

European Innovation system: a battle of yeasts and funguses

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Abstract— The paper provides some analysis elements of the European Innovation system with the perspective of the role that SMEs plays in the European economy and their activity in the European Innovation system. It also compares the strengths and weakness of the innovation system and suggests areas for priority. A metaphor is made comparing the traditional innovation chain as artificial projects enlarged with the effect of yeast and the truly required innovation chain as fomenting the proliferation of innovative funguses.

Keywords— *SME, research, innovation, market*

I. INTRODUCTION. WHY SMES ARE CRUCIAL FOR EUROPEAN ECONOMIC AND INDUSTRIAL HEALTH

Europe is populated of Small and Medium Enterprises including also micro Enterprises. A significant contribution to the European Value Added is obtained through the economic activity of SMEs and a large part of the European jobs are created by SMEs. But, what an SME is? In general, SME is a company which employs fewer than 250 persons and has an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.

The concept of SMEs includes micro, small and medium enterprises; nevertheless it is obvious that the operations and financing capacity of a 200 people SME is different from a 10 employee SME. Both are SMEs.

A further splitting of SMEs will also help to better design the best accompany measures to be implemented for the successful production of innovation and the exploitation of such innovation results:

- Micro Enterprise, which would include enterprises with less than 10 employees and less than 2 M€ annual turnover.
- Small Enterprise, which would include enterprises with less than 50 employees and less than 10 M€ annual turnover.
- Medium Enterprise, which would include enterprises with less than 250 employees and less than 50 M€ annual turnover.

The typical European firm is a micro firm. This is especially important taking into consideration the weight that SMEs have in European economy, being a major job engine for Europeans.

The overwhelming majority (99.8 %) of enterprises active within the EU-28's non-financial business economy in 2012 were SMEs (employing fewer than 250 persons), some 22.3 million. Perhaps the most striking phenomenon of SMEs is their contribution to employment. More than two thirds (67.1 %) of the EU-28's non-financial business economy workforce was active in an SME in 2012, some 89.7 million persons. Across the whole of the EU-28's non-financial business economy, SMEs accounted for 57.3 % of the EUR 6.18 billion of value added generated in 2012. The contribution of SMEs to non-financial business economy value added was 9.8 percentage points lower than their contribution to non-financial business economy employment, resulting in a lower level of apparent labor productivity.

More than 9 out of 10 (92.7 %) enterprises in the EU-28's non-financial business economy were micro enterprises (employing fewer than 10 persons); their relative share of the non-financial business economy workforce and value added was considerably lower at 29.1 % and 21.0 %. As such, micro enterprises accounted for the second highest share of employment and value added. Their relatively high weight in terms of their contribution to employment and value added was countered somewhat by the fact that they recorded the lowest level of apparent labor productivity, at EUR 33.3 thousand per person employed

Enterprises by size in Europe				
	Number of enterprises (thousands)	Persons employed (thousands)	Value added (Million €)	Apparent labor productivity (K€ per head)
All enterprises	22,347	133,767	6,184,825	45.2
All SMEs	22,303	89,690	3,557,448	39.7
Micro	20,718	39,000	1,300,000	33.3
Small	1,362	28,000	1,100,000	39.3
Medium	224	22,967	1,128,741	49.1
Large	44	44,078	2,627,377	59.5

Fig. 1. Eurostats. Business economy, size class analysis

Enterprises in Europe. SMEs by size class. Shares						
	Total	SMEs	Micro	Small	Medium	Large
Share in %	100	99.8	91.8	6.9	1.1	0.2
Persons employed	100	67.1	29.6	20.6	16.8	32.9

Figure 2. Eurostats. Key indicators for enterprises

Furthermore, 54% of the people employed in the R&D sector are working in SMEs. This scenario shows a tremendous contradiction with respect to the participation of SMEs in the cooperative research programmes, as they participate below 15% during last Seventh Framework Programme (2007-2013) being 20% the new target for the European Horizon 2020 framework programme (2014-2020).

On average across the EU, innovations were introduced by 79% of large manufacturing firms (those with more than 250 employees), by 58% from medium-sized ones (50–249 employees) and by just 44% of small ones (fewer than 50 employees).

If the innovation system should ensure a better position for the future competitive economy, Europe has a huge problem: those contributing largely to the value added and the jobs in Europe are those who participate and get involved less in the innovation projects. This has to be corrected!

From this high level comparison, it can be obtained the following key indicators:

- 98% of the European enterprises are of SME size.
- SMEs contribute to the 67 % of the European value added. Their contribution to jobs reaches the 57 % at European level. The trend is growing during last decade.
- For some European countries or Regions, the SMEs contribution to the National or Regional PIB can reach levels up to 85%. Their contribution to jobs reaches up to 75 %.
- SMEs activity at European Research and Development projects has reached 15% for some research thematics in the FP 7 and it is targeted as 20 % for the Horizon 2020. At national or Regional levels, their participation reaches up to 50%.
- SMEs show lower productivity rates clearly resulting from their lower involvement in research and innovation activities.
- There is a systemic gap between contribution to the value added and involvement in research and innovation, which corrections should be a priority for the European research and scientific programmes.

Therefore, the first conclusions, of statistical quantitative nature, are:

- ⇒ that Europe has a significant problem as their massive active economic players are poorly active in the Innovation. Consequently, there is a very crucial gap between the role of SMEs in the economic activity and the role of SMEs in the innovation and research camp.
- ⇒ Incentives and favorable conditions should be set for the involvement of SMEs in the research and innovation European programmes. Their lower labor productivity is a clear signal that SMEs should get involved in the innovation activities to adopt efficient tools, procedures and processes.
- ⇒ Research and Innovation programmes at European, National and Regional levels should be designed and operated with a priority target to foster the involvement of SMEs.

We review later in the paper whether this gap is motivated by lack of interest of SMEs or a systemic problem in the design and operation of the European and National research frameworks, or even a conceptual misunderstanding on how innovation should be promoted and implemented in the XXI century.

II. OPEN VERSUS CLOSED INNOVATION

In this section, we pay attention to qualitative elements: the kind of innovative and research organizations and how the economy is organized around a SME. The term “Open Innovation” has been promoted during last decade as an applicable approach for all types of sectors and enterprises classes, but it seems the SMEs are the enterprises who really practice this concept of “Open business ecosystem” and, consequently also, “open innovation”.

Figure 3 depicts a global perspective of the overall ecosystems surrounding the activities of the SME, the business landscape coming with the Millenials (Millenials are the new generation of citizens, workers and entrepreneurs who will be responsible for the European growth in the next decades).

Traditionally, the business development processes have taken place within the boundaries of a traditional company: using its own resources (tools, employees, offices, etc.). However, the companies of the Millenials will be constructed around a cooperative environment forming an entrepreneurship landscape where each component of the ecosystem is specialized in a given field (management, marketing, sales, operations, research, etc.).

According to the concept of open innovation, large corporations, small, medium and micro enterprises, universities, technology centers, associations must work together. Furthermore, the traditional concept of classifying the entities participating in the research programmes according to their legal form, regardless of their business environment, should be revised to align the potential

contribution of research programmes to the overall challenges of the nowadays economy.

Closed innovation

Although one could perceive that the current social, industrial and business trends point towards a “mandatory” open innovation, the research programmes are constructed in a way to foster the “closed innovation” against the option of open innovation. Programmes compensate the business companies who growth and increase their resources with a short term and materialist perspective. Companies have to demonstrate that they are investing on human resources or in equipment or in premises to justify they are entitled to get access to research and innovation awards and grants. Those companies practicing open approach do have much more difficulties to get access to the grants and awards.

Here are the high level conclusions on qualitative approach:

- ⇒ European research and innovation programmes compensate more to the traditional research infrastructures rather than truly innovative business and industrial landscapes.
- ⇒ The value of the idea should be put at the front of the evaluation more than the capacity or available infrastructures.

III. EUROPE AND UNITED STATES OF AMERICA

When making a comparison of the Innovation system at Europe and at the USA, one can notice two completely different philosophies of business and innovation chain.

The Europeans seems to self-question how we could make research teams larger and larger? While Americans seem to self-question how we can help those emerging innovative paths?

None of the major innovations which have happened in the USA were originated in any sort of large Private-Public Partnerships. However, Europe and even Member States do promote and prioritize large and large innovative Consortia. Why this different approach and sensitivity of the Europeans and the Americans? Who is right? May be, a possible explanation can be found when bringing the equation of yeasts and funguses. See below.

Furthermore, it is curious to compare that the majority of the top larger companies of the USA did not exist 25 years ago, while their Europeans fellow did exist.

IV. UNDERSTANDING THE BUSINESS CHAIN OF SCIENTIFIC AND INNOVATION OFFERING

Chapter II above has discussed the open innovation model claiming that the modern companies are structured around a sort of virtual extended enterprise. Several specialists on each of the crucial components of the value which the company creates cooperate to form a larger virtual enterprise, a sort of SME cluster of several disciplines.

When investigating where the innovation actions should focus, the business value chain has to be reviewed. Europe should be proud that its innovations system is quite capable to produce innovations, create new scientific results, produce scientific publications, register IPs, etc. However, the rate of conversion of those scientific results into business and economic value in the market is certainly much lower than it would be desirable. Why? Among other reasons, it seems that the focus of the promotion is made in the stages of the value chain which are less effective and, even do the efforts are made in these stages, the relevant innovators (SMEs) do participate minimally.



Fig. 3. Stages of the typical product value chain

The above chain describes that Europe is performing well in general from the overall point of view of large enterprises and academia, in the early stages of scientific production and demonstration of research results, while the conversion of those intellectual assets into pre-commercial and commercial value propositions is less effective, in addition to not counting with the role SMEs should play in such early stage of the innovation system.

Europe should set programmes and promoting activities to assist SMEs to make commercial reality their intellectual assets.

The new programmes should focus on activities to promote the conversion of scientific assets into business value propositions by bringing closer the scientific and technology groups to their potential clients. The research and technology development phases should be accompanied in their earliest stages by the future customers

or future converters of scientific assets into commercial products and services.

Europe needs an environment that stimulates not only knowledge creation, but also knowledge transfer into the market faster and better than anywhere else.

This challenge is about creating the entire innovation chain and putting pressure on turning good ideas into practical benefits by combining stakeholders' contributions in the entire innovation chain. One matter at this point is to make venture capital investors aware of the investment potential that lies in the projects developed by European SMEs under several financing programmes that don't have a direct market application.

⇒

⇒ Europe should involve SMEs in the research programmes. The current figure of 15 % involvement compared with their 57 % contribution to the value added or 67 % contribution to jobs creation represent a strategic mismatch of the European policies dealing with innovation. The 20 % target set for SMEs participation in the Horizon 2020 seems to be out of the reality of what is required.

⇒ Europe should pay more attention to assist the gap of converting research results into innovative business propositions, by linking technology offerers and technology buyers.

V. THE VALLEY OF THE DEATH IN INNOVATION

The valley of the death has been largely studied by many investigators and many reasons and specific issues have been identified for a large variety of different sectors and industries.

This paper defends the need of better and larger support to SMEs at the stage of crossing their valley of the death in addition to fostering and stimulating their research and innovation initiatives.

The European Innovation system should also focus on measures to fight against the ratio of SMEs dead and SMEs initiatives dead at the time of converting the results of a research activity into a pre-commercial or commercial value proposition.

The European Innovation system should launch measures to foster the interest of potential customers to the SMEs initiatives since the early days of an innovation plan. Buyers of technology should be motivated to pay attention to the SMEs research stages and set links which have the potential to be converted into future business relations, thanks to the mutual trust constructed during the research process.

Currently, the European Innovation system fosters the launch of research initiatives, but those initiatives do not

have similar support and accompanying actions when approaching to the exploitation stage of the research.

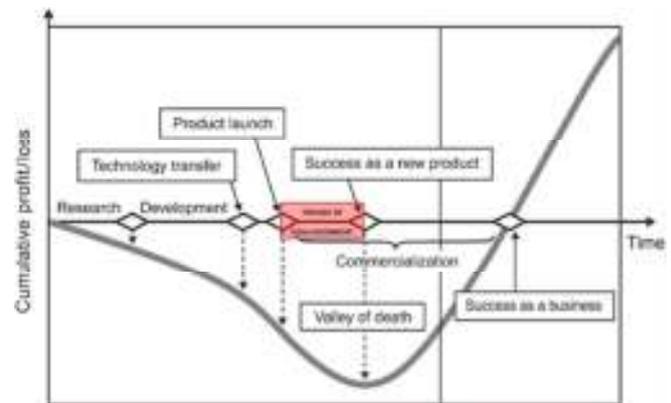


Fig. 4. Typical evolution of the profit/loss in an innovation process

⇒ The European Innovation system should move its attention from the early stages of innovation, which are relatively successful nowadays, to more crucial milestones of the innovative process, by fighting against the threats represented by the valley of the dead when launching innovative products or services.

V. THE EUROPEAN INNOVATION SYSTEM: A YEAST OR FUNGUS APPROACH

Since several years ago, may be a decade or so, Europe is focusing its strategic innovation policies towards fomenting the creation of large initiatives or the so called Public-Private Partnerships. While this approach may be very relevant for a number of key European innovation challenges, this same approach converted into a general policy, seems to be an historic error. Furthermore, many European countries are mirroring this European policy and also at national level, priority is given to large consortia and very ambitious innovative targets.

The European efforts seem to target projects like “putting a man in the Moon”, where the contribution of most of large players and all the ecosystem of the research resources would be necessary due to the size of the problem. Europe seems to have interest to compete with the larger North American players (Microsoft, Google, HP, IBM, Facebook, Apple, just to mention some of them in the ICT sector). Whereas this approach of supporting the technology Olympics might be justified for a limited set of cases, it seems a strategic error if the same policy is applied to the rest of the innovation system in general.

Having said this, there are good experiences of successful cases where the large cooperation among European innovators have created relevant results. For example, the European DVB system for digital television, or the European GSM first generation of mobile communications.

Could you imagine if the unique, or priority, sport facilities available for the society would be those of high tech installations which only the candidates for Olympic medals would be able to use and work out? What about the sports centers for the use of the society in general who have interest to shape their bodies and minds but not having interest to become candidates for the high level competition? Should Europe stop constructing sports centers and concentrate only in high tech sports facilities to show the world that we have athletes of the highest performance?

This is what is wrongly happening in Europe. Research is driven by “excellence”; in terms of Olympiads, only candidates for medals! Innovation should not be mapped as excellence. Innovation is a different concept at different layer. Innovation is progress, doing things in different manner, exploiting new economic opportunities, serving the needs of the economic ecosystems of each sector. If you start to run every week and shape your health and body shape, you are an innovator!, although you may not perform as an excellent athlete. Europe should forget the “champions” strategy as the main strategic approach for the selection of innovation projects and programmes. Certainly, we are all proud when we experience a champion success case, but such champion case does not serve, per se, to enhance the well-being of the European society at large.

Significant efforts and ideas are lost in the process of selecting “excellence” or “championship”. Artificial consortia are built to try to push for a baby who, at the time of born, European innovation system believe on babies already mastered at University and powerful and autonomous enough to drive their lives in a competitive landscape of the global economy just in their early days of their lives. This is a historic and crucial error which requires correction.

SMEs and SMEs innovation should be treated similarly as human life. Admit SME weakness at their early stages and accompany them till they are capable to fight in the market. European Innovation system is behaving as if humans would like to modify all the gens of the non-born

baby to ensure the baby has all potential to perform as society would love in an ideal and fictitious human kind approach. This is the concept of “*Yeast Innovation*”: artificial enlargement of the research projects to build the future, shape the future, constrain the future, imagine the future, invent the future, and what is more worrying, believing that such approach would empower our capabilities for the future.

The following figure represents the wrong approach (I repeat, this scheme might be appropriate for some very limited cases of huge problems to solve): projects are selected based on the theoretical excellence, selecting ideas as the absolute technology truth and, very irresponsibly, limiting the role of SMEs in those unnecessarily large initiatives. The author calls this approach as the “inverted pyramid”: projects are large at their origin (research and technology developments) and become diluted and atomized just at the time, they would require joining forces (the innovation stage).

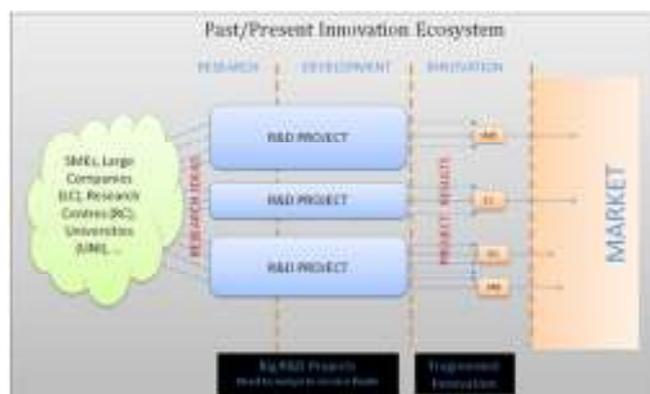


Fig. 5. The Inverted pyramid. A Yeast innovative approach

By the contrary, the USA and successful innovation programmes do emphasize the importance of competition for new ideas, proliferation of new innovative approaches, promotion of multiple number of technology developments and, consequently, higher camp for SME contributions. The proliferation of many funguses should not constitute a problem, but an asset and an indicator of the well health of the innovation system. None can predict the future, none can guarantee the success of a given technology, but the innovation should be based on facilitating that innovator funguses can appear here and there. Some of them will dye, others will survive and some will constitute the champions of the future.

Contrary to the current Innovation system, the effort in promoting innovation should be put in the stage closer to the market, closer to the valley of the death where SMEs and innovators require the support to perseverate in their ideas and their vision of the future.

Some advocators of the Yeast approach argue that funds for the support to the innovation system are limited. This is true. Indeed, this is the reason why efforts should be made on the right stages of the Innovation system. They claim that fragmentation of the research and the innovation is a problem for Europe which should be avoided. The author, however, argues that the Innovation system would be powerful if there is an ecosystem allowing ideas and entrepreneurs to show up and assume their risks visioning the future.

The European Innovation system should be less interventionist/controller to the research initiatives, should not be a selector of a-priori winners or champions, but a facilitator and promoter of as many as possible initiatives, mostly launched and driven by SMEs. When those technology innovations would have the potential to tackle the market and the risk of suffering the threats of the valley of the death, the European Innovation system should set mechanisms to assist innovators to find their markets and the application of their inventions. Making closer the relations of inventors and technology consumers or technology buyers should be one priority of the European Innovation system.

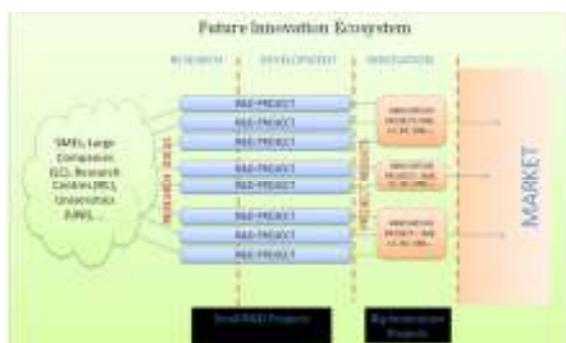


Fig. 6. The right pyramid: the fungus innovative approach

Europe

- ⇒ European Innovation system should invert the current wrong orientation of the pyramid to focus attention in the way to exploit the research results rather than selecting a-priori the winners (players, researchers, technologies).
- ⇒ The PPP concept should be limited to well-justified cases or problems where the cooperation of many players participating in the value chain of a given innovation would be required. Only limited number of research initiatives would equal the challenge of “putting a man in the Moon” initiative.
- ⇒ SMEs should find ways for launching their technology innovations without any limitation and prejudgment of a-priori assessment of excellence or championship. At the contrary, the support should be focused on enhancing the potential for exploiting the results.

VI. CONCLUSION

This paper has reviewed some key elements of the European Innovation system and advocates for significant changes in the way policies are constructed to select the ideas, projects, initiatives of the European research projects.

SMEs are crucial components of the overall innovation ecosystem and they should play a crucial role in the innovation ecosystem. The current target of 20% SME participation in the European Horizon 2020 programme seem a ridiculous objective in comparison with the role SMEs play in the overall European economy and value aggregation.

Academia and large enterprises do perform well in the early stages of research but the transfer of research results into exploitable businesses is poor. More emphasis should be made on the exploitation of results of the innovation and accompanying measures should be adopted to empower the overall chain of the innovation cycle.

A change of policies from promoting yeasts through artificial large consortia to facilitating and preparing the ground for the proliferation of innovative funguses should be adopted.

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Dr Seseña has worked for the Spanish Administration as head of research unit, Hispasat, Teledesic, ROSE Vision, Holistic Innovation Institute. He has been chairman of the European-Latin American research policies dialogue

Committee, the European SME research experts group and has contributed to the success of the Spanish AMETIC association promoting the involvement of Spanish SME researchers in national and European programmes.

He got prestigious Awards of the Chambers of Commerce and Industry of Madrid and Toledo for the best innovative entrepreneurship and best example of innovative SME.



Figure 7. The yeasts and fungus approaches

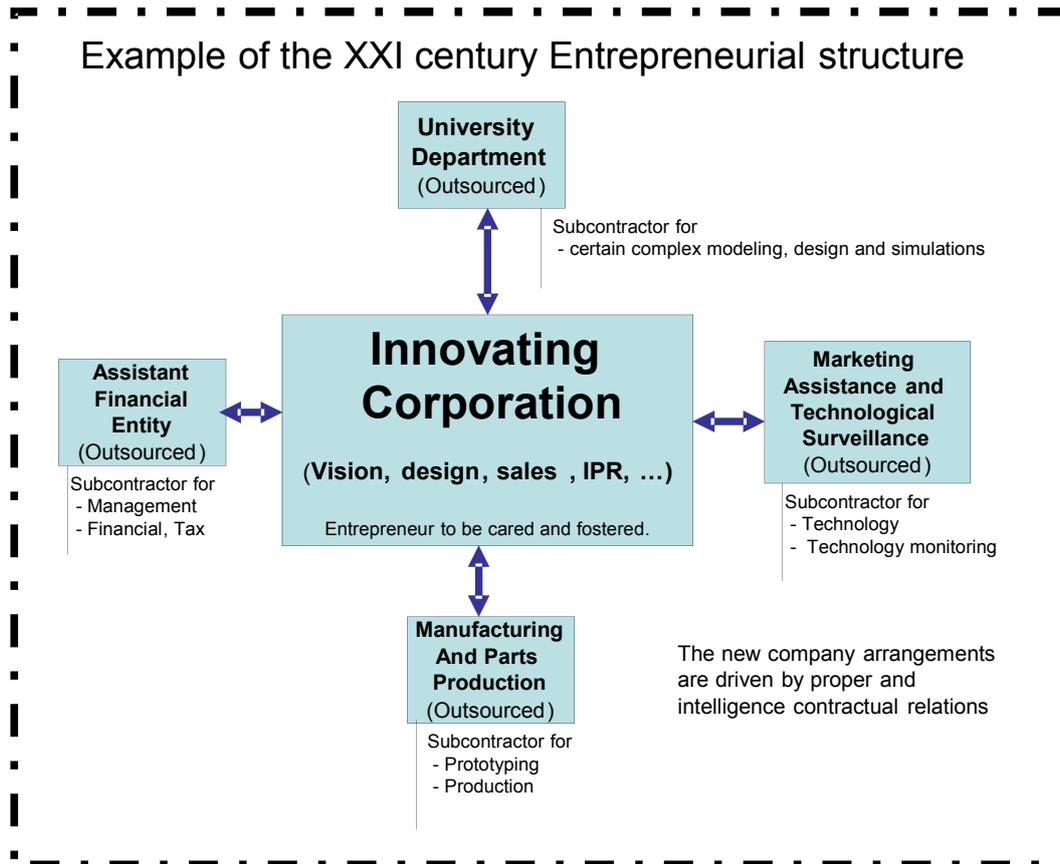


Figure 3. Open business ecosystem for SME