

## **Project Manager's Competencies Required by Corporate Management of Chemical Industry in the Czech Republic**

Jana Košťálová, Marie Bednáříková, Michal Paták

### **Abstract**

**Purpose of the article:** This paper focuses on the issues of project manager competencies in corporate practice. It presents required project management competencies from the point of view of corporate management representatives – human resource managers.

**Methodology/methods:** The paper introduces the outcomes of the research conducted in the chemical companies in the Czech Republic in 2019. The research involved 514 chemical companies that were active in manufacturing chemical substances; in total, 60 from the addressed number of respondents replied.

**Scientific aim:** The scientific aim of this paper is to summarise the required project management competencies from the point of view of corporate management representatives.

**Findings:** The article presents the most important requirements for the project manager's competencies, project manager selecting tools and tools for enhancing competencies. The specification of requirements on this position and their verification, the selection of project managers and education in area of project management are indicative of one of the possible practical forms of Career Systems for Project Managers.

**Conclusions:** This paper identifies the required project management competencies from the point of view of corporate management representatives – human resource managers and tools usable for project managers' career development. The limiting factor of the paper is the scope of activity of the companies focussing solely on the chemical industry. Implementation of recommended tools and procedures in human resource management can bring a new dimension into corporate human resource management, project management, improvements in relationships in the teams, in the workplace, and broader possibilities of employee development.

**Keywords:** Project Management, Project Manager, Project Manager Competencies, Project Management Education, Career Path, Career Development

**JEL Classification:** J21, J24, J28, M53

## Introduction

The position of a project manager belongs to very demanding positions as it has a number of specifics compared to other professions. When managing projects, project managers usually bear significant responsibility for achieving the project objective and for keeping the project budget and the project schedule. They have to cope with a great amount of uncertainty, as well as manage and count, given the temporary nature of projects, with limited possibilities of career growth within one organisation. Project management (PM) standards, other PM methodologies, and a number of research papers define and recommend a suitable scope of knowledge and skills a project manager should have. The research question is to what extent knowledge and skills specified in this manner are actually required by potential employers. This paper aims to assess what qualification and other requirements are imposed on project managers by potential employers represented by Human Resource (HR) managers, what procedures they apply while selecting project managers, and what possibilities of further training and enhancement of project manager competencies they use. Another benefit can be seen in the insight into the manufacturing area – chemical industry, which is not primarily perceived as an area where PM is the primary activity of the corporate business activity. Nevertheless, even here projects, as tools bringing innovation and changes, are crucial, and it is necessary to enhance the possibilities of increasing their success rate.

### 1. Literature review

#### 1.1 Project manager competencies

The key target in the area of PM is increasing the success rate of projects. An adequate scope of knowledge of project managers, project team members, but also the members of

the top management is one of the ways how the project success rate can be increased.

A number of authors (Ozzorhon, *et al.*, 2022; Lin, 2021; Mir, Pinnington, 2014; Bakhsheshi, Nejad, 2011; Müller, Turner, 2007; Turner, Müller, 2005) confirm an important influence of project manager on the project success rate. According to Crawford (2005), it is possible to define the competence as “the knowledge and understanding, skills and abilities that a person brings to a job”. A competent project manager is able to possess some attributes to fulfil their role, and will demonstrate a certain level of performance (Bredillet *et al.*, 2015). A detailed range of project manager competencies is mainly defined in the international PM standards – standards of the Project Management Institute (PMI), Projects IN Controlled Environments 2 (PRINCE 2) by the Association for Project Management (APM), and particularly in standards of the International Project Management Association (IPMA), which is primarily focussed just on the definition of project manager's competencies (PMI, 2017; APM, 2012; IPMA, 2017). Within all the international PM standards, it is possible to verify the level of PM competencies using certification examination (Axelos, 2017; IPMA, 2015; PMI, 2018; Svirakova, 2014).

PM competencies can be structured into homogenous groups, and we can encounter a number of classification points of view. The IPMA (IPMA, 2017), in the form of the National Competence Baseline, specifies three basic areas of competencies: technical, behavioural and contextual competencies. There are 46 competency elements, which are required for successful project implementation in practice. Hager, Gonczi (1996) define division of job competencies into: declarative knowledge, procedural skill, and behavioural competencies.

Cheng *et al.* (2005) specify two PM competencies: generic competencies and job-task competencies, specific for each sector,

where the project is implemented. Suikki *et al.* (2006) divide PM competencies into three areas: PM knowledge areas, leadership areas, leadership skills and business environment. The impact of leadership competencies on the success rate of PM has been elaborated by Crawford (2005) and Shi, Chen (2006).

Tabara *et al.* (2017) specify a holistic model of competence, which is built on three pillars: the general knowledge, the necessary practical skills and the necessary social competence. Do Vale *et al.* (2018) divided the project managers' competencies in four categories – contextual, managerial, technical, and behavioural. Maqbool *et al.* (2017) extend the view of the impact of PM competencies on the project success rate by additional important factors as emotional intelligence and transformational leadership. Also, Thomas, Mengel (2008) accentuate emotional intelligence as very important. Similarly, Clarke (2010) emphasises emotional intelligence and leadership as important. The issues of defining PM competencies are also dealt with by Fisher (2011), who accentuates conflict management, or Liikamaa (2015; 2006), who specifies requirements in the area of personal and social competencies. Bredillet *et al.* (2015) also points out requirements in the area of ethics of project managers. Ramazani, Jergeas (2015) recommend developing critical thinking within enhancement of PM competencies to develop critical thinking for dealing with complexity, developing softer parameters of managing projects as interpersonal skills and, as Vlahov *et al.* (2019) recommended, the whole range of behavioural competencies.

Müller, Turner (2007; 2010) follow on from previous studies and confirm that equipment quality in the area of PM differs in different project types, particularly in the area of leadership, and extend the requirements imposed on project managers by mastering stress management. So, it is possible to consider defining industry-specific

PM competencies, as it is possible to see in the proposal of model of construction project manager's competencies by Dziekoński (2017), according to a study by Ahsan *et al.* (2013) or as Ozzorhon *et al.* (2022) presented in their study also from construction industry. Specifics of different industries Jabar *et al.* (2019) also mentioned, they focus on PM competencies in building industry or Ribeiro *et al.* (2021) who focused on specifics of PM competencies in area of information technologies especially in area of Industry 4.0. What may also affect defining PM competencies is the project type, which should be reflected in selecting a training framework for project managers (Trad, Kalpić, 2014; Cicmil, Gaggiotti, 2018). Yin *et al.* (2019) recommended as a tool for evaluation of competence in PM tool TODIM (interactive and multi-criteria decision-making method).

There is also national definition of PM competencies. On the basis of international PM standards and other professional resources, in the Czech Republic, what has been developed is an overview of competencies in the form of the database of the National System of Occupations, defining the scope of work of the project manager and the recommended qualification requirements in the field of professional theoretical skills, professional practical skills and soft skills (Ministry of Labour and Social Affairs CZ, 2017). This Nation System of Occupations mainly serves as an important HR management tool for defining requirements imposed on the position of a project manager and standardization of job descriptions. Furthermore, it takes account of local specifics in these requirements.

This adjustment of PM competencies with respect to project comprehensiveness, type, industrial orientation, and local modifications involves increasing requirements concerning more precise specification of the scope of these competencies, which is mainly reflected in the process of selecting a worker for the position of a project manager.

## 1.2 Project manager selection

As for companies implementing projects, HR management is demanding due to the fact that it is affected by a specific character of activities within projects, which mainly include the following (Huemann *et al.*, 2007; Huemann, 2010; Sato, Gnanaratnam, 2014):

- Temporary nature of projects;
- Dynamism;
- Project-portfolio resource and multirole demands;
- Parallel existence of line managers and project managers and participation of project team members and managers in temporary and line organisation structure; and
- Selection of internal or external project managers.

HR management in the projects is focused on the selection and recruiting of project managers and team members, resource allocations (Engwall, Jerbrant, 2003), the education of project specialists, the project managers career development (Keegan, Turner, 2003), management of project overload (Zika-Viktorsson *et al.*, 2006) and reduction of stress (Aitken, Crawford, 2007) and management of employee-wellbeing (Turner *et al.*, 2008).

Within the process of recruiting of project managers, it is possible to make use of a number of available tools, such as the Big 5 Model (extroversion, conscientiousness, neuroticism, openness toward experience, tolerance,) solving case studies, tests of intellectual intelligence, social intelligence and emotional intelligence (Kocianova, 2010). Nowadays the tools as Assessment Centre selection methods, projective tests, or expressive techniques, scaling, an integrity test, camera tests or other soft skills assessment tools (Caruth *et al.*, 2009) are also very often used.

For project manager selection, it is possible to use some other specialised procedures. Varajão, Cruz-Cunha, (2013) present application of the IPMA Competence Baseline in combination with the Analytic Hierarchy

Process for selection of the most suitable project manager for project. Hadad *et al.* (2013) present the decision-making support system module for selecting of project managers. A problem that also cannot be omitted in the area of project manager selection is the gender topic, particularly in the areas like engineering and construction, where PM is perceived as male-dominated (Pinto *et al.*, 2015).

An overview of the range of preferred project manager competencies within the process of selecting workers for the position of a project manager can be obtained from published papers analysing advertisements for the position of a project manager. It is especially industry, where they most frequently require technical skills in accordance to the type of industry, communication skills, team management skills and leadership (Ahsan *et al.*, 2013; Chipulu *et al.*, 2013). The most frequently required university education is on academic level, mainly the Bachelor's level (Ramazani, Jergeas, 2015; Chipulu *et al.*, 2013).

## 1.3 PM education

In the case of insufficient knowledge of a newly recruited employee, but also in the case it is necessary to extend the knowledge of project managers, project team members, but also the top management, the activity of HR management includes ensuring PM education. Studies from practice showed that PM education was not on a sufficient level (Berggren, Söderlund, 2008; Karanja, Malone, 2021). However, this area is also subject to development, and next studies have proved that PM education is becoming more and more important in practice, increase the efficiency of projects (Contreras *et al.*, 2015), and so it is necessary to adapt it to the market needs as much as possible (Ramazani, Jergeas, 2015).

As for university courses, PM has become a standard part curricula in the fields of economy and management; it is a part of

technical study disciplines, particularly in information technologies, civil engineering, mechanical engineering, but also in a number of other areas (Karanja, Malone, 2021). Teaching often involves some of the international PM standards. Karanja, Malone (2021) based on the analysis of PM curriculum from universities criticise the excessive focus on technical competencies. There are available innovative attitudes at university level, like gamification at university PM courses (Tews *et al.*, 2020).

There are also a lot of courses as part of lifelong learning. To acquire a standard level of knowledge, it is possible to make use of the above certification system within the IPMA, PMI or PRINCE 2 standards (Axelos, 2017; IPMA, 2015; PMI, 2018). The certification could give the overview of PM knowledge of candidates during recruitment process (Farashah *et al.*, 2019).

Cicmil, Gaggiotti (2018) present responsible project management education (RPME), which is focused on the development of the skills, knowledge and competencies of PM as well as on a diverse, political and ambiguous context of contemporary projects. RPME also reflects the ethics, environmental and social responsibility in projects.

Ewin *et al.* (2017) and Hansen (2004) recommends that education should mainly be focussed on strengthening soft skills, which may significantly contribute to decreasing the number of project failures. Shi (2011) includes representation of PM training and knowledge management in the conditions of a high level of PM maturity to the following extent:

- The organisation has a training budget for PM which is aligned with the personal development plans of PM professionals in the organisation;
- The organisation has got regular PM training system for top managers, for project managers and project team members;
- The organisation has a sound knowledge management system of PM including the

learning system to improve the effectiveness of the PM professionals.

#### **1.4 PM career development support**

Effective PM education is very closely associated with the long-term goals of the organisation and long-term plans of career development support (Medina, Medina, 2014). The PM career is unique, as it is significantly affected by the above-mentioned specifics of activities in the area of PM.

In such a demanding environment, it is essential to offer project specialists support in their career development (El-Sabaa, 2001). A project can be understood as a temporary organisation (Turner, Müller, 2003), and what is also substantially limited in this context is planning of a project manager career. Preparation of career development support is then associated with the programme and portfolio management rather than with PM. Compared to support of line managers, one of the possibilities of supporting project managers in their career is in structuring a project portfolio from the point of view of project complexity and requirements imposed on the level of project managers' knowledge and experience on the basic, senior and master level (Bredin, Söderlund, 2013) or project manager, senior project manager and project director (Hölzle, 2010).

Hölzle (2010) states that a project manager's career is affected by the individual and organisational side. The organisation needs to respond to individual career preferences in a flexible and dynamic way (Chen *et al.*, 2004). An organisation frame for the creation of career opportunities is called career path or career path model (Hölzle, 2010). Hölzle (2010) presents the most important factors which influence the project manager's career path: the different requirements of skills for different project complexity, the increase of requirements with the leader of project manager career (know-how, experience, training *etc.*), including of mentoring activities, alignment of all organisational career paths

to allow for a fair and transparent promotion policy in the organisation. Importance of mentoring as a part of activities in project career path Kilkelly (2015) also confirms.

By Bredin, Söderlund (2013) the existence of career model in the company helps better steer the project manager's career. It could help to project manager to understand what employer expects from employee and employee could expect from employer in context with regard to promotion, status, payment, training, feedback, assignments and future opportunities.

## 2. Research methodology

A literature review resulted in the preparation of a quantitative research conducted at chemical companies based in the CZ. A pilot research was performed in the second half of 2018 in the form of structured interviews at 10 companies. The outcomes of this pilot research were the basis for implementation of a blanket research in the form of electronic questionnaire survey with HR managers of chemical companies in the CZ in the second half of 2019. The blanket research involved 514 chemical companies that were, under the classification of economic activities in accordance with the Czech statistic rules (CZ NACE), active in manufacturing chemical substances and preparations as of 1 January 2018. Specifically, they were HR managers of these companies who were addressed within the research. In total, 60 from the addressed number of the respondents replied. The questionnaire was divided into three parts – the first part asked the respondents about the requirements imposed on PM competencies, the second part asked about PM education, and the third part dealt with identification of the company and assessment of the scope of utilization of PM.

In view of the fact that the research was conducted in the conditions of the CZ, PM competencies were assessed through the

National System of Occupation (Ministry of Labour and Social Affairs CZ, 2017), as it is based on the national environment and defining requirements imposed on project managers was thus close and understandable for the HR managers involved in the research. The compilation of a list of competencies also took account of a list of technical, behavioural and contextual competencies of project managers defined by the IPMA (IPMA, 2017).

The respondents' attitudes to the importance of the PM applicants' skills were assessed using a seven-point scale 1–7 (1 = low importance, 7 = high importance). The obtained data was subsequently processed using the statistical software of IBM SPSS Statistics and analysed using descriptive and inferential analysis tools. The Friedman test at 0.05 significance level was used to verify the statistical significance of differences in the importance of skills in the group. The Bonferroni correction was used in post hoc pairwise comparisons.

## 3. Research outcomes

### 3.1 Characteristics of the chemical companies and project activities

Although the companies that took part in the research are active in the area of chemical industry, from the point of view of their manufacturing activities and utilization of PM they are a diverse group of companies. The company size is proportionate to the number of employees. The respondents' replies imply that they are medium-sized or large companies with more than 50 employees. As for the focus of projects, chemical companies mainly implement investment projects (74% of the respondents), R&D projects (65% of the respondents), and customer projects (53% of the respondents). However, the companies also implement, to a lesser extent, some other types of projects, e.g. projects focussed on organisational changes, restructu-

*Table 1. Activities carried out as part of PM in the chemical companies surveyed*

Project activities	Respondents
PM at all stages – initialisation, planning, implementation, monitoring and reporting, handover, evaluation, and closure	85%
Determining the schedule and financial plan of the project implementation	64%
Assembling, leading and managing the project team	64%
Coordination of work processes and continuity of activities in individual tasks	61%
Project change management	61%
Collaboration in the tendering and contracting of the project	58%
Project financial resources, costs, revenues and cash-flow management	58%
Reporting the state of implementation of the project to the project team and towards the project owner and management of the companies concerned	55%
Ensuring the transfer of project outputs and their acceptance by stakeholders	55%
Coordination and cooperation in the creation of input analyses of the subject matter and objectives of the project	52%
Managing all available resources in the project	52%
Managing and checking complete project documentation	52%
Project risk and opportunities analysis and management	45%
Project quality management, including hygiene and work safety inspections	42%
Managing communication in the project, supporting and stimulating project members for effective performance	36%
Collection of project ideas across the organisation	27%
Programme management, project portfolio management	24%

*Source: (Authors).*

ring, or reengineering. If a company implements customer projects, PM is a significant part of the corporate activity, as the majority of manufacturing is of a project character. However, chemical companies are mostly manufacturing companies where the share of project activities is, within the total range of corporate activities, rather smaller.

Projects are implemented by the companies both within individual organisational units, and in the form of a matrix organisational structure. Only 18 % of the respondents confirmed presence of a project management office (PMO) in their organisational structure. If companies have a PMO, its function is most often implementational (50% of the respondents), less often only supporting (33% of the respondents), or strategic (17% of the respondents). What is also low is the rate of support of PM using a PM information system (30% of the respondents).

The scope of application of PM in practice by the companies involved in the research was assessed through the basic activities based on international PM standards. Table 1 shows the PM activities performed by the respondents.

From the above data, it can be stated that the chemical companies surveyed use PM in the basic scope (time management, finance management, team management, including continuous monitoring throughout the whole life cycle of the project). There is less use of activities related to the management and coordination of multiple projects, programmes or project portfolios, which corresponds to the predominant type of implemented projects and their integration into the organisational structure.

### 3.2 Requirements concerning PM competencies

Within the assessment of the requirements imposed on PM competencies, the respon-

*Table 2. Assessment of importance of general, professional theoretical and practical skills, and soft skills of applicants.*

<b>General skills</b>	<b>Mean</b>	<b>Median</b>	<b>Professional (theoretical) skills</b>	<b>Mean</b>	<b>Median</b>
Conceptual thinking	6.19a	6	Principles of teamwork	5.61a	6
Analytical thinking	6.09a	6	Risk management in project management	5.58a	6
Language capability of the native language	5.85a	6	Indicators of economic investment and project efficiency	5.56a	6
Computer capability in project management	5.83a	6	Financial planning and controlling	5.49a	6
English language capability	5.49a	6	Time management	5.44a	5
Numerical capability – knowledge of practical mathematics	5.11	5	Work motivation and efficiency evaluation in project management	5.41a	5
Knowledge of corporate economics	4.98	5	Selection and deployment of workers in project teams	5.38a	6
Knowledge of corporate management	4.91	5			
Driving licence	4.68	4			
Basic legal knowledge in the extent civil and commercial law	4.40	4			
<b>Professional (practical) skills</b>	<b>Mean</b>	<b>Median</b>	<b>Soft skills</b>	<b>Mean</b>	<b>Median</b>
Project time framework management	5.93a	6	Self-reliance	6.09a	6
Project team management	5.93a	6	Problem solving	6.07a	6
Project risk management	5.89a	6	Active approach	6.07a	6
Project information and documentation management	5.80a	6	Cooperation (collaboration)	6.02a	6
Change management	5.78a	6	Effective communication	6.00a	6
Project scope management	5.70a	6	Workload management. resistance	5.84a	6
Project quality management	5.70a	6	Flexibility	5.73a	6
Project integration management	5.65a	6	Information management	5.70a	6
Project resource management	5.65a	6	Leadership	5.58	6
Project financial management	5.46	6			

*Source: (Authors).*

a – The differences in the mean values in the group of skills are not significant at 0.05 level.

Notes: Used scale: 1–7 (1 = low importance, 7 = high importance).

dents commented on the qualification requirements, requirements imposed on an applicant's experience, and requirements imposed on general skills, professional theoretical skills, professional practical skills, and soft skills. Furthermore, they evaluated the procedures applied within selection of project managers for projects.

As for selection of project managers, the selection criteria the respondents consider as most important are education (85% of the respondents) and applicants' experience (83%

of the respondents). These criteria were preferred to criteria such as language skills and PM certifications. As for the requirements concerning academic education, 44% of the respondents consider a bachelor degree as sufficient. From the point of view of the field of study, they most preferred an interdisciplinary course combining education in the area of economy and management and technical education in the given industry (48% of the respondents), or only technical orientation of university studies (39% of the respondents).

As for the job experience, 52% of the respondents consider 1 to 3-year experience of applicants as sufficient, and 66% of the respondents prefer experience in more branches of business.

The respondents assessed the importance of selected general skills, professional theoretical skills, professional practical skills and soft skills within evaluation of applicants for the position of a project manager. Table 2 shows the assessed skills in the order from the most important skills to the less important ones in respective groups as seen by the respondents. The result of the Friedman test shows that the differences in the importance of general skills ( $\chi^2 = 201.422$ ;  $p < 0.001$ ), professional practical skills ( $\chi^2 = 20.365$ ;  $p = 0.016$ ) and soft skills ( $\chi^2 = 21.980$ ;  $p = 0.003$ ) are significant at the 0.05 level. Post hoc pairwise comparisons revealed the most importance skills without significant differences in the group (noted in Table 2). On the contrary, the differences in the importance of professional theoretical skills ( $\chi^2 = 5.838$ ;  $p = 0.559$ ) are not significant at 0.05 level.

As for general skills, the most required ones are conceptual and analytical thinking, and what is also important is good knowledge of the native language, English language, and computer capability in PM. Identified differences in other areas of skills are marginal.

As for the assessment of applicants and tools for selecting a project manager as such, project managers are most often recruited from internal sources, *i.e.* from the own employees (61% of the respondents). 59% of the respondents recruit outsiders for the positions of project managers for long-term co-operation in PM. 29% of the respondents select PM for a currently prepared project only. Services of an external specialised PMO are used for PM only marginally (16% of the respondents).

Project managers are most often full-time employees for a project or projects (74% of

the respondents). Very rarely, they are part-time employees or employees combining PM and some other job duties.

Within the selection of a project manager as such, HR managers apply a number of tools and methods to check the applicants' abilities. Most often, they make use of case studies (67% of the respondents). 20–25% of the respondents also apply other tools such as IQ tests or verification of soft skills. 26% of the respondents use their own sets of entrance tests. They also test knowledge in the area of information technologies and language skills. To a lesser extent, they also apply other tools, such as projective tests in the form of association, construction, completion, or expressive techniques (18% of the respondents), the assessment centre method (18% of the respondents), social (15% of the respondents) and emotional intelligence tests (13% of the respondents), and the Big 5 Model (8% of the respondents).

### **3.3 Experience in the area of PM education and a career path**

58% of the respondents confirmed that their companies regularly finance employee training in the area of PM. On average, they channel EUR 4 – 8,000 to this activity annually. Training for project managers is most often focussed on PM basics (88% of the respondents), development of soft skills in PM (71% of the respondents), trainig in the area of PM information systems (59% of the respondents), and hard PM skills (47% of the respondents). Company training also involves top managers, whose training in the area of PM is most often focussed on soft skills in PM (73% of the respondents), PM basics (53% of the respondents), and hard PM skills (40% of the respondents). Project team members are also trained, particularly in PM basics (69% of the respondents), in the area of hard PM skills and soft PM skills (always 38% of the respondents) and PM information systems (31% of the respondents).

As for the forms of training, most often

they are lectures (68% of the respondents), participation in professional conferences (63% of the respondents), cooperation with an external project manager or an expert in the area of PM (42% of the respondents), studying professional literature (42% of the respondents), and 32% of the respondents use coaching or electronic forms of training. Only 26% of the respondents choose preparation for certification, including a certification test. This probably results from very low awareness of the international PM standards and the possibility of certifying knowledge within these standards (28% of the respondents). The respondents who have encountered PM certification mainly know PRINCE2 (60 % of these respondents). Although 60% of the respondents confirmed that they consider, when recruiting employees for the project manager positions, long-term utilization of workers in PM, but only 29% of the respondents continue to work with these workers in the form of support of their career growth through making a career plan.

#### 4. Discussion

As Dziekoński (2017) and Ahsan *et al.* (2013) declare in their research, the requirements on PM competencies vary depending of industry and project's characteristics, so it is important to analyse the different industry areas and investigate their specifics to improve the way the projects are managed.

The education, certification, communication, time management, and technical skills are preferable in construction, ICT, engineering, and generally in technical areas in comparison to government and healthcare (where the most important competencies are communication and stakeholder management) (Ahsan *et al.*, 2013). On the other hand, in chemical industry, the general managerial skills are preferable, as well as the soft skills. Preference of general managerial skills and technical skills in technical disciplines was

confirmed by Jabar *et al.* (2019) for area of building construction. It is possible to recognise the increase of importance of computer capability and generally the knowledge in area of information and communication technologies, as Rebeiro *et al.* (2021) associated it with Industry 4.0 (Ustundag *et al.*, 2018; Dastbaz, Cochrane, 2019) and which could be linked with trend of Chemistry 4.0 in chemical industry (Deloitte, 2016; Kneißel, 2020). It tends the hard skills and technical skills are preferable in technical areas, but it is possible to recognise the increase of importance of soft skills also in this area. Ribeiro *et al.* (2021) predict the change in the way of communicating, interacting, the speed and capacity of work and the basic knowledge that the project manager must present and that the competencies associated with Industry 4.0 go further than the competencies defined by the the PMI or IPMA.

The specific required skills impacted the recruitment process and training especially the specification of ideal applicants and scope and impact of the training of project managers in specific areas of industry. As Contreras *et al.* (2015) declare, to recruit the right person and to organise training in area of PM increase the efficiency of PM. It was confirmed by the output of research in chemical industry, HR managers prefer applicants with PM experiences, minimally bachelor education in economy and technical combination. They also support training in PM to improve the required skills.

#### 5. Recommendations

On the basis of the data acquired within the research performed at chemical companies in the Czech Republic, it is possible to obtain a clear picture of what general requirements and requirements concerning PM competencies HR managers in the companies impose on the position of a project manager and how they implement further development in the

area of PM education. At the same time, it is possible to identify weak points and suggest recommendations which should lead to improvements in the situation in the areas of selection, assessment, and further development of project managers:

Broader use of procedures in compliance with the international PM standards;

Assessment of the level of PM using PM maturity models – obtaining unbiased evaluation of the level of PM at the company, *i.e.* also of the level of the project managers' knowledge;

Broader use of comprehensive training of project managers and project team members using a checkback in the form of certification;

Broader use of PM certification for assessment of applicants for the position of a project manager, particularly for verification of their PM professional practical skills;

Broader application of HR management methods and tools for verification of competencies and skills (an assessment centre, social and emotional intelligence tests, the Big 5 Model, practical verification of soft skills, *etc.*);

Broader utilization of various forms of training, participation in professional conferences, access to professional forums (*e.g.* e-learning, professional education servers, PM webinars, virtual reality, membership in professional associations, *etc.*);

Making project managers familiar with new methods and techniques (Agile Management, Design Thinking, RPME, Sustainability in PM, *etc.*);

Involvement of a PMO for a larger support of projects, project managers and project team members, creation of methodological PM procedures on the level of the company, cooperation of the PMO with the members of top management in strategic management, particularly in the area of project portfolio, programme, and PM;

Cooperation of the PMO with the HR department and top management, setting methodological rules of career development

of project managers involved in projects, and specification of the possibilities of their further development in the form of a career plan;

Creating and discussing, on a regular basis, individual career plans and their fulfilment together with project managers in personal terms in compliance with methodological procedures;

Being more active in the area of career development, being active in offering the workers the possibility of further development – in the form of education, in the form of involvement in more demanding projects, transfer to other projects within the holding structure, *etc.*

Adopting alternative approaches leading to increasing the level of PM, *e.g.* in the form of cooperation with external experts, utilization of external project managers, co-operation with consulting firms, professional associations, *etc.*

These recommendations are also applicable in other areas with a character of manufacturing that is similar to that of the chemical industry, and so it is possible to generalise them to a wider range of companies. However, it is also necessary to point out that not only PM competencies of project managers play an important role in the success rate of project. Requirements in this area must also be imposed on PM team members, and what also has significant effects is the organisation level of PM competencies and awareness of the importance of PM in top management (Loufrani-Fedida, Missonier, 2015).

## 6. Conclusion

The paper is aimed at the issues of selection, assessment, and further development of project managers in the corporate environment from the point of view of HR managers. The assessed companies prefer applicants with 1 to 3-year experience, and they prefer uni-

versity technical education combined with education in economy and management. The Bachelor's level of university education is considered as sufficient. The position of a project manager is occupied both from the internal, and from the external sources. What is positive is the finding that when recruiting from external sources, HR managers opt for making a long-term employment contract with project managers and plan, providing the experience is positive, to employ a project manager on a long-term basis for future projects. When they assess applicants, the PM competencies they mainly require include: conceptual and analytical thinking, teamwork principles, knowledge of project risk and financial management, time management, team and project risk management, information and documentation management, self-reliance, problem-solving capabilities, and they also appreciate an active approach. The process of recruiting project managers involves a number of methods and tools for verification of the applicants' knowledge and competencies.

The companies support PM education. Such training involves not only project managers, but also project team members and members of top management. As for its content, it mainly covers PM basics, a project information system, hard PM skills and soft skills. Most often, training is in the form of lectures. What is on a very low level is awareness of PM certification and of the possibility of verifying or proving the knowledge in this way. Another drawback is a low level of support of project managers through career

development and creation of a career plan.

The recommendations are mainly aimed at broader utilization of the international PM standard for specification of activities, the scope of training, and particularly in the form of certification for verification of the level of knowledge. Especially for companies implementing customer projects, it is desirable to support project managers and project team members in the form of a PMO. Close co-operation between the PMO and the HR department is a way how to improve utilization of HR resources within planning projects, programmes, and a portfolio, and it is also a way how to help project managers improve their career prospects in their profession.

The limiting factor of the paper is the scope of activity of the companies focussing solely on the chemical industry, and there are also local limitations, as the research covered one country only. The authors have conducted a similar research in the area of the metallurgical industry (Kostalova *et al.*, 2018), where the situation is, also in view of the similarities of both industries, similar. It would also be of benefit to compare the outcomes across other areas of industry and services, or to compare them internationally. Nevertheless, in spite of the above-mentioned limiting factors, the research outcomes made it possible to obtain the basic overview of the approach of HR managers to the process of selecting project managers. At the same time, they made it possible to obtain an overview of the scope and forms of PM education, which can help companies to improve the PM maturity.

## References

- Aitken, A., Crawford, L. (2007). Coping with stress: dispositional coping strategies of project managers. International Journal of Project Management, 25(7), pp. 666–673. DOI:10.1016/j.ijproman.2007.02.003.
- Ahsan, K., Ho, M., Khan, S. (2013). Recruiting project managers: A comparative analysis of competencies and recruitment signals from job advertisements. Project Management Journal, 44(5), pp. 36–54. DOI:10.1002/pmj.21366.
- APM (2012). APM body of knowledge. High Wiccombe: APM.
- Axelos (2017). PRINCE2 Project management

- certifications. Retrieved from: <https://www.axelos.com/certifications/prince2>.
- Bakhsheshi, H. A., Nejad, R. S. (2011). Impact of project managers' personalities on project success in four types of project. International Conference on Construction and Project Management, 15(2), pp. 181–86.
- Berggren, C., Söderlund, C. (2008). Rethinking project management education: Social twist and knowledge coproduction. *International Journal of Project Management*, 26(3), pp. 286–296. DOI:10.1016/j.ijproman.2008.01.004.
- Bredillet, Ch., Tywoniak, S., Dwivedula, R. (2015). What is a good project manager? An Aristotelian perspective. *International Journal of Project Management*, 33(2), pp. 254–266. DOI:10.1016/j.ijproman.2014.04.001.
- Bredin, K., Söderlund, J. (2013). Project managers and career models: An exploratory comparative study. *International Journal of Project Management*, 31(6), pp. 889–902. DOI:10.1016/j.ijproman.2012.11.010.
- Caruth, D. L., Caruth, G. D., Pane, S. S. (2009). A guide to planning, recruiting and selecting for human resource professionals. Santa Barbara: ABC-CLIO.
- Chen, T. Y., Cang P. L., Yeh, C. W. (2004). A study of career needs, career development programs, job satisfaction and the turnover intentions of R&D personnel. *Career Development International*, 9(4), pp. 424–437. DOI:10.1108/13620430410544364.
- Cheng, M. I., Dainty, A., Moore, D. R. (2005). What makes a good project manager? *Human Resources Management Journal*, 15(1), pp. 25–37. DOI:10.1111/j.1748-8583.2005.tb00138.x.
- Chipulu, M., Neoh, J. G., Ojiako, U., Williams, T. (2013). A multidimensional analysis of project manager competences. *IEEE Transactions on Engineering Management*, 60(3), pp. 506–517. DOI:10.1109/tem.2012.2215330.
- Cicmil, S., Gaggiotti, H. (2018). Responsible forms of project management education: Theoretical plurality and reflective pedagogies. *International Journal of Project Management*, 36(1), pp. 208–218. DOI: 10.1016/j.ijproman.2017.07.005.
- Clarke, N. (2010). Emotional intelligence and its relationship to transformational leadership and key project manager competences. *Project Management Journal*, 41(2), pp. 5–20. DOI:10.1002/pmj.20162.
- Contreras, C. A. R., Almaguer, K. P. J., Tovar, Y. S. (2015). Perceptions of the impact of training, compensation and recruitment on project effectiveness. *AD-MINISTER*, 27, pp. 5–26.
- Crawford, L. (2005). Senior management perceptions of project management competence. *International Journal of Project Management*, 23(1), pp. 7–16. DOI:10.1016/j.ijproman.2004.06.005.
- Dastbaz, M., Cochrane, P. (2019). *Industry 4.0: and Engineering for a Sustainable Future*. Springer, Switzerland, 235 pp.
- Deloitte (2016). *Industry 4.0 and the chemicals industry Catalyzing transformation through operations improvement and business growth*. Deloitte University Press, 20 pp.
- Do Vale, J. W. S. P., Nunes, B., de Carvalho, M. M. (2018). Project Managers' Competences: What do Job Advertisements and the Academic Literature Say? *Project Management Journal*, 49(3), pp. 82–97.
- Dziekoński, K. (2017). Project managers' competencies model for construction industry in Poland. *Procedia Engineering*, 182, pp. 174–181. DOI:10.1016/j.proeng.2017.03.157.
- El-Sabaa, S. (2001). The skills and career path of an effective project manager. *International Journal of Project Management*, 19(1), pp. 1–7. DOI:10.1016/s0263-7863(99)00034-4.
- Engwall, M., Jerbrant, A. (2003). The resource allocation syndrome: the prime challenge of multi-project management? *International Journal of Project Management*, 21(6), pp. 403–409. DOI:10.1016/s0263-7863(02)00113-8.
- Ewin, N., Luck, J., Chugh, R., Jarvis, J. (2017). Rethinking Project Management Education: A Humanistic Approach Based on Design Thinking. *Procedia Computer Science*, 121, pp. 503–510. DOI:10.1016/j.procs.2017.11.067.
- Farashah, A. D., Thomas, J., Blomquist, T. (2019). Exploring the Value of Project Management Certification in Selection and Recruiting. *International Journal of Project Management*, 37, pp. 14–26. DOI:10.1016/j.ijproman.2018.09.005.
- Fisher, E. (2011). What practitioners consider to be the skills and behaviours of an effective people project manager. *International Journal of Project Management*, 29(8), pp. 994–1002. DOI:10.1016/j.

- ijproman.2010.09.002.
- Hadad, Y., Keren, B., Laslo, Z. (2013). A decision-making support system module for project manager selection according to past performance. *International Journal of Project Management*, 31, pp. 532–541. DOI:10.1016/j.ijproman.2012.10.004.
- Hager, P., Gonczi, A. (1996). What is competence? *Medical Teacher*, 18(1), pp. 15–18. DOI:10.3109/01421599609040255.
- Hansen, S. (2004). The Supervisor in the Project-Organized Group Work Should Participate in Developing the Students' Project Competencies. *European Journal of Engineering Education*, 29(3), pp. 451–459. DOI:10.1080/0304379031000165859 6.
- Hölzle, K. (2010). Designing and implementing a career path for project managers. *International Journal of Project Management*, 28(8), pp. 779–786. DOI:10.1016/j.ijproman.2010.05.004.
- Huemann, M., Keegan, A., Turner, J. R. (2007). Human resource management in the project-oriented company: A review. *International Journal of Project Management*, 25(3), pp. 315–323. DOI:10.1016/j.ijproman.2006.10.001.
- Huemann, M. (2010). Considering human resource management when developing a project-oriented company: Case study of a telecommunication company. *International Journal of Project Management*, 28(4), pp. 361–369. DOI:10.1016/j.ijproman.2010.02.008.
- IPMA (2017). IPMA standards. Retrieved from: <http://www.ipma.world/individuals/standard/>.
- IPMA (2015). About certification. Retrieved from: <http://www.ipma.world/certification/>.
- Jabar, I. L., Abdul-Azis, A. R., Suresh, S., Renukappa, S., Enshassi, A. (2019). A project management competency framework for industrialised building system (IBS) construction. *International Journal of Technology*, 10(4), pp. 657–666. DOI:10.14716/ijtech.v10i4.2773.
- Karanja, E., Maloone L. C. (2021). The role of industry and academia partnership in improving project management curriculum and competencies. *Journal of Economic and Administrative Sciences*, Early Access. DOI:10.1108/JEAS-12-2020-0200.
- Keegan, A. E., Turner, J. R. (2003). Managing human resources in the project-based organisation.
- Turner, J. R. (Ed.), *People in Project Management*. United Kingdom: Gower, Aldershot, pp. 1–12.
- Kilkelly, E. (2015). The changing face of project leadership: a look at how senior project manager roles have evolved and what skillsets they require now. *PM World Journal*, 4(6), pp. 1–5.
- Kneißel, B. (2020). Chemistry 4.0: Reinventing the chemical company with digital transformation. KPMG Reaction. Retrieved from: <https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/07/reaction-23.pdf>.
- Kocianova, R. (2010). Human resource management activities and methods (in Czech). Prague: Grada Publishing, 224 pp.
- Kostalova, J., Bednarikova, M., Patak, M. (2018): Requirements for competences of project managers in metallurgical companies in the Czech Republic. *Metalurgija*, 57(1–2), pp. 131–134.
- Liikamaa, K. (2015). Developing a project manager's competencies: A collective view of the most important competencies. *Procedia Manufacturing*, 3, pp. 681–687. DOI:10.1016/j.promfg.2015.07.305.
- Liikamaa, K. (2006). Key aspects of the project manager's personal and social competencies. *Global Partnership Management Journal*, 2(1), pp. 16–22.
- Lin, Y. C. (2021). A study on the relationship between project management competency, job performance and job motivation in e-commerce industry. *Measurement Business Excellence*, 25(1), pp. 24–57. DOI:10.1108/MBE-10-2020-0144.
- Loufrani-Fedida, S., Missonier, S. (2015). The project manager cannot be a hero anymore! Understanding critical competencies in project-based organisations from a multilevel approach. *International Journal of Project Management*, 33(6), pp. 1220–1235. DOI:10.1016/j.ijproman.2015.02.010.
- Maqbool, R., Sudong, Y., Manzoor, N., Rashid, Y. (2017). The impact of emotional intelligence, project managers' competencies, and transformational leadership on project success: An empirical perspective. *Project Management Journal*, 48(3), pp. 58–75. DOI:10.1177/875697281704800304.
- Medina, R., Medina, A. (2014). The project manager and the organisation's long-term competence goal. *International Journal of Project Management*,

- 32(8), pp. 1459–1470. DOI:10.1016/j.ijproman.2014.02.011.
- Ministry of Labor and Social Affairs CZ (2017). The national system of occupations. Retrieved from: <https://nsp.cz/odborne-skupiny>.
- Müller, R., Turner, J. R. (2007). Matching the project manager's leadership style to project type. *International Journal of Project Management*, 25(1), pp. 21–32. DOI:10.1016/j.ijproman.2006.04.003.
- Müller, R., Turner, J. R. (2010). Leadership competency profiles of successful project managers. *International Journal of Project Management*, 28, pp. 437–448. DOI:10.1016/j.ijproman.2009.09.003.
- Mir, F. A., Pinnington, A. H. (2014). Exploring the value of project management: Linking Project Management Performance and Project Success. *International Journal of Project Management*, 32(2), pp. 202–217. DOI:10.1016/j.ijproman.2013.05.012.
- Pinto, J. K., Patanakul, P., Pinto, M. B. (2015). Bender biases in hiring project managers: perceptions of trust and likeability. *IEEE Transactions on Engineering Management*, 62(3), pp. 325–334. DOI:10.1109/tem.2015.2415251.
- PMI (2017). A guide to the project management body of knowledge. 6 ed., Newton Square: PMI, 250 pp.
- PMI (2018). Certifications. Retrieved from: <https://www.pmi.org/certifications>.
- Ozzorhon, B., Akgemik, O. F., Caglayan, S. (2022). Influence of project manager's competencies on project management success. *Gradevinar*, 74(1), pp. 21–33. DOI:10.14256/JCE.2453.2018.
- Ramazani, J., Jergeas, G. (2015). Project managers and the journey from good to great: The benefits of investment in project management training and education. *International Journal of Project Management*, 33(1), pp. 41–52. DOI:10.1016/j.ijproman.2014.03.012.
- Ribeiro, A., Amaral, A., Barros, A. (2021). Project Manager Competencies in the context of the Industry 4.0. *Prodecia Computer Science*, 181, pp. 803–810. DOI:10.1016/j.procs.2021.01.233.
- Sato, C. E. Y., Gnanaratnam, A. S. (2014). The differences between an internal and external project manager. *Revista de Gestão e Projetos Journal of Business and Projects*, 5(2), pp. 1–23. DOI:10.5585/ gep.v5i2.264.
- Shi, Q. (2011). Rethinking the implementation of project management: A Value Adding Path Map approach. *International Journal of Project Management*, 29, pp. 295–302. DOI:10.1016/j.ijproman.2010.03.007.
- Shi, G., Chen, J. (2006). The human side of project management: Leadership skills. Newtown Square: PMI, 89 pp.
- Suikki, R., Tromstedt, R., Haapasalo, H. (2006). Project management competence development framework in turbulent business environment. *Technovation*, 26(5–6), pp. 723–738. DOI:10.1016/j.technovation.2004.11.003.
- Svirakova, E. (2014). System dynamics methodology: Application in project management education. 11th International Conference on Efficiency and Responsibility in Education Location, 5–6 June, 2014, Prague, Czech Republic.
- Taraba, P., Kavkova, V., Trojan, J. (2017). Development of the knowledge system based on formation of holistic competence of project managers in the Czech Republic. CSIT 2017, 5–8 September, 2017, Lviv, Ukraine.
- Tews, T., Skutmoski, G., Lanston, C., Patching, A. (2020). Innovation in project management education let's get serious! *Construction Economics and Building*, 20(3), pp. 124–141. DOI:10.5130/AJCEB.v20i3.7040.
- Thomas, J., Mengel, T. (2008). Preparing project managers to deal with complexity: advanced project management education. *International Journal of Project Management*, 26(3), pp. 304–315. DOI:10.1016/j.ijproman.2008.01.001.
- Trad,A., Kalpić, D. (2014). The selection and training framework (STF) for managers in (e-) business innovation transformation projects – managerial recommendations. *Procedia Technology*, 16, pp. 768–774. DOI:10.1016/j.protcy.2014.10.026.
- Turner, J. R., Huemann, M., Keegan, A. E. (2008). Human resource management in the project-oriented organisation: employee well-being and ethical treatment. *International Journal of Project Management*, 26(5), pp. 577–585. DOI:10.1016/j.ijproman.2008.05.005.
- Turner, J. R., Müller, R. (2003). On the nature of the project as a temporary organisation. *International Journal of Project Management*, 21, pp. 1–8.

- DOI:10.1016/s0263-7863(02)00020-0.
- Turner, R., Müller, J. R. (2005). The project manager's leadership style as a success factor on projects: A literature review. *Project Management Journal*, 36(2), pp. 49–61. DOI:10.1177/875697280503600206.
- Ustundag A., Cevikcan, E. (2018). *Industry 4.0: Managing the Digital Transformation*. Springer, Switzerland, 286 pp.
- Varajão, J., Cruz-Cunha, M. M. (2013). Using AHP and the IPMA competence baseline in the project managers selection process. *International Journal of Production Research*, 51(11), pp. 3342–3354. DOI:10.1080/00207543.2013.774473.
- Vlahov, R. D. Klindzic, M., Radujkovic M. (2019). Information modelling of behavioural project management competencies. *Information technologies and learning tools*, 69(1), pp. 186–197. DOI:10.33407/itlt.v69i1.2713.
- Yin, J., Guo, J., Ji, T., Cai, J., Xiao, L., Dong, Z. (2019). An extended TODIM method for project manager's competency evaluation. *Journal of Civil Engineering and Management*, 25(7), pp. 673–686. DOI:10.3846/jcem.2019.10521.
- Zika-Viktorsson, A., Sundström, P., Engwall, M. (2006). Project overload: an exploratory study of work and management in multi-project settings. *International Journal of Project Management*, 24(5), pp. 385–394. DOI:10.1016/j.ijproman.2006.02.010.

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**Jana Košťálová, Ing., Ph.D.**  
University of Pardubice  
Faculty of Chemical Technology  
Department of Economy and Management of Chemical and Food Industries  
Studentská 537, Pardubice, 532 10  
Czech Republic  
Phone: +420466037789  
E-mail: jana.kostalova@upce.cz

**Marie Bednáříková, Ing., CSc.**  
University of Pardubice  
Faculty of Chemical Technology  
Department of Economy and Management of Chemical and Food Industries  
Studentská 537, Pardubice, 532 10  
Czech Republic  
Phone: +420466036297  
E-mail: marie.bednarikova@upce.cz

**Michal Paták, Ing., Ph.D.**  
University of Pardubice  
Faculty of Chemical Technology  
Department of Economy and Management of Chemical and Food Industries  
Studentská 537, Pardubice, 532 10  
Czech Republic  
Phone: +420466036299  
E-mail: michal.patak@upce.cz