



Project management competency framework

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PROJECT MANAGEMENT COMPETENCY FRAMEWORK

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Abstract

Research on the role and profile of project managers has been a growing concern in the field with researchers and professional associations developing a fragmented body of knowledge regarding project management competency. In order to address this issue, this article systematically reviews the literature regarding project management competency. This review found that a project managers' competency profile is composed of 81 competencies divided across 11 dimensions: influencing, communication, emotional, contextual, management, cognitive skills, professionalism, knowledge and experience, project management knowledge, and personal skills and attributes. Based on the competencies identified, we developed a project management competency assessment instrument that can be used by practitioners and academics.

Keywords:

Project management; project manager; competency; profile; framework.

1. Introduction

In recent years, there has been a growing concern regarding the human factor contributions to project management. For instance, the annual publication about project managers' (PM) competencies almost doubled from 138 articles in 2014 to 256 articles in 2018. During the same period, professional associations such as the Association for Project Management (APM) and the Project Management Institute (PMI) both published frameworks describing PM core competencies (1,2).

On the practitioners' side, PMI's framework assesses project manager's abilities in terms of knowledge, performance, and personal competencies regarding their best practices guides (1). Similarly, the APM framework assesses the project manager against 32 competencies, most of which focused on technical aspects. On the academics side, researchers have used instruments such as the Leadership Dimensions Questionnaire (LDQ), the McBer Competency Framework, the Mayer-Salovey-Caruso Emotional Intelligence Test, the General Mental Ability (GMA), the Inwald Personality Inventory (IPI), the Multifactor Leadership Questionnaire (MLQ), and the Myers-Briggs Type Indicator (MBTI) to assess PM competencies (3-11).

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However, while the efforts of professional associations and researchers have helped to uncover many different perspectives about project management competencies, this naturally led to the creation of an extensive but also fragmented body of knowledge regarding the topic. Therefore, there is a gap regarding a complete competency framework that describes project managers in all their complexity, going beyond technical competencies. Thus, the objective of this article is two-fold. First, we focused on identifying and grouping all project management competencies to create a complete framework. Second, based on the competencies identified, we developed a project management competency assessment instrument.

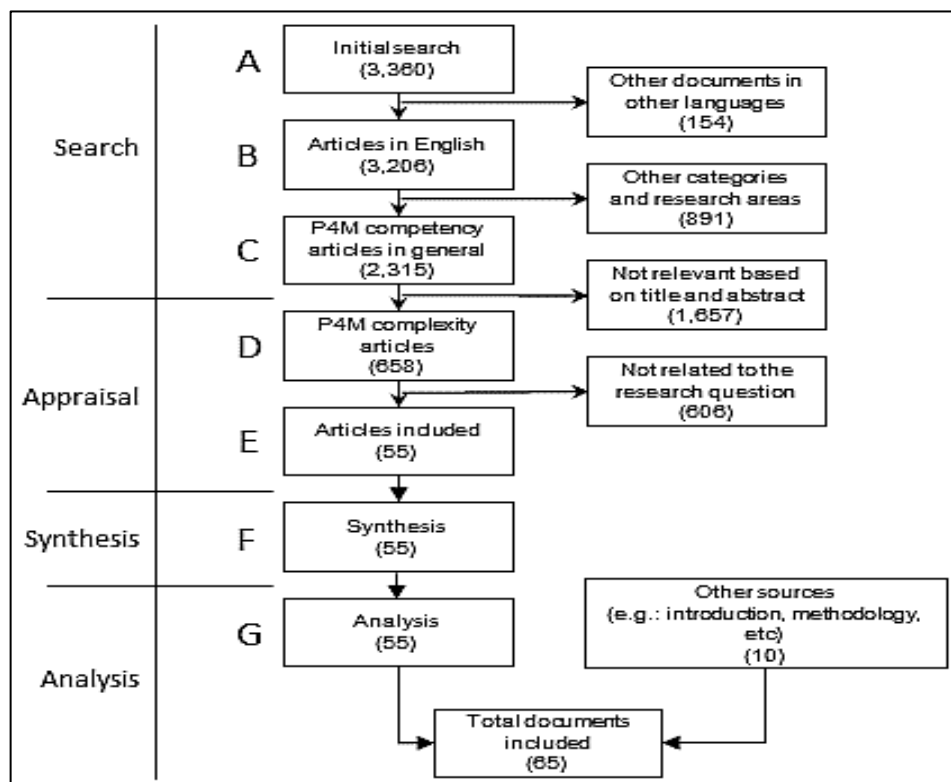


Figure 1: systematic review process

2. Methods

The method chosen to conduct the systematic review was the Search, Appraisal, Synthesis and Analysis (SALSA) framework (12). For this, a step by step process was designed (Figure 1). The first two stages of the SALSA framework, search and appraisal, were divided into steps A to C and

D to E, respectively. The remaining stages, synthesis and analysis, were composed of stages F and G, respectively.

In order to minimize the risk of missing relevant sources (12), the search stage was conducted using the broadest terms possible related to project, program, portfolio, and PMO (project management office) competency. The Web of Science Core Collection was the main database used. The keywords used to search titles, abstracts, and keywords were ["project manage*" OR "program* manage*" OR "portfolio manage*" OR "PMO" OR "project management office*"] AND [competence* OR skill* OR ability* OR knowledge*]. The Science Citation Index Expanded (SCI-EXPANDED), the Social Sciences Citation Index (SSCI), and the Emerging Sources Citation Index (ESCI) were the indexes used. Conference proceedings, book citations, and other sources were excluded from the search to avoid grey literature and to allow us to focus on peer-reviewed documents (Step A). The search results were further refined to include articles in English (Step B). A final filter was applied to exclude research areas and Web of Science categories related to biology, medicine, and health sciences, among others, focusing on research areas such as business, management, and engineering (Step C).

After step C, a total of 658 articles related to project, program, portfolio, and PMO competency were identified. Given the diversity and number identified during the appraisal stage, title, abstract, and full text were analyzed to select articles specifically related to the research topic. The combination of several search query possibilities, especially common keywords such as knowledge, ability, skill, and competency, led to results addressing different research areas. Articles were excluded from the results (Step D) based on their title and abstract when featuring the same words, but with different meaning. Any unrelated articles were excluded (Step E), resulting in a final datasheet with 55 articles.

During the synthesis stage (Step F), the articles were coded (13) to develop a line of argument using the thematic and narrative synthesis approaches, since this study combined documents with different objectives and methods to develop a robust literature review.

Finally, the analysis stage (Step G) was conducted to verify the consistency of the synthesis stage and ensure that the findings were sufficiently robust. Articles were organized according to the number of codes and data saturation was found after eight articles and no new competencies were found after that, showing that the sample was enough and robust.

3. Project management competency framework (PMCF)

Research on project management competency was explored from different perspectives, leading to discussions focused on specific topics such as leadership, emotional intelligence, general and project management competencies, among few others. The focus of specific topics created a fragmented view, therefore, Figure 2 illustrates the PMCF based on all competencies discussed by

authors over the years. Moreover, it highlights the project management core competencies (inner bar) according to the number of times researchers found them to be more significant than other competencies. Given that authors organized project management competencies in different ways, competencies are presented in eleven main groups created according to competencies' affinities.



Figure 2: Project management competency framework

Project managers have a profile that focuses more on social competencies (right side), rather than individual competencies (left side). For instance, 38 social competencies accounted for an average

of 28.64% mentions in the examined literature. On the other hand, the 43 individual competencies accounted for an average of 23.69% mentioned in the literature. In the following sections, each group is discussed.

3.1. Influencing skills

The influencing skills group represents six competencies that have the ability to produce effects on the actions, behaviors, and opinions of others. Among these competencies are leadership (63.46% - 33 sources), conflict management (42.31% - 22 sources), influence/persuasion (38.46% - 20 sources), motivating others (36.54% - 19 sources), negotiation (34.62% - 18 sources), and charisma (9.62% - sources). Despite their differences, some competencies are correlated and are often described as one. For instance, leadership, influence/persuasion, and motivating others are usually used concomitantly to describe the ability to lead people toward an objective. Similarly, conflict management and negotiation are usually used concurrently to describe the ability to build consensus or find a common ground on issues related to the project. Charisma, on the other hand, plays a more passive facilitating role, enhancing the effect of the previously competencies.

Leadership is the ability to lead or guide people toward an objective and it was regarded as a core competency by many authors (14–23). Leadership is exercised in different ways, thus many styles were developed, such as servant leadership (24), leadership by example (25), inspirational leadership (26), task-oriented leadership (27), relationship-oriented leadership (27), transactional leadership (5,11) and transformational leadership (3–5,11). Among these styles, transformational leadership was most positively correlated with high-performing managers and projects. In addition, competencies such as influence/persuasion and motivating others are also associated with high-performing managers (16,23,26,28–31). Influence/persuasion, for instance, can be described as the “capability to persuade others to change a viewpoint based on the understanding of their position and the recognition of the need to listen to this perspective and provide a rationale for change” (32). Similarly, motivating others can be described as the ability to inspire followers toward a vision or objective (5) and in contrast to persuasion, it relies more on the emotional aspect of people.

Another competency frequently discussed by authors is conflict management. In the case of the construction industry, it is occasionally described as claim or dispute management (19,33,34). Nevertheless, conflict management can be defined as the “ability to arrive at effective solutions to conflict whilst maintaining good relationship” (35) and project managers can exercise it through different strategies, such as avoiding conflict (8), facilitating conflict solving (36), building consensus (25), resolving conflicts (21,26) and managing conflicting situations in general. Similar to conflict management, negotiation is another competency commonly mentioned as an important ability for project managers. It is ability to reach an agreement, and in the project management context it is usually associated with procurement (37,38), conflicts (26,39), and team negotiations (9).

Finally, charisma was an aspect mentioned by few authors (4,21,25,31,40). Nevertheless, it is related to influencing skills, given that it can be described as the ability to influence others, attract their attention and admiration, and being likeable. Despite being neglected by most project management researchers, it was considered a core competency by Yasin et al. (25) in the case of project managers in the Portuguese public administration sector and by Skulmoski and Hartman (31) during initiation and closeout phases in IT projects.

3.2. Communication skills

Communication skills represent one of the most mentioned competencies in the project management literature. It describes the ability to exchange information between individuals, but authors mentioned several skills that form a competent communicator. Not surprisingly, basic skills such as verbal (42.31% - 22 sources), written (40.38% - 21 sources) and listening (19.23% - 10 sources) communication were highly mentioned, ranking as first, second and fourth in this group. Additionally, communication types such as multi-level (32.69% - 17 sources), open (15.38% - 8 sources), clear, direct and concise (15.38% - 8 sources), engaging (15.38% - 8 sources), multi-cultural and contextual communication (11.54% - 6 sources), and presentation skills (11.54% - 6 sources) were mentioned as important competencies.

Basic communication skills were highly regarded as core competencies; however, reading was left aside by authors. Some authors such as Davis (41) and Creasy and Anantatmula (42) vaguely mention decoding as forming part of communication skills, although it can be applied both for reading and listening. Similarly, Hwang and Ng (19) and Gray and Ulbrich (43) briefly mention reading as a communication skill, although without going into further detail. The lack of discussion about reading as an important communication skill raises concerns, given that a great deal of information in projects is communicated in written contracts, plans, lessons, reports, among others. Stressing the role of written communication as an important competency and neglecting the role of reading skills raises the question of whether project managers are more focused on writing information on paper as a way to comply with bureaucracies, rather than reading the available information and, most importantly, understanding it.

Besides the basic skills, complementary communication skills describe important aspects of PM communication competency. On one hand, skills such as multi-level, multi-cultural, contextual, and open communication encompass skills regarding whom project managers communicate with. On the other hand, complementary skills such as clear, direct, concise, and engaging communication as well as presentation skills explain how the project managers share information.

For instance, multi-level communication was regarded as a core competency by several authors (17,18,34) and describes the ability to effectively communicate with different levels of individuals involved in the project, such as superiors, stakeholders, team members, and peers. Similarly, multi-cultural and contextual communication describes PM ability to tailor the message according to the

context. This skill is especially important in projects involving foreign languages (39,44) or when technical information needs to be translated into common words that allow individuals from different cultural and social backgrounds to understand the message (15). In addition to that, open communication skills describe PM openness to create meaningful two-way communication in which questioning and feedback are encouraged (4,21,27,31).

Focusing on the message, rather than the interlocutors, skills such as clear, direct and concise communication, presentation and engaging communication help project managers to improve their effectiveness. For instance, clear, direct and concise communication was regarded as a core competency, especially when involving team members and executive stakeholders (4,27,40). Similarly, other authors also highlighted the role of presentation skills and the importance of using pictorial and graphical information to facilitate communication (21,45), especially during planning phases (31). In addition, an engaging communication with lively, enthusiastic, and appealing images about the project was regarded as an important aspect to win the support of stakeholders and team members (4,8). All in all, these skills show a preference toward a clear, direct, and concise message using visual presentations whenever possible, combined with an engaging defense of the argument presented.

3.3. Team working skills

The team working skills group is composed of seven competencies that focus on the way people work together to deliver projects. Some competencies are usually associated with each other, such as collaboration (48.08% - 25 sources) and support (28.85% - 15 sources), developing others (28.85% - 15 sources) and team building (25.00% - 13 sources), delegation (30.77% - 16 sources) and escalation (5.77% - 3 sources), and, as a result, trustworthiness (34.62% - 18 sources).

Collaboration was the most researched competency in this group and it is usually described interchangeably as teamwork (3,16,26), collaboration (11,26,31,46), or cooperation (16,44,47). Despite the different definitions, collaboration describes the ability to work together, varying from simply sharing information and resources to a very interdependent working relationship. Support, on the other hand, is the ability to assist someone and it is usually described by authors as consultation (44,48,49), facilitation (21,31,36,40), or simply supporting others (4,15,23,47). Therefore, support assumes a more passive role in which the individual does not need to actively engage in the working relationship such as in a collaboration but needs to be available whenever necessary.

While collaboration and support focus on existing working relationships, developing others and team building skills focus on developing people in order to have an effective collaboration and supportive working environment. Developing others, for instance, describes the ability to effectively help individuals to improve their skills, knowledge, and performance levels. PM attitudes toward developing others vary from case to case, although authors argue that coaching

(8,21), mentoring (50), training (4,47), sharing knowledge, job shadowing (22), among others, are effective strategies. In turn, team building is the ability to make a group of people effectively work together, transforming a dysfunctional group into a cohesive team. In order to do so, project managers must focus on fostering communication between groups (40), properly select interdisciplinary team members (25), build coalitions within the project team (50), motivate and develop trust between team members and project parties (22,36), among others.

Another pair of competencies that facilitates teams working together is delegation and escalation. Delegation describes the ability to effectively transfer power and responsibility regarding an activity, and it has a twofold usage in the literature. On one hand, when authors refer to delegation as a way to motivate team members, asking them to take more responsibilities, the term empowerment is used (6,24,28). On the other hand, when the focus of transferring responsibility is to share the workload, authors tend to refer to it as delegation to emphasize the need for decentralizing activities (19,25,27,34). Therefore, project managers need to identify when and how to delegate activities, whether the intention is to empower someone or to balance the workload. It is worth mentioning, however, that delegation and empowerment are effective only when the necessary power and authority to execute the new responsibilities are also transferred. Equally important to delegation is the ability to know when and how to escalate issues in the project. Authors, however, focus little attention on this competency, and only Brill et al. (21), Stevenson and Starkweather (17) and Starkweather and Stevenson (18) raise it as a project management competency.

Finally, trustworthiness was the second most researched competency and it describes people's belief that someone will act as expected. Because of that, many authors also refer to it as reliability (48,49,51) or, as Medina and Francis (46) described it, "whether the project manager [or team members] can be relied upon to act without reminders and finish tasks". In order to develop trust in a team, authors argued that defining clear roles and responsibilities (43) and improving communication (8) are common strategies. As a result, establishing trust is an important aspect to motivate team members, mitigate risks, resolve conflicts (8), and facilitate project success (22). Moreover, Skulmoski and Hartman (31) argued that trustworthiness is an important aspect in all project phases, but especially at the closeout phase, when being honest, truthful, and trustworthy are key elements to make the client believe that the project was delivered as agreed.

3.4. Emotional skills

The emotional skills group is composed of six competencies related to individuals' mental states, sensations, beliefs, or desires, namely stress management (44.23% - 23 sources), interpersonal skills (42.31% - 22 sources), interpersonal sensitivity (40.38% - 21 sources), self-awareness (30.77% - 16 sources), self-motivation (28.85% - 15 sources), and empathy (13.46% - 7 sources). Within this group, two subsets of competencies can be identified. On one side, interpersonal sensitivity, interpersonal skills, and empathy are competencies focus on emotion toward or from

others. On the other side, self-awareness, stress management and self-motivation focus on emotion within the individual.

Interpersonal sensitivity describes the ability to sense and understand emotions expressed or felt by others. The discussion regarding interpersonal sensitivity as a PM competency is usually carried out by researchers investigating leadership (6,7,28,29,32) and emotional intelligence (3,41,52) in projects and programs, and it is usually highlighted as a core competency to facilitate the work of project managers. Interpersonal skills, on the other hand, focus on using and managing someone's emotions. The way project managers use interpersonal skills varies substantially, but when authors described it as a core competency, they argued that establishing and maintaining interpersonal relationships (44), accepting flaws of others (25), having high concerns for people (26), giving personal attention to members who seem neglected (4), showing an interest in members as individuals and not only as project resources (46), and developing an understanding of the relationship between behaviors and feelings (23) were important aspects to help to influence others' emotions. Empathy describes the ability to understand and feel emotions from the perspective of another, and despite being less researched in the project management competency literature, it plays an important intermediary role between interpersonal sensitivity and interpersonal skills. Thus, empathy facilitates interpersonal sensitivity by understanding someone's emotions from the others' perspective and not from the observer's perspective. Consequently, a better understanding of someone's emotions facilitates the decision-making process regarding how to use interpersonal skills to manage emotions toward the desired outcome.

On the second subset of competencies, self-awareness is the ability to sense, understand, control and managing oneself emotions. Comparatively, it does for oneself what interpersonal sensitivity and interpersonal skills do for others. Self-awareness was considered a core competency among many project management leadership researchers (3,6,7,28,29), but its applicability goes way beyond this area. In general, self-awareness is usually used to assess the "situation and subsequently adjusting one's behavior - verbal, emotional, and so forth, and hence to be seen in a positive light" (42). Moreover, in harsh field conditions such as some NGOs' working environments, the risk of terrorism acts, bomb explosions, kidnapping, government abuses, and long working hours demand project managers and team members the ability to self-manage their emotions and physical state (15). In these situations, in addition to self-awareness, managers and team members need to use stress management skills. As Brière et al. (15) added, one may remain calm and not panic to not worse the situation. However, stress management also applies to non-hostile environments, given that projects tend to have challenging deadlines, limited resources, conflicting interests, and many other restrictions and frustrations that can stress those involved. For that reason, authors tend to describe it in different ways, such as emotional resilience (7,29,32), self-control (9,16,48,49,51), relaxation (48,49,51), patience (15), persistence (35), perseverance (45), emotional stability (52), mental capacity (31), or being good under pressure (20,21). Whatever the term used, stress management is the ability to resist and manage the emotional and physical

effects of demanding circumstances or events experienced. Finally, another emotional skill raised by authors was self-motivation and it describes the ability to positively influence or find stimuli to pursue an objective. In the literature, it is usually related to enthusiasm (14,50), job satisfaction (45), positive attitudes (21,40,50), or simply as motivation to achieve results and make an impact (6,28,32).

3.5. Contextual skills

The contextual skills group represents five competencies related to the understanding and management of circumstances or facts that surround a particular event, situation, or environment, namely adaptability (44.23% - 23 sources), contextual awareness (30.77% - 16 sources), strategic alignment (19.23% - 10 sources), political awareness (17.31% - 9 sources), and networking (15.38% - 8 sources). Similar to other groups, some contextual skills are related to each other, such as contextual and political awareness, adaptability and strategic alignment, and networking as a facilitator.

Contextual awareness, for instance, describes the ability to understand the social and institutional context in which the project is executed. In practice, it is related to the understanding of the project's commercial and business environment (14), the differences between cultures, beliefs systems and values of those involved in the project (14,15,23,34,39), the characteristics of the local environment (15,34,39), and which organizations are involved in the project delivery (25,26,53). As one may note, contextual awareness deals with explicit and observable contextual aspects, while political awareness deals with implicit and hidden contextual aspects. Therefore, political and contextual awareness complement each other. Political awareness can be described as the ability to understand the political context in which the project is executed. In practice, a competent PM with political awareness is capable of identifying hidden, diffused or conflicting interest agendas, navigating through them, foreseeing the implications of various scenarios based on these interests, and power relationships (26,54).

While contextual and political awareness focus on sensing and understanding the context in which the project is developed, strategic alignment and adaptability deals with the responses under those circumstances. Strategic alignment, for instance, describes the ability to align team members and the project toward an objective. This may occur within the project or in relation to a program, portfolio, or organizational strategy (48,49,51,55). In order to do so, project managers inform members regarding the project's strategic values, goals and vision, thus aligning, focusing and managing expectations among team members (21,26,36,40). Strategic alignment, on the other hand, focuses on the long-term strategies and orientations, while adaptability prepares managers to deal with the daily dynamics involved in a project. Therefore, adaptability describes the project manager's ability to be flexible and rapidly adapt to new conditions, especially in situations involving high levels of ambiguity and change (17,18,31,43).

Alongside the prior four competencies in this group, networking plays an important role in facilitating understanding and the response to the context. Thus, networking describes the ability to connect and interact with others, exchange information, and develop professional and social contacts. In developing a network of contacts, project managers facilitate the role of gathering information to understand the context and drive the response toward the right individuals. Authors highlighted how having a network of contacts was an important aspect to engage team members (9), stakeholders, such as members of the public, local contacts, funding sources, beneficiaries, and partners in NGO projects (15,22,25), or even rapidly reach people in corporate or senior management by bypassing slow formal communication channels (54).

3.6. Management skills

The management group is composed of five generic skills related to the processes of administration, conduction, and controlling factors and people in a project, namely monitor and control (38.46% - 20 sources), planning (26.92% - 14 sources), directiveness (25.00% - 13 sources), organization and coordination (23.08% - 12 sources), and prioritization (17.31% - 9 sources). Similar to other groups, some competencies are complementary to each other given their similar characteristics. For instance, planning and prioritizing are competencies that order projects, while directiveness, organization, and coordination deal with its execution. Alongside these, monitoring and controlling links these competencies and provides a feedback loop between them that facilitates proper management.

One of the first competencies used by project managers is planning, which describes the ability to think, make sense of, structure and organize information required to achieve a goal in a formal or informal plan. In the literature, planning is usually related to defining the project's scope, scheduling the activities, forecasting risks, estimating resources, etc. (19,21,54). Similarly, in bodies of knowledge such as the PMBoK (56), it is also described as planning a specific project management knowledge area. However, it is important to understand that planning goes beyond conventional project management knowledge areas. Complementing the role of planning in structuring the project, prioritizing adds the ability to order the level of importance between factors and people involved. It usually involves the prioritization of work (40,44), the identification of issues (16), the development of a sense of urgency (21), and prioritizing between projects and programs in the context of portfolios (55). In summary, planning and prioritization complement each other and play the essential role of ordering and structuring the project through successive prioritizations, decisions, and information organization.

Directiveness, and organization and coordination are competencies that complement planning and prioritization given that they transform what was planned into action. Directiveness, for instance, describes the ability to assertively define the direction and guide others toward an objective. In practice, this competency is exercised through an assertive direction with clear roles and goals (27), making team members comply with the plans (16), or, as Miterev et al. (54) stated, "holding the

program together and directing people to meet the business commitments”. In opposition to directiveness, organization and coordination focus on a hands-on attitude to ensure the achievement of defined goals, thus it describes the ability to systematically arrange and order things and people with the purpose of enabling them to effectively work together. Project managers use this competency when coordinating the work and activities of others, determining the workflow or order of tasks (44,46), structuring information flow (54), coordinating subcontractors’ interfaces to avoid potential risks (26), organizing project staff and process expertise (50), among others.

Alongside these competencies, monitoring and control checks the progress of activities and people, keeping their performance within defined parameters. Common monitor and control activities involve frequently reviewing plans (39), controlling project team members (39), and supervising their work (27). These activities are usually executed by previously defining, measuring, evaluating the work (21,22,34,45,48,49), review and assess portfolio performance (55) and monitor other initiatives that may affect their project outcomes (50).

3.7. Cognitive skills

Cognitive skills encompass competencies such as problem solving (34.62% - 18 sources), creativity and innovativeness (32.69% - 17 sources), decision-making (32.69% - 17 sources), critical analysis (30.77% - 16 sources), strategic perspective and system thinking (30.77% - 16 sources), vision and imagination (23.08% - 12 sources), intuitiveness (15.38% - 8 sources), and learning (13.46% - 7 sources), which describes abilities related to mental processes of perception, memory, judgment, and reasoning, in contrast with emotional and volitional processes.

Two competencies are often related to determine how managers envision the project. Vision and imagination describe the ability to share a view of the future state after the project. Project managers with that ability are usually described as strategic thinkers, visionaries, having a long-term orientation, having a strategic vision of the project or can look ahead and picture future scenarios (15,21,25,50,51,54). While vision and imagination look what is ahead the project, strategic perspective and system thinking looks the project’s broader picture, identifying patterns and connections between the elements that constitute the project (9,16,50). Researchers on PM leadership also identified this competency and described it as having the ability to see the wider issues and broader implications (7,28,32). Therefore, vision and imagination, and having a strategic perspective and system thinking complement each other, with the first looking ahead and the later looking at the broader picture.

Critical analysis and intuitiveness are two different and opposing competencies that focus on reasoning about a concrete project issue. Critical analysis describes the ability to logically reason and analyze issues in a project. Authors argued that project managers with this competency have the ability to gather information from a wide variety of sources, breaking down or deconstructing it to understand the implications and causes of a situation in a systematic manner

(16,23,31,32,43,45). Conversely, intuitiveness describes the ability to understand something instinctively, without logically or consciously reasoning about it. Authors described it as an important competency when project managers face incomplete or ambiguous information, arguing that they must use both rational and emotional perceptions to make a judgement (6,7,28,32).

Based on the wider or long-term vision of the project, and the logic or instinctive reasoning about issues, project managers are able to use problem-solving and decision-making competencies. Problem-solving, for instance, describes managers' ability to formulate a solution to overcome an unwelcome issue or question in the project. Some authors described four stages to solve problems: identification, framing, analysis and decision making (21,41,43). Additionally, Zhang et al. (26) argued that problems need to be quickly solved, so managers need to avoid allocating blame between project parties and focus on solving problems (36), for which managers need to develop their decision-making skills. However, decision-making goes beyond problem-solving and describes the ability to make choices in general. In practice, project managers are constantly asked to make time-sensitive decisions (21,39) and embrace collective decision-making processes (26,36), which demands sound judgement to arrive at an effective decision.

Finally, two other cognitive skills that facilitate the use of previously described competencies are learning and creativity. First, learning describes the ability to acquire and absorb knowledge and other skills, contributing to the continued development of competencies essential to project delivery. For that reason, authors argued that project managers not only should seek out information, but also invest in self-development and life-long learning as strategies to be ready to deal with project-related issues (16,31,45). Project managers need to use the knowledge acquired in a creative and innovative way to deliver better solutions. Aga et al. (4) and Fisher (23) described creativity as an important leadership aspect that helps team members to rethink problems, and develop novel solutions and ideas. Moreover, Skulmoski and Hartman (31) found that creativity is an important competency, especially during project initiation when project managers and team members are faced with challenging problems and new requirements. Together, learning and creativity help to accumulate and use knowledge in favor of the other cognitive skills.

3.8. Professionalism

The professionalism group represents PM qualities that can be encompassed into two major attributes: ethics (32.69% - 17 sources) and accountability (15.38% - 8 sources). All in all, professionalism focuses on how people behave on the job, describing the positive behaviors expected from a professional. Professionalism is one set of competencies that is noticed when present but much more perceived when it is absent.

Project management ethics describes moral principles that govern professional behaviors when conducting a project. As such, authors described many core attributes that can be encompassed under the ethics umbrella, such as integrity (21,23), honesty (21,23,25,31), respectfulness (31),

loyalty (23,25), reliability (49), punctuality and politeness (31). As a whole, these competencies help to build a better working environment with less uncertainty and in which team members can trust each other.

In addition to the ethics attributes, authors also highlighted the importance of developing accountability and responsibility skills. Medina and Francis (46) argued that managers should take an active responsibility to show their commitment to the project, rather than always delegating tasks to the team. Additionally, Yasin et al. (25) and Blixt and Kirytopoulos (51) argued project managers should also be accountable for their actions and decisions, claiming that accountability is a core competency, especially in projects concerning the public sector.

3.9. Knowledge and experience

The knowledge and experience group focus on general knowledge and experiences required from project managers. In this group, the most mentioned competencies were technical expertise (42.31% - 22 sources), experience (17.31% - 9 sources), business expertise (13.46% - 7 sources), and administrative expertise (13.46% - 7 sources).

Among the knowledge competencies, three kinds of expertise were mentioned by authors: technical, business, and administrative. Technical expertise was by far the most mentioned competency, and describes the knowledge and skills necessary for managing technical tasks (20,25,31,45,54), technology (9,35,44,50), products and the systems (39) involved in the project. Business expertise describes the ability to understand and identify patterns and common behaviors in the industry in which the project is executed (31,39,53). Administrative expertise, on the other hand, describes the knowledge and skills related to the logistics, managerial activities, and workflow within the organization and the project (10,25). The kind of expertise required in a project uncovers three levels of analysis. For instance, technical expertise focuses on the micro-level of the project, dealing with execution matters related to technologies and technical tasks. In contrast, business expertise focuses on the macro-level, usually dealing with issues outside the project. Administrative expertise concerns the meso-level, supporting the activities carried out by the previous levels within organizational boundaries.

Experience was another competency mentioned by authors to describe the knowledge and skills gained by executing projects and tasks over a long time period. Different than knowledge within specific domains, experience was mentioned in a generic form, encompassing aspects of technical, administrative, and business experiences (14,22,53).

3.10. Project management knowledge

The project management knowledge group is composed of eighteen competencies focused on specialized knowledge, techniques, and practices, mostly organized into traditional body of knowledge such as the PMBoK (56). Therefore, the project management knowledge group is

divided into two subgroups. On one side are the traditional project competencies to manage human resources (50.00% - 26 sources), time (42.31% - 22 sources), stakeholders (40.38% - 21 sources), risk (40.38% - 21 sources), quality (36.54% - 19 sources), cost (34.62% - 18 sources), procurement (34.62% - 18 sources), scope (26.92% - 14 sources), resource (25.00% - 13 sources), communication (21.15% - 11 sources), requirements (15.38% - 8 sources), and integration (11.54% - 6 sources). On the other side are additional project management knowledge such as methods (44.23% - 23 sources), client/customer management (23.08% - 12 sources), health and safety management (19.23% - 10 sources), knowledge management (17.31% - 9 sources), change management (17.31% - 9 sources), and supply chain management (13.46% - 7 sources).

Comparing traditional project management competencies described in bodies of knowledge such as the PMBoK (56) and those found in academic literature, the former shows a more extensive set of competencies required from project managers. For instance, the PMBoK divide resource management into two different disciplines in the academic literature: human resources management focusing on personnel, roles and responsibilities (8,27,40) and resource management that focus on estimation (34), and materials and equipment allocation (34). Requirement management (25,48,51) is a separate domain from scope management in the academic literature, contrasting with PMBoK, which encompasses both areas. Project management knowledge competencies concerning cost and procurement also extended their focus. In the academic literature, cost management also incorporates topics related to finance management (15,25,34,48,50), which gives the discipline a balanced view regarding expenses (cost management) and budgeting (finance management). Similarly, procurement management in the academic literature also incorporated legal (25,35,44,48,51) and contract management knowledge (34,35,48) as key competencies for procurement management. As one may notice, bodies of knowledge such as the PMBoK cover most traditional project management knowledge competencies, although it is necessary to recognize that project managers are required to know much more than only the good practices. Therefore, training providers, recruiters, and self-educated professionals should look beyond good practices and current bodies of knowledge.

In addition to the traditional project management knowledge competencies, the academic literature also discussed other competencies such as the knowledge of project management methods (14,21,22,47), client/customer management (8,16,36,47,49), knowledge and information management, health and safety management (15,33,48), change management (15,26,39), and supply chain management (14,36). All in all, the existence of additional project management knowledge competencies reinforces the argument that project managers need to learn more than traditional project competencies described in the existing bodies of knowledge.

3.11. Personal skills and attributes

Finally, the last collection of competencies is the personal skills and attributes group, which focuses on the main individual PM characteristics. This group has ten competencies: achievement

orientation (38.46% - 20 sources), commitment (28.85% - 15 sources), initiative (28.85% - 15 sources), confidence (25.00% - 13 sources), openness (17.31% - 9 sources), detailist (13.46% - 7 sources), courage (7.69% - 4 sources), sense of humor (7.69% - 4 sources), multi task (3.85% - 2 sources), and discipline (3.85% - 2 sources).

The three most mentioned competencies in this group were achievement orientation, commitment, and having initiative, all of which are required for active project management. Achievement orientation, for instance, is a very desirable competency, since is usually related to being productive, focused, motivated by delivering results and achieving goals (16,25,27,31,43,48). Similarly, commitment, engagement or conscientiousness is a core competency described as the ability to define a course of action and stick to a plan, despite adversities (6,7,15,24,28,32,43,51). While achievement orientation focuses managers toward an objective and a commitment to keep them on track, initiative plays the role of getting things done and proactively avoiding issues (16,21,40).

Another two contrasting competencies mentioned in the literature were confidence and courage. On one hand, confidence describes a full trust or belief in the ability to achieve project goals (4). On the other hand, courage is used to challenge assumptions. Therefore, project managers must work to build confidence in their course of action, but also have the courage to challenge people and ideas in order to achieve a project's goals.

Five additional personal attributes were identified in the literature, although few authors argued they are key characteristics of a project manager. These are openness (23,48), being detailed (31,40), having a sense of humor (45), multitasking (47), and being disciplined (21).

4. PMCF as an assessment instrument

The PMCF presents a comprehensive set of competencies that maps the whole profile of a project management professional and can that be used by practitioners and academics to assess people working in the project management industry. However, the PMCF needs to be tailored to the context within it will be applied, given that competencies may vary according to organizational processes, roles, responsibilities and the level of proficiency required for each of them. Nevertheless, using the PMCF as the foundation to analyze the relationship between people and processes (who does what), competencies and organizational processes (what people should know to work on the process), and competencies and people (what people already know) may prove a valuable exercise to better understand the project management competency level.

The assessment objective may vary from academics to practitioners. Academics, for instance, may use the PMCF constructs alongside Likert scale to find correlations between project management competencies and other factors. Practitioners, on the other hand, may use the PMCF combined with proficiency scale in order to evaluate people involving in organizational projects. Focusing on the

practitioners side, there are two relative similar ratings scale regarding project management competencies, namely the APM's (2) and PMI's (1) competency level scales. APM's (2) rating is scale is more descriptive, as illustrated in Table 1, therefore easier to use:

Table 1 - Project management competency rating scale

Level	Description
1. Aware	One has an awareness of the knowledge needed for the competency. As only awareness is required at this level, no application is expected.
2. Practiced	One has a working knowledge of, and can describe, the competency. Applies the competency under supervision, primarily in non-complex situations.
3. Competent	One has a comprehensive knowledge of the competence in situations of limited complexity. Applies the competency independently, primarily in situations of limited complexity.
4. Proficient	One has a detailed knowledge of the competency in complex situations and can critically evaluate and adapt as required. Applies the competency independently, primarily in complex situations. Supervises others applying the competency.
5. Expert	One has an in-depth knowledge of the competency in complex situations. Can critically evaluate, adapt or develop new theories and/or methods if required and educate others. Applies the competency independently, primarily in complex situations. Recognized as an expert by others senior professionals, who is called on by others for advice on the competency.

In addition to the five levels described in Table 1, is important to incorporate an initial level represented by zero, in which one do not know the competency. The result is a project management competency assessment instrument (Annex 1 – Project management competency assessment instrument) that can be used by individuals (self-assessment) or managers (assessing others). By applying the PMCF, one may find competencies gaps that need to be addressed to perform well on the job or, on the contrary, find that one is above the required threshold for the job, therefore being able to be perform well in a higher or more complex position. Moreover, as roles and processes require different competencies, the PMCF allows managers to identify multi-competency people that can be allocated for different roles or processes, giving the organization flexibility to manage their talents.

5. Conclusion

The purpose of this article was to identify all PM competencies to develop a complete profile and an assessment instrument tailed to this profession. In order to achieve such an objective, a systematic review was used as the research method.

The findings showed that project management competency profile is formed of 81 competencies divided across 11 dimensions: influencing, communication, emotional, contextual, management, cognitive skills, professionalism, knowledge and experience, project management knowledge, and personal skills and attributes. In summary, among the 81 PM competencies, 48 were correlated with project success, most of them related to leadership, emotional competencies, team working, and project management knowledge.

Additionally, assessing project management competency using the identified constructs may prove positive to individuals and organizations. The use of an assessment instrument based on a comprehensive set of competencies may be an important step toward better understating the complexities and nuances of a professional. Moreover, by applying the PMCF as an assessment instrument organizations and instruments can identify competency gaps, improving investments by training people on the right competencies, improve development programs and recruiting and selection processes, assess the impact of firing or moving people to other departments, effectively manage talents in the organization, among many other benefits.

Despite the benefits and strengths of a systematic review, this article was limited by the difficulty to code different terms and data instruments used to express the same competency. Therefore, further research is needed. For instance, it would be interesting to investigate the relative importance between competencies according to a person's role and organizational process or according to their gender, ethnicity, or personality.

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Annex 1 – Project management competency assessment instrument.

Item	Dimension	Competency	0 – None	1 – Aware	2 – Practised	3 – Competent	4 – Proficient	5 – Expert
1	Influencing skills	Leadership						
2		Influence/persuasion						
3		Motivating others						
4		Conflict management						
5		Negotiation						
6		Charisma						
7	Communication skills	Verbal communication						
8		Written communication						
9		Listening						
10		Reading						
11		Multi-level communication						
12		Open communication						
13		Clear, direct and concise communication						
14		Engaging communication						
15		Multi-cultural and contextual communication						
16		Presentation skills						
17	Team working skills	Collaboration						
18		Support						
19		Developing others						
20		Team building						
21		Delegation						
22		Escalation						
23		Trustworthiness						
24	Emotional skills	Interpersonal sensitivity						
25		Interpersonal skills						
26		Empathy						
27		Self-awareness						
28		Stress management						
29	Self-motivation							
30	Contextual skills	Contextual awareness						
31		Political awareness						
32		Adaptability						
33		Strategic alignment						
34		Networking						
35	Management skills	Planning						
36		Prioritizing						
37		Directiveness						

38		Organization and coordination							
39		Monitor and control							
40	Cognitive skills	Vision and imagination							
41		Strategic perspective							
42		Critical analysis							
43		Intuitiveness							
44		Problem solving							
45		Decision-making							
46		Learning							
47		Creativity							
48	Professionalism	Ethics							
49		Accountability							
50	Knowledge and experience	Technical expertise							
51		Business expertise							
52		Administrative expertise							
53		Experience							
54	Project management knowledge	Human resources management							
55		Resource management							
56		Requirement management							
57		Scope management							
58		Cost and finance management							
59		Procurement and contract management							
60		Time management							
61		Stakeholder management							
62		Risk management							
63		Quality management							
64		Communication management							
65		Integration management							
66		Project management methods							
67		Client/customer management							
68	Knowledge and information management								
69	Health and safety management								
70	Change management								
71	Supply chain management								
72	Personal skills and attributes	Achievement orientation							
73		Commitment							
74		Initiative							
75		Confidence							
76		Courage							
77		Openness							
78		Detailist							
79		Sense of humor							
80		Multitasking							
81		Discipline							