IFAST WP3.3.

Considerations about early engagement of the industry on Accelerator Activities

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Preliminary conclusions

1. Facts affecting the analysis

A wide variety of companies. A very heterogeneous community. We have not to expect a unified message from the industrial community.

Two different final aims of the industry involved on ASc&T:

- aim for series productions to reach the general market and
- aims limited to specific products for the Scientific Infrastructures.

Two different approaches, with different positions of the companies.

Two relation mechanisms: procurement via contracts and collaboration in projects. Similar conclusions extracted from both.

Very different level of knowledge of the field: some companies are just informated via closer institutions, other invest a bigger effort on the collection of information: via conferences, infrastructures, face-to-face meetings, ...

Very different conclusions from the funding rate considered as minimum acceptable. It depends on a number of factors, related to the added value in terms of intellectual return to the company or the distance to the market or the availability of resources, among others.

In summary, at first sight, the industry involved on ASc&T seems not to be a very consolidated, well organized community.

2. The global opinion of the industry on a deeper involvement on Low TRL

By vast majority, the interviewed companies are in strong favor of being involved at low TRL. They think that it is beneficial for both sides.

Only a small proportion, all of them smaller industries, limit this interest specifically to some aspects of their work, mainly due to lack of resources.

Most of the companies prefer to limit their actions based on their existing resources, on a conservative approach.

We have identified a number of companies with long experience really critic with the current model, strongly claiming a different approach, closer to the *old times* of industry-research institutions early contacts.

As a co-lateral remark, we received two messages

- It is a good praxis involving to the final buyer early on the industry/academia collaboration, when this is not the research institution in charge of the development.
- Companies find big difficulties on the last steps to the market. Regulation and legal aspects are a severe burden to them, with a few help from institutions and specialized companies.

3. The ideal industry-research labs interaction model within the ASc&T sector

From the feedback of the industries, we identify that, in the fields in which the research institutions could work with industry at low TRL and the institution decide not to do it, somehow, the research institution becomes a competitor of the industry. **The procurer can become a competitor**.

If going to a higher level of integration of the industry at low TRL, the model demanded by the most experienced industry would suit the following points:

- Involve the company from the design stage, separating this from the production stage. Involve the final user since the very early beginning.
- Pursue well defined research and development programs, with integrated aims and long term.
- A strategy coordinated with the industry: the objectives defined according with the resources of the research institutions and the resources and capability of the industry, put in common. The growing plan defined together. Joining strategies.
- Prepare the industrial ecosystem at longer terms. Face the "peaks and valleys" on the demands for research developments.
- A work program based on the trust, on solid relations. This simplifies tremendously the IP concerns.
- Support for training of young expert engineers and scientists. Sharing training personnel between research institutions and industry. Sharing the costs
- On this last issue, it is important the training personnel to be in the industry, at least partially.
- Use and expand innovation procurement procedures. Relevant examples in other fields.

4. The case of working at low TRL

Some relevant companies declare cases in which the research institutions in the ASc&T field keep the policy of covering by themselves the first stages of the technological research, developing its own first prototypes. When this is the case:

- The result is not optimum from the final technical outcome viewpoint; industry claims that prototypes developed in this format, in many cases, are subject to foregoing improvements.
- Procurements based on prototypes developed by the research institutions alone are subject to limitations that can affect the contract development itself. Prototypes subject to improvements mean modification of specifications, longer delivery terms and larger costs.
- The previous point can also have implication on the tendering evaluation process. Should the tendering companies have to raise the quoted prices for contingencies at the risk of losing the tender? In some cases, the conclusion is that the company decides to accept the contract without budget for contingencies for changes that are, at the end, needed.
- It has been reported conflict of interest of the industry involved in a collaboration role before placing the contract. Providing support to the research institutions at early stages was considered as a non-equity advantage for applying to the tender.

- Early engagement is good for an adequate IP management. The IP generation, when engaged at high TRL models, is not ideal to the industry.
- Some critic comments received from the IP strategy of the TT Offices of some research institutions.

5. Limitations of the low-TRL model (jmp-> this is the only point not extracted from the companies)

It can be concluded that there are two arguments limiting the low TRL approach:

1. The collaboration at low TRL model is only applicable in the scenario of a consolidated industrial ecosystem. We understand that this collaboration model cannot be used in the cases in which there is no industry capable to cope with the low TRL stages, either due to lack of resources or limitation of time.
2. The business at ASc&T is relatively small, wavy and shorter term. It is difficult to consolidate an industrial fabric under these premises. This scenario is even more negative to encourage an engagement at early stages.

Counter-arguments for these two points:

- To #1: Our mission is working for consolidating the industrial ecosystem. We are committed on this.
- To #2: Would it be possible to consolidate an industry of science synergic with other fields (Space, Fusion, ...), to cover somehow the gaps? (*Sensitive question*)

it should be the goal of our strategy to cover these constraints. It is a motivation of framework projects like iFAST. (*Sensitive question*).

6. What else we can do to promote a low TRL approach

In order to deploy an advanced low TRL research institutions-industry collaboration program in ASc&T, some actions can be foreseen to carry on from the research institutions and industry.

Actions from the research institutions

In the topics in which we decide start working at low TRL, **changes must be done within the research institutions to adapt our activity to this model**:

- we have to avoid prototyping internally in some aspects or, at least, not alone;
- IP must be shared since the early beginning;
- tender processes must be adapted to this strategy.

The following general concepts are more relevant at low TRL:

- A strategy coordinated with the industry: the objectives must be defined according with the resources of the research institutions and the resources and capability of the industry, put in common.
- Well defined research and development programs, with integrated aims and long term.
- More proactivity on setting a long-term strategy with the industry.
- Proactivity on Education and training programs for stays both at research labs and industry.
- Avoid peak-valley activity gaps. Increase the dimension range. Create integrated industrial plans. Trying to find synergies with other fields. In particular, Fusion and Space.
- The growing plan defined together. Joining strategies.
- A better internal organization among the industrial community, helping to create a coordinated strategy. It is not only the academia the ones who has to mobilize towards a common direction.

7. About tendering and partnership tools to promote low TRL

Current procurements and project partnership models

Partnership on research projects is mainly of interest to gain expertise, to close links with research institutions, as investment on know-how. They consider it as an investment and, for such, they accept the cofund that this partnership implies.

Procurements are faced on two approaches: for products with expected final market (in all the times, at long-term) or just supply of reduced number of units for the research institutions. Both models are valid to them, although none of them are strong sources of profit.

In general terms, the companies agree to join the two model of collaborations. They find added value on them both.

Specific messages received

- Separate the tender in steps.
- A good tendering strategy: the institution places an order for a preliminary study and then, to avoid problem of the competition during the tender, the institution owns the documentation produced before.
- The rules must be clear. Avoid too many options, it is limiting, in term of costs. More options mean that the company has to look for protections.

Having said that, they highlight that there are no golden rules.

Limitations reported

In general terms, in the accelerator field, the difficulty is how to enter in the prototype work before the tendering. When requesting a quotation for a concept under drawing, it is a tricky issue. Many times, the design must be adapted before the development stage towards industrial specifications.

Before the contract, the risk for the company is that the discussions with the institution are started in many cases providing know-how in advance, modifying the design, with no guarantee of being awarded. The company may spoil its time and know-how to improve a design that other company may win. From the industrial point of view, this procedure discourages from sharing information with the research projects. They report that this happens quite frequently.

In many cases, accelerators, synchrotrons and other related facilities provides designs not completely finalized. And, from this step, budget quotations are requested. Some companies do not just offer this help; they simply go to the tender. But, in the tender, the design is frozen and, if not optimized, the product is less reliable, more expensive.

Successful tendering processes

Among the options discussed on procurements, only innovative procurements such as PCP are mentioned as a model well suited to work at low TRL.

More advanced models in other fields

Examples to follow have been found in other fields. In pace applications, ESA has specific programs for low TRL: it is the case of the former TRP, currently TDE (Technology Development Element). It is a mandatory program of ESA, in which countries contribute according to their GDP. ESA defines the technology to be developed under this model.

Besides, we want to highlight that ESA has set out procurement procedures flexible enough to be adapted to modifications during the procurement phase. CCN (Contract Change Notice, ESA own regulation as International Organization): sometimes, motivated by ESA, sometimes, requested by industry.

8. Viability of advancing towards low TRL programs

In our field, research institutions have more internal technological capacity than other communities. So, apparently, there is room to move to models with more reduced internal costs. (Internal costs of CERN: 50%, internal costs of ESA: 25%). (*sensitive question*)

But deploying a program based on the recommendations providing in this report can represent an actual outsourcing of know-how and own technology from the public institutions. At the end, would it be a positive strategy?

We are not in position to answer this point, because of the difficulties of an ideal accompanying of the industry to our programs. We emphasize that the industrial collaboration in our field is bound to the following variables:

1. The specificity of ASc&T field. A reduced sector, in terms of industrial mass.
2. Short-term programs. Difficult to adapt.

We may conclude that there no exists guarantee that a reduction of internal costs can be efficiently complemented with industrial developments.

In any case, there are previous representative examples that can help us: NASA carried out this evolution already.

9. What we can do

Research institutions

- Leverage our internal technological capacity in line with the existing industry.
- Insisting on promoting E&T programs, making them visible to industry with lower experience and contacts via ILO.
- Assuring long-term development plans
- Promote the integration of roadmaps within synergetic communities (*). Join strategies specifically on ASc&T.
- To promote synergies with other less closer fields. In particular, Fusion and Space, that might help to avoid peak-valley activity gaps.
- Work with the funding agencies to open new innovative tendering processes, more flexible to changes and contingencies.
- Use and expand innovation procurement procedures. Relevant examples in other fields.

(*) To be further discussed.

The industry (*jmp-> just initiated; to be improved***)**

- A major effort on self-organization. Industry associations must be encouraged.
- Being proactive in the information about projects and tenders. Via conferences, sharing research projects (in particular the transversal work packages of integration projects, or via ILOs, among others.
- Help to cofund the needed investment, at a fair balance, depending on the distance to the market.
- Proactivity on Education and training programs.

10. Consequences

A successful program of collaborating at low TRL in the ASc&T field could most probably at the end modify our Research Infrastructure model.

It would impose a strategy most difficult to define: an integral coordination with synergic communities and with other fields may be necessary, what it is a relevant challenge. (*sensitive question*)

The Space model is a reference that this is possible and, most likely, efficient. But it must be defined whether this model is reachable for us, since our field has the constrains previously defined.

11. Recommendations

1. Promote among the research institutions a change of attitude about the design and prototyping processes in particular. Promote a global analysis about the actual resources available both at the research center and in the industry to carry on the work. Not rely only on internal resources.

2. Work on procurements procedures more suitable to innovation. Following implementations in other fields more advanced on low TRL programs

3. Continue with the objectives of promoting the integration of roadmaps within synergetic communities in ASc&T, to increase the market dimension. (This may have implications at higher levels of strategy.)

4. Expand this objective to coordinate strategies on horizontal technologies with related communities. (This can be a not very realistic recommendation; too complicated.)

5. Insist on E&T programs as a most valuable aspect. Improving the existing limitations.

6. Insist on a better internal organization of the industry of science.

7. Insist on a deeper involvement of the industry on the research plans on ASc&T. Provide more resources to contacts with research institutions; deeper involvement on research projects.

8. Support and reinforce the roles of ILOs as most valuable communication link.

(jmp:

· a problem: two types of recommendations: either obvious recommendations or too complex to achieve. To discuss

· The messages to the industry must be reviewed and extended)