

Figure 1

BASICS OF COMPETENCY MODELING

Competency modeling came out of the human resource management (HRM) world. It is not our intention to describe all the HRM methods and models in depth; there are other sources for that. For example, this article refers frequently to the Society of Human Resource Management glossary [15]. Our purpose is to help cost engineers understand the basics of competency modeling and provide some references and examples, so they can better work with management and their human resource departments to develop and apply models.

Lepsinger and Lucia provide a good definition of competency models: “a descriptive tool that identifies the skills, knowledge, personal characteristics, and behaviors needed to effectively perform a role in the organization and help the business meet its strategic objectives [11]. Their definition suggests that for best performance a model not only identify the skills and knowledge needed for a job, but define the expected levels of performance. It goes further to suggest that the model tie skills and knowledge to organizational roles, and tie everything back to business objectives and strategies.

However, most companies stop at just listing skills and or duties for given jobs; they only ask, “What does this person or position have to do?” Their purpose is to just hire folks like always and get on with the work. For that, all they need is a job posting; to fill a hole on the roster. That approach does not get things done any better, faster or at lower cost than before-but, in a downsizing world, managers rationalize that “its not my job to worry about that” or “I don't have time for anything more.” Of course, when business is expecting better results, it's easy to see the wrong-headedness of the rationalization.

So how can you move beyond job postings? Figure 1 illustrates a path from simple job postings and status quo performance to robust competency and career development and improved performance and effectiveness. The basic job posting only describes

the nature of the work, the duties and responsibilities it entails, and basic skills, e.g. must be able to perform risk analyses, and employee characteristics e.g. education level, desired. Unless the job posting is derived from a competency model, it does not usually consider how the job or posting's contents tie to overall business objectives, organization needs, beyond the project at hand, or career paths that may be associated with this job. The posting is usually developed as-needed to fill a position.

The job posting can be improved by adding some performance expectations, more definitive skills and knowledge requirements, and some consideration of how the job fits in the specific organization. This enhanced document is sometimes called a job description. Job descriptions are often developed as standing reference sources from which an organization can more easily develop job postings as needed. It can also serve as a rudimentary basis of employee performance assessments. The skills and knowledge requirements are generally more definitive than a job posting, e.g. must be able to perform Monte Carlo analysis in support of risk analysis. However, like job postings, unless a job description is derived from a competency model, it does not usually consider how the contents tie to overall business objectives, organizational needs for the rest of the company, or career paths that may be associated with this job.

A few take the extra effort at the job description stage to identify and prioritize core competencies. The Society for Human Resource Management (SHRM) defines personal core competencies as those “which employees must possess in order to successfully perform job functions that are essential to business operations” [15]. The authors suggest also adding “and business objectives.” CII defines organizational core competencies as those for which the market cannot “provide it in an effective and/or reliable way” [2]. However, to truly understand what is core to the business, companies must use a more robust “organizational development” (OD) approach to develop competency and career models.

SHRM defines the OD process as “a planned organization-wide effort to improve and increase the organization's effectiveness, productivity, return on investment and overall employee job satisfaction through planned interventions in the organization's processes” [15]. Few companies take this final step to developing competency and career development models. The word development is key. Development considers the concept of skills and knowledge maturity or progress towards business objectives in alignment with the culture and environment as indicated in figure 1.

Models often describe the competency maturity or progress path in discrete levels or steps that are often called a technical ladder. Most companies recognize four or five steps with headings such as the following:

1. Basic or entry,
2. Intermediate or junior,
3. Advanced or senior,
4. Master, expert or principle.

A competency development model is often illustrated as a table with the basic skills and competencies (core and non-core) listed in the first column, and the levels of performance across the top. In each intersecting cell of the table, the expected perform-

ance of the given skill at the given level, e.g. levels 1 though 4 is described. The description needs to have enough information for a person's performance to be objectively assessed. Examples of such a table are provided later in this paper.

Once a model is created, the organization has all the information needed to readily create job descriptions and job postings as needed, with assurance that the job posting meets business requirements as well as specific job requirements.

Closely related to competency development is career development. This is defined by SHRM as “the process by which individuals establish their current and future career objectives and assess their existing skills, knowledge or experience levels and implement an appropriate course of action to attain their desired career objectives” [15]. A career development model facilitates this process by providing pre-defined career paths or ladders which SHRM defines as “the progression of jobs in an organization's specific occupational fields ranked from lowest to highest in the hierarchal structure” [15]. Alternate career paths are usually available for employees to consider.

A mistake some companies make is to have just one combined supervision and technical career ladder for a given area of expertise. At these companies, the top step of that single ladder will say supervisor or manager rather than expert or master. If this is the only path, the result will be a lack of technical expertise. Experts will either leave the company for more rewarding work, or worse, accept promotion to the proverbial level of incompetence, i.e. many technical experts make poor supervisors. The best approach is to design parallel or branched supervision and technical paths. Technical experts should receive better compensation than their supervisors if it is consistent with their relative contributions to business objectives.

Along with the organizational and competency development process, enlightened companies will also have a performance management process. SHRM defines this as “the process of maintaining or improving employee job performance through the use of performance assessment tools, coaching and counseling as well as providing continuous feedback” [15]. Competency development models support this by identifying expected levels of performance. The process usually includes the expectation that higher performing employees will contribute to performance improvement by coaching, mentoring and/or helping train the lower performers.

CONSIDER THE EMPLOYMENT AND COMPETENCY MARKET

A weakness the authors find at some owner companies is a failure to align their competency or career development models with the external employment market. For example, we have seen several companies start off on the wrong foot in developing a new cost estimating department by aligning the cost estimator ladder (and compensation) with the accounting ladder. A little bit of market research (e.g., a call to AACE or discussion with their contractors) would have shown them how different the jobs, compensation and other characteristics of these fields are.

Another example of poor external alignment is failing to address the mobile workforce. An analysis by the Clearinghouse on Adult, Career, and Vocational Education (ACVE), states that “job mobility in the U.S. work force has become the standard employment pattern in today's workplace” with the Bureau of Labor Statistics reporting that 10 percent of the work force changes jobs every year [4]. For better or worse, loyalty to the company cannot be counted on to retain staff. The ACVE article goes on to conclude that “ the dynamics of the changing workplace demand continued skill development, self-reliance and resilience, and lifelong learning.” What this means is that your competency modeling efforts will be unsuccessful if candidates or staff view your models as being out of sync with the market, e.g., job descriptions that no other company would recognize, have poor learning opportunities, e.g. only internal training on how to use proprietary company methods, or don't support or encourage employee involvement in professional organizations like AACE.

Finally, owner companies have failed to align their organizational competencies with the competencies of their contractors. This is where organizational development methods such as CII's owner/contractor work structure (OCWS) can help [2].

SOME REFERENCES AND STANDARDS

Hopefully you now have some idea of the purpose, definition and use of competency and career development models. However, if you have not developed one before, it helps to have some industry examples to use. It is also useful to understand what the external employment market's expectations are.

A prime example of an industry competency model is the National Occupational Standards for Project Control developed by the Engineering Construction Industry Training Board (ECITB) of the United Kingdom and endorsed by the Association of Cost Engineers (ACostE) [7]. This 109-page model is very broad, including 51 separate units of competence covering both basic skills and core competencies as shown in table 1. Cost estimating is included in this standard. However, the coverage could be considered fairly shallow, with its scope stopping at high level of outline. For example, Unit 24 “Prepare Project Cost Estimates”

Table 1

Units of Competence Groups	Number of Units Included
Using Technical Skills	9
Working with People and Managing Yourself	10
Developing the Project	10
Project Implementation	20
Closing Out the Project	2

Table 2

Basic Skills	Core Competencies
Quantification/Measurement	Strategic Planning
Communication Skills	Budgetary Process
Personal and Interpersonal Skills	Cost Estimating
Business and Management Skills	Cost Planning
Professional Practice	General Procurement Advice
Computer and Information Technology	Documentation (Bills of Quantities)
Construction Technology	Tendering Process
Construction Law and Regulation	Account Management
	Construction Change Management
	Feasibility Studies

is just over one page in length, and does not explicitly list any particular methods of preparing or validating estimates. However, the overall outline is a good one for users to consider.

Another industry example is the Pacific Association of Quantity Surveyors' (PAQS) "Standards for Quantity Surveyors or Construction Economists." This standard provides the basis for competency evaluations of quantity surveyors or construction economists in many countries of the Asia-Pacific [14]. As shown in table 2, the standard includes eight basic skills and ten core competencies" of the profession.

This standard could also be considered somewhat shallow. For example, the cost estimating unit has only 4 sub-elements and

does not include any specific methodologies. But once again, the overall outline is a good one for users to consider.

AACE International has just updated its recommended practice 11R-88, "Required Skills and Knowledge of Cost Engineering" [1]. This model is unique in that it is organized in alignment with AACE's Total Cost Management (TCM) Framework [9]. The Framework is an annotated process map that shows how each of the skills and knowledge areas of cost engineering are applied over the life cycle of assets and projects. It also includes a section on people and performance management that introduces the topics covered by this paper.

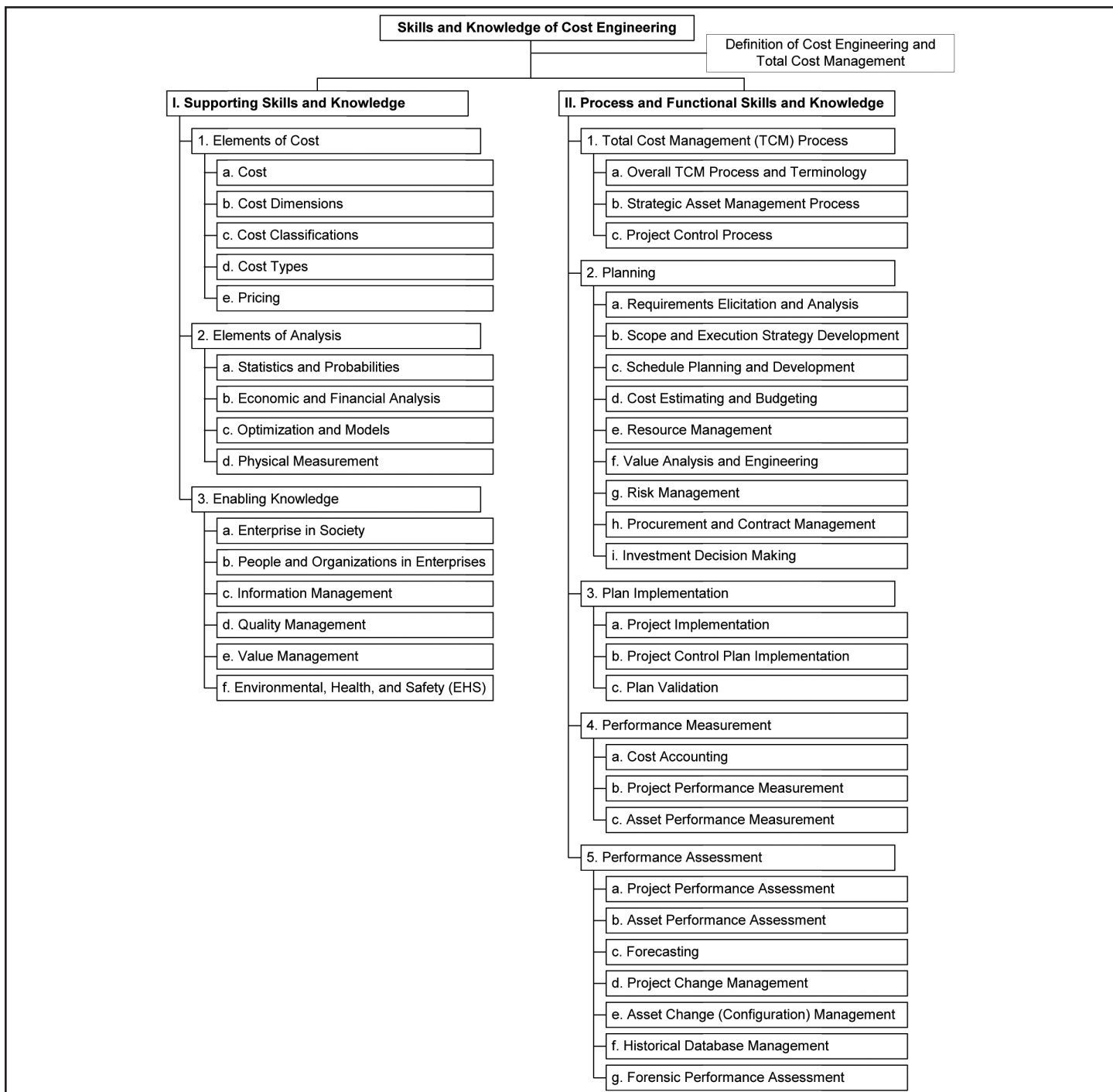


Figure 2

By reviewing the Framework and 11R-88 together, one can better understand how each competency is related to the others. This is important, because the competency model for one function usually includes some non-core competencies from related functions. Another useful aspect of 11R-88 is that for cost estimating and most other functions, it generally includes more specific methodologies than the ECITB and PAQS models. Figure 2 illustrates the content of 11R-88. The International Cost Engineering Council (ICEC) is another source that has links to other references and examples. ICEC's website includes a list of "Worldwide Educational and Competency Standards in Cost Engineering, Quantity Surveying, and Project Management" [10].

AN EXAMPLE COMPETENCY/CAREER MODEL FOR COST ESTIMATORS

Having presented the concepts and some reference sources, this section describes a specific example of a competency or career development model for a cost estimator. Table 3 shows the types of skills and competencies that might be expected of a cost estimator. The example list of skills is reasonably generic, but would be modified depending on the company, industry, region, and so on. This example is derived from an actual competency model. However, the actual model is much more detailed, including more specific skills under most of the headings shown. The skills in this example are reasonably aligned with the external AACE 11R-88 recommended practice.

The business objectives of the company were considered in the development of the example model, particularly at the lower levels of detail (not shown). This model was an outgrowth of the effort to organize an estimating department for a process industry owner company. That effort was described in another AACE paper that includes more information on organizational development related to the competency modeling [6].

Table 3, which was described previously, illustrated the competency model's first column which lists the skills. Table 4 shows an example of the expected levels of performance, the top row of the competency model, for one of the basic skills, in this case, writing. The performance expectation descriptions in the table have enough information so that the employee and manager can objectively assess whether the level of performance has been achieved. The levels of performance coincide with the four step career ladder for the organization's estimators.

Finally, table 5 provides an example of how the model can be used as a performance assessment tool. In the example, each skill

Table 4

Competency	Performance Level			
	Junior	Intermediate	Advanced	Senior
<p>Writing Develop clear, concise, and presentable reports and documents that meet customer specific needs</p>	<p>Prepares basic estimate basis memos, reports, etc. Needs some assistance.</p>	<p>Develops non-standard reports for special studies with occasional assistance.</p>	<p>Proficiently develops any report, user manual, study, paper, etc. as needed.</p>	<p>Expert writer, may be published in professional publications.</p>

Table 3

GENERAL CAPABILITIES	
Education and Training (list degrees, certifications, other courses and training, etc.)	
Communication Skills (list writing/reports, presentation, listening, etc.)	
Planning, Organizing, Delegating	
Resourcefulness and Follow-Through	
Decision Making	
Initiative, Volunteering, and Self Development	
Teamwork and Relationships	
Quality, Follow Procedures, Support Change, Accuracy	
Leadership, Role Model, Mentoring, Training	
GENERAL ESTIMATING SKILLS AND KNOWLEDGE	
Estimating Process	
Engineering Document Reading	
Quantification / Take-off from Engineering Documents	
Estimate Basis Memorandum / Scope Definition	
Execution Strategies	
Work Breakdown Structure (WBS)	
Account Coding	
Obtaining / Using Cost Data and Vendor quotes	
Extensions / Adjustments	
Risk Factor Assessment and Contingency	
PROJECT CONTROLS KNOWLEDGE	
General Project Controls Knowledge	
Cost Control, Budgets and Forecasts	
Planning / Scheduling Requirements	
Progressing, Earned Value	
Change Management	
ESTIMATING METHODOLOGY SKILLS AND KNOWLEDGE	
Data Analysis & Benchmarking	
Labor Productivity Analysis	
Database Line Item Development and Organization	
Normalization (inflation, metallurgy, location, etc.)	
Historical Data Analysis, Benchmarking, Estimate Validation	
Strategic and Conceptual Estimating	
General Factors and Ratios	
Algorithms (list equipment factored, capacity factored, modeling, unit, line-item, etc.)	
Adjustment of Database Line Items (database as reference)	
Creating and Using Assemblies and Frequencies	
COMPUTERS AND SOFTWARE SKILLS	
General Use Software and Hardware Skills (list various programs used)	
Company Software Skills (list various programs used)	
Estimating Software Skills (list various programs used)	
Hardware Skills (list as appropriate)	
DISCIPLINE AND TRADE KNOWLEDGE	
List appropriate disciplines, trades and phases	
INDUSTRIAL PROCESS KNOWLEDGE	
List appropriate WBS areas/units to appropriate level of breakdown	
COST COMPONENT KNOWLEDGE	
List appropriate cost components to appropriate level of breakdown	

is weighted for its contribution to business objectives, i.e. core versus non-core with core being greater weight. The performance rating of the employee can be entered for each skill and a weighted performance can be calculated. In actual use, this would be done for the complete competency model including all the skills listed in table 3.

By having a model such as this, everyone involved knows ahead of time what the expectations are, how they are weighted, and how performance will be assessed. During assessments, management must review personnel performance in light of what is driving or constraining it. If skills need to be improved, focused

Table 5

Competency	Weight	Performance Rating	Weighted Score
Labor Productivity Analysis	5	2	10
Database Line Item Development and Organization	5	3	15
Normalization (inflation, metallurgy, location, etc.)	5	3	15
Historical Data, Benchmarking, Estimate Validation	20	4	80
Strategic and Conceptual Estimating	20	4	80
General Factors and Ratios	10	4	40
Algorithm	20	5	100
Adjustment of Database Line Items	5	4	20
Creating and Using Assemblies and Frequencies	10	4	40
Subtotal	100		400
Weighted Score (5=far exceed expectations, 1=far below expectations)			4.0

training can be planned. If motivation or confidence is an issue, compensation, coaching, or mentoring alternatives might be considered. If performance is constrained by processes, bureaucracy, working conditions, and so on, these factors must be considered in further process and organizational development. In general, the process should improve the satisfaction of the employee with their job and career prospects, while also improving organizational effectiveness. Unfortunately, in the short run, most companies don't have the staff to plan and carry out all these developments. As was mentioned, consultants and retired staff will likely need to be called in to help. Use these resources to also build internal competency in process and organizational development so you won't be dependent on their services forever.

We hope you can see how competency and career development models can help companies improve organization effectiveness and employee job satisfaction. We also hope we provided enough examples and references so that you can start to improve your own models, or at least communicate better with your human resources staff. However, be aware that this paper just scratches the surface of the topic. For more perspective on the topic of competency and maturity in cost engineering, and a good list of references, the papers by Greg Skulmoski are recommended [16,17]. Ginger Levin and Parviz Rad also provide a good overview of project management organizational development or maturity [12]. Using the information and tools presented in this paper and other reference sources, you can improve your organizational effectiveness by dovetailing your process development or re-engineering efforts with competency development.

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