Quality Initiative at ESO

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ABSTRACT

An initiative is under way at ESO Headquarters to optimise operations, in particular in the engineering, technical and associated management areas. A systematic approach to strengthen the operating processes is in preparation, starting with a mapping of the extensive existing process network. Processes identified as sufficiently important and complex to merit an in-depth analysis will be properly specified and their implementation optimised to strike a sensible balance between organisational overhead (documentation) and efficiency. By applying methods and tools tried and tested in industry we expect to achieve a more unified approach to address recurrent tasks. This will enable staff to concentrate more on new challenges and improvement and avoid spending effort on issues already resolved in the past.

Keywords: Quality, quality management, operations, process, process design, process improvement

1. INTRODUCTION

ESO, the European Southern Observatory is an organisation with an extremely wide spectrum of activities: designing observatories, telescopes, and instruments; supervising or executing their construction; organizing scientific observations from call for proposals through selection of observing programmes and execution of actual observations to archiving and distribution of calibrated data; operating, maintaining and upgrading the facilities; fostering scientific cooperation within and beyond the member states; running the administration of an intergovernmental organisation with 700+ staff.

As a publicly funded organisation ESO must seek ways to operate efficiently and with sufficiently high quality levels.

Over more than 5 decades ESO has grown in many respects: the number of staff, telescopes, instruments, observing proposals and observers has skyrocketed and the budget multiplied. Consequently, the management methods applied to the administration of the organisation and to the scientific and technical operations had to be adapted and have changed.

The ESO Quality Policy reads: "*To realise ESO's mission and goals in a cost-effective manner and according to the full satisfaction of the ESO user community, the Organisation commits itself to support, implement and practise an appropriate Quality Management System.*

ESO's Quality Management shall draw closely upon relevant established international standards and practices to achieve an agreed, verified and documented quality in all its projects, and business and operations processes. This shall include clear strategies for defining requirements, achievement of goals, error prevention, acquiring feedback from end users, and for continual improvement.

Quality is a comprehensive process, which is considered an essential part of all ESO operations. All ESO staff shall assume responsibility for fulfilling their commitments and contribute to ESO's mission of excellence." To fill this Policy with life a Working Group (WG) consisting of the authors has been tasked to propose a Quality Management System (QMS) and work out an implementation plan.

In 2004, one branch of ESO already took the step of introducing a QMS: La Silla Observatory got the certification according to ISO 9001:2000. However, the certification was subsequently not renewed. The WG consulted colleagues involved in the certification process and received generally positive feedback: The certification process was perceived as very useful, even though it added considerable workload on top of the usual daily operational tasks.

Nevertheless, the WG concluded that ESO should not pursue formal certification for various reasons: the overhead involved is substantial over an extended period of time, there is no regulatory requirement and no element of competitive advantage as in a commercial market environment. We decided to rather identify the elements of a QMS most important

for ESO and propose their implementation, to maximise the effect of improved operational quality with a minimum of additional effort. “Operational” in this context explicitly includes technical and programmatic activities at the ESO headquarters in Garching.

2. THE ELEMENTS OF A QUALITY MANAGEMENT SYSTEM

[1] identifies the following eight elements that top management can use in order to lead an organisation towards improved performance**:**

1. Customer focus;
2. Leadership;
3. Involvement of people;
4. Process approach;
5. System approach to management;
6. Continual improvement;
7. Factual approach to decision making;
8. Mutually beneficial supplier relationships.

Each of these quality management elements should reasonably be part also of the future ESO QMS, and all of them are to some extent already present in ESO. The WG is however convinced that trying to make ESO compliant to e.g. ISO 9001 or aiming at formal certification would constitute a very major effort, and we do not think that this is necessary or desirable.

3. THE ELEMENTS OF THE PROPOSED QMS

The WG proposed the following two elements from the list above as the cornerstones of the future ESO QMS:

1. The process approach;
2. Continual improvement.

The reason is the statement in [2] that *“A desired result is achieved more efficiently when activities and related resources are managed as a process.”* The key benefits identified are:

- *Lower costs and shorter cycle times through effective use of resources;*
- *Improved, consistent and predictable results;*
- *Focused and prioritized improvement opportunities.*

Naturally, a very large part of ESO’s activities is already run as processes. However, in the WG’s experience and confirmed in interviews with colleagues a large number of these processes are at the moment not properly documented, nor are they consistently applied or used in the same way across different parts of the organisation. This situation leads to redundant activities and may provokes needless discussions and disagreement. It invites taking short cuts, which may introduce unnecessary risks. Misunderstandings about responsibility or authority in certain situations may result in personal conflicts. The practice of developing procedures, archiving the related instructions and finally implementing them is quite erratic and uncoordinated and thus inefficient.

On the other hand, a system based on a formal process management where processes are properly documented has a large number of advantages:

a. Processes can be analysed, discussed, agreed to or objected against, rated, improved and finally put into force.

b. Defined processes tell people what they have to do, what they can expect, what they have to deliver. They streamline the sequence of tasks, thus improving efficiency. They clarify input and output and responsibilities through ownership of the process.

c. Staff can be trained in their application.

d. Missing or low quality input to a process may indicate missing or deficient process(es) that should deliver this as output.

e. A process inventory and optimisation helps in identifying redundant processes and ensures that the best one only is used, thus improving homogeneity across the organisation.

f. Processes operate across organisational boundaries and motivate contributors for the (higher level) process outcome. They clarify responsibilities and help to improve communication and coherence in the organisation.

g. A process handbook constitutes a highly valuable database for newcomers and eases cross-training when staff change their positions.

h. Well-designed processes make it easier to quantify the estimate of time and resources an activity will require. Feeding practical experience back into the regular process audit will lead to continual improvement.

i. Quantitative information resulting from processes helps basing decisions on facts. See item 7 in the list at the beginning of this section.

j. As processes may have internal or external customers, sharpening this focus will lead to greater customer satisfaction.

4. PROCESS METHODOLOGY

A (business) process is a sequence of activities (tasks) that are triggered by an event (input). These tasks perform transformations that add value and finally lead to a measureable, tangible result (output) for the customer. Processes can be subdivided in stages where the output of one stage constitutes the input for the next stage. One person only is responsible for a stage. A process has an owner who is responsible for running it, supplier(s) contributing to the process, customer(s) to whom the process output is provided, sponsor(s) as the ultimate authority in whose interest the process is running.

It is important to

1. Include all stakeholders in their appropriate roles (minimum: owner, customer(s), sponsor, contributor(s));
2. Follow the principle of continual improvement (which necessitates certain metrics for quantifying performance and efficiency of a process);
3. Follow the principle of working in pursuit of a concrete result instead of obeying functional constraints.

In particular item 3 is strongly emphasised in the literature: following processes that use resources from different functional (structural) departments helps shifting the focus from “who does what” to “what needs to be done”. “Process-oriented organizations break down the barriers of structural departments and try to avoid functional silos.”

Business processes can be categorized as core processes that add primary value, management processes that set the goals and operating principles of an organisation, and supporting processes that enable the other processes, e.g. purchasing, accounting, reviewing, archiving.

Processes usually interact with other processes, be it at the same level or at different levels. This is important because the output of one process is very often the input to another process. The better these two processes are aligned, the smoother is their interaction and the more effective is the operation of each process that depends on others for input.

Processes should be

a. Specified: the process framework established;

b. Designed: process stages defined, process flow, stage assurances (controls, metrics) and the process map (flow chart) worked out in detail;

c. Improved.

Not all processes need this full set of activities: For simple, subordinate processes it is usually sufficient to provide a basic flow chart. More elaborate processes, for instance the core processes need a careful specification and design, in particular with respect to their interaction with other processes.

Process specification and design are tasks to be accomplished by the process owner. He/She has the knowledge of the details and distributes tasks to the persons working with and for the process. These collaborators should ideally participate in the design: they have the deeper knowledge and their participation improves their accepting what is written down. In

addition, reflecting on the processes already leads to recognising weak spots and results in a first level of improvement. A sense of "ownership" will usually develop.

4.1 Process specification

Process specification establishes the framework of a process. This means, among others,

1. Identifying input, output and outcome of the process;
2. Naming the customer(s), who use the process output and outcome;
3. Naming the owner, i.e. the person responsible for running the process;
4. Identifying subordinate and support processes;
5. Identifying the transformations effected by the process;
6. Identifying the process flow.

4.2 Process design

Once a process is well enough specified it must be designed. This means, among others,

1. Defining the process stages;
2. Defining the detailed flow of the process;
3. Defining process metrics and controls;
4. Preparing the process map (flow chart).

4.3 Periodic checking of the processes

As the environment in which processes operate usually changes with time (new requirements, tools, staff…) it is necessary to check periodically if the processes are still adequate or if they can be improved. Therefore, they should undergo regular checks, their frequency depending on the importance and cost of the process, how often it is used and how long it takes to complete. This is the second element of our proposed QMS: Continual improvement (see section 3).

5. IMPLEMENTATION PLAN

5.1 Typical stages of a QMS implementation

The WG found a very practice oriented approach to introducing a QMS in organisations resembling ESO to some extent. [3] is an ISO 9001 implementation guide for German government agencies. According to chapter 3 of this guide the introduction of a QMS (any QMS, not necessarily ISO 9001) should follow these steps:

1. Information phase
2. Analysis of current status
3. Introduction of QA system
    a. Establishment of QA organisation
    b. Documentation of processes
    c. Preparation of QA manual
4. Training colleagues on the system
5. Improvement and audit of the QA system.

5.2 Practical implementation at ESO

The ESO WG has completed step 1 of the sequence laid out above. As ESO does not have a permanent entity that could execute Step 2, we will swap Steps 2 and 3a. Currently we are therefore in the process of setting up a temporary "Quality Management Project Team" (QMPT) that will coordinate the work needed to implement the process approach. This corresponds to step 3a.

The next step will be the setting up of an inventory of existing processes (step 2) by the QMPT, mainly through interviews with known process owners and sponsors. During this phase the QMPT will also identify the basic properties of the more important processes, including in particular their owners and their interaction and relative interdependence.

The main body of the work will be step 3b, the documentation of the processes. Because of the limited availability of resources, in order to achieve the highest effectiveness, the best approach is to prioritize this activity, starting with the core processes, then working downward from there. In practice the QMPT will, together with the process owners, analyse the existing processes and identify and specify missing ones. Collaboration with and support of the process owners will be crucial: They are the ones who know their processes best, so it will be their task to write down the specifications and the details, including the flow charts, whereas the role of the QMPT members will be more that of "coaches" steering this particular process. For this purpose, the QMPT will provide a well-prepared and easy to use set of templates supporting the process owners in a coherent process specification and design. This constitutes step 3c.

It will be necessary for the QMS to be effective organisation-wide to make colleagues aware of the existence of the newly designed processes. So the QMPT will need to make all new information easily available and provide training to all affected process owners (step 4).

6. EXPECTED BENEFITS AND COSTS

6.1 Expected benefits

The added value of a QMS based on a formal implementation of the business processes can be assessed by suitable Key Performance Indicators (KPIs), which give a measure both at the global level of the overall performances of the organisation and at the local level of the performance of the single process. The KPIs should be defined by the process sponsors, i.e. by those who "profit" from the process outcome and who also pay for the running of the process (see below). The process owners should naturally participate in the KPI definition, and the QMPT should support it. Monitoring of the KPIs will mainly be in the hands of the process owners, as they obviously must have all the necessary information related to the process. Again, the QMPT should support the monitoring, but only in a consulting role.

We expect that the implementation project will lead to improvements in (most of) the analysed processes, although the process owners will have to do the actual work on their processes. It is impossible at the moment to know how many recommendations will be given to process owners and what exactly they will do with these recommendations. The following analysis can only be qualitative. It should however illustrate the potential for the individual processes and for the organisation.

Obvious KPIs for processes are duration and cost. Measuring the duration of a process run should be straightforward. The cost of a process consists of capital costs (tools, spare parts, consumables, external contracts etc.) and work time; the latter usually being the more important factor in ESO processes. Improvement in this context can therefore lead to a reduction in run time and in capital cost (less expenses for tools, spare parts, consumables by a more efficient use or management of these resources) or in work time (e.g. abolishing unnecessary work, more efficient use of staff time through better tools (e.g. software) or smarter process stages).

The (absolute) cost of running an instance of a process is thus the sum of the value of the consumables, the corresponding share of spares and tools, plus the time of the staff involved. An improved process will use less consumables and/or less staff time. They may also take less time to execute, e.g. due to abolishment of unnecessary steps or interactions between actors. Examples: too many signatures on a document, involvement in decisions of too many levels of hierarchy, unclear responsibilities.

At the global organisation level higher efficiency should result from better coordination of processes, e.g. if the output of one process is better matched to the required input of the next process.

Avoiding parallel development of similar/concurrent procedures will prevent loss of staff motivation ("I worked for the bin" in case one of the parallel developments is afterwards scrapped).

Properly documented processes make it easier for new staff to "come up to speed". This will help in addressing the upcoming generation change in ESO.

6.2 Expected costs/effort

We estimate that setting up the implementation project will consume approximately 0.2 man-months (MM). Preparing the initial process inventory will require another 0.2 MM by the QMPT.

To obtain a realistic estimate of the effort needed to do a full process analysis and design the WG performed the exercise on two existing, well known and frequently run processes: The process for conducting a project review, and the process

for creating and archiving a document. We found that the work on each of those processes required approximately 5 man-days, distributed over three persons each. This appears to be more on the high side due mainly to the fact that at the time the WG members had little or no practical experience in this type of work. Trying to extrapolate the total effort for a significant number of ESO processes must take this into account as well as the facts that both processes are well established in ESO and already fully documented, although no intentional or systematic improvement has yet been attempted; that ESO process owners so far have no practical experience in systematic process specification, design or improvement; that ESO processes vary widely in scope and complexity.

A preliminary survey of existing processes in a specific part of ESO identified about 20 processes that appear worth of proper analysis and design. Rounding that up to 25 (we may have missed some) and estimating the effort necessary to analyse and design them results in a total of 2.5 MM. Half of that would be spent by the QMPT supervising and steering the exercise. The other half would be distributed among the process owners; as they know their processes best they will have to perform the specification and design, with support by the QMPT.

6.3 Expected schedule

ESO does not have a permanent Quality Department or equivalent. Tasks related to quality and product assurance are so far executed by more or less specialised staff within the corresponding programmes or projects. The members of the QMPT (current assumption: 6 persons like the original WG) will have other assignments as well meaning they will work only part-time on this project. Our estimate is that the project definition phase will take approximately 2 months after a formal decision and project kick-off by management. Preparing the process inventory will require a minimum of 6 months. Analysis and specification of the identified processes should take 18-24 months.

7. CURRENT STATUS, OUTLOOK

In April 2016 ESO management declared its intention to follow the recommendations of the WG. The QMPT will shortly be installed and the work started.

In the end we expect a clear and measurable improvement in overall ESO activities and operations: Through the documented processes, and through the resulting change in work culture.

REFERENCES

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[2] ISO 9001:2008: Quality Management Systems – Requirements
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