



Managing Intellectual Capital

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W. Mark Dale

Director
Northeast Regional Forensic Institute
University at Albany
Albany, New York

Wendy S. Becker

Assistant Professor
Department of Management
University at Albany
Albany, New York

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Introduction

Intellectual capital is a strategic resource in organizations. This article discusses strategies for increasing the intellectual capacity of the forensic science laboratory. It begins with a definition of intellectual capital using a resource-based model of organizations. Next, it discusses laboratory structure and the measurement of laboratory efficiency. Human resource metrics and the importance of communicating with funding agencies are considered. The article concludes with a discussion of an overall strategy for increasing intellectual capital in forensic laboratories and offers a case example using a forensic advisory group.

Human Resources as Intellectual Capital

Demonstrating that investments in human resources lead to improved laboratory performance is critical to laboratory directors (Koussiafes 2004). Resource-based models propose matching the overall strategy of the organization with its human resource practices (Barney 2001). Originating from economics, the resource-based view considers human resources as assets as opposed to variable costs. The resource-based view is the philosophy behind initiatives to consider human resources as intellectual capital. In this model, human resource practices support the *intellectual capital* of the forensic laboratory by making the most of the job-related behaviors of the talent pool. Certain conditions must be present to maximize organizational performance. Intellectual capital must be *valuable, rare, inimitable, and nonsubstitutable* (Wright et al. 1994). These criteria are discussed next as they apply to forensic laboratories.

Intellectual Capital Adds Value to the Forensic Laboratory

The knowledge, skills, and abilities that forensic employees possess vary greatly within a laboratory and across laboratories. In the labor market, individuals differ with respect to the necessary job attributes they possess. Employees who work at a higher level of proficiency are more valuable to the laboratory. Laboratories that are able to select, develop, motivate, and retain skilled employees will outperform laboratories that are not.

By using a measurement system, laboratories can demonstrate that skilled employees add value. Utility analysis is one method to estimate the financial value that employees add (Cascio 2000). Other methods include costing employee turnover and determining the value of forensic services to customers and the community (Becker et al. 2005; Dale and Becker 2004). These techniques can be used to show that investing in intellectual capital results in a more effective laboratory organization.

Intellectual Capital Is Rare

Forensic science skills are increasingly in short supply, and there is wide evidence of a growing shortage of needed technical workers (Becker et al. 2005; Peterson and Hickman 2005). There have been various estimates of the number of additional scientists needed. Fisher (2003) estimates that 10,000 new forensic scientists will be needed in the next five to ten years. The U.S. Department of Labor predicts that 10,000 new forensic scientists will be needed by 2012, a 19 percent increase from 2002 (O*Net Online 2004). Peterson and Hickman (2005) estimated that 1,900 additional full-time employees would have been needed to achieve a 30-day turnaround for all requests for forensic services in 2002.

Intellectual Capital Is Inimitable

Laboratory goals and environmental circumstances must be in alignment to be interrelated and internally consistent. When demand for employees is high, other agencies can lure away top talent and take advantage of the laboratory's investment in and training of employees. But employees are not perfectly mobile; moving from one organization to another involves transactional costs, such as the loss of seniority and pensions. In addition, employees understand that they may not thrive in a new organization because the rewards, culture, and other factors are not compatible with individual needs, interests, and skills. Therefore, even though some employees can and will be induced to move, the full package of human resource practices and support systems must be designed to retain intellectual capital as much as possible (Dale and Becker 2004; Wright et al. 1994).

Intellectual Capital Is Nonsubstitutable

Laboratories that institute practices to develop and motivate people have a source of sustained competitive advantage over laboratories that do not. The laboratory must (1) encourage people who possess needed skill profiles to join and stay with the organization and (2) reinforce and motivate the needed job behaviors.

High turnover rates of forensic scientists are costly (Becker and Dale 2003; Perlman 2004; Sewell 2000) and can lead to an erosion of the forensic intellectual capital within the laboratory. Losing experienced forensic scientists creates a "brain drain." Unanticipated retirement can seriously deplete the intellectual capital in a forensic laboratory. Laboratory managers need strategies for supporting their intellectual capital. Human resource systems must be used strategically to identify, measure, and retain key employees, increasing the intellectual capital of the laboratory.

Laboratory Structure

Laboratory structure must be designed to provide the best forensic service for the geopolitical area that the laboratory serves. The trend in designing modern organizations is toward flat, autonomous structures with direct reporting relationships to management. However, most large organizations

have hierarchical structures with specialized units reporting to upper management (Hoskisson et al. 2004). In the forensic laboratory, hierarchical structures may appear to be the most efficient. However, in practice, they may hinder the sharing of knowledge and become dysfunctional, especially when processing multidiscipline cases. For example, a high-priority multidiscipline case may involve ballistic, hair, fiber, and DNA evidence analyses. The most accurate and timely analyses are needed *across all of the disciplines*. One lead scientist must be given responsibility for managing the entire case. The best of both hierarchical and flat structures can be leveraged by implementing an organizational structure that facilitates communication between technical forensic disciplines and management. These new structures are essential for large laboratory systems with multiple facilities and disciplines.

An efficient structure for a large laboratory or forensic system is shown in Figure 1. Managers of the major forensic disciplines report directly to the laboratory director or deputy. In addition, an information officer or librarian reports directly to the director. Evidence control, safety, security, finance, budget, administrative, and clerical support personnel also report to the director. In the example shown, additional expertise is provided in a consultative relationship with the director. The groups providing specialized expertise include quality assurance groups, technical working groups, forensic advisory groups, and the laboratory's customers. Advisory groups offer unique expertise that increases the intellectual capital of the laboratory.

Figure 1: An Efficient Organizational Structure for a Large Laboratory or Forensic System

Measuring Laboratory Efficiency

Management must establish and track measures of laboratory efficiency to monitor and identify trends. Efficient staffing has a critical impact on the criminal justice system. Forensic services must be identified and measured to meet the supply and demand of the laboratory's geopolitical area. For example, the laboratory must address such questions as, How many controlled-substance analysis cases need to be analyzed in a timely manner, for example, in less than 30 days? How many scientists and support staff are required to support this demand? The right amount of forensic intellectual capital in both the management and technical expertise of the laboratory will make a significant difference between mediocre and excellent performance. Management must evaluate annually the laboratory mission, goals, and objectives. For example, the laboratory mission could be to provide and *apply the best science to the best evidence in a timely manner*. These related goals can be stated as:

Goal 1: Apply the *best science*.

Goal 2: Apply the best science *to the best evidence*.

Goal 3: Apply the best science to the best evidence *in a timely manner*.

Developing Human Resource Metrics

Understanding the labor market is critical to developing measures of the laboratory's human resources. Yet it is difficult to forecast applicant populations. Forecasting reconciles the gap between labor supply and future labor demands. Laboratory administrators need to initiate strategic planning, taking into consideration the demand for laboratory services. Determining the demand for services requires analyzing all cases submitted to the laboratory, including cases that involve lesser offenses.

Laboratories can develop human resource metrics for recruitment and selection. Predicting future recruitment needs in operational terms involves job analysis, time-lapse data, and yield ratios (Becker and Dale 2003). Laboratories also must estimate the value of their services to the community. Agencies can estimate staffing needs based on a ratio of 1 forensic scientist (defined as a testifying scientist) for every 30,000 people in the respective population (Dale and Becker 2003). Estimates based on geopolitical populations provide a common standard across disparate units and agencies. Alternatively, laboratories may estimate staffing needs based on the ratio of forensic scientists to police officers that results in acceptable performance for that jurisdiction (Fischer 2003). Cascio (2000) demonstrated how organizations can quantify employee value by estimating the cost of selection, job performance, and turnover. A case study that focused on forensic science laboratory performance and employee turnover is provided in Dale and Becker (2004).

Communicating to Management

In order to obtain needed resources, laboratory management also must be able to effectively communicate the staffing model to upper management. The effective application of forensic science on the best evidence will allow the criminal justice community to exclude more suspects and make more quality arrests in cases that contain evidence. This will allow police departments to devote more time to cases that do not contain any probative evidence. Examples of the types of metrics that may be measured in the forensic laboratory include:

1. Cases/items analyzed per laboratory.
2. Cases/items analyzed per scientist.
3. Ratio of local, state, and national ballistic hits in the National Integrated Ballistics Imaging Network (NIBIN) per firearms examiner and per capita of service region.
4. Ratio of local, state, and national latent fingerprint hits in the Automated Fingerprint Identification System (AFIS) per fingerprint examiner and per capita of service region.
5. Ratio of local, state, and national DNA hits in the Combined DNA Index System (CODIS) per DNA scientist and per capita of service region.
6. Number of technical support personnel.
7. Total cost of analyses per case and per item.
8. Total cost of rework.
9. Turnover of line staff and supervisors.
10. Quality system measures, including:
 - a. Number of corrective actions.
 - b. Number of types and frequency of corrective actions per discipline over time.
 - c. Number of errors per case, per item.
 - d. Timeliness of analyses.

- e. Total backlog.
- f. Complaints, both internal and external.

Increasing Intellectual Capital in Forensic Laboratories

A four-pronged human resource strategy should be employed to increase the intellectual capital available to the laboratory (Dale 2004). First, critical support for the staffing plan must be obtained from the agency's upper management. Next, vacant positions need to be aggressively recruited and filled. Advertisements should be posted on the Web sites of organizations for forensic professionals, on the agency's own Web site, and in major forensic science publications. New upper-management positions (e.g., scientific leaders) need to be established and filled first. The intent of these positions is to provide scientific leadership and an upper-level career ladder for the line staff, as well as to stabilize the scientific management of the sworn police laboratory with civilian scientific professionals. Finally, a fresh influx of forensic intellectual capital should be developed from relationships with an experienced forensic advisory group.

The forensic advisory group can help create an organizational culture that values and significantly raises the laboratory's intellectual capital. The forensic advisory group comprises experienced active and retired forensic professionals from public and private laboratories in various disciplines and from within the academic community. The main role of the forensic advisory group is to act as an expert resource to the laboratory. Members of the forensic advisory group are chosen for their ability to encourage trust, collaboration, and the sharing of knowledge with laboratory staff. The forensic advisory group provides biannual audits using American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) accreditation criteria. Three months after the audit, a review meeting serves as follow-up to discuss corrective action. The planned recurrence of visits from the forensic advisory group, along with regular phone calls and e-mails, creates a new culture of collaboration between laboratory staff and the forensic advisory group.

Case Example: Creating a Forensic Advisory Group

Table 1 demonstrates how a forensic advisory group can add intellectual capital to a large metropolitan laboratory. Members of a forensic advisory group were asked to provide data to document the number of times they were actively involved in various forensic and academic activities, including years of experience attained, training and education received, classes taught, degrees earned, papers published, and professional meetings attended. Each activity represents different types of knowledge and experience; the collective group of activities represents intellectual capital. All 15 forensic advisory group members supplied the requested background information, resulting in a 100 percent response rate. These data were compared to the corresponding background information of the laboratory's upper management (15 managers). The ratios of the raw scores of the forensic advisory group and laboratory management are displayed in Table 1. There is an intellectual capital ratio of 10 (forensic advisory group) to 1 (laboratory) for the general total of all criteria measured. These are raw categorical measurements using a variety of criteria. No attempt was made to weight one criterion more than another. Some of the significant ratios of intellectual capital were in college classes taught (189:1), laboratory audits conducted as auditor (44:1), seminars and training given (48:1), service as an accreditation team captain (24:1), professional organization committee memberships held (28:1), and years of experience attained (2.39:1). These data demonstrate the potential that postgraduate education and active involvement in professional organizations have on laboratory intellectual

capital and the overall quality of forensic laboratory services.

Table 1: The Value-Added Intellectual Capital of the Forensic Advisory Group

Output measures derived from the forensic advisory group were significant. Noncompliance to ASCLD/LAB accreditation criteria was reduced from more than 100 instances to fewer than 10. This increase in quality was accomplished in one year with two audits, one corrective-action forensic advisory group seminar, and numerous e-mail and telephone communications. Other output measures resulting from the forensic advisory group are the number and type of corrective actions, interactions between the laboratory and the forensic advisory group, and an increase in the types and frequency of casework technical reviews. Six Sigma quality metric tools—such as Pareto diagrams, histograms, control charts, statistical analyses, and management of nonconformance data—are the keys to root-cause corrective-action analyses and continuous improvement of forensic services. If organizations can *measure* intellectual capital and quality, they can better *manage* intellectual capital and quality (Pande et al. 2000).

Managing Multiple Constituencies

Laboratory management must establish a coalition of support to fund the staffing model. This function is the most important task for the laboratory director. The amount of support from the parent agency and the criminal justice community will determine the performance of the laboratory director. Presentation skills, supported with thorough details on productivity, must be practiced and refined to obtain buy-in from the agency and its customers. The laboratory director's presentation skills are critical to obtaining the proper support for the laboratory. The director should present select cases with visual aids to show how the laboratory can be used to solve crimes in a timely manner. Regular presentations must be made to the upper-level command staff of the parent agency, as well as to members of the agency's human resource and financial units.

Conclusion

The effective administration of a forensic science laboratory focuses on intellectual capital as a strategic resource. Laboratory structure, human resource metrics, and communication with funding agencies are integral to effective administration. This article has presented an overall strategy for increasing the intellectual capital in laboratories, along with a case example that suggests developing a trusting, productive relationship between a laboratory and a forensic advisory group.

In the case example, the comparison between the activities of laboratory managers and members of the forensic advisory group demonstrates the potential of collaboration to improve the quality of the laboratory's services. In particular, the key ratios provide support for professional development activities. The academic and professional expertise of the forensic advisory group was most critical in providing assistance to the laboratory. Agencies should encourage their personnel to engage in formal and continuing education activities, along with active participation in professional development. In this way, they increase the intellectual capital in their organizations and, in turn, improve their level of service to the community.

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