

Career Pathing for Software Professionals

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Unlike in more established professions, career paths for software professionals have never been well defined.

Adopting and executing a well-defined software career path presents a significant opportunity. For individuals, career pathing supports enhancing their personal capabilities and advancing in their careers. For companies, career pathing allows for increasing staff capability and capacity over time without adding staff.

This white paper outlines Construx's mature career pathing program (Construx's Professional Development Ladder), which was first deployed in 1998. This program has been deployed at companies worldwide and has been regularly updated since then. It has been developed by leading software industry experts and is based on software industry standards.

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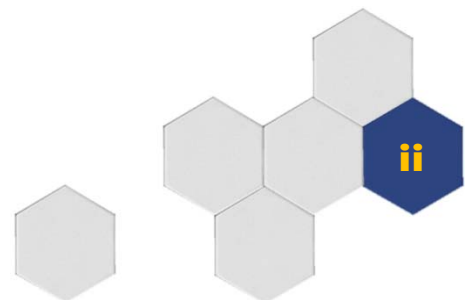
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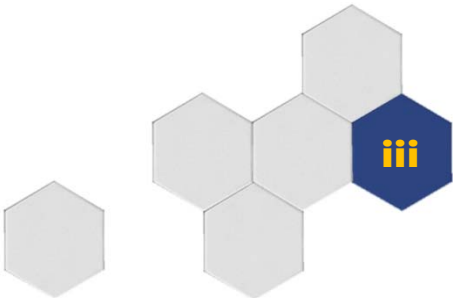
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The Need for Career Pathing for Software Professionals

The field of software development has been providing jobs for software professionals for more than 50 years. Unlike more established professions, such as law, medicine, and engineering, however, career development for software professionals has never been well defined.

In the career development of an attorney, the path toward becoming a full professional consists of completing an undergraduate degree, completing law school, working at one or more clerkships, and passing the bar exam. After that, the newly minted attorney will typically join a firm as an associate, then work toward becoming a senior associate, and finally a partner. The established fields of medicine, accounting, and engineering provide similarly well-defined career paths.

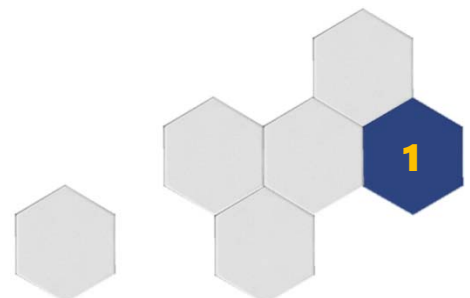
The field of software development, in contrast, provides almost no career support. Some software professionals enter the field through undergraduate programs in computer science or software engineering, but many enter through backgrounds in engineering, mathematics, or fields other than software. Once in the profession, even people who have educational backgrounds specifically in software will find there is no meaningful support for career *development*. A software professional's career is defined more as hopping from one technology or toolset to another, or completing one project after another—which amounts to a series of lateral experiences rather than a progression of steadily increasing skill.

Construx believes that a software professional's experiences should accumulate and build in ways that tap into each person's ability to grow over time and that result in steadily increasing contributions to their organizations. When done with focus, this leads to greatly accelerated rates of career development, which is beneficial to both the individuals and their organizations.

Best Practices Are the Missing Leg for Career Development in Software

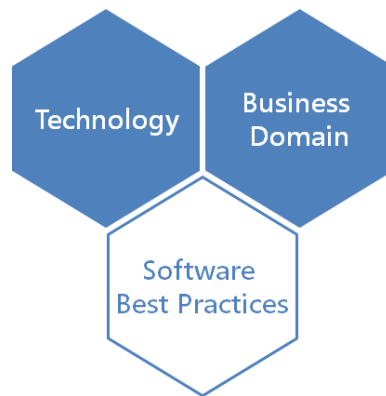
After spending more than 20 years working with hundreds of leading companies worldwide, we have found that professional capability for software professionals is like a three-legged stool in which the legs are:

- Technology knowledge
- Business domain knowledge
- Software development best practices knowledge



Technology Knowledge is knowledge of specific programming languages and technology platforms. This type of knowledge tends to be acquired by software professionals automatically, through on-the job, hands-on technology work. Most organizations already understand the importance of this type of knowledge.

Business Domain Knowledge is knowledge of the business or scientific or technical area in which a business operates. Businesses instinctively recognize the importance of such knowledge, so most businesses provide support for their software professionals to acquire this kind of knowledge and enhance their capabilities in this area.

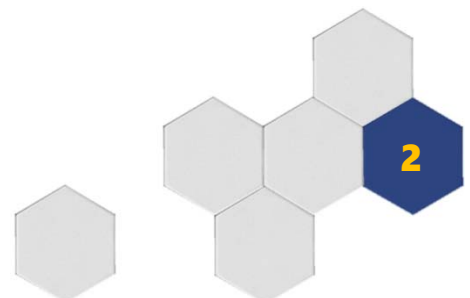


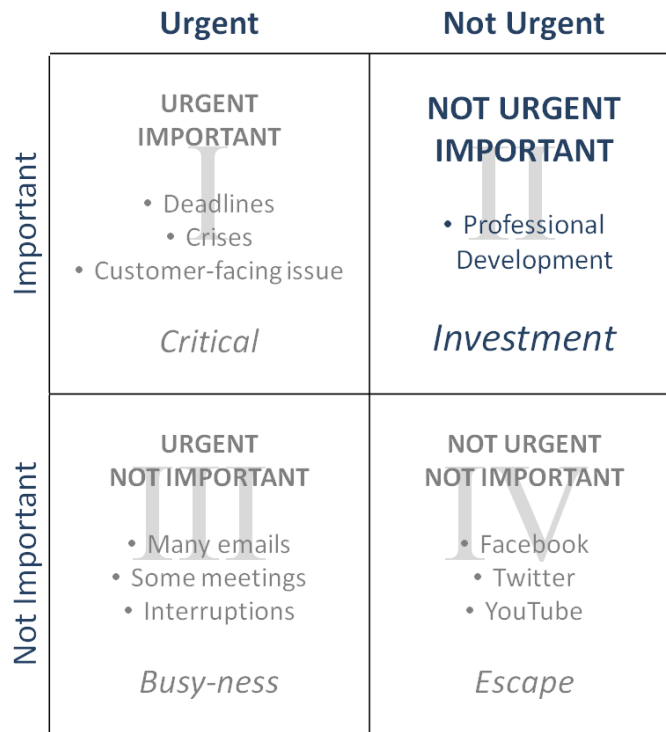
Software Best Practices are the missing piece of professional development in most organizations.

Software Development Best Practices Knowledge is the knowledge of principles that apply regardless of which detailed technology is used and regardless of the specific business area. This is knowledge of how to design and write high quality code, how to successfully architect large systems, how to employ Agile practices effectively, how to manage large projects and teams, how to support dozens or hundreds of product permutations, how to achieve desired levels of quality—and how to do all of the above quickly, efficiently, and transparently, in ways that support the business.

Research for decades has shown an overwhelming return on investment for acquiring capability in software development best practices, and the benefits of competence in these areas should be obvious.

Yet cultivation of Software Development Best Practices Knowledge is often neglected. Best practices knowledge is not as glamorous as leading edge technologies, and it is not as self-evidently beneficial as understanding the business a person is working in. Development of this type of capability becomes lost in day-to-day firefighting, falling prey to what Steven Covey would describe as “important, but not urgent.”



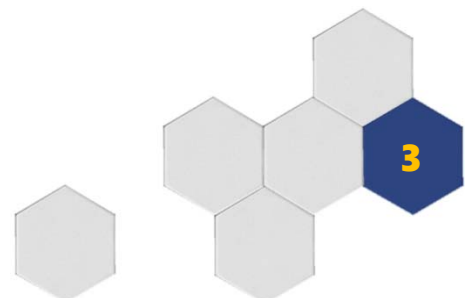


Improving capability in Software Best Practices can fall into the trap of being important, but not urgent, and therefore never occurring.

Software Development Best Practices Knowledge ends up being the missing third leg of the stool, even though all three legs are important.

The Need for Deep Career Development in Software

Deep capabilities in software development best practices cannot be developed with short or intermittent focus. Development of such capabilities requires a sustained focus over time. Certainly carefully selected YouTube videos can provide insights, and 1-day and 2-day classes are often useful. But the state of the art in the software industry has long since surpassed the point where even highly intelligent individuals can invent all the best practices they need on their own. Becoming a truly capable software professional is a goal that requires not hours, days, or weeks, but a sustained focus over a period of years.



The Importance of Software Development Best Practices

A focus on **Software Development Best Practices** has been shown for decades to provide some of the highest ROIs available to businesses. Companies that have systematically invested in improving their use of software best practices have reported ROI's as high as 1000% or higher, with *most companies* reporting ROIs in the 500% range. These gains would seem almost too good to be true, except that dozens of companies have reported them.*

These companies complete more projects on time and on budget. They deliver more projects each year, with more predictability and better transparency. Their releases are more satisfying to their customers, and each release produces more business gain. Their technical staff has higher morale and lower turnover.

Gains of this magnitude are not achieved overnight, and they are not achieved by focusing narrowly in a single area. They are achieved through a systematic, sustained focus on the full spectrum of software development activities. This includes best practices in areas like these:

- Writing high quality, clean code
- Defining systems that fully satisfy user needs and that delight their customers
- Managing large projects and teams effectively and efficiently, including architecting large systems successfully
- Conducting high-risk projects in ways that minimize risks and maximize desirable outcomes
- Achieving low defect counts and high levels of released quality
- Maintaining quality and flexibility as software evolves and matures over time
- Testing thoroughly, reliably and productively
- Achieving the full flexibility promised by Agile practices
- Delivering dozens or hundreds of product permutations, on time, with high quality
- Making technical decisions that fully consider impacts on business profit and loss
- Measuring software development processes and continually improving customer satisfaction, quality, schedule, and productivity

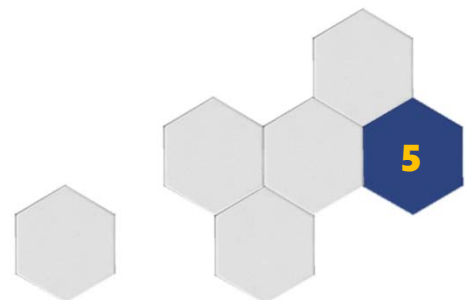
An unexpected finding in software development is that average practice is much closer to the worst practice than to the best. Because most organizations have not yet invested in software best practices to any significant degree, this means that most organizations still have the opportunity to realize the returns of 500% or more that can be obtained from a focus on software best practices.

"The Business Case for Better Software Practices," Steve McConnell, 2016

Is Professional Development the Responsibility of the Individual or the Organization?

Career development for software professionals benefits both the individual and the organization. Individuals who develop themselves professionally will experience steadily expanding skill sets and steadily increasing abilities to contribute to their organization.

Some organizations have chosen to use Construx's Professional Development Ladder (PDL) as a framework for career advancement and promotion. The PDL readily supports that either as the centerpiece or as a supplement in organizations that have existing HR systems in place. If the organization does not choose to recognize PDL work explicitly, individuals who choose to advance themselves through the PDL will enhance their skills and will be recognized as higher contributors naturally.



Corporate Benefits of Software Career Pathing

Defining career paths for software professionals using Construx's PDL provides both expected and unexpected benefits.

Defined career pathing Many organizations are aware that they do not have defined career paths for software professionals. Construx's PDL provides a well-defined, mature, highly-structured solution to that problem.

Accelerated staff development Focused professional development supports growing staff capabilities much more quickly than is possible simply through accumulating ad hoc work experience.

Defined promotion criteria The PDL can be implemented independently of promotion programs, but, if desired, it provides a structured means of assessing staff members' progress and defining expectations that will lead to promotion.

Help for managers in supporting professional development Many managers simply do not know how to fully support the development of their software professionals. Construx's PDL provides a comprehensive, mature approach that helps managers support the development of their technical staff.

Improved retention of technical staff Research has shown for decades that technical staff value learning more than monetary rewards or public recognition. Companies that invest in staff development retain staff better.

Alternative to management path Many organizations provide career pathing for their high potential managers, but little support for their high potential technical staff. Motivated technical staff face a low glass ceiling, which means either they switch to management or leave the company. Software career pathing allows motivated technical staff to realize their full potential on a technical path, which maximizes their technical contribution to your organization.

Skills inventory When an organization commits to Construx's PDL, it can begin thinking of staff capacity in terms of capability levels and knowledge areas (KAs). The organization can keep track of capacity by saying, "We have 10 people at Leadership in Development and 25 at Competence. We have 5 people at Leadership in Design and 15 at Competence."

Staff capacity planning The next step beyond the skills inventory is to use the PDL for capacity planning. In PDL terms this looks like, "We currently have 20 staff members at leadership level in Requirements, and next year we want to have 25. We can develop 3 internally, which means we need to hire 2."

Construx's Unique Capabilities in Software Career Pathing

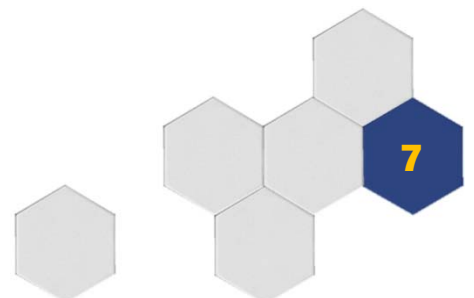
Version 1.0 of the Professional Development Ladder was first deployed within Construx and released publicly more than 20 years ago. Since then, the ladder has been deployed at companies in the US and throughout the world. We have steadily incorporated experiences implementing the ladder into successive versions; the ladder has continued to evolve and improve to meet the needs of software professionals and their organizations.

Construx was founded by Steve McConnell. McConnell is best known as the author of *Code Complete*, but he has also had a career-long interest in software professionalism. He served as chair of the IEEE Professional Activities Board, which oversees software professionalism issues, including development of the Software Engineering Body of Knowledge, university curriculum standards in software engineering, university accreditation standards in software engineering, and professional certifications and licensing. McConnell is also the author of *Professional Software Development*, a book that focuses on software development career pathing, as well as other steps needed to establish software engineering as a true profession.

Construx's Principal Consultant is Steve Tockey. Tockey is the author of *Return on Software* and *How to Engineer Software*. He served as chair of the IEEE committee that implements professional certifications in software engineering and has been a frequent advisor on other software-professionalism initiatives.

Numerous other Construx staff members have participated in creation of professional certification exams, including writing exam questions, reviewing exam questions, and reviewing exam results.

As a company, Construx has spent more than 20 years training, coaching, and consulting with software professionals around the world. We believe there is no other company in the world that is in a better position to support career pathing for software professionals.



Individual Benefits of Software Career Pathing

Investing in professional development using Construx's PDL provides numerous benefits to software professionals.

Become more effective at your job A person who develops themselves using Construx's PDL will rapidly acquire the skills needed to produce higher quality software, more efficiently, with fewer headaches.

Become more valuable to your organization As your skills improve in both breadth and depth, your level of contribution to your projects will steadily improve. The changes in your day-to-day work will seem slight, but you will acquire work experience more strategically, in ways that ensure your experience accumulates and builds.

Remove professional blind spots Many software professionals are self-educated. Even professionals who earned undergraduate degrees in computer science or related fields often say that their real education began when they began working. This pattern of self-education tends to leave blind spots—"you don't know what you don't know." Construx's PDL provides for systematic accumulation of knowledge and experience that results in a well-rounded professional.

Become qualified for the specialization you want Construx's PDL has been designed to support development of both breadth and depth, including specializations such as Architect, Agile coach, Product Owner, Software Development Engineer in Test. If you follow Construx's PDL, you will become qualified to do the kind of work you most want to do.

Structure and support your personal development The professional who is tasked with the challenge of reading 2000 pages in a year might give up before they even start. But the goal of reading 40 pages per week seems easily manageable. Construx's PDL provides support and structure for manageable, steady accumulation of expertise over time.

Base your career development on the most respected career plans Even a highly motivated software professional who wants to develop their skills will be faced with the question, "What specifically should I do to develop my skills?" Where do I start? Construx's PDL has been developed by some of the software world's leading experts and provides extensive guidance on a carefully selected sequence of professional development activities.

Overview of Construx's Professional Development Ladder

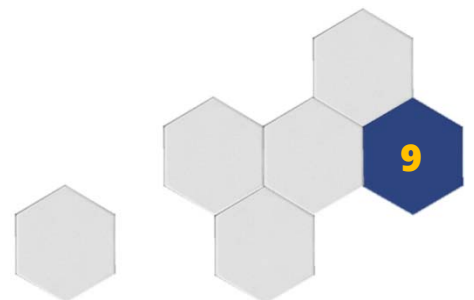
Construx's Professional Development Ladder (PDL) has been designed to support long-term career pathing for a variety of software staff, including developers, testers, scrum masters, product owners, business analysts, project managers, architects, and other common software positions. Construx's Professional Development Ladder provides direction and structure while still allowing the interests of individuals to guide their specific career paths.

The PDL's Building Blocks for Software Career Pathing

To provide career pathing for software professionals, Construx's PDL is comprised of four building blocks:

- Standards-based software development Knowledge Areas (KAs)
- Defined Capability Levels
- Professional development activities—including training, reading, defined experience, and certifications—needed to attain each combination of Knowledge Area and Capability Level
- Role-specific career paths, built using the Knowledge Areas, Capability Levels, and professional development activities described above.

Each of these building blocks will be defined in the rest of this white paper.



PDL Component: Standards-Based Software Development Knowledge Areas

The Construx Knowledge Areas (KAs) define the body of knowledge that software professionals should understand and be able to apply. The KAs are based on the Software Engineering Body of Knowledge¹ (SWEBOK) knowledge areas and are enumerated below.

- Configuration Management
- Construction
- Design
- Foundations
- Maintenance
- Models and Methods
- Process
- Management
- Quality
- Requirements
- Testing

We based the ladder on SWEBOK because the *SWEBOK Guide* is the reference standard for software development best practices (ISO Technical Report 19759).

Each of these Knowledge Areas is described in more detail in Figure 1.

¹ Bourque, Pierre and Richard E. (Dick) Fairley, eds. *SWEBOK V3.0, Guide to the Software Engineering Body of Knowledge*, IEEE Computer Society Press, 2014, Available at: www.swebok.org

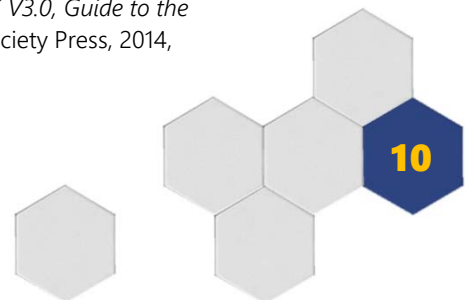


Figure 1 Construx Knowledge Areas (KAs)

KA	Description
Configuration Management	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 detailed creation of working software through coding and debugging—and also through detailed design and testing.
Design	Defining the architecture, components, interfaces, and other characteristics of a system or component—the bridge that analyzes requirements and defines the internal structure that serves as the basis for construction.
Foundations	Combines the SWEBOK knowledge areas of professional practices, computing foundations, mathematical foundations, engineering foundations, and engineering economics.
Maintenance	Supporting already-built software—including system installation, deployment, operation, adaptation, perfection, evolution, and migration.
Models and Methods	Syntax, semantics, and pragmatics of notations; representations of information, behavior, and structure; and defining and assessing heuristics, formal methods, prototyping, and Agile methods.
Process	Defining Agile software lifecycles and other lifecycles; measuring software quality, timeliness, and productivity; and assessing and improving software quality, timeliness, and productivity.
Management	Activities related to initiating, estimating, planning, tracking, and managing risks on projects. Involves both managing things and managing people.
Quality	Activities associated with providing confidence that software will satisfy stated and implied needs under specific conditions, including needs for functionality, performance, and safety. Includes planning, managing, measuring, assessing, conducting, and improving these activities.
Requirements	Elicitation, analysis, modeling, specification, documentation, and management of the functions to be implemented in software.
Testing	Dynamic verification that a program or system exhibits expected behaviors, performed by executing software to detect defects and evaluate features.

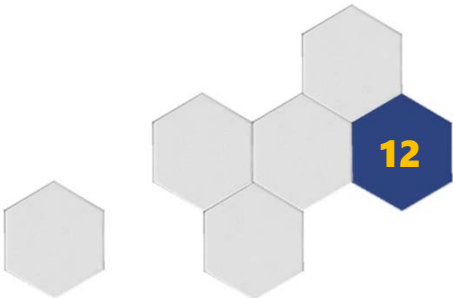
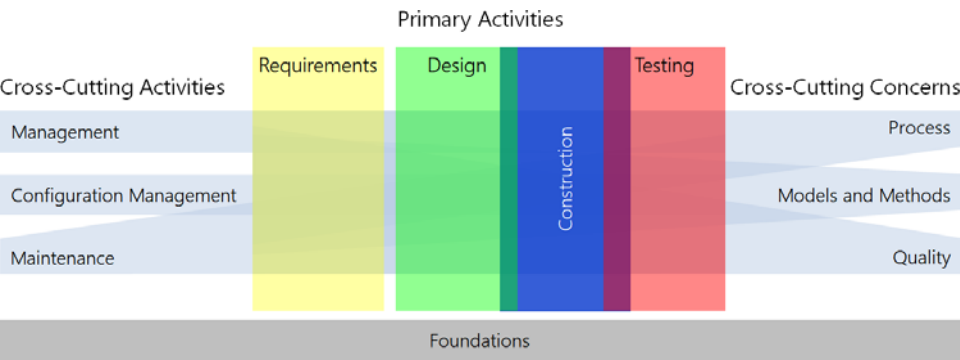
Note: Construx's implementation of the KAs has been adapted from the SWEBOK Guide based on our experience implementing the Professional Development Ladder.

In the SWEBOK, some of the KAs are activities, and some are disciplines or areas of interest. For people who are accustomed to thinking of activities such as requirements, design, and testing as *phases* rather than *activities*, the SWEBOK can require a mental shift to understand that these activities can be identified, discussed, examined, and, ultimately, improved by focusing on the details of each activity, independent of when in the project the activity happens to be performed.

The KAs overlap to significant degrees. For example, Process and Quality intersect as do Process and Management. Construction includes elements of Design and Testing, and Testing is effectively a subset of Quality. Agile practices are embedded implicitly throughout each of the KAs, where appropriate.

Figure 2 shows how the KAs interrelate.

Figure 2 Interrelationships among the Knowledge Areas



PDL Component: Capability Levels for Software Professionals

Construx recognizes four levels of capability in career development: Introductory, Competence, Leadership, and Mastery. Each of these levels includes defined performance standards. Details of the capability levels are described in Figure 3.

Figure 3 Summary of the Capability Levels

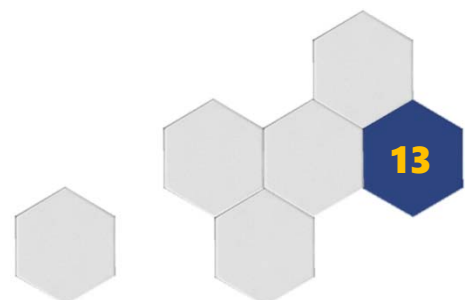
Introductory The professional performs or is capable of performing basic work in an area, generally under supervision. The professional is taking effective steps to develop his or her knowledge and skills.

Competence The professional performs effective, independent work in an area, serves as a role model for less expert professionals, and occasionally coaches others.

Leadership The professional performs exemplary work in an area. The professional regularly coaches professionals and provides project-level and possibly company-wide leadership. The professional is recognized within the company as a major resource in an area.

Mastery The professional has deep experience across multiple projects and performs reference work in an area. The professional provides industry-level leadership and is recognized outside the company for expertise in the area. Industry-wide, only a handful of professionals will attain this level within each KA. Many organizations will not have any staff members at the Mastery level in any of the KAs.

The goal of career development for individuals under Construx's PDL is to attain broad Competence capability and selected Leadership capability. Some professionals will choose to plateau at the Competence level without reaching Leadership in any KA. Conversely, a very small fraction will choose to pursue the Mastery level. Construx's role-specific career paths provide guided development up to the Leadership level. Achievement of Mastery can be achieved within customized versions of the PDL.



The Cornerstone of the PDL: The Professional Development Matrix

The cornerstone of Construx's Professional Development Ladder is an 11x3 Professional Development Matrix (PDM) that is produced when the KAs and Capability Levels are combined. This is illustrated graphically in Figure 4.

The Professional Development Matrix appears simple, but it is deceptively powerful. Career goals can be defined in terms of which boxes are checked in the matrix. Career progression can be defined by charting a path through highlighted sections of the matrix. Professional development activities can be defined in terms of which cell they support in the PDM. The matrix arising from the combination of the 11 Standards-Based Knowledge Areas and the 3 Defined Capability Levels provides an organization for career development that is simultaneously highly structured and highly flexible.

Figure 4 The 11x3 Professional Development Matrix (PDM)

[illegible]

PDL Component: Professional Development Activities

In Construx's Professional Development Ladder, each "cell" in the Professional Development Matrix consists of the activities needed to achieve performance at that level of capability. We believe that true career development for software professionals must consist of the combination of notional learning (books), hands-on learning (classroom or self-paced training), and real-world experience. Thus our PDL contains these types of activities:

- Reading
- Classroom or self-paced training
- Defined experience

To achieve Introductory, Competence, or Leadership level in a KA, a professional will need to complete the combination of training, reading, and experience defined for that cell in the matrix. For example, if a professional wanted to achieve Competence in Design, the professional would need to complete the reading, training, and experience defined for the "Design – Competence" cell in the PDM. We have found that being exposed to similar learnings on each topic in reading, training, and experience provides important reinforcement. Construx has defined the full set of activities needed for each of the 33 cells in the matrix.

Reading, and Types of Reading

Reading is a key part of career development, and we believe that true professional development cannot occur without focused reading that goes beyond short articles on the internet. In our ladder, we differentiate between three types of reading: "Inspectional," "Analytic," and "Syntopical."²

Inspectional reading is used to attain a quick overview of an article or book. Analytic reading is what we normally think of when we think of reading, i.e., deep reading with intent to fully understand material. Syntopical reading refers to reading a collection of related materials together for the purpose of comparing, contrasting, and extracting more meaning from the material than could be acquired by reading any one source on its own.

² See "How to Read a Technical Article," Steve McConnell, *IEEE Software*, Nov/Dec 1998. ([link](#))



The Construx PDL uses Inspectional reading to support acquiring broad knowledge at the Introductory level. It uses Analytical reading for purposes of acquiring working knowledge throughout the capability levels. And it uses Syntopical reading at the Leadership level to provide the deepest possible understanding of leadership material.

Training and the Role of Self-Paced Learning in Professional Development

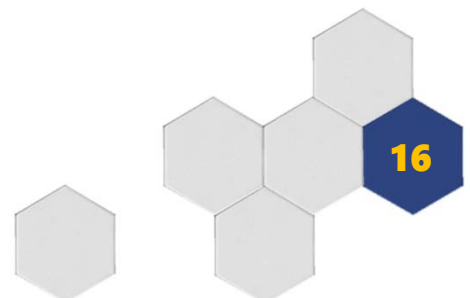
When Construx released Version 1.0 of our Professional Development Ladder in 1998, “training” was synonymous with “classroom training.” Classroom training offers numerous advantages, especially including a rich interactive experience with live feedback from an instructor who is a subject matter expert. However, individuals who wanted to pursue professional development independently were often thwarted by classroom training logistics. They would need to travel to participate in training that was convenient for their schedule, or wait until their organization scheduled training for a group. This inserted delays in professional development, or in some cases, created gaps due to classroom training that never occurred.

Online self-paced training has completely changed what is possible in professional development. Individuals may now obtain professional development at times and places that are most convenient for them, without the delays associated with classroom training. This allows each individual to take charge of their own professional development and supports more rapid skills enhancement than was previously possible.

Defined Experience

Development of truly enhanced capability in a software professional cannot be accomplished without extensive hands-on experience. However, not all experience is created equal. There’s truth in the old joke: If a professional has been working for 10 years, have they really acquired 10 years of experience, or have they acquired the same year of experience 10 times?

Experience must be obtained deliberately, in ways that add up over time, which is why Construx’s PDL requires *Defined Experience*.



PDL Component: Role-Specific Career Paths

The Professional Development Matrix provides a powerful backbone for Construx's career pathing, effectively serving as a career-path generation engine. Over the past 20 years, this engine has been used to generate countless career paths. Now, for general use, Construx has used the PDM to generate five role-specific career paths for the most common software roles:

- Software Architect
- Agile Technical Coach
- Software Technical Manager
- Software Quality Manager
- Software Product Owner

Each of these career paths includes an end goal, activities prescribed to support meeting the end goal, and a multi-level path toward the end goal.

Career Path Levels

Career Path Levels provide a way to organize professional development activities, break sets of activities into manageable chunks, and measure progress. Path Levels can also provide a mechanism for advancement and promotion, if desired.

Construx has followed the traditional model for engineering training in development of our Career Paths. An engineering education is based on the combination of depth and breadth. It is important that engineers, "know what they don't know." Breadth is required to become aware of potential blind spots.

A Path-Level progression requires a professional to obtain both additional breadth (more knowledge areas) and depth (deeper understanding within knowledge areas). It requires an increase in both knowledge and experience.

Figure 5 describes the general attributes of each of the Career Path Levels. These are general descriptions that apply independent of specific roles.

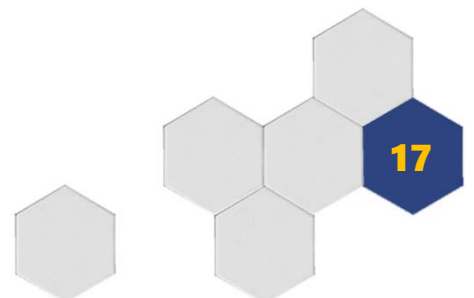


Figure 5 Career Path Levels

Each pre-defined career path defines Levels 1-4. Some of Construx's pre-defined career paths define a Level 5.

Level 0 This person is beginning to learn the principles of software development and is generally still in school or just out of school. This person works under close supervision. This level is the normal entry point for career pathing, and the person will stay in this level until completing requirements for Level 1.

Level 1 The professional who has completed Level 1 has some background in software development. This person generally has completed a formal education in a software-related discipline, has minimal professional experience, or both. This person is capable of performing work in selected areas with minimal supervision. *Level Completion Objective: Introductory capability in all KAs; Competence in 2 KAs*

Level 2 The professional who has completed Level 2 has a fairly strong background in software development and can work independently as needed. This person is expected to be a strong contributor within selected areas on their own teams and is beginning to provide leadership within their own teams. This person has worked multiple completed projects and has experience in each of the basic software development lifecycle steps needed to release a product. *Level Completion Objective: Introductory capability in all KAs; Competence in 4 KAs; Leadership in 1 KA.*

Level 3 The professional who has completed Level 3 has consistently had "wins" during his or her participation in all aspects of small and large projects and has been essential to those projects' success. This person has a track record of consistently rendering clear technical judgment and routinely considering project-level issues. This person often provides leadership to others within their own teams and is beginning to provide leadership to the larger organization. *Level Completion Objective: Introductory capability in all KAs; Competence in 6 KAs; Leadership in 2 KAs.*

Continued ...

Figure 5 Career Path Levels (continued)

Level 4 The professional who has completed Level 4 is a champion who can consider both internal and external aspects of a project and ensure 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 their project's success. This person routinely provides leadership within their own teams and is recognized as a major technical resource to others in their organization. *Level Completion Objective: Introductory capability in all KAs; Competence in 8 KAs; Leadership in 3 KAs.*

Level 4 is the highest level for most career paths. Paths beyond Level 4 can be created using the ladder structure to define more advanced capabilities, if needed.

Level 5 The Level 5 professional is a truly rare champion who fully considers internal and external aspects of sets of projects, the effects of a portfolio of projects on the company's technical and business strategy, and the success of the portfolio of projects with customers. This person takes ownership of company-level strategy in their areas of focus and makes unique contributions. This person routinely provides broad leadership throughout the organization, and this person's decisions have a significant impact on the company's success. *Level Completion Objective: Introductory capability in all KAs; Competence in 9 KAs; Leadership in 5 KAs.*

Not all professionals will choose to advance through all levels. By the time a professional has reached Level 3, the professional will be making significant contributions to their projects and will be providing leadership within their teams. For many professionals, Level 3 will be a plateau level, which Construx believes is consistent with professional practice.

Of the professionals who choose to advance beyond Level 3, the vast majority will choose to plateau at Level 4.

An Example of Ladder-Based Career Progression

Let’s follow the progression of a software development-oriented professional from Level 1 to Level 5 on the **Software Architect Path**, using the structure of the Professional Development Matrix. When completed, this program will support the professional in achieving Introductory capability in all KAs, Competence capability in 9 KAs, and Leadership capability in Construction, Design, Testing, Requirements, and Quality. The Matrix view of this is shown in Figure 6.³

Figure 6 Full requirements for the Architect Path

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Management	Quality	Requirements	Testing
Introductory	●	●	●	●	●	●	●	●	●	●	●
Competence	●	●	●	●	●	●			●	●	●
Leadership		●	●						●	●	●

Progression toward this end result consists of working through five levels.

Figure 7 shows the requirements for the professional to complete Level 1.

³ For the most up-to-date description of these requirements, see “Software Architect Career Path,” Construx Software, 2018.

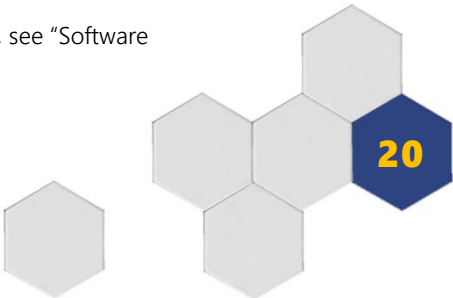


Figure 7 Requirements to complete Level 1 on the Software Architect Path

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Management	Quality	Requirements	Testing
Introductory	●	●	●	●	●	●	●	●	●	●	●
Competence	○	●	○	○	○	○			○	○	●
Leadership		○	○						○	○	○

At Level 1, the professional will complete Introductory work in all KAs and achieve Competence in Construction and Testing. The focus on completing Introductory work in all KAs at Level 1 is based on the traditional approach to engineering education in which breadth is obtained prior to depth. Depth will be acquired incrementally in higher levels. The focus on Competence work in Construction and Testing lays the foundation for eventual work toward Leadership in these two areas. The expected time in this level is 1-2 years.

Figure 8 shows the requirements for the professional to complete Level 2.

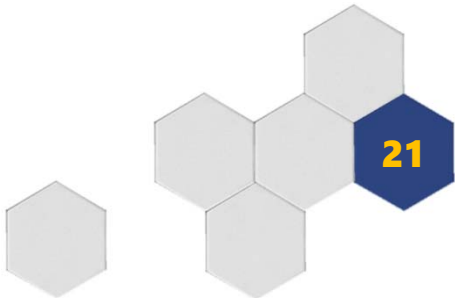


Figure 8 Requirements to complete Level 2 on the Software Architect Path

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Management	Quality	Requirements	Testing
Introductory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competence	●	✓	●	○	○	○			○	○	✓
Leadership		●	○						○	○	○

At Level 2, the professional will achieve Competence in Configuration Management and Design. The development-oriented professional will achieve Leadership competence in Construction. At this level, the professional works independently, is a strong contributor in Construction, and has begun to provide leadership within their own teams in Construction. The expected time in this level is again 1-2 years, but closer to 2 years than to 1.

Figure 9 shows the requirements for the professional to complete Level 3.

Figure 9 Requirements to complete Level 3 on the Software Architect Path

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Management	Quality	Requirements	Testing
Introductory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competence	✓	✓	✓	○	●	○			●	○	✓
Leadership		✓	○						○	○	●

At Level 3, the professional will achieve Competence in Maintenance and Quality and Leadership in Testing. The Level 3 professional continues to provide leadership in Construction and has begun to provide leadership within their own teams on Testing. The expected time in this level is about 2 years.

Some professionals will choose to plateau at Level 3, and Construx views this as expected and acceptable. At this level the professional has become a strong contributor to their teams and can provide leadership as needed. This person is viewed as a valuable team-level resource.

For those who choose to advance beyond Level 3, Figure 10 shows the requirements to complete Level 4.

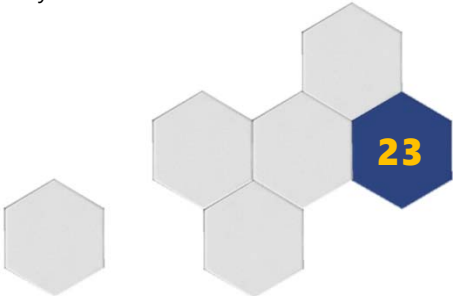
Figure 10 Requirements to complete Level 4 on the Software Architect Path

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Management	Quality	Requirements	Testing
Introductory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competence	✓	✓	✓	○	✓	●			✓	●	✓
Leadership		✓	●						○	○	✓

At Level 4, the professional will achieve Competence in Models and Methods and in Requirements, and Leadership in Design. The Level 4 professional is now providing leadership in the full set of skills needed for a top developer, including in the areas of Construction, Testing, and Design.

As with the other levels, the expected time in Level 4 is about 2 years. The expected time to progress from Level 1 through Level 4 for a professional starting Level 1 with minimum experience is 6-8 years.

Level 4 represents a solid level of career accomplishment for most professionals on the Software Architect Path. A professional at this level is providing consistent leadership at the project level and is viewed as a major resource to their teams and their organization. Most professionals will not advance beyond Level 4.



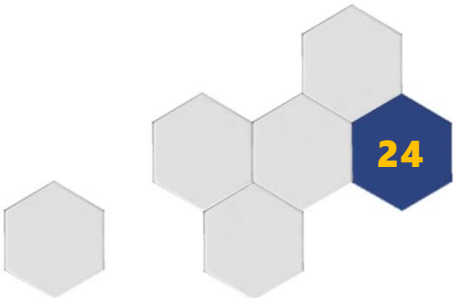
A few professionals will choose to advance to Level 5. Figure 11 shows the requirements for the professional to complete Level 5.

Figure 11 Requirements to complete Level 5 on the Software Architect Path

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Management	Quality	Requirements	Testing
Introductory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competence	✓	✓	✓	●	✓	✓			✓	✓	✓
Leadership		✓	✓						●	●	✓

At Level 5, the professional will achieve Competence in Foundations and Leadership in Quality and Requirements. The Level 5 professional is now providing company-wide leadership in the full set of skills needed for a software architect, including Construction, Testing, Design, Requirements, and Quality.

As with the other levels, the expected time in Level 5 is about 2 years. The expected time to progress from Level 1 through Level 5 for a professional starting Level 1 with minimum experience is 8-10 years.



Examples of Detailed Ladder Requirements

The Professional Development Ladder contains a matrix of 3 capability levels and 11 Knowledge Areas, for a total of 33 unique capability areas. Within each cell of the Capability/KA matrix, there is a set of specific activities, such as reading books, taking classes, and obtaining professional experience, that must be completed. In total, the professional development ladder is comprised of about 500 detailed requirements.

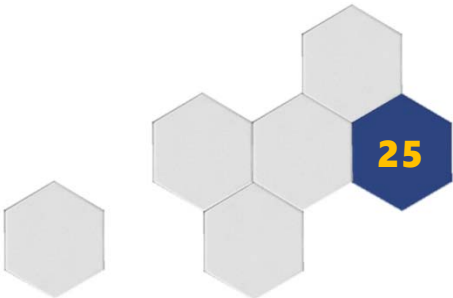
Let’s look at the requirements for Introductory, Competence, and Leadership in the Management KA. Figure 12 shows the reading and professional experience necessary to achieve Introductory capability in the Management KA.

Figure 12 Example of Introductory Requirements in the Management KA

Category	Activity
Reading	"A brief history of project management (and why you should care)," Chapter 1 in <i>Making Things Happen</i> , Scott Berkun (20 pages)
Training	Agile Planning and Estimation (2 hours)
Professional Experience	Participate in a daily Scrum / daily Kanban
	Participate in a retrospective
	Participate in a story point (or equivalent) estimation session (planning poker, affinity, etc.)
	Participate in sprint planning or equivalent
	Review and discuss project artifacts related to Management
	Participate in a sprint review or equivalent

The activities shown in this figure represent the effort needed to complete 1 of the 33 cells in the Professional Development Matrix, as shown below.

Capability Level	Knowledge Area										
	Configuration Management	Construction	Design	Foundations	Maintenance	Models and Methods	Process	Project Management	Quality	Requirements	Testing
Introductory								●			
Competence											
Leadership											



Work at the Introductory level is lighter than work at the higher levels. As Figure 13 illustrates, significantly more effort is required to achieve Competence capability in the Management KA.

Figure 13 Example of Competence Requirements in the Management KA

Category	Activity
Reading	Learning Agile: Understanding Scrum, XP, Lean, and Kanban, Stellman and Greene (420 pages, Inspectional)
	Management 3.0: Leading Agile Developers, Developing Agile Leaders, Jurgen Appelo (464 pages, Analytical)
Training	Software Estimation in Depth (9 hours)
	Software Project Management Boot Camp (5 hours)
	Understanding Software Projects Lecture Series (14.5 hours)
Professional Experience	Coach individuals on estimation skills and practices
	Collect and apply team data (velocity, sprint health metrics, etc.)
	Create and maintain a release burndown chart (or equivalent)
	Facilitate a daily Kanban, daily Scrum, etc.
	Facilitate sprint planning or equivalent
	Implement risk mitigations
	Lead a group estimation session (e.g. planning poker, wide-band delphi, etc.)
	Lead a retrospective
	Lead a review and discussion of project artifacts related to Management
	Lead a risk identification activity
	Lead a risk prioritization activity
	Lead a sprint review or equivalent
	Participate as a reviewer in a formal review of one or more project artifacts in Management
	Participate in release planning

This table enumerates the activities needed to complete the “Management – Competence” cell in the Professional Development Matrix.

Moving from Competence to Leadership in a knowledge area is the largest step. Figure 14 identifies a representative set of activities and level of effort required for this transition.

Figure 14 Example of Leadership Requirements in the Management KA

Category	Activity
Reading	The 21 Irrefutable Laws of Leadership, John C. Maxwell (336 pages, Syntopical)
	The Five Dysfunctions of a Team, Patrick Lencioni (229 pages, Syntopical)
	What Got You Here Won't Get You There: How Successful People Become Even More Successful, Marshall Goldsmith (256 pages, Syntopical)
Training	10x Software Development (3 hours)
	Kanban Overview (3 hours)
	Risk Management (4 hours)
	Scrum in Depth (7.5 hours)
Professional Experience	Act as a consultant / coach / mentor to other project teams in Management
	Coach Scrum Masters, managers, and others in organization on estimation skills and practices
	Create a business case, project charter, etc. for a significant project
	Create a project-level estimate at project inception
	Create a release plan for a significant project
	Create a vision for a significant project
	Lead planning, estimation, and tracking activities for a significant project
	Lead risk management activities for a significant project
	Lead work in Management for a major system
	Observe release planning for other projects throughout the organization
	Provide consulting / coaching / mentoring in Management within a team

Construx's pre-defined career paths define a representative amount of reading, training, and professional experience needed to achieve leadership. In practice, professionals are encouraged to adapt the paths to suit their detailed interests.

Professional Development Plans

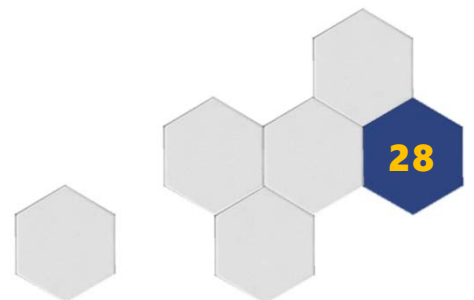
As you can see in the preceding section, requirements for each cell can be extensive, and each Career Path Level transition requires completion of multiple cells over a period of 1-2 years. The scope of work needed can become daunting, so professionals who use Construx's PDL organize their work using Professional Development Plans (PDPs).

PDPs provide a mechanism to plan, track, and document a professional's progress along the ladder. Each Professional Development Plan outlines the long-term goals of the person and describes the specific activities (reading, training, professional experience, and other professional activities) that will occur on shorter term horizons. We recommend that professionals map out their detailed activity goals 3-6 months at a time to make the level of effort more manageable. 2000 pages of reading over 2 years can seem overwhelming, but 250 pages in a quarter or 25 pages a week does not seem so challenging.

Larger companies often have supports in place for career planning, and those may be used instead of PDPs when they are available.

Use of Mentors

Ideally, PDP work is supplemented with coaching by an active manager or mentor interaction. We recommend that both manager and mentor sign off each professional's PDP. Additionally, we recommend ongoing mentor meetings to track the professional's progress against the plan and provide an external commitment for the professional and reinforcement for meeting PDP goals.



Implementing the Professional Development Ladder

Version 1.0 of the Professional Development Ladder was first deployed within Construx and released publicly in 1998. Since then, we have continued to evolve the ladder, releasing Version 2.0 in early 2002 and Version 3.0 in 2010. The ladder has continued to evolve and has been 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

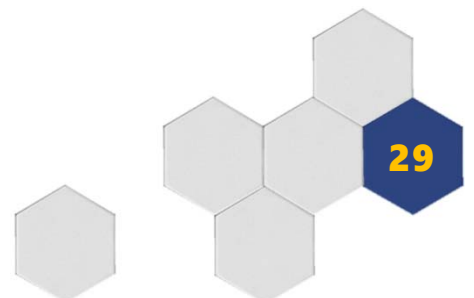
Structural and cultural reinforcements are helpful to the success of the ladder. Ideally, the professional development ladder will become engrained in the culture of the organization. Numerous reinforcements can be used to help employee buy-in and encourage development using the ladder:

- Mentoring program
- Training program
- Discussion groups
- Book clubs

Customized Career Paths

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 their specific career path but does so within the constraints established by their company. For example, the pre-defined developer path focuses on Construction, Design, and Test, but a specific individual might want to focus instead on Models and Methods rather than test.

This type of customization is expected and encouraged. Indeed, one benefit of the Professional Development Matrix is that the level of rigor required to progress from Level 1 through Level 4 will remain about the same when one KA is substituted for another. This combination of structure and flexibility is one of the strengths of Construx's PDL.



Addition of Knowledge Areas

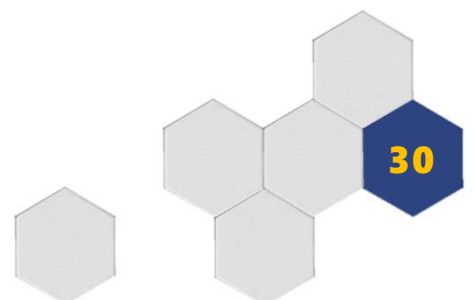
The 11 KAs in Construx's PDM are focused on software development best practices. We intentionally do not include technology-specific or business-specific KAs. In our work with companies implementing software career pathing, however, we have found that most companies will add technology-specific and/or business-area specific KAs, while keeping Construx's PDL as the overall professional development framework.

Beyond Leadership

Our pre-defined career paths are based on moving from Introductory to Competence to Leadership. We have found that this is sufficient for most organizations. For organizations that want to support development beyond Leadership, into Mastery, customized career paths can be developed.

Mastery can be incorporated into definitions of Career Paths beyond Level 5. For example, here are definitions that can be used for Level 6:

Level 6 This person routinely makes key decisions on the goals and structure of the company and is vital to the company's success. This person consistently works to design and produce groundbreaking, world-class products. This person takes primary responsibility for defining corporate practices. This person makes contributions within multiple technical areas, both within and outside the company. These professional contributions are made in ways that enhance the company's overall well-being and contribute to industry leadership. *Career Path Objective: Introductory capability in all KAs; Competence in 9+ KAs; Leadership in 5+ KAs; Mastery in 1+ KAs.*



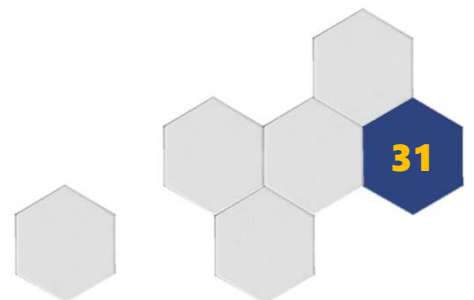
Conclusions

Career pathing and career support have been largely missing for software professionals. This has undermined the ability of both individuals and organizations to fully develop professional skills.

Construx's Professional Development Ladder provides structured but flexible support for software professionals' skills development. It defines the breadth of knowledge, the depth of knowledge, and the overall capabilities needed to ensure that a software professional's experience adds up to increasing capability over time.

The Professional Development Ladder is based on an 11x3 Professional Development Matrix, created by combining Capability Levels and Knowledge Areas. This approach brings objective structure to an area that is often characterized by a high degree of subjectivity. By requiring capabilities across numerous knowledge areas, the PDL ensures broad skills development. Professionals can use the pre-defined career paths to support skills development, or they can use the flexible PDL framework to define career paths more customized to their interests.

For implementation in larger organizations, the PDL can be tailored to add or remove capability levels, knowledge areas, and specific ladder requirements.



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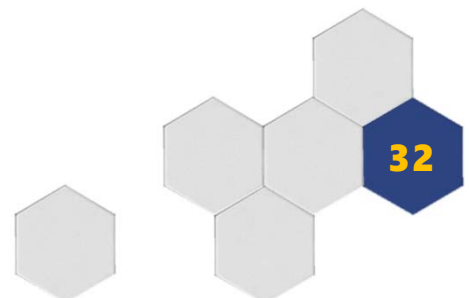
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Construx

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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 (425) 636-0100.

