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A LIFELINE FOR EUROPE'S YOUNG RADICAL INNOVATORS

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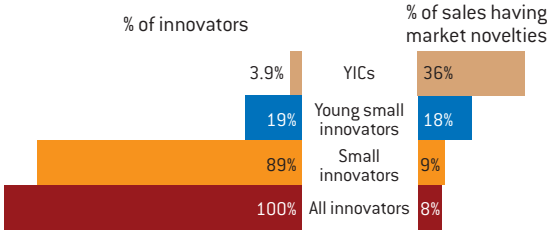
SUMMARY Europe's young, dynamic, high-growth firms are in a precarious position, despite their pivotal role in bringing radically new innovations to market. EU start-ups face higher entry and growth barriers than their counterparts in the United States, and consequently Europe has fewer **young innovative companies** (YICs) than the US. Those that Europe does have are less R&D intensive. The main barriers to innovation are access to finance and the difficulty that YICs have in accruing the benefits from their innovations. In the current crisis, YICs must also adapt to a double whammy of credit that is even more constrained than usual, and higher bankruptcy risk. Policymakers must provide support for these firms, and they must get their policy interventions right.

POLICY CHALLENGE

EU member state recovery programmes pay most attention to large, long-established firms, and all but ignore young, radical innovators. This short-term approach jeopardises the long-term benefits that breakthrough innovations can bring. An EU YIC programme should first and foremost deal with financial constraints, and should reward the risk-taking inherent in radical innovation. Such a programme could be targeted to particular policy areas – especially environmental technology development – would relate to the pre-commercialisation stage of projects, would involve phased financing, and would not include the typical EU stipulation that projects should involve cross-border collaboration. However, project applications and evaluation should be pooled at EU level to ensure highest standards of excellence in the selection procedure.

YICs: a rare but important source for radical innovations



Source: author's calculations.

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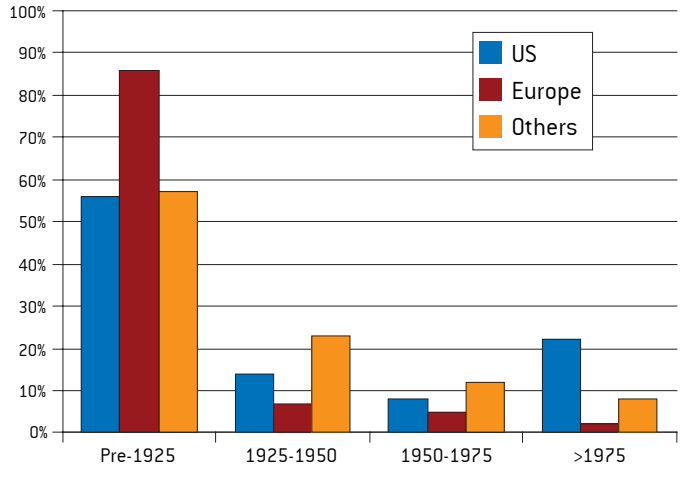
THE EU-US GROWTH PERFORMANCE GAP is often explained by the former's lack of young, dynamic high-growth businesses. The evidence suggests indeed that new EU firms face higher barriers to entry, exit and growth compared to their US counterparts (see eg Bartelsmann *et al* 2004, Philippon and Véron, 2008). Europe is missing out on the direct contribution to growth from these firms, but is also less likely to benefit from the growth-enhancing innovations they bring.

An examination of a sample of the largest companies in terms of market capitalisation and research and development spending illustrates this. In the US (and also other non-European countries) young companies make up a much larger proportion of leading innovators than in the Europe (Figure 1). Illustrative examples are Microsoft (founded 1975), Amgen (1980) and Cisco (1984), respectively the US's fourth, tenth and twelfth largest R&D spenders. The European picture is much bleaker: the first young company in the list is SAP (founded 1972), Europe's twenty-second largest R&D spender.

Not only does Europe have fewer young leading innovators, the ones it does have are less R&D-intensive than their US counterparts. The average R&D-to-sales ratio of US young leading innovators is 7.4 percent, almost twice as high as the average US ratio (3.85 percent). Europe's few young leading innovators have a one percent R&D-to-sales ratio, which is substantially below the overall European ratio (2.5 percent). Young firms in the US thus contribute even more to overall US R&D then to US turnover, whereas in Europe this is not the case (Table 1). This can mostly be attributed to the different sectors in which these young companies operate. In the US, 70 percent of young leading innovators are in biotech (4) or ICT (13), while in the Europe, only two are ICT firms.

Figure 1: Share of *leading innovators* by age cohort



Source: author's calculations. Note: Figure based on a sample of 226 companies, obtained from matching firms in the FT Global 500 from 2007 with the 2007 EC-IPTS Top 1000 EU and non-EU R&D scoreboard companies. Leading innovators are thus defined both by their market capitalisation and R&D expenditures. The US has 80 companies in this sample, Europe 86 and other countries 60.

Table 1

Contribution of young leading innovators to total leading R&D and sales: US and Europe

	R&D	Sales
US	28%	15%
Europe	2%	6%
Total	16%	12%

Source: author's calculations. Note: The total is the sum of R&D and sales of all 226 leading innovators in the matched sample. Young is defined as founded after 1950. The US has 24 young leading innovators, Europe seven.

In addition, if we focus on **radically new innovations** that have the potential to generate new markets, young companies become even more pivotal. Incumbent firms spend more on R&D for incremental innovations that build on their existing competences, but are less active when it comes to radical innovations that make their existing competences redundant (Henderson and Clark, 1990, Henderson, 1993). Small young firms, not concerned with safeguarding existing skill-sets and market positions, are more inclined to introduce these radical innovations. Baumol (2002) reports an impressive list of major innovations introduced by small US firms during the last century. Table 2 shows a selection from this long list.

Baumol (2002) stresses that society can only benefit fully from the breakthrough innovations of small, young firms if it has an innovation system that effectively links small and large firms, with the latter following-up and improving the breakthrough innovations of the former. The US is fortunate in having this symbiosis. A less efficient system, or one that impedes young, radical innovators, might

[1] With thanks to the ZEW (Zentrum für Europäische Wirtschaftsforschung), Mannheim, for supplying access to the firm-level data. Full analysis of the data is reported in Schneider and Veugelers (2008).

Table 2 Major innovations by small US firms in the twentieth century		
Air conditioning	High-resolution CAT scanner	Optical scanner
Biomagnetic imaging	Hydraulic brake	Pacemaker
Polaroid camera	Kidney stone laser	Quick-frozen food
Electronic spreadsheet	Microprocessor	Soft contact lenses
Heat sensor	Magnetic resonance scanner	Two-armed mobile robot

Source: Own selection from Baumol (2002) .

have a severe indirect impact on an economy's overall innovative and growth performance.

One barrier to innovation is **access to finance** (Hall, 2005). Reputation and collateral are important in accessing external finance and consequently young innovators are more likely to experience constraints than established firms, particularly if these young firms propose more radical investment projects.

Moreover, young radical innovators will be affected disproportionately by a financial crisis. Innovating companies that rely on external financing, and who find it more difficult to access external finance because of their risk profile, will be particularly hard hit by malfunctioning financial markets. Furthermore, in a recession with high bankruptcy risks, the negative effect of credit constraints on R&D investment is exacerbated for firms at higher risk of bankruptcy (Aghion *et al*, 2007). As a consequence, in the current combined financial and real economy crisis, young firms with radical innovative projects are threatened by the double whammy of constrained credit and higher bankruptcy risk, reducing the chances of new radical innovations that will lay the foundations for future growth seeing the light of day. All this calls for greater-than-usual government support for young radical innovators.

It is one thing to make a case for policymakers to pay particular attention to this category of business. It is another thing to get the policy intervention right. We still do not know enough to support evidence-based policy design for young radical innovators in the EU. Are young innovative companies indeed the most promising firms in terms of radical innovations in the EU? What obstructions do these companies face? Can policy intervention make a difference?

This policy brief brings together arguments from analysis and proposes general and specific policy recommendations. Empirical evidence from the 2005 wave of the German Community Innovation Survey (CIS 4) is used[1]. This is a regular pan-European Eurostat survey on the innovative strategies of firms. We use the German survey, as this includes information on the age of the firms.

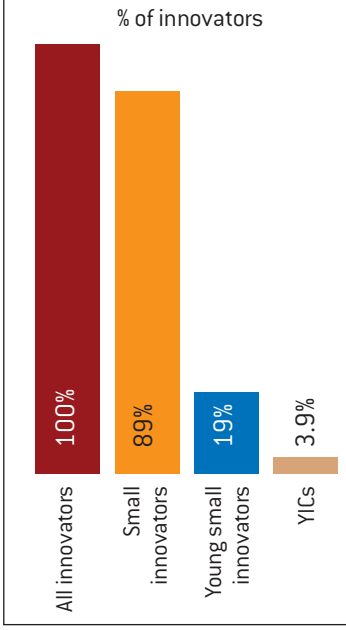
ARE YOUNG RADICAL INNOVATORS SPECIAL?

If young radical innovators deserve policy attention, it is not because they represent a large share of EU GDP or employment, nor will they ever account for a significant proportion of EU R&D expenditure.

The German sample confirms the rarity of young, highly-innovative companies. We define ***young innovative companies*** **(YICs)** as companies that have introduced new products or process innovations, that are less than six years old, that have fewer than 250 employees and that spend at least 15 percent of their revenues on R&D[2]. This definition is in line with the revised EU state aid rules, that allow for more favourable treatment of young innovative companies by EU member states[3].

Only four percent of the 1342 innovation-active companies in the German CIS sample, qualify for YIC status, representing 0.05 percent of sample employment[4]. They are particularly present in knowledge-intensive, technological sectors, specifically services such as information and communication technology (ICT) services and R&D services (Figure 2).

Figure 2: YICs: a rare species in the innovation eco-system



Source: author's calculations.

[2] The label YIC (young innovative company) has become fairly established. It was introduced by a biotech consortium proposing a Europe-wide tax status for young innovative companies (www.yicstatus.com). France and Belgium have already adopted such a status, but using different criteria (both use the 15 percent R&D to sales ratio, but France has an age limit of eight years, Belgium 10 years).

[3] EU state aid rules define Young Innovative Enterprises' ('YIEs') as being less than six years old, externally 'certified' on the basis of a business plan as being capable of developing products or processes that are technologically new or substantially improved, and that are at risk of technological or commercial failure, or have R&D intensity of at least 15 percent in the last three years or currently (for start-ups). See www.ec.europa.eu/competition/state_aid/legislation/horizontal.html

[4] Similar results are found in the Flemish CIS sample.

THE RADICAL YICS

The evidence from German CIS data supports the importance of young, small innovative companies, even if they are small in numbers and size, as introducers of more radical innovations. First, the innovative activities of the YICs in this sample have a much more 'basic' R&D profile[5]. Second, in terms of innovation output, YICs have a substantially – 2.4 times – higher sales of new or substantially improved products, compared to other innovators. For more radical innovations (measured as the share of sales of ***market novelties*** – Table 3), the performance differential for YICs over other innovators is even more impressive, at five times higher. These summary statistics support the notion that YICs' superior innovative performance emerges most strongly for more radical innovations, qualifying them as young radical innovators[6].

Econometric analysis confirms this superior innovative performance by YICs (Table 4). YICs achieve on average a higher level of innovation performance than other innovators. This result is more emphatic for sales with market novelties. It is important to stress that the significant positive result for YICs remains evident after correcting for firm size, age, R&D intensity and the 'basicness' profile of the firm's innovation strategy. This underlines why YICs are not the same as small innovators, or young innovators or R&D-intensive innovators. Their special character comes from combining all in one: youth, smallness and a highly R&D-intensive profile.

Table 3

YICs and radical innovative performance

Variables	YICs	Other innovators	Significant difference between YICs and other innovators
Share of sales of new/improved products	0.600	0.261	***
Share of sales of market novelties	0.360	0.072	***

Source: Schneider and Veugelers (2008). Note: *** represent significantly different means between YICs and other innovators at one percent significance level.

Table 4

Effect of company characteristics on innovative performance

	Share of sales with new/improved products	Share of sales with market novelties
Age of the company	– *	– **
Size of the company	– *	n.s.
R&D intensity	+ ***	+ ***
Basic R&D	n.s.	n.s.
YIC	+ ***	+ ***

Source: On the basis of Schneider and Veugelers (2008). Note: the asterisks refer to the estimated effect being statistically different from zero, with *** indicating a one percent significance level; ** a five percent and * a 10 percent significance level; n.s. reflects a non-significant effect. Age and size (measured through employment) are in logarithms. Also included are industry dummies. Number of innovation-active firms used in the estimates (excluding East Germany): 1086.

These superior innovative performance results for YICs hold up in the face of small changes in the YIC definition criteria, such as the age and size threshold. With more substantial changes to the criteria, particularly with respect to R&D intensity, the target group of companies becomes larger but less exceptional in their innovative performance, particularly on radical innovativeness (Schneider and Veugelers, 2008).

To summarise, the evidence from the German CIS data confirms the presumption that young, small, innovation-intensive firms are a tiny, but distinct group, achieving significantly higher innovative sales, particularly the more radicals ones, than do other innovation-active firms. Since radical innovations are those most likely to trigger follow-up innovations by incumbents, their 'social' return can be substantial. Thus, impeding the innovative behaviour of YICs could have a significant broader impact.

BARRIERS TO INNOVATION BY YICS

As already shown, YICs, which combine the disadvantages of smallness, youth, lower levels of retained earnings and more risky innovative projects, are more likely to be **financially constrained** than other small or young or innovative firms.

A second barrier, arising from the **difficulty of appropriating the returns from innovation**, may also impact YICs differently. Often lacking the scale to accrue all the necessary complementary assets for successful commercialisation (including access to distribution channels or intellectual property management), YICs may find it

[5] 'Basicness' is measured by the relative importance of universities and public research organisations, as a source of input for innovation activities relative to suppliers and customers.

[6] Note that the degree of novelty is as assessed by the respondents themselves and may include a subjective bias, which may be stronger in young hubristic entrepreneurs.

harder to appropriate the returns from their innovations (eg Gans and Stern, 2002). If YICs are less able to capture the externalities they generate, the divergence between the social and private rate of return on their R&D is larger.

YICs report higher obstacles to innovation than other innovating firms (Table 5)[7]. When comparing across barriers, the results confirm the presumption that financial constraints – both internal and external – are the main barriers to innovation for YICs. Although this ranking also holds for other innovating firms, the YIC differential is largest on both types of financial constraint and is strongly statistically significant[8].

For other barriers to innovation, there is unfortunately no factor in the survey allowing a sufficiently detailed assessment of the difficulty YICs face in appropriating returns on R&D investment. Only when it comes to the problem of finding partners is there a notably higher effect for YICs, a result that might signal obstacles to the indirect effects of YICs interacting in 'co-optition' (a mixture of competition and co-operation) with other more established players (Schneider and Veugelers, 2008).

A NEED FOR POLICY SUPPORT FOR YOUNG RADICAL INNOVATORS?

Considering the combination of barriers linked to the operation of financial markets and to appropriation of returns from innovation, the case for government intervention seems particularly strong for young radical innovators if society is to benefit from the social returns from their more radical innovative efforts.

Innovation policy typically addresses the access-to-finance problem, providing incentives such as subsidies, loans or tax credits.

Effective government intervention is, however, conditional on avoiding government failure. Lerner (1996) provides an excellent review of the literature on how to deliver the necessary public funding in a risky environment without losing the monitoring function of private venture capital firms and without trying to secure monitoring through clumsy and costly contracts. His analysis of the US Small Business Innovation Research subsidy programme confirms that positive findings were confined to firms located in areas that also had substantial private venture capital activity.

The evidence from the German CIS sample confirms this risk of government failure. Although a high share (40 percent) of YICs in the sample receive subsidies, once correcting for other firm, industry and region characteristics, YICs are not significantly more likely to be receiving subsidies – if YICs receive subsidies, it is not because they are YICs. This is consistent with the observation that most German innovation programmes do not specifically target YICs. On average, receiving R&D subsidies is associated with higher innovative performance, but this is not the case for YICs. In fact, subsidised YICs do worse than non-subsidised YICs in terms of new/improved products. This result applies even more for products with market novelties (Schneider and Veugelers, 2008). All this suggests that general subsidy schemes do not account for YIC-specific characteristics (such as riskiness or radicalness) sufficiently to leverage complementary private funding and spur higher-grade innovative performance. These empirical results need to be treated with caution at this stage, but they do suggest that subsidies

Table 5

Obstacles to innovation

Barriers to innovation	% firms reporting barrier as relevant: YICs	% firms reporting barrier as relevant: Other innovators	Difference in mean score between YICs and other innovators
External financial constraints	95.65%	75.75%	-1.049***
Internal financial constraints	93.30%	66.42%	-1.074***
Innovation costs too high	93.33%	87.71%	-0.493***
Uncertain demand for innovative products	89.13%	74.60%	-0.193
Difficulty of finding cooperation partners	67.39%	53.90%	-0.323**
Resistance to change	52.17%	60.08%	0.180

Source: Schneider and Veugelers (2008). Note: Respondents were asked to score each (potential) hampering factor on a scale from zero (not relevant) to three (high). The numbers in the first two columns indicate the share of firms that considered this factor to be relevant (ie firms that scored it as one or more). The last column reports the difference in mean score. *** significantly different at one percent, ** at five percent. Only a selection of barriers is reported. For the full results, see Schneider and Veugelers, 2008.

[7] Again, as these data reflect subjective evaluations, the result could be traceable to a bias if YICs were more susceptible to complain about business conditions than other innovators. But even if this were the case, the relative ranking of barriers remains interesting.

[8] This result for financial barriers survives an econometric analysis, correcting for other firm and industry characteristics (Schneider and Veugelers, 2008). The econometric analysis confirms that small innovators are more likely to be financially constrained (both internally and externally), and so are innovators that have a more basic innovative profile. But on top of this, YICs are significantly more likely to be financially constrained both internally and externally.

must be carefully designed in order to be effective[9].

A CALL FOR POLICY SUPPORT FOR EU YOUNG RADICAL INNOVATORS

The current economic crisis calls for a swift reaction to **support young, small radical innovators**. EU member state recovery programmes pay most attention to large incumbent firms, ignoring the young radical innovators, with far less sizeable impact. This approach focuses on the short-term impact but jeopardises the long-term social benefits from breakthrough innovations. A commitment to provide an 'equivalent' level of support to young radical innovators, compared to large and old incumbents, would improve the balance.

Beyond the more immediate response to the crisis, there is also a more long-term need for this type of instrument, which is currently not part of the innovation policy toolbox in many member states or at EU level. Beyond committing sufficient resources to young radical innovators, it is perhaps even more important to get the details right. What follows are directions as to how policymakers should design their interventions.

HOW TO DESIGN POLICY FOR YOUNG RADICAL INNOVATORS

First, since young radical innovators need a symbiotic overall innovative and 'co-optitive' environment, any specific policy for these firms must be part of **overall innovation and growth policy**. Second, a **specific policy** approach should tackle the barriers faced by young radical innovators, at least those rooted in market failure and where governments can act without inflicting new barriers. Two preliminary remarks before discussing the design of such specific policies: first, given that we still know very little about what 'medicine' will work for young radical innovators, more emphasis should be put on evaluating policy initiatives *ex-ante* and *ex-post*. Second, any specific policy intervention should avoid 'lock-in', whereby companies stop growing in order not to lose their aid status.

A **specific policy** for young radical innovators implies first and foremost dealing with financial constraints. Supporting private capital market development, especially the high-risk, early-stage segments, is particularly important for this because the efficiency of any public funding improves when it operates in tandem with private venture capital. Public funding programmes for young radical innovators must be carefully designed so that they reward the risk-taking inherent in radical innovation. For instance, because a risky profile often translates into a bimodal distribution of outcomes – a high probability of large returns, as well as big failures – the focus should be more on achieving these outcomes, rather than reaching average/incremental results. Favourable tax treatment of R&D can help finance growth, particularly where tax credits are payable even when the firm is not making sufficient profit to offset the value of the credits against its tax bill.

Effective intellectual property (IPR) protection is often essential to enable young radical innovators to raise finance, to access new markets and to appropriate the returns from newly-acquired market positions. Young radical innovators should be a particular target group for reducing the cost of IPR protection (Van Pottelsberghe, 2009).

IMPLICATIONS FOR EU POLICYMAKING

EU policy is important in terms of the broader framework conditions and the climate for innovation, which young radical innovators need (BEPA, 2008). Particularly important are well-functioning and large integrated products and service markets, underlining the importance of EU competition policy and single market instruments.

In light of the access-to-finance barrier for innovation, the financial services sector warrants particular attention. Having a more open, integrated and competitive EU financial sector is a necessary condition for minimising the access-to-finance barrier. In particular, high-risk financing and the early-stage venture capital markets are pivotal. Removing barriers to EU-wide venture capital markets has long been on the EU policy agenda, but has still not been achieved.

Although innovative SMEs are at the centre of EU innovation policy, young radical innovators are rarely a specific focus for EU instruments, such as the Seventh Framework Programme for Research and Development and the Competitiveness and Innovation Programme. Recently,

[9] The need for policy design to account for the specifics of YICs is also suggested by Colombo *et al* (2008). They found that new technology-based firms in Italy benefit more (in terms of firm growth) than mature ones from financial support if public funds are allocated through a selective evaluation process.

new state aid rules for innovation have identified young innovative enterprises. Identifying this group in EU soft law is a big step towards more targeted national level policy. It should also be used in the EU's own funding programmes.

Box 1 puts forward an EU-level proposal for redressing financial market failure at the pre-commercialisation phase affecting innovative SMEs, particularly young radical innovators. The proposed programme awards funds for high-risk, innovative projects planned by young and small companies, during the critical start-up and development stages, when financial market barriers are at their highest. In addition, it encourages the commercialisation of the project in later stages. If implemented properly, the plan will not only enhance the chances of projects being funded but would, through certification, reduce barriers in later project phases by easing access to private venture capital investment. The proposal is based in large measure on the US Small Business Innovation Research programme (Lerner, 1996), and is in line with the EU's subsidiarity principle.

BOX 1: A (GREEN) EU YIC PROGRAMME

The programme would fund project proposals from small, young businesses to help bring to market highly innovative and groundbreaking ideas in EU Framework Programme-research areas.

- (Part of) the funding could be targeted to **designated policy areas**, such as climate change and energy.

Funding would only relate to the **pre-commercialisation stage of the project**, where there are still major uncertainties and financial market failures. Subsequent commercialisation would require the use of other (private) funding.

In view of the high risks/uncertainties involved, financing should be **phased**.

- Phase 1 (conceptual design) is a feasibility study to evaluate the scientific and technical merit of the idea. Awards should be small and for a short period.
- Phase 2 (prototype development) is to expand on the phase 1 results. Amounts here are much larger and for a longer period.
- Phase 3 (commercialisation) should be an integral part of the proposal; selection should be based on evaluation of the commercialisation strategy, but this phase should not be funded.

Projects should be evaluated on the basis of scientific and technical characteristics, but also and above all on the expected (social) commercial returns. Evaluation should assess positively the risky and groundbreaking nature of the project. This implies a **mixture of expertise** in the selection committee (not only scientific but also technological, commercial and financial). Evaluation should be **highly selective** and conducted to the highest standards of excellence. This would make the programme a mark of quality (certification), which will help selected participants attract additional current and later (private) funding (phase 3).

Funding should be directed towards **innovative small firms only**, as these suffer most from access-to-finance barriers.

- Firms with more than 250 employees would qualify. But as there is also evidence that larger companies face financial barriers, at least for highly innovative projects, the size threshold could be extended to 500 employees as long as firms pursue high-intensity, high-risk innovative activities.
- A special higher financing scheme should be envisaged when **young** companies are selected.

Unlike most current EU funding programmes, there would be no requirement to **collaborate** on these projects either nationally or internationally. As these projects seek to bridge the gap between the research phase and the commercialisation phase, companies would be more reluctant to apply for funds if they are obliged to collaborate. Bonuses might be considered for intra-EU collaboration, but should not be a condition of application/selection.

Within the 2007-2013 EU budget, a total amount of €1.75 billion should be allocated to the programme. This

would come close to three percent of total EU budget spending on research and innovation.

The **programme** should be designed as a pilot, **evaluated** and adjusted or terminated if unsuccessful.

Arguments for an EU-level approach:

- Economies of scale in the selection procedure, and competition among applicants at EU level guarantees high-quality projects (cf the European Research Council).
  - A higher degree of excellence in the evaluation stage can be assured because of selection of evaluators from a wide – even world-wide – geographical base.
  - By pooling applications at EU level, it will make it easier to establish high-quality networks of experts, willing to evaluate top-quality projects and further supporting private venture capital demands of the next stage.
  - This can thus set in motion a virtuous circle of supply and demand in which a steady increase in good-quality projects will in turn trigger more financing.
- By targeting areas with high probability of international spillovers, such as climate change and energy, the EU supports complementary areas in which individual countries might under invest. In addition, targeting green projects supports the EU's broader climate change goals by improving, through innovation, the efficiency of mitigation and abatement policies.
- Increasing the likelihood of commercialisation in EU-FP research areas will improve the leverage from past and present EU R&D funds into EU growth and jobs, directly addressing Europe's failure to leverage its strength in research into commercial success.
- The non-funded commercialisation strategy should involve the dissemination of the innovations throughout the EU market and beyond.

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