The Role of Project Manager in Agile Software Teams: A Systematic Literature Review

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ABSTRACT The use of Agile methodologies in software development has grown steadily over recent years. One of the main emphases of these methods is employing cross-functional and self-organized teams and highly skilled developers in software projects. In such a condition, project management would be a serious concern. Indeed, it would be confusing whether Agile teams are really in need of the role of the project manager. While Agile methodologies do not explicitly define the role of the project manager, many reports mention the existence of this role in Agile projects in real environments. So, it seems that the existence of this role is debated. Conducting a Systematic Literature Review, this study tried to find out answers to the ambiguities and questions regarding the role of Agile project management, the role of the project manager, and related issues. Focusing on the primary studies, the results show that there is no independent job called project manager in Agile methodologies. However, there is a need for it. Moreover, in the absence of this role in Agile methodologies and the need for it, it seems that this role would be structurally different from the traditional role of the project manager in terms of responsibilities and duties. Finally, the results show that pre-defined roles in Agile methodologies are often responsible for the project manager duties in software teams with no project manager.

INDEX TERMS Agile project management, Agile project manager, Agile software development, project manager, Scrum, systematic literature review.

I. INTRODUCTION

Project management has been proposed as a system for prediction and correction of collective performance. This concept includes a set of best practices to organize the required activities to complete a project [1], [2]. As well, project management as an organizing matrix or a network of project planning performs a set of unique, one-time tasks [3]. Therefore, project management is not distinct from other project activities, rather acts as a protector of them [1]. Meanwhile, the overlap of the concepts in project and project management prevents a correct understanding of the difference between the two concepts. The concept of the project refers to achieving a specific goal based on a set of activities and duties that are done by sources and in the specific start and end dates [4], [5]. While the concept of project management often

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refers to the operations that include the stages of defining requirements, determining the amount of work, allocation of required resources, execution plans, monitoring the progress, and regulating the deviation from the plan [4], [6]. A correct understanding of project management shows that project management can achieve project goals and expectations and bring more probable success upon it through its influence over the project [4].

Project Management Institute (PMI) and the International Project Management Association (IPMA), as the pioneer leaders of project management, provide international management standards to obtain a desirable performance [1]. These standards are widely accepted and can put organizations at a superior position in business if continuously applied. The standards mentioned above are presented in the forms of frameworks, practices, techniques, and how to use particular tools or knowledge processes in guidelines called "Project Management Body of Knowledge"

(PMBOK) [1], [7]. For instance, PMBOK includes several knowledge processes in different project management dimensions such as integration of project management, project range management, time management, costs management, risk management, human resources management, communications management, risk management, and procurement management [7]. In addition, PMI defined various practices, strategies, and techniques concerning Earned Value Management (EVM), Project Configuration Management (PCM), Work Breakdown Structures (WBS), and the skills required by project managers [1].

Software projects as a special type of project are also required to be supported by project management processes. Furthermore, due to the central role of the software development life cycle in such projects, project management would be more critical in software projects rather than other projects. So, software project management has received considerable attention in recent years. Furthermore, by the emergence of Agile methods as the replacement of plan-driven methodologies, project management, and its various aspects have been the central attention of many software researchers [8].

Due to the adherence of Agile methods to the values defined in Agile manifesto [9], most of the formal activities in software development are either missed or do not have explicit definitions [10]. Hence, project management in these methods is somewhat different from disciplined software development methods, such as waterfall-based methods and Rational Unified Process (RUP). This is mainly because disciplined methods have tried to define all necessary activities, including project management activities explicitly [11]. In fact, the management of Agile projects is managing complexity, handling the challenges related to the lack of clarity in requirements definition, and the issues associated with the inherent uncertainty caused by accepting the changes. On the other hand, Agile project management should be able to organize software teams with characteristics of self-organization, self-management and empowered. This is also important in Agile distributed projects where more effort is required to handle particular issues such as different cultures, time zones, trust, and knowledge management [12]. However, sometimes achieving the advantages promised by knowledge management processes required more discipline and providing the required technical and management infrastructure [13].

Nevertheless, it will be confusing whether such teams are basically in need of project management, if it is possible to manage such projects, how an individual can be introduced as the project manager to gain success in an environment where each member of the team is individually responsible for the success or failure of the project, what unique characteristics a manager might have in such projects while each member of Agile teams has a special and sufficient skill or specialty to develop projects desirably and in a word if it can be possibly stated that project management and project manager are meaningless concepts in Agile approach.

Conducting a Systematic Literature Review (SLR), this study has tried to find out answers to the above questions

and ambiguities regarding the role of Agile project software manager. The results of this study will enhance Agile teams' understanding of project management duties and responsibilities in Agile projects and guide them to handle management issues when the role of project manager has been eliminated in software teams. The results also have managerial implications associated with distrusting project management activities and responsibilities to Agile proposed roles.

The rest of this paper is organized as follows. Section II provides the literature review, followed by Section III, which describes the process of the SLR. Section IV explains the data analysis process, the results, and answers to the research questions. Section V provides a detailed discussion regarding the findings along with the threats to the validity of the finding. Finally, Section VI concludes the paper and provides some future research directions.

II. BACKGROUND

The principle of SLR research studies is based on the review of the works conducted on the subject under study. So, the SLR research study will be fruitful by investigating the results of previous studies accurately. In this method, only the most important and common citation databases were used to extract the related studies. However, this may lead to neglect of studies that have been sporadically published in other databases. Therefore, this study tried to use the most common and well-known databases to cover most of the reputable related articles published in various databases. In addition, a brief description of the works related to the present study was provided from miscellaneous databases.

Project management traditionally has been defined as a multifaceted process that can lead to the successful implementation of projects in different areas such as planning, time and cost control, and quality assurance [4], [14]. Foundation of OMI and IPMA is introduced as a manifestation of project management in the real-world [14]. However, various challenges and issues have been reported in this area. The most popular challenges are related to planning, cost estimation, cultural issues, communication, and the other aspects introduced by PMBOK [15], [16]. Moreover, it seems that the techniques introduced in PMBOK are insufficient to control and achieve success.

Individual-based values have been addressed as new parameters to direct and manage projects [17]. Hence, managers have been recommended to take advantage of individuals during the projects. Stating that the best project managers are not the ones that merely organize teams, [17] announced communication skills as characteristics of premier managers. Using these skills, project managers encourage teamwork and collaboration among project team members.

Traditional project management defines various planned and disciplined methods that are not applicable in software development whenever the development process needs for iterative cycles [18]. This will happen mainly when software teams are using Agile methods in their projects. In this case, Agile project management would be the

best alternative. Agile project management defines various key elements that are applicable in traditional project management, too [18], [19]. These elements are visual control, co-located high-performance teams, Test-Driven development, adaptive control, collaborative development, feature-driven development, leadership, and collaboration rather than command and control, move the focus from C (Cost) to R (Revenue) and Lesson learned [18].

Agile project management methods are constantly ready to resolve the inability of most software companies to deliver the product in the promised time, budget, and quality [19]. Meanwhile, a question arises whether Agile project management methods can be adapted to or imported to PMBOK. The answer to this question is almost positive. Indeed, many Agile related concepts can be transferred to the best practices and concepts in PMBOK guidelines [20]. In one study, Agile managers are divided into two categories of Agile resource managers and project managers [21]. This study introduces Scrum as an Agile method in which there are some roles that can do the duties of project managers.

Great focusing on rational factors has been addressed as the major reason for failure in most of the projects [22]. Based on Gallup's behavioral economics research, a new method called "behavior-based management" has been introduced to increase the project chance of success [22]. This approach allows the involved groups in the projects to make use of higher levels of commitment and emotional performance to improve their performance. In one study, success and failure of several projects conducted from 2000 to 2008 have been reviewed and indicated the top ten success factors in which using Agile processes were the top [23]. In another study, specifications of small and medium enterprises (SMEs) have been explained and concluded that these companies do not need rigorous project management [24]. Also, Lean project features have been addressed in another study, and the Lean Project Delivery System (LSPD) has been introduced to improve project management in the Lean project.

To sum up, it seems that Agile project management is the best choice for software companies. Due to the rapid prevalence of Agile methods, Agile project management would be strongly important. Furthermore, it seems that Agile project management is not only applicable to software companies, but also it is adaptable in non-software companies [25]. However, little effort has been spent on how to apply Agile project management in software projects, as well as its specific dimensions, roles, and responsibilities.

III. RESEARCH METHOD

The current study has been conducted based on the SLR guidelines [26]–[28]. SLR is a secondary study that tries to identify, analyze, evaluate, and interpret all the existing results concerning a particular subject through an accurate method [26]–[28]. SLR helps the researchers to find the evidences and documents, to critically analyze the selected documents, to make new evidences by the combination of

the selected documents and do all these steps by avoiding the researcher's bias [27], [28]. The main steps in SLR are planning, conducting and reporting [28]. In the current study, Kitchenham and Charters' method [28] has been used to follow the SLR steps, as depicted in "Fig.1" [28]. At the same time, parallel snowballing technique was used together with database search to achieve high-quality results [29], [30]. However, it led to an increase in the review effort.
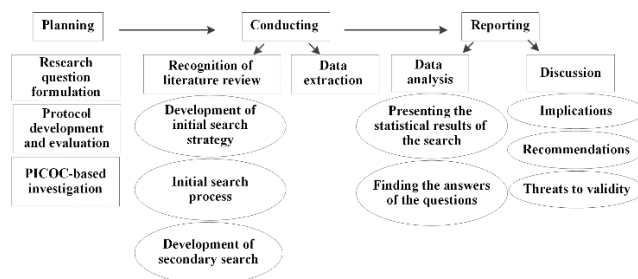

FIGURE 1. The SLR steps adapted from [28].

A. RESEARCH QUESTIONS

Petticrew and Robert [31] suggested that formulated questions in SLR should cover five essential elements. These elements, abbreviated as PICOC, include Population, Intervention, Comparison, Outcomes, and Context. Research questions in the current study were formulated as follows based on PICOC:

1) MAIN QUESTION 1 (MQ1)

Is there such a role as a project manager in Agile methodologies?

2) SECONDARY QUESTION 1 (SQ1)

What are the differences between project manager (if there is) in Agile methodologies and traditional/plan-driven methods? And how compatible is that to the Agile approach?

3) SECONDARY QUESTION 2 (SQ2)

Is there a need for the project manager in an Agile project?

TABLE 1. PICOC for research questions.

Element	Keywords and Related Words
Population	Agile software teams, Agile software developers, business parties
Intervention	Environmental and cultural features, roles, and behaviors
Comparison	N/A
Outcomes	Agile software teams functionalities
Context	Agile software teams and companies

4) MAIN QUESTION 2 (MQ2)

Who is in charge of carrying out tasks and taking over responsibilities in teams with no project manager? Table 1 shows the PICOC elements required to design the research questions.

B. IDENTIFYING THE LITERATURE

The general conditions inserted in Table 2 were considered to identify the relevant literature. It should be noted that only English language studies were included in the selection process.

TABLE 2. General condition for the search process.

Year	Type
2001-2019	full text

1) THE SEARCH STRATEGY

The initial search strategy was based on searching the keywords related to the research subject. Table 3 shows the search strategy (target keywords), and A-F attachments are the search strategy procedure at any database.

TABLE 3. The search strategy adopted in the review process.

Keywords
Agile management
Agile project management
Agile project manager
Agile manager rules
Agile project manager challenges/ issues/ obstacles
Scrum project manager
Scrum project management

2) INITIAL SEARCH PROCESS

The initial search process was conducted by searching the keywords in the six popular databases in computer science and software engineering. Table 4 shows these databases and the location of searching keywords in each database.

TABLE 4. Selected databases and location of searching keywords.

Database	Location of search
ACM	Title/ Abstract
IEEE Xplore	Title/ Abstract
Sage	Title/ Keywords/ Abstract
Science Direct	Title/ Keywords
Springer	Title/ All words
Taylor & Francis	Title/ Keywords

TABLE 5. The results of the initial search of keywords in each database.

Keywords	ACM	IEEE Xplore	Sage	Science Direct	Springer	Taylor & Francis
Agile management	24	27	7	93	11	8
Agile project management	12	10	4	36	25	2
Agile project manager	8	0	0	1	0	1
Agile manager rules	0	0	0	0	0	0
Agile project management challenges/ issues/ obstacles	0	0	0	0	0	0
Scrum project manager	1	0	0	0	0	0
Scrum project management	1	3	0	7	1	0

Table 5 shows the results of the initial search for each keyword in each database. The numbers in the table indicate the number of studies found in the search process. It should be noted that in the search process for different keywords in a database, usually, the same results were obtained. So, it was necessary to omit similar studies.

3) SECONDARY SEARCH STRATEGY

The secondary search stage includes screening all the studies found in the initial search based on the determined criteria. Screening in this study was based on the rejection criteria presented in Table 6.

TABLE 6. Rejection criteria.

Code	Description
Rej 01	Presenting a list of articles on Agile project management (e.g., SLRs)
Rej 02	Not focusing on project management and Agile concepts
Rej 03	Merely focusing on the concept of project management in non-Agile environments
Rej 04	Merely focusing on the concept of Agile approach without focusing on project management
Rej 05	Focusing on Agile project management concepts in only a particular discipline in the development process such as Risk management, Knowledge management, etc. Focusing on Agile project management concepts in non-Agile methods without focusing on the project manager
Rej 06	Focusing on presenting metrics, models, framework, method, theory and/or special tools for Agile project management
Rej 07	Studies related to Agile project management published by several publishers

Having applied the secondary search strategy on the results of the initial search, the remaining studies were coded by S1 to Sn, as primary studies related to the research questions. Appendix G presents the results of the secondary search process.

C. DATA EXTRACTION PROCESS

The data extraction process is performed to prevent bias in the collected data. This process is first done by the first researcher and second researcher as a data extractor and data checker/controller [27], [28]. In the current study, the aforementioned process was carried out in multiple reviews by the first and second authors on the results of the initial search to apply the rejection criteria. This stage continued until the above-mentioned authors reached an agreement on approving or rejecting each study. However, they had disagreements in some cases, where the third author stepped in and reviewed the aforementioned studies. The third author, fortunately, agreed with one of the other two authors about the studies because according to [28], the original author of a study has to be contacted with, in case of at least two of the authors do not reach an agreement on approving or rejecting a study.

The following sections provide the SLR stages, including data analysis and findings, and a detailed discussion, including recommendations and threats to validity.

IV. DATA ANALYSIS AND FINDINGS

The obtained results and extracted data are investigated in this section by descriptive statistical tools such as tables

and figures. In the current study, of the total 199 studies found in the initial search, a total number of 35 studies were introduced as the final results by implying rejection criteria and according to the agreement of the authors. Most of the accepted papers are journal articles, and the least of them are conference papers.

Among 35 final studies accepted in this research, the maximum statistics is related to journal papers, and the lowest one is related to conference papers. "Fig.2" shows the portion of studies in the final results based on the publication type.
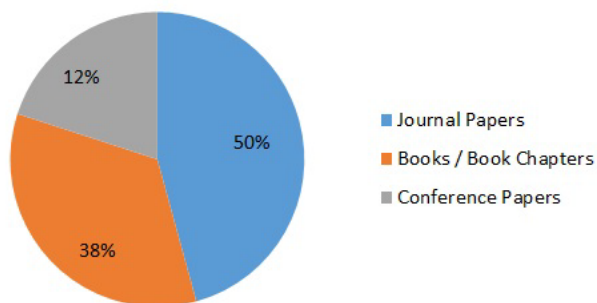

FIGURE 2. Proportions of resources according to the publication type.

"Fig.3" shows the number of selected studies based on the publication year. The results of this figure show that most of the papers were published in 2015. The oldest and latest studies were published in 2003 and 2019, respectively.
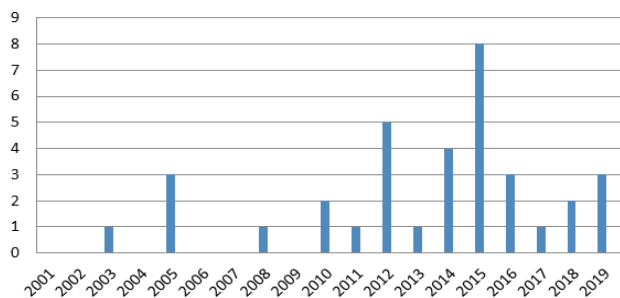

FIGURE 3. The number of primary studies by years.

In addition, Table 7 presents the number of accepted studies in the databases.

TABLE 7. The number of accepted STUDIES by databases.

Database	Number of the confirmed studies
ACM	5
IEEE Xplore	7
Sage	1
Science Direct	7
Springer	12
Taylor & Francis	3

A. ANSWERS TO THE RESEARCH QUESTIONS

In order to answer the proposed questions in the current study, the extracted data were investigated based on reviewing the

primary studies. Table 8 shows a list of primary studies that were suitable to answer the formulated research questions. As shown in the table, among the primary studies, 32 studies were suitable to answer MQ1, and only seven studies could be employed to answer MQ2. This shows that MQ1 was investigated with more evidence compared to the other questions.

TABLE 8. List of relevant primary studies for each research question.

RQ	Study Code	Number of Primary studies
MQ1	S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S23, S24, S25, S26, S27, S29, S30, S31, S32, S33, S34, S35	32
SQ1	S3, S4, S5, S10, S12, S16, S18, S23, S26, S27, S28, S29, S31	13
SQ2	S2, S3, S5, S12, S14, S16, S20, S21, S22, S24, S29, S31	12
MQ2	S4, S5, S6, S16, S18, S23, S24	7

1) EXISTENCE OF PROJECT MANAGER IN AGILE METHODOLOGIES? (MQ1)

A review of the selected and approved studies does not confirm the existence of the independent role of the project manager in Agile methodologies. Of the 35 selected studies, 32 studies referred to the concept of Agile project management. However, none of them addressed the existence of a role as an Agile project manager. This issue has been investigated in S16, S18, S21, S22, S28, and S35 in another way. S16 focused on the transformation of the waterfall Project Management Office (WPMO) into the Agile Project Management Office (APMO). This study addressed the role of the Change coach to support the transformation without mentioning the role of the project manager.

S18 believed that Agile teams do not have a separate role for the project manager, and discussed who are responsible for performing the responsibilities of the project manager in Agile teams. S21 mainly focused on investigating the factors influencing the Agile of project managers in global software projects. Reviewing the history of project management from traditional to Agile, S22 focused on the difference between the management approach in the two. It indicated that Agile managers should look for strategies that focus on business values and deliverable artifacts. In contrast, traditional project managers focus on time, financial limitations, and risks. S28 highlighted the positive effects of the quality of teamwork on the success of the project in Agile teams. S35 compared the plan-driven and Agile approach for managing software projects. It indicated that Agile project management leads to better dynamic project management and reducing the negative impacts on the success of the projects. Nonetheless, that study does not present an accurate definition of the scope, duties, roles, and characteristics of Agile project managers.

Of the 32 studies that deal with the concept of Agile project management, S23, S26, and S27 directly studied the concept of Agile project management and addressed concepts such

as Agile management. However, they did not provide any evidence to indicate the existence of an independent role with those titles in Agile projects. S23 clearly stated that the title "project manager" can be seen as one of the four states of the mentor, coordinator, negotiator, and process adapter.

S26 focused on Agile managers (not necessarily Agile project managers) and considers Agile managers responsible for clarifying the jobs and responsibilities of team members to make sure of the team arrangements and reliability. This study has also shown the key role of Agile managers in guiding teams to learn and adapt continuously. Tough, this study has not demonstrated the existence of the independent job of the project manager. S27 focused on the viewpoints of several Agile experts on how to manage agility and the role of Agile managers. Most of the views considered Agile managers as occasional facilitators and notified their indirect intervention in development steps. In one of the viewpoints, while the existence of Agile leadership has been considered essential for helping and guiding the team, the existence of managers has been considered optional.

The studies that can be indirectly helpful in answering the first question can be divided into two groups. A part of these studies merely investigates the concept of project management (Group A). The other part has attempted to study this concept in a specific methodology like Scrum (Group B). Table 9 presents the above categories, which will be briefly described in the following sections.

TABLE 9. Classification of primary studies by indirect answer to MQ1.

(A) Concepts of Agile project management	(B) Project management in a specific methodology				
	Scrum	XP	Kanban	FDD	DSDM
S3, S9, S10, S12, S13, S14, S15, S17, S20, S25, S30, S31, S32, S33, S34	S2, S4, S5 S6, **S7**, S8 **S11**, S19, S24, S29	**S7**	**S11**	**S7**	S1

a: CONCEPTS OF AGILE PROJECT MANAGEMENT
As seen in Table 9, 15 studies were merely focused on the concept of Agile project management. While expressing the modern teams need to modern management, S3 has defined modern manager as the one who has a good understanding of the modern development needs, human relations and other dynamic aspects of the Agile development team. In fact, Agile development calls for Agile management that can interact with Agile teams of different generations with different cultural and geographical backgrounds. S9 showed personal flexibility as the key to Agile management. S10 introduces Agile management as an approach that can be the background to define the changes needed by Agile organizations. This approach can facilitate team performance, increase the flexibility of the team, motivate the team, and promote the customer acceptance culture. Although using Agile management has been introduced as a serious challenge in big projects or organizations.

S12 considers Agile managers as those who tell others what to do and organize the tasks. This study addresses different duties and titles for Agile managers. Though, no specific role has been addressed to the Agile project manager. Explicitly using the experiences of multiple project managers in software companies who had employed both traditional and Agile methodologies, S13 considers that the effectiveness of Agile management in the success of projects and customer relationships is more than that in traditional management.

S14 studied the managers challenges in using Agile methodologies in traditional organizations and sufficed at presenting strategies to confront the challenges of accepting agility instead of presenting an Agile management structure. However, two special roles have been defined for project managers, namely "protector" of the team against probable problems and challenges, and "coach" to guide the team in accepting their new roles and responsibilities. In a study, S15 investigated the effect of Agile practices on software team trust. It stated that since the role of project managers in Agile software development has changed into a leader, the managers need to trust their teams more. This study has not discussed the role and responsibilities of Agile project managers. S17 focused on the contextual utility of Agile project management and showed the association between Agile maturity and performance is positively moderated by project emergent complexity.

S20 has shown in which situations Agile project managers can be influential in small teams and increase efficiency and quality. S25 showed the positive effects of collaborative environments on Agile management and considered the role of project managers to be continuous monitoring. S30 investigated Agile distributed software development risks and associated a part of the aforementioned risk to the risks in project management that can threaten different phases of a project.

Showing the purposes of iteration in Agile development and critical decisions associated with the success of Agile projects, S31 assumes that the main purpose of Agile management is achieving success, among which quality and team satisfaction are the most important factors. S32 introduced Agile management as the most important factor in achieving team productivity. S33 attempted to identify the challenges of collaborative decisions and considered the roles of Agile self-managing teams to be significant in handling these challenges due to the role of managers in most decision-making processes. Furthermore, S34 studied the barriers of decision making in Agile teams and indirectly considers the Agile project manager responsible for correct and appropriate decision-making.

In total, the studies of this group were mainly focused on introducing the concepts, principles, and other aspects of management in Agile development and paid less attention to the role of Agile managers (including project managers).

b: PROJECT MANAGEMENT IN A SPECIFIC METHODOLOGY
This group includes 11 studies, most of which were focused on using Scrum methodology. As shown in Table 9, only

S7 has used Scrum, Extreme Programming (XP), and Feature Driven Development (FDD). S11 also did their investigations in Scrum and Kanban environments. S1 is the only study that focused on DSDM.

S1 studied the Dynamic System Development Method (DSDM) methodology and its focus on project management and stated that considering the similarities of this methodology to RUP in terms of project management dimensions, there is a complete view of the project management in this method. One of the roles defined in this methodology is the project manager, who can be a person in the technical team or users who is responsible for macro-project management. Mentioning the prevalence of Scrum, S2 attempted to investigate a case study about Agile management and reported its initial findings. The results of this study mainly indicated the challenges of using Scrum as a project management framework. Taking Scrums an Agile Project management framework in a particular study, S4 showed the effects of Agile project management on creating business values and its effects on productivity and quality. According to this study, Agile project management can improve team quality and productivity. This study highlighted the role of leadership and its effects on software development instead of the management role. S5 investigated different aspects of Agile project management. This study emphasized the understanding of different autonomy levels as an effective factor in the success of Agile managers and defined the role of managers as facilitators and supervisors. Although this study emphasized the specific application of Agile project management in small projects, it informed about the prevalence of its applications in big projects in the future.

S6 studied Agile project management in distributed environments and referred to roles such as local managers. Although it has presented this role in another section in the form of Scrum manager, no explicit reference is made to it. Investigating the principles of project management as defined in PMBOK and practices related to project management in Scrum, XP, and FDD, S7 has shown that these methodologies do not cover all the aspects of PM. Risk management, costs, and procurement are such items. S8 presents a balanced process of project management that can be helpful in traditional environments, moving to Agile. In this process, the combination of Scrum and some of the practices of traditional project management based on CMMI and PMBOK has been applied, and its positive effects have been shown in cost estimations. However, the details of this process and its probable roles have not been addressed explicitly.

S11 used Scrum and Kanban to achieve desirable project management in a project and showed that the combination of them is useful in achieving a more accurate work. S19 showed that Scrum has a considerable impact on the software project management areas, including project time and cost, project resource management, project scope management, project human resource management, project quality., and project risk management. S24, based on Scrum and PMBOK principles, considered the role of project manager in Agile

methodologies to be merely a guide and mentor who supports its self-organized team. The project manager in this study is described as the Scrum Master. S29 declared the Scrum Master to be an adaptive and facilitator leader who is also responsible for overcoming obstacles and motivate its self-organized team.

2) ROLE OF PROJECT MANAGER IN TRADITIONAL VERSUS AGILE PROJECTS? (SQ1)

The initial investigation of the MQ1 is not a sign to confirm the existence of an independent role called "project manager" in Agile methodologies. Nonetheless, project management duties seem to exist in a way, and other roles are responsible for them. To this end, in response to SQ1, the studies were investigated with an emphasis on finding an answer again.

S3 mentioned the responsibilities on the Agile managers' shoulders and considered the following items as the most important duties of project managers: creating general goals, team goals, promoting self-organizational teams, facilitating communication channels, maintaining team sustainability, creating a dynamic learning environment, creating backgrounds to receive quick feedbacks and solving the team problems. Nevertheless, this study has stated that the program manager seems to be a better title to be used in Agile teams instead of the project manager. This study considered the role of managers as facilitators who are not directly involved in the product development process.

Conducting an experimental study of the Scrum framework in the field of project management, S4 has mentioned the above framework useful in achieving higher efficiency and quality. This study also considers that assigning responsibilities of project management to other jobs defined in Scrum will eliminate the focus on project management responsibilities. Therefore, the structural difference between the common role of "project management" and Scrum roles can be observed. S5 mentioned the structural differences between traditional and Agile project management and stated that the focus of the traditional project management is on direct monitoring and controlling and standardizing work processes, while the focus of the Agile project management is on self-management of the teams. In this view, Agile project management is a facilitator and organizer of sessions that investigates team obstacles. It is mentioned in this study that a person titled the project manager is also used in many teams to help the Product Owner to work on the requirements and handle other stuff related to software development.

S10 considers Agile managers to be responsible for facilitating organizational changes that are responsible for maximizing team motivation and flexibility and interpersonal trust. S12 considers Agile managers responsible for motivating individuals and teams, creating an Agile structure, building an organizational culture adaptive to changes, and coordinating team efforts with the defined goals. These definitions show the structural difference of the responsibilities mentioned above between project management and the role

of the project manager. S16, as mentioned before, suggested the role of Change coach to facilitate the transformation of WPMO into APMO. This role, as S16 suggested, is responsible for facilitating the change process as well as acting as an educational assistant. S16 considered Agile coach as Agile project manager and emphasized on updating the responsibilities of Agile roles to support the project management at the team level.

Denying the existence of the independent role of project management in Agile teams, S23 mentioned that software teams still use such titles. Roles such as mentors, coordinators, negotiators, and process adaptors have been associated with this role in this study. As it was earlier mentioned in the current study, these items are structurally different from the traditional project management. S26 confines the role of project management to the traditional methodologies and states that unlike traditional methodologies, project management in the Agile approach should be focused on the team autonomy, and managers should merely focus on facilitating strategies and overcoming problems that threaten the teams.

Mentioning that there is no need for an independent project manager, S27 emphasized the facilitating role of Agile managers and their limited power in Agile teams. Though, it recognized the right to question and follow up mainly for managers. With the aim of investigating the effect of Team Work Quality (TWQ) on Agile projects success, in response to one of the survey questions in this study, S28 compared TWQ in Agile and traditional teams and concluded that regarding team coordination, TWQ could be formed in traditional teams despite their strong management and in Agile teams despite their self-organization which has replaced strong leadership. However, regarding the mutual support and coherence, traditional hierarchical management cannot facilitate. However, focusing on iterative development, Collective Code Ownership, and daily meetings can facilitate this important fact in Agile software development.

Expressing the lack of reliance on Agile teams on project managers, S29 believes that the responsibilities of project managers are divided among the team members in Agile methodologies. In this study, Agile managers like Scrum Masters are merely facilitators of the process, eliminators of barriers, and team motivators. S31 also considered the pillars of project management and managerial roles different in Agile and traditional methodologies such that decision making responsibility is on the teams, and managers are only servant leaders. Overcoming barriers, team empowerment, and coordinating are other responsibilities of Agile managers.

3) THE NEED FOR PROJECT MANAGER IN AGILE PROJECTS? (SQ2)

Table 8 shows the studies that have been used to answer this question. Although S2 emphasizes the necessity of project manager in Agile methodologies, it only recognizes official

Agile roles like Scrum roles. In addition, S3 believes that the new Agile thinking calls for new management that is structurally different from the common one in the traditional methodologies. The project manager should also be Agile to be able to participate as one of the Agile roles like Scrum Master, mentor, or even developer. S5 refers to the existence of the role of project manager and its different properties in Agile projects. Although this study emphasizes the existence of self-organized teams, it was still addressed the role of the project manager.

S12 takes a modern managerial style necessary for the current self-organization in Agile teams. S14 has mentioned project managers should take the responsibilities of being protectors and guides and has stated that such managers need to be creative for the team to be successful. S16, as mentioned before, discussed the necessity of project manager, but considered Change coach as an alternative.

S20 considers project managers responsible for selecting the appropriate Agile methodology, although this study has not investigated the issues after selecting the Agile methodology and the special role of project managers. S21 attempts to make software system project managers Agile, although it has not presented an accurate definition of the characteristics and responsibilities of such managers.

S22 compared the traditional and Agile project managers and considered delivering products and business values as the main responsibility of Agile project managers. Mentioning the differences between Agile and traditional project management, S24 stated that the responsibility of the project manager is to support the team. Focusing on the self-organization of Agile teams, S29 believes that these teams do not rely on project managers, although it takes self-organization as a challenge for the traditional project teams and managers. S31 believes that the golden triangle of time, budget, and quality is necessary for the success of the project managers and has referred multiple times to the necessities of this role. However, it has not defined any position for the Agile project manager.

4) DISTRIBUTION OF PROJECT MANAGEMENT DUTIES WHEN THERE IS NOT A THE ROLE OF PROJECT MANAGER (MQ2)

As was found while analyzing the first question in this study, no independent role called the project manager is determined in Agile projects, and the assumption is that the project management duties are done by other roles. Studies presented in Table 8 are investigated to answer this question.

In S4, the responsibilities of project management are on the shoulders of the defined roles in Scrum, that is, the Product Owner, Scrum Master, and members of the development team. Product Owner is responsible for showing the project and products to the stakeholders and managing the duties. Members of the development team should be self-organized and self-managed when playing technical roles.

The Scrum Master plays the role of a leader, motivator, barrier solver, and facilitator in development practices. S5 emphasizes that the teams need to be self-managed, and not only should they take the executive responsibilities, but also, they should be responsible for monitoring, management, and improvement. In such conditions, the Product Owner will be responsible for providing a project vision and guiding the project's value flow, while the Scrum Master will act as the facilitator of the processes who overcomes the obstacles.

S6 considers the Scrum Master a new managerial role that solves the problems and obstacles while facilitating the development process. S16, as addressed before, introduces the Change coach instead of the project manager. S18 directly discussed the roles that are responsible for providing the duties of the project manager in an Agile team. This study addressed all the Scrum roles as well as financial supporters to perform the project manager responsibilities.

S23 recognizes the Scrum Master and Product Owner responsible for managerial duties in software projects. The Product Owner is responsible for notifying the development team about customer requirements and priorities, and the Scrum Master is responsible for facilitating team activities and overcoming obstacles. S24 believes that the role of the project manager is redefined in modern project management, and it is merely as a guide or mentor/coach who works by the team. According to this viewpoint, the coach/ mentor, guide, or Scrum Master are modern project managers.

V. DISCUSSION

In the current research study, 35 studies were used to answer the research questions. The findings of SLR on answering the research questions and details of threats to validity will be discussed in this section.

A. IMPLICATIONS

The current SLR findings in response to MQ1 indicate that there is no independent role called project manager in Agile methodologies, but this role may be assigned to the available roles in Agile teams in the form of responsibilities and duties. In addition, the investigations done to answer SQ2 show that although there is no independent role called project management in Agile methodologies, there is a need for this role. In fact, the aforementioned studies implicitly consider self-management and self-organization of Agile teams necessary for creative management to achieve team success.

Investigations done to answer SQ1 showed that project management in Agile is structurally different from the traditional project management in terms of responsibilities and duties. This type of management is often accompanied by a lack of direct intervention in the development process. Agile project management can adapt to the Agile approach by setting general goals, team goals, promoting team self-organization, facilitating communication channels, maintaining team sustainability, creating a dynamic learning

environment, quick feedback and receiving backgrounds, and solving team problems. In the end, while answering MQ2, it was found that the responsibilities of the project manager in teams without independent project manager are based on the inherent self-management of Agile teams and redefinition of the above concept is upon the defined roles such as the roles in Scrum which often appear as guides or mentors/coaches by the team. Nonetheless, one of the studies (S4) considers assigning the responsibilities of the project manager in Agile software development to Scrum jobs leads to a lack of focus on project responsibilities.

A review of the finalized studies provided a list of the activities and responsibilities defined for project management in the form of the roles available in Agile teams, as shown in Table 10.

TABLE 10. Responsibilities and duties of the Agile project management.

No.	Duties	Primary study
1	Motivating, increasing customer acceptance, facilitating organizational changes, maximizing flexibility and trust	S10, S15, S29
2	Collaboration with teams with different cultural and geographical backgrounds and different generations	S3
3	Organizing affairs	S12
4	Providing access to productivity, quality, and team satisfaction	S4, S32
5	Handling the challenges on collaborative decision making	S33
6	Change coach	S16
7	Correct and appropriate decision making	S34
8	Coordinator, negotiator, process adaptor, focus on commercial values and artifacts deliverable	S23
9	Understanding different levels of team self-governed, organizing meetings, investigating barriers	S5
10	Continuous observation on collaborative environments	S25
11	Clarifying jobs and responsibilities, assuring the correct team setting, guiding the team towards continuous learning and adaptation	S26

Furthermore, the findings of the SLR show the various Agile roles, which are considered as Agile project managers, as shown in "Fig.4".

It seems that although none of the primary studies mentioned about having a particular role as project manager, various duties of a project manager are assigned to other team roles. Specifically, Scrum Masters and Agile Coaches are those who are responsible for most of the project management responsibilities in an Agile software project.

B. RECOMMENDATIONS

According to the definitions presented regarding project management, this concept shows the organizational responsibilities which facilitate the project process [3]. project management is also introduced as an organizational state of management that includes a set of best practices to solve complicated organizational processes [1], [32].
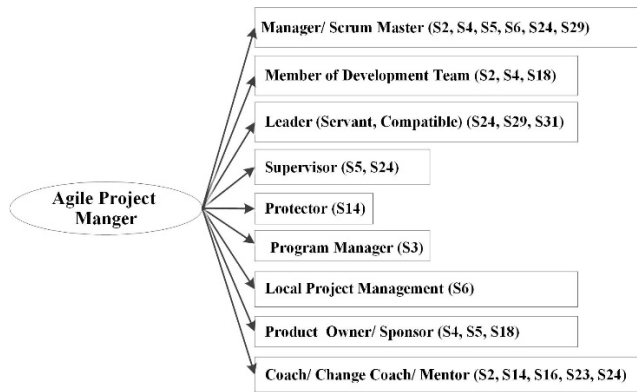
FIGURE 4. Various Agile roles are considered as an alternative to the Agile project manager.

Therefore, project management is not distinct from other activities but acts as a protector of other activities [1]. This also is considered in all projects (not only in Agile software projects). Indeed, following Agile principles may lead to increased customer interaction, better collaboration in the team, and more flexibility [33].

Research findings presented in Table 10 and "Fig.4" indicate that it is a set of unique activities and duties that are presented in the form of Agile project management. Hence, considering the inexistence of an independent role called Agile project management on the one hand, and the relationship between the responsibilities and duties presented in Table 10 and the roles determined in "Fig.4", the key elements are introduced for desirable management of Agile projects.

Covering the concept of project management, this important point can be defined as a global policy like PMI or PMBOK standards to enhance the Agile project management challenge by the use of the best practices to solve the complicated processes in Agile software development. For example, motivating, enhancing customer acceptance, facilitating organizational changes, maximizing flexibility, and trust are major duties and responsibilities introduced (S10, S15, S29) in Table 10 for Agile project managers. Moreover, according to "Fig.4", Scrum Master (S2, S4, S5, S6, S24, S29) and coach/change coach/ mentor (S2, S14, S16, S23, S24) are mainly introduced as Agile management roles. Reviewing the scope of Scrum Master duties, it can be inferred that Scrum Master is a servant leader in Scrum teams. Therefore, by defining the Scrum Master as a servant leader to motivate, enhance customer acceptance, facilitate organizational changes, maximize flexibility and trust, a key element can be standardized for Agile project management.

C. THREATS TO VALIDITY

It is necessary to consider threats to validity when discussing the finding of SLRs. Such threats can be categorized into four main types, including construct, internal, external,

and conclusion. Construct validity is related to the degree in which an investigation measures what it claims to be Measuring [34]. Internal validity is the extent to which a causal conclusion based on a study is warranted. It is determined by the degree to which a study minimizes systematic errors. External validity is the degree to which extent the results can be generalized to other contexts [34], [35]. Conclusion validity of a review study deals with reaching appropriate conclusions through rigorous and repeatable treatment.

Since the threats to validity affect the results, the authors attempted to minimize bias in selecting the initial studies, data extraction, and data analysis; however, there might be errors in the results like other studies. In selecting initial studies, attempts were made to select the databases with the highest frequency of publishes in the software field. However, other studies from different databases were reinvestigated in Section II. In addition, in the search phase, apart from the general strategies presented in Table 4 for the search strategy of each database, search filters were attached to appendixes A-F separately in each database so that similar results were achieved in case of repeating the research steps. Furthermore, all the stages in Section III were completely clarified and documented. In data extraction phase, since the articles on the subject need to be studied deeply and comprehensively, rejection criteria presented in Table 6 were introduced at the time of setting the protocol so that the final studies are selected without the bias on the publication (which is focused on the studies with positive results). In addition, checklists were considered for a better focus on more important points in each study, so that each author can write down the main and more relevant sections in them and scrutinize in the meetings.

In the studies published by multiple publishers like the papers published both in conference and book, the more complete and detailed version was used. In the data analysis phase, first, the studies holding answers to each question were listed individually by the authors, and then the results presented in Table 8 were achieved by holding numerous meetings and combining individually obtained evidence. Having analyzed and reviewed the answers given to the research questions multiple times, suggestions were finally presented for the desirable management of Agile projects. However, it cannot be claimed that the results and findings of the current SLR are completely correct. However, there is hope that they can be useful to some extent in the field mentioned above.

VI. CONCLUSION AND FUTURE WORK

Project management in Agile methodologies is subject to changes due to its commitment to the governing principles and values, managing complications, lack of clarity in expressing the requirements and uncertainty. Therefore, Agile project management should be able to organize self-governed, self-organized, and self-managed teams. However, the important point is whether such teams are essentially

in need of project managers and how a role called project manager can be introduced in an environment where each member of the team is individually responsible for the success or failure of the project. Accordingly, the current study was carried out to investigate different aspects of this issue by putting forward two main and two secondary questions using an SLR method.

Results of 35 final selected studies in this research indicate that there is no independent role called project manager in Agile methodologies; however, there is a need for it. In addition, due to the absence of such a role in Agile methodologies and the need for it, it seems this role (if there is) will be structurally different from the traditional project manager in terms of responsibilities and duties. Existing differences are mainly compatible with the Agile approach by assigning the responsibilities and duties to the Agile defined roles. In addition, the results of the current study indicate that the defined roles in Agile methodologies are often responsible for the project manager's duties in software teams with no project manager.

Findings of the current study can help Agile teams to understand the responsibilities and duties better and achieve more success while maintaining the inherent self-governing, self-management, and self-organization, as expected in Agile software development.

Results and findings of the current study are intended to be used in future work to develop an appropriate standard for Agile project management. Moreover, the aforementioned developed standard needs to be applied to evaluate and rate the qualitative level of the managerial roles in Agile projects. The results of this study can also be used in developing an appropriate ontology for the Agile manager role.

APPENDIX A
See Table 11.

TABLE 11. How the search strategy has been applied in the Science Direct database.

Science Direct
Advanced search for in title or keywords Refine your search: journal & books & all computer science Years: 2001 to 2019

APPENDIX B
See Table 12.

TABLE 12. How the search strategy has been applied in Springer database.

Springer
Find resources: with all of the words, where the title contains Show documents published between the start year 2001 and end year 2019 include preview – only content

APPENDIX C
See Table 13.

TABLE 13. How the search strategy has been applied in the ACM database.

ACM
Select item from the ACM full – text collection Where Title/ Abstract matches all Publication year: 2001 – 2019

APPENDIX D
See Table 14.

TABLE 14. How the search strategy has been applied in the IEEE Xplore database.

IEEE Xplore
Search: full text & metadata in document title/ Abstract Content filter: All Results Publishers: All Content types: Journals & magazines Publication year from 2001 to 2019

APPENDIX E
See Table 15.

TABLE 15. How the search strategy has been applied in the Sage database.

Sage
Browse journals by discipline: materials & engineering Subject: engineering & computing Anywhere: title/ keywords/ abstract Published in: all journals Access type: all content Published in: 2001 to 2019

APPENDIX F
See Table 16.

TABLE 16. How the search strategy has been applied in Taylor & Francis database.

Taylor & Francis
Search for title/ keywords Publication date: 2001- 2019 Not only show content I have full access to

APPENDIX G
See Table 17.

TABLE 17. Results from the secondary search.

Source code#	Database
S1 [36]	Springer
S2 [37]	Springer
S3 [38]	Springer
S4 [39]	Springer
S5 [40]	Springer
S6 [41]	Springer
S7 [7]	Springer
S8 [42]	Springer
S9 [43]	Springer
S10 [44]	Springer
S11 [45]	Springer
S12 [46]	Springer
S13 [47]	IEEE Xplore
S14 [48]	IEEE Xplore
S15 [49]	IEEE Xplore
S16 [50]	IEEE Xplore
S17 [51]	IEEE Xplore
S18 [52]	IEEE Xplore
S19 [53]	IEEE Xplore
S20 [54]	Taylor & Francis
S21 [55]	Taylor & Francis
S22 [11]	Taylor & Francis
S23 [56]	ACM
S24 [57]	ACM
S25 [23]	ACM
S26 [58]	ACM
S27 [59]	ACM
S28 [60]	Science Direct
S29 [61]	Science Direct
S30 [62]	Science Direct
S31 [63]	Science Direct
S32 [64]	Science Direct
S33 [65]	Science Direct
S34 [66]	Science Direct
S35 [67]	Sage

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