

PMI's Models of Project Management Knowledge – Life Cycles, Process Groups and Knowledge Areas

Crispin (Kik) Piney B.Sc., PgMP

1. Abstract

The PMI standards present knowledge using three overlapping models, as follows: life cycles, processes clustered into process groups, and knowledge areas. Analysis of these models shows that, although life cycles are a stand-alone concept, the other two models should be presented in a hierarchical manner, with knowledge areas as the highest level, subdivided with respect to the generic set of process groups, and these process groups containing the processes specific to the corresponding knowledge area. It should be noted that this structure is not how the concepts were first developed for the original *PMBOK® Guide*; however, the original structure was well-meant but incorrect. This note proposes a reworking of those original ideas to provide a consistent model that avoids the current – and damaging – confusion between process groups and life cycle phases.

2. Introduction

One role of a PMO is to act a “Centre of Excellence” for the managing of projects and programs within the organization. As part of this role, it needs to ensure an effective set of life cycle phases and a structured application of program and project management processes. A large number of organizations attempt to base themselves on PMI's *PMBOK® Guide* – and do it wrongly. Much of the responsibility for this confusion lies with the way in which the *PMBOK® Guide* is structured around process groups.

Many books and courses describing PMI's standards (whether for projects, programs or portfolios) talk about process groups as if they were phases. The standards in some places recognize this, and the *PMBOK Guide®* states “process groups are not phases”, but has not found a way of presenting the concepts sufficiently clearly to eliminate the confusion. Phases and process groups are both valuable concepts if used correctly, and this confusion is damaging to the profession.

PMI's standards – whether for projects, programs or portfolios – have now all adopted the same set of models for structuring the knowledge required in order to apply best practice in that domain. This three-dimensional view can be confusing even to practitioners in the field and experience shows that this is definitely the case for life cycles and process groups which are frequently confused (this is even the case with books and training courses aimed specifically at PMI's certification exams).

This article is designed to clear away some of the confusion and provide a basis for better understanding – and, potentially, changes to the way PMI standards are structured.

3. The Three Models

PMI presents three ways of structuring the field of project management. These are:

1. Life cycles (section 2.1 of the *PMBOK® Guide*)
2. Processes grouped into five process groups (chapter 3)
3. Knowledge areas (chapters 4-12).

3.1 Life Cycles

A life cycle is a set of normally sequential, interdependent phases leading from the start to the end of the project. It may be helpful to think of the life cycle of a butterfly (egg, caterpillar, pupa, butterfly)¹.

¹ As a terminological aside: “life cycle” refers to this development chain, “lifetime” refers to the span of time between the start and end of an item (we won't reach the stars in my lifetime) and “lifespan” measures the elapsed time from the start to the end of an event (e.g. the average human lifespan is still increasing in many countries).

The goal of a project life cycle is to subdivide the chronological development of the project into distinct parts (called “phases”) in order to ensure effective management and technical control by limiting the amount of future investment and work authorized at any point in time. In some circumstances, phases are subdivided into smaller elements, often called stages, as shown in Figure 1 below:

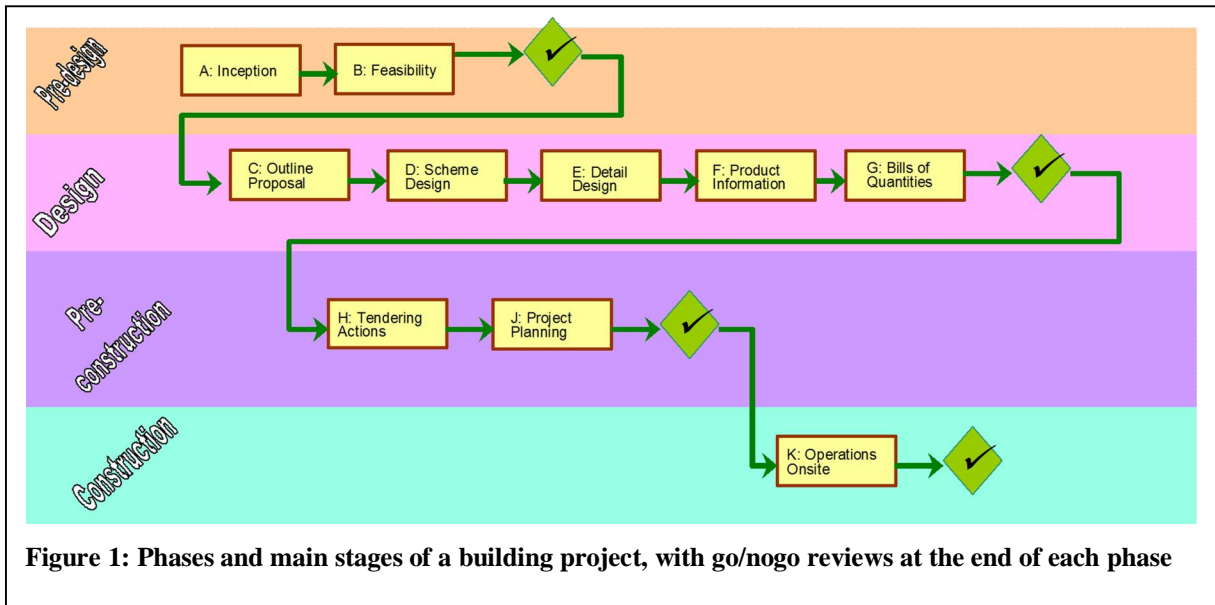


Figure 1: Phases and main stages of a building project, with go/nogo reviews at the end of each phase

It is interesting to note that the PRINCE2 standard by OGC explicitly states that one defining characteristic of a project is that it has a life cycle: in other words, if it does not have a life cycle, it is not a project.

3.1.1 Generic Structure

Since, as shown above, the actual project life cycle depends on the technical area of the development, a common set of terms at a higher level would be useful.

PMI tried (and failed) to get some of the way towards accepting the idea of, and defining, a generic *project structure* within which the project life cycle would fit. In the earlier editions, the generic form had an initial phase and a final phase, separated by an indefinite number of intermediate phases. Other authors have recommended a 4-*segment* structure. To avoid confusion, these must not share names with other artefacts such as process groups. My suggestion is the DO-IT structure of

- Define (or Decide) - the segment is closed once the decision do go ahead is made (this may entail developing the business case, carrying out feasibility studies, etc.)
- Organize - this segment entails developing the design, planning and sizing the effort, getting approval for all of this
- Implement - the segment in which the resources are deployed to create the deliverables and have them accepted
- Terminate - tidy up, wind down, stop².

3.2 Processes

A process in its most general form is a mechanism for transforming an input or set of inputs into an output or set of outputs by the application of a set of tools and techniques (e.g. the “drill a hole” process starts with a piece of wood [the Input], uses a drill [the Tool] and delivers: a piece of wood with a hole, plus sawdust [the Outputs]).

The whole subset of the body of knowledge addressed by PMI is translated into a number of processes (40 or so, per standard). A process can only belong to a single Process Group and a single Knowledge Area.

² For people who prefer an alphabetical mnemonic, Max Wideman has the CDEF life cycle: Conceive, Develop, Execute and Finish.

3.3 Process Groups

In the PMI standards, the processes are grouped into five process groups under the mnemonic IPECC:

1. Initiating
2. Planning
3. Executing
4. Controlling
5. Closing

The potential for confusion arises because (apart from “controlling”), the names of the groups could apply to life cycle phases. The confusion is compounded by the fact that PMI presents the concept of processes and process groups before describing knowledge areas. This issue is explained in more detail later on in this article.

Note however, that processes from the various process groups can be invoked in many phases. IPECC repeats within each one of the above phases, but to be more precise, there are multiple, simultaneous, asynchronous IPECC cycles running within each phase (e.g. you may be identifying new risks, while executing a part of communication plan, while closing a procurement, etc.)³

3.4 Knowledge Areas

A knowledge area (KA) is a subdivision of the body of knowledge that corresponds to a specific set technical or managerial activities that require a specific set of skills and experience to execute effectively.

There are nine knowledge areas defined in the Guide to the Project Management Body of Knowledge – such as Time Management, Risk Management, etc, – and several more defined within the Standard for Program Management.

It is at this point that the full value of processes can be seen: for example, in order to be able to manage time effectively in a project, you need to describe the actions clearly, and the process approach has obvious benefits for this. The process groups provide a means of carrying out the analysis and definition of each knowledge area in a consistent manner⁴: in any knowledge area, you may need to:

- do some initial setting-up (“initiating”)
- plan the activities in order to achieve the knowledge-area-related result (“planning”)
 - these will be integrated into a consolidated action plan (this is the link all of the KAs have to the Integration KA)
- Carry out the actions relevant to the KA (“execution”)
- Determine the effectiveness and alignment to the plan (“monitoring”)
- Propose additional actions, if any, based on the results of the current status (“control”)
- Carry out any knowledge-area-specific actions to terminate some or all of the activities in the KA (“closing”)

A process in one knowledge area can invoke, and provide inputs for, one of processes in the same or in other knowledge areas. The processes for each knowledge area are invoked whenever the need arises – for example, for Risk Management:

- Plan Risk Management (which is really an initiation process but that PMI has put into “planning”) is required in order to determine the overall approach applicable to the rest of the processes (it is known as “Establish [Risk Management] Context in ISO 31000). It needs initially to be carried out early in the life cycle so that it can be integrated into the project management plan, but also needs to be reiterated whenever the context is better understood or changes.

³ Fans of Sting might like to re-read this sentence while listening to the first verse of Windmills of Your Mind!

⁴ Apparently, in the original development of the *PMBOK® Guide*, the initial decomposition of the body of knowledge was in terms of processes. The concept of “process groups” and that of “knowledge areas” were developed in order to cluster together processes with similar characteristics. However these concepts add even more value if the way in which they are applied is reversed from the original bottom-up approach: break the body of knowledge up, first, into knowledge areas to capture skills, and then use the process groups to drive the analysis of each knowledge area in terms of processes

- Identify Risks, Analyse Risks (with two categories of analysis), and Plan Risk Responses belong in the “planning” group (Identification is a prerequisite to the Analysis, but is not obviously part of Planning – but there is no “Analysis” process group).
- Plan Risk Responses is a part of the “planning” group and
- Monitor and Control Risks belongs in the “monitoring and controlling” group – although it would be preferable to separate monitoring from controlling –
 - Monitoring includes
 - Checking the “watch list” of accepted risks
 - Tracking symptoms and warning signs of risks for which responses are required
 - Identifying triggers for contingency actions
 - Control implies
 - Executing actions agreed in the approved plan based on validated trigger conditions
 - Proposing additional actions to address the current situation
 - Requesting risk reassessment (full risk management cycle) under specific conditions such as phase transition, major events, etc.
- The PMI standards do not propose any explicit “closing” process for risk management, although there are a number of closing actions
 - When a risk can no longer occur: to exclude it from the active list
 - When the project terminates, transfer the information
 - Update risk-related lessons learned
 - Transfer any future, operational uncertainties to the receiving organization
 - Close outstanding project risks and archive the risk register.

4. Linkage

The second part of this article will address the changes required in the *PMBOK® Guide* or to local explanatory documents produced by the PMO as a Centre of Excellence to support their program and project managers in applying life cycles, knowledge areas and process groups in the most effective manner possible.

5. Process Groups within Knowledge Areas

As explained in Part 1, PMI's standards present each of the three models in the order: life cycles (chapter 2), processes in their groupings (chapter 3), and then knowledge areas (chapters 4 and ff.). This approach can give the impression on reaching Chapter 4 that knowledge areas are arbitrary clusters of the processes that were described in the earlier chapter. This is of course not the case at all, since the reverse is true and processes provide the driving force for delivering part of the corresponding knowledge area. In this way, the process groups provide a structured way of analysing one knowledge area at a time, identifying the best practices relative to that area, and describing the processes involved in delivering these best practices (e.g. "what do we need to do with respect to initiation to deliver effective integration?").

Seen another way, each Knowledge Area is a process in its own right, made up of component (sub-) processes. This view provides a progressive way of developing the content of each knowledge area in a manner compatible with the overall approach of the *PMBOK® Guide*: i.e. progressive elaboration and hierarchical decomposition.

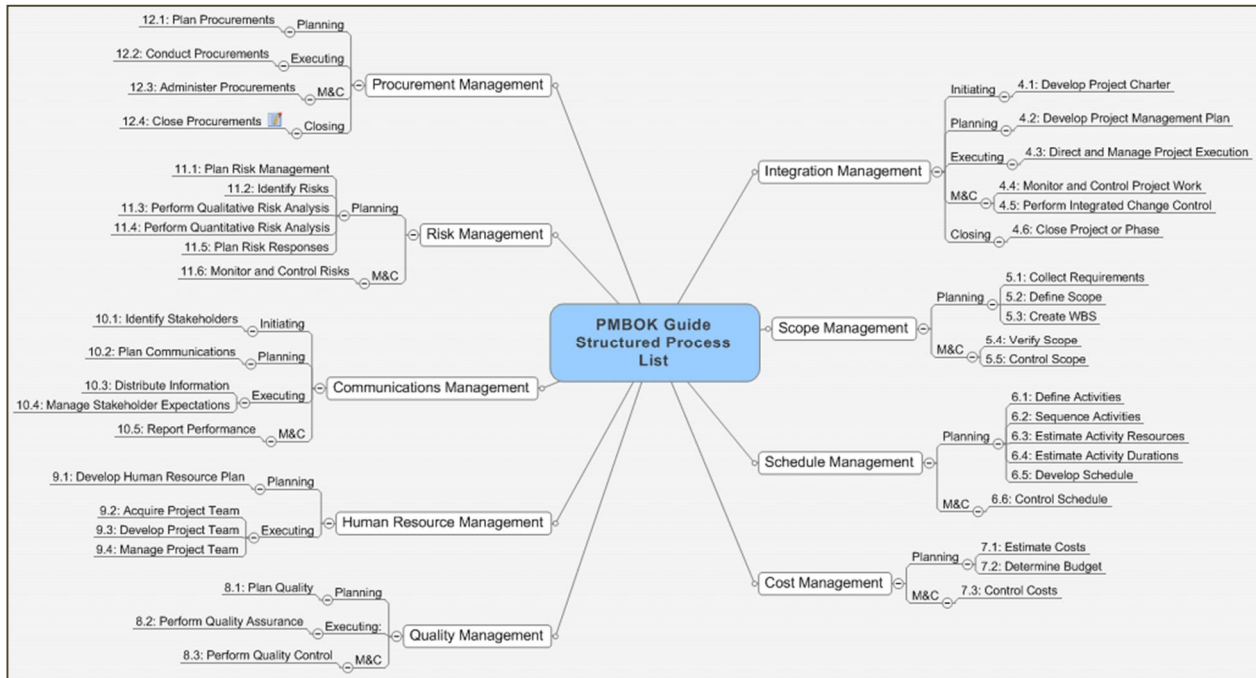
This analysis is best carried out by focussing, within the knowledge area, on each of the process groups in turn as explained in Part 1, using the example of Project Risk Management.

In this way, the process groups are an aid to analysis and understanding within a knowledge area. They provide a logical sequencing of steps *within* each knowledge area, and, in accordance with the progressive elaboration approach for projects, some or all of this sequence is normally reiterated a number of times during the lifetime of a project.

The crucial, additional point to understand is that although this looping happens in all knowledge areas, the loops are normally out of step with each other between knowledge areas although there can be some interactions (e.g. when a contract terminates ["closing" in Procurement Management] it is good practice to assess the situation with respect to risk ["planning" in Risk Management]).

Table 3-1 in the *PMBOK® Guide* gives the full set of processes in terms of both their corresponding process group and their knowledge area. Although this table is useful in that it shows the two groupings on a single chart, it fails to show the important concept that the process groups are clusters within the corresponding knowledge area and have much less significance outside those areas. For example, the Executing processes in Communications Management are *Distribute Information* and *Manage Stakeholder Expectations* and, in Integration Management, *Direct and Manage Project Execution*; these processes have much less in common with each other than they have in common with the other processes in their own knowledge area.

Table 3-1 can be shown using a mind map technique, in the hierarchy: Knowledge Area, Process Group, Process as shown below:



5.1 Potential for Confusion

Figure 3-3 in the *PMBOK® Guide* seems to show that the process groups do have a valid existence of their own outside the knowledge areas. The PDCA diagrams showing sequential links between the progress groups adds to the confusion already created by using life-cycle phase names for the process groups: Initiating, Planning, Executing, Controlling, Closing. This is dangerously misleading as it seems to associate process groups with phases within a specific life cycle. As an example, the terminology sometimes used of a project “being in the execution process group” is meaningless since, at any time, its active processes may be taken from more than just a single process group: so the project is actually “within” many process groups most of the time.

To explain why this multi-use of terms is a source of confusion, consider the following example:

You have a number of potential diseases (say 9, like Knowledge Areas), each with its own set of pills (40 or so, in all, like PMI's processes). There are, as we all know 7 days in the week, called Monday, Tuesday, etc. (our life cycle).

Now, you find that for organizational reasons, the Para-Medical Institute (PMI) has supplied you with the pills boxed together by similar characteristics, into 7 boxes called Monday, Tuesday, etc. (based on the traditional children's rhyme: for example "Monday's child is fair of face" for the pale pills, "Thursday's child has far to go" for the laxatives, etc.). They have included an instruction

sheet that states clearly “the names on the boxes **do not correspond to** the days on which you should take the pills”⁵.

For any given disease, or set of diseases, you will have to take pills from one or more of the boxes (labelled Monday, Tuesday, etc.) on one or more days of the week, depending on the disease and your constitution.

I, for one, would consider this to be a less than optimal way of ensuring compliance with the prescribed treatment regimen for a specific disease – as you would be tempted to confuse the pill boxes with a set of chronological instructions!

6. Changes to the *PMBOK® Guide – Fourth Edition*

6.1 Textual Changes

All of the text needs to be reviewed for references to process groups and adapted to make the relationships clear.

- ❖ “Project management is accomplished through the appropriate application and integration of the forty-two logically grouped project management processes comprising the five process groups.
 - Change to
 - “Project management is accomplished through application of the nine knowledge areas by means of the forty-two project management processes that make up the five process groups.”
- ❖ “The repetition of processes across all five process groups, as described in Chapter 3, provides that additional degree of control, and defines the boundaries of the phase.”
 - This is wrong. The definition of the boundaries of a phase is a life cycle feature that is supported within the Integration knowledge area.

6.1.1 Definition of the Process Groups – First Option

The first approach would be to change these definitions in order to avoid phase-related terminology (p.39). This does not change the composition of the process groups.

- **Initiating Process Group.** Those processes that determine the environment, set the rules and authority under which work should be carried out, and obtain the corresponding approval for that work.
- **Planning Process Group.** Those processes required to establish the scope, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.
- **Executing Process Group.** Those processes performed to deliver the work defined in the corresponding management plans.
- **Monitoring and Controlling Process Group.** Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and assess the corresponding changes.
- **Closing Process Group.** Those processes performed to finalize all activities relative to a given knowledge area.

The removal of the phase-related terms in the definitions of the Initiating and Closing groups makes it clear that these concepts need to be catered for elsewhere, and this need can best be satisfied by adding the following Controlling process to the Project Integration Management knowledge area: *Manage Phase Transitions*; this process can be defined in such a way as to allow the removal of the *Close Project or Phase* process.

6.1.2 Definition of the Process Groups – Improved Option

Given the preceding discussion, the need for the Initiating process group is much less clear so this group could be removed or replaced by an Analysis process group. The new definition as an **Analysis Process Group**⁶ would allow it to capture a number of processes currently rather uncomfortably in the planning

⁵ This statement was inspired by the one in the *PMBOK Guide®* that states “process groups **are not** project phases”

⁶ IPECC would become APECC

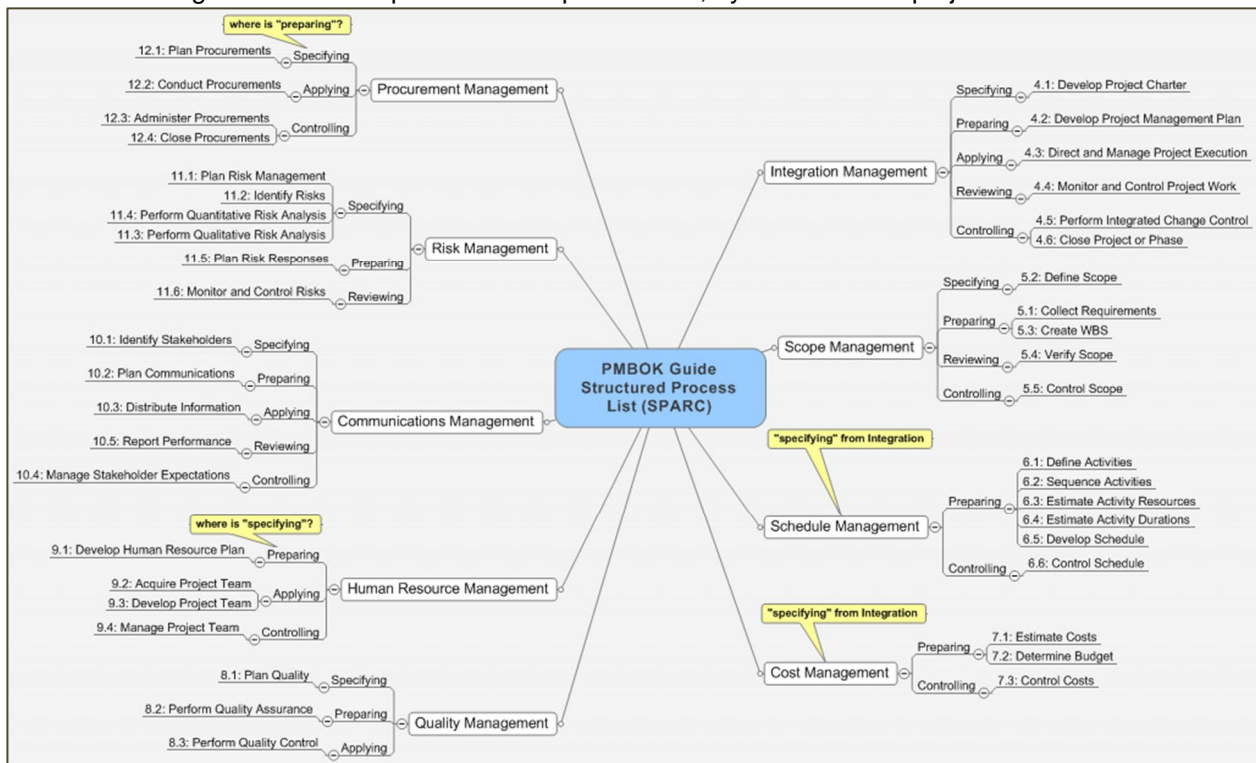
group: Collect Requirements, Plan Risk Management, Identify Risks, Perform Qualitative Risk Analysis, and Perform Quantitative Risk Analysis.

In fact, as a more radical, but much better alternative, and to provide a clear break with the past, a set of “knowledge area steps” (KASes) should be defined to replace the process groups. In contrast with process groups which seem to span the entire project scope, knowledge area steps are meaningful only within the corresponding knowledge area. A KAS is a set of activities normally carried out together within a knowledge area, and the KASes are normally carried out sequentially within a KA, and can be reiterated as required.

The concept of “process groups” should then be replaced by the following “knowledge-area steps” (SPARC):

1. **Specifying.** Those processes to set the rules and authority under which the KA work should be carried out, and determine the environment for the work. This would mainly incorporate Initiating and Analysis.
2. **Preparing.** Those processes required to define the course of action required to attain the objectives to which the KA should contribute.
3. **Applying.** Those processes performed to deliver the work defined in the corresponding management plan for the KA.
4. **Reviewing.** Those processes required to track, review and report the progress and performance of the KA work.
5. **Controlling.** Those processes required to regulate the progress and performance of the KA work – including closing it down –, identify any areas in which changes to the plan are required; and assess the corresponding changes (note: this would also provide the functions covered by the Closing PG)

Using these definitions, Table 3-1 from the PMBOK® Guide could be restructured accordingly. The analysis required for this restructuring raises a number of questions on the set of processes for some of the KAs as shown below: for example, 12.1 “Plan Procurements” should probably be subdivided into two – one for the make-or-buy decisions (“specifying”), the other to develop the procurement documents (“preparing”). In addition, information for “specifying” the general guidelines for Schedule, Cost and Resource Management must be provided from process 4.1, by means of the project charter.



7. Conclusion

These changes and clarifications are designed to provide a logical and easily-understood model that a PMO can implement within an organization, avoiding the current confusion around the position of process groups. The mode is as follows:

- Life Cycles adapted to technical practice, to give sequential, end-to-end control of the endeavours
- Knowledge Areas which define the project-related competencies required within the project teams
 - The details of each knowledge area are described as a logical progression of Knowledge Area Steps
 - For each KAS within each KA, a definition of the corresponding processes in terms of Outputs, Tools & Techniques, and Inputs.⁷

A perceptive reader will have noticed that the set of KASes above divides the Monitoring & Controlling process group into two separate groups. This will be the subject of a future entry.

⁷ I have chosen to mention Outputs before Inputs, since a process exists to deliver outputs, so these should be determined and defined before anything else.