

The four-step approach for the creation of the HR Concept for the EPIC Centre of Excellence in Production Informatics and Control (EPIC CoE)

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Abstract

The Centre of Excellence in Production Informatics and Control (EPIC CoE) was established with the objective to be a leading, internationally acknowledged and sustainable focus point in its field, representing excellence in research, development and innovation related to Cyber-Physical Production. Within this paper a comprehensive four-step approach for the HR concept for the EPIC Centre of Excellence, which contains of the four processes attraction, recruitment, development and retention of a highly skilled and qualified workforce, is developed. This approach allows a structured analysis of the requirements a holistic HR concept needs to fulfil and guides through a standardized process to develop a profound HR Concept. In the first step of the approach (attraction), the vision, mission and concrete targets of the EPIC CoE are analysed to build the strategic basis for the derivation of strategic objectives for the HR-concept to identify necessary roles and an employment structure to be able to provide an attractive working environment for highly experienced professionals. In a second step, a comprehensive career plan for each defined employee group is derived from the core-, management- and support-processes of the EPIC CoE. It includes the academic formation and technical experience profiles, necessary skills and attitudes as well as future activities and responsibilities within the CoE. This information will be gathered within a competence profile for each role, which builds the basis for the recruitment of suitable employees (recruitment). Based on that career plan, necessary training and qualification programs are defined considering the employees' strengths and weaknesses to ensure the development on their specific career paths (development). Finally, the CoE needs to be able to retain its qualified workforce. Therefore, different retention mechanisms, like an incentive system is developed (retention). As a result, this research work will help the CoE to implement a HR management and development concept based on the developed career plans. This research work is integrated in the EU H2020 funded project EPIC (Excellence Center for Production Informatics and Control).

Key Words: Competence Management, Competencies, Human Resource Management, Digitization, Industry 4.0

1 Introduction

The Centre of Excellence in Production Informatics and Control (EPIC CoE) was established with the objective of representing excellence in research, development and innovation related to Cyber-Physical Production (CPP). The big challenges of the new technological era, when information and communication technologies are fundamentally transforming and revolutionizing production, are responded by EPIC CoE as a leading-edge knowledge centre of cyber-physical production systems. Its aim is to accelerate innovation, realize industrial solutions, train new generations of highly qualified professionals and support the development of a sustainable and competitive European manufacturing ecosystem. In this regard, EPIC CoE will be active in applied research and provide services to the Hungarian industry.

To reach these goals and assure an effective HR Management, a structured and thorough approach for the creation of a holistic HR concept that will continuously qualify human resources during their lifetime at the CoE is needed, considering individual adaptations due to organizational condition changes. Therefore, in the first part of this contribution a generic approach is developed that allows a structured analysis of the requirements a holistic HR concept needs to fulfil and guides through a standardized process to develop a comprehensive HR concept suitable for companies. Subsequently this methodology will be used to specifically create the HR concept for the EPIC CoE. The main results will finally be presented through selected examples.

2 Concept Outline of the four-step approach

The essential purpose of this paper is to support organisations with a comprehensive four-step methodology that can be used to create a HR management and development concept. Therefore, the main processes—which need to be described and executed—are: attraction, recruitment, development and retention of a highly skilled and qualified workforce. The approach combines the development of a substantial career plan for this workforce and the definition of required competence profiles in order to derive necessary actions, such as trainings or incentives. As a result, this methodology will help organisations to implement a generic HR management and development concept based on the developed career plans. The following figure gives an overview on the four steps of the methodology, which will be explained in detail in the following.

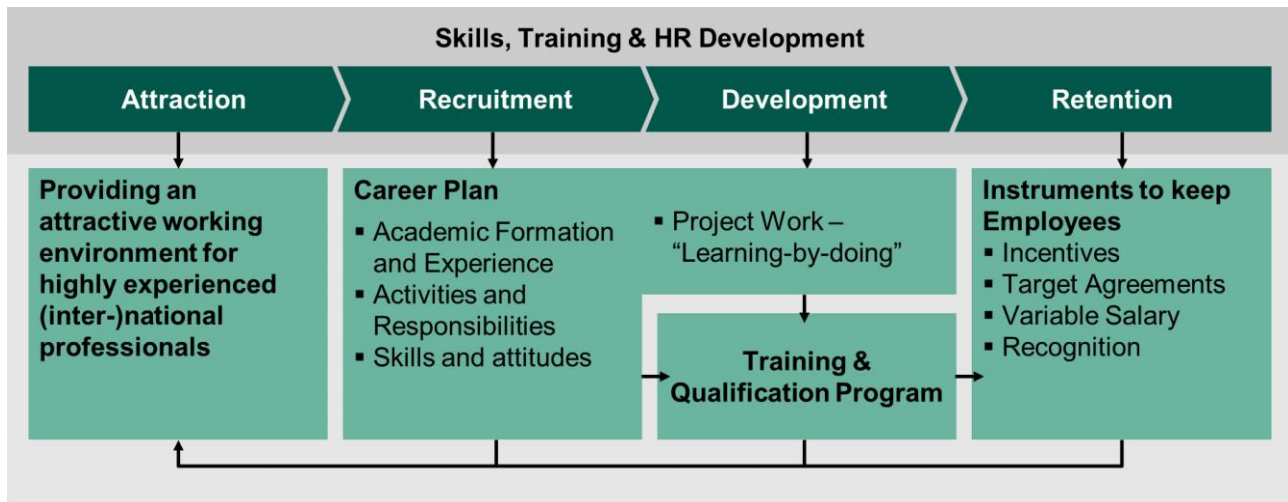


Figure 1: Concept outline of the four-step approach to develop a HR concept for companies

The first part focuses on the attraction of employees by suggesting general strategies to provide an attractive working environment for prospective employees. To guarantee the recruitment of the right person followed by an appropriate professional development, a comprehensive career plan is required. It includes an academic formation and technical experience profile, the necessary skills and attitude as well as future activities and responsibilities in the company. Based on that career plan, necessary training and qualification programs can be derived to ensure a suitable development considering an employee's strengths and weaknesses. At last, the company needs to be able to retain its qualified workforce. Therefore, the HR management and development concept highlights essential instruments for the organisation to keep its employees. Identified instruments are for example the introduction of incentives, target agreements, variable salary or recognition strategies. (Jochmann 2013; Meifert 2013; Schmeisser, Sobierajczyk et al. 2014).

2.1 Step 1: Employees Attraction

Business success becomes increasingly dependent on a qualified workforce. Especially in the area of R&D&I people and their talents are the company's most important asset. Thus, the effective management of human resources can provide competitive advantages. In particular, employers need to develop awareness for the importance of being attractive to young talents.

Some of the most critical drivers for the attraction and recruitment of new employees are the image and reputation for applied R&D&I as well as the reputation of the company in this sector. Furthermore, the attractiveness highly depends on the exposure to industrial research work as well as the general mind-set and culture for innovation and entrepreneurship.

Another major driver for the attractiveness of an employer are the opportunities for learning and growth offered, which include academic degrees, professional experience, exchanges, language classes, responsibility and recognition. Providing an attractive working environment (e.g. through a good laboratory infrastructure for R&D&I, prototyping and pilot applications, collaborative atmosphere, feedback culture, etc.) and benefit plans (e.g. health care, relocation packages, national and international exchange, etc.) also increase the attractiveness of an employer.

In addition, partnerships with universities and national research institutes, which are renowned internationally, attract young talents. Applied research institutes also need to think of competitive compensation models with excellent universities (e.g. through variable remuneration).

2.2 Step 2: Recruitment

In this chapter, the required competence profiles consisting of academic formation and experience, activities and responsibilities, soft skills and attitude are explained in more detail. For the recruitment process, it is mandatory to have pre-defined roles that are well described in competence profiles. As a result of having that, the company knows what competences are needed when recruiting new personnel, while at the same time the employee will have a better understanding of the profile for his/her own role which will make the overall process clear for both sides.

Since all organisations have specific processes like technical processes (e.g. production process), or administrative processes (e.g. procurement process), the required competences needed for the execution of these processes should be matched with the competences of employees. Therefore, the roles and functions that are gradually developed are described as *process-based competence profiles*. The details for each role are derived from the sub-processes and aggregated into the respective components. (Schreiber, Rietiker 2010)

Each competence profile includes four pillars: an academic and technical experience profile, the necessary skills and attitude as well as common activities and responsibilities for the specific role (based on Bernien 1997; Eck, Claus, D., Rietiker 2010; Solga, Ryschka et al. 2011; Wien, Franzke 2013). This comprehensive list of required competences ensures that the right person fills the certain job and therefore is able to support effectively the business processes. The following table shows a generic competence profile.

Table 1: Generic Competence Profile

Academic and technical experience profile	<ul style="list-style-type: none"> ▪ In this part the formal qualifications that are required to fill a certain competence profile are defined. They comprise both aspects, the technical experience and the academic background, which are both important to define who should act in a certain job position, e.g.: <ul style="list-style-type: none"> ○ Academic degree (M.Sc.) in the field of Engineering, Exact or Biological Science or ongoing PhD ○ Experience with portfolio management of R&D&I projects (1+ years)
Skills and attitude	<ul style="list-style-type: none"> ▪ The necessary skills and attitude required to be able to fulfil the tasks. In other words, the abilities and the behaviour of the employee should match the required ones in the competence profile, e.g. as the managerial positions vary from the technical positions, the first need decision making skills and how to manage people, where the second need analytical ability and being organized in documenting the work.
Activities and responsibilities Primary (responsible)	<ul style="list-style-type: none"> ▪ Responsibilities and processes directly linked with that role. For instance, one of the primary responsibilities of an employee in his/her role as a researcher is to conduct research projects and scientific work.
Activities and responsibilities Secondary (supporting)	<ul style="list-style-type: none"> ▪ Responsibilities and processes that are needed or desirable for a better fulfilment of primary responsibilities, but is not a goal in itself. For instance, one of the secondary responsibilities of a researcher is to do the Education and Training.

Each of the employees has to have a certain set of skills and behaviours to be able to face the tasks appearing in the individual institutes of innovation. The most important organizational and specific as well as optional skills and behaviours are shown in the following table.

Table 2: Examples of skills and behaviours (based on Solga, Ryschka et al. 2011; Wien, Franzke 2013; Kadishi 2008)

Organizational skills and behaviours	Specific skills and behaviours	Optional skills and behaviours
<ul style="list-style-type: none">• Cooperation• Innovation/ creativity• Communication• Interpersonal relationships• Goal-orientation	<ul style="list-style-type: none">• Responsibility• Flexibility• Analytical ability• Project and process management• People management• Change management• Decision making	<ul style="list-style-type: none">• Being organized• Client-orientation• Analytical ability• Negotiation• Orientation for knowledge• Networking (building relationships)• Systemic vision• Market-orientation

In order to progress to the next higher level of the career plan, certain new activities will have to be gradually overtaken. Furthermore, competences, skills and attitudes have to be developed. For this reason, a training concept is constructed, which is described in the following section 2.3. However, the requirements are imposed with an initial flexibility to ensure an agile human resource development process. Requirements that are not fulfilled upon employment may be made up for within a restricted timeframe. This initial flexibility is transferred to permanent flexibility that is however limited in terms of deviation from the required profile and foresees an even shorter timeframe for the requirements fulfilment.

2.3 Step 3: Qualification and Training Programs

In order to cope with current challenges, companies need well-qualified employees. Therefore, continuous qualification helps companies to remain competitive in an always-changing market environment. Skills always have to be aligned towards current and future challenges. It is necessary to keep the employees in the range of “flow” to ensure that tasks are accomplished appropriately and that employees remain motivated. This will further lead to the achievement of prominent business success. (Meifert 2013; Wien, Franzke 2013)

The word “career” defines the sequence of related jobs and work activities a person holds during his/her lifetime. From a company’s perspective, the concept of a career only relates to all work activities and positions of an employee within the company. Therefore, career planning is defined as the process of analysis where a person stands today and where this person needs and wants to develop herself/himself into the future. During this process, individual development expectations are matched with pre-defined career paths to ensure that an employee meets current challenges while being highly motivated. (Frank 2009; Holtbrügge 2015)

To support the employees on their individual career paths, career plans are developed. The structure of a career plan implies that in order to progress to the next higher level certain activities as well as competences, skills and attitudes have to be developed. For this reason, an approach to create a specific training concept is developed and described in the following section. First, the integration of the qualification and training in the HR management and development concept is discussed. In addition, the strategic role of qualification and training is further explained and the developed qualification and training concept is given.

2.3.1 Integration of Qualification and Training into the HR management and development concept

Focusing on all activities concerning the professional education, learning and training of individuals and teams, human resource development heavily influences the organizational development and thus, the present and future performance of any organization. Therefore, the three main functional areas of human resource development can be defined as personal development (qualification and training), team development (collaboration) and organizational development (structure and processes). (Becker 2013; Neuberger 1994; Flato, Reinbold-Scheible 2006; Wilson 2012)

As part of the personal development, qualification and training have an essential role for the HR management and development concept. Qualification is defined as knowledge or skills in a certain area that make someone eligible for a job or position. In this regard, education generally includes all purposeful and conscious activities to provide the necessary skills and to ensure the proper performance of specific tasks. It includes all learning processes offered by the company. Subsequently, qualifying someone means to prepare this person for prospective work activities. (Becker 2013; Hentze, Metzner 1991)

Training, on the other hand, is the action of teaching someone a specific skill or knowledge, so that trainings can be defined as the instrument for qualification. Since a qualified workforce can be a company's competitive advantage, qualification and training become strategic functions have a great influence on business success.

Since not only the performance of an individual, but also the sum of all individual achievements has a strong influence on the company's success, also group dynamics must be considered. Teams are a special form of group in which several individuals interact with each other to fulfill a specific task together (Alter 2016; Becker 2016; Schiersmann, Thiel 2014). During this fulfilment process, the performance of the team may be weakened by new tasks, requirements or composition (Becker 2016). Thus, the team development takes over all measures that initially ensure the maintenance of performance and further increase the efficiency of a team (Alter 2016, p. 22). This includes measures such the change of work tasks, the composition or change of teams as well as the clarification of roles, rights and duties (Schiersmann, Thiel 2014). In summary, team development thus forms an important pillar for successful personnel development in addition to qualification and trainings.

2.3.2 Definition of general qualification areas and exemplary trainings

The following table presents the most essential qualification areas for the R&D&I sector and lists some exemplary trainings that could be used to qualify employees at the EPIC CoE.

Table 3: General qualification areas and exemplary trainings

Qualification area	Exemplary trainings
Project management	<ul style="list-style-type: none"> Basics on project management Agile project management Project planning & controlling Conflict resolution
Marketing, acquisition & utilization	<ul style="list-style-type: none"> Acquisition techniques Scientific publication Transferring ideas into solutions
Leadership & management	<ul style="list-style-type: none"> Leadership in difficult situations Business simulation Selecting suitable employees
Business administration & organization	<ul style="list-style-type: none"> Business process management Process optimization Contract design
Compliance	<ul style="list-style-type: none"> Prevention of corruption Privacy policy
IT-service management	<ul style="list-style-type: none"> IT-tools & -skills E-learning
Career & self-management	<ul style="list-style-type: none"> Strategic self-management Effective time management Systematic career development
Communication	<ul style="list-style-type: none"> Professional presenting Communication techniques Solving conflicts constructively
Office management	<ul style="list-style-type: none"> Basics for team assistants Information & task management Event management
Travel management	<ul style="list-style-type: none"> Business trip planning Travel expense accounting
Language skills	<ul style="list-style-type: none"> Portuguese for foreign scientists Scientific writing skills Smart small talk English for researchers
HR management	<ul style="list-style-type: none"> Staff development Employment law Payments

2.4 Step 4: Retention Strategies

The retention strategy is a basis to be able to retain well-qualified personnel. Besides activities of rewarding employees for performing their jobs effectively and efficiently, one part of the retention strategy is to ensure harmonious working relations between employees and managers. Furthermore, the maintenance of a safe and healthy work environment has to be considered. Responsibilities for the management are:

- Fair treatment of employees
- Open communication
- Face-to-face resolution of conflicts
- Promotion of teamwork
- Respect for the dignity of each employee

Retention strategies can comprise different aspects and elements. As retention strategies need to match the special need of each company individually, only the performance management of employees as well as the salary as a retention incentive are described in this chapter. Many other strategies that are not mentioned can also be successful, if they consider the needs of the company and the employees.

2.4.1 Performance Management for Employee Retention

Each employee of the CoE should go through a standardized evaluation process. The management of the CoE should assess the skills, work and behaviour of the staff in order to help them to improve weaknesses as well as strengthen strengths.

To consider performance management of employees as part of the retention strategy, first the goals / objectives for each individual employee have to be defined. They build the basis for an individual evaluation process that can be of different nature. As the goals should be easy to measure, target agreements of the following fields should be considered as purposeful: finance, planning, articulation and influence as well as execution and operation. Each of the goals can have a medium, high or critical impact.

After a review of the defined goals, the evaluation process of managers, employees as well as peers and clients is conducted. Therefore, subsequently after the (self-)evaluation is prepared, first the managers, peers and clients are evaluated by the employees, who then evaluate the managers. In a next step, the immediate managers validate the assessment results. At the end of this process, the feedback is presented. This supports each individual employee to have a clear understanding of his / her personal development and thus helps to ensure a strong motivation for current and future job roles and tasks. A final visit completes the evaluation process. (Armstrong, Taylor 2014; Becker 2013; Meifert 2013)

2.4.2 Salary as a retention incentive

The salary depends on different factors but it can also be used as an incentive system. Depending on the performance of the individual employee as well as the qualification, the salary can be increased. According to the possibilities of salary adjustments, the terms *framework*, *designation* and *realignment* are defined as follows in this context:

- The framework is the need for career advancement due to changes in roles and responsibilities. Even the termination of roles and responsibilities, or the change in the structure of position creates the need for career advancement.
- Whereas the designation is the movement of an employee within the framework to ensure the reliability of a function. If it were necessary to hire a new employee in order to ensure the reliability of a function, it would be the role of admission and not the role of designation.
- The realignment is the change of the salary of employees resulting from a salary range adjustment in order to maintain competitiveness.
- A promotion is the change of an employee's job position to a higher level due to the good employee performance (vertical career growth).

3 Results of the execution of the methodology to create a HR concept for the EPIC CoE

After the generic 4-step-methodology has been described, the results of its application for the development of the HR concept of the EPIC CoE will be described in the following. Within the European research project EPIC, a Center of Excellence in Production Informatics and Control (EPIC CoE) will be designed and established in Budapest in Hungary. Therefore, the know-how and the infrastructure of the already existing and well-established STAKI institute is used and builds the basis for further developments of the EPIC CoE.

3.1 Step 1: Employees Attraction of the EPIC CoE

Based on the experiences of the HR strategy of SZTAKI some good practices for the attraction of employees can be derived and are presented below for the new HR Concept for the EPIC CoE Ltd.

SZTAKI has many advantages because of its linkage to young students as well as graduates, which supports the build-up of a solid relationship between universities and the industry. This ensures the preparation of the next generation of workforce to be able to enter the industry efficiently. Consequently, this relationship will support the development of a professional network that could be extended to all international relationships. The role of SZTAKI is to maintain this network that includes industrial contacts (e.g. from Hungarian I4.0 Platform) and working groups.

Another advantage is that the SZTAKI has the freedom to further develop the network, e.g. researchers can build/initiate own groups for their personal development.

As the EPIC CoE is just starting its operations in 2018, it has no own attraction yet. As the Centre grows and establishes services of high quality, the own reputation will increase and will be more and more attractive for employees in the future.

3.2 Step 2: Recruitment of employees for the EPIC CoE

The following table shows a set of functions and roles that are developed for the EPIC CoE. Roles with similar activities and responsibilities are clustered into groups. This allows the development of career paths within one group (e.g. Research Assistant to researcher, etc.).

Table 4: Overview about roles within EPIC Ltd.

Management	Director
	R&D Manager
	Industrial Coordinator
Research Staff	Leading Researcher
	Researcher
	Research Assistant
	Project Manager
Technical Staff	System Engineer
	Developer
	Analyst
Operations	Finance
	IT Support
	Marketing & PR
	IPR & Legal
	HR Coordinator
	Account Manager
Administration	

For each specific role, a competence profile is developed that states the requirements for the fulfilment of the role. It comprises the needed academic and technical experience, skills and attitude as well as primary and secondary activities and responsibilities of each position. The following table shows an example of a competence profile of a researcher that is derived from the core-, management- and support-processes of the EPIC CoE.

Table 5: Example of Competence Profile - Researcher

Academic and technical experience profile	<ul style="list-style-type: none"> ▪ Academic degree (M.Sc.) in the field of Engineering, Exact or Biological Science or ongoing PhD ▪ Proven experience with applied research (1+ years) ▪ Experience with industrial projects (1+ years) ▪ Experience with acquiring of R&D&I projects (1+ years) ▪ Experience with portfolio management of R&D&I projects (1+ years) ▪ Experience with team management (focus on multidisciplinary teams, 1+ years) ▪ International experience (3-6 months)
Skills and attitude	<ul style="list-style-type: none"> ▪ Capacity planning, sense of priorities and deadlines ▪ Practice leadership, attract responsibility, decision making ▪ Focus on results and goals ▪ Flexibility, being able to work under pressure
Activities and responsibilities Primary (responsible)	<ul style="list-style-type: none"> ▪ 1. Management Processes <ul style="list-style-type: none"> ▪ Strategic Planning ▪ Stakeholder Management ▪ 2. Core Processes <ul style="list-style-type: none"> ▪ Research Projects ▪ Scientific Work ▪ 3. Support Processes <ul style="list-style-type: none"> ▪ Communications Management (internal & external) ▪ Visits /Business Trips
Activities and responsibilities Secondary (supporting)	<ul style="list-style-type: none"> ▪ 1. Management Processes <ul style="list-style-type: none"> ▪ Change Management ▪ 2. Core Processes <ul style="list-style-type: none"> ▪ Industry Projects ▪ Education & Training ▪ 3. Support Process <ul style="list-style-type: none"> ▪ Conferences & Events ▪ Marketing & PR

3.3 Step 3: EPIC CoE Qualification and Training Programs

Supporting an employee to be qualified for the next career stage is part of the qualification and training concept. With the help of selected trainings, the competence profile of an employee will be continuously aligned to current and future challenges. In this regard the following figure shows the possible career paths that are identified for the EPIC CoE, where some of the career paths are within the same group (e.g. researcher gets promoted to be a leading researcher) while other career paths reach from one group to another (e.g. researcher gets promoted to be a project manager).

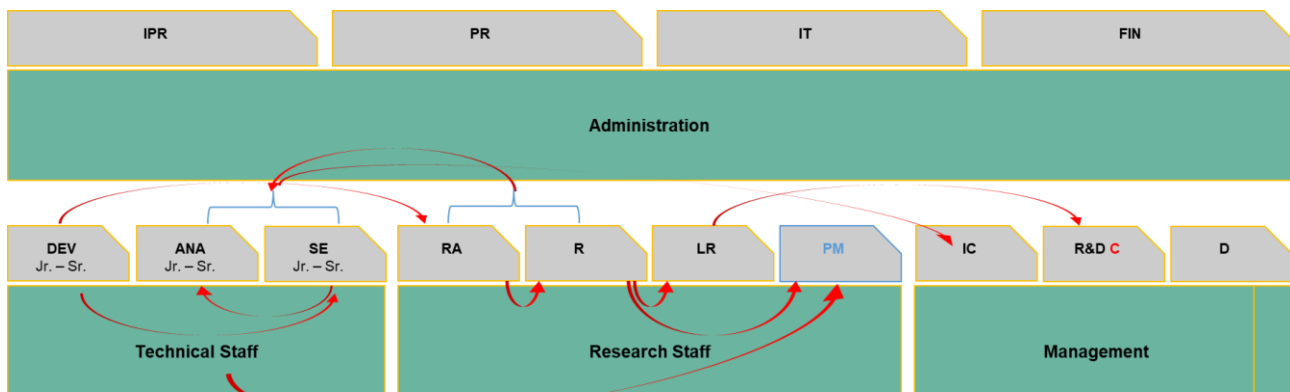


Figure 2: Possible Career Paths

Skills and trainings are needed to enable employees to develop into new roles on their specific career paths within their groups or beyond. In this regard, table 6 shows an example of formal requirements for the qualification and trainings for the transition of a researcher to a project manager. Only if those formal requirements are fulfilled, the employee can fulfil the new competence profile of the project manager.

Table 6: Example of Qualification and Trainings from Researcher to Project Manager

New skills	<ul style="list-style-type: none"> ▪ Leadership skills (e.g. Delegation skills, organizational skills) ▪ Time-management ▪ Negotiation skills ▪ Industry oriented mind-set ▪ Interface between research and industry
Soft skill's Trainings	<ul style="list-style-type: none"> ▪ Leadership skills ▪ Professional communication skills (negotiation)
Professional Training	<ul style="list-style-type: none"> ▪ Specific on-the job specialization trainings: industrial applications, technologies
Management Training	<ul style="list-style-type: none"> ▪ Project and time-management ▪ Strategic-, change-, & risk- management
Activities and responsibilities Primary (responsible)	<ul style="list-style-type: none"> ▪ Industry Projects ▪ Communications Management (internal & external)
Activities and responsibilities Secondary (supporting)	<ul style="list-style-type: none"> ▪ Stakeholder Management ▪ Risk Management ▪ Change Management ▪ Quality Management

3.4 Step 4: Retention Strategies for the EPIC CoE

Final retention strategies are not implemented yet and still being discussed due to the early stage of development of the EPIC CoE. However, the stated options for retention incentives (chapter 2.4), like an effective performance management with individual and adaptable target agreements as well as salary incentives, can be already seen as very important pillars for the retention of the EPIC CoE employees.

4 Conclusion

In this contribution, a four-step approach for the development of an HR-concept for companies has been developed. The four steps were designed to establish a clear understanding of the complexity of the HR development process throughout the hierarchy levels and functions of organizations. Furthermore, their description is the foundation of an integrated competence management for companies.

The methodology could be successfully applied at the EPIC CoE through its modularity and transparency. The results deliver comprehensive competence profiles for the specific job roles and groups as well as qualification and training requirement profiles for the development of the employees' job roles on their individual career paths. Moreover, they build a solid knowledge basis for the further development of the EPIC CoE HR concept. Thus, retention of the employees is crucial, in this regard, strategies still have to be developed and applied.

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