

PISOC

Pilote Ingénierie Système en Occitanie

A set of systems engineering pilot projects, called PISOC (Pilote Ingénierie Système en Occitanie), was executed in the region of Occitanie in France. The PISOC projects were financed by the AFIS, the French Association of Systems Engineering and the French government agency Direccte. During 2 years (2017-2018), PISOC involved supporting 6 Small and Medium-sized Enterprises and Very Small Entities in the deployment of Systems Engineering within the French program 'Industry of the Future' with 8 consultants, some of them volunteers from AFIS. This document provides a synthesis and a set good practices from this experience.



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OBJECTIVES

The objectives of this project were to identify the priorities of pilot Small and Medium-sized Enterprises (SMEs) and Very Small Entities (VSEs) to "test" their acceptability of the implementation of Systems Engineering (SE) and to measure the effectiveness of the actions put in place.

A team of 8 consultants intervened, partly on a voluntary basis, to support this implementation with SME-VSE. Each of the consultants has signed a code of ethics to respect the method and share the results.

Companies were chosen in sectors as different as space, agriculture, nuclear, aeronautics and automotive, ranging in size from 10 to 150 people and established between 1994 and 2016.

The feedback presented here is based on the situations encountered in the project while preserving the confidentiality of the particular situation of each company.

CONTRIBUTORS

The 6 SMEs-VSEs participating in the project showed a particular motivation to advance their SE capacity. These are:



Aboard Engineering (embedded electronics, automotive sector, 17 persons), **AgreenCulture** (robotics, agricultural sector, 19 persons), **Donecle** (drone inspection, aeronautical sector, 20 persons)



ECIA group (electricity ventilation, nuclear sector, 150 persons), **MECANO ID** (structures and equipment, space segment, 75 persons), **OREKA Solutions** (decommissioning simulation, nuclear sector, 10 persons)

The 8 consultants from AFIS were: Vincent Chapurlat (IMT Alès), Pierre De Chazelles (Airbus), Raphaël Faudou (Samares Engineering), Alain Kerbrat (Collesys), Michel Galinier, Roland Mazzella, Alain Roussel (CS) and Stéphane Galinier (Thinklink) PISOC project leader.

APPROACH

The approach is based on a global progress plan as described in the French book titled "Les Clés de l'Ingénierie des Systèmes" (1) co-authored by two members of the team of consultants of the project.



The PISOC 7-Step Implementation Loop

As shown in the figure below, the approach used, for the PISOC projects, consists of 7 steps in a loop: Initialization with an SME-VSE, Awareness of the teams, Evaluation of projects, Recommendations to senior management, Drafting of the Progress Plan, Diffusion in the SME-VSE and a New evaluation.

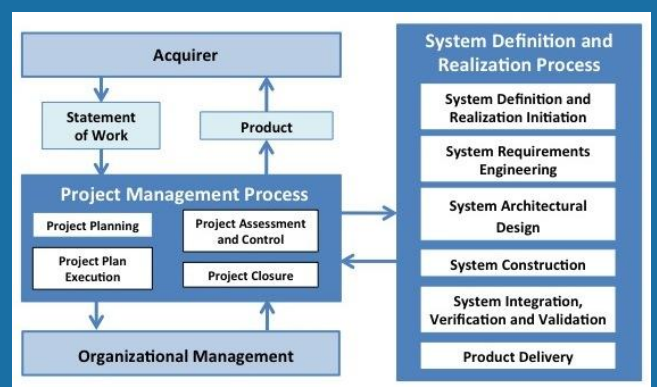
FRAMEWORK

The team has developed a common reference system to address the situation of each SME-VSE in a consistent manner. This repository is composed of:

- "The Keys of Systems Engineering" book (1)
- Systems Engineering 'Management and Engineering Guide' of the Basic profile of ISO/IEC 29110 (2)
- SE awareness support (3 hours)
- "Systems Engineering Process" Pocket Guide
- Matrix template for evaluation and scoring
- Code of ethics

ISO/CEI 29110

The ISO/IEC 29110 series of standards and guides has been developed specifically for very small organizations (VSEs) (i.e. companies, organisations, services or projects, having up to 25 people). As shown in the figure below, the systems engineering Basic Profile Guide defines two processes.



The goal of the Project Management process is to systematically establish and execute system development tasks that meet the project objectives with the expected quality, time, and cost.

The purpose of the System Definition and Realization process is the systematic completion of the analysis, design, construction, integration, verification, and validation activities according to the

specified requirements of the new system or system to be modified.

For each task in these processes, the Guide defines the roles associated with their execution. The input products necessary for the execution of the tasks are indicated and their contents are described. It is the same for the output products.

The ISO/IEC 29110 does not impose a life cycle model, leaving the VSE free to choose the life cycle that best suits their needs among cascading, iterative, incremental, scalable and agile models.

INITIALIZATION PHASE

This first phase consists of meeting a SME-VSE and presenting the SE pilot project to its management. In return, the company presents its business objectives. Business objectives are the strategic objectives for the success of the development of the company. The objective of this phase is to obtain senior management's support for the pilot project so that senior management becomes a strong sponsor and to clarify its business objectives so that the systems engineering project can use them as a foundation.

Senior management proposes a person to carry the project internally, the pilot projects to be evaluated and the people to be interviewed. A planning of the different stages is established.

Good Practices

The pair of consultants covers SE competencies, consulting with SME-VSE, maturity model assessment and change management.

It must be verified that the SE initiative does not conflict with other improvement plans.

When presenting the business objectives, ensure that they are mature (clear and stable for the duration of the SE action).

Identify as soon as possible a pilot project or a concrete opportunity for deployment.

Plan the initiative on a restricted calendar of 2 months maximum for the first part: Initialisation until the establishment of the Plan of Progress. This makes it possible to preserve all the dynamics in an SME-VSE.

AWARENESS PHASE

This phase consists in making the SME-VSE aware of SE, its vocabulary, its issues and its benefits. The leader of the progress plan and the interviewees are invited to a sensitization session lasting approximately 3 hours.

The management of the SME-VSE can participate and invite other collaborators to this session. The feedback shows that the acceptance of the approach by the teams would not be possible without this awareness, even if it is not a sufficient condition.

Good practices

In the introduction of the sensitization session, clarify the motivation of Management that legitimizes the approach (sponsor of the project).

The term 'systems-engineering' can be scary to an SME-VSE, the awareness must demystify it and particularly its hypothetical 'heaviness'.

The keywords detected during the initialisation phase must be used again during this awareness. The link between these keywords and the different chapters of the presentation helps learners of the SME-VSE to better understand the presentation.

It is during this awareness that the SME-VSE goes, for the first time, to project on the establishment of the SE. Consultants must take this change into account and be concrete.

Learners must have written support covering the various points discussed.

EVALUATION PHASE – INTERVIEWS

This phase consists of interviewing the persons responsible for the projects to be evaluated. They must be responsible for different areas (e.g. management, design, calculation, manufacturing, quality, purchasing) so that the evaluation covers all the processes described by the repository used, the Management and Engineering Guide of the SE Basic profile of ISO/IEC 29110 (2).

Good practices

The interviews are scheduled in the same week of the awareness session.

At the beginning of the interviews, a presentation of the project impacted and the role of the interviewee allows the consultant to capture the vocabulary of the enterprise.

The person in charge of the progress plan and its dissemination must be part of the evaluation team. He is the representative of the company in the team.

Exchanges are used to ensure that the interviewees know the business objectives.

The intervention is ideally done in pairs to facilitate the exchanges, a consultant asks the questions and the other takes the notes.

Avoid the integration of a new person during the interview if that person has not attended the awareness session. That person would not be adequately prepared for the evaluation.

EVALUATION PHASE - FINDINGS

The results of the evaluations, i.e. the findings, are synthesized and documented by the team. The evaluation matrix is completed for the project management and the systems definition and realization domains and scored. After this synthesis, the provisional findings are the subject of a formal validation review with the interviewees, to become approved findings.

Good practices

The presentation of provisional findings to the interviewees is done during a joint session with the consultants, the interviewees and the manager responsible for the progress plan. Senior Management is not present.

The meeting is not over until a consensus is reached amongst the attendees on the findings and their documentation.

If consensus is not possible on a particular point, it is removed from the presentation of the findings.

The findings are presented as documented to Senior Management.

RECOMMANDATIONS PHASE

Using the findings, validated with the interviewees, the consultants propose a few recommendations (5

to 10) for the implementation of the SE processes, illustrating their capacity to achieve the business objectives.

The presentation to Senior Management begins with the findings validated with the interviewees and then with the project management and SE recommendations. Finally, an overview presents the links between the recommendations and the business objectives.

Good practices

An essential point is the correct understanding of the coupling of the recommendations with the business objectives of the enterprise.

The recommendations should promote concrete actions for short- and medium-term gains for the SME-VSE.

A classification of the types of project (e.g. by size and complexity) makes it possible to define an application of the recommendations by class.

Senior Management must conclude by giving the main directives of the progress plan (adopted recommendations). An overview of the business objectives and the recommendations helps define priorities.

Eventually, it may be useful to propose to the Senior Management a presentation of the recommendations to all the interviewees.

PROGRESS PLAN

Based on the recommendations that Senior Management has chosen to deploy, the person responsible for the Progress Plan prepares it and plans the dissemination within the company.

The team of consultants supports the leader of the progress plan in this preparation.

Good practices

The progress plan must be established within a maximum of 2 months after the start of the SE project.

The progress plan should prioritize the successful implementation of recommendations rather than an exhaustive plan of all recommendations. It is better to deploy two recommendations rather than launch

everything without being able to deploy them due to a lack of resources.

Select carefully the projects that will be targeted for the deployment of the recommendations and ensure that the improvement actions are concrete and tangible. A concrete implementation in a project is preferable to detailed rewriting of all processes.

Beware; the progress plan seems more difficult to start in large SMEs.

DISSEMINATION PHASE

The person responsible for the deployment is in charge of implementing the progress plan in the enterprise. This phase can last between 10 to 18 months.

Good practices

Disseminate within an existing or new project, which explicitly requires a systems approach.

If they did not participate to the evaluation, the employees that must implement the progress plan may feel constrained. It is the match between their function in the company and what is asked of them that will enable them to feel concerned.

A new practice is deployed in a single pilot project. Dissemination to other projects is done in the second time on the basis of feedback. Avoid an ambitious progress plan which would deploy a new practice in the whole enterprise.

Foster deployment on a voluntary basis using a bottom-up approach. The collaborator who is waiting for an improvement will be best able to disseminate it. Experience shows that the top-down logic is much longer to implement in a large organization.

At the end of the deployment, the SME-VSE must validate the practices after their implementation. The SME-VSE can then edit and document their process repository.

NEW EVALUATION

The SME-VSE ends the loop with a new evaluation, similar to the one already carried out. It can be conducted internally if the person in charge of the

progress plan is capable. If not, he can call on the consultants.

The comparison of this new evaluation with the previous evaluation highlights the results obtained.

RETURN ON INVESTMENTS

The feedbacks shared twice during the project (mid-project and end-of-project workshops) between all SME-VSE, consultants, AFIS and Direccte illustrated the following points:

Good practices

"The development of the SE allowed a **better integration of the product evolutions** with a production of more regular versions, fewer incidents and a better commitment of the engineers responsible of development."

"The implementation of SE has a **structuring effect**. Its implementation makes it possible to identify the important issues versus the minor issues and to consider the growth of the workforce more serenely."

"The SE is clearly a **valued know-how** for our clients and partners in our contracts and also with for shareholders in the case of mergers/acquisitions."

"The introduction of the SE has clearly resulted in a **significant reduction in costs** associated with late detection of problems."

"Linking requirements and their causes makes the functionalities of our product **more responsive to market expectations**."

Note: To preserve the confidentiality of each SME-VSE involved in the project, these ROIs have been anonymized and consequently made less precise.

THIS IS ONLY THE BEGINNING OF A STORY...

The PISOC project is a tremendous Systems Engineering implementation success in SME-VSE of very various domains. It demonstrated that it is possible in spite of the supposed complexity of its processes, if it is linked to business objectives and focused on realistic and concrete recommendations.

This project only needs to be extended; firstly, for the SMEs-VSEs who initiated it, but also for all those who have shown their interest everywhere in France, by organizing:

- The extension of the support to have a more complete feedback of experience and root the approach in the SMEs-VSEs.
- The recognition of PISOC and the SE by industrial domains and large customers.
- The certification of SMEs-VSEs so that their initiative is valued. AFIS analyzes the possible solutions.
- The strengthening of the support to SMEs-VSEs, to provide them a dedicated technical environment: selection of SE tools, regional workshops, access to a group of consultants, deployment packages, website serving the PISOC community.
- The certification of consultants.
- The sharing and communication, with the aim of reinforcing the PISOC action in SME-VSE, with large customers and government agencies.

You are an SME, a VSE or a public organisation with SE activities, a consultant, a person responsible for the economic development or industrial performance? Do not hesitate to contact us.

LINKS AND PUBLICATIONS

AFIS website: www.afis.fr, contact@afis.fr

(1) M. Galinier, S., Galinier, M., Laporte, C.Y., **Les Clés de l'Ingénierie des Systèmes**, Cépaduès Éditions, 2017. <https://www.cepadues.com/livres/les-cles-ingenierie-des-systemes-9782364935976.html>

(2) **ISO/IEC TR 29110-5-6-2:2015** Systems and software engineering - Life cycle profiles for Very Small Entities (VSEs) - Part 5-6-2: Systems engineering - Management and engineering guide: Generic profile group: Basic profile, International Organization for Standardization: Geneva, Switzerland. Freely available from ISO in French or English: <https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>

The PISOC experience, systems engineering for SMEs in Occitanie, France - Stéphane Galinier, THINKLINK. INCOSE EMEA Biannual Workshop, September 19th 2017, Mannheim, Germany.

Connecting Business Development and Systems Engineering with ISO/IEC 29110 Standard in Small and Medium Enterprises of France. Stéphane Galinier, Claude Y Laporte, 4th IEEE International Symposium on Systems Engineering, October 1-3 2018, Rome, Italy.

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