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Article

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# Comparison of different Standards and Norms in Project Management

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## Abstract

**Successful project management requires the use of process models that meet the requirements of the respective project context. Such process models can be derived from standards and norms in project management. During the 20<sup>th</sup> century, traditional, plan-based standards and norms were published by various international organizations such as the Project Management Institute or the International Project Management Association. Today, the variety of approaches includes not only the traditional ones, but also agile project management and hybrid combinations. In this paper, important standards and norms are summarized and compared. Strategies in training, professional application and the design of new procedural models can be derived from the results.**

## 1 Introduction

Project management has been known for many years as a management approach that enables the successful definition, execution and completion of projects of various types. Significant contributions were made during the rise of space programs in the mid-20<sup>th</sup> century. The purpose was to ensure that such critical programs could be completed with the highest possible degree of certainty including safety of the project outcome. In the 1950s and subsequent years, process models were developed to facilitate the quality and safety of the project outcome [1]. Examples include the waterfall model [2][3], the Vee-model [4], the spiral model [5], and simultaneous engineering, also known as concurrent engineering [6]. Wynn and Clarkson provide a broad overview of many process models for engineering development projects [7].

In 1986, Takeuchi and Nonaka presented their groundbreaking paper about a "new development game" [8]. They studied projects in several Japanese companies and derived relevant success factors. They found that successful technical development projects need some built-in instability to arrive at innovative solutions. Project teams need the freedom to organize their own work. They also emphasize that sequential development phases are prone to rework later, and suggest overlapping phases instead. They also highlight the need for learning and knowledge transfer, as well as subtle control.

The contributions of Takeuchi, Nonaka and others contributed significantly to the emergence of agile process models in the 1990s. Product complexity increased significantly

due to technical progress and the growing importance of software. Many projects failed because they were not able to derive a complete and consistent set of requirements, implement them without errors, and test them successfully. In addition, many products lost their customer orientation. New values and principles for successful technical development projects were proclaimed and processed into new process models. Schwaber and Sutherland introduced Scrum in 1995 as a process model for agile software development [9]. Scrum integrates many success factors of Takeuchi and Nonaka. In the following years, other agile process models, such as Extreme Programming [10] and the Crystal Family [11] became popular.

In 2001, Beck et al. summarized important values and principles of this new way of working, and published them online as the agile manifesto [12]. Today, these values and principles characterize agile process models and an agile, customer-centric, iterative, and flexible approach to project management that facilitates the development of innovative products. Most agile process models are particularly suited to small teams working together in a confined space. Good products are seen as much more important than strict controlling, project reporting and documentation. However, applying iterative development to projects other than software development requires special techniques. The reason is that other types of projects often require more time to progress than software programming. Overall, this led to the formation of hybrid process models, such as the water-scrum case process model, which replaces one or more phases of the waterfall model with iterative, scrum-like development. In 2009, DevOps emerged as a process model that combines

software development with software operations and can thus also be considered a hybrid process model [13].

Like cooking recipes, process models guide through the project management lifecycle. A process model is a description of a process at the type level. From this type level, instantiations can be derived and executed [14]. Process models are generic models for process execution which are not necessarily controlled by a formal international organization. An example is the waterfall process model. Unfortunately, the terms standard, framework, methodology, and process model are not consistently used in literature. In order to establish a clear terminology in this paper, the following definitions are applied: Standards and norms in project management are internationally accepted, documented, and mostly controlled requirements and guidelines for project management. While standards are often associated with official standardization organizations such as the International Organization for Standardization (ISO), norms are considered less formal. In this work, no distinction is made between standards and norms. Mostly, both terms are mentioned to make clear that both views are taken into account. Examples include the PMBoK [15], ICB 4.0 [16], PRINCE2 [17], and the ISO 21502 [18]. Additionally, Scrum [19] and Kanban [20] are nowadays established project management norms. Standards and norms help the involved people to apply the process models by providing comprehensive knowledge about project management, methods, roles, and tools. In general, standards are documented requirements and guidelines for repeatable tasks and processes. They can include criteria, methods, processes, and practices. Frameworks, in contrast, are logical structures for classifying and organizing complex information [21]. They are rather vague or generic and have to be adjusted to a certain situation before they can be applied. An example is the framework for the construction and tailoring of engineering development process models (FELICS) [22]. Another term found for the description of project management guidelines is project management methodology. A methodology is a documented approach for performing activities in a coherent, consistent and reproducible manner [23]. Typically, it is much more detailed and can be applied right away, e.g. the method of creating a work breakdown structure.

The aim of this paper is to provide an overview and comparison of the widely used standards and norms in project management. This information can be used to define curricula in education and training. It will also help practitioners to select the standard that best fits their project context and task. Finally, the overview can be used to derive new process models for project management.

## 2 Methodology

To ensure the quality of the research presented in this paper, established research methods were used. First, relevant standards and norms were derived from a literature review [24]. The identified standards and norms were read and relevant building blocks were grouped for comparison purposes. Finally, the standards and norms were mapped to current process models for completeness and usefulness.

## 3 State of the Art Standards and Norms

It is not easy to determine the relevance of standards and norms in project management in general. In this work, the relevance of a standard and a norm was derived from the distribution of the corresponding certificates. Most organizations that issue such standards offer certificates for individuals or companies. The certificates can be used to demonstrate competencies related to the respective standard. Often, such certificates are on the wish list of potential employers of project managers.

The most common certificates in project management in Germany [25] are issued by the Deutsche Gesellschaft für Projektmanagement (GPM), i.e. the German chapter of the International Project Management Association (IPMA) [16], the Project Management Institute (PMI) [15], and Axelos with Projects in Controlled Environments (PRINCE2) [17]. Among the most common agile certificates [26], on the other hand, are the Certified Scrum Master Certificates from ScrumAlliance.org [27], and the Professional Scrum Master from Scrum.org [28]. Two widely known standards have been added to this list for which there are no well-established certificates, namely the ISO 21502 which just recently received an update [18] and Kanban as a simple and robust standard, that is applicable to many projects and in many situations [20]. In summary, the following standards were selected for comparison:

- Project Management Body of Knowledge (PMBoK) of the Project Management Institute (PMI) [15]
- Individual Competence Baseline (ICB 4.0) of the International Project Management Association [16]
- Projects in Controlled Environments (PRINCE2) of Axelos [17]
- International Standard ISO 21502 Project, programme and portfolio management - Guidance on project management [18]
- Scrum [19]
- Kanban [20]

## 4 Comparison of Standards and Norms

The standards were read and analyzed by the authors in order to derive the building blocks. Each of the standards has its specific strengths and characteristics. They are described or published in very different ways. While the PMBoK is described in a book with about 750 pages, Kanban can be summarized in 10 sentences (4 principles and 6 practices). The analysis, thus, started with the identification of core elements, i.e. elements, which serve as common basis for the data collection. The core elements selected in this research were:

- Name: Each standard can be identified with a unique name.

Table 1: Overview of the core elements name, general characteristics, roles, structure, and methods of relevant standards

Standard / Process Model	General Characteristic	Roles	Structure	Methods	Certificates
PMBok [15] (> 700 pages)	process-based, mostly plan-based, traditional point of view	several roles with strong emphasize on project manager; further roles include sponsors, governing bodies, steering committees, project mgt. offices, team, suppliers, customers, end users, stakeholders	5 process groups: initiating, planning, executing, monitoring and controlling, closing; 10 project management knowledge areas assigned to process groups: integration, scope, schedule, cost, quality, resource, communications, risk, procurement, stakeholder	methods can be derived from the knowledge areas; for each process group, different methods are proposed; methods include: project charter, project plan, work packages, cost estimation, risk, analysis, quality plan, communications plan, stakeholder mgt. plan	several levels are available: foundation: certified associate in project management (CAPM); professional: project management professional (PMP); additionally: agile add-on certificates like the agile certified practitioner (PMI-ACP)
ICB 4.0 [16] (> 400 pages)	competence-based, mostly plan-based, traditional point of view	several roles, including project sponsor, steering committee project manager, project team, customers, suppliers, employees, line and program managers	3 competence domains: people (consisting of 5 competence elements, i.e. strategy, governance, compliance, power, culture), perspective (10 elements, i.e. self-reflection, integrity, communication, engagement, leadership, teamwork, conflicts, resourcefulness, negotiation, result orientation), and practice (14 elements, i.e. design, requirements, scope, time, organization, quality, finance, resources, procurement, plan and control, risks, stakeholders, change, select and balance)	methods can be derived from required knowledge and skills which are assigned to each competence element, e.g. strategy plan, governance, project design, requirements management, scope plan, scheduling, quality assurance finance, project plan, controlling, risks, stakeholders	several levels are available: basic: basic certificate; foundation: IPMA level D certificate; professional: IPMA level C certificate; additionally: agile add-on certificates like the hybrid+ certificate
PRINCE2 [17] (> 400 pages)	focus on best practices and business case, mostly plan-based, traditional point of view	3 groups in project board: executives, senior users, and senior suppliers; additionally, roles like project assurance, change authority, project manager, project support, team manager	3 building blocks, i.e. 7 core principles (business justification, roles, focus on products, learning, manage by exception, manage by stages, tailoring), 7 themes (business case, change, organization, plans, progress, quality, risk), 7 processes (closing, controlling, directing, initiating, stages, product, and starting-up)	methods are assigned to principles, themes, and processes; examples include methods for detailed product description, change control, project plans, stage plans, team plans, risk analysis, business case, quality plan, reporting	several levels are available: foundation: PRINCE2 foundation certificate; professional: PRINCE2 practitioner certificate; additionally: agile stand-alone certificates like the PRINCE2 agile foundation certificate and the PRINCE2 agile practitioner certificate
ISO 21502:2021 [18] (> 60 pages)	process-based similar to PMBoK, mostly plan-based, traditional point of view	several roles, including project sponsor, steering committee, project manager, project team, customers, suppliers, employees	5 process groups: initiating, planning, implementing, controlling, closing	18 subject groups (themes): integration, planning, benefits, scope, resources, time, cost, risk, issues, change control, quality, stakeholder, communication, change, reporting, information/documents, procurement, lessons learned	no certificates available
Scrum (Scrum Guide) [19] (> 10 pages)	definitions and rules for roles events, and artifacts, focus on incremental development, agile approach	scrum team including product owner, development team, and scrum master	5 events (sprint, sprint planning, daily scrum, sprint review, sprint retrospective), 3 artifacts (product backlog, sprint backlog, increment) and several timeboxes	events and artifacts associated to methods, like iterative scope planning, size estimation, stand-up, meeting, and reviews	several levels are available, e.g. professional Scrum master I and II from scrum.org or certified Scrum master and advanced certified Scrum master from scrumalliance.org
Kanban [20] (≈ 1 page)	based on rather general principles and practices; large degree of freedom for tailoring, agile approach	no specific definition of roles; existing roles are to be respected; they should be carefully developed towards an agile mindset	4 principles (start where you are, improve incrementally, respect current roles, facilitate leadership); 6 practices (visualize workflow, limit work in progress, manage workflow, make process policies explicit, develop feedback loops, improve conjointly)	use of Kanbanboard, regular feedback loops, and the definition of an individual set of rules	Kanban certificates are not very common, scrum.org offers the professional Scrum with Kanban certificate

- General characteristics: This element describes the characteristic in a general way.
- Roles: Each standard comes with a certain integrated roles or at least some inherent understanding of relevant roles and their integration into the projects.
- Structure/Elements: The standards are structured in a

certain way which facilitates their understanding and emphasizes their approach to project management.

- **Methods:** Project management requires the application of methods in order to set-up the project, to conduct it, and to close it successfully. Typically, each standard introduces a certain set of methods.
- **Certification:** Some standards offer certificates which can be used to demonstrate certain competences regarding the respective standard.

In the next step of the data analysis, the standards were summarized according to the core elements derived in the preceding step above. The result of the analysis and data collection is shown in Table 1, which is an updated and extended version of the examination in [22]. The table also summarizes the number of content pages for each standard. While the three traditional standards PMBoK, ICB 4.0, and PRINCE2 comprise hundreds of pages, the agile representatives Scrum and Kanban show a rather compact documentation. The update relates to the addition of the "Certificates" column and the replacement of ISO 21500 with its successor, ISO 21502:2021.

The data collection and classification according to the core elements show that the standards have both, differences and similarities with regard to the identified core elements. While PMBoK, ISO 21502, and to some extent PRINCE2 take a process-based approach, ICB 4.0 is a competence-based standard. The process-based standards have a different perspective, i.e., they focus on the lifecycle process and provide guidance on what to do in which phase of project execution. The competence-based approach focuses on the skills and competence elements that the stakeholders must have in order to successfully execute the project. One of the distinctive features of PRINCE2 is its comprehensive approach, which also includes best practices and comparatively detailed information on how to tailor the standard.

The four standards PMBoK, ICB 4.0, PRINCE2 and ISO 21502 originate from traditional plan-based project management approaches. Recently, there have been attempts to integrate agile approaches as well, but a solid and comprehensive integration has not yet been completed. Mostly, agile is seen as something different rather than an integrative part of modern project management, in which different approaches are used depending on the context and situation.

In contrast to the previously mentioned standards, Scrum and Kanban are agile standards and process models that help to apply the values and principles of the agile manifesto in daily project management. Even though their description differs significantly, both standards can be applied to a variety of projects in which the context allows for an agile way of working. The most common definition of Scrum comes from the Scrum Guide [19], which explains the standard in 13 pages. Scrum uses multiple timeboxes to structure the project and help the stakeholders to work efficiently and effectively on the project scope. Kanban is defined by only four principles and 6 practices. Instead of using timeboxes, it is flow-oriented and allows for asynchronous work.

## 5 Discussion and Conclusion

There is a large number of standards, norms, and procedural models in project management that have different characteristics. The motivation for using such a standard as a guide is manifold: They provide orientation for practitioners, help companies to provide comparable qualifications for all those involved in project management, and serve as proof of the individual's competence through corresponding certificates. In addition, the standards and norms reflect the state of the art in project management. As such, they serve as a basis for reflection and future development of the corresponding processes, competencies, roles, methods, values, and principles.

Although the standards and norms considered in this paper have been identified with care, there are other documented approaches to project management. Examples include the approaches and certificates of the International Association of Project Managers, APMG International, TÜV, and other organizations. In addition, there are standards that are relevant only to certain industries, such as the U.S. Food and Drug Administration's (FDA) design control requirements for medical device development projects. This paper focuses on the most common standards and a comparison of their core elements. These common standards were derived from statistics on the distribution of relevant certificates and supplemented by ISO 21502 and Kanban.

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