SYSTEMATIC LITERATURE REVIEW OF PROJECT MANAGER'S LEADERSHIP COMPETENCIES

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ABSTRACT

Purpose:
Over the last few decades, a large number of research studies have been carried out on project manager's leadership competencies. However, systematic literature reviews are still scarce in the project management literature. Therefore, the purpose of this article is to conduct a systematic literature review on project manager's leadership competencies based on published empirical research studies.

Methodology:
We employed a systematic literature review (SLR) methodology to synthesize research in a rigorous manner and a total of 1,780 articles were identified in the first step and a final sample of 60 research studies were synthesized.

Findings:
Synthesis of the findings in this SLR on project manager's leadership competencies revealed: a) there is a lack of categorization or ranking of leadership competencies; b) 20 research studies (46%) were conducted with sample sizes of less than 100; c) only a few research studies (<10%) used interview data for analysis; and d) none of the research studies reported adoption of a triangulation method.

Implications/Limitations:
This study prioritized project manager's leadership competencies as 'high priority', 'moderate priority', and 'low priority'. We recommend a sample size between 200 and 300 to produce sophisticated results and enhance the credibility, generalizability and validity of future research.

Originality:
Future research studies are suggested to consider systematic literature review combined with face-to-face and group interview in addition to employing triangulation methods. Besides highlighting implications for practitioners, this SLR has advanced the understanding of how to conduct systematic literature reviews in a robust manner.

Keywords: Systematic literature review, project manager, leadership, leadership competencies.

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1. INTRODUCTION

Competence is an area of work, competency is the behaviour supporting an area of work, and competencies are the attributes underpinning a behaviour (Moore, Cheng, and Dainty, 2002). The topic of project manager's leadership competencies has been cited as a critical success factor for determining either the success or failure of a project, which is an area of much debate in the literature (Nixon et al., 2012). Indeed, leadership competencies have been defined as "a cluster of related knowledge, attitudes, skills, and other personal characteristics that affect a major part of one's job, correlates with performance on the job, can be measured against well-accepted standards, can be improved via training and development, and can be broken down into dimensions of competencies" (Limsila and Ogunlana, 2008). On this matter, Woodruffe (1991) articulated that competence is an ability to perform a task successfully. According to Crawford (2007), the competencies of project management personnel and project success can be closely related to each other. According to the dictionary definition, the word competency and competence are readily interchangeable (Moore et al., 2002). However, the influence of a project manager's leadership competencies in achieving project success appears to have been ignored in most of the project management studies (Turner and Muller, 2005).

Project management is a key skill-set related to the area of engineering, construction and architectural management (Ahuja et al., 1994), since clearly built environment and civil engineering work is designed and delivered according to specified and agreed projects. Researchers have explored this area from a theoretical perspective, for instance, investigating the

relationship between construction project management theory and transaction cost economics (Walker and Kwong Wing, 1999). Other researchers have assessed how to improve the performance of the earned value analysis technique as a construction project management tool (Howes, 2000) and the development of a diagnostic framework and health check tool for engineering and technology projects (Philbin and Kennedy, 2014). Although it has also been reported that this sector faces a number of major challenges associated with managing projects as identified by Wilkinson (2001), where many of the fundamental problems associated with managing construction projects were found to be relationship-based. In this context, new processes can be deployed in order to improve the management of relationships on construction projects, e.g. through adopting a lean construction management (LCM) model via a number of visual tools in order to support the planning and control process in a systematic manner (Brady et al., 2018). Such developments in the construction sector do however rest on the ability to enhance the leadership competencies of project managers as part of wider soft skills (Zuo et al., 2018), so that they are able to adopt and integrate new working practices and ultimately ensure the successful delivery of engineering projects.

Traditional project management approaches support delivery of the project in accordance with schedule, budget, scope, and quality requirements (Kerzner, 2017). However as mentioned previously, many authors point to the continued difficulties that projects encounter and especially those that involve technological or engineering complexity (Philbin, 2008), for instance in the construction engineering (Flyvbjerg, 2007) and IS/IT (information science/information technology) sectors (Patanakul, 2014). Consequently, new methodologies have been proposed, such as the Shenhar and Dvir (2007) approach of viewing project success from a broader

perspective and the need to ensure project management arrangements are tailored to the specific project situation (i.e. related to the contingency theory) since not all projects are the same (Nicholas and Steyn, 2017). Moreover, project success consists of criteria or standards, which assess project results or outcomes (Creasy and Anantatmula, 2013) and include both short-term success (namely cost, schedule, scope and quality) and long-term success (such as customer satisfaction, team satisfaction, organizational success and preparing for future) (Ahmed and Azmi, 2016).

A further major trend has been the increasing adoption of agile project management practices (Highsmith, 2009), where a range of agile tools and techniques are applied to ensure project delivery. Although with this approach, there can be a need to change or even reduce the project specification in order for the project to remain on track according to the schedule and budgetary requirements. Nevertheless the agile movement continues to build momentum and the initial technology and industrial applications are now being extended into other sectors, such as managing projects in the higher education sector (Philbin, 2017). Although these approaches provide different perspectives on project management, the role of the project manager, and the leadership skills that are associated with the role remain central to the performance of any project (Müller & Turner, 2007b). Moreover, empirical studies can be pursued to achieve this goal but an important approach to properly probe and survey the current state of knowledge in a specific area is to adopt a systematic literature review.

The literature review is an important tool for research in order to manage the diversity of knowledge arising from an academic inquiry (Tranfield et al., 2003). In contrast, a Systematic Literature Review (SLR) differs from traditional literature reviews, since the method adopts a

scientific, transparent and repeatable process to mitigate bias and provide an audit trail for the conclusions of the study. According to Klassen et al. (1998, p. 700), a systematic literature review is "a review in which a comprehensive search for relevant studies on a specific topic, and those identified are then appraised and synthesized according to a pre-determined explicit method". Consequently, the SLR approach provides clarity, transparency, and impartiality as well as inclusive coverage in a particular area (Thorpe et al., 2005). SLRs are used for comprehensive, objective, and systematic reporting of previous research studies and are often contrasted with traditional literature reviews (Weed, 2005). Furthermore, Parris and Peachey (2013) have argued that there is a current knowledge gap in regard to how to conduct an effective systematic literature review, how to integrate the arising conclusions, and how to critically assess studies through synthesis of the findings. It is therefore critical when using the SLR approach to ensure a rigorous treatment of the literature results is achieved, thereby maintaining the empirical nature of the technique and also allowing synthesis of the findings to generate outputs and insightful findings that adequately further the scope of the literature in the area of interest.

In the field of the project manager's leadership competencies, systematic literature reviews are limited. Therefore, in this paper, we identified different criterion words from the literature that were searched through selecting appropriate databases on project manager's leadership competencies. The systematic literature review of project manager's leadership competencies reveals that two dominant review studies have been conducted during the last decade; firstly by Turner and Müller (2005) on the project manager's leadership style as a project success factor, and secondly by Nixon et al. (2012) on the significance of project manager's leadership performance towards project success or failure. Apart from these two review studies, there is presently a scarcity

of articles synthesizing research studies on project manager's leadership competencies and/or styles. Conversely and during the last decade systematic literature reviews were conducted by León and Farris (2011) and Hoppmann et al. (2011) that focused on the subject of lean product development. Systematic literature reviews are therefore a recognized methodology in order to investigate a field and allow scholars to survey the current and emerging trends in a given area.

Müller and Turner (2007b) previously conducted a study on 'matching the project manager's leadership style to project type' and used three types of leadership competencies (namely intellectual, managerial and emotional) to measure leadership style. Leadership competencies are a combination of knowledge, skills, and personality characteristics that leads to superior results (Crawford, 2007), while leadership style is a joint outcome of the leader's personal traits, self-related cognitive information, and the underlying motives to understand operation situation (Toor & Ofori, 2006). Nevertheless, Müller and Turner (2007b) used leadership competencies as the focus of their work but concluded that the project manager's leadership style influences project success, and different leadership styles may be appropriate for different types of projects. These assertions potentially create a misunderstanding in the literature regarding the apparent disparity between leadership competencies and leadership styles. In order to avoid this situation, both terms can be used interchangeably.

A literature review was conducted by Turner and Müller (2005) on whether the project manager's leadership style is a success factor for projects, and whether its impact can be different for different types of projects. They found that the literature on project success factors did not typically cite the project manager's leadership style or competencies as a critical success factor for projects.

Although the Turner and Müller (2005) study was comprehensive through focusing on the project manager's leadership styles, it was not however based on use of the systematic literature review methodology. Conversely, Hollenbeck et al. (2006) discussed models for leadership competencies, but were limited to theoretical assumptions since the objective of the study was neither to develop, test or validate any specific model for leadership competencies. The Nixon et al. (2012) study was limited to exploring how the performance of project manager's leadership determines the project outcomes. Thus, the SLR method has not been employed to conduct studies on project manager's leadership competencies, nor prioritize leadership competencies of a project manager. Therefore, the SLR study reported here was designed to fill these gaps and address the following research questions: a) Which leadership competencies of the project manager have been investigated and what is their frequency in literature? b) Do project manager's leadership competencies have any category or priority in the literature? c) Are there any limitations of research methods and sample size in published empirical studies? and d) What are the key implications for academicians and the practicing project manager based on these research studies?

The SLR study reported here significantly contributes to the existing body of knowledge on construction, engineering and project management as earlier review studies related to project manager's leadership were only focused on certain more narrow aspects. Namely, identifying leadership competencies including personality and leadership styles of the project manager as a success factor for projects; suggesting that different competency profiles are appropriate for different types of projects (Turner and Müller, 2005); and exploring how leadership performance in project management can determine project outcomes (Nixon et al., 2012). Although these review studies emphasized researchers' efforts to conceptualize and operationalize project

manager's leadership competencies, however, none of the review studies were based on the SLR methodology. Therefore, this study aims to bridge the gap through utilizing the SLR methodology to synthesize project manager's leadership competencies based on published empirical research studies. The focus of this research study was to evaluate only empirical research so as to provide a comprehensive perspective on project manager's leadership competencies, while ensuring the studies represent the latest developments and therefore provide a view on the 'state of the art' of the field.

The structure of this paper is as follows. Firstly, there is a summary of the origins of project manager's leadership competencies in order to generate the aforementioned research questions based on relevant theory. This is accompanied by further introductory material on project management challenges in the context of project manager's leadership competencies. Then, a summary of the systematic literature review method is provided, including details of the exclusion and inclusion criteria, databases searched, searched items, research design, sample size, and matrix method. Next, the article presents the analysis of research studies followed by discussion of findings of the systematic literature review on project manager's leadership competencies that is derived from 60 research studies. Thereafter, the article explains the methodological contribution of the systematic literature review method in the field of project management. Finally, the conclusions are presented, including implications, limitations, and suggestions for future research.

2. METHODS

2.1 Searched Keywords

The published articles investigating project manager's leadership, leadership competencies, leadership styles, or related areas were searched from different databases. Following the Padalkar and Gopinath (2016) approach, the focus of the searches was limited to titles and abstracts of articles published in the project management literature and this was done in order to ensure that the articles included an adequate level of detail on project management and associated leadership competencies. As suggested by de Araújo, Alencar, and de Miranda Mota (2017), an initial search was performed through various databases based on different keywords, including the following: "leadership competencies", "leadership styles", "project leadership", "project manager's leadership", "leadership competencies and styles", "project manager's leadership competency", "project manager's leadership style", and "leadership and project success". The numbers of publications per keywords in each bibliographic database are provided in Table 1.

Insert Table 1. Number of publications per keyword searched from bibliographic databases

2.2 Searched Databases

The search for published articles was conducted in a systematic manner following the order of listed databases and according to the aforementioned keywords and key phrases based on the methodologies of Busalim (2016) and de Araújo, Alencar, and de Miranda Mota (2017). The systematic literature review included searching in the following electronic databases: Cambridge Journals, EBSCOHOST, Emerald, IEEE, JSTOR, SAGE Journals, Science Direct, Scopus, Taylor and Francis, Web of Science, and Wiley Online. The published titles and abstract of articles were reviewed by the researchers for inclusion in this research study. Furthermore, all search results were limited to peer-reviewed journal articles published in English.

2.3 Research Design

Abstracts were retained for the following steps in the research study if they included the terms: a) project manager's leadership; b) leadership competencies, or project manager's leadership competencies; c) leadership styles or project manager's leadership styles; d) project leadership reference to project success, project performance, or organizational performance. This method ensured that the publications had the necessary coverage of project manager's leadership competencies. Abstracts satisfying these criteria were ranked as one (1), or two (2), according to the significance of the content and empirical results. Following the methods by Ali and Miller (2017) and Igarashi, de Boer, and Fet (2013), a number of steps followed and the appropriate ranking criteria that were used during the abstract and the article selection process, which are illustrated in Figure 1. Based on this initial review, articles with non-relevant results or those containing searched keywords only in the background or discussion were ranked at three (3) and subsequently excluded. The rank one (1) and two (2) abstracts were reviewed in detail and retained for complete review of the articles based on the presence of the key terms, i.e. project manager's leadership, leadership competencies, styles, or project leadership in all major sections of articles.

Insert Figure 1. Research design flow chart for systematic literature review (SLR)

2.4 Exclusion and Inclusion Criteria

We followed the Igarashi, de Boer, and Fet (2013) methodology to develop exclusion and inclusion criteria for selection of the articles. The initial search required that the articles included in the review were studies that must: i) be published in the English Language; ii) be published in peer

reviewed journal; iii) be related to the construction, engineering or project management area; and iv) include the specific searched keywords. The corresponding numbers of articles found using specific keywords in a given period of time from each database are summarized in Table 1. In the next step, the researcher scrutinized if there were any duplicate publications from the databases that were searched. Next, the researcher recorded the number of duplicates, and then deleted the duplicated journal articles from the last database searched in order to keep a record of total new articles found.

The second screening process was conducted to assess the eligibility against inclusion criteria, and then full text articles matching the inclusion criteria were retrieved from the corresponding databases. The inclusion criteria for the second screening required that: i) the published papers should be peer reviewed articles, ii) the papers should discuss project manager's leadership terms in the title or abstract, and iii) the papers examine project manager's leadership theory either qualitatively or quantitatively. Articles were excluded if any of these inclusion criteria were not found in the abstract, results, or discussion sections.

2.5 Sample Size

We adopted the procedure developed by Ali and Miller (2017) and the key terms outlined in the inclusion and exclusion criteria section were used to identify peer reviewed articles. The large number of papers identified using searched terms from different databases confirmed that there has been a surge of interest in this matter in the project management literature. A total of 1,780 articles were retrieved from searching the databases and 364 articles were selected based on title analysis following the methodology of Igarashi, de Boer, and Fet (2013). Then, we conducted

abstract analysis and removed 162 irrelevant articles. Further, 58 duplicates were deleted and there remained 144 articles matching the initial inclusion criteria. Afterwards, 26 articles were excluded based on inclusion and exclusion criteria, i.e. they did not match the aim of this study. A sample of 118 articles was obtained after screening in accordance with the stated inclusion and exclusion criteria. Then, 58 articles were excluded based on irrelevancy found during text analysis of complete articles, due to the area of focus not being on the subject of project manager's leadership competencies. As a result, a final sample of 60 articles was identified for the full review process in order to synthesize the research studies, which met the inclusion criteria for the systematic literature review on project manager's leadership competencies. Out of these 60 articles, we found 44 empirical studies and 16 theoretical studies during the complete review process, which were drawn from a variety of peer reviewed journals for detailed review. A summary of the publications from the systematic literature review is provided in Table 2.

Insert Table 2. Summary of the publications from the systematic literature review

3. ANALYSIS

The matrix method suggested by Garrard (2013) was employed as the strategy for organizing and abstracting pertinent information from the publications. Consequently, the following information was abstracted from each article: (a) the types of leadership competencies based on the findings of the research studies (b) the types of research methods and sample sizes used in the studies? (c) the main respondents and the origin of the research studies? and (d) the sample size of each empirical study. As a result, 60 research studies were identified and synthesized through use of the matrix method. A summary of the year of publication for these articles is shown in Figure 2.

Insert Figure 2. Summary of the year of publication for the articles from the SLR

Analysis of the literature review findings from a broader perspective reveals that project manager leadership competencies is an area of concern for project stakeholders regarding performance improvement. Similarly, there is a growing interest to identify the leadership competencies or styles that are more suited to a project manager and in certain situations, i.e. related to contingency theory. Indeed according to Hollenbeck et al. (2006), the current state of knowledge and theories may not be extensive enough to build a strong model for leadership competencies that can specify the most effective interactions between project stakeholders and the corresponding situations. The majority of research on the project manager's leadership competencies consists of developing and validating theoretical frameworks, and establishing measurement tools with the intention that future scholars can apply these tools to explore project manager's leadership competencies in practice. However, a limited amount of research has been undertaken in order to synthesize the literature on project manager's leadership competencies. Therefore, the present review was explicitly targeted to explore research studies on project manager's leadership competencies, as evidenced from Table 3.

Insert Table 3. Summary of the systematic literature review on project manager's leadership competencies.

Leadership competencies are gaining recognition both in academia and industry. In practice, leadership competencies or their combination vary from person-to-person and project-to-project,

and of course this is a feature of the working environment and the people involved. According to the research findings, the popularity of project manager's leadership competencies based on the systematic literature review method is illustrated in Figure 3. This analysis shows the resulting graph for project manager's leadership competencies through analysis of the 44 empirical studies. Each axis on the graph represents a specific leadership competency identified through synthesis of this SLR and the corresponding frequency from the literature. On the basis of this synthesis we classified leadership competencies in the following order (starting with the highest first and decreasing in order thereafter): communication (14), developing/growth (13), achieving (12), critical analysis (12), empowering (12), managing resources (12), strategic perspective (12), conscientiousness (11), engaging (11), influence (11), motivation (11), sensitivity (11), vision and imagination (11), emotional resilience (10), intuitiveness (10), self-awareness (10), attentiveness (5), managerial expertise (5), knowledge sharing (5), effectiveness (3), administrative expertise (3), teamwork (3), PM expertise (3), monitor (3), producer (3), cognitive ability (2), decision making (2), helping relationship (2), managing conflict (2), facilitator (2), innovator (2), integrator (2), task proficient (2), extraversion (1), openness (1), mentor (1), broker (1), coordinator (1), director (1), interpersonal skills (1), experience (1), communicating expectations (1), defining roles and responsibilities (1), establishing trust (1), and personal characteristics (1). For further details on the top-rated leadership competencies see Appendix A.

Insert Figure 3. Popularity of project manager's leadership competencies based on SLR

Since the focus of this research study was to gain an insight into the research studies that focus on the project manager's leadership competencies, we excluded those studies that did not meet this criterion. The approach adopted in this review entails extensive searches of relevant databases with

the intension of ensuring, as much as possible, that relevant literature on project manager's leadership competencies was identified. The findings of the systematic literature review allowed synthesis of the research methods used in 44 empirical studies, which are summarized and placed into a matrix, as given in Table 4.

Insert Table 4. Summary of research methods of systematic literature review studies.

This SLR research study consists of a synthesis of 60 research studies. In these articles, leadership competencies or styles (i.e. the terms) have often been used and sometimes both terms have been used interchangeably to measure these concepts. Most of the studies showed a significant association between leadership competencies (or styles) and project performance. A few studies demonstrated a significant relationship between leadership competencies and project success or project management success, which is shown from a synthesis of project manager's leadership competencies along with authors and years of publication, as presented in Table 3. Moreover, project manager's leadership competencies identified from evaluation of this SLR are placed in different clusters (see Figure 4).

Insert Figure 4. Clusters of project manager's leadership competencies.

From the 60 articles considered as part of the systematic literature review, 44 research studies included in this SLR used a variety of sample sizes ranging from less than 50 to above than 1,000. In regard to sample size of the reviewed articles, there were 14% studies with less than 50 respondents as sample, 32% having samples between 50 and 100, 23% studies with a sample of

more than 100 and less than 200, 20% studies with a sample between 300 and 500, 9% studies having a sample size between 500 and 1,000, and only 2% studies having greater than 1,000 sample size. For further explanation, graphical depiction of sample size used in these research studies is shown in Figure 5.

Insert Figure 5. Graphical depiction of sample size of SLR studies.

Most of the studies measured leadership competencies or styles by using validated or study-specific questionnaires, or structured interviews. Leadership competencies and styles were mostly measured by adopting a validated questionnaire such as a leadership dimension questionnaire (LDQ) and multifactor leadership questionnaire (MLQ), or alternatively with adapted/newly developed questionnaires or through conducting interviews. Project success was generally measured using a self-reported questionnaire including project success assessment questionnaire (PSAQ), which is a standard and well-accepted way of measuring this outcome. The investigative methods to find relationships used in these studies were varied in terms of the tests used and their complexity. The majority of studies used a statistical test, such as Spearman's correlation, simple regression, hierarchical regression, and structural equation models, while a few studies did not report any significant method for testing hypotheses on the directions or the nature of the relationship. A small number of research studies (<10%) conducted interviews to enable data analysis and none of the research studies reported adoption of the triangulation method.

The specific search items used to identify articles in this SLR emphasized that there has been a surge of interest in the area of project manager's leadership competencies. A total of 202 articles were selected based on review of their abstracts and titles containing the searched key items. The

review of the literature shows that a considerable amount of research has been conducted on project manager's leadership competencies or styles, but a limited number of review studies have been conducted during the last decade to synthesize research studies on project manager's leadership competencies. The review of 60 research studies revealed that: a) there is an ambiguity with respect to competencies and styles when both terms are interchangeably used to capture and define project manager's leadership, b) leadership competencies have not been categorized or prioritized, c) researchers used multiple but limited measurement tools and methods to examine the influence of project manager's leadership competencies, and d) there is no standard sample size for conducting both qualitative and quantitative studies to support a robust analysis via use of an appropriate software package, e.g. SPSS, AMOS, PLS, and NVIVO.

4. DISCUSSION OF THE FINDINGS

Earlier review studies conducted in the field of project management were limited to certain areas, for instance to project manager's leadership style as a critical success factor (Turner and Müller, 2005), performance of project manager's leadership (Nixon et al., 2012), discussion on leadership competencies model (Hollenbeck et al., 2006), lean product development (León and Farris, 2011), and lean product framework development (Hoppmann et al., 2011). This SLR study has explored the application of the systematic literature review method to the case of project manager's leadership competencies based on published empirical research studies. The possibilities of generalization of this study results may potentially be limited to the diversity in definitions, SLR, study designs, and measurement methods used for leadership competencies, styles, and project success, as well as the variability in the methods used to evaluate the association in terms of tests and complexity. We made significant effort to prioritize project manager's leadership

competencies, synthesized in this SLR, based on their frequency identified from the empirical research studies. We categorized and prioritized these leadership competencies into three categories as "high priority", "moderate priority", and "low priority', based on means of frequencies, as presented in Table 5.

Insert Table 5. Summary of categorization criteria and priority levels matrix.

This SLR reveals that a number of terms have been used widely in the literature in the context of project manager's leadership, which includes competencies, styles, profiles, dimensions, roles, and factors. These terms having different concepts and meanings but are being used simultaneously in the literature regarding project manager's leadership, and this adds a further complication and challenge in regard to interpreting the results from the SLR. In many cases the previous literature has disregarded the need to clearly differentiate between the leadership competencies and styles of a project manager as limited evidence has been found from the synthesized literature. In order to clarify these contentions, a study conducted by Ahmed and Azmi (2016) differentiated between leadership competencies and styles, and the study concluded that both leadership competencies and styles are different. Therefore, these terms need to be clearly understood and used by the researcher and project manager to avoid uncertainty arising when interpreting the literature and to support effective strategies for ensuring project outcomes are fully realized.

A number of studies included in the SLR reported that project manager's leadership competencies are often correlated with project success and different leadership competencies may be appropriate for different types of projects. Project success is measured through short-term and long-term

benefits, so project managers should devote increasing energies into rich communication both within the project and project environment (Andersen et al. 2006). Consequently, a relationship-oriented project manager should be well suited to deliver complex projects. Also, the rich and quality experience as well as positive attitude a project manager possesses can lead to higher chances of project success. The systematic literature review reported here fills the current knowledge gap, allows structured analysis and provides critical synthesis of findings that are relevant to project managers in the construction sector. In agreement with Parris and Peachey (2013), we not only ascertain the current state of the field in project manager's leadership competencies research and the synthesis of divergent studies in this systematic literature review but we have also advanced a rigorous methodology for conducting a systematic literature review.

5. CONCLUSIONS

Planning and organizing skills are significantly important for an engineering project manager to achieve the project objectives of delivery according to budget, schedule, scope, and quality requirements. This is especially the case for projects from the built environment and civil engineering sector. Synthesis of leadership competencies has revealed that communication and developing teams are the most critical for the project manager. These skills are important for a project manager to effectively and efficiently manage the engineering project team members and other key project stakeholders who have a vested interest in the outcomes of any engineering project. This SLR reveals that a project manager possessing certain leadership competencies does not necessarily guarantee the successful delivery of engineering projects. However, adoption of critical leadership competencies (such as communication, developing/growth, achieving, critical analysis, empowering, managing resources, organizational/strategic planning, etc.) by the project

manager should improve the probability of project success and help to mitigate project risks. Moreover, the success, or failure, of any project will be contingent on the specific project circumstances as well as less tangible aspects, such as the attitude adopted by the project manager, willingness to accept and respond to unforeseen changes as well as personal resilience. Nevertheless, our research has identified through empirical research the most popular leadership competencies for a project manager. These leadership competencies are particularly needed by project managers engaged on construction and engineering projects where project complexity is high and there are difficult issues and risks that arise. The need for enhanced leadership competencies in the construction sector is envisaged to continue and especially in the context of the adoption of new technologies associated with new adaptations of BIM and Industry 4.0; the subsequent technical complexity will require strong leadership competencies across engineering projects to ensure the benefits provided by such technologies can be realised.

This study has addressed the aforementioned research questions. Project manager's leadership competencies have been synthesized and their frequencies have been reported (research question a). Project manager's leadership competencies have been categorized (research question b). Limitations have been identified for the research methods and sample sizes from studies included in SLR (research question c). The key implications for academicians and the practicing project manager from the engineering and construction sector have been synthesized based on the research studies from the SLR (research question d).

This paper has directed efforts to build a chronology of project manager's leadership competencies by synthesizing extensive literature to contribute towards the associated body of knowledge and

to enhance our understanding for establishing linkages between project manager's leadership competencies and project outcomes. This work has been positioned in the context of engineering projects and the construction sector. This systematic literature review of the 60 research studies provides evidence regarding the influence of project manager's leadership competencies on engineering projects. The subsequent analysis of available data from the systematic literature review suggests that greater levels of leadership competencies are associated with improved project performance leading to project success. However, future directions suggested by such empirical studies have not yet been significantly addressed and therefore, further research in this area is needed. Although we conducted this SLR in a disciplined manner, there are potential limitations in terms of the measurement methods, study designs, and inconsistency in the results of SLR studies. This SLR has been limited to searching indexed journals available in the selected databases, which were peer-reviewed and the articles were written in English language. There may be research studies on project manager's leadership competencies published in other languages that would contradict or complement some of the conclusions drawn from this SLR.

This SLR was limited to the literature on project manager's leadership competencies published in peer-review journals. Future studies are suggested to consider conducting the SLR method on leadership competencies other than the projects field to highlight its significance. Also, most of the empirical studies used cross-sectional study design and the Likert scale for measurement, which limits the analysis of the association between leadership competencies, or styles, and project success. The analysis of sample size in this SLR studies reveals that two-thirds of empirical research studies (69%) conducted at a country/regional level were limited to a sample of less than 200 responses, therefore, we recommend a sample size between 200 and 300 in order to enhance

the credibility and validity of future research, ensure generalizability of results at country/regional level, and produce sophisticated results using variety of analysis software. Furthermore, we prioritized leadership competencies as 'high priority', 'moderate priority', and 'low priority' that might be useful in managing complex, large, and small projects, which should be considered by future research studies to further investigate and validate the effectiveness of these priorities on different types of projects.

The lack of ranking and prioritisation of leadership competencies that are easier or harder to develop in the architectural, construction engineering and project management environment is one of the limitations of this SLR, which is a recommended area for future research. Furthermore, as the aim of this study was to synthesize project manager's leadership competencies based on research studies including both empirical studies (44) and theoretical studies (16); however, separate SLRs of empirical and theoretical studies were not part of this study due to word count and other constraints. Thus, an autonomous SLR of both empirical and theoretical studies may be a further fruitful area for future research. Additionally, we suggest conducting interviews and focus group discussions with construction, engineering and project management practitioners to provide future research studies with more validity and reliability. Employing a systematic literature review combined with engineering practitioner face-to-face and group interviews (i.e. a mixed method) would allow triangulation to take place, thereby providing a robust research approach to be employed in future research studies.

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Appendix A: Further details on the top-rated leadership competencies

Communication:
Clearly communicate vision and instructions among project team members and establish formal communication channels among stakeholders.

Developing/ growth:
Develop competencies and invest efforts in coaching for growth of others to contribute effectively in projects.

Achieving:
Focus to achieve project objectives and take decisions based on core issues as well as mitigate significant risks.

Critical analysis and judgment:
Critically probe the project issues to identify advantages, disadvantages, and shortcomings as well as make sound judgments and decision based on realistic assumptions.

Empowering:
Encourage project team members and give autonomy to take challenging tasks as well as solve problems and produce innovative ideas.

Managing resources:
Transform project objectives and long-term goals into action plans through forward planning and organizing resources, and regular monitoring of team members' work through providing constructive and honest feedback.

Organizational/ Strategic perspective:
Consider and analyze project issues from a broader perspective, and identify opportunities and threats to balance short-term and long-terms implications of the project.

Conscientiousness:
Demonstrate commitment to pursue an ethical solution to a challenging issue and encourage the project team to support the chosen direction.

Engaging:
Engage team members to achieve project objectives through enthusiastic and lively interaction.

Influence:
Encourage project team members to provide their views based on logic and their position through recognizing the need to listen and giving a rational premise for change.

Motivation:
Motivate project team members through energy and drive to attain project objectives with the ability to face rejection or questioning.

Sensitivity/ Agreeableness:
Aware of needs and perceptions of project team to arrive at decisions and suggest balanced solutions to challenges and problems.

Vision and imagination:
Establish sound priorities for future work with a clear and innovative vision of the future direction of the organization to meet project and longer-term business objectives.

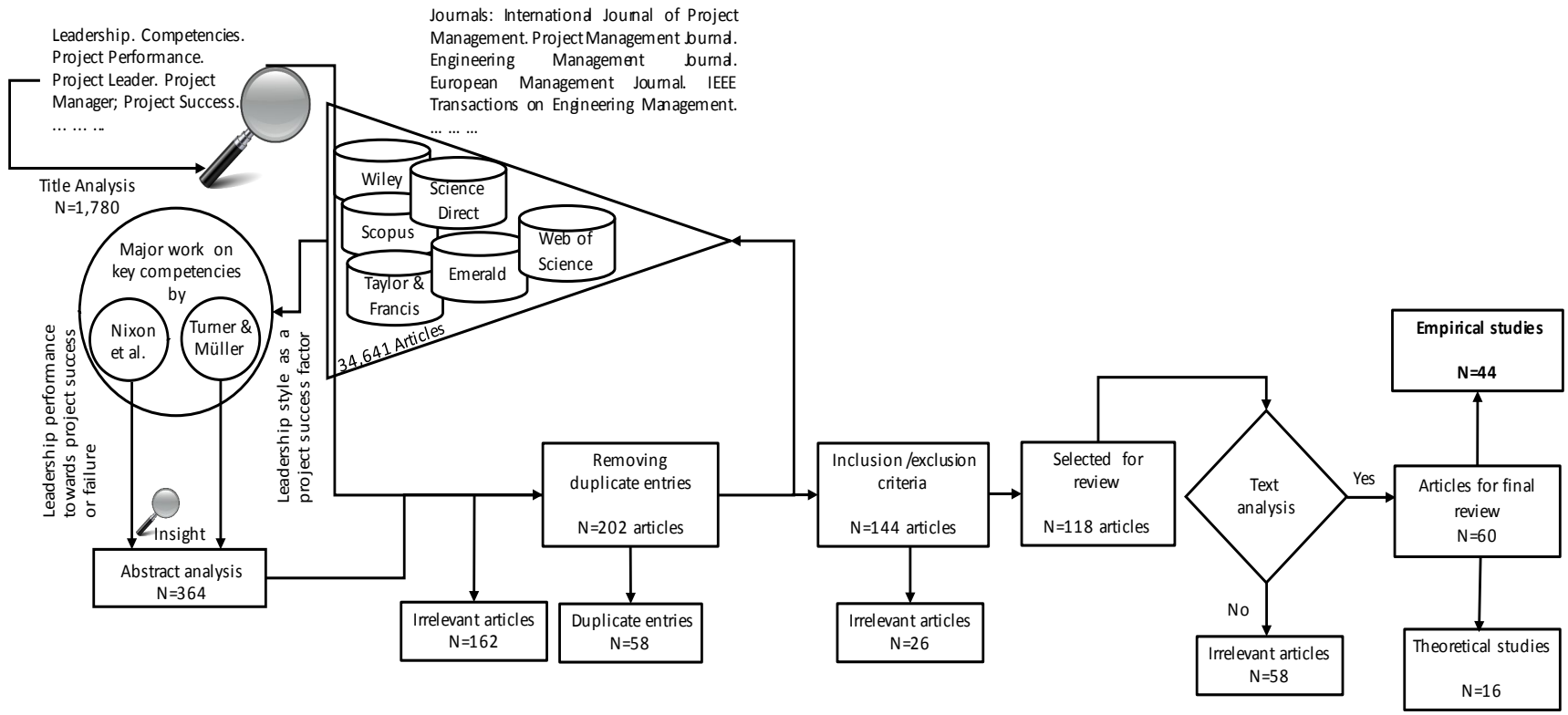

Figure 1. Research design flow chart for systematic literature review (SLR)

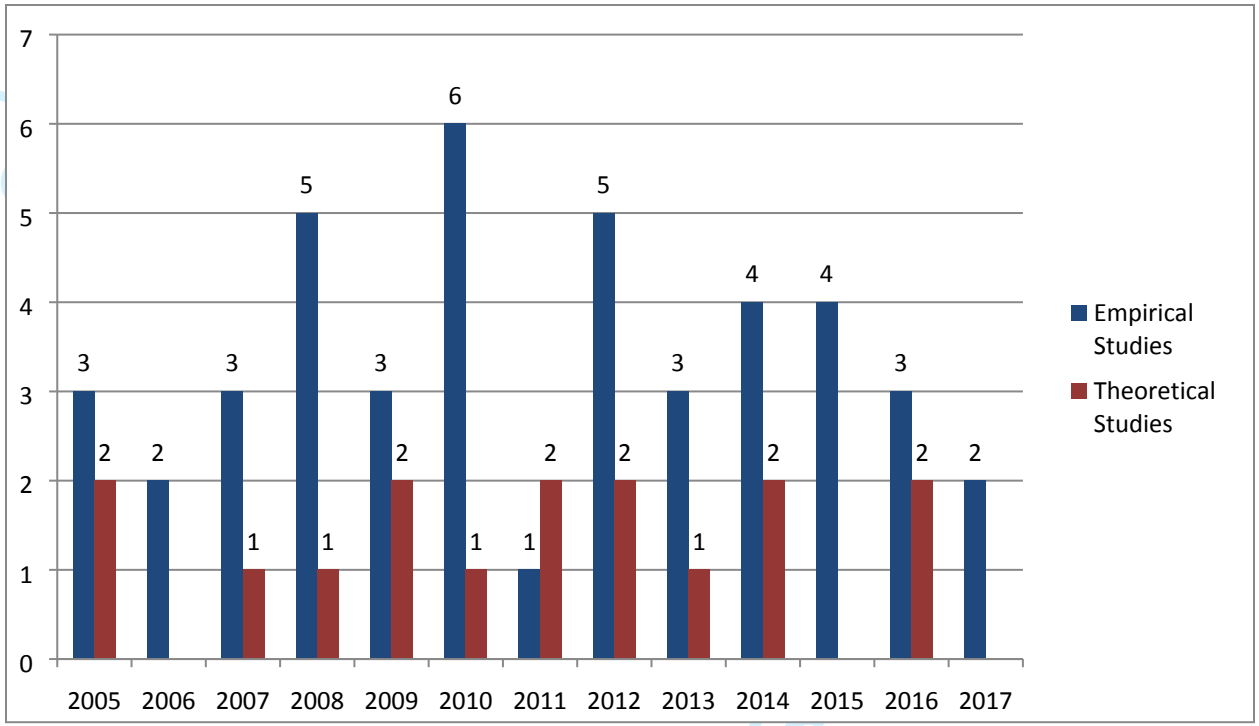

Figure 2. Summary of the year of publication for the articles from the SLR.

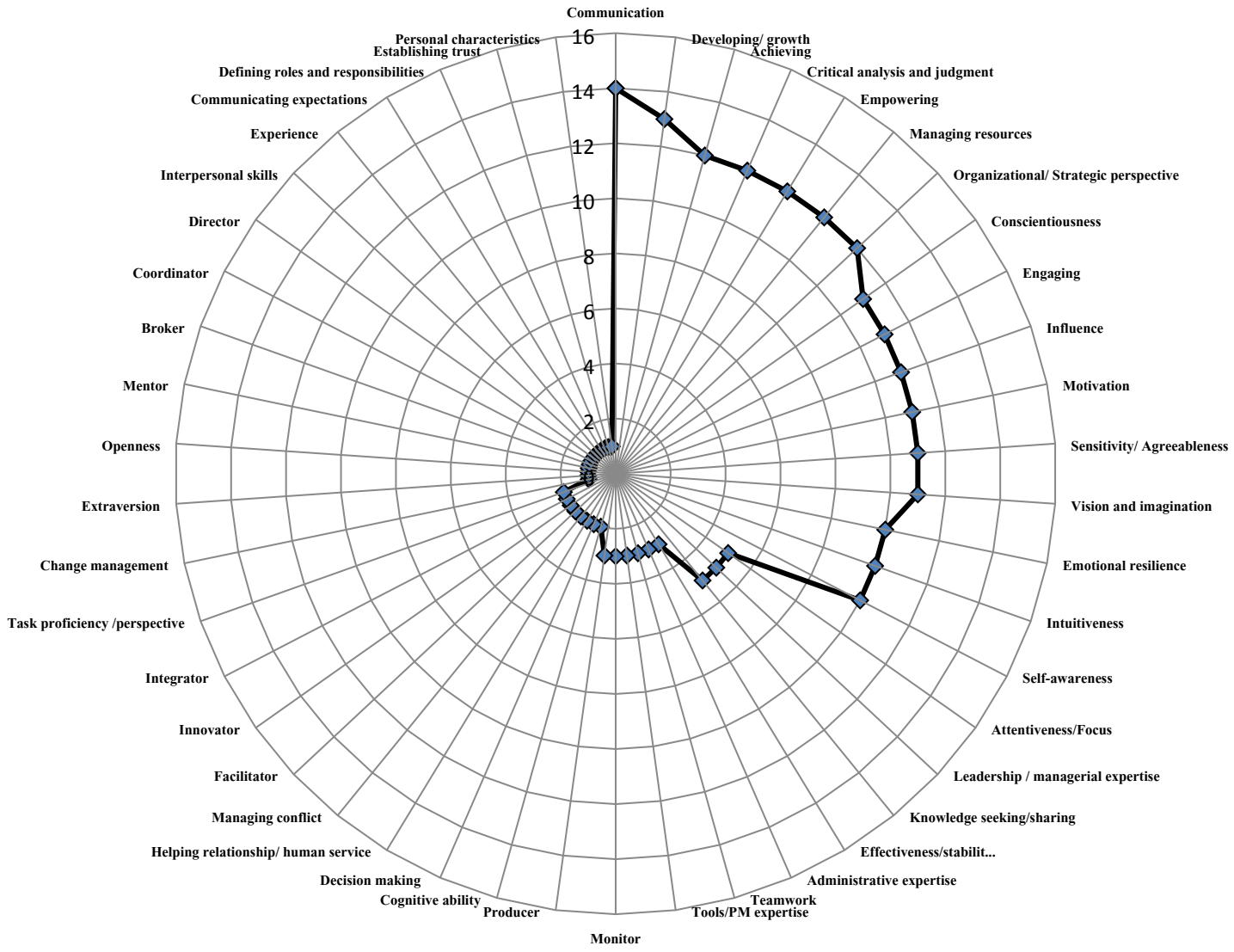

Figure 3. Popularity of project manager's leadership competencies based on SLR.

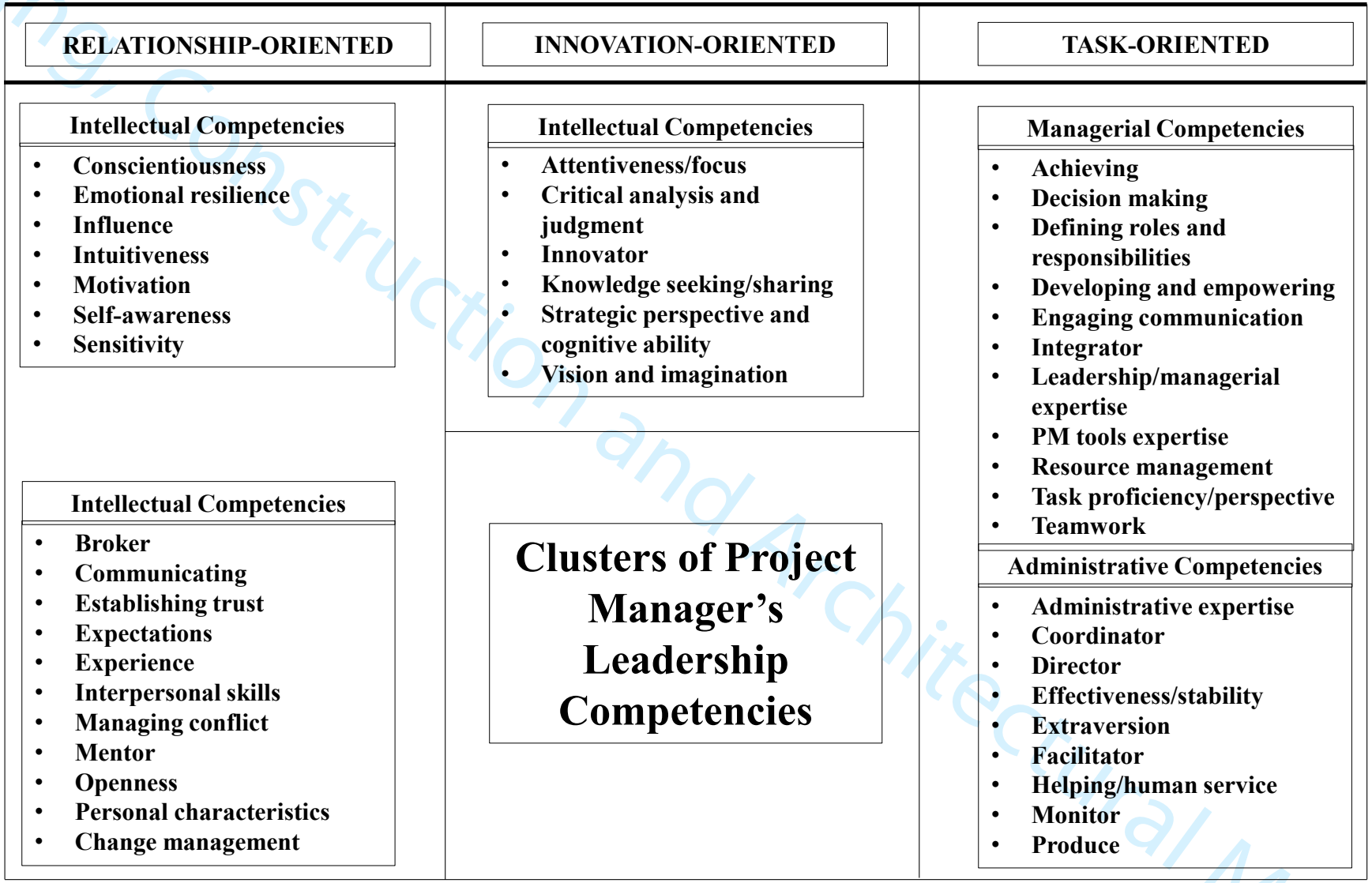

Figure 4. Clusters of project manager's leadership competencies.

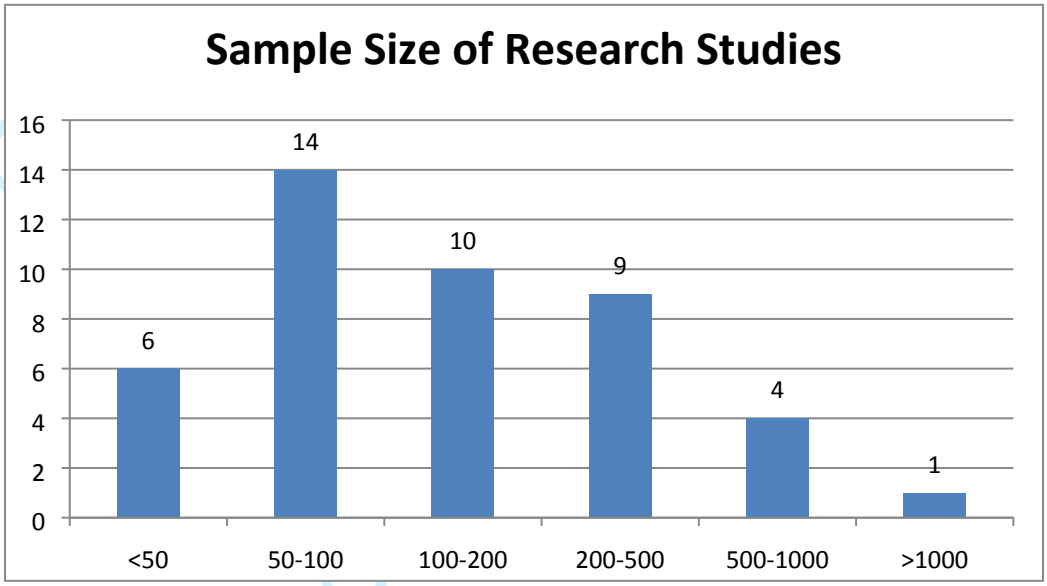

Figure 5. Graphical depiction of sample size of SLR studies.

Table 1. Number of publications per keyword searched from bibliographic databases

Databases / Keyword	Publications							
	Leadership competencies	**Leadership styles**	**Project leadership**	**Project manager leadership**	**Leadership competencies and styles**	**Project manager's leadership competency**	**Project manager's leadership style**	**Leadership and project success**
Cambridge Journals	31	24	100	23	1	1	3	9
EBSCOHOST	815	5,343	2,389	332	307	27	138	292
Emerald	152	191	302	14	5	2	1	491
IEEE	2,561	209	611	82	4	2	11	106
JSTOR	11	58	62	2	0	4	10	9
SAGE Journals	21	69	5	0	0	0	0	0
Science Direct	146	292	409	56	14	9	10	74
Scopus	1,503	2,588	4,751	527	89	39	60	773
Taylor and Francis	174	382	205	89	11	4	10	89
Web of Science	925	1,859	2,656	321	58	35	39	483
Wiley Online	207	324	437	60	16	5	5	77

Table 2. Summary of systematic literature review publications

Database/ Publisher	Journal	No of Articles	Literature Review
Science Direct	International Journal of Project Management	11	Ahadzie et al. (2014); Andersen (2016); Dolfi and Andrews (2007); Eweje, Turner, and Müller (2012); Kaulio (2008); Lloyd-Walker and Walker (2011); Loufrani-Fedida and Missonier (2016); Medina and Medina (2014); Müller and Turner (2007); Müller and Turner (2010); Qureshi, Warraich, and Hijazi (2009);
Wiley Online	Project Management Journal	8	Anantatmula and Thomas (2010); Clarke (2010); Geoghegan and Dulewicz (2008); Jugdev and Müller (2005); Prabhakar (2005); Shao, Müller, and Turner (2012); Turner and Müller (2005); Zhang and Cheng (2015)
Science Direct	Leadership Quarterly	2	Avolio, Reichard, Hannah, Walumbwa, and Chan (2009); Battilana, Gilmartin, Sengul, Pache, and Alexander (2010)
Taylor & Francis	Engineering Management Journal	2	Ahmed and Anantatmula (2017); Anantatmula (2010)
Scopus	International Journal of Managing Projects in Business	2	Christenson and Walker (2008); Ika and Saint-Macary (2012)
Science Direct	Procedia - Social and Behavioral Sciences	2	Nahod, Vukomanovi, and Radujkovi (2013); Obradovica, Jovanovicb, Petrovica, Mihica, and Mitrovica (2013)
ProQuest	African Journal of Business Management	2	Kuen, Zailani, and Fernando (2009); Shokrzadesh, Sabbaghian, Pardakhtchi, and Abolghasemi (2012)
Scopus	International Journal of Information Technology Project Management	1	Ahmed and Mohamad (2016)
Scopus	International Journal of Productivity and Performance Management	1	Nixon, Harrington, and Parker (2012)
Scopus	The Journal of Modern Project Management	1	Ahmed and Mohamad (2014)
Scoups	Baltic Journal of Management	1	Andersen, Birchall, Jessen, and Money (2006)
Scopus	European Management Journal	1	Müller and Turner (2007a)
IEEE	IEEE Transactions on Engineering Management	1	Muller, Geraldi, and Turner (2012)
ProQuest	Interdisciplinary Journal of Contemporary Research in Business	1	Shibru and Darshan (2011)
Scopus	International Journal of Operations and Production Management	1	Malach-pines and Dvir (2008)
Taylor & Francis	Journal of Construction Engineering and Management	1	Chan and Chan (2005)

Database/ Publisher	Journal	No of Articles	Literature Review
Scopus	Journal of Construction in Developing Countries	1	Limsila and Ogunlana (2008)
JSTOR	Journal of Economic Development, Management, IT, Finance & Marketing	1	Galvin, Gibbs, Sullivan, and Williams (2014)
Scopus	Journal of Managerial Psychology	1	Dulewicz and Higgs (2005)
ProQuest	Journal of Public Administration Research and Theory	1	Moynihan, Pandey, and Wright (2012)
Springer	KSCE Journal of Civil Engineering	1	Yang, Wu, and Huang (2013)
Scopus	Management Research News	1	Curran, Niedergassel, Picker, and Leker (2009)
JSTOR	World Journal of Social Sciences	1	Ying, Ken, and Ting (2012)
Science Direct	Journal of Engineering and Technology Management	1	Aronson et al. (2006)
ProQuest	Journal of Empirical Studies	1	Fung (2014)
Scopus	Journal of Management in Engineering	1	Larsson et al. (2015)
Science Direct	Procedia Computer Science	1	Montequin et al. (2015)
Scopus	Journal of Applied Environmental and Biological Sciences	1	Khanaposhtayi and Abyane (2015)
Science Direct	Journal of Cleaner Production	1	Tabassi et al. (2016)
Emerald	Journal of Enterprise Information Management	1	Tseng (2017)
JSTOR	Society and Economy	1	Blaskovics (2016)
EBSCOHOST	Asian Journal of Management Research	1	Bakar, Razak, Abdullah, and Awang (2009)
EBSCOHOST	Research Journal of Recent Sciences	1	Ahmed and Mohamad (2014)
Emerald	International Journal of Leadership in Public Services	1	Spencer (2007)
JSTOR	Journal of Management	1	Morgeson, DeRue, and Karam (2010)
ProQuest	International Journal of Business and Management	1	Prabhakar (2008)
Web of Science	International Journal of Management, Business and Administration	1	Lunenburg (2011)
Web of Science	International Journal of Scientific and Engineering Research	1	Ahmed et al. (2013)
	Total	**60**	

Table 3. Summary of literature review on project manager's leadership competencies

Project Manager's Leadership Competencies	Literature References
Communication	Dulewicz and Higgs (2005); Brill, Bishop, and Walker (2006); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Gilley, Gilley, McConnell, and Veliquette (2010); Müller and Turner (2010); Clarke (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Ahmed and Anantatmula (2017)
Developing/ growth	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); R. Müller and J. R. Turner (2010); Gilley, Gilley, McConnell, and Veliquette (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Larsson et al. (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016)
Achieving	Dulewicz and Higgs (2005); Müller and Turner (2007b); Limsila and Ogunlana (2008); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016)
Critical analysis and judgment	Dulewicz and Higgs (2005); Brill, Bishop, and Walker (2006); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016)
Empowering	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Gilley, Gilley, McConnell, and Veliquette (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016);
Managing resources	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Gentry and Sparks (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016)
Organizational/ Strategic perspective	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed

Project Manager's Leadership Competencies	Literature References
	and Mohamad (2016); Tabassi et al. (2016); Andersen (2016)
Conscientiousness	Dulewicz and Higgs (2005); Aronson et al. (2006); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016)
Engaging	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010);Müller and Turner (2010);Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016);
Influence	Dulewicz and Higgs (2005); Müller and Turner (2007b); Limsila and Ogunlana (2008); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016)
Motivation	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Gilley, Gilley, McConnell, and Veliquette (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016)
Sensitivity/ Agreeableness	Dulewicz and Higgs (2005); Aronson et al. (2006); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016)
Vision and imagination	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016); Tabassi et al. (2016)
Emotional resilience	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016);
Intuitiveness	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014);

Project Manager's Leadership Competencies	Literature References
	Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016)
Self-awareness	Dulewicz and Higgs (2005); Müller and Turner (2007b); Geoghegan and Dulewicz (2008); Müller and Turner (2010); Müller and Turner (2010); Müller, Geraldi, and Turner (2012); Galvin, Gibbs, Sullivan, and Williams (2014); Ahmed and bin Mohamad (2014); Khanaposhtayi and Abyane (2015); Ahmed and Mohamad (2016);
Attentiveness/Focus	Brill, Bishop, and Walker (2006); Clarke (2010); Montequin et al. (2015); Andersen (2016); Tseng (2017)
Leadership / managerial expertise	Brill, Bishop, and Walker (2006); Gilley, Gilley, McConnell, and Veliquette (2010); Andersen (2016); Ahmed and Anantatmula (2017); Tseng (2017)
Knowledge seeking/sharing	Brill, Bishop, and Walker (2006); Ahadzie et al. (2014); Montequin et al. (2015); Zhang and Cheng (2015); Tseng (2017)
Effectiveness/stability	Aronson et al. (2006); Limsila and Ogunlana (2008); Gentry and Sparks (2012)
Administrative expertise	Brill, Bishop, and Walker (2006); Larsson et al. (2015); Andersen (2016)
Teamwork	Gilley, Gilley, McConnell, and Veliquette (2010); Clarke (2010); Gentry and Sparks (2012);
Tools/PM expertise	Brill, Bishop, and Walker (2006); Blaskovics (2016); Ahmed and Anantatmula (2017)
Monitor	Fung (2014); Andersen (2016); Tseng (2017)
Producer	Fung (2014); Larsson et al. (2015); Andersen (2016)
Cognitive ability	Limsila and Ogunlana (2008); Ahadzie et al. (2014);
Decision making	Limsila and Ogunlana (2008); Montequin et al. (2015)
Helping relationship/ human service	Limsila and Ogunlana (2008); Montequin et al. (2015);
Managing conflict	Brill, Bishop, and Walker (2006); Clarke (2010)
Facilitator	Fung (2014); Zhang and Cheng (2015);
Innovator	Fung (2014); Zhang and Cheng (2015)
Integrator	Zhang and Cheng (2015); Larsson et al. (2015)
Task proficiency /perspective	Ahadzie et al. (2014); Andersen (2016)
Change management	Gentry and Sparks (2012)
Extraversion	Aronson et al. (2006)

Project Manager's Leadership Competencies	Literature References
Openness	Aronson et al. (2006)
Mentor	Fung (2014)
Broker	Fung (2014)
Coordinator	Fung (2014)
Director	Fung (2014)
Interpersonal skills	Ahadzie et al. (2014)
Experience	Ahadzie et al. (2014)
Communicating expectations	Ahmed and Anantatmula (2017)
Defining roles and responsibilities	Ahmed and Anantatmula (2017)
Establishing trust	Ahmed and Anantatmula (2017)
Personal characteristics	Blaskovics (2016)

Table 4. Summary of research methods of systematic literature review studies

Sr. No.	Author/ Year	Methods / Techniques	Measurement Scale	Country/ Region	Respondent	Sample Size
1.	Ahmed and Anantatmula (2017)	Survey questionnaire, correlation, regression, structural equation modeling	5-point Likert	Pakistan	Project managers of public sector projects from Pakistan.	289
2.	Tseng (2017)	Survey questionnaire, correlation, hierarchical regression	7-point Likert	Taiwan	Managers from large Taiwanese corporations.	125
3.	Andersen (2016)	Survey questionnaire, descriptive, factor analysis	7-point Likert	Norway	Project managers from government and private industry in Norway.	180
4.	Blaskovics (2016)	Semi-structure 3-step interviews	Interviews	Hungary	Project managers of Hungarian companies from the ICT sector.	25
5.	Tabassi et al. (2016)	Survey questionnaire, descriptive, factor analysis	5-point Likert	Malaysia	Project managers of sustainable building projects from three large cities in Malaysia.	70
6.	Khanaposhtayi and Abyane (2015)	Survey questionnaire, Fuzzy analytic analysis process	5-point Likert	Iran	Lecturers and project management experts.	15
7.	Larsson et al. (2015)	Survey questionnaire, descriptive, correlation, hierarchical regression	5-point Likert	Sweden	Project managers of largest public infrastructure clients in Sweden.	162
8.	Montequin et al. (2015)	Survey questionnaire, descriptive, frequency, correlation	5-point Likert	Australia, Europe, New Zealand, UK, USA	Project managers from different industries.	78
9.	Zhang and Cheng (2015)	Survey questionnaire, descriptive, correlation, regression	5-point Likert	China	Designers engaged in construction and engineering design projects in China.	178

Sr. No.	Author/ Year	Methods / Techniques	Measurement Scale	Country/ Region	Respondent	Sample Size
10.	Ahadzie et al. (2014)	Structured quantitative survey, descriptive, correlation, multiple regression	5-point Likert	Ghana	Project managers of real estate companies from Ghana.	61
11.	Fung (2014)	Survey questionnaire, descriptive, correlation, path analysis	7-point Likert	Malaysia	Project managers from the PMI Malaysia Chapter.	201
12.	Galvin et al. (2014)	Survey questionnaire, descriptive, correlation	5-point Likert	USA	Project managers from different industries in USA.	38
13.	Medina and Medina (2014)	Web quantitative survey, descriptive, correlation, regression	5-point Likert	Sweden	Project managers and project team members from industrial companies in Sweden.	63
14.	Nahod et al. (2013)	Survey questionnaire, descriptive, correlation	6-point Likert	Croatia	Project management professionals from the construction industry in Croatia.	472
15.	Obradovica et al. (2013)	Survey questionnaire, descriptive, correlation, regression	5-point Likert	Serbia	Project managers from top 10 companies in Serbia.	75
16.	Yang et al. (2013)	Survey questionnaire, factor analysis, structural equation modeling	5-point Likert	Taiwan	Project directors, project planners, and project superintendents from the construction industry in Taiwan.	213
17.	Eweje et al. (2012)	Survey questionnaire, Descriptive, correlation, regression	5-point Likert	Global survey	Project managers.	69
18.	Moynihan et al. (2012)	Survey , Descriptive, correlation, structural equation modeling	5-point Likert	USA	Senior managers.	1538

Sr. No.	Author/ Year	Methods / Techniques	Measurement Scale	Country/ Region	Respondent	Sample Size
19.	Müller et al. (2012)	Survey, descriptive, correlation, hierarchical regression	5-point Likert	Sweden and UK	Project managers from PMI and IPMA.	119
20.	Shao et al. (2012)	Survey, descriptive, correlation, regression	5-point Likert	Multiple organizations	Program managers from PM associations.	172
21.	Shokrzadesh et al. (2012)	Survey, descriptive, correlation, regression	6-point Likert	Iran	Atomic Energy Organization of Iran.	328
22.	Ying et al. (2012)	Survey, descriptive, correlation	5-point Likert	Malaysia	Lecturers in higher education in Malaysia.	93
23.	Shibru and Darshan (2011)	Survey, descriptive, correlation	5-point Likert	India	Workers at Ethiopian leather companies.	145
24.	Clarke (2010)	Survey, correlation, regression	5-point Likert	UK	Project managers from PMI Chapter in the UK.	67
25.	Anantatmula (2010)	Structured questionnaire & interviews Interpretive structural modeling	Inter-views	USA	Project managers, senior managers, consultants, and other managers.	69
26.	Anantatmula and Thomas (2010)	Survey questionnaire, interpretive structural modeling, descriptive, regression	5-point Likert	Global projects	Project managers having a project management qualification.	76
27.	Battilana et al. (2010)	Survey questionnaire, descriptive, correlation, regression	5-point Likert	UK	Middle and top-level managers.	89
28.	Müller and Turner (2010)	Survey questionnaire, descriptive, factor analysis, regression	5-point Likert	Australia, Europe, New Zealand & USA	Members of PMI, APMA, APM and ASAPM organizations.	400
29.	Curran et al. (2009)	Questionnaire, descriptive, regression	7-point Likert	Europe & USA	Lab manager to chief executive officer (CEO), from the chemical, pharmaceutical and biotechnology industries.	84

Sr. No.	Author/ Year	Methods / Techniques	Measurement Scale	Country/ Region	Respondent	Sample Size
30.	Kuen et al. (2009)	factor analysis, correlation, , hierarchal regression	5-point Likert	Malaysia	Managers from Manufacturing organizations.	79
31.	Qureshi et al. (2009)	Survey questionnaire, descriptive, correlation	5-point Likert	Pakistan	Managers from 28 different organizations.	50
32.	Christenson and Walker (2008)	Interviews, qualitative research design, case studies		Canada & Australia	Participants of workshops from public service organizations.	23
33.	Geoghegan and Dulewicz (2008)	Survey, descriptive, regression	5-point Likert	UK	Project managers and project sponsors.	52
34.	Kaulio (2008)	Questionnaire, frequency of occurrence, qualitative analysis		Sweden	Project managers.	48
35.	Limsila and Ogunlana (2008)	Survey Descriptive, correlation	5-point Likert	Thailand	Project managers and other workers.	156
36.	Malach-pines and Dvir (2008)	Questionnaire, descriptive, correlation	5-point Likert	Israel	Project managers who managed projects in Israel during 2002-2007.	289
37.	Dolfi and Andrews (2007)	Survey questionnaire, Descriptive, correlation	7-Point Likert	North America	Project managers.	858
38.	Müller and Turner (2007)	Survey questionnaire Descriptive, Correlation, ANOVA with post-hoc Scheffe test	5-point Likert	Australia, Europe, New Zealand, North America	Professionals and members of PMI, IPMA, AMP and personal contacts.	959
39.	Müller and Turner (2007)	Interviews, survey questionnaire descriptive, correlation, multivariate regression	5-point Likert	Project management associations (PMI, IPMA, APA and ASAPM)	Project workers from USA, Australia and Europe from different industries.	400
40.	Andersen et al. (2006)	Survey questionnaire KMO, PCA, correlation, regression	5-point Likert	UK, France, Norway, China	Project managers, sponsors, project champions, and clients.	529

Sr. No.	Author/ Year	Methods / Techniques	Measurement Scale	Country/ Region	Respondent	Sample Size
41.	Aronson et al. (2006)	Survey questionnaire descriptive, correlation, model fit indices	5-point Likert	USA	Product, senior engineering, technical and marketing managers	143
42.	Chan and Chan (2005)	Survey questionnaire descriptive, correlation, regression	5-point Likert	Australia, China, UK, Singapore	Architects, structural engineers, and surveyors	510
43.	Prabhakar (2005)	Survey questionnaire descriptive, correlation, regression	5-point Likert	29 Nations	Project managers from 28 countries.	153
44.	Dulewicz and Higgs (2005)	Survey questionnaire descriptive, correlation, regression	5-point Likert	UK, Europe	Managers and officers.	222

Table 5. Summary of categorization criteria and priority levels matrix

Criteria for Categorization of Priority Levels			
Round of Frequencies Mean	***1st round***	***2nd round***	***3rd round***
Priority Criteria	>Mean=High	>Mean=Moderate	=1 and <Mean= Low
Sample (N)	N=46	N=30	N=13
Mean (M)	M=5	M=2	M<2
Prioritized Competencies (n)	n=16	n=17	n=13

Priority Levels		***High Level***	***Moderate Level***	***Low Level***
High		▪ Achieving ▪ Communication	▪ Administrative expertise ▪ Attentiveness/Focus	▪ Broker ▪ Change management
>Mean=High	15	▪ Conscientiousness	▪ Cognitive ability	▪ Communicating expectations
	14	▪ Critical analysis and judgment	▪ Decision making	▪ Coordinator
	13	▪ Developing/ growth	▪ Effectiveness/stability	▪ Defining roles and responsibilities
	12	▪ Emotional resilience	▪ Facilitator	▪ Director
	11	▪ Empowering	▪ Helping/human service	▪ Establishing trust
	10	▪ Engaging	▪ Innovator	▪ Experience
	9	▪ Influence	▪ Integrator	▪ Extraversion
	8	▪ Intuitiveness	▪ Knowledge seeking/sharing	▪ Interpersonal skills
	7	▪ Managing resources	▪ Leadership/managerial expertise	▪ Mentor
	6	▪ Motivation	▪ Managing conflict	▪ Openness
>Mean=Moderate	5	▪ Organizational/Strategic perspective	▪ Monitor	▪ Personal characteristics
	4	▪ Self-awareness	▪ PM tools expertise	
	3	▪ Sensitivity/ Agreeableness	▪ Producer	
=1 and <Mean= Low	2	▪ Vision and imagination	▪ Task proficiency /perspective	
	1		▪ Teamwork	
Low				

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Paper Title: SYSTEMATIC LITERATURE REVIEW OF PROJECT MANAGER'S LEADERSHIP COMPETENCIES

Journal: Engineering, Construction and Architectural Management

Email from Editor on 23.04.2020

	Comments	Correction/ Revision
Editors Comments		
	The reviewer(s) have recommended publication, but also suggest some minor revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s)' comments and revise your manuscript.	We appreciate the editor and reviewers support and for providing constructive and encouraging feedback and suggestions to improve the manuscript. We have addressed all the comments and suggestions with track changes.
Referees comments		
Referee #1:		
Comments:	This is a nice work and I look forward to seeing the paper in the next format after review.	The authors would like to thank the reviewer for appreciating the research work recommending to the editor for seeing the paper in the next format after review.
1. Originality:	This is a well-crafted study to identify project managers' competencies. The paper provides a nice contribution to the management literature. However, this is a journal grounded in Engineering, Construction, and Architectural Management (ECAM) and the paper needs to address what the contributions to the ECAM community are.	Thanks for acknowledging a well-crafted study and its contribution to the management literature as well as highlighting the need to address its contribution to the ECAM community. The contribution of the study for the ECAM community has been included in the revised manuscript based on empirical studies synthesized in the SLR conducted in engineering, construction, and other projects environment. Moreover, several pertinent references from the *Engineering, Construction and Architectural Management* journal as part of the Introduction Section strengthen the positioning of the article to the engineering and construction sector. Various other links and insights are also provided to ensure the research study is highly relevant to the ECAM community.
2. Relationship to Literature:	Given that ECAM is a construction-related journal, it is not clear if this field was properly considered in the literature review. Is there anything to be said about project managers in CEM environments. - The paper is already very long but there is value in	The competencies of project managers identified in SLR are from engineering, construction and other projects. In the revised manuscript, the project managers' competencies focus in CEM environments have also been highlighted at relevant places.

	Comments	Correction/ Revision
	describing/explaining the top competencies identified in a table (for example those with 10+ entries within the 44 studies analyzed).	Yes, it is true that SLR is already long but it is also a good suggestion and there is value to describe/explain the top competencies (10+ entries). As suggested, we have described and explained the top competencies (10+ entries) and placed in the Appendix.
3. Methodology:	The method is well-grounded and explained throughout the paper. The figures and tables are very helpful to comprehend the process taken to analyzed the data and the results derived from that.	Thanks for appreciating the well-grounded/explained methods as well as figures and tables used to explain the analyzed data and results in the paper.
	- What part of the papers analyzed are part of the ECAM related literature? And what competencies did they highlight for ECAM practice?	More than 33 empirical studies (two-third) in SLR (out of 44) are from construction, engineering and project management journals, and more than 25 studies involved respondents working on civil work, construction, engineering or infrastructure projects which uses a mix of competencies and majority falls in high and moderate level competencies.
	- Why papers selected were "published over a 13-year period (2005 to 2017)" why that number of years?	The period 2005-2017 was mentioned due to limited evidence of empirical studies on leadership competencies of project managers in earlier literature, especially, in first literature review study conducted on project manager's leadership styles by Turner & Muller in 2005 and introducing competency school of leadership by Dulwicz & Higgs in 2003 and 2005, after that, a number of studies based on the competency school have explored the leadership competencies. Here, the review comment is valid because the period (13 years) is not adding much value as empirical studies on project manager's leadership competencies have been considered while conducting this SLR. Therefore, the statements regarding 13 years or 2005 to 2017 have been removed from the revised manuscript.
	- Are the clusters of competencies that could be indicated in the analysis? This could provide more power to the findings if these are clustered versus presented only in a piecemeal fashion.	This a good idea of clustering competencies to provide power to the findings. We have clustered these competencies in the revised manuscript.

	Comments	Correction/ Revision
	- Which criteria was used to categorize the competencies in high, moderate, or low priority?	The criteria used to categorize the competencies in high, moderate, or low priority was based on means of frequencies, which have been added in the competencies priority table of the revised manuscript.
4. Results:	The findings are properly analyzed according to the method presented. - How do the findings apply specifically to construction engineering and management? Construction is a peculiar type of project-based systems, so what competencies are needed in this specific environment?	The implications and findings with respect to construction, engineering, and management have been updated in the revised manuscript. Competencies needed in specific environment have been clustered and added in the manuscript.
5. Implications for research, practice and/or society:	Which of the competencies might be easier or harder to develop? The authors could speculate, based on the information they have from the study, about that. The study identified the most popular competencies, but are they the most effective? This could be a future research question.	We agree with the referee that the paper is already long. However, which competencies are easier or harder to develop, or most effective in which environment is one of the limitations of this SLR, and this is a recommendation for future research.
6. Quality of Communication:	The paper is very well written and the language used is appropriate to the discussion. The sections of the paper flow well and provide clarity to the method and results presented.	Thanks for appreciating that the paper is well written, and the language is appropriately used for discussion, the flow of paper's sections is well presented, and methods and results are presented with clarity.
Reviewer #2:		
Comments:	The study has the potential to establish a seminal approach for the review of literature in this and similar research areas.	Thanks for the encouraging and motivating comments on conduct of this SLR study.
1. Originality:	The rigour and scope of the methodology is commendable in what is often a rather poorly analysed area of qualitative study.	We thank the referee for commending the rigour and methodology used in this qualitative study.
2. Relationship to Literature:	The review is comprehensive in breath and scope albeit whilst specific criteria are not expanded on in detail, it is reasonable to deduce that a systematic review of the literature has been undertaken to underpin the thematic findings of the study.	We very much appreciate the comments on the comprehensiveness of review in breadth and scope and the findings of the study. It is agreed that we tried to explain specific criteria, keeping in view the significance and length of the paper.
3. Methodology:	See Section 1.	Once again thanks for appreciating and encouraging the authors on methods employed in the study. Yes, it

	Comments	Correction/ Revision
	The paper is in essence a methodological pilot bringing triangulation of mixed methods to bear on a largely subjective and disruptive area of research.	highlights the significance and use of triangulation methods based on findings of the SLR.
4. Results:	Whilst a set of findings are presented and prioritized they are merely reflective of the literature analysed across a period of time which has been subject to significant changes in project management styles and drivers. The strength of the study lies in the methodology and the alignment of diverse sets of results across 1,780 papers.	Yes, findings are based on analysis of SLR which are subject to significant changes in project management environment. To further strengthen the findings, the criteria for prioritizing and clustering of competencies have been included in revised manuscript considering the length of the paper.
5. Implications for research, practice and/or society:	The study presents a commendable exemplar of how to conduct a systematic literature review notably in a subjective and disruptive area of research.	Thanks for the commendable remarks on the conduct of systematic literature review in a subjective and disruptive area of research.
6. Quality of Communication:	Well-written and ably communicated.	Thanks for the acknowledgment of the quality of communication in the paper.

SYSTEMATIC LITERATURE REVIEW OF PROJECT MANAGER'S LEADERSHIP COMPETENCIES

ABSTRACT

Purpose:
Over the last few decades, a large number of research studies have been carried out on project manager's leadership competencies. However, systematic literature reviews are still ~~very~~ scarce in the project management literature. Therefore, the purpose of this article is to conduct a systematic literature review on project manager's leadership competencies based on published empirical research studies ~~published from 2005 to 2017~~.

Methodology:
We employed a systematic literature review (SLR) methodology to synthesize research in a rigorous manner and a total of 1,780 articles were identified in the first step and a final sample of 60 research studies were synthesized.

Findings:
Synthesis of the findings in this SLR on project manager's leadership competencies revealed: a) there is a lack of categorization or ranking of leadership competencies; b) 20 research studies (46%) were conducted with sample sizes of less than 100; c) only a few research studies (<10%) used interview~~s~~ data for analysis; and d) none of the research studies reported adoption of a triangulation method.

Implications/Limitations:
This study prioritized project manager's leadership competencies as 'high priority', 'moderate priority', and 'low priority'. We recommend~~ed~~ a sample size between 200 and 300 to produce sophisticated results and enhance the credibility, ~~generalizeability~~generalizability and validity of future research.

Originality:
Future research studies are suggested to consider systematic literature review combined with face-to-face and group interview in addition to employing triangulation methods. Besides highlighting implications for practitioners, this SLR has advanced the understanding of how to conduct systematic literature reviews in a robust manner.

Keywords: Systematic literature review, project manager, leadership, leadership competencies.

SYSTEMATIC LITERATURE REVIEW OF PROJECT MANAGER'S LEADERSHIP COMPETENCIES

1. INTRODUCTION

Competence is an area of work, competency is the ~~behavior~~behaviour supporting an area of work, and competencies are the attributes underpinning a ~~behavior~~behaviour (Moore, Cheng, and Dainty, 2002). The topic of project manager's leadership competencies has been cited as a critical success factor for determining either the success or failure of a project, which is an area of much debate in the literature (Nixon et al., 2012). Indeed, leadership competencies have been defined as "a cluster of related knowledge, attitudes, skills, and other personal characteristics that affect a major part of one's job, correlates with performance on the job, can be measured against well-accepted standards, can be improved via training and development, and can be broken down into dimensions of competencies" (Limsila and Ogunlana, 2008). On this matter, Woodruffe (1991) articulated that competence is an ability to perform a task successfully. According to Crawford (2007), the competencies of project management personnel and project success can be closely related to each other. According to the dictionary definition, the word competency and competence are readily interchangeable (Moore et al., 2002). However, the influence of a project manager's leadership competencies in achieving project success appears to have been ignored in most of the project management studies (Turner and Muller, 2005).

Project management is a key skill-set related to the area of engineering, construction and architectural management (Ahuja et al., 1994), since clearly built environment and civil engineering work is designed and delivered according to specified and agreed projects. Researchers have explored this area from a theoretical perspective, for instance, investigating the relationship between construction project management theory and transaction cost economics

(Walker and Kwong Wing, 1999). Other researchers have assessed how to improve the performance of the earned value analysis technique as a construction project management tool (Howes, 2000) and the development of a diagnostic framework and health check tool for engineering and technology projects (Philbin and Kennedy, 2014). Although it has also been reported that this sector faces a number of major challenges associated with managing projects as identified by Wilkinson (2001), where many of the fundamental problems associated with managing construction projects were found to be relationship-based. In this context, new processes can be deployed in order to improve the management of relationships on construction projects, e.g. through adopting a lean construction management (LCM) model via a number of visual tools in order to support the planning and control process in a systematic manner (Brady et al., 2018). Such developments in the construction sector do however rest on the ability to enhance the leadership competencies of project managers as part of wider soft skills (Zuo et al., 2018), so that they are able to adopt and integrate new working practices and ultimately ensure the successful delivery of engineering projects.

~~During the last few decades, a significant amount of research has been conducted in the field of project management but there remain a number of major challenges associated with managing projects.~~ Traditional project management approaches support delivery of the project in accordance with schedule, budget, scope, and quality requirements (Kerzner, 2017). However as mentioned previously, many authors point to the continued difficulties that projects encounter and especially those that involve technological or engineering complexity (Philbin, 2008), for instance in the construction engineering (Flyvbjerg, 2007) and IS/IT (information science/information technology) sectors (Patanakul, 2014) ~~and construction engineering sectors (Flyvbjerg, 2007)~~.

Consequently, new methodologies have been proposed, such as the Shenhar and Dvir (2007) approach of viewing project success from a broader perspective and the need to ensure project management arrangements are tailored to the specific project situation (i.e. related to the contingency theory) since not all projects are the same (Nicholas ~~&~~ and Steyn, 2017). ~~Indeed~~ Moreover, project success consists of criteria or standards, which assess project results or outcomes (Creasy and Anantatmula, 2013) and include both short-term success (namely cost, schedule, scope and quality) and long-term success (such as customer satisfaction, team satisfaction, organizational success and preparing for future) (Ahmed and Azmi, 2016).

A further major trend has been the increasing adoption of agile project management practices (Highsmith, 2009), where a range of agile tools and techniques are applied to ensure project delivery. Although with this approach, there can be a need to change or even reduce the project specification in order for the project to remain on track according to the schedule and budgetary requirements. Nevertheless the agile movement continues to build momentum and the initial technology and industrial applications are now being extended into other sectors, such as managing projects in the higher education sector (Philbin, 2017). Although these approaches provide different perspectives on project management, the role of the project manager, and the leadership skills that are associated with the role remain central to the performance of any project (Müller & Turner, 2007b). Moreover, empirical studies can be pursued to achieve this goal but an important approach to properly probe and survey the current state of knowledge in a specific area is to adopt a systematic literature review.

The literature review is an important tool for research in order to manage the diversity of knowledge arising from an academic inquiry (Tranfield et al., 2003). In contrast, a Systematic Literature Review (SLR) differs from traditional literature reviews, since the method adopts a scientific, transparent and repeatable process to mitigate bias and provide an audit trail for the conclusions of the study. According to Klassen et al. (1998, p. 700), a systematic literature review is "a review in which a comprehensive search for relevant studies on a specific topic, and those identified are then appraised and synthesized according to a pre-determined explicit method". Consequently, the SLR approach provides clarity, transparency, and impartiality as well as inclusive coverage in a particular area (Thorpe et al., 2005). SLRs are used for comprehensive, objective, and systematic reporting of previous research studies and are often contrasted with traditional literature reviews (Weed, 2005). Furthermore, Parris and Peachey (2013) have argued that there is a current knowledge gap in regard to how to conduct an effective systematic literature review, how to integrate the arising conclusions, and how to critically assess studies through synthesis of the findings. It is therefore critical when using the SLR approach to ensure a rigorous treatment of the literature results is achieved, thereby maintaining the empirical nature of the technique and also allowing synthesis of the findings to generate outputs and insightful findings that adequately further the scope of the literature in the area of interest.

In the field of the project manager's leadership competencies, systematic literature reviews are limited. Therefore, in this paper, we identified different criterion words from the literature that were searched through selecting appropriate databases on project manager's leadership competencies. The systematic literature review of project manager's leadership competencies reveals that two dominant review studies have been conducted during the last decade; firstly by

Turner and Müller (2005) on the project manager's leadership style as a project success factor, and secondly by Nixon et al. (2012) on the significance of project manager's leadership performance towards project success or failure. Apart from these two review studies, there is presently a scarcity of articles synthesizing research studies on project manager's leadership competencies and/or styles. Conversely and during the last decade systematic literature reviews were conducted by León and Farris (2011) and Hoppmann et al. (2011) that focused on the subject of lean product development. Systematic literature reviews are therefore a recognized methodology in order to investigate a field and allow scholars to survey the current and emerging trends in a given area.

Müller and Turner (2007b) previously conducted a study on 'matching the project manager's leadership style to project type' and used three types of leadership competencies (namely intellectual, managerial and, emotional) to measure leadership style. Leadership competencies are a combination of knowledge, skills, and personality characteristics that leads to superior results (Crawford, 2007), while leadership style is a joint outcome of the leader's personal traits, self-related cognitive information, and the underlying motives to understand operation situation (Toor & Ofori, 2006). Nevertheless, Müller and Turner (2007b) used leadership competencies as the focus of their work but concluded that the project manager's leadership style influences project success, and different leadership styles may be appropriate for different types of projects. These assertions potentially create a misunderstanding in the literature regarding the apparent disparity between leadership competencies and leadership styles. In order to avoid this situation, both terms can be used interchangeably.

A literature review was conducted by Turner and Müller (2005) on whether the project manager's leadership style is a success factor for projects, and whether its impact can be different for different types of projects. They found that the literature on project success factors did not typically cite the project manager's leadership style or competencies as a critical success factor for projects. Although the Turner and Müller (2005) study was comprehensive through focusing on the project manager's leadership styles, it was not however based on use of the systematic literature review methodology. Conversely, Hollenbeck et al. (2006) discussed models for leadership competencies, but were limited to theoretical assumptions since the objective of the study was neither to develop, test or validate any specific model for leadership competencies. The Nixon et al. (2012) study was limited to exploring how the performance of project manager's leadership determines the project outcomes. Thus, the SLR method has not been employed to conduct studies on project manager's leadership competencies, nor prioritize leadership competencies of a project manager. Therefore, the SLR study reported here was designed to fill these gaps and address the following research questions: a) Which leadership competencies of the project manager have been investigated and what is their frequency in literature? b) Do project manager's leadership competencies have any category or priority in the literature? c) Are there any limitations of research methods and sample size ~~based on~~in published empirical studies ~~published from 2005 to 2017~~? and d) What are the key implications for academicians and the practicing project manager based on these research studies?

The SLR study reported here significantly contributes to the existing body of knowledge on construction, engineering and project management as earlier review studies related to project manager's leadership ~~and~~ were only focused on certain more narrow aspects. Namely, identifying leadership competencies including personality and leadership styles of the project manager as a

success factor for projects; suggesting that different competency profiles are appropriate for different types of projects (Turner and Müller, 2005); and exploring how leadership performance in project management can determine project outcomes (Nixon et al., 2012). Although these review studies emphasized researchers' efforts to conceptualize and operationalize project manager's leadership competencies, however, none of the review studies were based on the SLR methodology. Therefore, this study aims to bridge the gap through utilizing the SLR methodology to synthesize project manager's leadership competencies based on published empirical research studies ~~published over a period of 13 years (2005 to 2017)~~. ~~This~~ The focus of this research study was to evaluate only empirical research ~~time period was selected~~ so as to provide a comprehensive perspective on project manager's leadership competencies~~the research studies undertaken~~, while ensuring the studies represent the latest developments and therefore provide a view on the 'state of the art' of the field.

The structure of this paper is as follows. Firstly, there is a summary of the origins of project manager's leadership competencies in order to generate the aforementioned research questions based on relevant theory. This is accompanied by further introductory material on project management challenges in the context of project manager's leadership competencies. Then, a summary of the systematic literature review method is provided, including details of the exclusion and inclusion criteria, databases searched, searched items, research design, sample size, and matrix method. Next, the article presents the analysis of research studies followed by discussion of findings of the systematic literature review on project manager's leadership competencies that is derived from 60 research studies. Thereafter, the article explains the methodological contribution

of the systematic literature review method in the field of project management. Finally, the conclusions are presented, including implications, limitations, and suggestions for future research.

2. METHODS

2.1 Searched Keywords

The published articles investigating project manager's leadership, leadership competencies, leadership styles, or related areas ~~during a thirteen-year period (from 2005 to 2017)~~ were searched from different databases. Following the Padalkar and Gopinath (2016) approach, the focus of the searches was limited to titles and abstracts of articles published in the project management literature and this was done in order to ensure that the articles included an adequate level of detail on project management and associated leadership competencies. As suggested by de Araújo, Alencar, and de Miranda Mota (2017), an initial search was performed through various databases based on different keywords, including the following: "leadership competencies", "leadership styles", "project leadership", "project manager's leadership", "leadership competencies and styles", "project manager's leadership competency", "project manager's leadership style", and "leadership and project success". The numbers of publications per keywords in each bibliographic database are provided in Table 1.

Insert Table 1. Number of publications per keyword searched from bibliographic databases

2.2 Searched Databases

The search for published articles ~~from 2005 to 2017 (i.e. over a 13-year period)~~ was conducted in a systematic manner following the order of listed databases and according to the aforementioned

keywords and key phrases based on the methodologies of Busalim (2016) and de Araújo, Alencar, and de Miranda Mota (2017). The systematic literature review included searching in the following electronic databases: Cambridge Journals, EBSCOHOST, Emerald, IEEE, JSTOR, SAGE Journals, Science Direct, Scopus, Taylor and Francis, Web of Science, and Wiley Online. The published titles and abstract of articles were reviewed by the researchers for inclusion in this research study. Furthermore, all search results were limited to peer-reviewed journal articles published in English.

2.3 Research Design

Abstracts were retained for the following steps in the research study if they included the terms: a) project manager's leadership; b) leadership competencies, or project manager's leadership competencies; c) leadership styles or project manager's leadership styles; d) project leadership reference to project success, project performance, or organizational performance. This method ensured that the publications had the necessary coverage of project manager's leadership competencies. Abstracts satisfying these criteria were ranked as one (1), or two (2), according to the significance of the content and empirical results. Following the methods by Ali and Miller (2017) and Igarashi, de Boer, and Fet (2013), a number of steps followed and the appropriate ranking criteria that were used during the abstract and the article selection process, which are illustrated in Figure 1. Based on this initial review, articles with non-relevant results or those containing searched keywords only in the background or discussion were ranked at three (3) and subsequently excluded. The rank one (1) and two (2) abstracts were reviewed in detail and retained for complete review of the articles based on the presence of the key terms, i.e. project manager's leadership, leadership competencies, styles, or project leadership in all major sections of articles.

Insert Figure 1. Research design flow chart for systematic literature review (SLR)

2.4 Exclusion and Inclusion Criteria

We followed the Igarashi, de Boer, and Fet (2013) methodology to develop exclusion and inclusion criteria for selection of the articles. The initial search required that the articles included in the review were studies that must: i) be published in the English Language; ii) be published in peer reviewed journal; iii) be related to the construction, engineering or project management areapublished over a 13-year period (2005 to 2017); and iv) include the specific searched keywords. The corresponding numbers of articles found using specific keywords in a given period of time from each database are summarized in Table 1. In the next step, the researcher scrutinized if there were any duplicate publications from the databases that were searched. Next, the researcher recorded the number of duplicates, and then deleted the duplicated journal articles from the last database searched in order to keep a record of total new articles found.

The second screening process was conducted to assess the eligibility against inclusion criteria, and then full text articles matching the inclusion criteria were retrieved from the corresponding databases. The inclusion criteria for the second screening required that: i) the published papers should be peer reviewed articles, ii) the papers should discuss project manager's leadership terms in the title or abstract, and iii) the papers examine project manager's leadership theory either qualitatively or quantitatively. Articles were excluded if any of these inclusion criteria were not found in the abstract, results, or discussion sections.

2.5 Sample Size

We adopted the procedure developed by Ali and Miller (2017) and the key terms outlined in the inclusion and exclusion criteria section were used to identify peer reviewed articles. The large number of papers identified using searched terms from different databases confirmed that there has been a surge of interest in this matter in the project management literature. A total of 1,780 articles were retrieved from searching the databases and 364 articles were selected based on title analysis following the methodology of Igarashi, de Boer, and Fet (2013). Then, we conducted abstract analysis and removed 162 irrelevant articles. Further, 58 duplicates were deleted and there remained 144 articles matching the initial inclusion criteria. Afterwards, 26 articles were excluded based on inclusion and exclusion criteria, i.e. they did not match the aim of this study. A sample of 118 articles was obtained after screening in accordance with the stated inclusion and exclusion criteria. Then, 58 articles were excluded based on irrelevancy found during text analysis of complete articles, due to the area of focus not being on the subject of project manager's leadership competencies. As a result, a final sample of 60 articles was identified for the full review process in order to synthesize the research studies, which met the inclusion criteria for the systematic literature review on project manager's leadership competencies. Out of these 60 articles, we found 44 empirical studies and 16 theoretical studies during the complete review process, which were drawn from a variety of peer reviewed journals for detailed review. A summary of the publications from the systematic literature review is provided in Table 2.

Insert Table 2. Summary of the publications from the systematic literature review

3. ANALYSIS

The matrix method suggested by Garrard (2013) was employed as the strategy for organizing and abstracting pertinent information from the publications. Consequently, the following information was abstracted from each article: (a) the types of leadership competencies based on the findings of the research studies (b) the types of research methods and sample sizes used in the studies? (c) the main respondents and the origin of the research studies? and (d) the sample size of each empirical study. As a result, 60 research studies were identified and synthesized through use of the matrix method~~, which have been published during the 13-year period (from 2005 to 2017)~~. A summary of the year of publication for these articles is shown in Figure 2.

Insert Figure 2. Summary of the year of publication for the articles from the SLR

Analysis of the literature review findings from a broader perspective reveals that project manager leadership competencies is an area of concern for project stakeholders regarding performance improvement. Similarly, there is a growing interest to identify the leadership competencies or styles that are more suited to a project manager and in certain situations, i.e. related to contingency theory. Indeed according to Hollenbeck et al. (2006), the current state of knowledge and theories may not be extensive enough to build a strong model for leadership competencies that can specify the most effective interactions between project stakeholders and the corresponding situations. The majority of research on the project manager's leadership competencies consists of developing and validating theoretical frameworks, and establishing measurement tools with the intention that future scholars can apply these tools to explore project manager's leadership competencies in practice. However, a limited amount of research has been undertaken in order to synthesize the literature on project manager's leadership competencies. Therefore, the present review was

explicitly targeted to explore research studies on project manager's leadership competencies, as evidenced from Table 3.

Insert Table 3. Summary of the systematic literature review on project manager's leadership competencies.

Leadership competencies are gaining recognition both in academia and industry. In practice, leadership competencies or their combination vary from person-to-person and project-to-project, and of course this is a feature of the working environment and the people involved. According to the research findings, the popularity of project manager's leadership competencies based on the systematic literature review method is illustrated in Figure 3. This analysis shows the resulting graph for project manager's leadership competencies through analysis of the 44 empirical studies. Each axis on the graph represents a specific leadership competency identified through synthesis of this SLR and the corresponding frequency from the literature. On the basis of this synthesis we classified leadership competencies in the following order (starting with the highest first and decreasing in order thereafter): communication (14), developing/growth (13), achieving (12), critical analysis (12), empowering (12), managing resources (12), strategic perspective (12), conscientiousness (11), engaging (11), influence (11), motivation (11), sensitivity (11), vision and imagination (11), emotional resilience (10), intuitiveness (10), self-awareness (10), attentiveness (5), managerial expertise (5), knowledge sharing (5), effectiveness (3), administrative expertise (3), teamwork (3), PM expertise (3), monitor (3), producer (3), cognitive ability (2), decision making (2), helping relationship (2), managing conflict (2), facilitator (2), innovator (2), integrator (2), task proficient (2), extraversion (1), openness (1), mentor (1), broker (1), coordinator (1),

director (1), interpersonal skills (1), experience (1), communicating expectations (1), defining roles and responsibilities (1), establishing trust (1), and personal characteristics (1). For further details on the top rated leadership competencies see Appendix A.

Insert Figure 3. Popularity of project manager's leadership competencies based on SLR

Since the focus of this research study was to gain an insight into the research studies that focus on the project manager's leadership competencies, we excluded those studies that did not meet ~~this criteria~~this criterion. The approach adopted in this review entails extensive searches of relevant databases with the intension of ensuring, as much as possible, that relevant literature on project manager's leadership competencies was identified. The findings of the systematic literature review allowed synthesis of the research methods used in 44 empirical studies, which are summarized and placed into a matrix, as given in Table 4.

Insert Table 4. Summary of research methods of systematic literature review studies.

This SLR research study consists of a synthesis of 60 research studies. In these articles, leadership competencies or styles (i.e. the terms) have often been used and sometimes both terms have been used interchangeably to measure these concepts. Most of the studies showed a significant association between leadership competencies (or styles) and project performance. A few studies demonstrated a significant relationship between leadership competencies and project success or project management success, which is shown from a synthesis of project manager's leadership

competencies along with authors and years of publication, as presented in Table 3. Moreover, project manager's leadership competencies identified from ~~review~~evaluation of this SLR are placed in different clusters (see Figure 4).

Insert Figure 4. Clusters of ~~P~~project ~~M~~manager's ~~L~~leadership ~~C~~competencies.

From the 60 articles considered as part of the systematic literature review, 44 research studies included in this SLR used a variety of sample sizes ranging from less than 50 to above than 1,000. In regard to sample size of the reviewed articles, there were 14% studies with less than 50 respondents as sample, 32% having samples between 50 and 100, 23% studies with a sample of more than 100 and less than 200, 20% studies with a sample between 300 and 500, 9% studies having a sample size between 500 and 1,000, and only 2% studies having greater than 1,000 sample size. For further explanation, graphical depiction of sample size used in these research studies is shown in Figure 45.

Insert Figure 45. Graphical depiction of sample size of SLR studies.

Most of the studies measured leadership competencies or styles by using validated or study-specific questionnaires, or structured interviews. Leadership competencies and styles were mostly measured by adopting a validated questionnaire such as a leadership dimension questionnaire (LDQ) and multifactor leadership questionnaire (MLQ), or alternatively with adapted/newly developed questionnaires or through conducting interviews. Project success was generally measured using a self-reported questionnaire including project success assessment questionnaire (PSAQ), which is a standard and well-accepted way of measuring this outcome. The investigative

methods to find relationships used in these studies were varied in terms of the tests used and their complexity. The majority of studies used a statistical test, such as Spearman's correlation, simple regression, hierarchical regression, and structural equation models, while a few studies did not report any significant method for testing hypotheses on the directions or the nature of the relationship. A small number of research studies (<10%) conducted interviews to enable data analysis and none of the research studies reported adoption of the triangulation method.

The specific search items used to identify articles in this SLR emphasized that there has been a surge of interest in the area of project manager's leadership competencies. A total of 202 articles were selected based on review of their abstracts and titles containing the searched key items. The review of the literature shows that a considerable amount of research has been conducted on project manager's leadership competencies or styles, but a limited number of review studies have been conducted during the last decade to synthesize research studies on project manager's leadership competencies. The review of 60 research studies revealed that: a) there is an ambiguity with respect to competencies and styles when both terms are interchangeably used to capture and define project manager's leadership, b) leadership competencies have not been categorized or prioritized, c) researchers used multiple but limited measurement tools and methods to examine the influence of project manager's leadership competencies, and d) there is no standard sample size for conducting both qualitative and quantitative studies to support a robust analysis via use of an appropriate software package, e.g. SPSS, AMOS, PLS, and NVIVO.

4. DISCUSSION OF THE FINDINGS

Earlier review studies conducted in the field of project management were limited to certain areas, for instance to project manager's leadership style as a critical success factor (Turner and Müller, 2005), performance of project manager's leadership (Nixon et al., 2012), discussion on leadership competencies model (Hollenbeck et al., 2006), lean product development (León and Farris, 2011), and lean product framework development (Hoppmann et al., 2011). This SLR study has explored the application of the systematic literature review method to the case of project manager's leadership competencies based on published empirical research studies ~~published over a period of 13 years (from 2005 to 2017)~~. The possibilities of generalization of this study results may potentially be limited to the diversity in definitions, SLR, study designs, and measurement methods used for leadership competencies, styles, and project success, as well as the variability in the methods used to evaluate the association in terms of tests and complexity. We made significant effort to prioritize project manager's leadership competencies, synthesized in this SLR, based on their ~~popularity~~ frequency ~~in~~ identified from the empirical research studies. We categorized and prioritized these leadership competencies into three categories as "high priority", "moderate priority", and "low priority', based on means of frequencies, as presented in Table 5.

Insert Table 5. Summary of categorization criteria and priority levels matrix.

This SLR reveals that a number of terms have been used widely in the literature in the context of project manager's leadership, which includes competencies, styles, profiles, dimensions, roles, and factors. These terms having different concepts and meanings but are being used simultaneously in the literature regarding project manager's leadership, and this adds a further complication and challenge in regard to interpreting the results from the SLR. In many cases the previous literature

has disregarded the need to clearly differentiate between the leadership competencies and styles of a project manager as limited evidence has been found from the synthesized literature. ~~To~~ In order to clarify these contentions, a study conducted by Ahmed and Azmi (2016) differentiated between leadership competencies and styles, and the study concluded that both leadership competencies and styles are different. Therefore, these terms need to be clearly understood and used by the researcher and project manager to avoid uncertainty arising when interpreting the literature and to support effective strategies for ensuring project outcomes are fully realized.

A number of studies included in the SLR reported that project manager's leadership competencies are often correlated with project success and different leadership competencies may be appropriate for different types of projects. Project success is measured through short-term and long-term benefits, so project managers should devote increasing energies into rich communication both within the project and project environment (Andersen et al. 2006). Consequently, a relationship-oriented project manager should be well suited to deliver complex projects. Also, the rich and quality experience as well as positive attitude a project manager possesses~~, there are~~ can lead to higher chances of project success. The systematic literature review reported here fills the current knowledge gap, allows structured analysis and provides critical synthesis of findings that are relevant to project managers in the construction sector. In agreement with Parris and Peachey (2013), we not only ascertain the current state of the field in project manager's leadership competencies research and the synthesis of divergent studies in this systematic literature review but we have also advanced a rigorous methodology for conducting a systematic literature review.

5. CONCLUSIONS

Planning and organizing skills are significantly important for an engineering project manager to achieve the project objectives of delivery according to budget, schedule, scope, and quality requirements. This is especially the case for projects from the built environment and civil engineering sector. Synthesis of leadership competencies has revealed that communication and developing teams are the most critical for the project manager. These skills are important for a project manager to effectively and efficiently manage the engineering project team members and other key project stakeholders who have a vested interest in the outcomes of any engineering project. This SLR reveals that a project manager possessing certain leadership competencies does not necessarily guarantee the successful delivery of engineering projects. However, adoption of critical leadership competencies (such as communication, developing/growth, achieving, critical analysis, empowering, managing resources, organizational/strategic planning, etc.) by the project manager should improve the probability of project success and help to mitigate project risks. Moreover, the success, or failure, of any project will be contingent on the specific project circumstances as well as less tangible aspects, such as the attitude adopted by the project manager, willingness to accept and respond to unforeseen changes as well as personal resilience. Nevertheless, our research has identified through empirical research the most popular leadership competencies for a project manager. These leadership competencies are particularly needed ~~to~~by project managers ~~managing~~engaged on construction and engineering projects where project complexity is high and there are difficult issues and risks that arise. The need for enhanced leadership competencies in the construction sector is envisaged to continue and especially in the context of the adoption of new technologies associated with new adaptations of BIM and Industry 4.0; the subsequent technical complexity will require strong leadership competencies across engineering projects to ensure the benefits provided by such technologies can be realised.

This study has addressed the aforementioned research questions ~~identified earlier~~. Project manager's leadership competencies have been synthesized and their frequencies have been reported (research question a). Project manager's leadership competencies have been categorized (research question b). Limitations have been identified for the research methods and sample sizes from studies ~~published from 2005 to 2017~~included in SLR (research question c). The key implications for academicians and the practicing project manager from the engineering and construction sector have been synthesized based on the research studies from the SLR (research question d).

This paper has directed efforts to build a chronology of project manager's leadership competencies by synthesizing extensive literature to contribute towards the associated body of knowledge and to enhance our understanding for establishing linkages between project manager's leadership competencies and project outcomes. This work has been positioned in the context of engineering projects and the construction sector. This systematic literature review of the 60 research studies provides evidence regarding the influence of project manager's leadership competencies on engineering projects. The subsequent analysis of available data from the systematic literature review suggests that greater levels of leadership competencies are associated with improved project performance leading to project success. However, future directions suggested by such empirical studies have not yet been significantly addressed and therefore, further research in this area is needed. Although we conducted this SLR in a disciplined manner, there are potential limitations in terms of the measurement methods, study designs, and inconsistency in the results of SLR studies. This SLR has been limited to searching indexed journals available in the selected

databases, which were peer-reviewed and the articles were written in English language. There may be research studies on project manager's leadership competencies published in other languages that would contradict or complement some of the conclusions drawn from this SLR.

This SLR was limited to the literature on project manager's leadership competencies published in peer-review journals ~~over a 13 year period (from 2005 to 2017)~~. Future studies are suggested to consider conducting the SLR method on leadership competencies other than the projects ~~management field~~ field to highlight its significance. Also, most of the empirical studies used cross-sectional study design and the Likert scale for measurement, which limits the analysis of the association between leadership competencies, or styles, and project success. The analysis of sample size in this SLR studies reveals that two-thirds of empirical research studies (69%) conducted at a country/regional level were limited to a sample of less than 200 responses, therefore, we recommend a sample size between 200 and 300 in order to enhance the credibility and validity of future research, ensure ~~generalizeability~~generalizability of results at country/regional level, and produce sophisticated results using variety of analysis software. Furthermore, we prioritized leadership competencies as 'high priority', 'moderate priority', and 'low priority' that might be useful in managing complex, large, and small projects, which should be considered by future research studies to further investigate and validate the effectiveness of these priorities on different types of projects.

~~Identification~~The lack of ranking and prioritisation of leadership competencies ~~which are easier or harder to develop, or~~that are easier or harder to develop ~~most effective~~ in the architectural, construction~~,~~ engineering and project management environment is one of the limitations of this

SLR, which is a recommended area for future research. ~~As~~ Furthermore, as the aim of this study was to synthesize project manager's leadership competencies based on research studies including both empirical studies (44) and theoretical studies (16); however, separate SLRs of empirical and theoretical studies were not part of this study due to word count and other constraints. Thus, an autonomous SLR of both empirical and theoretical studies may be a further fruitful area for future research. Additionally, we suggest conducting interviews and focus group discussions with construction, engineering and project management practitioners to provide ~~any~~ future research studies with more validity and reliability. Employing a systematic literature review combined with engineering practitioner face-to-face and group interviews (i.e. a mixed method) would allow ~~for~~ triangulation to take place, ~~which would be a~~thereby providing a ~~powerful~~ robust research approach ~~for~~ to be employed in future research studies ~~to employ~~.

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Appendix A: Further details on the top-rated leadership competencies

Communication:
Clearly communicate vision and instructions among project team members and establish formal communication channels among stakeholders.

Developing/ growth:
Develop competencies and invest efforts in coaching for growth of others to contribute effectively in projects.

Achieving:
Focus to achieve project objectives and take decisions based on core issues as well as mitigate significant risks.

Critical analysis and judgment:
Critically probe the project issues to identify advantages, disadvantages, and shortcomings as well as make sound judgments and decision based on realistic assumptions.

Empowering:
Encourage project team members and give autonomy to take challenging tasks as well as solve problems and produce innovative ideas.

Managing resources:
Transform project objectives and long-term goals into action plans through forward planning and organizing resources, and regular monitoring of team members' work through providing constructive and honest feedback.

Organizational/ Strategic perspective:
Consider and analyze project issues from a broader perspective, and identify opportunities and threats to balance short-term and long-terms implications of the project.

Conscientiousness:
Demonstrate commitment to pursue an ethical solution to a challenging issue and encourage the project team to support the chosen direction.

Engaging:
Engage team members to achieve project objectives through enthusiastic and lively interaction.

Influence:
Encourage project team members to provide their views based on logic and their position through recognizing the need to listen and giving a rational premise for change.

Motivation:
Motivate project team members through energy and drive to attain project objectives with the ability to face rejection or questioning.

Sensitivity/ Agreeableness:
Aware of needs and perceptions of project team to arrive at decisions and suggest balanced solutions to challenges and problems.

Vision and imagination:
Establish sound priorities for future work with a clear and innovative vision of the future direction of the organization to meet project and longer-term business objectives.