Factors influencing project manager's ability to deliver a software engineering project

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Abstract. *Mostly pushed by the maturity of information and communication technology (ICT) and readiness of customers to embrace the change, the software engineering organizations (the Organizations) have built their businesses, engineering teams and managers around culture, working processes and methodological frameworks scaled mainly for onsite work, accompanied with managerial (authoritative or delegator) influence style. With already present lack of available software engineers (SE's), new era for software engineering managers begun with the need for response to change called "COVID-19". Relying on their experience gathered in years long projects, authors are analyzing challenges that the Software Engineering Project Manager (PM) is faced while delivering software project with a group of SE's, working together in geographically distributed environment.*

Keywords. software engineering project management; team culture; distributed teams; agile software development, servant leadership.

1 Introduction

The goal of any project is to deliver added value (product or a service) defined by the Contract, constrained with three variables – timeframe, budget, and quality. According to Mir and Pinnington (Mir and Pinnington, 2014), traditional project management approaches which exclusively pursue the mentioned success criteria are considered ineffective, and despite advancement in project management processes, tools and systems, project success will not significantly improve. From the other side, project cannot be delivered without people (team) working on it. Bonebright (Bonebright, 2010) analyzed that there are more than 250 different models and theories that were being used in team development practice, whereby one of the most common theory is the Tuckman's five stages of group development – forming, storming, norming, performing, and adjourning. Each of these stages requires from PM to adapt the leadership and managerial style, approach skills for both – the SE team and every individual. The idea is to get the best from each individual and from the group.

The Research Problem. Today's requirements for SE's grew and current destabilization of workforce requirements within global economy under crisis, highly influenced by COVID-19 situation, has changed the way engineering organizations are running their businesses. That is why the whole project's organization is dependent on the PM to assemble all required resources (physical, financial, human, political etc.). With lack of available potential employees on the Market and related high cost, lack of opportunity to retain people, Customers more often rely on their subcontractors like software companies to support their business in both – technical and industry specific processes and knowledge. Being faced with the fact "I can work anywhere in the world" and "I can be paid a lot more that I earn now", SE is lured into everyday recruiting process. Since teamwork, team culture and task management is more complex in distributed working environment, PM should not rely only on technical knowledge of SE's – their skills and motivation are more and more important. There is much that is not understood in context of what PM is doing on the software engineering project. Different stakeholders see their picture and no one, even the PM itself, cannot perceive the whole picture with ease. The software engineering PM profession started to be drastically complex with two new changes that came in parallel – (a) lack of SE's on the market and (b) presence of remote working environment.

Expected outcomes and results of this paper are: (a) To contribute to a better understanding of how remote work and insufficient work power influence the complexity of a software project management and (b) Face the authors' collected experiences from software engineering projects with recent theoretical background and provide the baseline for better high-level understanding of SE project management and its complexity.

The significance of the study for audiences. This paper can help any stakeholder around software engineering project or development team to better understand the complexity of PM environment.

Researchers interested in software engineering project management can find this paper useful for further research studies related to software engineering project management, team culture, distributed teams, agile software development and servant leadership.

The Case. This Research covers analysis of factors influencing PM's ability to lead a distributed SE team, working in strong project-oriented matrix organization, delivering a complex custom-made software, based on time and material or fixed scope contractual obligations, for an external Customer (mid-sized, large-sized enterprise or a governmental institution).

Recent studies that have addressed the research problem are covered trough indictive design in **Section 3**. **Section 4** covers **a narrative review of factors** influencing Project Manager's ability to deliver a software engineering project, strongly relying on subjective experience of authors, gathered in years long project activity. Discussion is identifying the gap between theory covered and practice presented, while conclusion has been made as a wrap-up, giving indications on research limitations and future research possibilities.

2 Research methodology

Social constructivism is an interpretive framework whereby individuals seek to understand their world and develop their own subjective meanings that correspond to their experience (Creswell, 2009). By designing the research using the **Social Constructivist** worldview, authors rely as much possible on their own views of the situation being studied, bringing personal value into the research. To contextualize the problem, authors have highlighted their own understanding and knowledge related to factors influencing PM to deliver SW engineering project, collected through their extensive practical experience working as a PM or a team member.

To challenge authors' subjective interpretation of knowledge and related observations, **theoretical background** of latest scientific findings is given beforehand and compared in the discussion section.

Theoretical background has been made through the analysis of scientific findings related to the topic of this research, sourced in the bibliographic database Web of Science (WoS). Initial WoS search (criteria: *"software engineering project management (Topic) and 2020-2022 (Year Published) and Article (Document Type) or Computer Science, Software Engineering (Web of Science Categories)"* has been made on 29th of June 2022 and returned 62 results. Further analysis has been made through sorting of titles according to citation (highest first) and further subjective perception of authors. Further analysis of articles that are rated within upper 25% most quality papers (first category quartile; Q1), resulted in 13 articles cited at least one time. Additional reduction has been made, based on following criteria

1. Article needs to be published in a scientific journal,
2. the content needs to be relevant for this Research,
3. Article must be cited at least one time,
4. At least one author of article that meets above mentioned criteria's, must have issued more than 20 scientific publications in total AND Sum of times cited is larger than 100 AND the research area must be primarily related to Computer Science (Software Engineering) AND the author must have more than 5 years of scientific research experience.

Concluding, six articles were chosen for inclusion. Although the number is very limited, the purpose of the theoretical background is not to give a comprehensive analysis on the topic, but rather to focus onto most recent findings by relevant authors.

3 Theoretical background

Šmite et al (Šmite et al., 2021) are exploring barriers between national and organizational cultures and their implications to the agile software engineering. In their work, authors are recommending that the organization needs to pay special attention to the process of onboarding new team members into the cultural norms and the term "trust" as a prerequisite for shared leadership in agile team is mentioned, so it is impossible in everchanging environment, with insufficient number of people on the project (of required seniority, knowledge, skills etc.) to expect that the team can work without senior leadership and management**.** Self-organizing agile teams need to be navigated and secured from their senior colleagues with more widen experience, knowledge, and skills – experts that can coach SE's, encouraging them, managing team's boundaries, dealing with unexpected problems within a team, managing the expectations of stakeholders outside of a team. Concluding, to support a SE, the atom of a 'container' called software engineering project team in matrix organizational structure, the organizations need PM with new skills that were not needed through the history of software engineering work.

Shastri et al., (Shastri et al., 2021) presented and described the role of a Scrum Master (SM) in agile projects. They analyzed the role of the Scrum Master (SM) in agile projects and described following group of SM's work: (a) process adapting, (b) negotiating, (c) mentoring, (d) protecting, (e) coordinating, and (f) facilitating. Their study for the first time presents a multifaceted study of the multiple dimensions of the SM role (facilitation, mentoring, negotiation, process adaption, coordination, and protection).

Chapetta and Travassos (Chapetta and Travassos, 2020) proposed framework to support researchers to observe and control SE's productivity. They mentioned Conway's law ("A system reflects the organizational structure that built it") as a project concern in context of communicational barrier among SE's that might influence the productivity of SE team and concluded

that the number of SE's and their variation over time affects the software development productivity. Same authors are also referencing to a Curtis' law ("Good designs require deep application domain knowledge") and concluding that the rate at which software projects get inputs and produce outputs is concerned with the domain knowledge of their SE's. Long-term effect of increasing the project duration promotes slight losses in software development productivity, because software development is creative work and highly human-related, so the complexity of leading, managing, and motivating SE's can be found as complex set factors that can influence the productivity of individual SE in environment where change is defined as constant.

By analyzing internal dynamics of the different stakeholders, Russo (Russo, 2021) is identifying critical success factors and their relations to a large-scale agile project and its success, and the role of SE's as one of the most crucial aspects to lead to a SE project.

Mendes et al. (Mendes et al., 2021), analyzed the relationship between decision-making and personality, and concluded that SE's personality can influence the decision-making style.

4 Analysis of factors influencing ability to lead a software engineering project

Existing technological and communicational readiness, society, government, business environment and world economy trends faced the software engineering companies with lack of adequate manpower able to support customer from different segments – consumer, industrial and government. The more stakeholders are present in project environment, the more complex is to run the project, satisfy communicational flows and manage all the expected outcomes. The new working paradigm defined a SE working in a distributed environment as a key factor that is influencing the organizational design, where new standards and expectations are strongly influencing the organizational and project culture and values, their ability to motivate individuals and deliver successful software projects (shown in Fig. 1).

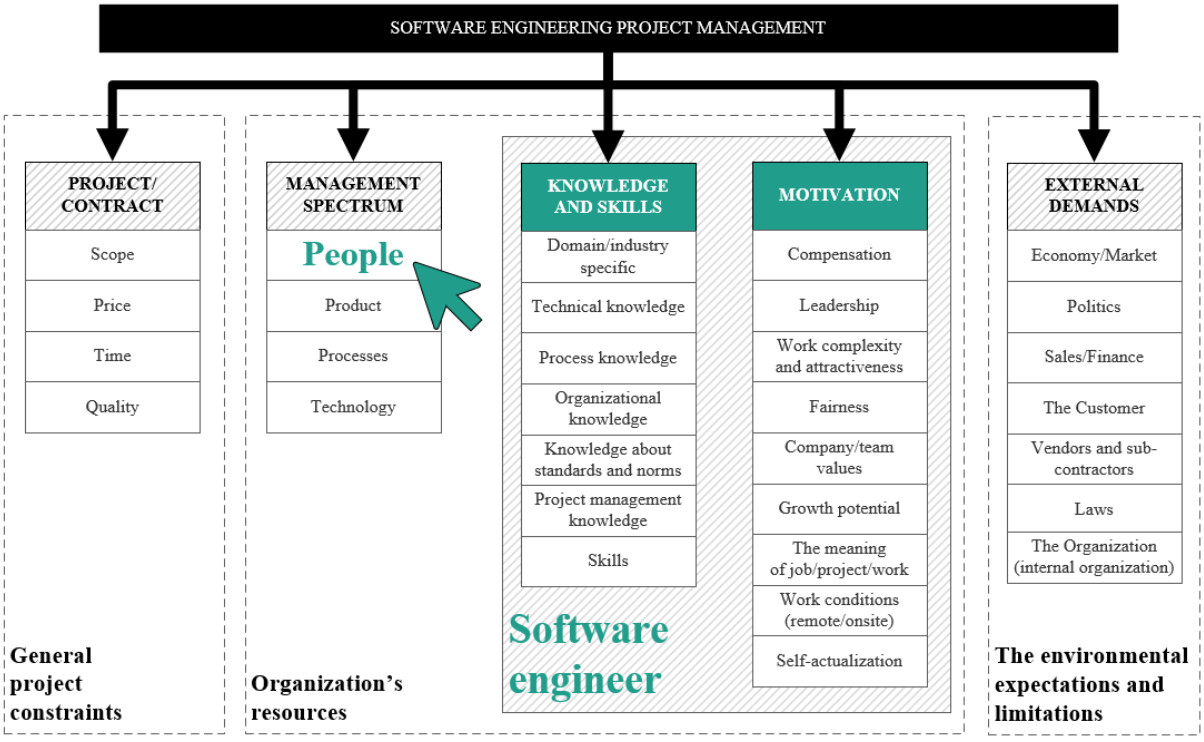

Figure 1: High-level decomposition of software engineering PM focus areas

Current economic trends brought to the software engineering projects a high level of uncertainty. Due to these high economic demands, Project can be at risk if PM is not skilled to motivate engineering team, positively affecting team spirit and values, create safe environment based on loyalty, respect, and trust. Considering that every individual has its unique motivational factors, PM needs to adapt its personality, communication style, motivational approaches, and decision-making style to every individual SE uniquely.

4.1 Perceiving the stakeholders' expectations of project outcome

If PM understands and influences interactions and expectations of a power structure (political awareness and sensitivity) around and within the project environment, he will more easily run the project.

Stakeholder is any individual or a group, internally within the Organization or externally, that have an interest from positive project outcome. All about the project is about meeting the objective and subjective expectations of stakeholders. Constrained with their knowledge, available information and attitude, and influence level, different stakeholders are shaping different perception, understanding and expectation of project outcome. If stakeholders would interpret successful project as a project that is delivered within contractual obligations (objective constraints), strictly defined by the contract – project could be treated as successful. But there are objective (e.g. budget and time related) and subjective (e.g. stakeholders' expectations, unpredictable risks related to economic and market flows) constraints that are shaping the perception of the term "successful project" and are influencing the project outcome. To satisfy the overall, stakeholders' objective and subjective perception on whether the project is delivered successfully, these expectations will need to be embraced, challenged, and managed. In case these additional expectations are accepted, formally or not, they are negatively influencing on PM's ability to control the Project outcomes. More importantly, these expectations require from PM, SE team and other stakeholders to spend more time for informal project communication, always questioning subjective thoughts and their value to the Project.

If the Project is initiated to fulfil goals that are outside of the contractual obligations (e.g., strategic goals), it will be exposed to additional political, business and commercial assessments, expectations, influences, and pressures from different stakeholders. Below are analyzed the most important stakeholders that have influence on SE project environment:

- **Sponsor** is the most powerful representative of a client, and most often this is the Chief Executive Officer (CEO). His sponsorship is defined by the fact that he pays the software, so he can use his power to influence all other stakeholders.
- **Product Owner (PO).** In traditional organizational setups PO represents a Key Customer's expert, but in case the Organization is using any of agile approaches (e.g., Scrum) to deliver software solutions, PM authorizes an individual within the SE team to act as a PO. PO is in this case an individual, SE who is focused on product (domain knowledge), who can prioritize value of a different requirements and is skilled to communicate with both – business and technically sound individuals in project environment. Usually, subjected individual is the SE functionally working as a senior business analyst. As such, Product Owner represents "the right hand" of a PM and by this, he must have strong project management skills.
- **User** is the individual who uses the software.
- **Supervisory Board** is group of individuals from Customer's (e.g., CEO, Procurement, etc.) and Supplier's (e.g., CEO, Sales, etc.) side, headed by the Project Sponsor, and being responsible and authorized to bring project decisions that are outside/above PM's power and influence.
- **Project Manager (PM).** PM is central communication, leadership, managerial, people oriented, financially and business aware, decision-making role on a project. According to the contractual obligation, PM is most responsible for an overall project delivery, oversees many functional areas through the software project delivery and development processes.
- **Functional Manager (FM).** FM's are boosting SE's technical and functional knowledge of SE's. They are taking care the Project's technical and functional environment is aligned with the organization's strategy, processes, methodological approaches etc.
- **Software engineering team (SE team).** SE team, also called the development team, are a group of individuals having dispersed technical, functional, domain, process, methodological, project and other knowledge and skillset. They are using knowledge and skills to accomplish the same goal – deliver the software product/service defined by the project.
- **Software engineer (SE).** This construct represents an individual, a team member, the core of s Project, working on a delivery of a software product/service in role of business analyst, developer, quality assurance specialist (tester), database administrator, consultant etc.
- **Third parties.** With economic demands that created the SE's as the most valuable asset, third parties (e.g., vendors, subcontractors, agencies renting SE's etc.) and their SE's that are engaged on the Project by the Organization, have a big influence on the Organization, the Project and other individuals working on the Project.

4.2 Perceiving and contextualizing influencing factors within project environment

Through this paper are analyzed factors that are influencing perceived core values, labor costs, subjective and objective factors shaping the SE's

perception and environment, attitude, and eagerness to contribute to an SE team. Organizations being able to manage career development path of SE's, motivate and stimulate people – will be able to retain knowledge, retain customers, projects and potentially gain comparative advantage on the market. Leading distributed SE team and running multiple projects at the same time, with all analyzed objective and subjective factors influencing the project environment requires from PM to be a leader, manager, and multidisciplinary expert with extensive skillset. PM's working as a project tracker will fail.

In other to meet the stakeholders' expectations, PM needs to determine and manage different factors that shape the complexity of project environment. Since PM is constantly switching from one context to another, below given factors are on purpose not grouped in meaningful containers, so the reader could more easily perceive different levels of thinking in project management, demanding and constantly changing environment, skills needed for influencing others without formal authority, dependencies and different interdisciplinary approaches in decision making, different knowledge areas and skillsets, communication, and coordination complexity:

a. **The commercial Contract with the Customer.** If the Contract is not favorable for the Organization due to any reason (e.g., bad decisions, assumptions, or estimations through the sales process), PM and project team will have difficulties from the early start of the Project. Potentially, the PM, SE team or key SE can feel unmotivated because they will need to work harder to compensate bad decision of others. If not leaded and motivated with high level of commitment and support, SE's could easily leave the Project and/or Organization and leave the project with additional risks (more unsatisfied people on the project, new onboarding processes consuming already overallocated SE's, etc.).
b. **Project's commercial value is determining the stakeholder's involvement.** Managers are driven by financial aspects, so larger expected revenue and potential income imply that the interest of stakeholders for project outcome will grow. If the Project is worth more, it means the PM will need to spend more time communicating and managing expectation of stakeholders on different layers.
c. **The Organization's ability to timely ensure people for the Project.** PM and the Organization should be able to spend time to the socialization, functional, domain, project, organizational and cultural training of a new SE on a Project. Due to the lack of SE's on the market, bad sales process and related sales prices, inadequate motivational and stimulation measures – the Organizations are not able to deliver projects within given constraints.
d. **Number of SE's working on a project.** Communication requirements of all SE's individually, and SE team, are unique, need to be managed and satisfied. The bigger the SE team is, the more complex is to manage the project.
e. **Ability of the Organization to support projects.** To be able to compete on the market, larger organizations strive to be compliant with different industrial standards. Also, the bigger the organization is, the processes are more complex, it takes longer to satisfy all political, personal, procedural, objective, and subjective, formal, and informal procedures to bring project decision. Today PM's need to bring fast decision and they need supportive organizations, their functional/technical teams, that can respond to project requirements and constant changes.
f. **Expectations of Agile mindset and its perceived values**. Agile teams should be self-organizing, have a shared leadership, with complementary knowledge and skills to run the project. Often a lot of decision cannot be taken within the engineering team without the intervention or support of senior management outside of the team. Since the PM is the managerial role with the most dispersed knowledge, the PM by nature supports the SE team.
g. **Number of externalized SE's on the Project.** Interest for remote workers is shaped with the fact that there is not sufficient manpower on global level – and the whole world is trying to attract as many SE professionals as they can get. This reshaped the SE financial expectations, so some organizations are not able to compete a market and retain their SE's, and that is why they are going into commercial contracts with third-party companies that are renting SE's. The more externalized team member's Project have, the PM will be exposed to additional activities – commercial and legal work, administrative work, additional communication and coordination, objective and subjective expectations of additional stakeholders with different influence levels, potentially hidden costs, coordination meetings and making things happen, coordinating different roles, teams, vendors, seniorities, potentially bad contracts, track and report about service level, satisfying product requirements, get to know new external processes that need to be satisfied and aligned with project's and organizational standards and requirements, manage invoicing, contractual obligations, purchase orders, timesheets, motivate people and align different cultural and other expectations. On the top of that, managing the team of individual SE's from different entities, in distributed environment is,

additional level of complexity for all included stakeholders. All these can consume a lot of PM's time and due to that, strongly influences to project complexity and potentially satisfaction of all stakeholders.

In case externalized SE is unsatisfied or demotivated, PM has limited authority over his motivational or stimulative factors. Also, the Organization is not able to fully control how external SE's values and culture are influencing the Organization's and Project culture and team values.

h. **Domain knowledge.** SE's working for an Organization and its projects are having specific domain knowledge about customers and their processes. With high level of fluctuation of SE's working on a Project, organizations and project teams are losing its productivity, expertise, and safe environment for other team members. In addition to these findings, by subcontracting or partially externalizing project activities or tasks, the Organization is further risking by consciously losing this unique and hard to get knowledge. This may result in (a) inability of the Organization to ensure high-level quality of a maintenance services for the Customer, (b) losing the Customer's trust and perception of value, (c) further losing their SE's, and consequently (d) losing business.

i. **Different commercial types of projects.** Depending on type of contract (time and material based versus fixed scope based), from PM is expected to be skilled, experienced, and able to plan and use different approaches that will ensure successful project delivery. Different project types require different knowledge and skillsets.

j. **The Project duration.** The longer projects are more complex since the motivation of every individual SE is decreasing over time.

k. **The world became a big workforce village.** SE's, PM's and other stakeholders became aware that the corona crisis extended the boundaries of what the whole world though is acceptable working environment. The new perception, where SE's can work from anywhere in the world, for an employer from any country in the world created new challenges for the organizations and the way they plan and deliver projects. Engineering organizations across the world are redesigning their working processes to support remote SE workers and this will strongly influence on the SE market and the way we plan and deliver software engineering projects.

l. **The maturity of SE team.** If SE's have a previous positive experience working together on a Projects, sharing core values, believing each other, they will more easily became productive and efficient as a Team (or a Group). Constant fluctuations of team members and dispersed values within a team can negatively influence outcome of a Project. In case of fluctuation of people, new onboarding processes can be a burden to a most valuable SE's within a team and if they are repeatedly mentoring/coaching new colleagues – they will feel (a) unsafe because managers cannot control fluctuation, (b) angry/sad because they will feel that managers do not see their burden with every change, etc.

m. **Alignment of Organization's seniority levels with global standards and expectations**. Assumption that senior SE is the individual only with great technical knowledge is high project risk. Individual labeled as „senior SE" needs to have good understanding of overall project environment, organizational and project processes, understanding of different methodological approaches, good interpersonal communicational skills, being able to write project/product documentation on its own , being able to communicate with different stakeholders, with different managerial, he needs to understand business acumen, always questions decisions being made etc.

n. **The answers of Organization to high global demand for SE workforce.** Due to the exponential use of IT in all segments of human lives, the global economy does not have enough SE's to satisfy all the needs. Companies are using different tactical approaches to retain and/or grow their businesses and projects, like:

- Retention policies ensuring financial stimulation like bonus policies, extra benefices (company vehicle 24/7, extra healthcare, financing sport activities, etc.). Also, FM's are having more 1:1 conversation with their SE's, searching for feedback and trying to use more supportive attitude, continuously improve working atmosphere.
- Attraction policies like opening additional offices to expand reach on new markets, more being focused on students and cooperation with universities, using aggressive organization's self-promotion trough dispersed set of marketing activities (e.g., helping community), hiring attractive and pushy recruiters (and sometimes even non-competent) to attract SE's on social and other virtual and real-world environments etc.
- Process improvement can be done through activities like strategic alliances with other organizations to optimize and improve efficiency and productivity.

If dominant, the fluctuation of SE's within the team can be a burden to a most valuable SE's who are expected to repeatedly act as a mentor and/or a coach to a new colleague or to work overtime (to compensate lost time), to override bad coding, correct bugs or redesign the specification. Due to the long recruiting process for a new SE if not supported correctly, existing SE's can suffer from burnout/ exhaustion, team members can feel unsafe, and the project may be endangered etc.

o. **Geographically distributed SE team.** SE teams working in geographically distributed (also: hybrid, virtual or remote) environment are more exposed to:
   - divergent thoughts about project goals and methods being used,
   - emotional exhaustion,
   - health issues,
   - less teamwork,
   - unavailability of team members,
   - bad decision making of senior management, insufficient empathy etc.,
   - need for supportive management,
   - language barriers,
   - additional administration,
   - bad onboarding processes,
   - wrong subjective perception of Project and Organization's expectations,
   - hard to control working hours,
   - the PM's and Organization's ability to manage and control the need of introverted and extroverted SE's,
   - feeling a need for psychologically safety and perception of trusted environment,
   - overexposed to virtual communication and lack of interpersonal, face to face communication and social gatherings,
   - cultural differences,
   - hard to establish team or project culture and to align with Organizational culture, etc.

p. **Geopolitical changes**, like the one started on 24th February 2022, by the Russian invasion on Ukraine, redefined already disrupted economic and SE workforce flows. These changes are additionally supporting and shaping people fluctuation flaws.

q. **Compensation for the lack of the matrix organizational structure.** If working in a matrix organization structure, and managers that have the lack of leadership skills – SE can feel unsafe and frightened that his FM will not be able to bring the right decision related to his professional career, financial stimulation etc. In this case, from PM is expected to support the SE, motivate him, and create safe environment around individual.

r. **Organization's Management and its understanding of software engineering PM environment.** If the Organization's CEO and other managers are having low level of understanding of the complexity and specifics of SE project management, this can negatively influence on PM, who will need spend a lot more energy more thoroughly argumenting objective and subjective influencers to a Project.

s. **Alignment of organizational and project goals.** The organization need to have and constantly analyze and improve metrics that will ensure the alignment of new opportunities and projects to its mission, vision, strategy, organizational processes, norms, standards, and core values. Organizations often generate a lot of sales opportunities and dive into projects just to gain revenue. The goal of organizations should challenge and questioning the goals and expected outputs of every potential project with organization's mission and vision. Often, the PM is the role that have the highest strategic overview over the Project and could be able to align Organizational and Project goals and culture. But, due to the demanding environment, often nobody takes care of these alignments.

t. **Self-actualization in society and working environment**. Self-actualization is perception of an individual rated in terms of how valued he is, his role, job, employer, financial compensation, and stimulation compared to other individuals he knows in private or business world.

u. **Competencies and abilities of a PM.** Due to the sum of all uncertainties related to software engineering project, most of the projects fail. That is the reason why it is important to choose the right PM, the one that is competent and capable leading and managing all aspects of project environment. PM needs to be able to think about different aspects of equally treatment for all team members, taking into consideration seniority level, gender, functional role, private needs and obligations (e.g., family, friends etc.).

5 Discussion

Theoretical background showed that relevant authors individually focused **their areas of interest on dispersed topics** – (a) factors influencing software development productivity (Chapetta and Travassos, 2020), (b) understanding cultural barriers in distributed SE projects and correlation with agile organizational approaches (Šmite et al., 2021), (c) demystifying the role of a Scrum Master in agile projects (Shastri et al., 2021), (d) study of a large-scale Agile transformation in a mission-critical environment, where stakeholders' commitment was a critical success factor (Russo, 2021) and (e) relationship between decision-making

style and personality within the context of software project development (Mendes et al., 2021).

A research gap, characteristic for the disruptive environment today's organizations are facing, is identified in the fact that neither all authors together neither any of them separately did not cover a dispersed high-level analysis of subjective and objective parameters influencing PM's ability to lead a geographically distributed SE team working on a complex software engineering project. the published research represents valuable knowledge and asset in specific, narrow areas of scientific research. For instance, the SM's role and related work that Shastri et al. (Shastri et al., 2021) analyzed, represents only one dimension of PM work – the one related to providing servant leadership (the one who serves) to a SE team. But, PM needs to be an advocate of all stakeholders (including the SE team), and be able to represent different opinions, motivating, guiding, and supporting stakeholders to act in accordance with project goals. In case the Organization has its other Agile processes in place but did not ensure the Scrum Master role due to any reason, PM will have additional obligations within SE team.

6 Conclusion

By covering different factors and aspects influencing the complexity of leading software project, and facing them with existing literature findings, authors of this paper provided the baseline for better high-level understanding of SE project management and its complexity. Also, this Research additionally contributes to the topic by addressing the influence of remote working environment and insufficient SE workpower to a complexity of a software project management.

Research limitations and future work. This paper is presenting a preliminary research study, based on limited number of focused, most relevant, recently published papers and a subjective opinion of the authors, enriched by objective experience findings. Authors plan to use the results presented as a baseline for future research that will be extended by (a) interviewing software engineering project managers and different stakeholder types identified in this paper and (b) bringing the interview results together with existing literature reach, authors' experience and conclusions being made through this paper. Also, authors will deeply analyze how governmental and law institutions are creating safe environment for remote workers and analyze how this could contribute to standardize the requirements, knowledge areas and skills that SE working in a distributive environment should have.

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