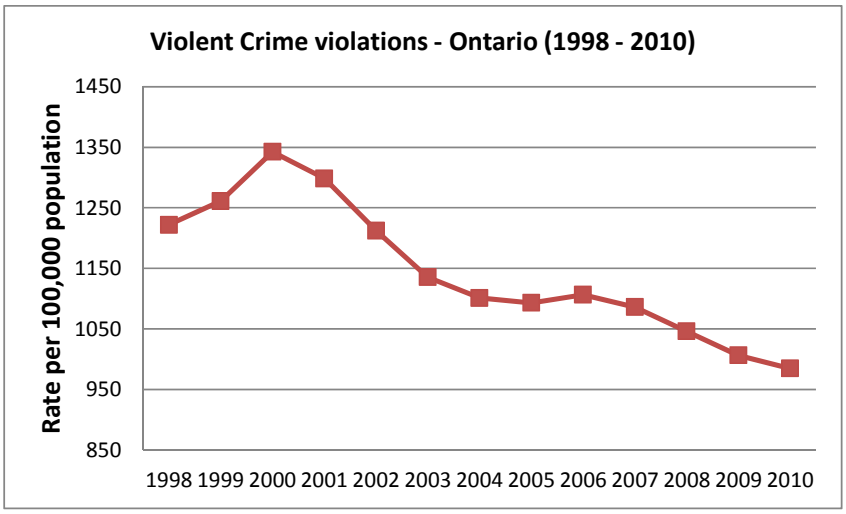

Figure 24 - Violent Crime per 100,000 population in Ontario (1998 – 2010)

Figures 23 and 24 demonstrate the trends for Total Crime violations, Property Crime violations and Violent Crime violations in the province of Ontario from 1998 to 2010. These data are presented as crime rate per 100,000 persons in the population

15.3 Recorded Crime and Crime Trends in Quebec

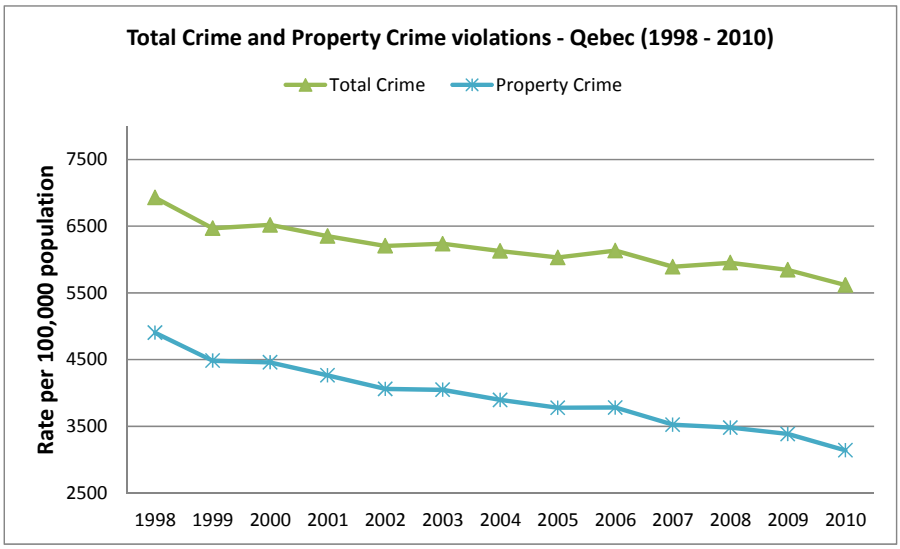

Figure 25 - Total Crime and Property Crime per 100,000 population in Quebec (1998 - 2010)

Figure 26 - Violent Crime violations per 100,000 population - Quebec (1998 - 2010)

Figures 25 and 26 demonstrate the trends for Total Crime violations, Property Crime violations and Violent Crime violations in the province of Quebec from 1998 to 2010. These data are presented as crime rate per 100,000 persons in the population

16.0 Appendix G – Rationalisation of RCMP FS&IS Service Delivery

To determine where the FS&IS should retain laboratories to optimise geographic coverage and customer support, it is instructive to consider the proportion of cases submitted to the RCMP FS&IS by province and territory.

	Alberta	British Columbia	Manitoba	New Brunswick	Newfoundland & Labrador	Nova Scotia	Northwest Territories	Nunavut	Ontario	Prince Edward Island	Quebec	Saskatchewan	Yukon Territory	Total
Counterfeiting	10.76%	28.13%	2.60%	0.95%	0.00%	2.36%	0.35%	0.00%	29.20%	0.71%	22.58%	2.36%	0.00%	100.00%
Opinion - Impaired driving	21.30%	36.17%	11.29%	8.59%	4.53%	6.76%	0.24%	0.00%	0.40%	1.35%	0.00%	8.74%	0.64%	100.00%
Blood Alcohol	31.05%	23.11%	9.50%	7.12%	4.84%	6.30%	0.55%	0.37%	0.37%	1.74%	0.00%	14.61%	0.46%	100.00%
DNA Casework	26.92%	30.05%	16.55%	2.96%	2.14%	6.61%	1.43%	0.89%	1.79%	0.58%	0.10%	9.41%	0.58%	100.00%
Document Examina	14.41%	33.90%	7.63%	6.78%	3.39%	10.17%	0.00%	0.85%	11.02%	0.85%	2.54%	8.47%	0.00%	100.00%
Explosives	27.27%	50.00%	4.55%	4.55%	0.00%	0.00%	0.00%	0.00%	9.09%	0.00%	4.55%	0.00%	0.00%	100.00%
Fire Analysis	15.56%	31.11%	13.33%	16.11%	0.00%	15.00%	0.00%	1.11%	5.00%	0.56%	0.00%	1.67%	0.56%	100.00%
Firearms and Ballistics	20.00%	38.07%	16.16%	3.90%	0.82%	12.01%	0.00%	0.19%	2.31%	0.60%	0.19%	5.32%	0.41%	100.00%
GSR	14.89%	37.23%	17.02%	3.19%	0.00%	9.57%	0.00%	0.00%	1.06%	0.00%	7.45%	9.57%	0.00%	100.00%
GSR Other	14.77%	38.64%	15.91%	3.41%	0.00%	7.95%	0.00%	2.27%	1.14%	0.00%	7.95%	7.95%	0.00%	100.00%
Serology/Biology	27.02%	30.17%	16.15%	3.27%	2.68%	7.64%	1.21%	0.90%	1.32%	0.67%	0.07%	8.20%	0.69%	100.00%
Toxicology (ante-mortem)	28.17%	28.17%	8.89%	5.80%	7.82%	11.86%	0.27%	0.00%	0.40%	0.54%	0.00%	7.68%	0.40%	100.00%
Toxicology (post-mortem)	2.37%	41.50%	21.74%	1.98%	0.79%	9.09%	0.00%	3.56%	1.98%	0.00%	0.00%	16.21%	0.79%	100.00%
Trace Evidence	21.37%	32.06%	9.92%	4.58%	3.05%	14.50%	0.00%	0.00%	4.58%	3.82%	0.00%	6.11%	0.00%	100.00%
Total	24.46%	31.49%	14.69%	3.96%	2.50%	8.02%	0.85%	0.66%	2.76%	0.74%	1.13%	8.20%	0.55%	100.00%

Table 24 –Submission of casework to RCMP FS&IS by Province and Territory

It can be seen that almost one third of the casework conducted by the RCMP FS&IS originates in British Columbia, and together submissions from British Columbia and Alberta account for 56% of the total casework.

Note: Whilst Ontario and Quebec have their own forensic provision in the Centre of Forensic Sciences and the LSJML these provinces do submit casework in specialist areas (e.g. Counterfeiting and post-blast Explosives Analyses) to RCMP FS&IS.

Table 26 summarises a potential grouping of provincial and territorial clients which RCMP FS&IS could support whilst consolidating the operational services in four laboratories – Vancouver (West), Edmonton (Central Plains), Ottawa (Central East), Halifax (Maritimes)

		Potential client groupings
Edmonton	32.66%	Alberta + Saskatchewan
Vancouver	32.04%	British Columbia + Yukon Territory
Halifax	15.88%	NB + NL + NS + NU + PEI (Maritimes & Nunavut)
Ottawa	19.43%	Ontario + Quebec + Manitoba + NW Territories
Total	100.01%	

Table 25 – Consolidation Scenario 1 – retain four laboratories

Table 27 summarises a potential grouping of provincial and territorial clients which RCMP FS&IS could support whilst consolidating the operational services in three laboratories – Vancouver (West), Edmonton (Central Plains), Ottawa (Central East and Maritimes)

		Potential client groupings
Edmonton	32.66%	AB + SK
Vancouver	32.04%	BC + YT
Ottawa	35.31%	ON + QU + NT + MB + NB + NL + NS + NU + PEI
Total	100.01%	

Table 26 – Consolidation Scenario 2 – retain three laboratories

It is recognised that RCMP FS&IS can, and will move work around the laboratory system to level the caseload and minimise the process time for clients.

The costs associated with the delivery of forensic services by the FS&IS are shown in Table 27.

	Administration[137]	RCMP Ops	FORESIGHT	Halifax	Ottawa	Winnipeg	Regina	Edmonton	Vancouver
	2010/10	**2010/11**	**2010/11**	**2010/11**	**2010/11**	**2010/11**	**2010/11**	**2010/11**	**2010/11**
FTE	76.4	311	387.4	36.5	73	26.5	27	58	90
Salaries(OT included)	$7,392,313	$21,386,210	$28,778,523	$2,819,413	$4,962,473	$1,764,816	$1,967,321	$3,811,874	$6,060,313
O&M									
Travel		$275,735		$31,169	$105,769	$29,557	$48,681	$119,543	$60,559
Freight/Postage		$181,972		$35,116	$62,496	$30,863	$20,184	$30,111	$33,313
Telecommunications	$181,438	$94,799	$276,237	$22,272	$5,330	$28,947	$29,693	$12,953	$8,557
Publication services		$1,999		$1,320	$0	$383	$184	($140)	$112
Contracted services real Property		$1,308,788		$625,374	$8,120	$505,341	$21,901	$167,270	$148,052
Corps of Commissionaire		$101,218		$30,175			$19,392	$53,371	$51,651
Professional services		$145,269		$21,900	$52,100	$6,770	$7,812	$11,334	$56,687
Rentals		$37,162		$7,623	$9,249	$9,027	$3,178	$2,450	$8,085
Building repairs		$79,764		$23,078	$36,571	$488	$2,419	$4,535	$17,208
Instrument repairs	$896,011	$530,320	$1,426,331	$40,824	$280,089	$58,341	$967	$70,128	$150,099
Misc repairs		$13,869		$1,765	$0	$8,099	$1,964	$2,151	$2,041
lab supplies		$2,012,328		$141,929	$821,966	$168,765	$7,297	$518,333	$872,371
Fuel(Freight related)		$43,931			$43,931				
Utility services/heating	$148,313	$338,314	$486,627				$333,544	$148,313	$4,770
Utilities&Materials		$257,778		$32,382	$38,754	$49,079	$28,517	$64,900	$109,046
Minor Capital		$1,675,464		$370,830	$330,794	$472,415	$7,128	$67,006	$494,297
PILT		$1,193,019		$94,619	$724,750	$186,144	$155,756	$158,299	$31,750
Other		$2,064		$162	$324	$770	$164	$721	$644
	$8,222,123	$8,293,793	$16,515,916	$1,480,538	$2,520,243	$1,554,989	$688,781	$1,431,278	$2,049,242
Capital									
Building work		$7,216,945		$726,047	$798,986	$3,377,040	$2,286,409	$122,390	$28,463
Vehicules		$0		$0		$0	$0	$18,607	
	-$2,971,701	$7,216,945	$4,245,244	$726,047	$798,986	$3,377,040	$2,286,409	$140,997	$28,463
TOTAL	**$12,642,735**	**$36,896,948**	**$49,539,683**	**$5,025,998**	**$8,281,702**	**$6,696,845**	**$4,942,511**	**$5,384,149**	**$8,138,018**

Fixed Cost Elimination Limits (2010/11 data)	($1,925,003)	($1,965,900)	($4,594,654)	($2,869,380)
Average year capital expenditure	$398,018	$718,863	$1,450,095	$1,241,041
Fixed Cost Elimination (using average capital expenditure)	($1,596,974)	($1,885,777)	($2,667,709)	($1,824,012)

Table 27 – RCMP FS&IS operational costs by site

[137] The entries in the Administration column, including the negative entry for Capital are the differences between the totals reported in the LabRat tool and those in the O&M report.

From the data supplied to the Project Team, RCMP FS&IS has a staff complement of 387.4 of whom 311 are directly involved in the delivery of operational casework. The remaining 76.4 staff have managerial, administrative, programme support and operational support duties.

It is interesting to note that the average salary of the Administrative Staff is $96,758 whilst that of the Operational Staff is $68,767 (i.e. Salary Costs divided by FTE numbers in each category).

Table 27 details the costs of RCMP FS&IS salaries, operations and maintenance activities, and capital expenditure for the 2010/11 financial year. Table 27 also shows an estimate of the categories from which potential savings may be realized from the elimination of some fixed cost components (e.g., capital expenditures, utilities, maintenance, Payments in Lieu of Taxes – shown in the greyed cells) from laboratories other than Edmonton and Vancouver, which would be retained in any of the restructuring scenarios presented. These totals represent an upper limit, rather than defined savings. A detailed analysis of ledger data is beyond the scope of the present study and should be examined prior to any decisions towards collapsing elements of the laboratory system.

The value of the potential savings is dependent on the manner in which Capital Expenditure is considered within the total fixed costs – the savings are apparently lower if an average year capital expenditure is calculated using RCMP CapEx data over 2008/09 to 2010/11.

A first pass analysis of the data presented in Table 27 provides a range for the upper limit of potential fixed cost savings of between $4.5 to $9.4 million, depending on which laboratories are closed and which are retained.

Consolidating the staff and operational delivery in four laboratories by closing the Winnipeg and Regina sites (Scenario 1 above) could lead to an annual fixed cost saving upper limit of between $4.5 and $7.5 million.

The rationale for this suggestion is that the services being delivered from the Regina laboratory (Firearms and remote Biology Case Reporting) and from the Winnipeg laboratory (Toxicology only) are each currently delivered from two other sites.

Consolidating the operational delivery at three laboratory sites by closing Winnipeg, Regina, and Halifax (Scenario 2 above) could lead to annual fixed cost savings upper limit of between $6.0 and $9.4 million.

Additional savings could be made in the costs of redundant administration and laboratory management positions but these savings would have to be offset by one-off costs of about $40,000[138] for each member of staff who is compulsorily transferred.

Note. There is a risk in such a major re-organization in that the RCMP FS&IS could lose very experienced staff if they chose to resign rather than accept relocation[139].

17.0 Appendix H – Benchmark Data Collection and Verification

[138] Data from RCMP
[139] RCMP FS&IS Staff and management interviews

The data used to construct the global laboratory sample were gathered from a few sources including participants in the FORESIGHT project[140], submissions of the LabRAT tool outside the FORESIGHT project, and extraction of publicly available data. To be included in the global sample a laboratory was required to meet several criteria, including:

- ASCLD/LAB accreditation and/or ISO/IEC 17025:2005 certification[141]
- Verification of budget submissions via public records or other independent sources
- Data submission following the definitions described by the 2011 LabRAT tool

To encourage a greater number of submissions, all participating laboratories were promised anonymity of their specific responses.

Some adjustments were made to submitted data and suspicious data (e.g., outliers, rounded entries) was not included until additional verification was received. These adjustments and verification included:

- Inferred expenses were added if no specific charge was made to the laboratory's budget for certain budget lines including utilities and telecommunications expenses
- As a first pass, any data points that fell beyond three standard deviations from the mean were removed until verified by the submitting laboratory with explanation regarding these outliers
- As a second pass, any data points that were outside a 25% value of the mean were removed until confirmed

Data Collected and Definitions

The data submitted by the Canadian laboratories and those of the global sample follow the standards developed through the FORESIGHT project as defined in the LabRAT tool.[142] This tool is a Microsoft Excel based instrument comprised of three worksheets of entry data from the laboratory. The opening worksheet provides basic direction for completion of the tool and solicits descriptive and contact information from the laboratory. The descriptive requests include:

- Jurisdiction (federal, state, local, private)
- Size Population Served
- Geographic Size Served
- Number of separate facilities
- LIMS Provider / Version
- Standard Work Week (hours)
- Administrative Office Area size
- Laboratory Area size
- Other Area
- Details concerning charges for utilities, telecommunication, rent, and overhead
- Description of the organization's fiscal year
- Mission statement
- Organizational changes from prior year submission

18.0 Appendix J – Global Benchmark Data

[140] The FORESIGHT project is described in detail in section 6.
[141] A list of all ASCLD/LAB accredited laboratories may be found at http://www.ascld-lab.org/labstatus/accreditedlabs.html
[142] Houck, M. M., Riley, R. A., Speaker, P. J., & Witt, T. S. (2009). FORESIGHT: A Business Approach to Improving Forensic Science Services. ***Forensic Science Policy and Management***, 85-95.

Consider the benchmarks for each of the key performance indicators. Two measures of central tendency, mean and median, are reported because of outliers in several of the investigative areas. Most comparisons will be highlighted with respect to median as a representation of "typical" laboratory performance.

Note: *all dollar measures are in 2010 Canadian dollars*.

18.1 Cost per Case

Cost per Case ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	$255.23	$123.51	$388.94
DNA Casework	$2,255.43	$2,185.57	$637.02
Document Examination (including handwriting)	$2,756.01	$2,280.82	$1,657.66
Explosives	$9,116.95	$6,549.74	$9,444.97
Fire analysis	$2,465.28	$1,567.06	$2,794.62
Firearms and Ballistics	$1,149.57	$816.09	$784.50
Gun Shot Residue (GSR)	$2,105.41	$1,647.95	$1,794.59
Serology/Biology	$663.34	$568.38	$516.01
Toxicology ante mortem (excluding BAC)	$662.89	$488.64	$805.54
Toxicology post mortem (excluding BAC)	$874.68	$651.69	$946.00
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	$5,528.02	$4,411.76	$5,441.96

Table 28 - Cost per Case

From the decomposition expression for the Cost/Case, an increase in the numerator component, Average Compensation, will increase the cost per case. Similarly, a decrease in denominator component will increase the cost per case. This may occur from either a drop in productivity, as measured by cases processed per FTE, or from an increase in capital investment for future productivity but financed via a drop in personnel expenses relative to total expenses.

18.2 Average Compensation

Average Compensation ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	$83,387	$82,466	$24,377
DNA Casework	$98,599	$99,458	$26,906
Document Examination (including handwriting)	$105,781	$87,647	$67,063
Explosives	$110,236	$105,043	$37,450
Fire analysis	$101,031	$88,630	$61,314
Firearms and Ballistics	$104,297	$100,894	$34,502
Gun Shot Residue (GSR)	$105,494	$99,337	$52,918
Serology/Biology	$84,490	$78,331	$36,585
Toxicology ante mortem (excluding BAC)	$91,916	$94,724	$24,399
Toxicology post mortem (excluding BAC)	$91,955	$87,983	$21,855
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	$100,553	$99,789	$41,657

Table 29 - Average Compensation

The Average Compensation measure includes all forms of compensation including normal salaries, employer benefits expenses, overtime, and expenditures for temporary employees.

As with the Cost per Case measure, the entries have been converted to **2010 Canadian dollars.**

Return to the decomposition measure for the cost/case. The denominator terms have the opposite effect on average cost. That is, as labour productivity or the **labour expense ratio** increase, average costs will fall. This confirms that, as the typical employee is able to process more cases per year, then the effect will be a decrease in the average cost as fixed expenditures are average over a higher volume of cases processed. Similarly, if a greater portion of the budget is devoted to personnel expenditures (as opposed to capital investment) *ceteris paribus*, more cases will be processed for the same expenditure at the opportunity cost of delaying investment in capital equipment for future returns.

The next two tables contain the LabRAT summary statistics for each of these ratio measures, labour productivity, and the percentage of the budget devoted to labour expenditures.

18.3 Cases per FTE

Labour Productivity (Cases per FTE) ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	1,000.22	825.34	754.56
DNA Casework	77.85	73.42	32.74
Document Examination (including handwriting)	60.67	57.18	34.98
Explosives	24.66	22.56	13.61
Fire analysis	93.01	85.19	58.23
Firearms and Ballistics	169.48	149.91	110.76
Gun Shot Residue (GSR)	111.73	88.97	87.63
Serology/Biology	229.37	182.22	227.06
Toxicology ante mortem (excluding BAC)	288.98	271.61	163.92
Toxicology post mortem (excluding BAC)	229.20	228.20	100.58
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	37.11	31.00	19.75

Table 30 – Labour productivity (Cases per FTE)

This measure is simply the number of Cases completed for each FTE employee retained by the laboratory. It gives an indication of the level of productivity within the average laboratory in the global group by investigative area.

The next measure, **Personnel Expense/Total Expense**, serves as a proxy for the level of analytical technology chosen. This measure has a significant negative correlation with **Capital Expense/Total Expense** and serves as simpler decomposition term for the return on investment.

This measure will be shown below to have a specific connection and analytical breakdown of the entire laboratory cost structure. Later, the cost structure will be detailed with a breakdown of expenses in capital, labour, consumables, and other costs. So, areas that are highly automated, such as evidenced by the DNA database processing line, should show a lower Personnel Expense/Total Expense.

18.4 Personnel Expense as a proportion of Total Expense

Personnel Expense/ Total Expense ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	71.81%	74.28%	9.75%
DNA Casework	62.20%	60.82%	12.51%
Document Examination (including handwriting)	78.08%	82.47%	11.14%
Explosives	72.88%	75.03%	16.98%
Fire analysis	76.02%	75.32%	11.80%
Firearms and Ballistics	80.69%	83.08%	9.51%
Gun Shot Residue (GSR)	76.94%	79.33%	11.00%
Serology/Biology	77.04%	80.06%	11.99%
Toxicology ante mortem (excluding BAC)	66.85%	64.39%	11.34%
Toxicology post mortem (excluding BAC)	67.23%	64.17%	12.85%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	71.55%	72.11%	13.39%

Table 31 – Personnel Expense as a proportion of Total Expense

18.5 Capital Expense as a proportion of Total Expense

Capital Expense/ Total Expense ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	3.79%	2.55%	4.79%
DNA Casework	8.04%	7.31%	5.66%
Document Examination (including handwriting)	2.85%	2.13%	5.04%
Explosives	5.79%	2.59%	9.36%
Fire analysis	4.20%	2.76%	8.75%
Firearms and Ballistics	5.09%	2.99%	6.33%
Gun Shot Residue (GSR)	5.45%	2.90%	9.15%
Serology/Biology	4.54%	3.32%	5.78%
Toxicology ante mortem (excluding BAC)	6.27%	4.85%	6.26%
Toxicology post mortem (excluding BAC)	5.05%	2.55%	6.71%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	8.28%	3.21%	13.36%

Table 32 - Labour Productivity (Cases per FTE)

These benchmarks offer a useful standard by which to compare the performance of other laboratories. Additionally, the summary statistics serve as a basis for simulation and scenario analyses, where alternative laboratory models may be evaluated with respect to the expected outcome.

18.6 Consumable Expense as a proportion of Total Expense

Consumables Expense/ Total Expense ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	6.98%	7.01%	2.84%
DNA Casework	12.49%	11.03%	7.28%
Document Examination (including handwriting)	3.04%	2.84%	2.57%
Explosives	4.66%	4.47%	2.35%
Fire analysis	3.61%	3.02%	2.47%
Firearms and Ballistics	2.61%	2.41%	2.01%
Gun Shot Residue (GSR)	2.73%	2.67%	1.47%
Serology/Biology	7.39%	5.72%	9.40%
Toxicology ante mortem (excluding BAC)	8.55%	7.71%	4.84%
Toxicology post mortem (excluding BAC)	7.13%	6.28%	4.24%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	3.46%	2.83%	3.32%

Table 33 - Consumable Expense as a proportion of Total Expense

18.7 Other Expense as a proportion of Total Expense

Other Expenses/ Total Expense ***Global Summary Statistics***

Investigative Area	Mean	Median	Std. Dev.
Blood Alcohol	17.42%	15.85%	8.49%
DNA Casework	17.27%	15.98%	8.25%
Document Examination (including handwriting)	16.03%	12.67%	9.65%
Explosives	16.68%	10.25%	14.48%
Fire analysis	16.18%	15.56%	10.10%
Firearms and Ballistics	11.62%	9.34%	7.39%
Gun Shot Residue (GSR)	14.89%	15.18%	7.80%
Serology/Biology	11.03%	10.93%	6.38%
Toxicology ante mortem (excluding BAC)	18.33%	18.88%	8.87%
Toxicology post mortem (excluding BAC)	20.59%	22.02%	11.12%
Trace Evidence (includes Hairs & Fibers, Paint & Glass)	16.71%	16.25%	7.03%

Table 34 - Other Expenses as a proportion of Total Expense

19.0 Appendix K – Glossary

The FORESIGHT project definitions of Investigative Areas include:

Blood Alcohol (BAC) - Analysis of blood or breath samples to detect the presence of and quantify the amount of alcohol.

Crime Scene Investigation - Collection, analysis, and processing of locations for evidence relating to a criminal incident.

Digital evidence - Computer, Audio & Video—the analysis of multimedia audio, video, and still image materials, such as surveillance recordings and video enhancement

DNA Casework - Analysis of biological evidence for DNA in criminal cases

DNA Database - Analysis and entry of DNA samples from individuals for database purposes

Document Examination (including handwriting) - Analysis of legal, counterfeit, and questioned documents, including the evaluation of hand written materials to categorize or identify a writer

Drugs – Controlled Substances - Analysis of solid dosage licit and illicit drugs, including pre-cursor materials

Evidence Screening & Processing - Detection, collection, and processing of physical evidence in the laboratory for potential additional analysis

Explosives - Analysis of energetic materials in pre- and post-blast incidents

Fingerprints - Development and analysis of friction ridge patterns

Fire analysis - Analysis of materials from suspicious fires to include ignitable liquid residue analysis

Firearms and Ballistics - Analysis of firearms and ammunition, to include distance determinations, shooting reconstructions, NIBIN, and tool marks

Forensic Pathology - Branch of medicine that deals with the determination of the cause and manner of death in cases in which death occurred under suspicious or unknown circumstances

Gun Shot Residue (GSR) - Analysis of primer residues from discharged firearms (not distance determinations)

Marks and Impressions - Analysis of physical patterns received and retained through the interaction of objects of various hardness, including shoeprints and tire tracks

Microscopy - either directly or as an adjunct to another instrument, is involved. Includes analysis of human and animal hairs (non-DNA) and textile fibres and analysis of paints—generically, coatings—and glass as trace evidence.

Serology/Biology - Detection, collection, and non-DNA analysis of biological fluids

Toxicology ante mortem (excluding BAC)—Chemical analysis of body fluids and tissues to determine if a drug or poison is present in a **living** individual. This does not include blood alcohol analysis (BAC). Toxicologists are then able to determine how much and what effect, if any, the substance might have had on the person.

Toxicology post mortem (excluding BAC)—Chemical analysis of body fluids and tissues to determine if a drug or poison is present in a **deceased** individual. Toxicologists are then able to determine how much and what effect, if any, the substance might have had on the person.

Trace Evidence (includes Hairs & Fibres, Paint & Glass)—Analysis of materials that, because of their size or texture, transfer from one location to another and persist there for some period of time.