

Professional Development Ladder

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Construx developed its Professional Development Ladder to address several challenges facing Construx specifically and the software industry generally, including insufficient knowledge transfer of industry best practices and undefined career paths for software engineers. Construx's professional development ladder supports increased productivity and capabilities of individuals and teams. A well-defined professional development path supports knowledge transfer of existing industry and organizational best practices to technical employees. The professional development ladder establishes a common vocabulary across an organization and builds a common base of knowledge and skills. The professional ladder provides guidance and support for career advancement for all technical staff, whatever their focus.

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Overview of the Professional Development Ladder

The professional development ladder was designed to support career paths for a wide variety of technical employees within Construx including developers, testers, business analysts, project managers, architects, and other common industry positions. We strove to build a professional development program that provided direction and structure while still allowing the interests of individuals to guide their specific career paths.

Providing paths for career advancement in a wide number of areas required extensive coverage of software engineering knowledge areas and support for skill progression within each area. To this end, the professional development ladder is built upon a set of knowledge areas and capability levels within each area.

Construx Knowledge Areas

The Construx Knowledge Areas (CKAs) define the body of knowledge that technical employees should understand and be able to apply.

The CKAs are based on the IEEE's Software Engineering Body of Knowledge¹ (SWEBOK) knowledge areas and are outlined below.

- | | |
|----------------------------|--------------------------|
| ■ Configuration Management | ■ Construction |
| ■ Design | ■ Engineering Management |
| ■ Technology | ■ Process |
| ■ Maintenance | ■ Quality |
| ■ Requirements | ■ Testing |

We choose to base the ladder on the SWEBOK because SWEBOK is rapidly emerging as a standard for defining the software engineering body of knowledge.

¹ IEEE, *A Guide the Software Engineering Body of Knowledge (Trial Version 0.95)*, IEEE Computer Society Press, 2002, Available at: www.swebok.org

Each of these knowledge areas is described in more detail in Table 1.

Table 1 Construx Knowledge Areas (CKAs)

CKA	Description
Configuration Management	A discipline of defining how project artifacts are organized and stored, how changes to those artifacts are controlled and managed, and how the system is released to the customer.
Construction	The creation of software according to a specified design. The primary activity is creating code and configuration data to implement functionality using the selected languages, technologies, and environments.
Design	The bridge between requirements and construction, design defines the structure and dynamic state of the system at many levels of abstraction and through many views.
Engineering Management	All aspects of management ranging from business and personnel management issues to project management issues.
Tools and Methods	The use of tools, technology, methodologies, and techniques for software engineering.
Process	Activities related to measuring and improving software development quality, timeliness, efficiency, productivity, and other project and product characteristics.
Maintenance	Activities related to system installation, deployment, migration, and operation.
Quality	Activities performed on static artifacts associated with providing confidence that a software item conforms or will conform to technical requirements.
Requirements	The discovery, analysis, modeling, and documentation of the functions to be implemented in software.
Testing	Activities associated with executing software to detect defects and evaluate features.

Capability Levels

Within each CKA, Construx recognizes four levels of capability: Introductory, Competence, Leadership, and Mastery. These capability levels support the progression of knowledge and skills within each knowledge area. Each CKA outlines the specific activities—such as reading books, attending classes, obtaining professional experience—necessary to obtain each level of capability. Table 2 summarizes each of the capability levels.

Table 2 Summary of Capability Levels

Capability Level	Summary
Introductory	The employee performs or is capable of performing basic work in an area, generally under supervision. The employee is taking effective steps to develop his or her knowledge and skills.
Competence	The employee performs effective, independent work in an area, serves as a role model for less expert employees, and occasionally coaches others.
Leadership	The employee performs exemplary work in an area. The employee regularly coach employees and provides project-level and possibly company-wide leadership. The employee is recognized within Construx as a major resource in the knowledge area.
Mastery	The employee performs reference work in an area and has deep experience across multiple projects. The employee has generally taught seminars or classes or has written papers or books that extend the body of knowledge. The employee provides industry-level leadership and is recognized outside Construx for expertise in the area.

Construx believes that effectiveness depends on a combination of experience and knowledge. We believe that a person cannot truly possess leading-edge knowledge in an engineering discipline unless the knowledge is grounded in experience. Leading-edge experience is not possible unless it's fully apprised of state-of-the-art knowledge. Consequently, when there is a discrepancy between the levels of an employee's experience and knowledge, the overall capability of the employee is generally closer to the lesser of that employee's knowledge or experience. Figure 1 summarizes this concept.

		Experience			
		Introductory	Competence	Leadership	Mastery
Knowledge	Introductory	Introductory	Introductory	Competence	-
	Competence	Competence	Competence	Competence	-
	Leadership	Competence	Competence	Leadership	Mastery
	Mastery	-	-	Mastery	Mastery

Figure 1 Overall Capability as a Function of Knowledge and Experience

Professional Development Ladder Levels

Combining knowledge areas and capability levels allows us to build career ladder levels. Ladder levels provide the mechanism for advancement and promotion. A ladder-level promotion requires an engineer to obtain both additional breadth (more knowledge areas) and depth (deeper understanding within knowledge areas). It requires an increase in both knowledge and experience.

For historical reasons, our ladder levels go from 8 to 15. College graduates will generally start at Level 9 while experienced engineers may start at Level 10 or 11. Level 12 is considered full professional status at Construx. Many engineers within Construx will choose not to go beyond Level 12 as Levels 13-15 can only be achieved by making significant, innovative contributions both to Construx and to the field of software engineering.

Table 3 describes each of the ladder levels and outlines the requirements for entering each level.

Table 3 Ladder Level Requirements

Ladder Level	Description	CKAs Covered
Level 9	This person is beginning to learn the principles of software engineering and is generally just out of school. This person works under close supervision.	Not Applicable
Level 10	This person has some background in software engineering. This person is either recently out of school or has 1-2 years work experience. This person is capable of performing work with limited supervision.	Introductory in all CKAs Competence in 3 CKAs
Level 11	This person has a fairly strong background in software engineering and can work independently as necessary. This person has worked on one or more completed projects and has experience in each of the basic software development lifecycle steps needed to release a product.	Introductory in all CKAs Competence in 6 CKAs Leadership in 1 CKA
Level 12	This person has consistently had “wins” during his or her participation in all aspects of small and large projects and has been essential to those projects’ successes. This person has a track record of consistently rendering clear technical judgment and routinely considering project-level issues. This person is innovative, consistent, and contributes beyond the assigned tasks. This person generally provides technical guidance to or supervises others.	Introductory in all CKAs Competence in 8 CKAs Leadership in 3 CKAs

Ladder Level	Description	CKAs Covered
Level 13	<p>This person is a champion who can consider both internal and external aspects of a project and ensures they are handled correctly and with consistently sound judgment. This person takes total ownership for all aspects of his or her project and makes many unique contributions. This person's decisions have a significant impact on Construx's profitability and overall well being.</p>	<p>Introductory in all CKAs</p> <p>Competence in 8 CKAs</p> <p>Leadership in 5 CKAs</p> <p>Mastery in 1 CKA</p>
Level 14	<p>This person is a major technical resource to others in the company. This person consistently overcomes very difficult technical challenges, and makes key decisions on the goals and structure of Construx. This person is familiar to many working software engineers both inside and outside Construx for one or more specific contributions that have advanced the art and science of software engineering. This person's areas of capability extend beyond company-level issues to industry-level issues.</p> <p>Work at this level requires a career-long commitment to the field of software engineering, including significant work outside of the Construx workday.</p>	Intentionally Not Defined
Level 15	<p>This person is indispensable to Construx's success. This person consistently works to design and produce groundbreaking, world-class products. Working software engineers both within and outside Construx regard this person as a leader within the software engineering field. This person takes primary responsibility for defining corporate practices. This person contributes frequently to the industry in numerous and varied ways.</p> <p>Work at this level requires a career-long commitment to the field of software engineering, including significant work outside of the Construx workday, and requires a degree of industry recognition for accomplishments that is well beyond the person's direct control.</p>	Intentionally Not Defined

An Example of Ladder-Based Career Progression

The professional development ladder supports a variety of career paths by allowing technical staff members to select the knowledge areas they wish to focus on. This provides both flexibility and structure as each person may guide his or her specific career path but does so within the constraints established at Construx. For example, a developer might focus on Tools and Methods, Design, and Construction; a project manager might focus on Engineering Management, Process, and Requirements; and a quality engineer might focus on Quality, Process, and Testing.

As an example of career progression on Construx's professional development ladder, let's follow the progression of a technically-oriented engineer from Level 10 to Level 12. The target leadership areas for this engineer are Tools and Methods, Design, and Construction. For each level, the boxes in gray indicate the obtained capability level in each CKA. Figure 2 shows the requirements for the engineer to reach Level 10.

	CKA									
	Config Mgmt	Construction	Design	Management	Tools	Process	Maintenance	Quality	Requirements	Testing
Introductory										
Competence										
Leadership										

Figure 2 Sample Ladder Requirements to Reach Level 10

As Figure 3 illustrates, to reach Level 11, the engineer adds depth by achieving Leadership in Construction and breadth by obtaining capability in several other CKAs.

	CKA									
	Config Mgmt	Construction	Design	Management	Tools	Process	Maintenance	Quality	Requirements	Testing
Introductory										
Competence										

Leadership										
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Figure 3 Sample Ladder Requirements to Reach Level 11

As Figure 4 shows, to reach Level 12, the engineer achieves Leadership in Design and Tools and Methods and obtains capability in two additional CKAs.

	CKA									
	Config Mgmt	Construction	Design	Management	Tools	Process	Maintenance	Quality	Requirements	Testing
Introductory										
Competence										
Leadership										

Figure 4 Sample Ladder Requirements to Reach Level 12

An Example of Ladder Requirements

The professional development ladder contains a matrix of 3 capability levels and 10 knowledge areas, for a total of 30 unique capability areas. Within each capability area of the Capability/CKA matrix there is a set of specific activities, such as reading books, attending classes, and obtaining professional experience that must be completed. In total, the professional development ladder is comprised of approximately 350 specific requirements.

Let's look at the requirements for Introductory, Competence, and Leadership in Engineering Management. Table 4 shows the reading and work experience necessary to achieve Introductory capability in Engineering Management.

Table 4 Introductory Requirements in Engineering Management

Type of Activity	Activity
Reading	<i>Software Project Survival Guide</i> , Steve McConnell "They Write the Right Stuff", Charles Fishman "Software Engineering Code of Ethics and Professionalism", ACM/IEEE-CS

Type of Activity	Activity
Work Experience	Review a project plan
	Plan and track personal activities

As Table 5 illustrates, significantly more effort is required to achieve Competency capability in the Engineering Management area.

Table 5 Competency Requirements in Engineering Management

Type of Activity	Activity
Reading	<i>Rapid Development</i> , Steve McConnell
	<i>Collaboration Explained</i> , Jean Tabaka
	“No Silver Bullets--Essence and Accidents of Software Engineering,” Fred Brooks
	“Software’s Chronic Crisis,” Wayt Gibbs
	“Programmer Performance and the Effects of the Workplace,” DeMarco and Lister
Work Experience	Participate in the creation of a project estimate
	Act as reviewer on at least one project plan
	Assist with project management on at least one project
Seminars	Software Project Management Boot Camp
	Software Estimation in Depth

Moving from Competency to Leadership in a knowledge area is significantly more customized. Table 6 outlines the types of activities and level of effort required for this transition.

Table 6 Example of Leadership Requirements in Engineering Management

Type of Activity	Activity
Reading	Reading is customized at the Leadership level. The focus area and selection of specific books and articles are worked out with the mentor and outlined in the Professional Development Plan. In general, about 1,000 pages are required to move from competence to leadership in each CKA.

Type of Activity	Activity
Work Experience	<p>Act as a project manager for at least one significant project</p> <p>Create project plans for at least two significant projects</p> <p>Proficient in analogy estimation techniques</p> <p>Proficient in historical data collection techniques</p> <p>Proficient in project planning, tracking, and status reporting techniques</p>
Seminars	<p>10x Software Engineering</p> <p>Risk Management</p> <p>Scrum Boot Camp (optional)</p>
Professional Experience	<p>At the Leadership level, employees are expected to contribute significantly within Construx and potentially to the industry at large. Examples of the professional experience expected at this level include:</p> <ul style="list-style-type: none"> • Teaching Construx or university courses • Obtaining professional certifications such as Project Management Institute's Project Management Professional • Book manuscript review or article refereeing for magazines • Active mentoring and coaching of other Construx employees in the leadership area

Lessons Learned

Version 1.0 of the Professional Development Ladder was deployed within Construx and released publicly in 1998. Since then, we have continued to evolve the ladder, releasing Version 2.0 internally in early 2002. The ladder has been evolved since then as well as deployed at companies in the US and throughout the world. Over time, we learned a number of important lessons about deploying and supporting a professional development ladder.

Structural and Cultural Reinforcements

Structural and cultural reinforcements are critical to the success of the ladder. To succeed, the professional development ladder must become engrained in the culture of the organization. Numerous reinforcements are needed to ensure employee buy-in and achieve the desired benefits.

While adoption of the specific reinforcements used at Construx is not essential to deployment of a professional development ladder, it is important to deploy structural and cultural reinforcements that will work within a particular organization.

Construx's specific structural and cultural reinforcements include the following programs.

Mentoring Program

Mentoring is an important component of professional development at Construx Software. It tailors the Professional Development Ladder to provide a relevant and practical professional development plan for each employee.

Mentors provide guidance and support as an engineer progresses up the professional development ladder. Mentoring is driven via a Professional Development Plan. All Level 8-11 employees at Construx develop and discuss their Professional Development Plan with their mentors.

One of the goals of the mentor program is to produce professional engineers' dedicated and self-directed in further professional development. Achievement of Level 12 constitutes a significant milestone in an employee's career and brings them to this level. As such, employees at Level 12 and above do not have mentors unless they specifically request a mentor or wish to work towards an additional grade level promotion.

An active mentor program is critical to ensure the knowledge requirements are met by the employee. To support this, the employee and mentor have meetings about 6-8 times a year; more often when the employee is within 6 months of a grade level promotion.

Professional Development Plans

Professional Development Plans (PDPs) provide a mechanism to plan, track, and document an employee's progression along the ladder. Each Professional Development Plan outlines the short and long-term goals of the employee and describes the specific activities (reading, seminars, work experience, and other professional activities) that will occur between the current and next review cycle.

The goals of a PDP virtually always include a grade level promotion within a 1-5 year horizon. The plan outlines the work an engineer needs to accomplish in that timeframe to achieve the promotion. More than one year out, the final details of the work are not fully described, but a high level path is outlined. By the time an engineer is 1 year from a promotion, the details of the work are described month-by-month to manager, mentor, and employee. The PDPs support objective and consistent promotion criteria throughout Construx.

Active manager and mentor interaction is critical to ensure the progress and completion of activities in the Professional Development Plan. To support this, the division VP and mentor must both sign the employee's Professional Development Plan. Additionally,

mentor meetings track the employee's progress against the plan and, if appropriate, adjust expectations about the timing of a promotion.

Professional Development Plaques

Construx recognizes a wide variety of milestones that occur during an employee's professional development—grade level promotions, achievement of professional certifications, first leadership role on projects, first class taught, first paper published, and other significant accomplishments. Professional Development Plaques provide a way to commemorate these milestones and reflect the importance Construx places on ongoing professional development.

Training Program

Construx targets 10-12 days of focused training per work year, in addition to the on-the-job training that occurs inherently in software development work. At lower experience levels, focused training consists mainly of attending classes and conferences. At Level 12 and above, training can consist of preparing for conference presentations, participating in standards committees, organizing specific interest groups, and other professional activities.

Performance Review Program

One of the most significant lessons we learned is that you can't forget standard performance reviews. Even with a detailed professional development ladder, employees still want traditional feedback on their performance. The ladder provides some feedback, but it is not a substitute for traditional reviews. Construx uses twice-yearly reviews in which the manager and mentor participate as equals.

Software Engineering Discussion Groups

Software Engineering Discussion Groups (SEDG's) provide a forum to gain and share software engineering knowledge. They are moderated forums in which a book from the professional development ladder is discussed and debated. Levels 9, 10, and 11 have an SEDG. Level 12 engineers are encouraged to join the SEDGs as a way of sharing experience and knowledge with more junior engineers.

Level 12 Recognition

Attaining Level 12—full professional status at Construx—represents a significant achievement in a software engineer's career at Construx. In recognition of this achievement, Construx provides a bonus equal to one year's difference in salary from Level 11 to Level 12, a reception in honor of the promotion, an ad in a local business newspaper, and a portrait in our lobby. This recognition symbolizes the importance we place on professional development.

Assimilating Experienced Engineers into the Ladder

We found a need to accommodate new employees who gained their experience at other companies. A number of our job candidates have extensive industry experience but have not met some of our other ladder requirements. Hiring these employees at our Level 10 or Level 11 salaries would make our offers non-competitive. As a practical matter, we wouldn't be able to hire many senior engineers. It became important to determine how a new employee could be brought in at Level 12 without compromising the integrity of the ladder and without diminishing the achievements of Construx employees who have worked their way up the ladder while at Construx.

To support this, we created "Transition Level 12." A Transitional Level 12 engineer is hired as a Level 12 engineer and has one year to complete the missing elements of the ladder, typically extensive reading. During this year, the employee meets with a mentor monthly to discuss the work they have completed and to deal with any progress issues. When backfilling is complete, the employee is recognized as a Level 12 engineer.

Conclusions

The professional development ladder provides structured but flexible support for career development at Construx. It defines the breadth of knowledge, the depth of knowledge, and overall capabilities, we expect from our technical staff.

The professional development ladder was built as a 10x3 matrix of capability levels and knowledge areas to provide both structure and flexibility. By requiring capabilities across numerous knowledge areas, Construx ensures broad skills development. Through the flexible framework, technical staff can choose career paths well-matched to their interests.

The professional development ladder can be tailored to add or remove capability levels, knowledge areas, and specific ladder requirements. A set of specific career paths—developer, tester, project manager—can be defined on top of the professional development ladder to provide additional structure and guidance.

Adoption of a professional development ladder may be difficult, if not impossible, without cultural and structural support in the organization, but some of the key concepts can be deployed regardless.

Our capability requirements are probably more intensive than average due to our corporate mission of advancing the art and science of commercial software engineering. However, the ladder's structure provides a flexible basis for deploying similar ladders to a wide range of organizations, both large and small. While the details may vary widely for different organizations, the underlying ladder foundation provides a high degree of integrity in each case.

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About Construx

Construx Software is the market leader in software development best practices training and consulting. Construx was founded in 1996 by Steve McConnell, respected author and thought leader on software development best practices. Steve's books *Code Complete*, *Rapid Development*, and other titles are some of the most accessible books on software development with more than a million copies in print in 20 languages. Steve's passion for advancing the art and science of software engineering is shared by Construx's team of seasoned consultants. Their depth of knowledge and expertise has helped hundreds of companies solve their software challenges by identifying and adopting practices that have been proven to produce high quality software—faster, and with greater predictability. For more information about Construx's support for software development best practices, contact us at consulting@construx.com, or call us at +1(866) 296-6300.



SOFTWARE DEVELOPMENT BEST PRACTICES

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