How To Build Competent People

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During the late 1970s and early 1980s, people were joining the industry faster than they could be brought up to speed effectively. As a result, performance declined. To prevent repeating history, the oil industry needs to do a much better job of developing competency quickly and reliably. Just how does one begin to do this? Fortunately, with one small exception, competency management is identical in theory to quality management—the difference is in what you measure. Quality management measures a physical quality (e.g., pipe dimensions and strength), while competency management measures and controls not some physical property but rather the ability of a person to perform an activity. The trick is how to measure someone's skill.

Quality management begins by creating specific operational definitions that describe what something is and how it is measured. Competency management follows a similar path by specifically defining how competent someone is at a skill. This means that competency management starts with a complete definition of the skills necessary to perform specific tasks necessary for success. What gets measured gets managed; if you cannot measure competency, then you cannot manage it.

But how do you measure competence? **Fig. 1** shows a small example of how it is possible (Brett et al. 2006). The figure is a small section of a Reservoir Engineering Competency Map. Such competency maps allow the skills of a particular individual to be quantitatively analyzed. The map lists all of the skills necessary for reservoir engineering (there are 134 of them) and defines the competency for each skill in one of four levels: Awareness, Basic Application, Skilled Application, and Mastery. The idea is to describe measurable levels of competency required for a job. If skill definitions are comprehensive enough, it is possible to describe job roles and an individual's capabilities in sufficient detail to effectively manage what is needed for a job and instruct employees on what skills they should master.

One important caveat is that it is easy to underestimate the amount of time required to create an inventory (with competency levels) of all the skills required for a given E&P discipline. Another issue is that as technology changes, it is necessary to update competency maps to reflect those changes.

THE COMPETENCY MANAGEMENT WHEEL

Once you have a competency map, managing competencies becomes straightforward—it might not be easy, but it is certainly not conceptually difficult. **Fig. 2** outlines an approach to managing technical competencies (Diggins et al. 2003; Waterfall et al. 2006).

This article, the second of two, describes how competency-based development could help the oil and gas industry survive the big crew change. The first article described the possible cost to the industry from this demographic shift—the equivalent of up to 20% of total industry E&P expenditures, or more than USD 35 billion per year (Brett 2007).

SKILL	AWARENESS	BASIC APPLICATION	SKILLED APPLICATION	MASTERY
Determination of Original Volumes in Place and Making Reservoir Performance Predictions	Describe the parameters required in order to perform a material balance and understand the limitations inherent in a material balance analysis.	Conduct quality control on data used in a material balance to ensure the most accurate solution possible with existing data. Calculate an average reservoir pressure.	Troubleshoot material balance analyses due to suspect data, incorrect assumptions, or unusual depletion behavior.	Perform material balance estimates for communicating reservoirs or reservoirs with variable fluid properties or partially undersaturated conditions.
	Describe the use of material balance techniques for calculating original-oil-in-place (OOIP).	Use material balance techniques to determine OOIP for black-oil-depletion drive reservoirs.	Apply the material balance equation for estimates of water influx, gas cap expansion, and oil zone gas saturation.	Use the material balance in combination with another relevant equation, such as water influx and well productivity, to analyze historical performance and predict future performance.
	Describe the use of material balance techniques for calculating original-gas-in-place (OGIP)	Use material balance techniques to determine OGIP for depletion-drive gas reservoirs.	Evaluate heterogeneous reservoirs that might include abnormal formation compressibility and reservoir compartments	Use a modified material balance expression that recognizes gas expansion in portions of the formation invaded by water as part of a waterdrive analysis.
	Describe the use of material balance to simultaneously determine in-place volumes, gas cap size, and aquifer characteristics.	Use material balance to simultaneously determine in-place volumes, gas cap size, and aquifer characteristics.	Evaluate material balance using available computer software.	Use material balance as a diagnostic tool in resolving reservoir description. Develop methods of solving for multiple unknowns using the principals of material balance.
	Describe how material balance can be used as part of reservoir predictions.	Use material balance as part of reservoir predictions. Understand uncertainties in material balance calculations caused by uncertainties in data and limitation of the method.	Integrate material balance analysis with nodal analysis to forecast future production performance and to optimize number of wells, types of completions, surface facility requirements, and pipeline capacity.	Use the material balance in combination with other relevant equations, such as water influx and well productivity, to analyze historical performance and predict future performance.

Fig. 1—Example of a portion of the reservoir engineering competency map.

At 10 o'clock on the wheel, the process starts by creating a tailored functional competency map. Managers create by consensus the tailored map by selecting the skills necessary from comprehensive competency maps. The tailored map is a list of only those skills needed for a specific role, and may include specific local requirements. In some organizations using this approach, job functions are fairly nonspecific (e.g., Level II drilling engineer), while in other organizations they are specific for each job role (e.g., Northern Division Senior Gas Production Engineer).

In a tailored functional competency map, for each job family (e.g., reservoir engineering), the applicable generic competency maps are selected and then used as a guide to create a set of skills necessary for that family. For example, a reservoir engineer needs at least some competencies from the petrophysics, geophysics, geology, production, and drilling competency maps in addition to the reservoir engineering competency map. Of course, some of these skills will need only an "awareness" or "basic application" level of competency. A reservoir engineer does not likely need to be skilled in the drilling competency of primary cement design, but he does need to at least be aware of, and possibly be able to perform, some basic application of this skill.

With a tailored competency map defined for key job roles as a foundation, individuals then can inventory competency levels for each skill. This activity could be accomplished on paper, although the number of individuals and skills at an organization may require a software tool for practicality. The idea is to allow individuals to create skill inventories and skill gaps, and then the employee and a supervisor/mentor can have a productive discussion about those competencies, room for improvement, and opportunities for future job roles. Competency inventory tools allow development activities to be linked to specific skills. That way, individuals can readily see the development options that exist (both formal training and work experience) and how they may be used to close the competency gap.

Development plans should include not only courses, but appropriate job assignments and work experiences. **Fig. 3** shows how a work experience inventory can be linked to a specific competency, which leads to creating specific and actionable development plans.

DIFFERENT APPROACHES

While most organizations implementing a competency management approach use something similar to the wheel in Fig. 2, there may be some important differences. These differences center on the software tool used, the number of different job roles with formal competency definitions, and the approach to ensure competencies. The key features of each of these differences follow.

Different tools to inventory competencies. The tools that organizations use to inventory competencies vary from custom versions to any of a number of competency-assessment tools. Each tool has pros and cons associated with price, user friendliness, features, reporting, and ability to be maintained. Serious consideration should be given to the pros and cons of each tool because competency management, while intellectually quite easy, does require a software tool for viability in practice. Our firm's experience, based on more than 16,000 personnel skill inventories, tells us that particular focus should be placed on user friendliness, so that people can easily use the system, and on reporting, so that information can be used to create personal development plans.

Number of job roles with definitions. Most organizations with formal competency management programs use one of two basic approaches when choosing the number of job roles with formal competency definitions: either the "two-level" approach or the "job position" approach. In the two-level approach, organizations define two levels for each job role (drilling engineer, petrophysicist, etc.). An E&P organization may have 10 to 20 such broad job roles. Then, for each of these roles, they define two competency levels. The purpose of the first-level competency definition is to ensure a common foundation of competencies and perhaps be used as a criterion for first promotion. The second level aims to ensure proficiency in the application for specific roles.

The two-level approach has the advantage of being much easier and quicker to implement and maintain. It requires significantly less ongoing staff work to assess personnel because formal assessment comes in frequently at one of the two levels, not for every possible job. It also can be organizationally easier to implement because a consensus can develop more easily around the definition of two levels than one definition for each job.

In the job-grade approach, detailed competency definitions for each job and pay grade ensure that competencies are a specific part of every promotion discussion and, if properly done and implemented, that each person will have the competencies required for each job role. The job-grade approach requires about five times the work to implement and maintain. The basic question is: Does the improved performance with more specific job definitions offset the added costs of using this approach?

Approaches to assurance. Organizations implementing a competency management approach generally have one of four approaches to competency assurance: Self-Assessment, Supervisor Validation, Formalized Review, or Formal Testing. The self-assessment approach relies on individuals to complete their own competency inventory and then use it for development planning. Organizations using this approach rely on the normal performance evaluation process to evaluate capability and use the competency system as a development aid. They often allow individuals to attend training courses only if they

have a self-identified competency gap. This approach is the easiest to implement, and it has the advantage of individuals buying into their own assessment and normally becoming motivated to close any identified competency gap. The disadvantages are that individuals may not be qualified to assess their own competence, there are often organizational forces inducing them to overstate their competence, and organizations using this approach help individual development by describing in specific terms what competencies are required for specific roles but cannot consistently ensure competencies.

Supervisor validation is an approach whereby the supervisor reviews and validates an individual's competency and skill inventory. This provides some assurance of the competency inventories and facilitates detailed development discussions between the employee and his supervisor. Disadvantages to this approach include the added time for a supervisor to review and approve the competency inventories, and supervisors are sometimes not qualified to assess the competency of their employees. For example, an asset team leader might not be qualified to assess the competency of the drilling engineer reporting to him. There also may be variations among supervisors on how they assess individuals. This means there will likely be variability in the definition of just exactly what a Level 2 reservoir engineer, for example, can do.

The formalized review approach is similar to the supervisor validation approach in that humans assure the validity of an individual's inventory. The difference is that instead of the employee's direct supervisor assuring competency, one or more specially trained formal reviewers conduct the assessment. This creates more consistent assurance, at an added cost. The primary difficulty with this approach is the time required to ensure the competency, both on the part of the reviewers and the time the employee spends collecting information to document competence.

Finally, the formal testing approach uses exams to ensure that an individual's competency inventory is accurate. An assessment needs to be developed for each skill and competency level and then used to verify individual competencies. Such exams take typically at least half a day and maybe a full day. This approach, if complemented by appropriate work experience inventories, has the advantages of being transparent, easy to administer, and, if properly done, quite accurate. This approach is not really viable when using the job-grade approach because of the number of tests required for each specific job. Also, if not extended to include some kind of assessment of work experience, formal testing can sometimes prove to ensure only the knowledge, or cognitive, component of competency, and not behavioral/motivational aspects. For example, it is possible for someone to pass a well-control test and yet be a poor drilling engineer. Formal testing needs to have an added work-experience dimension to be effective.

The purpose of this article was to survey possible approaches to accelerating competency development. The specific approach an organization should

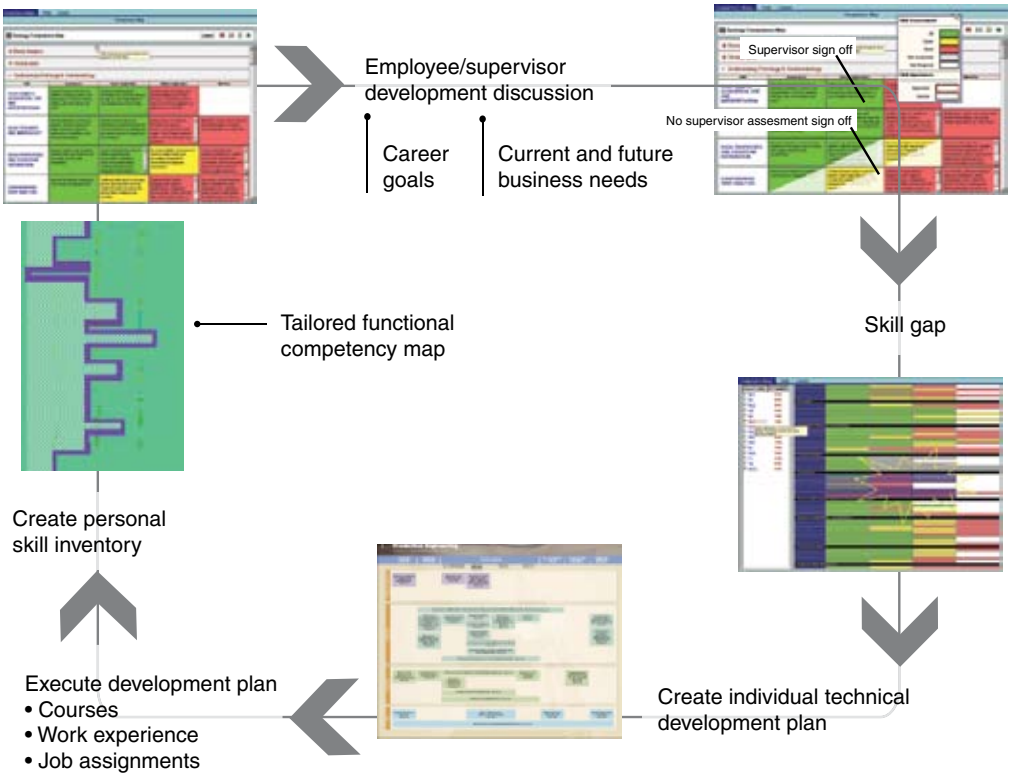

Fig. 2—An approach to managing technical competency.

EXAMPLE WORK EXPERIENCE INVENTORY					
Task	**Task Objectives For**	**Task Comments**	**Date**	**Initials**	**Witness**
	Reservoir Properties, Tubing Strings and Lift Mechanisms, Wellhead Equipment And Flow Control Devices, Surface Facilities	Use this area to make task notes for each line item activity and to document specific or unique aspects of each task	Date task completed	Initials task completed	Initials mentor/ approving authority for each task
	Reservoir Properties				
1	Obtain formation porosity values from well openhole logs and compare core sample microscopic views of porosity in a core laboratory.				
2	Perform several oil OOIP and gas OGIP volumetric calculations, identifying each equation variable, its source, also specifying proper units.				
3	Visit a pressure, volume, temperature laboratory and observe how phase diagrams for several reservoir fluids are derived, witness fluid property determination laboratory procedures.				
4	Write a one-page report for reference outlining the five major types of reservoir producing drive mechanisms, highlight the relatively efficiency of each.				
5	Witness several oilwell surveys designed to determine flowing bottomhole pressure and temperature. Document all data.				

Fig. 3—An example of a work-experience inventory.

implement depends on factors such as the number of people to be developed, the turnover rate, the need for a transparent criteria, the cost of incompetence, and the cost of assurance. No matter what the specific approach, though, the basic point of these two articles is that demographics mean that competency management will be financially beneficial in the near future. Tools and techniques allow organizations to proactively develop personnel with the skills necessary to perform to any specified level, and these tools can reduce the time required to develop competency. If the industry does not proactively work to reduce time to competency—by defining the skills needed and deliberately working to develop those skills—it is likely to repeat history and end up paying a big price for learning the hard way.

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