The KPI of CSI: A Business Application in the Public Sector

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ABSTRACT

The typical plan of study in business schools features a curriculum that is focused exclusively on the development of business managers in the for-profit world. The singular attention to the for-profit environment comes at the cost of neglecting the development of business decision-making skills for application in the public sector or the not-for-profit environment. Are academic institutions creating critical thinkers who are able to extend business principles to organizations across this broader spectrum? With nearly one-fourth of the U.S. population employed by organizations beyond the for-profit environment, it is critical to remember the necessary preparation of those B-school graduates who choose careers with these other organizations. This paper argues that modifications are needed that address this gap and examples are presented to apply base business skills to a particular public sector industry, the forensic crime laboratory.

INTRODUCTION

Business curriculums are similar in their emphasis on the role of the for-profit enterprise and that attention is supported by the content of most business finance textbooks (e.g., (Brigham & Houston, 2010) or (Gitman, 2009)). However, that singular attention on the majority sector often comes at the cost of ignoring the alternatives, the public sector and the not-for-profit sector. With close to 25% of U.S. employment coming from organizations in those two arenas, it begs the question as to whether the tools and techniques in business curriculums adequately translate across these sectors and if not, how to bridge the gap. Analysis of the not-for-profit entity or government organization frequently is left to specialty courses (e.g., Government Accounting or Service Learning) in most business schools, and it is the rare program in which managerial decisions of these other sectors are broadly addressed in mainstream courses. However, given the vast numbers of individuals who will graduate from business schools and then be employed in these alternative arenas, we must reconsider how much of the government and not-for-profit business curriculum is covered in mainstream courses or how well we have prepared students to think and extend their skills to new markets. And, once we have assessed that need, it may well require a reconsideration of the course content, applicable cases, and the classroom methodologies to enable business school graduates to be effective decision-makers in this broader group of organizations.

This consideration of the need for more coverage of business principles outside the realm of the for-profit environment begins in the next section with a look at the mission, objectives and measureable outcomes of each type of organization. As with any organization, success demands that a public entity or a not-for-profit organization have a clear definition of what that organization seeks to accomplish and must connect those objectives with measureable outcomes. In the next section, we address the objectives of each type of organization and generalize the

objectives for measurement across each organizational category. We follow that section with a look at several standard measures of performance in the for-profit world before addressing their counterparts in the public and not-for-profit environments. These measures are highlighted as performance proxies against a standard of wealth maximization and these serve as the point of departure to connect the objectives of the not-for-profit and government organizations to key performance indicators that point to signs of success in meeting their respective missions.

With over 40 million Americans employed outside the for-profit sector, a failure to address the adaptation of for-profit models and skills leaves a serious gap in the delivery of business education. There is a need for a greater translation of skills from the for-profit environment to these other sectors to enable sound business decisions to be made. We compare key performance indicators (KPI) in for-profit business models and search for comparable metrics in the other sectors.

Once the process of identifying measures is highlighted, the application of these measures is presented through a few examples using the one type of government organization, the forensic crime laboratory. Recent investigations of the industry ((European Network of Forensic Science Institutes, 2003) and (Houck, Riley, Speaker, & Witt, 2009)) have provided a wealth of data and great insight into a business process that offers a public sector example as to how to add this aspect of critical thinking to our classrooms. And, with the popularity of televisions shows from *CSI* to *Dexter*, the examples involve a public organization with which most students will have some familiarity, thus offering some initial interest. Above all, stepping back and considering a broader application of business principles, offers the means to better prepare B-school graduates as decision-makers in the fourth of the economy that has been largely overlooked in mainstream curricula.

MISSION, OBJECTIVES, AND MEASUREABLE OUTCOMES

When we analyze the performance of a for-profit business, as the name implies, we base our review on the ability of the business to generate profits over time. Across for-profit businesses, the performance standard becomes one that examines the connection between decisions and their contribution to increasing the discounted value of these profits, or more appropriately, the discounted value of future cash flows. For the publicly traded corporation, this is revealed through increases in stock price. And while we may not ever know the final answer to the optimization problem (i.e., what is the highest value attainable), we are able to assess whether managerial actions moved the firm closer to that theoretical maximum. Thus, for the for-profit business, the elementary marginal cost versus marginal benefit decision will guide each managerial action. If the action provides additional revenue in excess of additional costs, then managers should take that action.

From this for-profit foundation come many of the tools and techniques across the various business disciplines. While business tools are generally developed with the for-profit environment in mind, some tools and techniques translate better than others to the not-for-profit firm or the government entity. Developments in human resource management and leadership may have immediate applicability to these other markets, but tools surrounding evaluation of financial success have generally been developed with only the for-profit firm under consideration.

The singularity of this wealth maximization objective across all for-profit businesses has made the analysis of firm performance relatively simple. Principles arising from a wealth-

maximization criterion are independent of the specific products or services provided by a business firm. Hence, standard textbook treatments are just as applicable to the manufacturing firm as to the service sector business. For faculty, if a topic is presented that is applicable for one for-profit business then that same topic provides a technique that is applicable to all for-profit entities. Unfortunately, the extension to the not-for-profit and government entities is not so simple. A cursory review of these organizations reveals a wide variety of purported missions with a large number of stated goals, many stated goals which are not measureable and rest in more utopian ideals.

But all is not lost. Amongst the plethora of missions and objectives some common themes emerge which may be extended towards some general applications. Consider the mission and organizational goals of the not-for-profit organization. These organizations have been established around some common belief, goal, or objective. Rarely is that not-for-profit organization so successful that it can put itself out of business by completely curing a condition, eradicating some disease, returning some creature from the brink of extinction, or permanently establishing or restoring faith in some belief. Instead, the economic problem remains in evidence as there are never enough resources for these organizations to declare "mission accomplished" (Speaker, 2009a). In place of profit-maximization, these organizations are measured against a standard representing the amount of "good things" they are able to accomplish and that level of the provision of "good" increases with the ability to generate revenue. So, rather than following a profit-maximization model, these not-for-profit organizations fall more generally under some form of a revenue-maximimization optimization criteria to which they address as much "good" as possible.

While the for-profit firm makes its decisions to maximize the gap between revenues and costs, and the not-for-profit organization makes its decisions to maximize the revenue stream, the public organization faces an entirely different constraint which leads to yet a third type of optimization problem to guide its actions. Decision-makers with public entities are charged with the provision of some good or service and are directed to provide as much of that good or service as possible for the funds budgeted. While the managers of public organizations may have an opportunity to request the amount of funding to be budgeted, ultimately there is some type of legislative mandate that determines the funds available for a given period of time. For these public entities, the return on investment ratio relates this amount of good or service provided to the funds budgeted. Or as a corrolary, if you consider the inverse of that return on investment, then public organizations are faced with a cost minimization problem, where the average cost per service is the critical ratio to evaluate.

PUBLIC SECTOR EXAMPLES OF BUSINESS PRINCIPLES

Two examples are highlighted below to demonstrate the information content in the KPI and the feedback loop to managerial action. A portion of a public forensic laboratory is chosen so that the specific service may be better understood and connected to the various performance metrics. For each example, the fingerprint identification unit of a forensic laboratory has been chosen to demonstrate the transferability of business practices to the public sector. The fingerprint identification unit processes a latent fingerprint collected by police and attempts to connect that unique print to the individual leaving the imprint by comparison to ten-print cards from suspects or prints from a computerized database. Not all fingerprints entered into evidence will have the same quality of the latent print. The quality could range from the ideal of a very

clear full print to more difficult to assess partial print. Once potential candidate ten-print cards have been suggested by the identification of suspects or through the database filters, it is up to an analyst to test for a match between the latent fingerprint and the suspect or other candidate and make a determination whether a match can be found or whether the results are inconclusive.

The two examples have been chosen to highlight typical applications of ratio analysis in a public entity, where sound business principles may be extended to achieve greater efficiencies in the organization's performance. The first example highlights a situation where the KPI prompt questions regarding the implications of internal policy and whether there should be a reexamination of process and protocol. The second example shows how the KPI can identify the cause behind a weak performance and how to anticipate potential gains from changes in managerial practice.

Example 1: Cost-Benefit as the Basis for Decision Making

In this first example, consider a forensic laboratory fingerprint identification division that operates under a policy that requires comparison of a suspect's ten-print card with every latent fingerprint taken from a crime scene. Even if the first latent print strikes a confirmatory match, the laboratory must continue to compare every other latent print from a crime scene to meet the policy requirements. Suppose the laboratory plans to review the policy and has gathered the information highlighted in Table 1 with selected information from personnel allocation, cases processed, tests performed, and key expense accounts from the same period.

Table 1: Fingerprint Identification Personnel and Budget Totals

Item	Value
Full Time Equivalent Employees (FTE)	7.50
Total Tests Performed (TEST)	30,000
Total Cases Evaluated (CASE)	2,500
Total Labor Expenditures (LEXP)	$550,000
Total Other Variable Expenditures (OVEXP)	$175,000
Total Fixed Expenditures (FEXP)	$25,000
Total Expenditures (TOTEXP)	$750,000

The manager's decision as to whether or not to change the current policy depends upon the connection of the current policy with respect to the goals of the organization. As suggested earlier, presume that the organization's goal can be interpreted as one where the laboratory attempts to provide as much of the service as possible for its given budget (which translates into a minimization problem with respect to the cost per case), while maintaining industry standards with respect to the quality of the analysis.

While management has been charged with making decisions to meet the goals of the organization, the presumed cost minimization goal is difficult to assess since there is no known

optimum to suggest what that minimum might be. As with the for-profit firms, other organizations are left with comparisons of their performance with other organizations in the industry or with themselves over time. And, as with their for-profit counterparts, comparison of performance ratios helps to guide those decisions. From Table 1 we can calculate the first performance ratio, average cost of a case and compare this laboratory's performance to the industry or some subset of laboratories.

$$Average\ Cost = \frac{TOTEXP}{FTE} = \frac{\$750{,}000}{2{,}500} = \$300.00 \tag{1}$$

Suppose that the industry average cost for fingerprint identification is slightly less than the amount in (1) for our sample laboratory with an industry average cost of $294.12. While we do not know what the "best" performance could be, the comparison to the industry average suggests that this laboratory's performance appears to be reasonable. No red flags appear that suggest a performance level to raise management concerns. The sample laboratory appears to be average, or reasonably close to the average, with respect to meeting its objectives. However, as with the for-profit discussion in textbooks, the average of the entire industry includes both the good and the poor performers and might be nothing more than a sense of mediocre performance. If that is the case, suppose we chose a subsample of the industry, a select group of top performers to compute an average cost. Suppose further that we find that the "best practice" subsample group experienced an average cost of only $235.27 per case. In a comparison to this group of top performers, the red flags come out, as the sample laboratory is falling substantially short of the mark posted by this model group. The leadership of our sample laboratory must learn why their laboratory's performance is so much more costly and then determine whether there are lessons to learn and adopt for positive change and improvement towards meeting organizational goals.

As with the for-profit firm, decisions based upon a single ratio in isolation, can be fraught with trouble. The original DuPont expansion was devised as a mechanism to highlight that very point by breaking down a return of investment measure into ratios that helped to explain the performance, emphasizing the role of efficiency and risk and their relation to profitability. A similar breakdown for the public organization can highlight the component parts that lead to the different average cost measures. That DuPont-type expansion has been demonstrated elsewhere (Speaker, 2009b) and shows that the Average Cost is a function of efficiency (TEST/FTE), market conditions (LEXP/FTE), risk (TEST/CASE), and the production function (LEXP/TOTEXP). Specifically,

$$Average\ Cost = \frac{\left(\frac{TEST}{CASE}\right) * \left(\frac{LEXP}{FTE}\right)}{\left(\frac{TEST}{FTE}\right) * \left(\frac{LEXP}{TOTEXP}\right)} \tag{2}$$

An analysis of the details in this relationship shows that a laboratory may lower its average cost by reducing either numerator term, accepting more risk by reducing the testing intensity (TEST/CASE) or lowering the average compensation of its workers (LEXP/FTE). Alternatively, it can lower the average cost via an increase in either denominator term by greater efficiency by its analysts (TEST/FTE) or by choosing to forgo capital expenditures in place of additional analysts and immediate results (LEXP/TOTEXP).

Table 2: Fingerprint Identification Key Performance Indicators

KPI	Sample Laboratory	Industry	Best Practice Subsample
TOTEXP/CASE	$300.00	$294.12	$235.27
LEXP/FTE	$73,333	$80,000	$82,000
LEXP/TOTEXP	0.7333	0.8000	0.7500
TEST/CASE	12.000	10.000	8.500
TEST/FTE	4,000	3,400	3,950

Table 2 takes the information from Table 1 and calculates these KPI for our sample laboratory and provides comparable ratios for the industry and the select subset to highlight the reasons behind the performances noted above. Substituting the Table 2 values for each ratio, we have a DuPont-style expansion for the sample laboratory that breaks down the relationship in (1) into ratios representing risk, market conditions, efficiency, and analytical process.

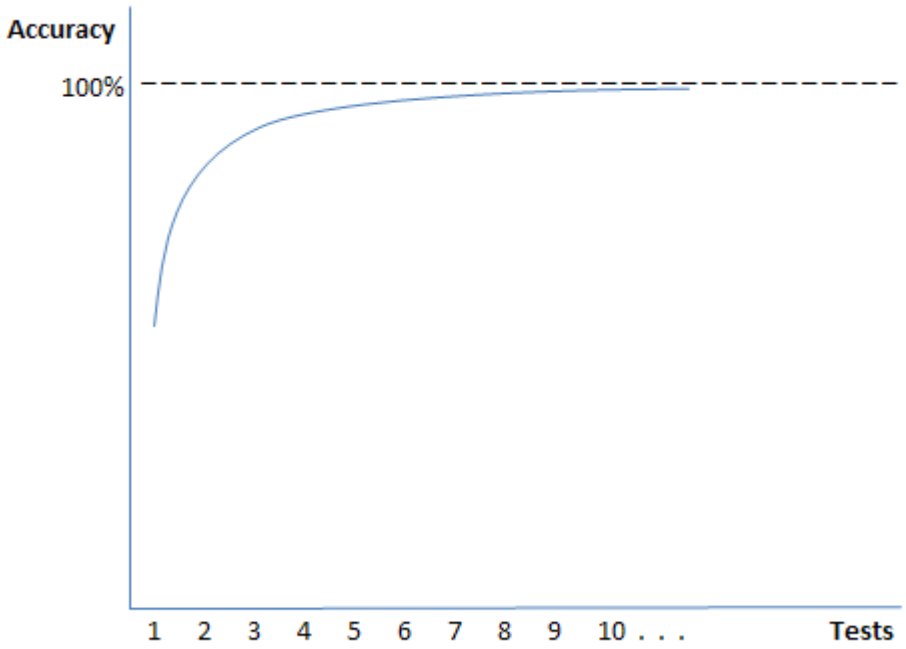
$$Average\ Cost = \$300.00 = \frac{\left(\frac{TEST}{CASE}\right) * \left(\frac{LEXP}{FTE}\right)}{\left(\frac{TEST}{FTE}\right) * \left(\frac{LEXP}{TOTEXP}\right)} = \frac{(12.0 * \$73{,}333)}{(4{,}000 * .7333)} \quad (3)$$

Inspection of Table 2 reveals that the sample laboratory compares favorably to the industry as a whole and the subsample in particular in many respects. The higher average cost does not appear to be the result of uncontrollable market conditions. The sample laboratory is able to staff its operation at a lower than average compensation which contributes to lowering the average cost in comparison to others. And, the sample laboratory is able to pay less, yet achieve above average productivity as the TEST/FTE remains above both comparison groups. The sample laboratory does have a slightly lower portion of expenses coming from labor compensation. While that does influence average costs upwards from a more capital intensive analytical process, it's also a higher investment in future periods which should have a positive influence to come and relative to the comparison groups, it only has a slight upward pressure on current period costs. That leaves the last of the components, the risk measure of testing intensity (TEST/CASE) as the main reason for the higher average cost. The sample laboratory tests at a rate that is 20% higher than the industry average and over 41% higher than the subsample of high performers.

As noted at the beginning of this section, assume that the sample laboratory has a policy that requires comparison of a suspect's ten-print card with every latent fingerprint taken from a crime scene, regardless of whether a "perfect" match was found in the first comparison. Is such a policy necessary to ensure the quality of service desired by the laboratory or can the laboratory adopt a more flexible policy? Recall that the ratio of TEST/CASE was proposed as a KPI to provide proxy measure for risk, where it was presumed that there was a positive relationship between the number of tests performed in a case and the accuracy of the analyst's interpretation of the data. Figure 1 illustrates the relationship between the accuracy of the case determination

relative to the number of tests performed. Note that the accuracy rapidly improves with the earliest tests and becomes asymptotic to the 100% accuracy very quickly.

Figure 1: Results Accuracy as a Function of Testing Intensity



Suppose the sample laboratory altered their testing policy to match the policies of the "best practices" subsample. That is, rather than test every latent print against each suspect, the testing ends when the analyst is able to make a definitive determination of a confirmatory match or until all latent prints are tested—whichever comes first. If we were to substitute the testing intensity of the "best practice" subsample for the testing intensity of the sample firm, then replacing TEST/CASE = 8.5 for the 12.0 value in (3) suggests a rough indication of the potential gains from such a policy change. Table 3 presents two scenarios from such a policy change.

In Scenario 1, the potential cost savings from the alternative policy are demonstrated under the circumstances of making a determination in the same number of cases, but for the reduced level of testing. The policy permits the laboratory to process the same number of cases, while releasing 2.19 FTE for alternative uses and reduces total expenses in the unit by $211.458, and average cost of a case falls from $300.00 to $215.42. That total savings in the laboratory budget can then be reevaluated for allocation to the highest valued area of the laboratory to best meet their mission.

Alternatively, Scenario 2 demonstrates what can be accomplished within the Fingerprint Identification unit if the entire expense reduction were to be reinvested in that unit. In this case all personnel are retained within the unit and the gains are represented by the 1,029 additional cases that may be processed within the same budget cycle. The average cost per case falls even further to $212.50 in this scenario.

Table 3: Fingerprint Identification Example 1 Output

KPI	Initial Level	Scenario 1	Δ_1	Scenario 2	Δ_2
FTE	7.50	5.31	-2.19	7.50	
TEST	30,000	21,250	-8,750	30,000	
CASE	2,500	2,500		3,529	1,029
LEXP	$550,000	$389,583	-$160,417	$550,000	
OVEXP	$175,000	$123,958	-$51,042	$175,000	
FEXP	$25,000	$25,000		$25,000	
TOTEXP	$750,000	$538,542	-$211,458	$750,000	
TOTEXP/CASE	$300.00	$215.42	-$84.58	$212.50	-$87.50
LEXP/FTE	$73,333	$73,333		$73,333	
LEXP/TOTEXP	0.7333	0.7234	-0.0099	0.7333	
TEST/CASE	12.000	8.500	-3.500	8.500	-3.500
TEST/FTE	4,000	4,000		4,000	

Of course there is a continuum of alternatives between these two extremes and overall laboratory management would decide on the best use of the savings. But, the key is that the simple extension of financial management principles to alternative goals offers the means by which managers may better address the economic problem for public and not-for-profit organizations alike. And in that public arena, such tools enable legislators and managers to understand the implications of various legislated mandates.

Example 2: Productivity Improvements and Expected Gains

The second example shows how the KPI can help to identify the cause behind a weak performance and how to anticipate potential gains from changes in managerial practice. Jokes regarding productivity and motivation of civil service are abundant today and have been around for a long time and we build this example around that notion. The reality is that any public organization is subject to the same forces that are found in the private sector. Performance in any organization is a function of a wide range of factors and the difference between the outputs of one organization versus another organization may be explained by any of these factors.

Table 4: Fingerprint Identification Example 2 Output

KPI	Initial Level	Scenario 1	Δ1	Scenario 2	Δ2	Scenario 3	Δ3
FTE	7.5	5.06	-2.44	6.72	-0.78	7.5	
$TEST$	20,000	20,000		26,542	6,542	29,625	9,625
$CASE$	2,200	2,200		2,920	720	3,259	1,059
$LEXP$	$550,000	$371,308	($178,692)	$492,759	($57,241)	$550,000	
$OVEXP$	$175,000	$175,000		$232,241	$57,241	$259,219	$84,219
$FEXP$	$25,000	$25,000		$25,000		$25,000	
$TOTEXP$	$750,000	$571,308	($178,692)	$750,000		$834,219	$84,219
$\frac{TOTEXP}{CASE}$	$340.91	$230.15	($110.76)	$256.88	($84.02)	$255.99	($84.92)
$\frac{LEXP}{FTE}$	$73,333	$73,333		$73,333		$73,333	
$\frac{LEXP}{TOTEXP}$	0.7333	0.7333		0.657	-0.0763	0.6593	-0.074
$\frac{TEST}{CASE}$	9.091	9.091		9.091		9.091	
$\frac{TEST}{FTE}$	2,667	3,950	1,283	3,950	1,283	3,950	1,283

Once again we use the fingerprint identification division of a forensic crime laboratory as our public organization. We make two changes in productivity from the prior example to launch this demonstration. Suppose that the organization described by the data in Table 1 is modified slightly to signify a lower level of production. In particular, suppose for the same personnel and budget that the sample laboratory is only able to conduct 20,000 tests on 2,200 cases. These updated values for the sample laboratory are illustrated in Table 4 along with the associated ratios depicting efficiency, risk, market conditions, and analytical process. Additionally, three scenarios are depicted to highlight the anticipated results from three alternative policies:

Scenario 1: Increase worker productivity to that level demonstrated by the "best practices" subsample for the same number of tests and cases;
Scenario 2: Increase worker productivity to that level demonstrated by the "best practices" subsample for the same total expenditure; and
Scenario 3: Increase worker productivity to that level demonstrated by the "best practices" subsample for the same FTE.

Consider the KPI in the lower half of the table for the initial situation and compare to the "best practices" subsample in Table 2. The sample laboratory has an average cost of $340.91 for a case compared to the $235.27 cost for the comparison group. As with the prior example, the sample laboratory has lower compensation and a comparable percentage of expenditures for labor services. In this second example, we see that the testing intensity (TEST/CASE) of 9.091 for the sample firm is only slightly higher than the 8.5 level of TEST/CASE of the comparison group. It is not until examination of the productivity of the average worker that any red flags appear. The sample laboratory shows that the average analyst conducts 2,667 cases to the 3,950 of the "best practices" group.

Suppose that the sample laboratory is able to discover what the "best practices" laboratories are doing differently and implements appropriate changes to put those best practices into play. Scenario 1 demonstrates the outcome of making those changes while holding the output constant. The Δ1 column shows that the same level of production may be achieved with 2.44 fewer FTE at a total cost savings of $178,692, which lowers the average case cost to $259.69, slightly higher than the level demonstrated by the "best practices" subsample. The total cost saving can then be put back under consideration for the entire organization to see where the greatest additional gains may be obtained.

Scenario 2 demonstrates the effect on the laboratory if the best practices are adopted and the total budget is maintained by the fingerprint identification unit. Because the other variable costs (e.g., expenditures for chemicals and reagents) increase as more tests are performed, that total expense level is exhausted before the available time for the analysts has been used. In this scenario, the average cost falls to $256.88, over 6,500 additional tests and 719 cases are processed, and 0.78 FTE are available for reassignment elsewhere in the laboratory.

Finally, scenario 3 illustrates the potential from fully employing all of the original FTE and increasing the other variable expenses to complete the tests that may be performed by the original analysts. While it will cost an additional $84,219 in increased levels of the other variable cost items to maintain full employment of these analysts, it offers a good example for flexible budgeting as the average cost falls to $255.99, some 9,625 additional tests are performed and over a thousand additional cases are able to be processed.

These three scenarios represent a small subset of what might be addressed, but they offer some suggestion as to directions that might be taken. From each of the business disciplines there will be many topics for which similar extensions may be made to include applications to the public organization.

CONCLUSIONS

Beginning with the reality that nearly a fourth of the U.S. workforce is employed in the public and not-for-profit sectors, a call is made for more attention to the nuances of the application of business principles to these sectors. While many developments in business education are directly transferable to all sectors, many other topics have been attributable to analysis of the wealth maximization objective of the for-profit firm and do not apply to the decision-making towards other goals of public and no-for-profit organizations. Such extensions to these other scenarios require a conscious effort towards inclusion and preparation of business school students to make informed decisions in the broader areas of their ultimate employment.

To highlight how applications would be modified, two examples with multiple scenarios are offered using one public sector, the forensic crime laboratory. The availability of data,

identifiable work product, and familiarity via the popular media makes this public sector organization a reasonable choice for examples. From applications to this sector, we see that a slight broadening of examples permits the potential for the proper implementation of business principles to a full range of organizations.

ENDNOTES

[1] These standards are established and reviewed through the American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB).

[2] Refer to Table 1 for a definition of each of the ratio components.

[3] That continuum of alternatives opens the door for a wide variety of avenues for exploration of this topic. For example, this offers an example for the presentation of optimization topics in managerial economics with the exploration of the utility functions of the public sector and comparison to relative prices from the budget constraint.

[4] This offers an opening for a host of topics where the inclusion of such examples permits a course to highlight the application of its discipline to the public sector via a specific change in practice. These could range from applications in leadership or personnel motivation to production possibilities in operations management.

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