APPLIED INFORMATION TECHNOLOGY SESSION

CREATING AN EDUCATIONAL FRAMEWORK FOR PROJECT MANAGERS AT A SOFTWARE COMPANY: A SAMPLE APPROACH

Srđan Atanasijević[1]*,
Monika Zahar[1],
Dejan Rančić[2],
Tatjana Atanasijević[1],
Milan Đorđević[3]

[1]University of Kragujevac,
 Kragujevac, Serbia.

[2]Faculty of Electronic Engineering,
 Nis, Serbia.

[3]Academy of professional studies
 Sumadija,
 Kragujevac, Serbia

Abstract:

Digital innovations and new technologies are transforming our lives, forcing all organisations, especially software engineering companies, to change their business processes. This rapid innovation and technology advancement positively affects project managers' and software engineers' learning and development, encouraging a new corporate, educational approach. In this study, the authors recognised how to keep up with this challenge and ensure the continuous improvement of employees' competencies, giving the company incredible opportunities to increase its performance and efficiency.

The authors of this paper follow the research questions of improving project management education and developing digital skills needed for a sustainable and competitive business environment using e-learning platforms and digital communication channels. This paper presents an approach for designing and implementing a corporate, educational system that trains project managers and software engineers to collect and share acquired knowledge on client projects. Also, this system should reduce the onboarding of newly employed engineers to the company and project managers to new positions.

Keywords:

Software Engineering, Project Management Education, Knowledge competencies, e-Learning Project Management.

INTRODUCTION

Companies that are unready or unwilling to become learning organisations will not survive in the digital transformation era, which is explicitly challenging for software companies [1].

Facilitating knowledge expansion was an essential requirement for Comtrade Project Management Organization (PMO). This extensive software engineering organisation employs over 150 project management professionals across 10 locations, working on over 400 active projects in various project management capacities such as Project Managers, Scrum Masters, Program Managers, and Engagement Managers.

To master and understand the change, our people and organisation had to consider learning and development a never-ending cycle of continuous improvement. A college degree is no longer sufficient to develop the skills needed to respond to rapidly changing business processes and technologies that change multiple times a year.

Correspondence:

Srđan Atanasijević

e-mail:
srdjan.atanasijevic@kg.ac.rs

In designing an educational framework for project management education in a software company, it is essential to approach the process with careful consideration and attention to detail. The goal is to create a comprehensive and effective training program that equips employees with the skills and knowledge necessary to manage projects from start to finish successfully. The first step is to thoroughly analyse the company's current project management practices and identify improvement areas. This can be done through surveys, interviews, and observation of recent projects. Once these areas have been identified, developing a curriculum that addresses these needs is next.

The curriculum should cover all aspects of project management, including planning, scheduling, budgeting, risk management, and communication. It should be engaging and interactive, with lectures, case studies, and hands-on exercises. Evaluating the program regularly and adjusting as needed is essential to ensure the training is practical. This can be done through feedback from participants, analysis of project outcomes, and assessments of employee performance.

Designing an educational framework for project management education in a software company requires a strategic and collaborative approach. By working closely with stakeholders, identifying areas for improvement, and developing a comprehensive curriculum, companies can ensure that their employees have the skills and knowledge necessary to manage projects.

2. BACKGROUND AND RELATED WORK

Project Management favourably impacts the software engineering business outcomes. It is defined [2] as "*applying knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management enables organisations to execute projects effectively and efficiently.*" In the age of globalisation, software engineering companies must define the range of skills and knowledge needed for successful project management to remain competitive.

By studying scientific literature, it was discovered that a vast amount of literature explores the education topic for PM. However, *only a few articles focus on the learning design framework and the conceptual model for development*, especially project management education monitoring. This paper aims to contribute to this study and emphasise the importance of project management education in large software engineering companies, presenting a framework for its custom development and measurement.

Many studies prove *that project management's relevant technical and soft skills are not appropriately taught in undergraduate and master's degree programs*. Research [3] investigates how project management education is taught in undergraduate degree programs of higher education in computing and its disassociation between theory and practice. A survey that is conducted with software PM educators indicates that there is a particular gap between academic and software industry expectations. As a result, there is a need to improve the project management curriculum, courses, and even student evaluation. However, the challenge of keeping pace with a rapidly changing business environment and technological advances remains since it requires constant adjustment of academic PM education with software industry trends.

Existing research in project management explores how digital innovation changes project management professional development. In [4], the authors present how digital transformation impacts project management performance and whether the current PM curricula match the market's needs. This research explores how PM professional bodies such as IPMA and PMI embrace PM competence development and propose several PM education actions as lifelong learning. The authors suggested organising these ongoing PM learnings and adopting them by PM in practice. Paper [5] identified that Project Management is vital in driving and implementing digital transformation, reflecting changes in their career path, qualification, and certification programs. In a paper [6], the authors point out that introducing systematic education is one of the pillars of the organisation's adaptability to market failures. *Systematic education and sharing experiences from past projects are imperative for the organisation's success.*

In a series of papers, the authors try to answer how *effective and efficient digital education channels* are through case studies and analysis based on the target group's research. First, the authors investigate the effectiveness of using the eLearning platform to prepare candidates for software engineering companies [7]. After five years of application, they conclude that it has fully justified its place as a tool in harmonising knowledge acquired at universities and the experience needed to work effectively on fundamental problems in modern engineering practice. Then, in [8], the authors describe a complex solution for education and knowledge exchange in a software engineering company. Finally, in the paper [9], the authors conclude that educational training for employee development within an IT company should efficiently increase professional knowledge.

The authors of this paper share their experiences and explain how to leverage that knowledge through project-based learning, active and collaborative learning, delivered as face-to-face, self-paced learning, and online training courses under the mentorship of experienced business analysts.

3. METHODOLOGY

In this paper, a combination of qualitative and quantitative techniques is utilised to explore the educational process area in a software services organisation. The focus is on conducting a case study without providing conclusive answers to research questions.

To achieve the general goals of the project, the following steps were taken:

1. A quantitative research approach was used to gather data on the company's education state. This involved conducting a survey, summarising the results, and drawing inferences from the data. The survey also yielded a list of desired educational content sorted by priority; and

2. Qualitative methods were employed to identify the most frequently used communication channels for sharing educational content. The PM community, offers several such channels, including existing company portals, newsletters, Skype, Slack, emails, audio and video conferences, and live meetings. The tracks with the highest utilisation rates were selected to be included in the PMO Education Roadmap.

4. STUDY, RESEARCH, AND FINDINGS

According to research published in this domain, authors affirmed the importance of custom-tailored, lifelong PM education in software engineering companies, which must be aligned with frequent market changes and measured through the metric system's framework on the corporate level.

The general opinion is that in software companies, after academic education, continuing education for the profession is just beginning.

4.1. FINDINGS BASED ON LITERATURE RESEARCH ANALYSIS.

Based on the findings presented in the literature, several unresolved challenges need to be addressed when developing a software company's project management education framework. These challenges include:

1. One challenge in designing a learning framework for project management education is lacking technical, scientific articles focused on this topic;

2. The issue of onboarding new members into an organisation's project management team is that relevant technical and soft skills are not consistently taught in undergraduate and master's degree programs. Furthermore, project management practices can vary significantly between companies;

3. To maintain existing project management knowledge and disseminate company-specific know-how, systematically educating and sharing experiences from past projects is imperative. However, this presents a challenge for knowledge acquisition and sharing; and

4. Choosing the most effective digital channel to distribute learning content to the right people promptly and encourage collaboration poses a challenge in digital education. Therefore, it is essential to consider the efficiency and effectiveness of these channels.

4.2. FINDINGS BASED ON CUSTOM RESEARCH STUDY.

The project management office at Comtrade created a questionnaire and survey to pinpoint pain points in project management, enhance existing practices, and transfer positive experiences to new projects. There are over 400 active projects, with a trend of starting 20 new ones each quarter. *The PM Insights survey* provides study details and can be accessed through the reference link [10].

The main objective of this study was to identify various aspects of project management practices and requirements and examine gaps to prioritise improvements. The project managers' responses provided valuable information that enabled us to determine areas for enhancement. Additionally, their willingness to share important opinions about the project management field and their connection to PM practices at Comtrade allowed us to identify gaps and critical factors that require improvement. Based on this information, we have created a roadmap for implementing concrete action plans.

The study involved 121 individuals (more than 80% of all) who hold positions such as project managers, scrum masters, delivery managers, and program managers. These professionals are directly involved in interacting with engineers and clients and are responsible for ensuring the successful execution of projects and contracts.

The radar diagram and the most significant gap analysis are presented in Figure 1. Table 1 shows Survey results across seven primary categories compared to desired values [10]. The most critical gap emerged in the "Education and Knowledge" (certifications, training) category, followed by the "Methodology" (project management methodology, tools and practice) and "Team" (team collaboration and coordination) categories [11].
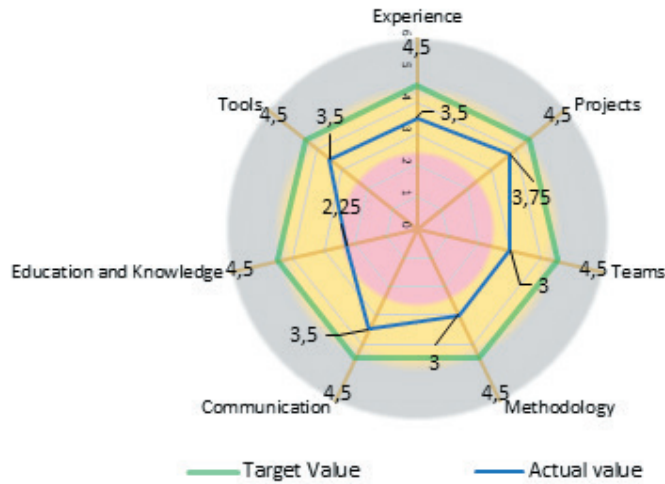

Figure 1 - PM Insights Survey results – Radar.

Table 1 - PM Insights Survey – The most significant gaps emerged, and improvement plans.

Category: Education and Knowledge	
GAP: -2.25	
Improvements	How
Focus on highly specialised educational content related to the latest methodologies or technologies. Accelerate PM, BA, SM, and project team readiness for new roles. Reduce time for project onboarding. Improve domain knowledge coverage. Create systematic and consistent learning content for dislocated teams. Reduce the Cost of learning and education. We are fostering continuous learning and professional development.	Develop PMO EDU portal, Improve PM Newsletters, Rethink PM Coffee Breaks Improve existing PM Community Competence Centre, PM Mentorship and Coaching.
Category: Project Methodology	
GAP: -1.50	
Improvements	How
Standardisation - create a common language to be understood by all. Formal PM processes improvements. Best practice sharing. Agile delivery – Keep pace with technological rapidly changing. Create project resource libraries and repositories.	Boost Expert group (Delivery and Processes), New PMO EDU portal content, Filesharing through the Seafile repository,
Category: Teams collaboration	
GAP: -1.50	
Improvements	How
Improve team collaboration and communication. Foster is sharing knowledge and personal experience. Transparency of expertise promotes personal competences	PMO EDU portal – offline content PM Coffee Breaks – in-person communication PM Newsletters - periodicals PMO Slack Channel – groupware, live

In data sources [10], the 2016 PM Insights Survey diagnostic showed that the main pain points were in categories: **Education & Knowledge, Methodology, and Teams** collaboration. Therefore, the organisation needs to establish a few new or improved processes to increase efficiency and effective project execution support effectiveness with an active role in the project environment's success.

4.3. RESULTS

Based on qualitative research of current project management practice, published scientific literature, and conclusions from a custom research study, the previous two paragraphs present definitive findings that clearly define the scope and direction of future work.

The framework aims to promote education, streamline processes, encourage knowledge sharing, and incorporate distinct terminology into everyday project management practices.

After analysing the latest market demands and survey results, we have identified three primary project goals or focus areas with expected outcomes:

Education and Knowledge

- Support creating and tracking education plans;
- Promote internal events;
- Raise awareness of certification; and
- Simplify learning, and bring closer education.

Methodology

- PM Process standardisation, set of appropriate metrics and relevant process KPIs;
- Formal PM processes improvement; and
- Best practice sharing.

Teams

- Business growth (more people in projects);
- Team optimisation for an agile approach; and
- PM (project managers) and TM (team managers) education.

5. DISCUSSION

The organisational focus shifted towards researching and implementing an educational framework that promotes effective knowledge sharing from our ongoing projects, standardisation of methodology in project management processes, and personalised independent learning tailored to the unique needs of everyone.

5.1. OUTCOMES AND BENEFITS

The PMO project team created a comprehensive solution for the organisation that serves as a central hub for all professional development and career-related needs. This one-stop-shop approach includes easy access to information about the company and its operations. Multiple digital communication channels are available through this platform to promote peer-to-peer communication and teamwork. The effectiveness and advantages of using this system for learning and collaboration rely heavily on the active engagement of all stakeholders.

Such an established framework provides a relational database containing data from all stakeholders in the process, all sources, and all channels across all project life cycle phases. Moreover, combining that data provides plenty of metrics and lists of KPIs that unambiguously show whether a process is effective.
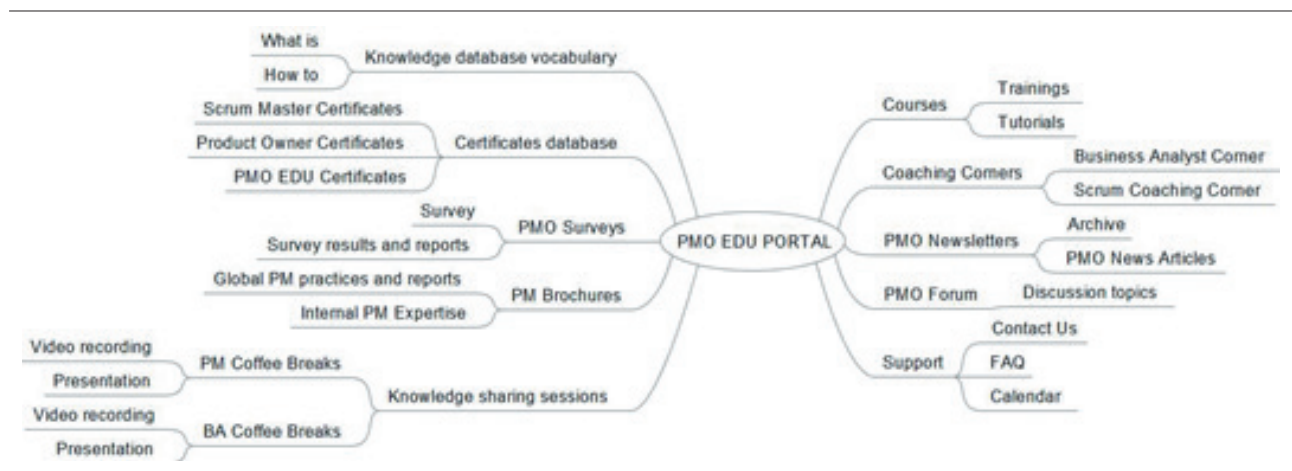

Figure 2 - PMO EDU portal Mind map.

The Comtrade PMO EDUCT portal [12] is a landing page, core for corporate knowledge sharing, collaboration, project resource libraries, aggregator of all initiatives, and a portal around which all additional PM Digital communication channels are developed, as shown in Figure 2. Our approach facilitates unlimited reach, is cost-effective, and addresses the needs of varied and globally widespread learners, keeping us on track to achieve business and project goals.

PMO EDU portal is structured in the following way [8]:

- **Courses** are distinguished on highly specialised training and tutorials for PMs, Scrum Masters, BAs, and project teams, as custom corporate eLearning content. Each activity includes the lesson's part and, in the end, knowledge validation through test exams and certification [13]. **Tutorials** help learners master a chosen process and tools;

- To ensure effective project onboarding, **Coaching Corners** are for everyone interested in Scrum Master and BA, with mentorship program plans, shared personal experience, solutions for everyday Scrum and BA problems, best practices, and tool recommendations;

- **Knowledge database** vocabulary – short educational content:
  - » **WHAT IS**: basic concepts of project management terms, tools, or techniques. The specific subject is explained to help PM practitioners easily understand and apply new knowledge;
  - » **HOW TO**: provides step-by-step information about some specific concept. These materials are tutorials that lead the user through the key features, functions, or steps that progress through a logical sequence to understand all the user's elements;

- **Certificates database:** Place where our colleagues' certificates are updated continuously and transparent – our hall of fame. The base contains Scrum Master, Product Owner, and PMO EDU certificates. We are always up to date with the knowledge and competencies of our employees;

- **PM Brochures**: Corner, where our project manager generously shares their knowledge and experience with others, is about global PM practices or internal expertise and skills;

- **PMO Forum**: Place for discussion and sharing knowledge peer-to-peer; and

- **Support**: It can be found frequently asked questions, contacts, and call to action to contribute by sharing content and ideas.

Other Multiple PM Digital communication channels available within the framework are:

- To gather community feedback, **Comtrade PM, surveys**: Survey questions and results lead us to find out the best improvements for the future, so as the concrete next steps that we can take to be more successful in project management and consequently on the market;

- **The PM Knowledge Sharing** initiative is being realised through PM Coffee Brakes and BA Coffee Brakes, held monthly as a delight for the whole PM community. Topics from best PM/BA practices and knowledge are discussed and shared within the community. Video and audio recordings from every session are always available here;

- To promote team culture **PMO Newsletter**: As a part of the monthly updating community with upcoming trends in the industry, news, internal and external events, conferences, training, or achievements in a for-on newsletter is being uploaded into the archive, so none of the information is missed;

- To foster collaboration **PM Slack channel:** Helps PM harmony and teamwork efficiency through messaging and team-oriented channels; and

- To encourage community exchange **Seafile**: PM internal share point for all documents, video sessions, tutorials, and templates.

6. CONCLUSION

This paper contributes to applying such a solution in practice and has an original contribution as an authentic approach. This framework allows us to pivot and adjust the KPIs anytime, respond to business priorities, or adapt to any company's situation.

With the presented approach, the company accomplished digital growth goals in all critical areas of PMO responsibility - standardisation of the process, the unification of project management tools, onboarding new PMs into the project organisation, and training them in specific project practices sharing knowledge and experiences from projects.

- A common language to be understood by all;

- Sharing knowledge and experience;

- Continuous professional development for Project, Program and Engagement Managers, Scrum Masters, and project teams;

- Accelerate professional training while balancing discipline with agility;

- Transparency of expertise, promotion of personal competencies;

- Assessing a PM professional's capability; and

- The following survey and framework assessment will show the directions of further development.

This paper aims to encourage organisations to create their own and adopt a framework exposed to its realistic priorities and needs in SW development that depend on: the dynamics and requirements of their clients, the capabilities and performance of their employees, and government expectations and investments.

7. REFERENCES

[1] S. Atanasijevic, "Inovativni modeli digitalne transformacije poslovanja-iskustva lidera," in *Naučna konferencija INFORMATIKA 2016 "Novi trendovi u razvoju informacionih sistema"*, Beograd, 2016.

[2] P. M. Institute, A guide to the Project Management Body of Knowledge (PMBOK guide) (6th ed.), Project Management Institute, 2017.

[3] M. L. Fioravanti and E. F. Barbosa, "Outlining Software Project Management Education by Surveying Educators," in *2019 IEEE Frontiers in Education Conference (FIE)*, Covington, KY, USA, 2019.

[4] R. Bierwolf, D. Romero, H. Pelk and C. J. Stettina, "On the future of project management innovation: A call for discussion towards project management 2030," in *2017 International Conference On Engineering, Technology And Innovation (ICE/ITMC)*, Madeira, Portugal, 2017.

[5] T. Braun, E. Ekstedt, R. A. Lundin and J. Sydow, "Digital Transformations of Traditional PBOs and Modern PNWs: Changing Management Practices in Project Society (Final Report)," PMI Sponsored Research, 2020.

[6] S. Atanasijevic, *Case Study: How to establish global PMO Office*, 2013.

[7] S. Atanasijevic, T. Peric and I. Boskovic, "Usage of Moodle e-Learning Portal in the Recruitment Process for New Comers Comtrade Group Case Study," in *The Fourth International Conference on e-Learning (eLearning2013)* , Belgrade, 2013. .

[8] S. Atanasijevic, T. Atanasijevic, V. Jankovic and M. Zahar, "Application of e-Learning technology in corporate education - Case Study of Comtrade's PMO EDUCT portal," in *The 10th International Conference on e-Learning (eLearning-2019)*, Belgrade, 2019.

[9] J. Stevanovic, S. Atanasijevic, T. Atanasijevic and M. Zahar, "Expanding the level of engineer knowledge for software modeling within corporate education by active and collaborative learning," in *2020 IEEE Global Engineering Education Conference (EDUCON)*, 2020.

[10] S. Atanasijevic, M. Zahar, V. Janković, M. Fimic-Rakovic, A. Z. Numić and S. Sabljic, "PM Insights Survey 2016 Radar Diagram Framework with Survey Responses," 2016.

[11] S. Atanasijevic, M. Zahar, V. Janković, M. Fimic-Rakovic, A. Z. Numić and S. Sabljic, "PM Insights Survey Analysis 2016," 2016.

[12] V. Jankovic, S. Atanasijevic, T. Atanasijevic and M. Zahar, "How to Establish a Project Management Education Process in a Software Company: from Defining a Roadmap to Effective Implementation," in *10th International Conference on Information Society and Technology (ICIST 2020)*, Kopaonik, 2020.

[13] M. Zahar, S. Atanasijevic and M. Vasilijevic, "How to Leverage Corporate e-Learning Platform, for Making Tool Used in Creating Candidates' Profile, Which Turns Business Opportunities Into Prospective Clients," in *The 11th International Conference on e-Learning (eLearning2020)*, Belgrade, 2020.