

COTS Selection for SMEs: a report on a case study and on a supporting tool

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1. Introduction

Since its creation in 1987, the "Centre de Recherche Public Henri Tudor", which is a technology transfer centre, has been promoting information technologies as one of its key technologies. For this it relies on its CITI department (Centre for IT Innovation) which currently has 70 R&D engineers. CITI's objective is to escort the Luxembourg economy towards the use of promising innovations coming from information and communication technologies through research, innovation and transfer (including training, advice, service, conferences, technical meetings, networking activities, etc.) [13]. One of CITI's missions is assistance to the SMEs sector. In particular, this assistance deals with the improvement of the relationship between SMEs and the suppliers of IT solutions in the selection and implementation of software solutions. The repetitive nature of these procurement projects undertaken with very short deadlines (about twenty days) determined by SME resources, compelled CITI to develop and adopt an adequate and "agile" approach to cope with such context. The proposed methodological approach is supported by two important elements, namely a knowledge management dimension based on the capitalization from the various projects undertaken, and the development of a specific CASE tool called OPAL¹. The "Prestagaz" information system renewal project will illustrate our process. Prestagaz is a SME with 100 employees specialized in the reconditioning of gas bottles. It approached our centre for advice on the renewal of its information system. Assistance was required since its computer service consists of a single person.

The main strategic goal for Prestagaz was to avoid multiple and redundant data input on a set of heterogeneous machines, and thereby to have a single, central information system. Thus for this SME, investment in ERP acquisition is the challenge to be

seriously considered. The market is not mistaken as growth forecasts for the ERP market are +40% from 2002 to 2005 (3.3 billion euros) [8]. There are many ERP solutions and even the main ERP players now have solutions suited to the SME market.

"Standish group" statistics demonstrate that three out of four IT projects fail [9,10]. A recent study shows that more than 30% of ERP projects are abandoned before the end of the project, 20% of the remaining projects exceed budgets, and more than 20% do not keep the project deadlines [7]. To conclude, ERP projects face the same risks as any other IT project. In these circumstances, the mission of the "Centre Henri Tudor" is to advise Luxembourg SMEs in avoiding the traditional causes of IT project failures and to promote the adoption of well defined procurement process and of "Requirement Engineering" practices [1,2,3,4]. Contrary to selection based on a comparison of software packages [5], our approach is based on structured process that relies on the elicitation of requirements and on measuring the actual fitness between each ERP solution and the requirements specification. By doing this, the selection of a solution and the functionalities to be installed fully satisfy the expectations and needs of the future users. This identification process of the optimal solution also has to satisfy the strategic objectives set by the company. For organizations confronted with this choice of software solutions, the stakes and financial, economic and strategic risks are many.

Most of the current approaches are based on a comparison of software solution functionalities against a set of needs [2,3,4,5], not always directly expressed by customers and end-users themselves. Moreover this comparison has been proved difficult since the different solution providers are describing their products in different ways.

Because of this poor formalization, such processes cannot be the basis of any capitalization of past experience for the same types of selection.

The "Centre Henri Tudor" process, based on a clear understanding of requirements, well answered the expectations of Prestagaz, which saw less in-depth

¹ OPAL : Outillage du Processus d'Acquisition d'un Logiciel
(COTS selection supporting tool)

questioning of the company's existing processes and procedures in the Centre's process. By using its methodological approach and a new tool called OPAL, the "Centre Tudor" implemented a process of requirements elicitation, of writing specifications to supervise a call for tenders. The call for tenders itself requires suppliers to make standardized answers and so facilitates comparison of the software offers. The OPAL software tool is supporting the production of these questionnaires and their traceability to requirements. Finally, besides its support to the methodology, the OPAL software tool is also a capitalizing tool that enables taking advantage of knowledge captured during former procurement processes, performed in an equivalent business or application area.

In the rest of the paper, we introduce our methodology built around three phases. Each of the phase will be illustrated by examples from the project carried out with Prestagaz using the OPAL as support in the development of the specifications and its publication as a questionnaire.

2. Scoping of the Domain and Identification of the Objectives

Step 1 : Kicking off the project

This step consists firstly of a working meeting with management, the main co-workers and the consultant. This kick-off meeting aims to describe the field of study, introduce the procurement process, and finally define the roles and responsibilities of the project's actors. This means including all the key people, representatives of the professional areas and functions of the company. There follows a gathering of knowledge of the IT strategic plan, then a study of the information system in place. The consultant gets acquainted with the processes and procedures current in the SME and identifies his/her interfaces. He/she gets acquainted with the application domain and identifies the company constraints and the project's strategic objectives in order to highlight the more measurable, concrete objectives. These concrete objectives are associated with business processes identified within the domain. Finally, along with the customer, the consultant selects the requirements weighting system in order to rank the future functionalities of the project. Also, a supplier rating system is chosen.

As performed with Prestagaz, this first step enabled knowledge gathering about the company and the general context of the project. During this step we identified two strategic objectives:

- Information consistency
- Work load reduction

We discovered 18 business processes in the company, theoretically all being covered by an ERP including a production management module.

The 18 business processes were reviewed with by five user groups:

- Logistics
- Production
- Commercial
- Maintenance
- Administration

A member of the Prestagaz staff was identified as the consultant's main contact.

For the weighting system used for ranking the functions, Prestagaz desired the most pragmatic possible benchmark, avoiding a "numerical" evaluation. This results in:

- Selection of the requirements weighting system. Prestagaz selected a logarithmic scale: strategic 5; very important 2; important 1; less important 0.5; accessory 0.25.
- Selection of the future notation of the matching of the offers with the requirements Prestagaz selected the SPICE² ISO 15504 model: fully 100%; largely 75%; partly 25%; none 0%.

To measure the matching between the offers and the specifications, Prestagaz desired a notation system avoiding the average score of 50% thus requiring the actors to give a more clear-cut opinion.

On Figure 1 is shown one of the OPAL screens enabling the capture of the strategic objectives and business processes to be listed and then, at the intersection of the two in the table below, the concrete goals to be defined.

² SPICE: Software Process Improvement and Capability dEtermination

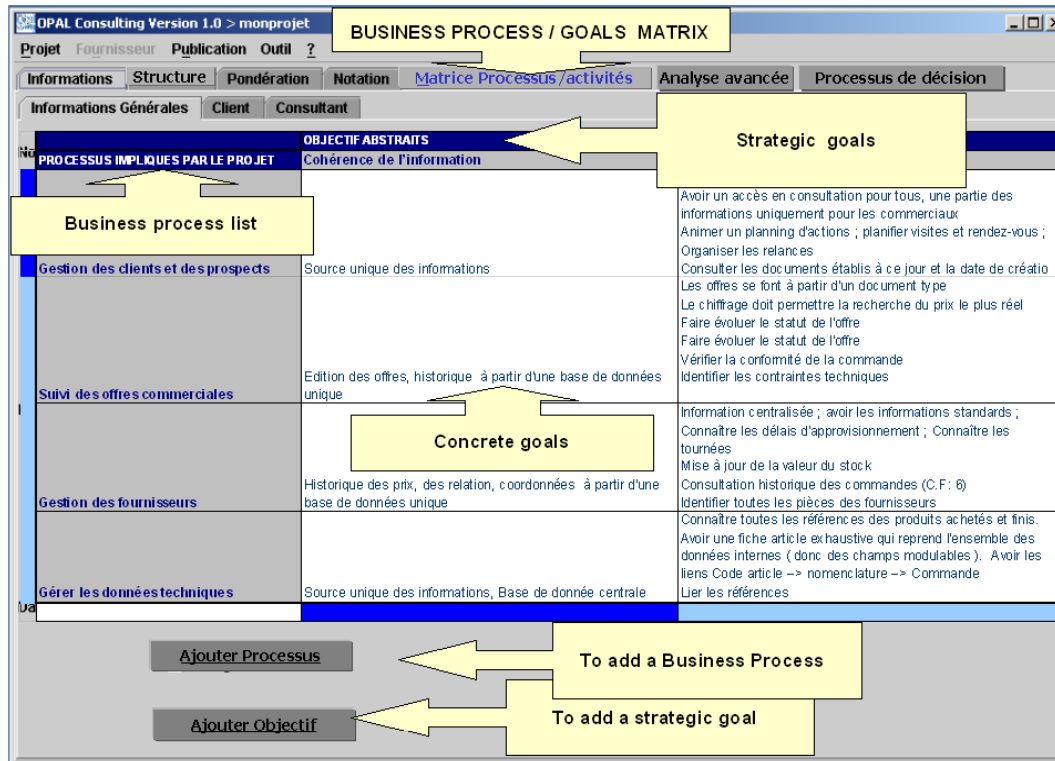


Figure 1: Capture of the strategic objectives and business processes

Step 2 : Requirements Specification

The requirements specification phase enables the functional and organizational needs of each user group to be identified. The analysis of the existing solution enables the strengths and weaknesses of the system in place to be revealed. Functional and non-functional constraints are thus identified in order to transcribe them into the future specifications. At the same time, the analysis of the company's business processes gets each user group to rank the importance of their requirements in order to describe the scope of the future project. This is finally confirmed by management according to the company strategy and the available budgets. The consultant goes through a phase of understanding and analysis of the information system environment. Finally he/she defines with management the functional and non-functional requirements of the future information system [6,12]. The emphasis is put on the maximum use of the users' vocabulary.

For Prestagaz, this step enabled the identification, formalization and ranking of the requirements and functionalities of the solution to be acquired. Interviews with the various company members enabled an accurate analysis of the current information system and thus the

strengths and weaknesses of each of the 18 business processes to be brought out.

The Prestagaz specifications include:

- 18 main high-level functional requirements for the 18 business processes
- 10 main high-level non-functional requirements
- 6 main call-for-tender requirements
- 134 detailed requirements
- 283 functional questions specifying each sub-requirement.

Using OPAL, we identified, for each business process, the requirements and sub-requirements to a level of detail enabling the uniqueness and non-interpretation of each sub-requirement.

During this phase it has been also possible to reuse of requirements previously collected during other projects regarding ERP system selection. Those reusable requirements are organized in terms of modules, each of them being associated with a main functionality of an ERP.

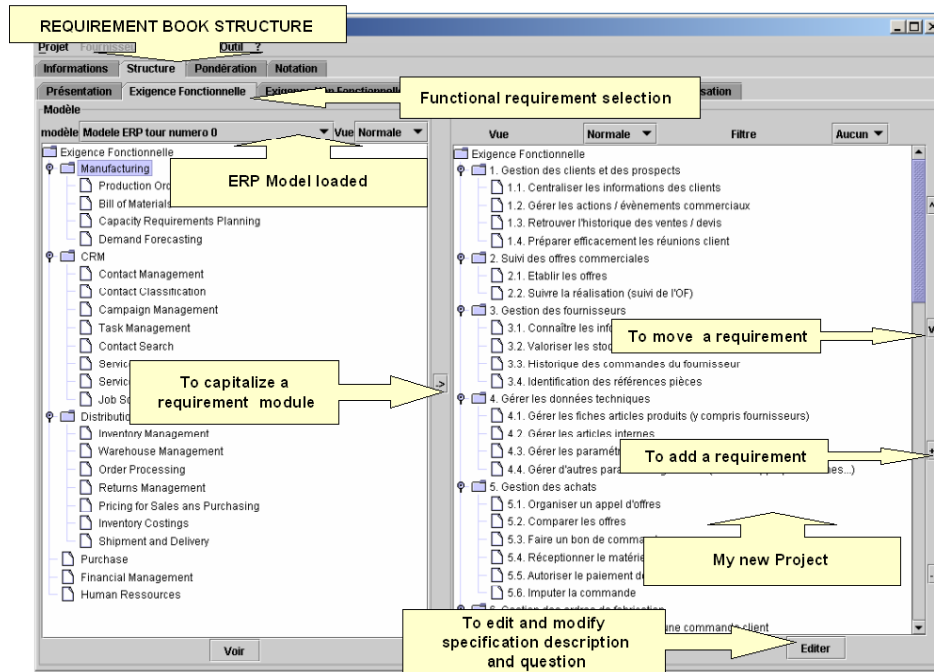


Figure 2: Reusing requirements

Figure 2 shows the OPAL screen associated with the opening a reusable model on the left and then the reuse of new requirements by transferring them into the project on the right. The consultant can then refine the description of the requirements and the formulation of his/her questions.

Each requirement is then ranked according to the risks and opportunities identified by each user group.

A synthesis made by management enables the user groups opinions to be unified.

Figure 3 shows the OPAL screen enabling a weighting of each requirement by each user group. A synthetic weighting, made by management, is then performed, and comments can clarify the reasons for a management decision. This weighting will enable the creation of the future selection grid of the offers by calculating the importance of each requirement in the score of the future suppliers.

Requirement ID	Description	Pond. P. logist.	Pond. P. prod.	Pond. P. comm.	Pond. P. achat	Synthèse Pondération	Pond. finale	Pond. N1	Pond. N2	Pond. N3	Pond. N4	Commentaire
1.	Gestion des clients et des prospects	Peu Import	Peu Import	Peu Import	Peu Import	Très important	0,57%	0,138	2			
1.1.	Centraliser les informations des clients	Très Import	Très Import	Très Import	Très Import	Très important	0,07%	0,017	0,25			
1.2.	Gérer les actions / événements commerciaux	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	1,44%	0,345	5			
1.3.	Retrouver l'historique des ventes / devis	Stratégique	Stratégique	Stratégique	Stratégique	Stratégique						
1.4.	Préparer efficacement les réunions client	Accessoire	Accessoire	Accessoire	Très important	Accessoire	0,25%					
2.	Gestion des achats	Accessoire	Accessoire	Accessoire	Important	Accessoire	0,04%	0,009	0,25			
2.1.	Organiser un appel d'offres	Stratégique	Stratégique	Stratégique	Stratégique	Stratégique	0,72%	0,172	5			
2.2.	Comparer les offres	Accessoire	Accessoire	Accessoire	Important	Accessoire	0,04%	0,009	0,25			
2.3.	Faire un bon de commande	Accessoire	Accessoire	Accessoire	Important	Accessoire	0,04%	0,009	0,25			
2.4.	Réceptionner le matériel	Important	Accessoire	Accessoire	Accessoire	Accessoire	0,04%	0,009	0,25			
2.5.	Autoriser le paiement de la commande	Important	Important	Important	Important	Important	0,14%	0,034	1			
2.6.	Imputer la commande	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,04%	0,009	0,25			
3.	Gestion des fournisseurs	Accessoire	Accessoire	Stratégique	Accessoire	Accessoire	0,25%					
3.1.	Connaître les informations des fournisseurs	Accessoire	Très important	Accessoire	Accessoire	Accessoire	0,26%	0,063	0,25			
3.2.	Valoriser les stocks	Accessoire	Très important	Accessoire	Accessoire	Accessoire	0,26%	0,063	0,25			
3.3.	Historique des commandes du fournisseur	Accessoire	Accessoire	Stratégique	Accessoire	Accessoire	0,26%	0,063	0,25			
3.4.	Préparer efficacement les réunions client	Accessoire	Accessoire	Important	Accessoire	Accessoire	0,26%	0,063	0,25			
4.	Gestion des personnes	Accessoire	Très important	Accessoire	Accessoire	Accessoire	0,25%					
4.1.	Gestion des congés et tournées	Accessoire	Très important	Accessoire	Accessoire	Accessoire	0,35%	0,083	0,25			
4.2.	Gestion des paramètres	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,35%	0,083	0,25			
4.3.	Recherche informations statistiques	Accessoire	Très important	Accessoire	Accessoire	Accessoire	0,35%	0,083	0,25			
1.	Infrastructure et exigences techniques	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,09%	0,05	0,25			
1.1.	Exigences	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,09%	0,05	0,25			
1.2.	Exigences	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,09%	0,05	0,25			
1.3.	Exigences	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,09%	0,05	0,25			
1.4.	Exigences de réutilisation des réseaux	Accessoire	Accessoire	Accessoire	Accessoire	Accessoire	0,09%	0,05	0,25			
- Exigence Fonctionnelle												
- Exigence Non Fonctionnelle												
- Critère d'Appel d'Offres												
Aff :												
Total Weighting for: Functional requirements							50%	TOT	12			
Non functional requirements								TOT	16			
Call for tender requirements									5			

Figure 3: Weighting requirements

3. Call for tenders

Step 3 : Market exploration

This step means looking for software packages and potential integrators by pre-selecting them on the basis of criteria corresponding to the requirements considered as having priority (functional and non-functional such as technical or budgetary aspects) and on their motivation. As part of the Prestagaz project, we investigated the software packages market to make up a list of suppliers liable to satisfy the main needs of Prestagaz's and to which the call for tenders will then be sent. Measurement of the attractiveness of the offer allowed the call for tenders to be well targeted.

- Pre-selection of 35 potential providers by consulting the Luxembourg database www.spiral.lu and the French CXP database www.cxp.fr. These neutral bodies pre-reference ERP suppliers and supply regularly updated directories [13,14].
- Motivated reply of 15 providers who were all consulted in the subsequent call for tenders.

Step 4 : Call for tenders

During this step, the specifications are published (functional, non-functional and call for tenders constraints). For a better coverage of the requirements a questionnaire is produced which enables the suppliers' various proposals to be compared more easily. This questionnaire is devised on the basis of reformulations of the requirements specification (functional, non-functional, supplier, budgetary and technical

requirements) and is then a full part of the call for tenders.

The providers consulted can thus answer the call for tenders simply by completing this questionnaire.

In Prestagaz's case, specifications were written at the same time as the accompanying questionnaire was developed. Indeed, reformulation of the specifications into a questionnaire enabled suppliers to give answers well fitted to the specifications thus requiring them to answer all the points of the call for tenders. The use of this standardized document by suppliers then facilitates treatment of the offers and their comparisons.

Key figures:

- production and sending of the call for tenders including the specifications and questionnaire to 15 companies,
- seven companies replied perfectly to the call for tenders,
- three companies did not reply in time,
- five companies declined the call for tenders,
- 100% of the questions were answered.

Figure 4 shows the OPAL screen enabling evaluation of the suppliers' offers. The following items can be seen:

- The response rate to the requirements of the supplier's offer,
- The rate of functional coverage,
- The rate of non-functional coverage,
- The rate of coverage of the call-for-tender criteria.

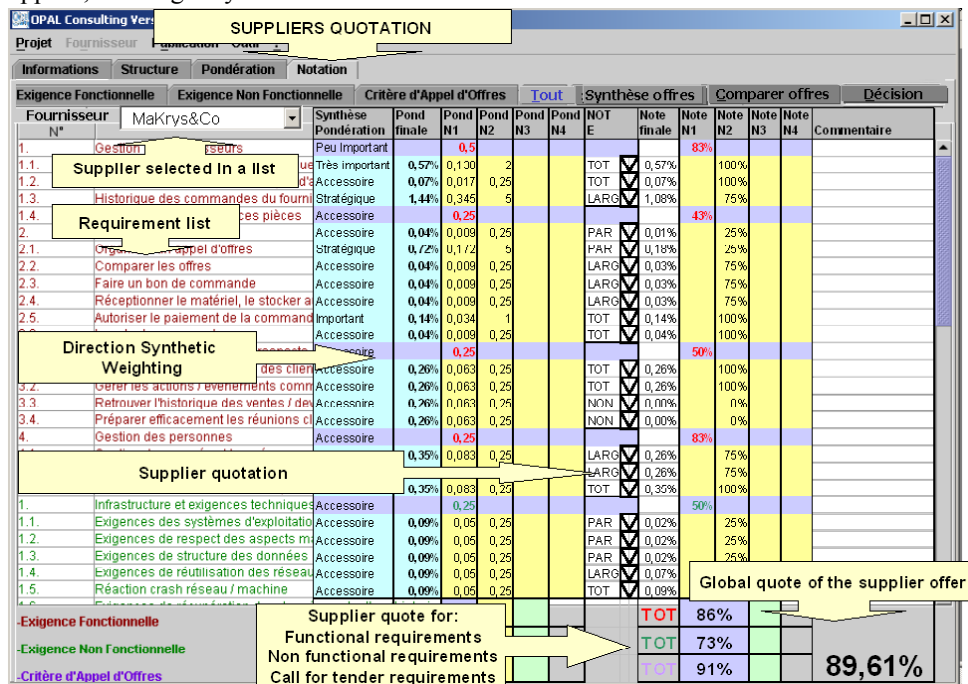


Figure 4: Evaluation of supplier's offers

4. COTS selection

Step 5 : Supplier selection

The supplier's offers are then analyzed using an evaluation grid of the offers, exactly structured like the questionnaire and, therefore, like the suppliers' offer. At the conclusion of this pre-selection phase, two or three better solutions will be retained for a check of the actual fitness with the initial needs.

The final selection is based upon an in-depth evaluation of the product. This selection is based on the running of a number of use cases traversing the whole requirements specification. Two weeks before the supplier's presentation, the consultant and the customer develop the most representative possible use cases. A reference database is supplied at the same time as the scenario to let the supplier prepare the most realistic possible demonstration. The evaluation grids are then revised by the customer according to the actual matching level between the solution and the requirements.

In Prestagaz's case, once the analysis of the providers' answers was carried out, it was possible to establish a classification according to the matching of the proposed solution with regard to the company's requirements and to pre-select the three best classed suppliers. Figures for the first round:

- Average response rate to the requirements of the specifications: 89%,
- Rate of functional coverage: 88%,
- Rate of non-functional coverage: 91%,
- Rate of coverage of the call-for-tender criteria: 95%,
- Average price of the software offer and services: € 100,000.

Next, test data were produced. These were used as a base for demonstrating the functionalities of the three solutions retained, with the objective of checking their coverage with regard to Prestagaz's needs. Following the organized demonstrations, the evaluations were revised with the customer.

The retained supplier's results were revised after the running of the test data by the customer and the consultant. They are as follows:

- Average response rate to the requirements of the specifications: 91%,
- Rate of functional coverage: 89%,
- Price of the software offer, equipment and services: € 150,000.

OPAL enables the simple rating of each offer and solution. The tool proposes a series of comparison criteria of the offers. The main ones are:

- List of advantages and disadvantages of the proposal,
- List of responses having a potential risk,
- Rate of coverage of the main requirements,
- Rate of coverage of the offer,
- Rate of functional coverage,
- Price of the offer,
- Quality/price ratio,
- Commercial score,
- Quality/price ratio * commercial score,
- The consultant's opinion.

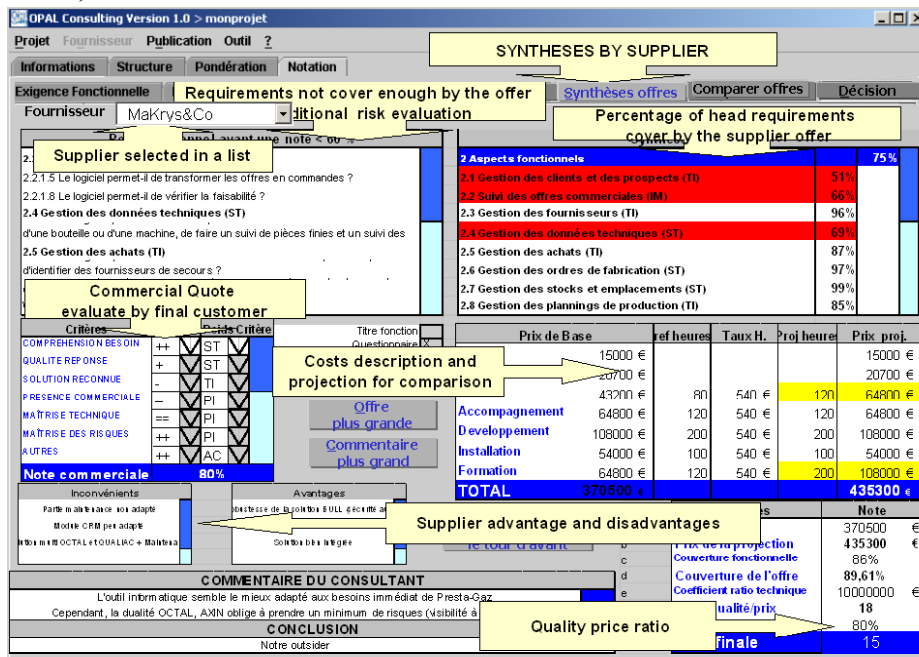


Figure 5: Details of each supplier's offer

Figure 5 shows the OPAL screen enabling identification of the strengths and weaknesses of each supplier. For each supplier, the consultant has a consolidated view of the offer comparison criteria.

oversees compliance with the lead times and the definition of a payments schedule linked to actual progress and delivery phases.

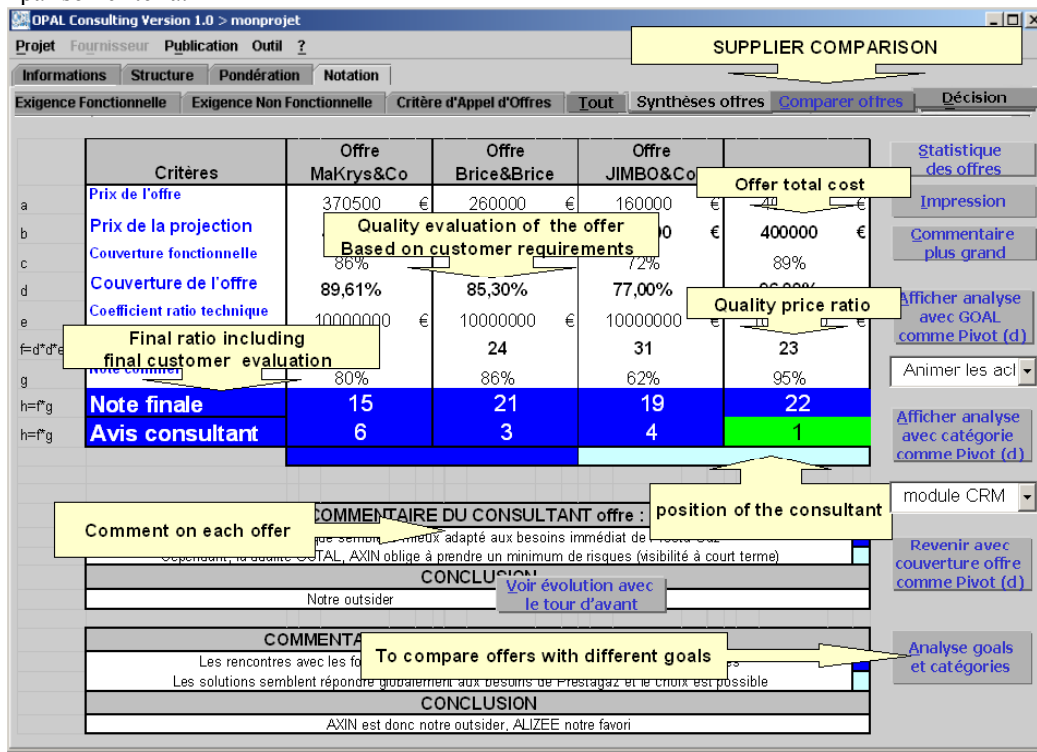


Figure 6: Offer comparison

It is then also possible to compare offers by summarizing it against the concrete goals previously defined and to which requirements are attached. By doing this, it is possible to offer a synthetic view to the end user, therefore, makes easier the understanding of the final choice.

Figure 6 shows the OPAL screen enabling the offer comparison. The consultant's opinion and other customer's comments can also be entered into the tool.

Step 6 : Contract

This last step consists in negotiating the clauses of the contract and confirming the commitments in terms of lead times, budget and schedule. This ultimate step closes the study and selection phase carried out by the consultant. The consultant helps the SME to negotiate the clauses of the contract, to confirm the commitments, and to put into the contract all the commitments made during the call for tenders (specifications, supplier's offer, etc.). He/she oversees the installation and commissioning requirement, he/she supervises the transfer of ownership clauses, definitions of the conformity checking phases, modalities of temporary acceptance and final acceptance, and finally he/she

5. Conclusion

In the paper, we have introduced the OPAL tool which is used throughout the procurement process, as a support for publication of the project documents. At the end of this process, a final report, summarizing all the phases and decisions, is generated and delivered by the consultant as the conclusion of his mission. The project performed in this way is automatically capitalized in OPAL as a new reusable model that can be used for any other project.

To conclude, despite the tool's relative novelty, one is forced to note that the consultant's procurement process is largely facilitated by the OPAL tool. The tasks of analysis and publication are far simpler than by the use of a spreadsheet.

By using Opal systematically, it seems possible to reduce consultancy loads by nearly 20% compared with an identical mission without a specific tool. Therefore it is clear that this tool will enable to better satisfy the budgetary constraints of consultancy offers among SMEs while ensuring the process's quality.

Today, we also note considerable interest in the tool from all those who need to produce specifications. They find in the tool, a repository of reusable requirements and thus the possibility of very effectively constructing their own specifications.

The Prestagaz company, with the help of the "Centre Henri Tudor" selected the ERP tool best suited to its business requirements. Since June, the winner of the call for tenders has been setting up the new information system in three major steps. The first concerns the commissioning of the logistics, purchasing and inventory management modules. These three modules are now all operational.

Today, Prestagaz thanks the "Centre de Recherche Public Henri Tudor" for having helped it to select the best ERP solution for its needs, not knowing how it would have coped with the project alone. On the other hand, the software provider is very satisfied finally to see the performance of a true procurement process capable of setting up a "win-win" relationship among customers and suppliers.

The technical solutions retained for producing the OPAL tool, are based on Open Source libraries, which guarantees openness and flexibility in its development and distribution

With the OPAL tool, we are currently handling six other projects:

- Choice of an accounting and financial management tool for a Luxembourg administration
- Choice of a business ERP suited for an SME in the security sector
- Choice of business software for an SME in health insurance
- Choice of business software for a group of SMEs involved in management services
- Choice of configuration management software for the "Centre Henri Tudor"

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