Knowledge Value-Added (KVA) Methodology

Definition

Knowledge Value-Added (KVA[1]) is a framework for measuring the value of corporate knowledge assets. Rooted in the knowledge economy, this framework provides several business valuation tools (i.e., knowledge and process audits) used by over 60 companies worldwide. Executives use these tools to measure the value of knowledge embedded in company core processes, technology, and employees. The reason for KVA's growing acceptance as a valid measurement tool lies in its sound theoretical underpinnings, its practicality, and its ease of use for companies competing in the evolving knowledge-intensive global business environment.

Overview

This tutorial explains the knowledge and process audits of the KVA methodology in detail and identifies specific real-world examples in which the technique was successfully employed to measure the performance of knowledge assets. It also provides an in-depth description of each step in the knowledge and process audits, thereby enabling readers to apply it to their own businesses. The Process Edge™ software suite incorporates this methodology explicitly, and an example of a screen from the tool suite is included.

Topics

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[1]The KVA methodology is a creation of Drs. Thomas J. Housel and Valery Kanevsky and has been published internationally in numerous articles and books about knowledge management and business process reengineering. Tom Housel is an associate professor in the Marshall School of Business at the University of Southern California, and Valery School of Business at the University of Southern California, and Valery Kanevsky is a lead scientist at Hewlett-Packard Labs in Palo Alto, California.

1. Introduction

KVA methodology provides a way to measure the value of knowledge assets deployed in core processes objectively. Valuation—the measurement of the value of knowledge embedded in company core processes, technology, and employees—is accomplished through two return ratios: return on knowledge (ROK) and return on process (ROP). The numerator of the ratio represents the percentage of the revenue or sales dollar allocated to the amount of knowledge required to complete a given process successfully, in proportion to the total amount of knowledge required to generate the corporation's total outputs. The denominator of the ratio is the cost to execute the process knowledge. *Tables 1* and *2* provide an example of the output of a knowledge audit for Ken Poland, Executive Director of the Construction Engineering and Support Process (CESP) at Pacific Bell.

Table 1. Outside Plant-Provisioning Center

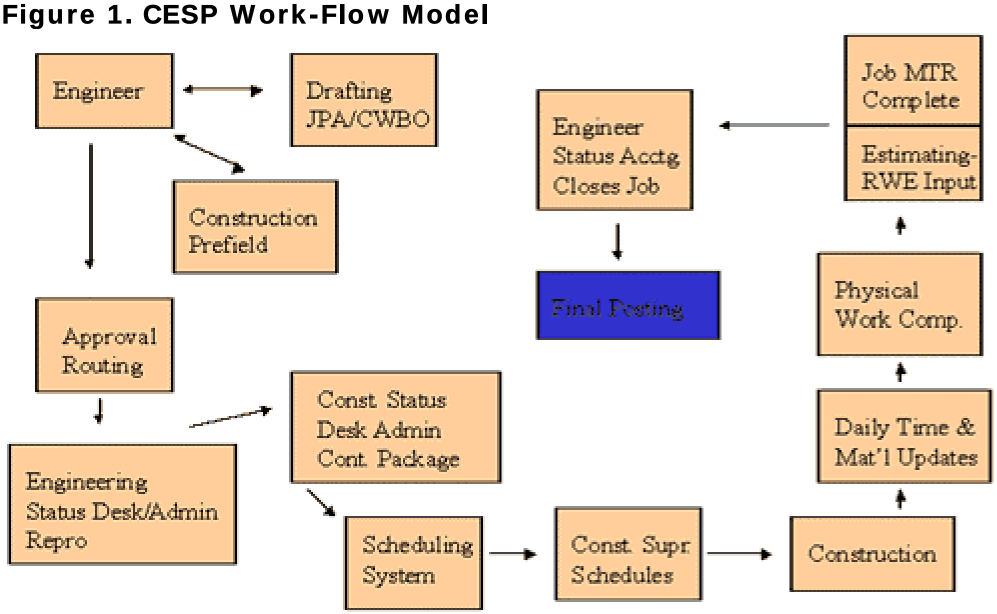
Subprocess	Learning Time (months)	Value Added	Process Instructions	Value Added
permit	301	$1,026	278	$264
CWBO	625	$2,133	300	$286
status	500	$1,706	2,750	$2,617
scheduling	9,000	$30,716	37,000	$35,212
reproduction	125	$427	2,750	$2,617
estimating	9,000	$30,716	31,750	$30,216
posting	9,000	$30,716	27,750	$26,409
IT	750	$2,560	2,500	$2,379
sum	29,301	$100,000	105,078	$100,000

Table 2. Outside Plant-Provisioning Center (Continued)

Subprocess	Execution Time (min)	Weekly Rate	Process Costs	ROK	ROP
permit	5,550	$628.00	$1,452	0.71	0.18
CWBO	9,000	$628.00	$2,355	0.91	0.12
status	33,000	$628.00	$8,635	0.20	0.30
scheduling	20,500	$661.00	$5,646	5.44	6.24
reproduction	15,000	$628.00	$3,925	0.11	0.67
estimating	81,000	$661.00	$22,309	1.38	1.35
posting	307,500	$661.00	$84,691	0.36	0.31
IT	100	$1,500.00	$12,000	0.21	0.20
sum			$141,013	0.71	0.71

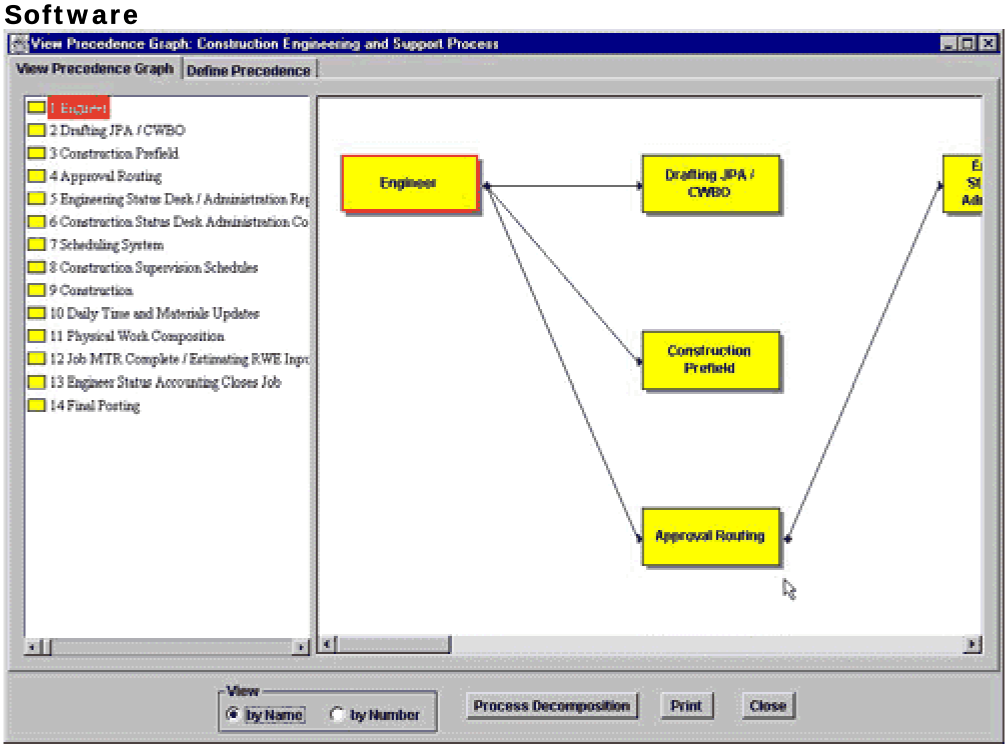
In this example of the KVA knowledge audit, aggregate data was gathered over a month. KVA analysts, using a workflow model of the process (see *Figure 1*), interviewed process subject matter experts (SMEs), made observations, and talked with process employees and managers to obtain average learning-time estimates and the number of roughly equivalent (in terms of their complexity and time to learn) process instructions required to complete each subprocess.

Figure 1. CESP Work-Flow Model



Comparing the permit subprocess to the estimating subprocess, for example, makes it clear that estimating provided an ROK (1.38 versus 0.71). That is, the amount of knowledge executed during the month (knowledge is a surrogate for the process outputs measured in common units) was significantly higher in the estimating subprocess than in the permit subprocess. Even though the cost for this subprocess was significantly higher, the KVA was also proportionately higher. A partial work-flow representation of the process using the ProcessEdge software is shown in *Figure 2*. KVA provides a performance-ratio estimate, demonstrating that this subprocess provided a much higher ROK.[2] KVA makes it possible to measure how well this particular process knowledge is doing in converting existing knowledge into value. This knowledge accounting provides management with a new view of how the investment in knowledge and learning is paying off—not just how much it costs.

Figure 2. Partial Work-Flow Representation Using ProcessEdge Software



A corporate-level KVA analysis of one very large cellular company revealed the following orders of magnitude differences in utilization of knowledge assets among the core functional areas. In this case, it was obvious that the network area was providing the lowest ROK. While it is not always the case that the lowest ROK should be the first core area to be improved, this analysis helped the executive in charge focus further analysis of the company's core operations (see *Table 3*).

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[2] In this example, the actual revenue attributed to the CESP was arbitrarily set at near the break-even point. To obtain a more accurate estimate of the revenue attributable to the CESP would have required a corporate-level knowledge audit such as the one completed for the large cellular company described in this section. The presumption is that a core process adds some level of value, as at a given point in time, by definition, it was part of the total output of the corporation. This being the case, any surrogate for the actual revenue can be used to determine the orders of magnitude differences among the subprocesses of the core process. The real value of the KVA analysis in this case is to determine the orders of magnitude differences to provide a baseline against which future improvements can be compared.

Table 3. ABC Cellular High-Level Knowledge Audit

ABC Cellular Functional Areas	ROK
sales	29.87
marketing	7.10
network	5.17
customer care	12.74
finance	25.46
human resources	7.36

As a result of KVA, the manager must determine how knowledge can be more effectively utilized to produce better return performance. If managers focused only on cost rather than the value of the knowledge in the process, they would have only one option—cut costs. However, if they cut costs in the estimation subprocess or in the sales process, both of which have relatively high costs, without maintaining the same output level, they would actually reduce the return on these knowledge assets. KVA standardizes the output of all processes by describing the output in terms of the units of knowledge required to produce it.

Other surrogates for the output that can be stated in roughly equivalent units are process instructions, computer code, and bits.[3] By comparing the estimates of any two of these surrogates, that by definition reflect the same underlying knowledge assets, it is possible to gage the accuracy of the estimates. In the CESP case, the process instructions and learning-time estimates correlated at 0.95.

Learning Time

The amount of knowledge embedded in a process can be represented as the amount of time necessary for an average person to learn how to complete the process correctly. The knowledge can also be represented by the process instructions (roughly equivalent in complexity) required to generate the process output successfully. On average, using a common individual as the referent point, learning time is proportionate to the amount of knowledge learned. In this way, learning time can be used as a common-sense indicator of the amount of knowledge embedded within a given process. Most process SMEs can provide actual estimates of the learning time required for a given process based on formal and informal training times, experience on the job, employee interviews, training manuals, and programs.[4]

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[3]The bit-level estimate yields the most accurate result, as an information theory bit is a universal unit primarily used when the KVA monitoring process is automated.

[4]A simple test can be conducted to determine if the knowledge required to obtain the outputs from each process has actually been learned. If someone (always use the same point of reference for the learner) can be taught to perform the process using the instructions, they should be able to produce the same process output. In theory, they will, and, if not, the estimate of the knowledge embedded in the process is not

KVA makes possible the initial estimate for allocating revenue or sales dollars to the various core processes or functional areas (usually no more than eight to ten). The real goal here is to establish relative orders of magnitude for the amount of knowledge embedded in core processes; the analyst may thus avoid a subjective debate over which processes are more important or valuable than others.

KVA also provides managers a means of framing decisions about how best to deploy, redeploy, or eliminate knowledge, which comes in handy when decisions are made about how best to automate a core process. The real issue is how to redeploy knowledge from people and procedures or work rules into information technology (IT) so that it can be executed more rapidly, therefore more often, and at a lower cost. If the automation does not improve the ROK of a given process, then steps must be taken to improve its functionality and performance.

This basic approach may be extended to estimate the amount of knowledge contained in IT. First, mangers must focus on IT outputs within the core process and then employ an SME to estimate the time necessary for learning how to generate the same output. Another way of getting this estimate of the knowledge embedded in the IT is to ask the SME to imagine that we have just thrown the IT out the window and must now supply its outputs by teaching our average person to produce them manually. In most cases, the average person would take much longer to produce the outputs (i.e., the cost of using the knowledge), but what must actually be determined is the learning-time estimate of how long it would take a person to learn to produce the given outputs.

In this manner, IT is simply another instantiation of process knowledge. KVA makes it possible to answer the long-troubling question about return on IT. Because numerators and denominators must come from different data sources (real revenues and costs), managers need not resort to manipulating cost (i.e., the denominator) to obtain the numerator (e.g., cost savings or cost avoidance) so that a quasi-return measure can be generated.

The actual analysis of a core process can take anywhere from two days to five weeks, depending on access to process SMEs, level of process complexity, and the experience of the KVA analyst. When analysts and process managers are satisfied with the estimates, a count is taken of the number of times the knowledge is executed (value) and the time it takes to execute (cost) in a given sample period. This is necessary to derive terms for ROK, return on process (ROP) ratios. Two very basic rules apply to knowledge estimation:

- Knowledge should be counted only when in use (not resident, in inventory, or redundant) so as to avoid overestimates. For example, even if a janitor has a Ph.D. in physics but uses none of this knowledge

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accurate. In actual practice with KVA, it usually suffices to cross-validate the learning-time estimates with the process-instruction estimates.

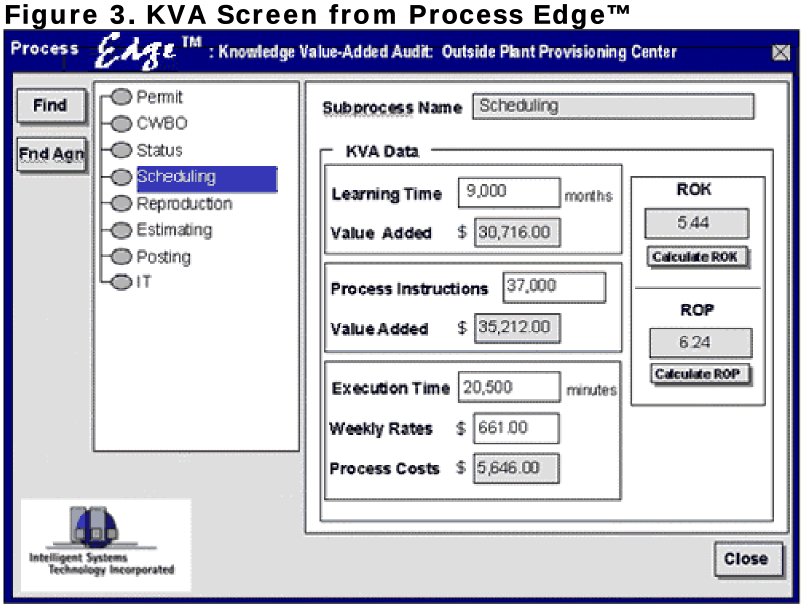
to clean the floors, only the actual knowledge executed during the cleaning process may be counted.

- Always strive to find the shortest description for the actual knowledge in use in a given process to obtain the output. For example, one employee working in the permit subprocess may use a complicated approach to complete the permit subprocess while a colleague employs a more direct one. The more succinct approach, which would have fewer process instructions and thus be learned more quickly, should be used for the learning-time and process-instruction estimate.

The actual time it takes to execute the subprocess (multiplied times resource costs: labor, machines, plant, information systems, etc.) is a flow-based estimate of its cost. KVA calculates the cost of a process in a new way by providing a cost-per-equivalent-unit output (described as a unit of knowledge). It is important to note that process costs alone, without reference to value, present a different picture of this core process's performance.[5]

The KVA approach is embedded in a process-modeling tool suite, Process Edge™, from Intelligent Systems Technology Incorporated (see *Figure 3*). This software will allow the analyst to gather and represent KVA data within a process workflow model as well as monitor the ongoing ROK and ROP of the processes under review. Using this kind of tool allows the analyst to model, simulate, and evaluate recommended process improvements objectively, based on the returns achieved before the first change is made to a core process.

Figure 3. KVA Screen from Process Edge™



[5]The reader is directed to a number of published studies of KVA to obtain a more detailed scientific justification for the core premises reviewed here. Several can be found on the KVA Web page at http://www.businessprocessaudits.com.

A complete KVA requires the seven steps shown in *Table 4*. The binary query method will not be described in detail below. This method is relatively time consuming and is primarily targeted for situations in which a very high level of accuracy is necessary.

Table 4. Knowledge and Process, Binary Query Audit Seven Steps

Steps	Learning Time	Process Description	Binary Query Method
One	Identify core process and its subprocesses.		
Two	Establish common units and level of complexity to measure learning time.	Describe the products in terms of the instructions required to reproduce them and select unit of process description.	Create a set of binary yes or no questions such that all possible outputs are represented as a sequence of yes or no answers.
Three	Calculate learning time to execute each subprocess.	Calculate number of process description words, pages in manual, and lines of computer code pertaining to each subprocess.	Calculate length of sequence of yes or no answers for each subprocess.
Four	Designate sampling time period long enough to capture a representative sample of the core processes final product or service output.		
Five	Multiply the learning time for each subprocess by the number of times the subprocess executes during the sample period.	Multiply the number of process words used to describe each sub process by the number of times the subprocess executes during sample period.	Multiply the length of the yes or no string for each sub process by the number of times the subprocess executes during sample period.
Six	Calculate cost to execute knowledge (learning time and process instructions) to determine process costs.		
Seven	Calculate ROK and ROP and interpret the results.		

Companies employing the methodology engage in analysis of their processes and subprocesses and, in many cases, examine these in detail for the first time. The results are incredibly powerful and can help direct strategies and operations toward value creation and cost-effectiveness.

Most simply, KVA methodology demonstrates the true contribution of knowledge to the creation of value—an essential step in terms of effectively managing knowledge assets. While KVA is a relatively new method (in development and use for over eight years), the process itself creates greater operational clarity and strategic vision for companies undertaking knowledge management initiatives.[6] In addition to these company-wide benefits, a KVA analysis enables companies to quantify the contribution of knowledge to their activities effectively, thus allowing them to better manage and leverage knowledge throughout the organization.

2. Case Example

What is most easily measured is not necessarily what is most necessary. Take dollars, for example. Traditional accounting techniques have found it easy to count dollars, as if that calculation alone proved valuable as a predictor of company fortunes. These techniques had no means of counting what dollars stood for within a company. Were they motivators to all levels of employees alike? Did dollars translate into increased employee creativity? Did dollars ensure loyalty to the company as well as high morale? Did dollars alone build the company team? These questions suggest that important measurements cannot be accomplished solely by traditional financial tools. When measuring the contribution of knowledge to the corporate bottom line, new approaches have been required for some time, and the KVA methodology provided one theoretically sound framework for attempting to measure the relative contributions of corporate knowledge assets objectively.

KVA Methodology

This section of the tutorial explains the KVA approach in detail via an in-depth case.[7]

For those who need a concrete guide, KVA can be delineated in seven steps. The case study that follows will provide an even more detailed example of how KVA might be applied to the service order-provisioning process of a telephone company.

XYZ Telephone Company Case Background

XYZ telephone company is the major operating company of XYZ holding company, accounting for approximately $11 billion in revenues for 1998. The company's mission is four-fold: provide high-quality and competitively priced services; lead their (increasingly competitive) markets in customer satisfaction and loyalty; foster employee commitment, initiative, and effectiveness; and increase shareholder value.

[6] KVA was created in 1991 and was originally labeled the business process auditing approach.
[7] Visit the http://www.businessprocessaudits.com Web site and the Research page to review the underlying scientific assumptions of the KVA methodology.

XYZ telephone company faces many new competitive challenges with the passage of the Telecommunications Act of 1996. Clearly, there is new pressure for price competitiveness. The company managed to reduce its expenses by 18 percent through a combination of a 6.8 percent reduction in head count and a 10.7 percent reduction in capital expenditures. These reductions allowed the company to hold its profit at approximately the same level over the past several years.

XYZ telephone company's management realizes that to maintain its market position and to expand into new services (e.g., interactive multimedia, cable TV, personal communication services) it must continue to focus efforts on maintaining current levels of service with fewer (and less expensive) employees. In addition, the company service level remains regulated to meet certain mandated standards. For example, customer holding time for access to company service representatives must be within a given number of seconds per call. Failure to maintain network reliability standards also can have severe consequences in the form of fines and stricter regulation of service.

With these dual pressures to compete and maintain service-level standards, company management realizes that any process changes (due to reengineering or other initiatives) must be well documented and monitored for effectiveness (in reducing cost and maintaining value) as well as for compliance to standards. After a preliminary evaluation of areas where process improvements would have the most positive effect on these two issues, it was decided to focus on the order-fulfillment process.

A high-level executive wanted to downsize the service representative function because this represented the largest cost bubble as a result of the large number of service representatives. These employees worked within the order-generation subprocess and were the lowest-paid employees in this process.

Unless the old process was redesigned to handle the same number of customer requests with fewer service representatives, the company risked reducing customer satisfaction—not to mention failing to meet hold-time standards. With reduced service representatives, more of the responsibilities for generating the SORD order would be pushed back to other functions, resulting in a higher-paid technician producing the same outputs as a service representative at a higher cost. In addition, greater time pressure would lead to more errors on the SORD orders, resulting in an increase of customer complaints and an increase in call load (from customers calling to resolve incorrect service as a result of SORD errors).

An intelligent information system was designed to allow the service representative to perform the functions of other order-generation technicians and produce SORD orders more rapidly. This system shifted more-expensive knowledge to less-expensive sources, ensured a lower error rate, and thus increased the output of this subprocess. It also permitted faster training for new service representatives, as the system did much of the work the representative performed with the old process.

The following is an example of how KVA was applied to this telephone company's order-fulfillment process. The seven-step knowledge audit method is outlined in detail to help the user understand the conceptual framework within an actual application of the method.

3. Step One: Identify Core Process and its Subprocesses

1. Establish the boundaries of the core process.

    A. Identify the end output of the core process (e.g., a sales order for the sales core process).

    B. Identify the subprocess outputs that eventually create the end product.

    C. Create an aggregate-level process diagram that depicts the inputs and outputs of the core and each of its subprocesses. There are workflow modeling tools to solve this problem (e.g., Process Edge™ from Intelligent Systems Technology).

2. Identify questions that should be asked in establishing the core process and its subprocess outputs.

    A. What is the final salable product or output of the core process? If there does not appear to be a final salable product or service, you can still calculate the order of magnitude of the increase or decrease in the return estimate, as will be described in greater detail in Step Seven.

    B. What subprocess outputs can be found in the core process output?

    C. What are the inputs and outputs of each of the subprocesses?

    D. How can the outputs of the computing automation be identified or its contributions to core and subprocess outputs be delineated? (This will allow the analyst to isolate the contribution provided by the IT.)

3. Gain concurrence on the description of the compound and component processes.

A. Begin with a strict description of the core and subprocesses.

B. The process owner or analyst may wish to isolate the unique contributions to output provided by the IT in terms of outputs created by the technology.

C. The management team must agree on the descriptions, or confusion may occur later in the KVA.

4. Use existing descriptions, found in the various places.

   A. job descriptions, work manuals, computer code, or other corporate documents

   B. quality improvement efforts that document the process flows

   C. time and motion studies that divide each process into individual tasks

5. Use any of the workflow modeling tools to create a document that includes detailed descriptions of the core and subprocesses, including process diagrams.

6. Describe the tasks for the subprocesses and core process.

Step One: Example

The order-fulfillment core process involves the sales, order generation, installation, and billing subprocesses. The sales subprocess involves selling the customer telephone service with any variety of features (e.g., call waiting, three-way conferencing). The order-generation subprocess produces something called a SORD order. This order is generated by taking the sales specifications for service and translating them into SORD language so that all of the databases (e.g., telephone number, telephone-line assignment) will be properly updated to set up the network to provide the desired service. The SORD order is basically a virtual representation of the final telephone service. The installation subprocess utilizes the SORD order when installing the telephone lines for service. The billing subprocess also utilizes the SORD order when setting up its databases to create and send billing records to the customer.

4. Step Two: Establish a Common Level of Complexity for Learning Time and Process Instructions

1. Establish a common definition of learning time for all processes under review. The purpose here is to establish an average unit of learning time that can be applied to estimating the learning times for all processes. This approach applies the assumptions of statistical averaging to help SMEs form a common frame of reference for learning-time estimates.

   A. Request that the SMEs teach everything needed to produce a unit of output for each subprocess. The goal is to identify an average unit of learning time. If specialized training (e.g., an engineering degree) is required to complete the subprocesses, a larger unit of time may be more appropriate. However, if the specialized training is a historical artifact that has since been obviated by moving the process knowledge into automation, it may not be necessary to use larger time units.

   B. It is important to include process automation within your estimates of subprocess learning time. In this case, ask the SME to teach what is needed to produce the IT's outputs within the subprocesses under review. (Make sure that they know that you are not asking for an estimate of the learning time required to create the software programs.) This estimate of the knowledge embedded in the IT will also ultimately lead to estimates of the value added by the current or planned IT.

   C. Probe the SMEs further if you cannot perform the required instructions without further instructions. For example, if SMEs instruct you to make the customer happy, you will need to probe them further to determine how this aggregate-level instruction should be performed. When an instruction or instruction description is more complex than others, it must be broken into the next level of detail. For example, "make the customer happy" must be broken down into "greet the customer with a smile," "offer them a beverage," "introduce yourself and ask for their name," etc., until it is at approximately the same level as the other process descriptions. If the SME tells you to "paint both sides of the left door green," however, you would probably not need further instruction, as the instruction is reasonably unambiguous and easy interpreted.

D. You can use the SMEs' learning instructions for your process instructions. You should also obtain rough-cut estimates of how long it would take to teach you how to perform the instructions required to produce the subprocess output. This learning time, as well as the process instructions, will serve as an estimate for the amount of knowledge contained in each subprocess and, subsequently, in the final output. Generating two independent estimates of knowledge is useful in that it allows you to test the accuracy and reliability of knowledge estimates by making a matched correlation test among the two. The higher the correlation, the better the estimates.

E. At the corporate level, you can use the learning time and process instruction estimates for the core and their subprocesses to backward allocate the company revenue in proportion to the learning time and process instructions (i.e., knowledge) associated with each core and its subprocess.

F. You may also wish to include the relative cost to learn how to produce the knowledge and process instructions necessary to produce the core and subprocess outputs, but remember that this cost is definitely not a surrogate for value.

2. Create a common language to describe the core and subprocesses.

   A. Identify an existing process language that can be used to describe the process outputs in terms of the activities required to produce the outputs.

   B. For example, a service order or some kind of written output from the subprocesses may be used to establish the process language.

   C. If there is no existing language, create a process description that would allow a reproduction of the process outputs, given the existing technology. This description can be developed by asking the process SMEs to teach you how to complete the tasks and procedures required to produce the outputs. This teaching also can be used to estimate the learning time required to complete the subprocesses successfully. (Again, do not confuse the time required to execute knowledge, which is cost, with the estimate of how much time it takes to acquire the knowledge, which is a surrogate for value.)

   D. Try to ensure that the process-description language is roughly equivalent. Go through each instruction or process task description and ask the SMEs, “Is this instruction at about the same level of complexity as another?”

E. This step is important and may require several iterations until concurrence among the SMEs and process owners is achieved. The result of this step is the determination of the amount of process instructions required to create the process output. The process instructions will be used to backward allocate the revenue proportionately to the instructions produced by each subprocess.

F. Develop a simple tracking sheet to record how long it takes to produce each instruction's output during the subprocess. This process instruction-execution time measure provides a proportionate estimate of the cost or investment in the subprocess. Execution time cost and investment includes the amortized cost of equipment, training, labor, infrastructure (lights, air-conditioning, etc.), and management overhead to produce the subprocess instruction outputs.

Steps One and Two are the most important for completing a KVA prior to modeling improvements in business processes. These ROK and ROP estimates serve as the baseline to evaluate the potential financial benefits of the proposed, modeled, and simulated process change—including automation—before such change is implemented. They also ensure that all will have a common understanding of the problem as well as a means by which to judge whether it has been successfully solved.

Step Two: Example

The KVA team has a meeting with the order-fulfillment process owner (Jeff), who was very familiar with all four subprocesses (having worked in several of them) as well as with SMEs from each subprocess. The purpose of the meeting was to establish a common unit of learning time and process instruction that could be used to estimate the time (and the number of instructions) it would take the average person to learn to produce the outputs of all four subprocesses.

The jobs associated with each subprocess had well-documented, on-the-job training times and process instructions. In addition to these learning times, it was necessary to estimate the amount of knowledge contained in the systems that supported these subprocesses. The group was asked how long it would take to train—and what process instructions would be needed for—the average new employee to obtain the outputs of the systems, if these were performed manually. (Keep in mind that you are seeking an estimate of the time it takes to learn how to execute the process, as opposed to the actual time it takes to execute the process.)

In developing a common reference point for estimating a unit of learning time and process instruction is important. Historical, planned training times to learn processes often imply a common reference point for learning times.

The analyst could, for example, ask the SMEs to think of the generic order case. With this as their reference point, they could be asked to estimate what it would take to teach each member of the core process how to generate the output of a subprocess. If there is a glaring disparity, you must factor in the specialized knowledge required for a given process within your average unit of learning time to ensure that the subprocess that requires it receives an accurate learning-time estimate. Try to establish a common level of complexity for each process instruction to avoid glaring disparities in the level of aggregation used to describe each instruction.

The learning time and process instruction estimates could be compared to the outputs of each subprocess to determine the reasonableness of expert judgments in the absence of historical learning time and process instruction data such as training program times and procedure manuals. Using the outputs is also useful when, as in this case, automation moves the process knowledge (learning time) from a human operator to a system. The projected implementation of the intelligent front-end to the SORD system allowed an explicit tracking of the movement of process knowledge away from several of the order-generation technicians (numbers administrator, loop facilities administrator, and mechanized loop assignment administrator) to the new system and the service representative. The service representative and the new system could now perform the functions of the more expensive and knowledgeable technicians.

5. Step Three: Calculate Time to Learn How to Execute Each Subprocess

1. With a common unit of learning time and process instruction established in Step Two, calculate the amount of time to learn and the number of process instructions needed to produce the outputs of each subprocess.

    A. Ask the SME to estimate how long it would take to teach the average person (you can use yourself as the common referent point for all knowledge estimates) to learn how to produce each subprocess output. It is important that the SME use the same point of reference when estimating learning time.

    B. Try to validate the learning-time estimates by comparing them to the core and sub-process instructions. If it appears that some outputs would be harder to learn than others that have been given the same or very similar learning-time estimates, the analyst should ask for further clarification and justification by asking the SME to describe the process instructions involved in the suspected estimates.

C. The analyst can validate learning time and process instruction estimates for the IT by asking the SME how long it would take the same person to learn how to perform manually the instructions currently performed by the IT to produce the process outputs. This will also yield the number of process instructions (in the same language used to describe manual parts of the processes) attributable to the outputs of the IT within each process.

D. Remember that the IT may not be solely responsible for the output but may be necessary to obtain the output. In this case, it is easiest to attribute half the value of a given output, in the form of a process instruction, to the technology and half to the human operator. A simple equal partitioning of the output to each contributor is the easiest way to assign value among the agents in a process. Remember that, in most cases, the analysis is at an aggregate level such that exact partitioning is only necessary when extreme accuracy is required for the process owner's given purposes.

2. Calculate the number of process instructions necessary to produce the outputs of each subprocess.

   A. Once the process instructions have been identified, they simply need to be counted for each subprocess. These counts represent the amount of value attributable to each subprocess.

   B. Workflow modeling tools can make these calculations automatically, once the processes have been described in terms of the necessary (roughly equivalent in terms of their complexity) instructions required to obtain the process outputs.

At the completion of this instruction, the amount of knowledge (i.e., learning time) contained in each process will be explicitly identified. This allows the process owner to understand the distribution of knowledge throughout the process, including the amount of knowledge contained in IT. Armed with this knowledge, the process owner can ensure that the knowledge is being deployed in a way that provides maximum returns. The manager can also begin to consider the redeployment of knowledge through consolidating processes, training new employees, and incorporating process knowledge in future IT.

Step Three: Example

SME experts from the four subprocesses were assembled in a single meeting to help establish a common reference point for the learning time and process instruction units. Following this meeting, it was decided that training times for new employees of each subprocess could be used for estimates of total learning times required to produce the outputs of the subprocesses. Interviewing the SMEs made it possible to determine the number of process instructions for each subprocess.

Reference to these training times established that the sales subprocess required approximately 120 hours of formal and 160 hours of on-the-job training. The order-generation subprocess jobs in aggregate required 160 hours of formal and 240 hours of on-the-job training. The billing technician, meanwhile, required 40 hours of formal and 40 hours of on-the-job training, with the installer requiring 40 hours of formal and 160 hours of on-the-job training.

The systems supporting the core process were primarily located within the order-generation subprocess (e.g., databases for telephone numbers, trunk and wire-pair availability and location, assignment of features in switches, etc.), the billing subprocess (e.g., estimates of distance, reference tables for the pricing of custom features, etc.), and minimally in the installer process (e.g., cable record databases). These estimates of training time were used as surrogates for learning times (or amount of knowledge contained within each subprocess). The order-generation systems represented 100 hours, the billing system 40 hours, and the installer system 10 hours of learning time. In total, the average learning time required to produce a customer's telephone service was 1,110 hours.

The process-task estimates for each subprocess correlated above 93 percent with their corresponding learning-time estimates. Given the high level of correlation, it was decided to use learning times and ROK for the return estimates, as both measures reflected the same underlying amount of knowledge.

The sales subprocess represented 25 percent, the order-generating subprocess 45 percent, the billing subprocess 11 percent, and the installation subprocess 19 percent of the aggregated core process-learning time. Given that amount of learning time is an approximation of amount of knowledge, and amount of knowledge is an approximation of value, a distribution of the value produced in this core process in terms of its subprocesses may be determined. A conservative estimate of the average order for telephone service was approximately $750 (counting installation and recurring service charges for an average number of months of service). For the purposes of this description of the seven-step method, this amount was used as a convenient surrogate for the value produced by the processes for the average order. However, a more accurate value allocation would come from performing a corporate-level knowledge audit to determine what percent of the corporate revenue came from this core process.

It is now possible to backward allocate the average revenue to the subprocesses proportionately in terms of the value (i.e., knowledge) they have added. Of course, it will be necessary to generate cost estimates to execute the subprocess knowledge in order to determine the subprocess ROKs.

It was useful to project the effect that SORD, with the implementation of the new intelligent front-end, would have on the redistribution of knowledge. The redistribution of knowledge could be validated by examining the outputs of the order-generation subprocess (i.e., the service representative and the new system). In fact, this led to a doubling of the ROK within this subprocess, even after the cost of the new system was included in this subprocess' process-execution costs. The actual impact of the new system could be partitioned, and its return could now be calculated.

To obtain the return estimates based on the new process, the SME must model and simulate the new process using workflow-modeling tools. The resulting ROKs can be compared to determine the potential order-of-magnitude increases in returns as a result of future knowledge management efforts. If the future returns do not improve substantially, it may be prudent to test other approaches to redistributing knowledge to IT in the process until the best returns are obtained. KVA will not substitute for the creative insights of the knowledge manager; it will, however, help to validate the decisions this manager makes, based on potential increases in returns.

6. Step Four: Sampling

1. Designate a sampling period long enough to capture a representative sample of the subprocesses outputs (i.e., final salable product or service where possible).

    A. For rough-cut estimates, it is necessary only to capture the learning-time estimates for the subprocesses for a generic case. This provides the estimates of the percentage of value produced by each process. These percentages will be used to backward allocate the revenue to the subprocesses.

    B. The rough-cut estimate gives the process owner a first look at the estimated return provided by each subprocess. To obtain a performance ratio, the SME will also need to provide an estimate of the cost to produce the output of each subprocess. This allows the ratio of the estimated value produced by the knowledge contained in each process over the estimated cost or investment required to produce the output.

    C. If the SME wishes to obtain a more precise estimate, it will be necessary to gather more data over a given sampling period.

This is critical when the price and cost to produce the process output varies widely over time. Variations may occur due to price wars, competitive pricing, and variable costs as a result of fluctuating raw material and labor costs.

D. If a sample is taken, the SME must be certain to use only those learning times related to the execution of one unit of output for the process. This is necessary because process outputs may vary in terms of the knowledge required to produce them. Obtain a minimum of estimates based on at least ten core process firings per process output examined.

E. Calculate the product of learning time by the number of firings of the corresponding process over the sampling period. This product will be used to backward allocate revenue.

F. The SME may have access to historical data which will allow calculation of the historical performance of processes under review. This data can be used to estimate the distribution of outputs (e.g., products and services) produced over a given time period. Given that the learning times have been estimated for each process, it is possible to calculate the performance of each process over time.

2. The same general approach may be used with process instructions. Rather than using learning-time estimates, the number of instructions executed during the sample period would be used. If a single estimate is used, this will also provide a preliminary rough-cut estimate. However, the process-instructions approach is generally implemented to obtain a more precise measure and is therefore used with a designated sample period.

The sampling period is useful because it helps establish the procedures for ongoing monitoring of the processes. This instantaneous process auditing can provide a nearly real-time process performance-feedback system that will allow the process owner to monitor variance in performance.

Workflow-modeling tools can be useful in simulating the sample period. Such tools will automatically calculate the number of times a process instruction executes and the work time and execution cost for each instruction.

Step Four: Example

The rough-cut knowledge audit does not require a sampling period. When the process owner wishes to validate the estimates of learning time and cost to execute learning time, this manager will find sampling useful. Each process output has its own frequency of firing and corresponding amount of process knowledge executed.

Each output employs a specific amount of knowledge that should be weighted according to the number of times the core process fires. Amount of process knowledge and learning time must be associated directly with the products and services produced by the execution of that knowledge. Sampling will provide statistical averages for each product or service line for an aggregated view of the subprocess and core process performances.

Once the learning time knowledge for each subprocess has been established, the next step is to take a sample of the number of times this subprocess is executed or fired during a sample period. A sample period for the order-fulfillment process was established so that it would be long enough to capture at least ten (or enough to achieve statistically reliable results that depend on the variability of the sample) core process firings per type of telephone service. The average case was used for this example of the seven-step method.

Historical data may be used to estimate the number of core-process firings per hour, day, week, or month.

The sample period took place over one month and revealed a relatively stable cost-per-firing of subprocess-learning time knowledge. An activity-based costing (ABC) of the core process was conducted that revealed the cost-per-activity within the subprocesses. However, the simple data-gathering technique used to capture the cost to fire the subprocess took less effort than the ABC approach and more directly matched cost to value produced. An order was not deemed complete until all its entries were correct, which often required rework. This rework activity was reflected in the greater cost to execute the process knowledge. Costs due to appraisal and prevention were reflected in the extended time taken to execute the subprocesses in order to gain a correct order. In this way, it was possible to drive the analysis down to the level of the cost to execute a particular piece of knowledge.

The sampling period also provided a distribution of the prices per different types of telephone service. With the advent of competitive pricing and much greater fluctuations in prices, it became important for future analyses not to rely on historical data but rather to collect new sample data.

7. Step Five: Sum the Learning Time and Process Instructions

1. Sum the total amount of learning time knowledge for each process to obtain the top half of the return ratio.

A. If the rough-cut method is used, this step should already have been completed in Step Three. If there was a sampling period, the learning times for each subprocess over the sample period would be aggregated in an arithmetic sum.

B. The process analyst or individual workers should, when possible, track the number of times a given process fires in the sample period. Workers must keep specific time records pertaining to the time devoted to a particular subprocess output. A simple score sheet can be utilized for employee self-recording or for analyst recording. This allows for an accurate recording of the amount of learning-time knowledge utilized and the amount of time (i.e., cost) required to execute the knowledge during the sample period.

C. Employees may work on multiple subprocesses nearly simultaneously for different core processes. The recording sheets must take this into account. With some processes, it is best to create a case file to record each firing of the core and its sub processes. For processes that have rapid firings, an observer must record the process firings.

D. In the case of multiple outputs from the same core process, the ROK and ROP for each output may be calculated using the seven steps uniformly. Only the learning times that are related to each given product may be used.

2. Sum the total number of process instructions over the sample period.

   A. Calculate the product of the number of firings by the number of instructions for each subprocess and then assess the sum of those products. Divide the products associated with each subprocess by this sum to obtain their percentage scores for backward allocation purposes.

   B. This can also be accomplished by taking the number of instructions for each sub process and multiplying it by the number of times this subprocess fires over the sample period.

   C. Automate this instruction by setting up counters for the completion of each core process output, along with its subprocess outputs. Some workflow software (e.g., Intelligent System's Process Edge™ Toll Set) is particularly amenable to this instruction, as it can capture transaction data at a subprocess level. However, if this possibility does not exist, an observer or the process workers must gather the data. Simple spreadsheets can be set up to provide a rolling tally of the number of process instructions produced on a routine basis during the overall sample period. These subsamples are most likely provided on an hourly or daily basis for processes that fire frequently during these time periods.

Step Five should be a relatively straightforward instruction if the proper recording methods are used. Based on experience to date, this recording activity should become routine and efficient quickly, even with large-volume processes.

Step Five: Example

The number of times the subprocesses fired during the sample period was multiplied by the amount of learning time for each subprocess. This resulted in the aggregate score for each subprocess.

The learning time for each subprocess was used to allocate revenue proportionately for different telephone-service types during the period. Only the learning times of the subprocesses that fired for the given type of telephone service were used.

The actual time consumed in collecting and counting the data represented about fifteen minutes per day using simple spreadsheets and manual counting from the data collection-time sheets.

8. Step Six: Calculate Process Cost

1. There are many different ways to capture cost. However, it is important to match the output or value of the process with the cost to generate it.

   A. Cost is primarily a function of how long it takes to execute process knowledge. By keeping careful time records, it is relatively simple to match the time it takes to execute process knowledge to the output of that knowledge in the subprocess. This is particularly true when the case approach is used and careful records are kept that track the time devoted to generating subprocess outputs for each core process firing. Each core process firing represents a case, and the case records are contained within each case folder.

   B. Be careful not to use traditional cost estimates that are not tied to knowledge and process instruction-execution times. These estimates generally aggregate costs based on generally accepted accounting practices or other cost-based methods (e.g., activity-based costing) that use nominal categories. The advantage of KVA is that it enables a link between the cost (or process investment) to generate value and the actual unit of value generated. Ultimately, KVA makes it possible to determine the ratio of value to investment cost or return-based measurement down to the single unit of output level.

C. Decisions must be made to determine which costs should be included in the process cost. For example, it may be appropriate to load the cost of management and infrastructure (e.g., training, machinery, IT, utilities, capital amortization) and process-worker salary into the cost subprocess. Remember that all costs were present during the execution of the processes and ultimately must be accounted for in some way. It might be useful, however, to attempt to isolate just those costs that pertain to the creation of the process outputs in your initial estimates. All other costs should be examined in terms of what subprocess outputs they support.

The cost question is complicated by 500 years of cost accounting and its derivatives. Most process owners know intuitively that some subprocesses add more value than others, but they have been given no means to measure the amount of value added. This is the reason that most analysts and process owners not familiar with this methodology tend to focus on the cost of processes, presuming that there is no objective way to measure value. A demonstration of how they may begin to focus objectively on value creation at the subprocess level may change their thinking.

Step Six: Example

Most businesspeople tend to focus exclusively on cost, expecting it to contain all of the information required to improve process performance. Process-execution duration was used to capture the cost to produce the subprocess outputs. Most of the cost of the process was tied up in the labor, as the network had been nearly fully amortized. Indeed, the legacy systems were so old that they, too, had been amortized. The only significant system costs represented the cost of real estate, utilities, and system maintenance.

For the purposes of the rough-cut method, loaded labor costs for the outputs of each subprocess were used. These estimates were derived from approximations of how long it took process employees to generate the outputs necessary to complete an order for telephone service. The salespeople take about three hours, on average, to make a sale. The loaded hourly wage for a salesperson was $35, which resulted in $105 per order. The order-generation technicians had varying labor rates and differing average times to generate a SORD order. The MLAC technician took about 45 minutes; the LFAC technician working together with the specialized common carrier (SCC) technician took about 40 minutes; the NAC technician took about 15 minutes; and the service representative took about 45 minutes. Totaled, these resulted in 145 minutes that, when multiplied by their labor rates, resulted in approximately $58 per order for the order-generation subprocess. It is interesting to note that the pressure was on to reduce the number of service representatives, because they represented the largest cost bubble in the labor force. But, as the actual results revealed, the service representative yielded the highest ROK of any of the subprocesses of the order-generation process. The installers' time per average order was 2 hours that, when multiplied by the hourly rate of $25, yielded a total of $50 per order. The billing subprocess was primarily completed by automated systems in which the billing administrator took only about 15 minutes per order or $7.50 per order when multiplied by the hourly rate of $30. The billing systems must be examined, as they had not been fully amortized as a result of some significant upgrading. If these costs had been factored in, the cost per order for the billing subprocess would have been closer to $7.50 for labor and $3 per order for the systems. The average cost per order for billing was really $10.50.

Based on cost estimates alone, it might may been concluded that the sales subprocess should be reengineered (downsized, with lower-paid salespeople) to reduce costs.

9. Step Seven: Calculate ROK and ROP

1. Given that the total amount of knowledge and process instructions have been summed in Step Five, it is now possible to backward allocate product or service value in proportion to where it was created in the core process.

    A. For the purposes of this explanation of the method, the average market price for a complex circuit was used as the estimate of revenue for the return calculations. The amount of knowledge and process instructions produced by each subprocess during the sample period represents its percentage of the total output of the process, although a single generic case was used for this example. Because this method is tautological (as are most accounting and auditing methods, beginning with a historical event such as the sale of the product or service), the sum of the knowledge and process instructions executed during the sample period is the total from which subprocess percentages can be easily derived.

    B. The percentage of the total knowledge and instructions for each subprocess represents its given percentage of the revenue generated during the sample period. The revenue is backward allocated based on this percentage. With the cost estimates based on Step Six, it is now possible to generate the return on this process investment cost.

C. By placing the backward allocated subprocess-revenue estimate over the cost to generate this percentage of the revenue, the return on investment in this use of knowledge (ROK) and process (ROP) may be calculated.

It is possible to provide an order-of-magnitude estimate of the return, based solely on the ratio of cost to amount of knowledge and process instructions executed during the sample period. In some cases, measuring all of the subprocess outputs of a company may be difficult. However, the methodology establishes that, by definition, the process under review has contributed to some percentage of the total revenue generated by the company. It is the order of magnitude of knowledge per cost ratios among the subprocesses that serves the analyst in making judgments about which subprocesses are under-performing and are therefore candidates for elimination or reengineering.

Step Seven: Example

The ROK for each sub-process was as follows:

- sales subprocess ROK = $187.50 (or 25 percent of the value generated by the average telephone service) divided by process execution cost of $105 = 1.8

- order-generation subprocess ROK = $337.50 (or 45 percent) divided by process execution cost of $58 = 5.8

- installation subprocess ROK = $142 (or 19 percent) divided by process execution cost of $50 = 2.85

- billing subprocess ROK = $82.50 (or 11 percent) divided by process execution cost of $10.50 = 7.86 (see *Table 5*).

Table 5. ROKs for XYZ Case KVA

Subprocess	Formal LT	OTJ	IT	Total	Percent	Revenue	Cost	ROK
sales	120	160		280	25.00	$187.50	$105.00	1.79
order generation	160	240	100	500	45.00	337.50	58.00	5.82
billing	40	40	40	120	11.00	82.50	10.50	7.86
installation	40	160	10	210	19.00	142.50	50.00	2.85
total				1,110	100.00	750.00		

Table 6. Costs Per Order

Cost for Executing the Knowledge	Duration	Loaded Rate	Per Order
sales	3	$35.00	$105.00
order generation	145	$24.00	$58.00
billing	15	$30.00	$10.50
installation	2	$25.oo	$50.00

10. Summary and Conclusion

This rough-cut analysis indicated that the sales and installation subprocesses were not performing as well as the other two processes. At first glance, it may seem counterintuitive to argue that the sales subprocess was not performing well compared to the others, as most executives place a high value on the sales subprocess. This is because this activity is presumed to be the easiest to associate with the revenue generated. While this may be true, several questions come to mind:

- Has the amount of knowledge required to be a salesperson been accurately represented?
- Is the sales force used efficiently?
- Are salespeople overpaid for the value they create?
- Is there another way to accomplish the sales subprocess output that would lead to a better ROK? Should the sales process knowledge be managed in a new way?
- If there is no other way to accomplish the sales subprocess output, what can be done to raise the ROK of this subprocess? Should the company simply move on to improve other subprocesses?

The ROK figures do not automatically dictate a course of action for a change effort. They serve as indicators of the relative performance of the subprocesses from a value-added perspective. The creative mind of the analyst must still produce a plan to improve the process, given the numerous complexities of a process within the context of the entire corporation, its strategic goals, competitive pressures, etc. Using workflow-modeling tools will greatly simplify the process of finding the best return on knowledge, process (ROK/ROP) among a group of potential process designs. Unlike existing methods, KVA with workflow modeling will provide an objective means of comparing process alternatives in terms of value as well as the cost to obtain that value.

Self-Test

1. The ________ of the ROP ratio is the cost to execute the process knowledge.

    a. numerator

    b. denominator

2. The amount of knowledge embedded in a process can be represented as _______________.

    a. the amount of time necessary for an average person to learn how to complete the process correctly

    b. the process instructions required to generate the process output successfully

    c. both of the above

    d. none of the above

3. The number of times the knowledge is executed is the ___________, while the time needed to learn the knowledge is the __________.

    a. cost; value

    b. value; cost

4. Knowledge should only be counted when in use.

    a. true

    b. false

5. How many steps are involved in KVA methodology?

    a. five

    b. six

    c. seven

    d. eight

6. Steps ____________ are the most important for completing a KVA prior to modeling improvements in business processes.

    a. One and Two

b. Three and Four

c. Five and Six

d. Seven and Eight

7. The rough-cut knowledge audit still requires a sampling period.

    a. true

    b. false

8. To obtain the top half of the return ratio, one must sum the total amount of learning-time knowledge for the sample period.

    a. true

    b. false

9. To capture cost, it is important to match the output of the process with the cost to generate it.

    a. true

    b. false

10. Once the first step in the KVA process (identify compound process and component processes), the next step is to _______________________.

    a. calculate learning time to execute each component process

    b. identify a common unit of learning time, process instruction

    c. allocate revenue to each component process

    d. calculate the cost to execute each component process

Correct Answers

1. The ________ of the ROP ratio is the cost to execute the process knowledge.

    a. numerator

    b. denominator

    See Topic 1.

2. The amount of knowledge embedded in a process can be represented as _______________.

    a. the amount of time necessary for an average person to learn how to complete the process correctly

    b. the process instructions required to generate the process output successfully

    c. both of the above

    d. none of the above

    See Topic 1.

3. The number of times the knowledge is executed is the ___________, while the time needed to learn the knowledge is the ___________.

    a. cost; value

    b. value; cost

    See Topic 1.

4. Knowledge should only be counted when in use.

    a. true

    b. false

    See Topic 1.

5. How many steps are involved in KVA methodology?

    a. five

    b. six

    c. seven

    d. eight

    See Topic 1.

6. Steps ____________ are the most important for completing a KVA prior to modeling improvements in business processes.

    a. One and Two

b. Three and Four

c. Five and Six

d. Seven and Eight

See Topic 4.

7. The rough-cut knowledge audit still requires a sampling period.

a. true

b. false

See Topic 6.

8. To obtain the top half of the return ratio, one must sum the total amount of learning-time knowledge for the sample period.

a. true

b. false

See Topic 7.

9. To capture cost, it is important to match the output of the process with the cost to generate it.

a. true

b. false

See Topic 8.

10. Once the first step in the KVA process (identify compound process and component processes), the next step is to _______________________.

a. calculate learning time to execute each component process

b. identify a common unit of learning time, process instruction

c. allocate revenue to each component process

d. calculate the cost to execute each component process

See Topic 4.

Glossary

ABC
activity-based costing

BPR
business process reengineering

CESP
Construction Engineering and Support Process

IT
information technology

KVA
knowledge value-added

ROI
return on investment

ROK
return on knowledge

ROP
return on process

SCC
specialized common carrier

SME
subject matter expert