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# Project Maturity and Competence Interface

Greg Skulmoski

## ABSTRACT:

*The recent surge of ideas surrounding organizational project management maturity and project management competency are reviewed in this article. A generally held belief is that if both competency and maturity are improved, then the likelihood of project success is also improved. To this end, some authors recommend that certain models become the basis for international certification. However, some of these models are incomplete, flawed or downplay the importance of cost engineering principles. The author presents a competency and maturity framework with which to assess certification programs. The multipurpose framework is also applied to project human resource management to show the interface between maturity and competency from a cost engineering perspective.*

**KEY WORDS:** Competence, maturity, project management, certification, human resources, contingency theory.

Project management is an evolving discipline where its participants are increasingly interested in the maturity of the project organization and the competency of its project managers [13, 21, 28, 34]. Many have related project management competence to project management effectiveness [11, 22, 26, 29]. As well, the maturity of an organization's project management capability is also reported to relate to project success [16, 39, 41]. There have surfaced numerous models of organizational project management maturity and competence. However, few have explicitly linked the two concepts. Francis T. Hartman and Greg Skulmoski [23], and J. Davidson Frame [18] are notable exceptions. Some authors have suggested that certain maturity and competence models might be robust enough to become the global standard for certification purposes [50]. Organizational project management maturity and competence seem to be promising constructs related to successful projects.

Maturity and competence as they relate to projects are described in this article. A preliminary framework is then presented that incorporates project management competence and organizational project management maturity, mediated by contin-

gency variables. Finally, applying the framework to project team selection is explained. Understanding the interrelationships between competency and maturity will better position project participants to contribute to the ever-evolving standards and certification movements in their own professional organizations, and to improve the critical interface between competency and maturity in their own projects.

## ORGANIZATIONAL PROJECT MANAGEMENT MATURITY

Isabelle Saures [41] describes organizational project management maturity as the organization's receptivity to project management. Francis T. Hartman and Greg Skulmoski [23] expand upon maturity to include the notion that the organization permits its project managers to do what is needed to successfully manage their projects. Organizations that embark on improving their organizational project management maturity by following some maturity model benefit by improved project performance, enhanced marketing opportunities and a structured path to improvement [41]. But exactly how do organizations foster project management? A common

approach that organizations employ to facilitate the management of its projects is by institutionalizing its project management processes, assessing their maturity and making incremental improvements [31]. Other methods that facilitate maturity are through training, mentoring and supporting project management. But which project management processes and other initiatives should an organization encourage thereby increasing the probability of project success? This is just one of many questions about project management maturity that has not been conclusively answered.

## Organizational Project Management Maturity and the PMBOK® Guide

Greg Skulmoski and John Schlichter [46] identified some of the extant organizational project management maturity models that have been introduced to the project management community. The many organizational project management maturity models can be placed on a continuum regarding how tightly they incorporate the Guide to the Project Management Body of Knowledge (PMBOK®). Some models, such as those referenced by Anita Fincher and Ginger Levin [16]; and William Ibbs and Young Hoon Kwak [25] tightly incorporate the project management processes detailed in the PMBOK® Guide using the Capability Maturity Model (CMM) framework. Many of those interested in project management maturity have been influenced by the applicability of the Software Engineering Institute's (SEI) CMM to the project environment [16, 20]. The CMM was developed by the Software Engineering Institute to help organizations better build and maintain software by evolving through a staged approach. The CMM allows an organization to judge their software processes and identify those which require improvement (SEI 2000). Other organizational project management maturity models use the PMBOK® Guide as a starting point to develop project management maturity but go well beyond the PMBOK® Guide in both depth and breadth of project management [23]. Finally, there are other project management maturity models that are not explicitly inter-linked with the PMBOK® Guide [39, 41].

What many of these models have in common is the prominence project management processes takes on, along with skills and knowledge. The SMART project management-based maturity model has integrated project management processes into its framework, and it also takes a more harmonized and comprehensive approach to project management maturity to include, among many other factors, the competency of the project team [23]. The hypothesis underlying many of these project management maturity models is that improved project performance is more likely if the organization is more mature with respect to its project management processes, rather than less mature. With the exception of William Ibbs and Young Hoon Kwak [25], organizational project management maturity has not been empirically related to organizational performance. The study of project management maturity is in its infancy.

### Certification

Few organizational project management maturity certification programs exist. Organizations can become certified in the PRINCE 2 method, which signifies the organization's maturity in project management. Some suggest that PRINCE 2 is evolving into the international de facto standard for project management [50]. The Software Engineering Institute also has a certification program for those organizations interested in formal methods of improving their software development using the capability maturity model. Some organizational project management maturity models incorporate a CMM-influenced staged progression of maturity and assessment. Research is currently under way to develop a certification program for organizational project management maturity similar to the one from Software Engineering Institute. The Project Management Institute (PMI) is currently developing the organizational project management maturity model (OPM3) and subsequent certification program [37]. However, even the most mature organizations will not achieve project objectives unless its people are competent. Because it is the people who perform project work, there is considerable interest in project management competency.

## PROJECT PARTICIPANT COMPETENCE

Competencies are commonly considered by organizations and others to help guide human resource management decisions. Many definitions of competence exist [2, 13, 17, 30]. J. Davidson Frame describes competence as consistently producing the desired results [18]. A competency can also be considered a group of related knowledge, skills, and attitudes that influences performance [35]. Frederick L. Ayer and William R. Duncan (1998) expand the definition of competency to refer to a specific, observable behavior or characteristic that leads to superior performance [5]. There is a strong tradition of behavior-based competency research by David McClelland [32], Richard Boyatzis [8], and Lyle Spencer Jr. and Signe Spencer [47] that adds to the concept of competency by including the individual's motives, traits, and one's self-image or social role.

Skills and knowledge form the foundation of competence. Project management theory and techniques can be learned in many ways, such as formal training and education, or by studying books like the **AACE International's Certification Study Guide** or PMI's **PMBOK® Guide**. Certification from either of these organizations demonstrates that the candidate has acquired specific knowledge and skills related to cost engineering and project management respectively. An example of a skill may be the ability to determine the critical path(s) in a network and knowledge that it is possible for a schedule to have multiple critical paths. There is a rich tradition of recognizing the importance of cost engineering and project management skills in the AACE International literature [6, 9, 24, 27, 30, 42]. F.T. Edum-Fotwe and R. McCaffer recommend broadening one's skill base beyond technical skills to include project management skills [15]. While skills and knowledge form the foundation of competency, other soft competencies (e.g. traits, motives, self image and social role) are also a part of competence.

A trait is a characteristic way in which a person responds to a set of stimuli [8]. People who believe they have control over their future have the efficacy trait. In projects, when these people encounter a problem, they take the initiative to discover solutions. They do not wait for someone else to fix the problem or expect luck to

take care of it. Intuitively, the efficacy trait is desirable for project participants; but do we consider this competency when we form project teams? Motives are another type of competency. Motives drive people's behavior [8]. For example, people who are motivated to improve or compete against a standard have the achievement motive. When people with a high achievement motive are given measurable objectives in the project setting, they are more likely to work to achieve the objectives. Do our project team members have a high achievement motive? Another dimension of competency is a person's self-image [8]. Self-image refers to a person's perception of himself or herself. A positive self-image of one's capability will likely help a person work on a novel project even though the person has not previously performed the assigned tasks. Finally, social role is a person's perception of the social norms and behaviors that are acceptable to the group or organizations to which he or she belongs. Professionalism, punctuality for meetings, and preparedness are all behaviors that may be important norms of a particular project team.

Competence is not only multidimensional, but also its focus and philosophical underpinnings can also be divergent. Sarah Blackburn delineates competence into two movements: behavior and standards schools. Both schools differ in their focus, purpose and orientation. Those in the competency school focus on the individual and superior performance. Their aim is to predict competent behavior. On the other hand, the standards school focuses on the job and on minimum levels of competency [7]. Criteria are set for accreditation or certification purposes. The AACE International certification process is an example of a standards-based competency approach.

### Certification

Harold Mooz and Kevin Forsberg identified 16 professional organizations that are concerned with project management [33]. Many of these professional organizations offer competency certification programs. The purpose of any professional certification program is to provide recognition of the capabilities of an individual in a professional area. One glaring omission from the Mooz and Forsberg 1998 list is that the AACE International certification program was not included. Mooz has since recog-

nized this oversight. The AACE International is a good example of a professional organization that has a well-established certification program. Certification from AACE International “indicates demonstrable expertise in the most current skills and knowledge . . . of cost engineering” [1]. The Project Management Institute also has a project management certification program [38]. The Association for Project Management is a UK based organization dedicated to the advancement of the project management discipline that also certifies project managers[3]. Another certification program is the Australian National Competency Standards for Project Management. Project participants can become certified at one of three levels of project management competence [4]. Project management competence is a global concern where many professional organizations certify their members. One issue that has been investigated but not been thoroughly addressed is which competencies most contribute to project success [44, 45]?

### COMPETENCE AND MATURITY

To date, few models incorporate both organizational project management maturity and project management competence. The SMART project management-based maturity model incorporates both maturity and competence [21, 23]. However, this model is in its infancy and is being further developed through the research program at the University of Calgary. For now, how can one easily assess both project management competence and maturity? One way to understand and assess competence and maturity is to use a well understood framework: inputs - processes - outputs (IPO).

### Project Management Competence and Maturity: Inputs - Processes - Outputs

Sometimes making sense of a complex world is made easier using familiar frameworks. Examining the multidimensionality of competence in terms of inputs, processes, and outputs, facilitates understanding project management competence and maturity. The IPO framework has also been used to forecast personnel requirements of traditional organizations [10, 12, 17] examine competence from an IPO perspective. One can assess the project man-

agement competence of others or one’s self by using the IPO competencies framework.

Input competencies are extremely varied and include knowledge, skills, traits, motives, self-image, social role, and behaviors. These are the competencies (inputs) a project participant brings to a project. Selecting the appropriate competencies for the project is facilitated by project classification [43].

Process competencies have been extensively examined in project management literature. Many have commented on the nature and use of particular processes which contribute to project success [19, 49, 50]. Some of the processes that contribute to project success are described in **AACE International’s Certification Study Guide** and PMI’s **PMBOK®Guide**. Examples of project management processes include planning, controlling, and closing a project [50].

Output competencies make up the final dimension of the IPO competencies framework. Marc Sattler and Gary Neights call for performance-based project management competencies but do not provide assessment metrics [40]. Perhaps the most developed output-based competency standards are those developed by the Australian Institute of Project Management [4]. These standards contain, among other elements, performance criteria which specify outcomes that demonstrate competent performance. A partial list of performance criteria for time management is presented in table 1 [4]. The assessor then determines whether there is evidence the candidate displays or has displayed the required performance-based competencies.

For example, the candidate would be required to prove that he or she involved the appropriate stakeholders to develop the

project schedule. The focus is on performance rather than on the acquisition of knowledge or the ability to follow a project management process. Performance-based competence is promising but lacks empirical support. That is, we do not know which performance-based project management competencies contribute most to project success. Thomas Lechler has concluded that project activities such as planning and control have a relatively small influence on project outcomes when compared with the human side of project management [29]. More work is required to better understand performance-based project management competencies.

Using the IPO competencies framework, one can examine a competence model to better understand its strengths and weaknesses. The AACE International certification program is primarily input based: skills and knowledge. One can conclude that a Certified Cost Engineer has a basic understanding of cost engineering skills and knowledge. However, one can not safely conclude that the same Certified Cost Engineer can effectively create a workable project schedule. To create such a schedule is an output competency resulting from applying knowledge (critical path method) to some process (scheduling). This is why astute managers not only look for certification, but also examine work experience and references. Therefore, for a competency certification program to be considered comprehensive, one should assess it from at least three perspectives: inputs, processes, and outputs.

Table 1—AIPM Manage Time: Performance Criteria

Manage Time	
Element	Performance Criteria
Develop Project Schedules	The duration and effort, sequence and dependencies of tasks are determined from the output of scope definition and with input from appropriate stakeholders, as the basis for the project schedule.
Manage Project Schedules	Ongoing analysis is conducted to identify and forecast variances and trends and to develop responses to achieve project objectives.

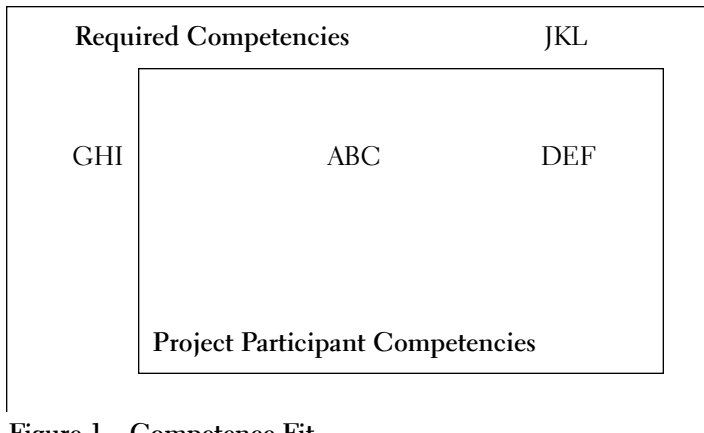


Figure 1—Competence Fit

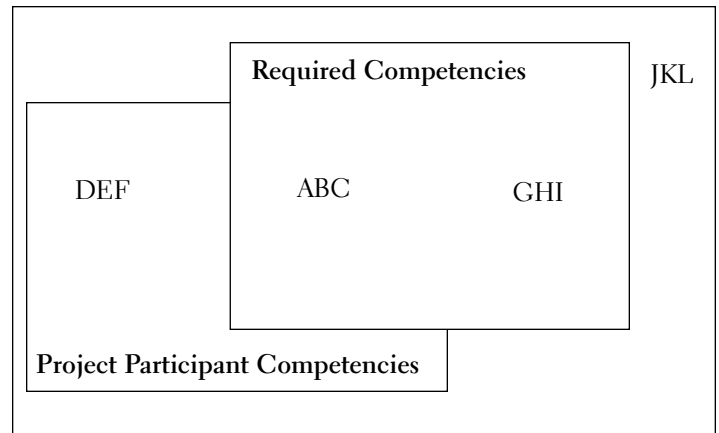


Figure 2—Competence Deficit

### COMPETENCE FIT

While there are many benefits to be gained from understanding project participant competence, one benefit is its use in project staffing. Staffing a project with the right human resources is critical to project success [18, 29, 51]. With a healthy fit between the competency demands of the project and those supplied by the project participants, success is more likely. With a poor fit, or competency deficit, then the project will likely face many struggles.

A healthy competency fit is displayed in figure 1. Here, as indicated by a set of competencies ABC, there is a substantial fit between the competencies required to successfully complete the project, and the competencies supplied by the participants. For example, sophisticated estimating, scheduling and resource leveling techniques ABC may be required which the project team members are able to perform. The DEF competencies set represents competencies not required to complete the project, yet are possessed by the participants. An example of one of these might be the project participants' ability to

effectively work in a strategic alliance. Competencies DEF are situated to the right to indicate these are cutting edge or may be required in the future by an organization or project. Competencies JKL may be required by the organization for some future project and are not currently possessed by the project participants. Should either the participant or the organization fail to obtain competencies JKL, then they risk reducing their capacity to compete in similar projects in the future. A competency required in the future by both the participant and the organization might be next year's "hot" computer programming language. The project has unfilled competencies represented by the competencies set GHI. Perhaps an improved understanding of risk using Monte Carlo simulations might facilitate project success, but the project participants currently lack this skill. Competencies GHI are situated to the left, which indicates they are of a lesser importance than ABC. The ratio of ABC to GHI competencies is an indication of competency fit. This project does not have a perfect competency fit since it is unlikely that there will be an exact match between all the competencies required by the

project for success and those competencies possessed by its project participants.

A competency deficit is illustrated in figure 2. Once again the set of competencies ABC (e.g. parametric estimating and CPM scheduling) are required to improve the likelihood of achieving project success and the project team possess this competency set. Competencies GHI (e.g. Monte Carlo simulations) would be useful in the project, but the project participants do not possess these competencies. The ratio of ABC to GHI competencies in figure 2 indicates there is a competence deficit. Too large a competence deficit and the project is likely to fail. DEF represents a competency set the project participants have but is not required by the project (e.g. slide rule skills). These competencies are situated to the left to indicate they are superfluous to successfully complete the project. These project participants have a poor mix of required and not required competencies. Competencies JKL (e.g. a new programming language) are neither held by the project participants nor required to complete the project. Thus, there are degrees of competency fit and a deficit for projects.

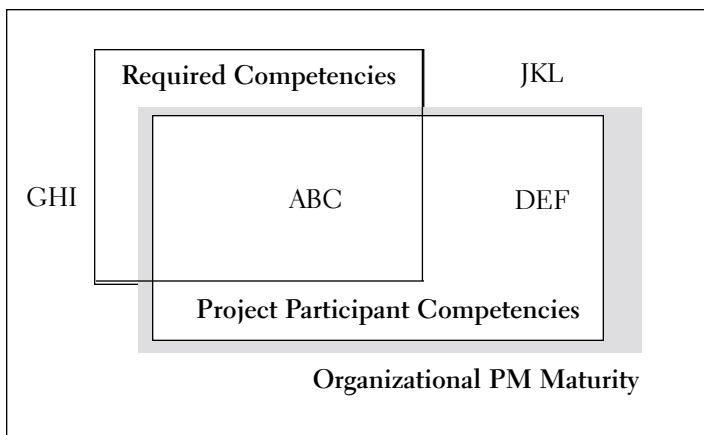


Figure 3—Maturity and Competence Fit

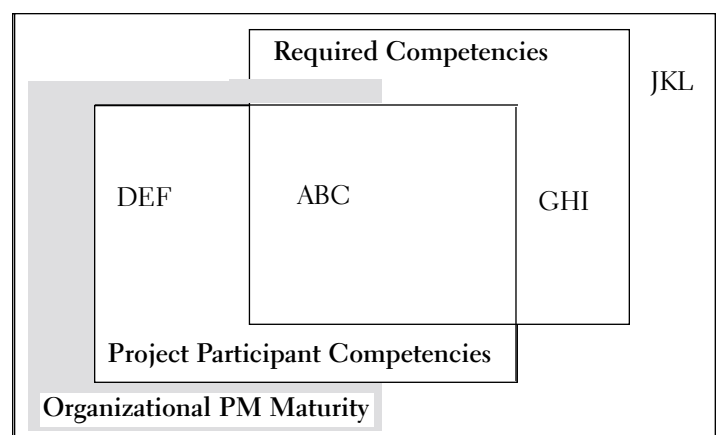


Figure 4—Maturity Misfit and Competence Deficit

## MATURITY FIT

Not only is project participant competence fit highly desirable, the maturity of the project organization and contributing organizations need to facilitate, rather than hinder the project management processes and project success. An organizational project management maturity fit occurs when the organization functions in ways that support the project participants (figure 3). That is, the organization allows its participants to do the things they need to do in order to deliver a successful project. The participants are not constrained by organizational or project policies that may hamper project success. Here, the organization will allow the project participants to do more than is necessary to successfully complete the project. For example, the organization might allow the participants to use an external mediator should a dispute arise. However, these particular project participants are not well-versed in dispute resolution and might not realize the benefits of using a mediator early in a dispute. Thus, the organization will allow project participants to do more than they might realize. A competence fit is also illustrated in figure 3 between the available project participant competencies and the competencies required to successfully complete the project.

On the other hand, it is possible to have a situation where the organization inhibits its participants from doing what is necessary to deliver a successful project (figure 4). In this situation, project participants may be inhibited from using best practice techniques to complete their assigned tasks and a misfit results between the project and

the organization. The organization may have policies and procedures that are counter-productive to the manner in which the project is desired to be conducted. An organizational project management maturity and competence misfit might occur if a project participant wishes to use range estimates (pessimistic and outrageous) for the budget and schedule, but is not allowed by the organization which demands single point estimates. Here, we have a misfit because the project participant has the ability to provide information rich estimates, but the organization's policies will not permit such estimates. One result is that a competency deficit is shown in figure 4. Project success in these deficit circumstances may be elusive. Thus, it is desirable to have a fit between the maturity of the organization with respect to its project management policies and practices, and the competence of its project participants. A misfit occurs if either a competence deficit and/or the organization hinders project success.

## INTEGRATED PROJECT MANAGEMENT COMPETENCE AND MATURITY FRAMEWORK

It is possible to combine the many dimensions of competence and maturity into one framework, the integrated project management competence and maturity framework (figure 5). At the core of the framework is the IPO competence framework. Competence is mediated by organizational project management maturity. Even though a project participant possesses

a particular competence, it may not be put to effective use if the organization inhibits it. Therefore, a organizational project management maturity and competence misfit occurs. Project participants and senior managers need to be cognizant of this critical interface.

A third dimension is added to this framework, contingency variables. Contingency variables are factors (e.g. relative project size, external environment, project/organizational culture, technical complexity, project uniqueness, etc.) that may affect the competencies most likely to have the greatest influence on successful outcomes [14] and affect the organizational project management maturity. For example, the successful completion of a public sector civil engineering project may require a different mix of competencies and organizational maturity than a similar project in the private sector. The public sector project may require certain political skills that are not as important in the private sector. To date, very little rigorous research has been conducted to understand and classify projects, and the interplay of contingency variables. Therefore, we do not know which competencies are most important for certain types of projects given the organizational project management maturity and mediating contingency variables.

### One Size Does Not Fit All

Project management competence and maturity, mediated by contingency variables now can be examined in one integrated project management competence and maturity framework. This framework may be applied in different ways to facilitate discussion and understanding. For example, some writers have suggested that PRINCE 2, may become the de facto global standard [50]. Since PRINCE 2 is a process and theory-based project management model, and lacks performance-based output metrics, it may not receive global acceptance as the one project management model to be embraced. Indeed, Harold Mooz and Kevin Forsberg [33] point out that project management is not a process, but a family of intersecting models. That is, no one model of project management competence and maturity is likely to be suitable for all contexts. For example, if a project manager was able to follow the processes and use the tools contained in the PMBOK® Guide for a large software

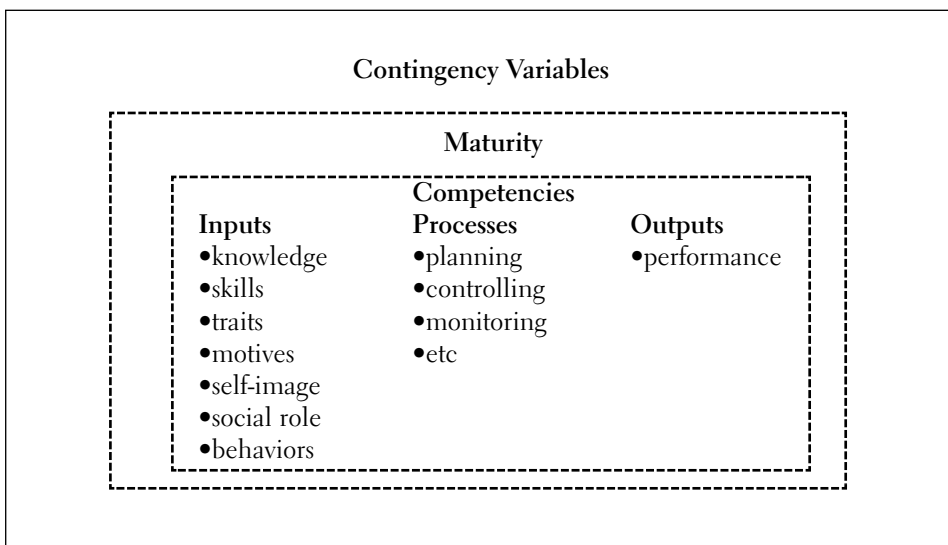


Figure 5—Integrated PM Competence and Maturity Framework

development project, that project might not be as successful as one where an equally competent project manager and team used the processes detailed in the capability maturity models that have been specially formulated for software development. Research has not been undertaken to determine which models and elements contribute most to project success.

### Project Human Resource Assessment

Understanding project management competence is important in job evaluations, staff development, recruitment and selection, professional registration, training needs analysis and planning, job descriptions, assessment and appraisal exercises [4]. The integrated project management competence and maturity framework can be used to assess one's own competencies and those of others. Some suggest that certification, such as the PMP from the Project Management Institute, does not guarantee project success [40]. Perhaps stated another way, a broad balance of input, process and output competencies is desirable. What is not known is which competencies are highly correlated with project success. However, a project participant does not need to acquire all competencies. Frederick L. Ayer and William R. Duncan [5] suggest that one may be missing some competencies and still be considered competent. Competency balance and alignment with both contingency variables and organizational project management maturity are ideal state conditions. Achieving competency is not an end to be achieved, rather a road to be traveled. To be effective, one needs to continually develop new competencies in an environment that is continually changing. The integrated project management competence and maturity framework can help a project participant to focus their development efforts to achieve balance.

The very nature of projects involves project participants coming together for a fixed period of time. When their duties are completed, the participants usually leave the project. The integrated project management competence and maturity framework can help industry clarify which competency elements are required by the project so that there is a competency fit

between the competencies required to successfully deliver the project and the competencies possessed by potential project participants. Professional associations might also benefit by examining professional development, standards development, and certification through a different lens called the integrated project management competence and maturity framework. Sometimes one gets a new and useful perspective when one looks at something familiar from a new perspective. More research is required to determine which competencies contribute most to project success. Specifically, we need to determine which input competencies (knowledge, skills, traits, motives, self-image, social role, and behaviors), project management processes, and which performance-based competencies contribute most to project success. Also, project participants need to achieve balance among the many dimensions of competence.

Professional organizations, such as AACE International are continuously changing with the times. One of the challenges they face is other professional organizations or advocates of models claiming that their models should form the basis for widespread certification. This is to say that, only if one has their certification, then shall they be considered competent or mature. To date there has not been a single project management framework that encompasses all the related dimensions and elements of competency and maturity. The integrated project management competence and maturity framework can clarify what type of competence is being certified by any given certifying body. AACE International and its members are well acquainted with various models based on inputs-processes-outputs. They have specialized and critical skills, knowledge, processes and standards that contribute to project success. AACE International and its members can play an important role and contribute to the development of competence and organizational project management maturity, and certification programs.

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