

Framework of standards, guides and methodologies for project, program, portfolio, and PMO management

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ABSTRACT

Project, program, portfolio, and Project Management Office (PMO) management standards, guides, and methodologies are indispensable for professionals and companies as they reflect the best practices in the area. However, the number and diversity of extant documents are significant and growing, making their identification, study, and selection difficult. To help overcome this issue, this article presents a framework that integrates and organizes a wide range of concepts, standards, guides, and methodologies for project, program, portfolio, and PMO management. We carried out a literature review of the available documents published by several international entities, including the leading professional associations. The documents were then compiled, analyzed, and organized comprehensively. Theoretically, the proposed framework provides a structured perspective on the standards, guides, and methodologies according to their purpose, scope, and detail. It is also a valuable tool for assisting practitioners in identifying references for managing their projects, programs, portfolios, and PMOs. Moreover, it provides teachers, students, and training entities with a basis for studying standards, guides, and methodologies and designing training courses.

1. Introduction

Managing projects, programs, portfolios, and Project Management Offices (PMO) (4P) is complex and challenging, and they should be carried out following best practices in applying knowledge, competencies, processes, techniques, and tools to meet the requirements of the undertakings. In this context, using standards, guides, and methodologies is mandatory [1], as they allow adopting the processes, techniques, and tools necessary to meet established objectives and stakeholders' expectations.

Furthermore, standardization promotes knowledge dissemination and increases predictability, thus reducing uncertainty and risk [2]. Process standardization is a subject of strategic importance for many companies as it enables them to deliver consistent quality in terms of products and services to customers [3]. Many standards, guides, and methodologies exist for 4P management. Still, to the best of our knowledge, there is no framework to organize and present these documents according to their conceptual nature to facilitate their adoption and use. This information would be very important for organizations to identify, assess better, and decide which standards, guides, and

methodologies to invest in [4], leading to better results and avoiding the loss of opportunities.

Given this gap, which affects the awareness, identification, study, selection, and adoption of the most appropriate references, this article proposes a new framework that identifies, in an organized way, various standards, guides, and methodologies for 4P. The framework aims to support researchers and practitioners when identifying standards, guides, and methodologies for study and use.

To develop the framework, an exhaustive literature review was carried out, which included the following macro-activities: 1) Problem formulation (problem: difficulty in identifying the standards, guides, and methodologies of 4P management); 2) Data collection (collection of main standards, guides, and methodologies of 4P management); 3) Organization and evaluation of data (full reading of the identified standards, guides, and methodologies); 4) Content analysis and interpretation (summarizing each standard, guide, and methodology, aiming at a deeper analysis of them); 5) Organization and presentation (classification and organization of the standards, guides, and methodologies and development of the framework). Two focus groups were performed to evaluate the framework and get feedback for

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improvement.

Theoretically, the framework provides a new organized perspective of standards, guides, and methodologies according to their scope, detail, and purpose, allowing researchers to have a clear perspective of the state of the art. For practice, it provides a tool for practitioners to identify the most appropriate references for their endeavors. Regarding education, the framework gives teachers, students, and training providers a basis for studying relevant standards, guides, and methodologies and designing training courses.

Following, Section 2 presents fundamental concepts. Then, Section 3 describes the research method. Section 4 presents the framework. Section 5 discusses the results. To conclude, Section 6 addresses the contributions, limitations, and future work.

2. Background

This section presents the conceptual background of the work carried out. The first section introduces the 4P management concepts. The second section focuses on the different types of documents included in the standards, guides, and methodologies framework.

2.1. Project, program, portfolio and PMO management

Within the global area of project management, it is helpful to distinguish between portfolio, program, and project management. In addition to these different levels of management, during the literature review, it was also possible to identify a relevant set of documents directly related to PMO management.

Projects can be defined as temporary endeavors to achieve one or more defined objectives. In other words, a project is a temporary undertaking performed to create a unique product, service, or result [1]. **Project management** involves coordinated activities to direct and control the accomplishment of agreed objectives, comprising the application of processes, methods, skills, knowledge, and experience to achieve specific project objectives in accordance with project acceptance criteria and within agreed parameters [5].

Programs can be defined as groups of program components (projects or other related work) managed in a coordinated way to realize benefits [6] that are not achievable through individual management [7]. **Program management** involves coordinated activities to direct and control the realization of identified benefits and deliverables [6], including the coordinated management of ongoing projects and activities (business-as-usual) to achieve beneficial changes [5].

Portfolios are a collection of portfolio components, such as projects, programs, or other portfolios and related works, grouped to facilitate their management to meet strategic objectives [8]. Those groups of projects or programs can be related or not [7]. **Portfolio management** involves coordinated activities to direct and control the accomplishment of strategic objectives [8]. It comprises selecting, prioritizing, and controlling an organization's programs and projects according to its strategic objectives and execution capacity [5].

PMOs are organizational bodies or entities that have been assigned various responsibilities related to centralized and coordinated project management in their domain [9]. A PMO is responsible for improving and optimizing the processes used in projects, programs, and portfolios, directly impacting their management practices and results.

2.2. Standards, guides, methodologies and others

In the context of 4P management, standards and guides can take several forms. Those considered for this work are standards, methodologies, guides, maturity models, and competence frameworks.

A **standard** is defined by the ISO/IEC [10] as a document, established by consensus and approved by a recognized body, that presents the general and repeated use, rules, guidelines, or characteristics, for activities or their results, to obtain the best results in a given context.

Documents such as ISO 21500:2021 [11] are included in this category.

According to Westland [12], a project management **methodology** consists in a set of principles, tools, and techniques used to plan, execute, and manage projects. Project management methodologies help project managers to lead team members and manage the work while facilitating team collaboration. A relevant example of a project management methodology is PM² [14]. PM² explains step by step what should be done for proper project management.

A project management **guide** or **framework** is a set of models, processes, activities, or standardized tools to plan, start, control, and finish a project (i.e., something vaguer than a methodology). For example, the "APM introduction to programme management" [14] states in its introduction that the purpose of the guide is to give an insight into program management – i.e., what a program is, how it functions, and how to view it; in other words, this kind of document provides an overview of the topic, but it is not a step-by-step guide (something expected from a methodology).

According to Wendler [15], a **maturity model** describes the development of an entity over time. For Pullen [16], maturity models are structured collections of elements that describe the characteristics of processes at different stages of development. An example is OPM3 [17].

Finally, a **competence framework** allows the development of training programs, the identification of competence gaps (both in individuals and organizations), the promotion of a professional's self-development, and ensures common references [18]. With this type of document, it is possible to make the knowledge and skills foundation necessary to carry out certain activities more transparently and provide a common vocabulary through which expectations and processes can be made conspicuously and publicly. The ICB [19] is an example of a competence framework.

3. Method

3.1. Literature review

One of the main aims of a literature review is to summarise the state of the art in a particular area [20]. The literature review should be coherent and logical to clarify the end result [21]. For the identification of the relevant standards, guides, and methodologies for the framework development (purpose of this work), the literature review carried out included the following activities: 1) Search for standards, guides, and methodologies related to 4P management; 2) Contact with project management experts, to identify additional relevant references; 3) Search for leading international standardization and professional entities and consequent search of the standards, guides, and methodologies proposed by them; 4) Additional ad-hoc searches in Web engines.

We started by searching for standards, guides, and methodologies already known by the research team, including some of the most prominent standards and guides in the area of project management (e.g., PMI and IPMA standards). Then, two experts in the field provided a long list of references. Those experts were identified and contacted based on the personal contact list of the researchers, and both are scholars and international experts (participating in project, program and portfolio management and related standardization committees and professional associations, including the International Organization for Standardization) with more than 20 years of experience in the field.

After that, a search was made on the institutional websites of the leading international standardization bodies and professional associations, focusing mainly on the following entities: Project Management Institute (PMI), AXELOS, International Organization for Standardization (ISO), Association for Project Management (APM), International Project Management Association (IPMA), and International Association of Project Managers (IAPM). These entities' standards, guides, methodologies, and maturity models were then identified, complementing the initial list. Finally, having verified some gaps in the category of frameworks and maturity models, an ad-hoc complementary search on the

Web was carried out with new keywords (e.g., “maturity model”), which allowed enriching the list of standards, guides, and methodologies.

The complete list of standards, guides, and methodologies considered in this work can be found in the appendix.

3.2. Framework development and evaluation

After identifying the relevant documents, the content of each one was analyzed in detail, following the process represented in Fig. 1. The first step consisted of selecting the document to be analyzed. Then, a complete document reading was done, and the main characteristics were systematized. Following that, a summary was developed, which consisted in a brief explanation of the document’s objective and content. Finally, the document was classified and included in the framework.

To evaluate the framework, we conducted two focus groups following the guidelines of Kontio et al. [22]. They included discussions with eleven experts with significantly different backgrounds aimed at 1) collecting the participants’ opinions about the framework’s usefulness and organization and 2) getting feedback for improving the model and respective dissemination. Carrying out two focus groups facilitated the discussion so all participants could better contribute. Furthermore, it was also relevant to facilitate the management of the participants’ heavy agenda. Participants were selected based on their experience in the field, following Kitzinger [23]. Looking for heterogeneity among the group participants, we considered diversity regarding backgrounds, roles, and experiences to get a well-rounded perspective. Krueger’s [24] guideline, which states that the group should not exceed twelve participants, was also considered. See Table 1 for participants’ demographics. All the participants’ contributions were anonymized and presented as P_n , whereas n is the code assigned to each participant.

The focus group sessions, with one of the authors acting as the main moderator, were performed via Zoom in March of 2024. Each session lasted an average of fifty minutes and started with an introductory presentation of the focus group agenda and the research objectives. Then, informed consent was requested to record the session, and data anonymity was ensured. Following this, participants were asked to write down all the standards, guides, methodologies, or other 4P management documents they knew. Afterward, it was presented a non-organized list of the standards, guides, methodologies, and other documents (all mixed down) resulting from the literature review, asking participants three questions: 1) Is there any standard, guide, methodology, or other documents in the list that you wrote down, not present in this list? 2) Do any of you have all of these standards, guides, or methodologies in your list? 3) Supposing that you would need to select one of these standards, guides, or methodologies for one of your endeavors, what would be the difficulties? It followed a brief discussion of the participants’ answers to these questions. The next step of the focus group involved presenting the developed framework and discussing the following questions: 1) Do you consider this framework helpful (and why)? 2) Would you like to have access to it for your work? 3) Do you have any suggestions for its presentation and dissemination? Finally, after getting feedback, the

moderator ended the focus group session by thanking participants for their participation and insights. The moderator tried to make both sessions as similar as possible to integrate results. The audio of the focus group sessions was recorded and lately transcribed so that we could deeply analyze the content of the discussions. Then, the transcripts were carefully read to examine the responses and identify the perceptions and opinions of the participants regarding the framework’s completeness and usefulness.

4. Framework of standards, guides and methodologies for the management of projects, programs, portfolios, and PMOs

This section first presents the proposed framework of standards, guides, and methodologies for 4P management. Next, each document included in the framework is briefly described.

4.1. Framework organization

The framework structure is shown in Fig. 2. At the top, the first level refers to the scope of the document, which may be related to portfolio management, program management, project management, or PMO. The second level specifies the type of content found in the document, which may globally (Global) cover a subject (e.g., project management), address one or a few specific aspects (Aspect(s)) (e.g., time management) within the specific subject at the first level, concern competencies or skills (Competencies/Skills), or be focused in governance (Governance).

Generally, a document is classified as **Global** when it comprehensively addresses the 4P management. It is the case, for example, of ISO 21502:2020 [25], which focuses on project management and presents an overview of project management through its areas of interest/knowledge areas and the processes related to those areas.

A document is classified as focusing on an **Aspect(s)** when it concerns a particular aspect of 4P management. For example, ISO 21508:2018 [26] focuses on Earned Value Management, a specific project and program management aspect.

A **Competence** is a set of knowledge, personal attitudes, skills, and experience required to succeed in a particular role [27]. A **skill** refers to the learned ability to produce predetermined results with maximum certainty, with the minimum expenditure of time, energy, or both [28]. The **Competencies/skills** dimension includes the documents (such as the ICB [19]) that address skills and abilities that the manager or professional of 4P needs to carry out his work.

Finally, **Governance** consists of principles, policies, and models guiding the direction and control of an organization [29] to provide value in meeting strategic and operational objectives [30]. The documents that present content on governance are included in this dimension. An example is ISO 21505:2017 – Project, program, and portfolio management – Guidance on governance [29]; this standard focuses on the governance of projects, programs, and portfolios.

The complete framework is presented in Fig. 3 and detailed in the

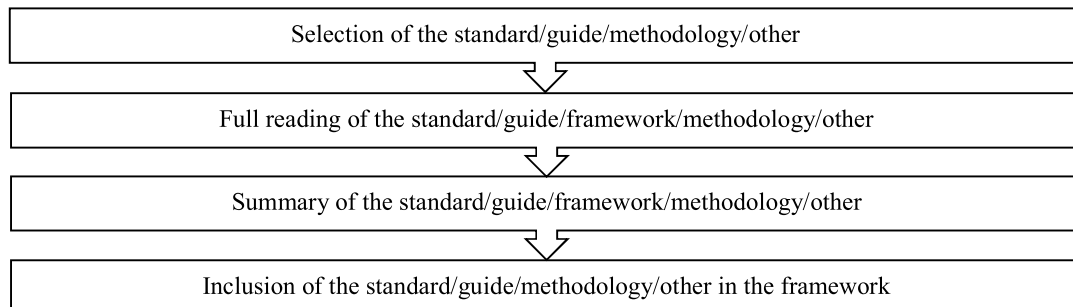


Fig. 1. Process for developing the framework.

Table 1
Participant's demographics.

Code	Age	Gender	Organization size	Academic qualifications	Current position	Professional experience	Experience
P1	54	F	Large; Public sector	PhD (in project management)	Professor; Researcher	>30 (years)	Project team leader; Consultant; Professor; Researcher; Coordinator of project management teaching programs
P2	37	F	SME; Private sector	MSc MBA (in project management)	Project manager; Service manager	>15	Project manager
P3	23	F	SME; Public sector	MSc	Consultant trainee; PhD Student	<1	Consultant
P4	41	M	SME; Private sector	MSc	Services director; PhD Student	>23	Business analyst; Project manager; IT coordinator, Services director
P5	22	F	Large; Private sector	BSc	Project management trainee; MSc student	<1	Project management team member (evaluation)
P6	44	M	Large; Public sector	PhD MBA in project management	Professor; Researcher	>25	Project manager; PMO director; Portfolio manager; Program manager; Consultant; Researcher; Professor
P7	23	F	Large; Private sector	MSc	Business analyst	<1	Business analyst
P8	26	F	Large; Private sector	MSc	Project manager	<2	Consultant; Project manager
P9	27	F	Large; Public sector	MSc	Researcher	>2	Developer; Analyst; Researcher
P10	38	M	Large; Private sector	MSc	Project manager; PhD student	17	CIO; Ministry director; Coordinator for ministry modernization; Portfolio, program, and project manager
P11	22	F	–	BSc	MSc student	22	(only academic)

Type	Abbreviation	Document	Reference	Portfolio management				Program management				Project management				PMO (Global)
				Global	Aspect(s)	Competencies/Skills	Governance	Global	Aspect(s)	Competencies/Skills	Governance	Global	Aspect(s)	Competencies/Skills	Governance	
Standards Methodologies Guides & Frameworks Maturity Models Competence Frameworks	...	...	...													

Fig. 2. Structure of the framework of standards and guides.

following sections.

4.2. Standards and guides description

Five types of documents are considered in the framework: Standards, Methodologies, Guides & Frameworks, Maturity Models, and Competence Frameworks.

4.2.1. Standards

The documents of the Standards category are described next.

ISO 15000:2021 – Project, programme and portfolio management – Context and concepts [11]: The organizational context and underlying concepts for undertaking project, program, and portfolio management are specified in this standard. Furthermore, it offers guidance on implementing or enhancing project, program, and portfolio management. It may be used regardless of project, program, or portfolio size, complexity, or duration.

ISO 21502:2020 – Project, programme and portfolio management – Guidance on project management [25]: It provides project management guidelines, offering high-level explanations of practices

that, in the context of project management, are seen to be efficient and effective. It is relevant to every kind of project, independent of its goals, delivery methods, life cycle model, size, complexity, cost, or length, and to all kinds of organizations, including nonprofit, public, and private ones.

ISO 21503:2022 – Project, programme and portfolio management – Guidance on programme management [6]: It offers program management guidelines as well as high-level explanations of pertinent terminology, definitions, prerequisites, concepts, and practices, including roles and duties that contribute to good practice. It may be used by any organization, public or private, of any size or industry, and with any kind of program, regardless of its complexity.

ISO 21504:2022 – Project, programme and portfolio management – Guidance on portfolio management [8]: It provides guidelines and principles for portfolio management. The guidelines are meant to be customized to fit each portfolio's unique context. It does not include instructions for managing programs, projects, or other particular kinds of portfolio management (e.g., financial).

ISO 21505:2017 – Project, programme and portfolio management – Guidance on governance [29]: It offers guidelines for the

Type	Abbreviation	Document	Reference	Portfolio management				Program management				Project management				PMO (Global)
				Global	Aspect(s)	Competencies/Skills	Governance	Global	Aspect(s)	Competencies/Skills	Governance	Global	Aspect(s)	Competencies/Skills	Governance	
Standards	ISO 21500	ISO 21500 – Project, programme and portfolio management – Context and concepts	[11]	X				X				X				
	ISO 21502	ISO 21502 – Project, programme and portfolio management – Guidance on project management	[25]									X				
	ISO 21503	ISO 21503 – Project, programme and portfolio management – Guidance on programme management	[6]					X								
	ISO 21504	ISO 21504 – Project, programme and portfolio management – Guidance on portfolio management	[8]	X			X									
	ISO 21505	ISO 21505 – Project, programme and portfolio management – Guidance on governance	[29]				X			X					X	
	ISO 21508	ISO 21508 – Earned Value Management in project and programme management	[26]					X				X				
	ISO 21511	ISO 21511 – Work Breakdown Structures for project and programme management	[31]					X				X				
	ISO 10006	ISO 10006 – Quality management – Guidelines for quality management in projects	[32]									X				
	ISO/IEC/IEEE 16326	ISO/IEC/IEEE 16326 – Systems and software engineering – Life cycle processes – Project management	[33]									X				
	SProgM	The Standard for Program Management	[34]					X			X					
	PSPCM	Practice Standard for Project Configuration Management	[35]									X				
	PSPE	Practice Standard for Project Estimating	[36]		X			X				X				
	PSS	Practice Standard for Scheduling	[37]									X				
	PSWBS	Practice Standard for Work Breakdown Structures	[38]					X				X				
	EVM	The Standard for Earned Value Management	[39]					X				X				
	SRMPPP	The Standard for Risk Management in Portfolios, Programs, and Projects	[40]		X		X	X		X		X		X		
	SPortM	The Standard for Portfolio Management	[41]	X		X	X									
	OPM	The Standard for Organizational Project Management	[42]													X
Methodologies	PM ² Project Management	PM ² Project Management Methodology	[13]									X			X	
	PRINCE2	PRINCE2: Managing successful projects	[43]									X				
	PRINCE2 Agile	PRINCE2 Agile	[44]									X				

Fig. 3. Framework of standards, guides, and methodologies for 4P management.

governance of projects, programs, and portfolios, as well as an explanation of the context in which it is conducted. Additionally, it may be used for project, program, or portfolio governance function evaluation.

ISO 21508:2018 – Earned Value Management in project and programme management [26]: It provides guidelines for Earned Value Management procedures in project and program management. It may be used by any organization, whether public or private, of any size or industry and in any kind of project or program, regardless of its size, complexity, or length.

ISO 21511:2018 – Work Breakdown Structures for project and programme management [31]: It offers work breakdown structures guidance for organizations managing projects or programs. It also provides relevant terminology, concepts, definitions, benefits, characteristics, applications, and other aspects of work breakdown structures.

ISO 10006:2017 – Quality management – Guidelines for quality management in projects [32]: Guidelines for implementing quality management in projects are provided in this standard. With the aim of satisfying project interested parties by implementing quality management, it may be used by organizations working on projects of various levels of complexity, whether they are standalone initiatives or are part of a portfolio or program, in various settings, and regardless of the type of the involved process, product, or service.

ISO/IEC/IEEE 16326:2019 – Systems and software engineering – Life cycle processes – Project management [33]: Its purpose is to assist project managers in managing the effective completion of projects involving systems (e.g., software). It outlines what must be included in the project management plan. It also includes comprehensive project management guidelines.

SProgM – Standard for Program Management [34]: It offers guidelines on program management principles, practices, and activities widely accepted as promoting good program management practices and applicable to most programs. It also aims to establish a shared understanding of the program manager role.

PSPCM – Practice Standard for Project Configuration Management [35]: It extends and details the PMBOK Guide, defining processes, techniques, and tools utilized in project configuration management. It guides the team, project manager, and other interested parties in understanding project configuration management and practicing it properly in a project.

PSPE –Practice Standard for Project Estimating [36]: It treats estimating as a live process inside projects and offers orientation for implementing a strong estimating discipline throughout a project. It serves as a guide for the project team, project manager, and any interested parties.

Type	Abbreviation	Document	Reference	Portfolio management				Program management				Project management				PMO (Global)
				Global	Aspect(s)	Competencies/Skills	Governance	Global	Aspect(s)	Competencies/Skills	Governance	Global	Aspect(s)	Competencies/Skills	Governance	
Guides & Frameworks	P3O	Portfolio, Programme and Project Offices	[45]													X
	MoP	MoP: Principles, practices, and procedures for successful portfolio management	[46]	X												
	M_o_R	M_o_R: The Management of Risk	[47]					X				X				
	PRAMG	Project Risk Analysis and Management Guide	[48]					X				X				
	PMBOK	PMBOK guide: A Guide to the Project Management Body of Knowledge	[1]									X		X		
	GE PMBOK	Government Extension to the PMBOK Guide	[49]									X				
	BRM	Benefits Realization Management: A Practice Guide	[50]		X		X	X		X		X		X		
	RM	Requirements Management: A Practice Guide	[51]					X				X				
	GPPP	Governance of Portfolios, Programs, and Projects: A Practice Guide	[30]				X			X					X	
	PMG	Project Managers' Guide	[52]									X		X		
	APMG	Agile Project Managers' Guide	[53]									X				
	PM ² Agile	The PM ² – Agile guide	[54]									X				
	APMBoK	APM Body of Knowledge	[5]	X		X		X		X		X		X		X
	APMIPM	APM Introduction to Programme Management	[14]					X								
	GUBMF	A guide to using a benefits management framework	[55]		X			X				X				
	PMPG	Portfolio Management – A practical guide	[56]	X			X									
	PM ² Portfolio Management	PM ² Portfolio Management Guide	[57]	X												
	DC: GGPM	Directing Change: A Guide to Governance of Project Management	[58]							X					X	
	EVM Handbook	Earned Value Management Handbook	[59]					X				X				
	EVM: APMGuide	Earned Value Management: APM Guidelines	[60]		X			X				X				X
	P2M	P2M – A Guidebook of Program & Project Management for Enterprise Innovation	[61]					X				X				
	GAPP	A Guide to Auditing Programmes and Projects	[62]					X				X				
	MSP	Managing Successful Programmes	[63]					X		X						
	PM ² Program Management	PM ² Programme Management Guide	[64]					X								
	SCRUM	The SCRUM Guide	[65]									X				
Maturity Models	P3M3	Portfolio, programme, and project management maturity model	[66]	X				X				X				
	OPM3	Organizational Project Management Maturity Model	[17]	X				X				X				X
	CMMI	Capability Maturity Model Integration	[67]		X			X				X				
Competence frameworks	PMCD	Project Manager Competency Development Framework	[68]											X		
	APM CF	APM Competence Framework	[69]			X				X				X		X
	ICM PMO	IPMA Reference Guide ICB4 for PMO	[70]													X
	OCB	Organisational Competence Baseline for Developing Competence in Managing by Projects	[71]			X	X			X	X			X	X	X
	ICB	Individual Competence Baseline for Project, Programme and Portfolio Management	[19]			X	X			X	X			X	X	
	ICB Portfolio Management	Individual Competence Baseline for Portfolio Management	[72]			X	X									
	ICB Program Management	Individual Competence Baseline for Programme Management	[73]							X	X					
	ICB Project Management	Individual Competence Baseline for Project Management	[74]											X	X	
	ICB4CCT	Individual Competence Baseline for Consultants, Coaches and Trainers	[75]			X				X				X		

Fig. 3. (continued).

PSS – Practice Standard for Scheduling [37]: Its purpose is to give project management practitioners a concise overview of the advantages and benefits of a good schedule model. It outlines the essential

components of a reliable and efficient project scheduling methodology and offers quantitative tools for evaluating how well this standard's guidelines are being applied.

PSWBS – Practice Standard for Work Breakdown Structures [38]: It offers guidelines and principles for creating, developing, and implementing Work Breakdown Structures (WBS). However, this standard does not provide detailed “how-to” guidance.

EVM – The Standard for Earned Value Management [39]: It offers an overview of Earned Value Management (EVM). It is practice-oriented and expands the perspectives on choosing and selecting the best course of action for project planning and delivery. Consequently, it helps project teams and other interested parties to customize their framework for planning, managing, and implementing delivery. It offers instructions on how to apply EVM in predictive, hybrid, and agile settings.

SRMPPP – The Standard for Risk Management in Portfolios, Programs, and Projects [40]: The implementation of risk management in the context of enterprise risk management (ERM), which encompasses the domains of project, program, and portfolio, is described in this standard. It explains risk management terminology and concepts and identifies the key elements of risk management that must be included in portfolio, program, and project governance layers.

SPortM – The Standard for Portfolio Management [41]: To help organizations effectively manage complex and demanding programs and project investments, it identifies performance management domains and project portfolio management principles that are widely acknowledged as good practices.

OPM – The Standard for Organizational Project Management [42]: Guidelines for developing an Organizational Project Management (OPM) framework are provided in this standard. By creating and connecting portfolio, program, and project management principles and practices with organizational enablers and organizational processes to support strategic objectives, OPM entails modifying and aligning practices and processes to provide the best support for accomplishing the organization’s strategic objectives.

4.2.2. Methodologies

The documents of the Methodologies category are described next.

PM² Project Management – PM2 Project Management Methodology [13]: It helps project managers oversee the whole project lifecycle and provide advantages and solutions to their organizations by effectively managing their projects. It incorporates widely recognized best practices in project management.

PRINCE2 – Managing successful projects [43]: It is an adjustable process-based project management methodology. According to this methodology, a project should have an organized and regulated beginning, organized and controlled means, and the ability to declare itself finished once the desired outcome is attained.

PRINCE2 Agile [44]: It offers the foundations of agile principles and techniques, together with PRINCE2 methodology. It combines the well-structured PRINCE2 governance with agile responsiveness and flexibility.

4.2.3. Guides & frameworks

The documents of the Guides & Frameworks category are described next.

P3O – Portfolio, Programme and Project Offices [45]: It offers a structure for decision-making and delivery support for organizational changes. It provides general guidelines to help people and organizations create, develop, and sustain suitable business support structures.

MoP – Principles, practices, and procedures for successful portfolio management [46]: It includes principles, techniques, and practices that help an organization implement portfolio management successfully. Instead of focusing on the efforts of individual initiatives, it concentrates on the transformation that project and program management as a whole delivers.

M_o_R – The Management of Risk [47]: Its purpose is to assist organizations in putting in place a framework for successful risk management, helping to make well-informed decisions regarding the risks affecting their operational, project, program, or strategic goals.

PRAMG – Project Risk Analysis and Management Guide [48]: This guide is focused on the risk issues that affect the project manager. It addresses how the project-level risk management process connects to corporate or program-level risk management.

PMBOK guide – A Guide to the Project Management Body of Knowledge [1]: It offers the fundamentals for project management. It is applicable independent of the industry, region, size, or mode of delivery (e.g., predictive, hybrid, or adaptive). It explains the system that projects work in, including governance, functions, project environment, and aspects to consider when determining how project and product management interact.

GE PMBOK – Government Extension to the PMBOK Guide [49]: It offers an overview of the main project governance characteristics commonly accepted as best practices and applicable to most public sector organizations. It establishes a framework for ensuring public sector projects’ successful and efficient management.

BRM – Benefits Realization Management: A Practice Guide [50]: It describes how to conduct Benefits Realization Management (BRM), emphasizing services and products, results, and process enhancement. It covers the daily organization and management of the endeavor to realize and maintain potential benefits from investments in projects, programs, and portfolios.

RM – Requirements Management: A Practice Guide [51]: It offers orientation for program and project managers seeking to comprehend the elements and significance of requirements management. It describes tasks to perform and the fundamental knowledge required to carry out requirements management on projects and programs in an efficient manner.

GPMP – Governance of Portfolios, Programs, and Projects: A Practice Guide [30]: It offers orientation to organizations and practitioners about improving or implementing governance on projects, programs, and portfolios. It clarifies the differences and offers further insight into the various types, domains, and functions of governance.

PMG – Project Managers’ Guide [52]: It comprehensively covers the topics of project implementation, from the initiation to the project close-out, providing the project manager with an overview of relevant topics in the daily operations of the project.

APMG – Agile Project Managers’ Guide [53]: To improve the analysis and evaluation of the project environment, it describes methods that may be applied to agile project management. It covers the “soft facts” of agile project management and the people involved in the projects.

PM² Agile – The PM²-Agile guide [54]: It supports institutions and organizations using PM² to effectively introduce Agile practices to their projects while maintaining enterprise awareness and compliance at the overall project level. PM²-Agile should be perceived/understood as an extension of PM².

APMBoK – APM Body of Knowledge [5]: It describes concepts, functions, and activities that make up professional project management. It is a well-established collection of project, program, and portfolio management knowledge.

APMIPM – APM Introduction to Programme Management [14]: It aims to give insights into program management, including definitions, how it works, and perspectives.

GUBMF – A guide to using a benefits management framework [55]: To prioritize investments (projects and activities), it aligns business units and project benefits with the organizational strategic objectives or KPIs (Key Performance Indicators). A collection of techniques, processes, and tools underpin the framework, ensuring that benefits are precisely identified, maximized, and collected.

PMPG – Portfolio Management – A practical guide [56]: It describes how portfolio management is a critical tool to help an organization maximize value and optimize the fulfillment of its strategic goals.

PM² Portfolio Management – PM² Portfolio Management Guide [57]: It is a framework developed to support institutions and organizations using PM² to effectively create, manage, and obtain benefits from

managing projects, programs, and components at the portfolio level. It has been developed as an extension of PM².

DC: GGPM – Directing Change: A Guide to Governance of Project Management [58]: Its aim is to persuade directors and other individuals holding corporate governance positions to embrace the best project and program governance practices. The interests of directors, project and program teams, and other interested parties must be aligned to accomplish it.

EVM Handbook – Earned Value Management Handbook [59]: It offers orientation for Earned Value Management (EVM) foundations and practice. EVM is useful for managing, planning, and controlling programs and projects, from small to large ones.

EVM: APMGuide – Earned Value Management: APM Guidelines [60]: It outlines the process for setting up and maintaining an Earned Value Management system.

P2M – A Guidebook of Program & Project Management for Enterprise Innovation [61]: It is a body of knowledge that combines project and program management to address complex issues. Its goal is to increase organizational value by considering changes in the external environment, providing solutions to complex problems, and increasing value.

GAPP – A Guide to Auditing Programmes and Projects [62]: This guide aims to provide direction to individuals involved with the executives and professionals participating in the program and project audit processes.

MSP – Managing Successful Programmes [63]: It is a well-established framework of best practices for program management that aims to facilitate enterprise agility and align projects and programs with organizational strategy. MSP prioritizes delivering benefit outcomes while actively involving interested parties and reducing risk.

PM² Program Management – PM² Programme management Guide [64]: It is a framework developed to support institutions and organizations using PM² to run their Programmes effectively. It has been developed as an extension of PM².

SCRUM – The SCRUM Guide [65]: It offers a lightweight, agile framework that helps individuals, teams, and organizations create value by finding adaptive solutions to challenging problems. It purposely just outlines the components needed to put Scrum into practice.

4.2.4. Maturity models

The documents for the maturity models category are described next.

P3M3 – Portfolio, programme, and project management maturity model [66]: It serves as a framework for performance evaluation, benchmarking, and improvement plan development within an organization. P3M3 enables the evaluation of the entire organization or certain business units to understand better. It looks at the entire system rather than just the processes.

OPM3 – Organizational Project Management Maturity Model [17]: It is an organizational project management maturity model. It provides knowledge about organizational project management, a tool to assess maturity, the ability to determine the organizational state on a maturity continuum, and the information necessary for the organization to decide whether or not to pursue a plan of improvement.

CMMI – Capability Maturity Model Integration [67]: It offers orientation for enhancing the organization's processes and ability to oversee the creation, acquisition, and upkeep of goods and services. Incorporating proven approaches into a framework assists an organization in evaluating its processes and organizational maturity, setting improvement priorities, and carrying out changes. It grounds many other maturity models.

4.2.5. Competence frameworks

The documents for the Competence frameworks category are described below.

PMCD – Project Manager Competency Development Framework [68]: It offers a framework for defining, evaluating, and improving

project, program, and portfolio management competencies. It outlines the essential components of competence and pinpoints the most likely to impact how well managers execute in the project, program, and portfolio domains.

APM CF – APM Competence Framework [69]: It defines the competencies that project professionals must possess for successful 4P management.

ICM PMO – IPMA Reference Guide ICB4 for PMO [70]: This standard defines the competencies of the individuals working in structures (Project Management Offices) that support projects, programs, and portfolios to run them effectively and efficiently.

OCB – Organisational Competence Baseline for Developing Competence in Managing by Projects [71]: It introduces the concept of organizational competence in project management. It provides a holistic approach to help organizations improve how they manage their programs, projects, and portfolios.

ICB – Individual Competence Baseline for Project, Programme and Portfolio Management [19]: It is a worldwide standard for individual competence in project, program, and portfolio management. It provides a comprehensive inventory of competence elements across projects, programs, and portfolios, supporting individual competencies development.

ICB Portfolio Management – Individual Competence Baseline for Portfolio Management [72]: It is a thorough inventory of the competencies a person must possess or acquire to manage portfolios properly.

ICB Program Management – Individual Competence Baseline for Programme Management [73]: It is a thorough inventory of the competencies a person must possess or acquire to manage programs properly.

ICB Project Management – Individual Competence Baseline for Project Management [74]: It is a thorough inventory of the competencies a person must possess or acquire to manage projects properly.

ICB4CCT – Individual Competence Baseline for Consultants, Coaches and Trainers [75]: The competencies of people in project, program, and portfolio management consulting, coaching, and training are covered in this framework. It concentrates on coaching, training, and consulting abilities, considering that professionals in these domains might have to transition between them.

5. Framework evaluation and discussion

Two focus groups were carried out to evaluate and discuss the proposed framework. The discussion was structured around two main themes: 1) participants' opinions about the framework's usefulness and organization; and 2) insights for improving the model and respective dissemination. The main results are presented next.

5.1. Framework completeness and usefulness

The focus group participants were first invited to write down a list of all standards, guides, methodologies, and other 4P management documents they were aware of. On the one hand, no standard, guide, methodology, or other document identified by the participants was missing from the proposed framework. On the other hand, the standards, guides, and methodologies identified by the participants were considerably fewer than those in the framework. This confirmed the completeness of the framework. Moreover, we asked a simple additional question: whether one of the documents was a framework or a methodology. About 50 % of the participants could not answer correctly, reinforcing the importance of the conceptual clarity provided by the proposed framework.

Then we presented an unorganized list of the standards, guides, and methodologies and asked participants, supposing that they would need to select one of them for one endeavor, what would be the difficulties? They stated that: 1) It is time-consuming to try to find all suitable documents (standards, guides, methodologies, and others) due to their high

number and diversity (P2, P4, P7, P9); 2) It is difficult to be aware of all documents and respective versions since the sources are dispersed (P1, P7); 3) It is not easy to know the focus of each document (P7, P8, P9, P11); 4) There is currently a great misunderstanding regarding concepts like “guide”, “framework” or “methodology”, or of what expected from each one (P9, P11); 5) The information available online (including the information provided by Artificial Intelligence (AI) apps) is not organized and it is easy to get imprecise or incorrect information (P6, P7). Furthermore, participants mentioned that it would be useful to have organized information about the guides, at least identifying their focus (e.g., portfolio management), to make it easier for practitioners to identify the suitable documents for their endeavors (P1, P2, P7). P3 also mentioned that having that organized information would contribute to more practitioners’ awareness regarding the several alternative documents to use.

After getting these insights, we presented the framework, asking participants if they would consider it useful (and why) and if they were interested in accessing it to support their activities. The answers were unanimously favourable since, in the participants’ opinion: 1) It helps to identify the documents according to their focus (e.g., project management) (P4, P5, P7); 2) It brings conceptual clarity, reducing ambiguity and misunderstanding regarding the document types (e.g., guides vs methodologies) (P1, P3, P6, P9), which is an important theoretical contribution; 3) It reduces the time needed when looking for suitable documents (P5, P6, P8, P9); 4) It raises awareness regarding the extant documents (P2, P3, P6, P8); 5) It is helpful for learning/teaching/researching purposes due to the provided organized list of documents (including in course design) (P3, P5, P6, P10, P11); 6) It reduces the risk of practitioners not thinking about alternatives to the guides that they know (P6, P7, P8); 7) It may help organizations, when contracting, to identify the guides that practitioners should know to apply to the position (P2); 8) It helps practitioners to think beyond the trending/mainstream documents (P7, P8, P9, P10); 9) It raises confidence on the documents classification (e.g., methodology) and focus (e.g., project management) (P9, P11). Participants P1 and P6 noted that it would be interesting to have information about the most used standards, for instance, in certain countries, industries, project types, etc. It would also be useful to have software capable of suggesting standards, guides, etc., according to user requirements.

5.2. Framework dissemination

Dissemination is a fundamental step in research. In that sense, we asked participants for suggestions for presentation and dissemination. As expected, they suggested academic and practitioner publications (P1, P2, P5, P9, P11) and dissemination workshops (P2). Another important suggestion was to create a website to make the framework accessible to the broader public (P3, P6, P10).

We then introduced a prototype of a website with information about the framework (see Fig. 4). The website is part of a larger project of an Observatory of Project, Program, and Portfolio standards proposed by Tenera and Varajão [4]. Again, we asked for the participants’ opinions. The overall perspective was very good, and the only suggestion for improvement was to create a complementary view of the available information. At the time, the information was only organized by document type (e.g., guides & frameworks, methodologies, etc.). Participants (P1, P3, P6, P7, P9) suggested adding a new view to enable information view by focus (e.g., project management). The website is available at observatory4ps.sciencesphere.org. At the end of the discussion, participant P1 asked, “Well, when will I be able to share the link with my students?... [smile]”. The final remarks were enthusiastic, particularly from some participants (e.g., P1, P2, P4, P9), all considering the framework and the supporting website beneficial for theory and practice.

6. Conclusion

This paper proposes a new framework of standards, guides, and methodologies for 4P management. Additionally, relevant documents related to PMO management are also considered.

The work presents several contributions. Theoretically, the framework provides conceptual clarity and an integrated perspective of standards, guides, and methodologies, facilitating its study and research. It also has the value of preserving the history of project management since it is a snapshot of the current state of the art of standards, guides, and methodologies in this area. On the practical level, the framework is a valuable tool to support the practices of project managers and organizations since professionals can use it to identify existing alternatives of standards and guides suitable to their needs. At the educational level, the framework provides teachers, students, and training entities with a basis for studying relevant references and designing training courses.



Fig. 4. Website prototype (sample pages).

This article is not without limitations. One of the limitations is related to the documents analyzed. On the one hand, the development of the work included the entities considered most prominent and relevant in the area, as well as the most frequently referenced documents. On the other hand, there is the risk that other entities and documents were not considered here, for example, because they are specific to a particular country or are not available in English. Those should be considered in future work.

For future work, because the world of standardization and best practices is constantly changing, leading to new references and existing references updates, it will be necessary to revisit this work periodically to maintain its timeliness, being strongly recommended replication studies (including country-specific studies, such as [76]). Another work proposal concerns the standards, guides, and methodologies presented in the framework – it would be interesting to study them deeply to understand their relationships as well as the weaknesses and strengths of each one, with a view to their synergetic improvement. It would also be interesting, although possibly utopian, to try to articulate the various references to create unified standards (e.g., a unified competence guide), reflecting the virtues of the various references.

Appendix. List of standards and guides

Note: The acronyms in *italics* are not defined by the entities that publish the documents (they were defined in this work to facilitate documentation referencing).

Abbreviation	Document	Ref.	Entity	Link
ISO 21500	ISO 21500 – Project, programme and portfolio management – Context and concepts	[11]	ISO	https://www.iso.org/standard/75704.html
ISO 21502	ISO 21502 – Project, programme and portfolio management – Guidance on project management	[25]	ISO	https://www.iso.org/standard/74947.html
ISO 21503	ISO 21503 – Project, programme and portfolio management – Guidance on programme management	[6]	ISO	https://www.iso.org/standard/82868.html
ISO 21504	ISO 21504 – Project, programme and portfolio management – Guidance on portfolio management	[8]	ISO	https://www.iso.org/standard/82867.html
ISO 21505	ISO 21505 – Project, programme and portfolio management – Guidance on governance	[29]	ISO	https://www.iso.org/standard/63578.html
ISO 21508	ISO 21508 – Earned Value Management in project and programme management	[26]	ISO	https://www.iso.org/standard/63582.html
ISO 21511	ISO 21511 – Work Breakdown Structures for project and programme management	[31]	ISO	https://www.iso.org/standard/69702.html
ISO 10006	ISO 10006 – Quality management – Guidelines for quality management in projects	[32]	ISO	https://www.iso.org/standard/70376.html
ISO/IEC/IEEE 16326	ISO/IEC/IEEE 16326 – Systems and software engineering – Life cycle processes – Project management	[33]	ISO	https://www.iso.org/standard/75276.html
<i>SProgM</i>	The Standard for Program Management	[34]	PMI	https://www.pmi.org/pmbok-guide-standards/foundational/program-management
<i>PSPCM</i>	Practice Standard for Project Configuration Management	[35]	PMI	https://www.pmi.org/pmbok-guide-standards/framework/practice-standard-project-configuration-management
<i>PSPE</i>	Practice Standard for Project Estimating	[36]	PMI	https://www.pmi.org/pmbok-guide-standards/framework/practice-standard-for-estimating
<i>PSS</i>	Practice Standard for Scheduling	[37]	PMI	https://www.pmi.org/pmbok-guide-standards/framework/practice-standard-scheduling-3rdedition
<i>PSWBS</i>	Practice Standard for Work Breakdown Structures	[38]	PMI	https://www.pmi.org/pmbok-guide-standards/framework/practice-standard-work-breakdown-structures-3rd-edition
<i>EVM</i>	The Standard for Earned Value Management	[39]	PMI	https://www.pmi.org/pmbok-guide-standards/foundational/earned-value-management
<i>SRMPPP</i>	The Standard for Risk Management in Portfolios, Programs, and Projects	[40]	PMI	https://www.pmi.org/pmbok-guide-standards/foundational/risk-management
<i>SPortM</i>	The Standard for Portfolio Management	[41]	PMI	https://www.pmi.org/pmbok-guide-standards/foundational/standard-for-portfolio-management
<i>OPM</i>	The Standard for Organizational Project Management	[42]	PMI	https://www.pmi.org/pmbok-guide-standards/foundational/organizational-project-management
<i>PM² Project Management</i>	PM ² Project Management Methodology	[13]	EU	https://pm2.europa.eu/downloads_en
PRINCE2	PRINCE2: Managing successful projects	[43]	AXELOS	https://www.axelos.com/certifications/propath/prince2-project-management

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CRediT authorship contribution statement

João Varajão: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. **Luciana Lopes:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation. **Alexandra Tenera:** Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

(continued)

Abbreviation	Document	Ref.	Entity	Link
PRINCE2 Agile	PRINCE2 Agile	[44]	AXELOS	https://www.axelos.com/certifications/propath/prince2-agile-project-management
P3O	Portfolio, Programme and Project Offices	[45]	AXELOS	https://www.axelos.com/certifications/propath/p3o-project-offices
MoP	MoP: Principles, practices, and procedures for successful portfolio management	[46]	AXELOS	https://www.axelos.com/certifications/propath/mop-portfolio-management
M_o_R	M_o_R: The Management of Risk	[47]	AXELOS	https://www.axelos.com/certifications/propath/mor-risk-management
PRAMG	Project Risk Analysis and Management Guide	[48]	APM	https://www.apm.org.uk/book-shop/project-risk-analysis-and-management-guide-2nd-edition/
PMBOK	PMBOK guide: A Guide to the Project Management Body of Knowledge	[1]	PMI	https://www.pmi.org/pmbok-guide-standards/foundational/PMBOK
GE PMBOK	Government Extension to the PMBOK Guide	[49]	PMI	https://www.amazon.com/Government-Extension-PMBOK%C2%AE-Guide-Third/dp/1930699913
BRM	Benefits Realization Management: A Practice Guide	[50]	PMI	https://www.pmi.org/pmbok-guide-standards/practice-guides/benefits-realization
RM	Requirements Management: A Practice Guide	[51]	PMI	https://www.pmi.org/pmbok-guide-standards/practice-guides/requirements-management
GPPP	Governance of Portfolios, Programs, and Projects: A Practice Guide	[30]	PMI	https://www.pmi.org/pmbok-guide-standards/practice-guides/governance
PMG	Project Managers' Guide	[52]	IAPM	https://www.iapm-cert.net/documents/pmg-en
APMG	Agile Project Managers' Guide	[53]	IAPM	https://www.iapm-cert.net/documents/apmg-en
PM ² Agile	The PM ² – Agile guide	[54]	EU	https://pm2.europa.eu/downloads_en
APMBoK	APM Body of Knowledge	[5]	APM	https://www.apm.org.uk/book-shop/apm-body-of-knowledge-7th-edition
APMIPM	APM Introduction to Programme Management	[14]	APM	https://www.apm.org.uk/book-shop/apm-introduction-to-programme-management-2nd-edition/
GUBMF	A guide to using a benefits management framework	[55]	APM	https://www.apm.org.uk/v2/media/y2phxpmi/benefits-management-framework-sample-chapter.pdf
PMPG	Portfolio Management – A practical guide	[56]	APM	https://www.apm.org.uk/book-shop/portfolio-management-a-practical-guide/
PM ² Portfolio Management	PM ² Portfolio Management Guide	[57]	EU	https://pm2.europa.eu/downloads_en
DC: GGPM	Directing Change: A Guide to Governance of Project Management	[58]	APM	https://www.apm.org.uk/book-shop/directing-change-a-guide-to-governance-of-project-management-3rd-edition/
EVM Handbook	Earned Value Management Handbook	[59]	APM	https://www.apm.org.uk/book-shop/earned-value-management-handbook/
EVM: APMGuide	Earned Value Management: APM Guidelines	[60]	APM	https://www.apm.org.uk/book-shop/earned-value-management-apm-guide-lines-2nd-edition/
P2M	P2M – A Guidebook of Program & Project Management for Enterprise Innovation	[61]	PMAJ	https://www.pmaj.or.jp/ENG/p2m/p2m_guide/p2m_guide.html
GAPP	A Guide to Auditing Programmes and Projects	[62]	APM	https://www.apm.org.uk/book-shop/a-guide-to-auditing-programmes-and-projects/
MSP	Managing Successful Programmes	[63]	AXELOS	https://www.axelos.com/certifications/propath/msp-programme-management
PM ² Program Management	PM ² Programme Management Guide	[64]	EU	https://pm2.europa.eu/downloads_en
SCRUM	The SCRUM Guide	[65]	SCRUM	https://scrumguides.org/
P3M3	Portfolio, programme, and project management maturity model	[66]	AXELOS	https://www.axelos.com/for-organizations/p3m3
OPM3	Organizational Project Management Maturity Model	[17]	PMI	https://www.pmi.org/learning/library/pmi-organizational-maturity-model-7666
CMMI	Capability Maturity Model Integration	[67]	CMMI Institute	https://cmmiinstitute.com/
PMCD	Project Manager Competency Development Framework	[68]	PMI	https://www.pmi.org/pmbok-guide-standards/framework/pm-competency-development-3rd-edition
APM CF	APM Competence Framework	[69]	APM	https://www.apm.org.uk/resources/find-a-resource/competence-framework/
ICB PMO	IPMA Reference Guide ICB4 for PMO	[70]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/e-books-ipma-standards/ipma-reference-guide-icb4-for-pmo-ebook/?v=35357b9c8fe4
OCB	Organisational Competence Baseline for Developing Competence in Managing by Projects	[71]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/organisational-competence-baseline-for-developing-competence-in-managing-by-projects-ebook
ICB	Individual Competence Baseline for Project, Programme and Portfolio Management	[19]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/e-books-ipma-standards/individual-competence-baseline-for-project-management-ebook/?v=35357b9c8fe4
ICB Portfolio Management	Individual Competence Baseline for Portfolio Management	[72]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/individual-competence-baseline-for-portfolio-management-ebook
ICB Program Management	Individual Competence Baseline for Programme Management	[73]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/individual-competence-baseline-for-programme-management-ebook
ICB Project Management	Individual Competence Baseline for Project Management	[74]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/individual-competence-baseline-for-project-management-ebook
ICB4CCT	Individual Competence Baseline for Consultants, Coaches and Trainers	[75]	IPMA	https://www.shop.ipma.world/shop/ipma-standards/e-books-ipma-standards/individual-competence-baseline-for-consultants-coaches-and-trainers-ebook

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