

Chapter # - will be assigned by editors

AI-supported systems for integrated skills-management and skills-development

Relevance, promise, status

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Abstract: In the context of digitization and digital transformation the skills requirements in businesses and organizations are changing rapidly. In these circumstances, a shift from a less flexible role-based approach to a more flexible skills-based approach to people management and people development is advantageous. In this chapter, we trace the arguments for this shift and differentiate jobs, tasks, competences and skills. Building on this, we sketch the elements of integrated skills management and development: definition, description, systematization, evaluation, development and validation. We discuss taxonomies of competences and skills as a key starting point and we point out different approaches to skills-management possible: top down, bottom up and mixed. Subsequently, we discuss examples of an emerging breed of AI-supported, dedicated solutions for an integrated approach to the management of competences and skills. We provide a short report on a large company currently piloting one such software solution and conclude that it remains to be seen to what extent the promise of these solutions will be kept.

Key words: Digital transformation, jobs / tasks / competences / skills, integrated competence / skills management, software solutions

1. INTRODUCTION

Competences and skills as the basis for successful operations and services have been a long standing topic and issue for organizations and management. Grasser, Loufrani-Fedida, and Oiry (2021, p. xv) trace a concern for the management of competences and skills back the French royal factories in the 18th century. As an area of research and systematic design, competence management emerged in the 1970s and 80s (Mc Clelland, 1973; Boyatzis, 1982; Spencer & Spencer, 1993). Today, there are several trends that contribute to a renewed interest in the systematic management of competences and skills in businesses and organizations. Among these are rapid developments in technology (including AI), automation, more organic forms of organization, more autonomous forms of organizing work, trends towards personalization / individualization as well as changing educational and professional biographies (Grasser et al., 2021, p. xvi; Kauffeld & Paulsen, 2018, pp. 25–26; Bersin, 2022a).

In the context of digitization and digital transformation skills requirements in businesses and organizations are changing rapidly. In these circumstances, a shift from a role-based approach (less flexible) to a more flexible skills-based approach to people management and people development is advantageous. In the past, however, systematic competence or skills management as the basis for targeted people development has proven to be rather cumbersome. Currently, new software solutions are emerging that promise to make targeted, skills-based people development more feasible.

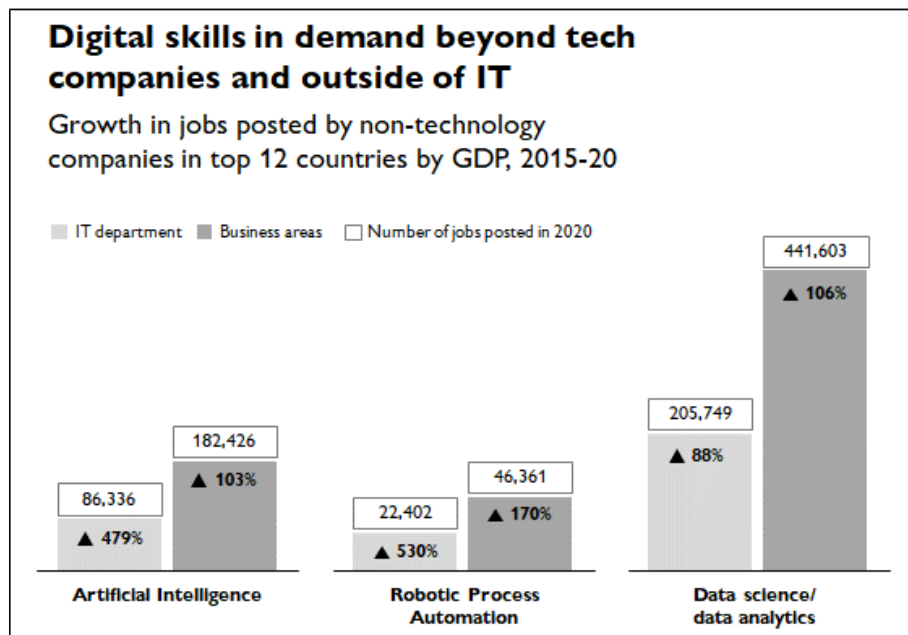
In this chapter, we trace the arguments for a more flexible approach to the management of and we differentiate tasks, jobs, skills and competences. Building on this, we sketch the elements of integrated competence / skills management and approaches taken. Subsequently, we discuss examples of an emerging breed of dedicated solutions to an integrated approach to the management of competences and skills. We conclude that it remains to be seen to what extent the promise of these solutions will be kept.

2. CHANGES IN WORK AND SKILLS REQUIREMENTS

In the context of digitization and digital transformation (Verhoef et al., 2021), there can be observed profound changes in work environments, work processes and skill requirements. These changes affect not only businesses and organizations positioned in the technology sector. They stretch far beyond. For example: almost any manufacturer, from sewing machines to automobile production, nowadays requires a software operating system for its

products and the tech talent that goes along with this. The following graph by Gartner Inc. illustrates this. It shows a dramatic growth in job postings that require advanced digital skills not only for IT-departments but also for business areas.

Figure 1. Demand for digital skills (Image source: Engler, 2020)



A recent study by McKinsey (Dondi, Klier, & Panier, Frédéric, Schubert, Jörg, 2021) has proposed a framework for foundational skills required for citizens' success in the workplace of the future. This framework is structured into four skill domains (cognitive, self-leadership, interpersonal and digital – see Table 1 below) and lists relevant future work skills in each of these. A framework such as this might serve as a starting point for systematic management and development of competences and skills as further discussed in section 3.

Table 1. Skill domains and skills for success in the future of work (Adapted from Dondi et al., 2021)

Cognitive		Interpersonal	
<u>Critical thinking</u> • Structured problem solving	<u>Planning</u> • Work-plan development	<u>Mobilizing systems</u> • Role modeling	<u>Developing relationships</u> • Empathy

<ul style="list-style-type: none"> • Logical reasoning • Understanding biases • ... 	<ul style="list-style-type: none"> • Time management & prioritization • Agile thinking • ... 	<ul style="list-style-type: none"> • Win-win negotiations • Crafting an inspiring vision • ... 	<ul style="list-style-type: none"> • Inspiring trust • Humility • ...
<u>Communication</u> <ul style="list-style-type: none"> • Storytelling • Asking the right questions • Synthesizing messages • ... 	<u>Mental flexibility</u> <ul style="list-style-type: none"> • Creativity & imagination • Translating knowledge to different contexts • Adopting a different perspective • ... 	<u>Teamwork effectiveness</u> <ul style="list-style-type: none"> • Fostering inclusiveness • Motivating different personalities • Resolving conflicts • ... 	
Self-leadership		Digital	
<u>Self-awareness & self-management</u> <ul style="list-style-type: none"> • Understanding own emotions & triggers • Self-control & regulation • Understanding own strengths • ... 		<u>Digital fluency & citizenship</u> <ul style="list-style-type: none"> • Digital literacy • Digital learning • Digital collaboration • ... 	
<u>Entrepreneurship</u> <ul style="list-style-type: none"> • Courage & risk-taking • Driving change & innovation • Breaking orthodoxies • ... 		<u>Software use & development</u> <ul style="list-style-type: none"> • Programming literacy • Data analysis & statistics • Computational & algorithmic thinking 	
<u>Goal achievement</u> <ul style="list-style-type: none"> • Ownership & decisiveness • Grit & persistence • Coping with uncertainty • ... 		<u>Understanding digital systems</u> <ul style="list-style-type: none"> • Data literacy • Smart systems • Cybersecurity literacy • ... 	

A long-term trend towards digital transformation is not the only driver for people development needs. Surveys, for example conducted by McKinsey, indicate that the COVID-19 pandemic has been contributing to the need for increased activity in skill building and people development (Billing, Smet, Reich, & Schaninger, 2021). In addition, there are other developments that contribute to changes in work and skills requirements. Prominent among these are developments such as ‘New work’, transformational leadership, and employee empowerment (e.g., Foelsing & Schmitz, 2021).

3. SKILLS-ORIENTED PEOPLE MANAGEMENT AND PEOPLE DEVELOPMENT

3.1 From role-based to skills-based organization

The organizational functions focusing on people management and people development are human resource departments and L&D functions (Craig, 1987). Recently, it has been suggested in numerous places that a profound change in the approach to the development of people and skills within an organization is required. The dynamic market and business requirements of today demand a shift from a less flexible, often role-based approach to a more flexible approach to people management and people development based on competences and skills (e.g., Guy, no date; Cantrell, Pearce, & Griffiths, 2021; Devine, 2021; Bersin, 2022a).

This is not entirely new. Almost 30 years back and in the context of organization development, Lawler (1994) has developed the same argument. Due to the changing nature of work (global competition, flattened structures and hierarchies, more adaptable processes), businesses and organizations need to switch from a job-based to a competency-based approach for managing processes and people (Lawler, 1994, p. 4).

“The alternative to job-based organizing is to design organizational systems in which the capabilities of individuals are the primary focus and which cause them to be managed in a way that facilitates organizations developing organizational capabilities that provide competitive advantage.” (Lawler, 1994, p. 6)

Lawler continues to sketch key aspects of a competency-based organization (1994, pp. 7–11):

- with regard to organizational design: less hierarchical structures, more cross-functional teams;
- with regard to work design: less focus on jobs, more focus on work teams;
- with regard to recruiting: less focus on fit for job openings, more focus on fit with development requirements;
- with regard to training and career development: less focus on training for job groups, more focus on individualized training and skill certification.

The contrast between a job- or role-based approach and a skills-based approach to managing talent is elucidated in the following graphic contrasting approaches to describing talent.

Figure 2. Elements of a job- / role-based description versus a skills-based description of organizational talent

Role-based description



Image source: scil

- Title function
- Team / unit assigned
- Manager / supervisor
- Tasks / duties
- Profile
 - Job level / grade
 - Education
 - Skill areas

Skills-based description



Image source: Much Skills / scil

- Person information
- Job Focus
- Soft Skills
- Technical Skills
- Articles & References

As has been pointed out by Guy (no date), Cantrell et al. (2021), and Devine, 2021 (2021), job- and role-based descriptions lack the flexibility, the detail as well as a common reference language for aggregation and search across organizational functions and units. Skills-based descriptions of talent, in contrast, provide just that: a highly detailed and dynamic description in a common language that can be employed across organizational units and functions. Such a detailed and dynamic descriptive system works well in an environment of (1) rapidly evolving jobs, (2) requirements for broad reskilling and upskilling initiatives, and (3) expectations for highly personalized development opportunities. It also allows for search, orchestration and reporting on talent-related issues across functions and units (Cantrell et al., 2021; Devine, 2021).

An example of a business organization moving towards a more skills-based approach to talent management is Schneider Electric with its 140'000+ workforce. A post on the public company blog (Employee Voices, 2019) describes the new 'Open Talent Market' for career development that is based on employee skills, competencies as well as development ambitions. The

solution leverages AI-technologies in order to match employee profiles (uploaded or imported from LinkedIn) with possible career moves, full-time roles, part-time projects, mentoring opportunities and learning suggestions.

Devine (2021) singles out the following benefits of skills-based talent strategies in businesses and organizations:

- Improved insight into skills available in the organizational talent pool and available jobs / projects;
- Improved insight into skills gaps at an organizational level;
- Opportunities for designing career paths based on a skills framework;
- Improved transparency in talent management processes (recruiting, development, career progression, etc.).

The relevance of a move from a role-based to a skills-based approach in people management and people development turns on the context an organization finds itself in. According to Devine (2021), three aspects are paramount: how fast skills are changing in a given industry; the need for organizational agility; and the extent to which work is organized into projects and tasks.

3.2 Tasks and jobs, skills and competences

Working towards systematic skills management, skills development and possibly a skills-based organization requires first and foremost a clear understanding of what is meant by “skill” respectively “competence”. As the discussion on skills, skills management and skills development straddles multiple disciplines and contexts, it often remains unclear what exactly is referred to by skills and competences (Rodrigues, Fernández-Macias, & Sostero, 2021, p. 4). And then there are prominent voices that employ the term “capability” as an alternative to competence (Bersin, 2022a).

With regard to tasks, jobs, skills and competences, Rodrigues et al. (2021) propose the following differentiation:

Table 2: Jobs, tasks, competences and skills (based on Rodrigues et al. 2021, p. 7-16)

Demand side (how labor input required is bundled)	Supply side (how ability to perform is bundled)	Example: Teacher / Trainer
Job “consistent bundle of tasks	Competence (knowledge, skills, attitudes)	Facilitate, support and encourage learning and development in others

(or task domain) that is associated with a specific position within an economic organization”	“a general ability to do well in a particular task domain.”	
Task domain “any cluster of tasks”	Skill domain the “cluster of skills” corresponding to a task domain	<ul style="list-style-type: none"> • Determine and specify learning needs • Plan and deliver units of teaching / learning • Design and implement assessments of learning • ...
Task “a discrete unit of work activity that contributes to the production of economic output”	Skill “the ability to perform a task well”	<ul style="list-style-type: none"> • Manage participants and classroom • Facilitate activating group work • Facilitate online sessions with breakout groups • Design exercises as formative assessments • Implement summative online assessments with digital editor • ...

Depending on the situation at hand, competences can and need to be labeled and described at different levels of granularity (North, Reinhardt, & Sieber-Suter, 2018, p. 62). In the context of workforce planning and recruiting, keywords for required competences / skills may be sufficient. In the context of developing a training solution, more detailed descriptions of skills and competences may be required.

Table 3. Levels of granularity in the description of competences / skills

Level of description	Example	Linguistic elements employed	Relevant contexts of use
Keyword	Facilitation / Online Facilitation	Noun / (adjective) + noun	Workforce planning and recruiting
Short version	Ability to plan & facilitate online webinars and events.	Verb + adjective + noun(s)	Decisions on staffing
Medium version	Ability to plan & facilitate online webinars and events for	Verb + adjective + noun(s)	Decisions on staffing

	large groups of participants.	+ descriptors of situational context(s)	
Detailed version	Ability to plan & facilitate online webinars and events for large groups of participants by drawing on a range of proven techniques and methods for activating and engaging participants.	Verb + adjective + noun(s) + descriptors of situational context(s) + descriptors of procedure(s)	Planning and implementation of competence development

In addition to more or less detailed descriptions of competences a systematic for evaluating the level of competences and skills is required. An example for an elaborate systematic for such levels is the one provided by Sieber (2010), which comprises four dimensions and six levels: (1) knowledge / understanding / experience; (2) complexity of the task; (3) degree of autonomy in carrying out activities; (4) ability to reflect on one’s own performance.

We will return to this distinction of levels of detail in definitions of competences / skills and the implications for competence / skill management towards the end of this chapter.

3.3 Integrated competence and skills management for people development

As has been pointed out above, the terms competence and skill are not differentiated systematically in discussions about workforce or talent development. Also, with regard to the type of technical solutions for talent management and development discussed in this chapter, mostly the terms skills and skills-management are employed. For the remainder of this chapter, our usage of terms will reflect the usage in the sources we refer to.

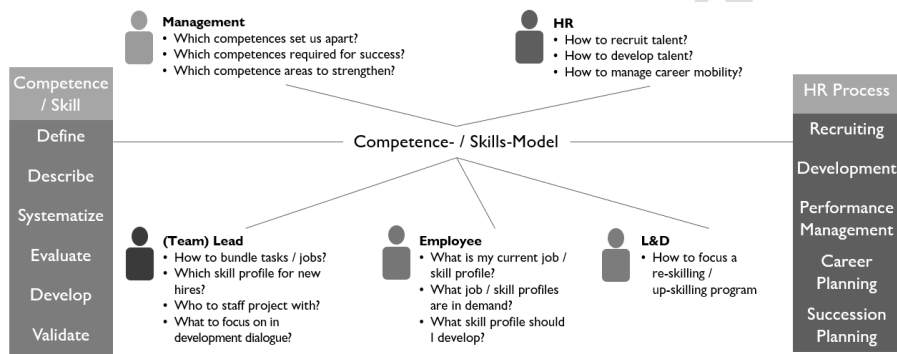
Following North et al. (2018, p. 35), systematic competence management builds on a sequence that comprises the following steps:

- definition of competences,
- description of competences,
- systematization / bundling of competences,
- evaluation of competence levels,
- development of competences,
- validation / certification of competences.

Often, it is assumed that these activities are the exclusive domain of human resource management. However, many different stakeholders, from (top) management to individual employees have a stake in these activities. The following graphic provides an overview of this. It represents

1. the contexts for which systematic competence management is relevant (from recruiting to development to succession planning; Figure 4, to the right),
2. the sequence of steps that are entailed in systematic competence management (from definition to validation; Figure 4, to the left), and
3. key stakeholders (management, (team) leaders, employees, HR professionals) along with key tasks they carry out and for which they need to refer to competences and skills.

Figure 3. Integrated competence management: stakeholders, contexts and steps



This chapter does not deal with the entire HR value chain but rather with the systematization, evaluation and development of competences and skills. In particular, it deals with how these activities can be supported by newly emerging platforms and tools Josh Bersin (2021c) refers to as 'SkillsTech'.

3.4 Taxonomies as starting point

A taxonomy, i.e., a structured, often hierarchical representation of relevant competences or skills at different levels, is a key element in systematic competence and skills management. Such a taxonomy provides an overview of competences / skills (either globally or for a specific domain) and supports their systematic management at different levels: at the level of a specific business or organization, at the level of an industry, or at a cross-industry level (World Economic Forum, 2021). A taxonomy is a key reference point for activities such as the creation of skills profiles, the matching of resources and people, development recommendations and development activities (North et al., 2018).

With regard to a skills taxonomy, businesses and organizations can pursue primarily two options. They can

- create a custom skills taxonomy themselves or

- adopt (and possibly later on adapt) a pre-existing skills taxonomy.

Starting with the latter option: there exist a range of elaborate skills taxonomies that have been developed at both national as well as supranational levels. Examples are the following:

- Occupational Information Network (O*NET, USA, <https://www.onetcenter.org/>)
- UK skills taxonomy (nesta, <https://data-viz.nesta.org.uk/skills-taxonomy/index.html>)
- European Skills / Competences, qualifications and Occupations (ESCO, <https://ec.europa.eu/esco/portal>),
- World Economic Forum Global Taxonomy for Skills at Work (WEF, <https://www.weforum.org/reports/building-a-common-language-for-skills-at-work-a-global-taxonomy>).

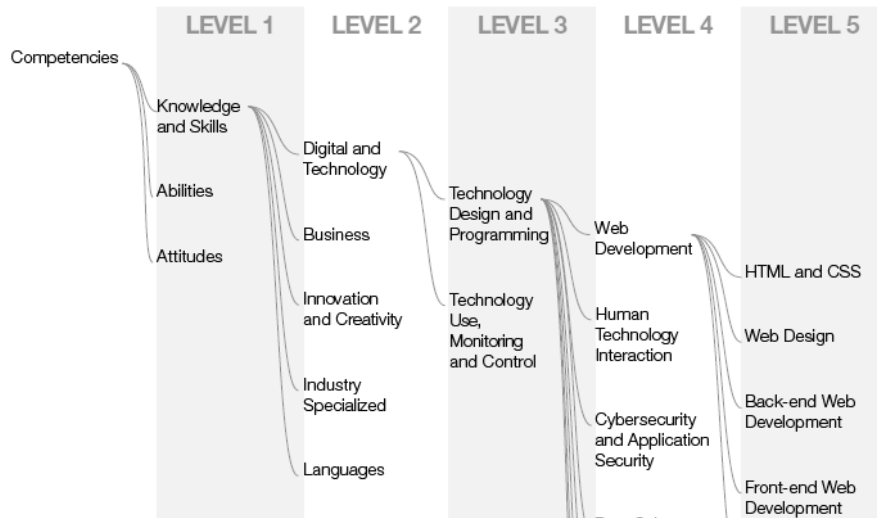
In addition, there are service providers that offer their customers general or customized skills taxonomies as a commercial service. Examples (in alphabetical order) are the following:

- Emsi Burning Glass (<https://burning-glass.com>),
- IYS Skills and Occupations Taxonomy (<https://www.itsyourskills.com/>),
- muchskills (<https://www.muchskills.com/>),
- Skilltree (<https://skilltree.at/>).

These service providers usually employ algorithms, machine learning and natural language processing technologies for generating their taxonomies based on ingested documents or publicly available data such as job postings or labor market data. The kinds of technologies and techniques involved in such an undertaking are described, for example, in Djumalieva and Seeman (2018).

One example of such a skills taxonomy is the one developed by the World Economic Forum (WEF). This initiative aims at supporting a more transparent and global skills-based labor market and also skills development by focusing on skills that are (currently) known to be of growing relevance (World Economic Forum, 2021, p. 2). The taxonomy features five levels, the first three of which are global and stable. The fourth level is adaptable and meant to evolve as the skills landscape continues to transform. The fifth level is where users can add their own information respectively their own taxonomy (World Economic Forum, 2021, p. 8). The following screenshot from this taxonomy illustrates these levels:

Figure 4. Levels in the WEF global skills taxonomy (Image source: World Economic Forum, 2021, p. 8)



3.5 Approaches: Top-down vs. Bottom-up

When it comes to implementing the systematic management of competences / skills for talent development, three approaches can be differentiated. These are variously termed as (1) ‘top-down’, ‘strategy-oriented’ or ‘classic’, (2) ‘bottom-up’ or ‘agile’, and (3) ‘middle-out’ or ‘mixed’. The following table lists key characteristics of these approaches as described by North et al. (2018, pp. 263–265), Kauffeld and Paulsen (2018, pp. 45–47) and Harwar (2021).

Table 4. Approaches to skills management and key characteristics

Approach	Key characteristics
Top-down / strategy-oriented / classic	<ul style="list-style-type: none"> Organizational strategy and high-level skill areas serve as starting points Effort to employ skills / skills taxonomy as reference point for systematizing all HR processes respectively for establishing an organization-wide system for managing competence Extensive expertise required in competence domains and competence respectively skill-management processes Extensive commitment of resources required
Middle-out / mixed	<ul style="list-style-type: none"> Combination of strengths of top-down and bottom-up approaches (Externally provided) Skills taxonomy as starting point Employees ‘claim’ skills selected from taxonomy Review of skills claimed by employees by supervisors

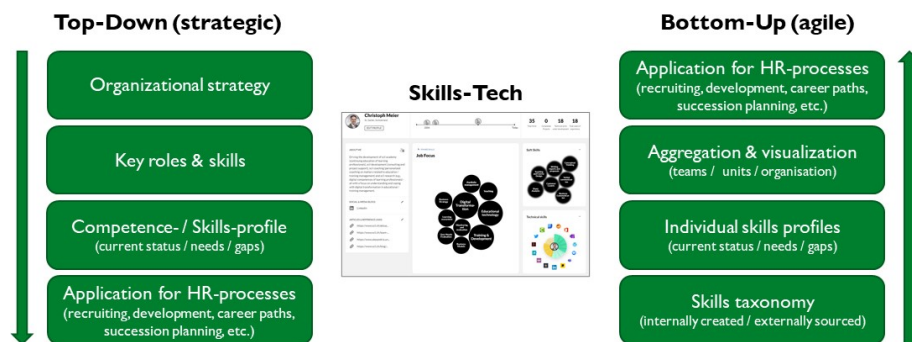
	<ul style="list-style-type: none"> • Systematization / aggregation for either unit-wide or even organization-wide views / representations
Bottom-up / agile	<ul style="list-style-type: none"> • Specific applications / situations of need / skill requirements as starting points (e.g., a particular re-skilling or up-skilling program) • Link with HR processes not in focus • More rapid implementation • More limited commitment of resources required

For the purpose of this chapter, we would like to propose the following differentiation between top-down and bottom-up approaches to organizational skills management:

- Top-down refers to an approach that is driven by a concern for the overall positioning of the organization and strategic initiatives. From this key job roles and key competence / skills requirements are derived. The resulting competence model and / or skills taxonomy provide(s) the basis for various HR processes, from recruiting via development to succession planning.
- Bottom-up refers to an approach that is driven by individual contributors laying claim to individual skill profiles. These skill profiles may be created from scratch or else by drawing on a model / taxonomy provided by an external service partner (see 3.4, above). The resulting information is subsequently aggregated and visualized. Information about future skill requirements may be integrated, for example, by drawing on (external) services analyzing developments in the labor market. The data available can then be employed for visualizing internal job markets and possible career paths as well as for articulating individual career goals.

Figure 6 below provides an illustration of this distinction of the two approaches. In practice, both approaches may be combined to varying degrees. Also, Skills-Tech-solutions may be employed to varying degrees.

Figure 5. Top-down versus bottom-up approaches to organizational skills management



4. AI-SUPPORTED SOLUTIONS FOR INTEGRATED SKILLS DEVELOPMENT

4.1 The implementation challenge

The implementation of competence-based human resource management and development is not a new challenge. For example, the first edition of the book “Kompetenzmanagement in der Praxis” (“Competence management in practice”), which contains numerous examples of implementation in companies and organizations, dates from 2005 (North & Reinhardt, 2005). However, the sustainable implementation of competence-based human resource management and competence-based people development is demanding and labor-intensive. Competence models or competence taxonomies have to be kept up to date continually – something that has proved to be very challenging (Stoller-Schai, 2022). In addition, derivatives of these competency models or taxonomies need to be developed for different tasks in human resource management - checklists for recruiting, topic lists to be covered in onboarding programs, links between competencies and development opportunities, tools for reviewing competency levels, etc.

In response to this challenge, it has been suggested that competency models or taxonomies should be kept very lean. Nachtwei (2018), for example, proposes to limit the set of competences that are systematically managed to 12. This is in stark contrast to the approach supported by providers of skills taxonomies. The ‘Open Skills Taxonomy’ provided by Emsi, for example, comprises more than 32’000 skills (generated from automated analyses of online job postings, profiles and resumes) and is updated every

two weeks (<https://skills.emsidata.com/#explore>). The advances in technology (e.g., artificial intelligence and natural language processing) that these solutions rely on nurture hopes that AI-based solutions might support less cumbersome, more automated, more systematic and, therefore, more sustainable implementations of skills-based talent management and talent development. In the subsequent sections of this chapter, several solutions for skills management will be reviewed.

4.2 Types of solutions available

Academic discussions of technical solutions for competence and skill management are a rare species. Bouteiller and Gilbert (2021) discuss the emergence and persistence of management tools for competence management in the context of the economic situation from the 1960s to the 1990s. However, they do not provide any detail on particular solutions and their functionality. Kauffeld and Paulsen (2018) devote a chapter of their book on competence management to IT-instruments, mostly focusing on the benefits of automated data processing compared to paper-and-pencil techniques. They discuss requirements related to data structure, competence analyses, or visualization of results at a rather high level. There are discussions by business analysts like Bersin (for example 2021a) or Fosway Group (2021) but with these it remains unclear to what extent the descriptions and statements are implicated by consulting contracts and fees.

In order to provide a first rough orientation, AI-supported solutions for skills management and skills development can be grouped into three categories:

- Solutions focused on skills management and skills development. Selected examples of these will be discussed below.
- Solutions for HR / talent management that are much broader in scope and address a wide range of talent management tasks ranging from recruiting to succession management. Examples are SAP Success Factors, Saba Talent Space or Workday Human Capital Management.
- Solutions by content service providers moving from content services towards the support for systematic skills management on the basis of extensive content libraries or professional networks. Skillsoft (<https://www.skillsoft.com/my-skills-contents>) and LinkedIn Learning are examples, specifically the recently released LinkedIn Learning Hub (Bersin, 2021b).

4.3 Solutions focused on skills management and skills development

The solutions reviewed for this chapter belong to the first category mentioned above. Overall, these solutions appear to be geared more towards a bottom-up approach to integrated skills management than a top-down approach. They were identified in the course of continued monitoring of the field of HR Tech and also web research. They can be compared and contrasted with regard to the process steps involved in integrated skills management that they support to varying degrees. They are discussed in alphabetical order.

The fact that a solution is included in this overview does not represent an endorsement or a statement on its qualities. The descriptions of these solutions are mostly based on information provided by the solution providers via websites or white papers.

The result of the mapping conducted is represented in the following table. In this table, key process steps that constitute integrated skills management are listed on the left-hand side. Whether or not a solution supports each step is listed in the columns to the right.

Table 5. Solutions reviewed and mapping of process steps supported

Supported by	EdCast	Huneety	People-Analytix	SkyHive
Process step				
Generate skills taxonomy	✓	✓	✓	✓
Integrate / consolidate diverse skills taxonomies	✓	-	-	-
(Manually) Update skills taxonomy / add new skills	✓	✓	✓	-
Create skill profiles for employees	✓	✓	✓	✓
Generate skill-gap-analyses for employees	✓	✓	✓	✓
Create / curate content for skill development	✓	-	-	-
Match learning content with skills in taxonomy	✓	✓	✓	✓
Match learning content with employee development needs (skill-gaps)	✓	✓	✓	✓
Employee access to matched learning resources				
- integrated functionality	✓			
- link to LMS / LXP		✓	✓	✓

- link to 3 rd party content such as LinkedIn				
Assess / evaluate new skill levels among employees after engagement with learning resources	✓	Repeat competency review	Repeat skills validation	-
Update skill profiles for employees	✓	-	-	-

4.3.1 Edcast Talent Experience Platform (TXP)

Edcast, a well-known player in the market for Learning Experience Platforms (LXP), has recently extended its platform and now markets its solution as ‘Talent Experience Platform’ (TXP) that supports learning, skill building and career mobility (see Bersin, 2021a; edcast, 2022). The component of the Talent Experience Platform devoted to skill management is called SkillsDNA™.

Edcast describes its “SkillsDNA™” as a comprehensive platform for skills-management that supports key stakeholders and key activities in the talent-management process:

- Top-management: aggregated views of the skills-scape for the organization to support workforce planning.
- HR managers: aggregated view of skills inventory and skills-gaps for workforce planning.
- Line managers: dashboard for tracking skills, skills-gaps, and skills-development for own unit / team.
- L&D professionals: building skills taxonomies and tracking skills, skills-gaps, and skills-development.
- Employees: skills assessment, skills profile (‘passport’), career pathing, and skills development plan.

There are four elements making up the infrastructural basis of SkillsDNA™: Skills Exchange™, Skills Engine™, Skills Graph and Skills Studio.

- Skills Exchange™ serves to normalize the elements of the skills taxonomy that come from multiple sources. As Bersin (2021a) has pointed out, one challenge in skills management derives from the multiple players involved and their potentially inconsistent skills taxonomies. Businesses and organizations that employ LMS or LXP services, content from external vendors and providers of skills taxonomies are confronted with the fact that these services come with diverse and often inconsistent skills taxonomies. Where one taxonomy labels a certain skill as “Unix”, another taxonomy might label the same skill as “Unix Shell” (Bersin, 2021a). Without a way of unifying these skills labels, there is no way to have a

coherent skills taxonomy for integrated and skills-based talent management. This is what Skills Exchange™ supports in that it maps diverse skills labels to the Skills Graph where skills definitions are finalized (edcast, n.d.).

- Skills Engine™ is the component that processes skills data. It acquires learners' skills by extracting them from documents such as resumes and profiles as well as by processing data on activities, data provided by an LMS and assessment data. It cleans the data and trains the Skills Graph on these. Content is auto tagged and mapped with the Skills Graph. In addition, Skills Engine™ performs content scoring: for any content item, each skill item in the taxonomy scores this content for relevance. The top scoring skill is then assigned to the content item.
- Skills Graph is the global taxonomy for the SkillsDNA™ services provided by edcast. The skills taxonomy is generated from automated analysis of job postings, resumes and online profiles (AI-supported natural language processing). It can be tailored to match an organization's specific skills via filtering from the global taxonomy or via custom skills added. Data derived from user interactions and algorithms are employed to further refine the model for better recommendations and for content discovery.
- Skills studio, finally, is the front-end tool for administrators respectively HR business partners to customize the organizational skills taxonomy. For each organization, two taxonomies are created and managed: one taxonomy on job roles and one on skills. Each job role is linked to the skills that associated with it. For each skill, a specific algorithm supports new learning content to be automatically attributed to this skill. Currently, over 20 industries and 5500 job roles are covered.

More information on edcast and its products / services is available at <https://www.edcast.com/>. Edcast has recently been acquired by Cornerstone (Bersin, 2022b).

4.3.2 Huneety

Huneety describes its platform as an “upskilling platform designed to bridge the skills gap between the ever-changing labor market expectations and its workforce”. The solution is designed to match skills to job positions and to talent in order to support (1) talent acquisition, (2) talent development and internal mobility, (3) career pathing and succession planning, and, (4) consolidated reporting (Huneety, 2021, pp. 16–18).

The solution provided by Huneety is described as featuring four components or functional areas: (1) development of a skills taxonomy, (2)

mapping of skills, (3) assessment of talent on skills ('competency review'), (4) suggestions for skills development.

- Taxonomy management: Huneety supports businesses and organizations in the creation of a skills taxonomy by starting out by either loading the standard taxonomy provided by Huneety or by creating a custom taxonomy. Skills may be added, removed or merged. A given skills taxonomy may be managed in several languages such as English, Spanish or Chinese.
- Skill mapping: An AI-assisted engine supports the aggregation of data from HR-systems and / or job market data and suggests a skills mapping for job positions and roles. Additionally, skills can be extracted from job descriptions.
- Competency reviews: 8-12 competencies and subskills required (including definitions) are mapped for each position in the company. Assessments from multiple sources (up to 360°) can be consolidated and results visualized. Gap reports and individualized development plans can be generated from this.
- Suggestions for learning and development: Learning content is connected to employee skills maps and an AI-assisted engine matches content with skills in the taxonomy and also generates recommendations for learning. "Huneety A.I Learning suggestions provides:
 - Suggestions of E-learning courses with free or paid options, suitable for any type of learning budget,
 - Certifications coming from the world's most recognized professional certification bodies,
 - Identification of internal mentorship opportunities by highlighting the best experts in each field." (Huneety, 2021, p. 19, sic)

More information on Huneety is available at <https://www.huneety.com/>.

4.3.3 People-Analytix

People-Analytix markets its products and services as solutions that support businesses and organizations in becoming more agile in people management and in coping with the ongoing skill shifts required in the context of digitalization of society and the economy. The solution is seen as complementing established solutions for HR management such as Workday, SAP or Oracle and can be integrated via APIs (People-Analytix.com, 2022b; People-Analytix.com, 2022a).

People-Analytix identifies trends in employment and skills requirements based on automated, AI-supported analysis of data on the employment market. Management is thereby alerted to imminent changes in talent profiles and

talent availability in specific industries. The solution supports skill-gap analyses and talent identification, a skill-oriented view on available resources for learning and development, employee-specific recommendations for learning and development and also an internal talent marketplace.

For managers, the solution provides (1) a skills inventory with an overview of team members and their skill profiles, (2) a dedicated view on the readiness of the team as well as of individual contributors with regard to certain skills, (3) vacancies tagged for skills and skill levels as well as available talent, and, finally, (4) performance indicators on user engagement.

For employees, the solution provides (1) a personalized dashboard with a list of skills, a list of skills yet to be validated, a list of relevant skills, and selected development opportunities; (2) a personal skill-profile with indications of missing skills and options to make skills visible for others; (3) a personalized view on development opportunities within the company along with an overall matching score, lists on matching skills and missing skills, and, finally; (4) personalized recommendations of internal learning resources – along with the skills that can be developed via these resources.

The skills taxonomy that People-Analytix provides is, essentially, an empty shell. The skills in the taxonomy (e.g., “negotiation”) need to be further specified by the company employing services from People-Analytix. To this end, a definition can be provided for each and every skill and three to eight skills levels can be specified (Küffer, 2022).

More information on People-Analytix is available at <https://people-analytix.com>.

4.3.4 SkyHive

SkyHive promotes its platform as a solution for scalable reskilling, for democratizing labor opportunities and for liberating human potential. At the core of its platform is an AI-enabled engine that continuously collects and analyzes labor market data points in real time in order to generate graphs on jobs, skills and training. Specifically, the SkyHive platform supports skills-based workforce planning, skills-based talent acquisition, skills assessment, talent development, and talent mobility / career development (skyhive.ai, 2022).

For workforce planning, SkyHive relies on the analysis of labor market intelligence in order to identify emerging skills and evolving roles. With regard to talent acquisition, SkyHive matches jobs and applicants based on skills. With regard to skills assessment, SkyHive employs automated skills extraction from existing employee data, enables employees to upload their own resumes for analysis and also enables the creation of skill profiles (presumably based on a taxonomy from which skills can be selected). For

learning and development, SkyHive aggregates learning content from Learning Management Systems and matches individual skill gaps with learning resources. Regarding talent mobility and career development, SkyHive supports skill-based proximity analysis for identifying career pathways at scale and also supports personalized reskilling pathways. Regarding integrations, the SkyHive website mentions the following: “SkyHive integrates with HCM/HRIS, LMS, ATS solutions”.

More information on SkyHive is available at <https://www.skyhive.ai/products/skyhive-enterprise>.

5. AN INSTANCE OF CURRENT IMPLEMENTATION

It was pointed out before that the solutions discussed above represent a new breed of tools. For businesses and organizations, it is therefore of interest how well these solutions support integrated skills management in real life. Bersin (2021a) mentions Novartis as one major company employing such a solution. With the express intention to provide an illustration of the practical use, Novartis was approached by the authors of this chapter. An interview was conducted with Marc Steven Ramos, Global Head Learning Strategy, Learning Innovation and Skills Management at Novartis (Ramos, 2022).

Novartis, a provider of pharmaceuticals and medicines with roughly 110'000 employees and headquarters in Basel, is one organization that is currently innovating its talent management and skills management activities. Systematic skills-management is important for Novartis as it contributes to staying competitive in dynamic markets. Systematic skills-management helps Novartis to (1) attract specific talent required by the organization, (2) retain talent through the provision of opportunities to grow and (3) provide targeted upskilling and reskilling activities on a broad scale. Novartis is currently piloting elements of edcasts SkillsDNA™ solution for a segment of its workforce. A more extensive rollout of the solution is envisaged for later in 2022.

Novartis has been working with different Learning Management Systems (LMS) to support focused talent development. These solutions have been employed to support the development of skills-based taxonomies and catalogs and to enable focused, skills-based training. However, these platforms have not been found as effective as was hoped for. In particular, they do not allow for the development and use of a unified and current skills catalog.

Currently, Novartis is piloting the following components of Edcasts' SkillsDNA™ platform for about 10'000 employees: Skills Engine™, Skills

Graph and Skills Studio. Additional components such as Skills Assessment and Skills Passport™ are planned for piloting and rollout at a later stage.

The solution provided by edcast allows Novartis to use the Emsi skills catalog. Emsi is an analytics software company that processes labor market data at a large scale based on AI-driven automated document analysis. The skills taxonomy provided by Emsi represents a leading solution in the field. It is organized into three levels, as the following examples indicate:

Table 6. Emsi Burning Glass Skills Taxonomy: structure and examples (Source Burning Glass Technologies, 2019)

Skill cluster family	Skill cluster	Skill
Information technology	Mobile development	<ul style="list-style-type: none"> • Active Server Pages • Backbone.js • CSS • Django • ...
	JavaScript and jQuery	<ul style="list-style-type: none"> • Django • AngularJS • CoffeeScript ...

At Novartis, this catalog is employed as the unified catalog for all skills-related talent management activities. Edcasts' Skills Studio enables Novartis to maintain this catalog and to add skills to it that are unique to Novartis. Building on this unified skills catalog, the goal is to provide personalized learning opportunities at scale and to support personalized career paths. One element that is particularly important for Novartis is the support for social learning, user generated content and knowledge management. The Edcast talent experience platform that is closely tied to the SkillsDNA™ platform supports this. Edcast TXP allows, for example, both team members and team leaders to easily create simple learning resources and to share learning resources as well as collections of resources and / or learning paths. Via the SkillsDNA™ platform, these resources can be tagged for skills and thus employed in targeted development activities.

Ramos acknowledges that much of the promise of this innovative approach to skills-management has not yet been proven within the context of Novartis. The work (and data) required for training and optimizing AI-supported solutions for application in the context of talent management at Novartis is considerable. However, Ramos maintains that the direction is the right one,

that the technology moves quickly and that it is necessary to explore (and take risks) in order to benefit from early mover advantages (Ramos, 2022).

6. CONCLUSION AND OUTLOOK

In the context of digitization and digital transformation, profound changes in markets, organizational patterns, work environments, work processes and skill requirements can be observed. These demand a more flexible approach to people management and people development - a challenge for human resource departments as well as for L&D professionals.

In this situation, competences and skills provide important reference points and allow for the specificity and dynamism required from talent management and learning professionals. They provide a common language that supports integrated talent management and talent development across functions, units and even organizations. However, working towards systematic skills management, skills development, and possibly a skills-based organization, requires first and foremost a clear understanding of what is meant by “skill” respectively “competence”. The inconsistent use of these terms in praxis blurs the required differentiation between (1) competences as bundles of knowledge, skills and attitudes required to do well in a particular task domain and (2) skills as the ability to do well in a specific task.

With regard to the systematic management of competences and skills in an organization, taxonomies (i.e., structured representation of relevant units at different levels), are key. Such taxonomies can either be created by businesses and organizations themselves or else be adopted from external service partners. While it has proven cumbersome to maintain taxonomies of competences or skills manually, recent advances in AI and software for competence- / skills management nurture hopes that new technical solutions might support more automated, more systematic, and more sustainable implementations of systematic, skills-based talent management and talent development.

This chapter has reviewed a small selection of AI-supported solutions dedicated to skills management and skills development. These solutions appear to be geared more towards a bottom-up approach to integrated skills management than a top-down approach. They support a broad range of tasks in skills management: the generation and continuous adaptation of skills taxonomies; the creation of skill profiles for employees; skill-gap analyses; the tagging of learning content for skills; matching learning content with employee development needs; evaluating new skill levels and updating employee skill profiles.

However, one aspect that is currently difficult to evaluate is whether or not these new solutions provide sufficient granularity regarding the definition of competences and skills. As has been pointed out in section 3.2, different contexts of talent management require different levels of detail when it comes to describing or formulating competences / skills. Taking the publicly available skills taxonomy developed by WEF as an example, it is unclear whether the formulations provided at the lowest level in the taxonomy (level 5) are sufficiently detailed for skills-based talent management or talent development activities. “Web Design” or “Front-end Web Development”, for example, do not provide verbs that specify what kinds of actions need to be performed. Determining that a person is lacking in skills in the task domain of web design or front-end development may be sufficient to direct attention to this task domain in a general manner. However, it does not sufficiently specify what actions employees need to be able to carry out and what actions they may need to be enabled for.

The solutions discussed in this chapter represent a new breed of software solutions for Human Resource Management and HR-Development. They are supported by AI, algorithms, machine learning and natural language processing. Currently, only few businesses and organizations are working with this new breed of solutions for integrated skills management at full scale. How much of the promise these solutions are attributed with can be realized and how much legwork their use entails when it comes to the adaptation to organizational specifics (e.g., further specification of competences / skills and respective levels) remains to be seen.

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