# THE EARLY PHASES OF INNOVATION: OPPORTUNITIES AND CHALLENGES OF PUBLIC-PRIVATE PARTNERSHIP

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**ABSTRACT**

*Innovations have acquired a key-role in the growth and competition strategies of firms in today's globalized world. Governments in many, in developed as well as in developing, countries recognize the need to promote innovations and fund innovative projects; particularly those carried out in cooperation with other public sector institutions such as universities and specialized R&D institutions. This public-private partnership seems particularly useful in the early phases of innovation.*

*This article discusses how the cooperation between the industry, the academia and the government may be utilized in the early phases of innovation (idea generation, evaluation and selection) to increase the innovative capability of firms in a given region or sector. For the purpose of identifying the opportunities and challenges of such collaboration this paper presents selected findings of two recent empirical surveys carried out at our institute. The focus of attention is centred on the needs of small and medium-sized enterprises (SME) which, on account of resource constraints, are usually more dependent on cooperation than big firms.*

**KEYWORDS**: Cooperation, Public-Private Partnership, Early Phases of Innovation, Front-end of Innovation, SME

## 1. INTRODUCTION AND BACKGROUND

Innovations are increasingly seen as a source of economic growth and simultaneously as a useful instrument to face the competition brought about by the forces of globalisation. Not surprisingly, innovations have acquired a key-role in the growth and competition strategies of firms, as indeed of many countries and economic regions. They are seen as an essential tool to stimulate growth, for instance by generating additional demand, and stay ahead of competitors. In developed countries they are thought to provide a vital buffer against challenges from low-cost providers from emerging countries such as China and India.

Governments[1] across developed countries have recognized the need for their firms to remain innovative and have constituted various "innovation funds" to support innovation-related activities of domestic firms. For instance, the German chancellor Angela Merkel announced at a recently held "National IT-Summit" an innovation-support programme by German federal government that will provide domestic firms in 17 "key areas" by 2009 with up to 15 billion euros as a part of its "high-tech strategy" [GFG, 2006a]. The key areas "include health care, security, energy production, nanotechnology, biotechnology, as well as information and communications technologies" [GFG, 2006b]. Other European countries have also set up similar programmes.

The attention is generally focused on certain industry sectors or on certain geographical regions. An example of such measures is the "Regional Innovation Strategies" (RIS) programme of the European Union (EU). Hereby, special attention is paid to small and medium-sized enterprises (SMEs), which usually are a vital source of employment in many countries. The SMEs are hereby encouraged to forge cooperation with universities and specialised research and development (R&D) institutions.[2] The funding is however not limited to SMEs alone, bigger concerns in developed as well as developing countries are also reported to regularly receive financial and other support for cutting-edge innovative projects.

Some developing countries, notably China and India, have also started their own innovation-support programmes. For instance, in India a "National Innovation Foundation" has been established with government's participation "to help India become an inventive and creative

[1] The term "government" in this paper includes also quasi-governments like the European Commission.

[2] For the sake of simplicity, all academic institutions including universities and specialized R&D institutions are hereafter jointly referred to as "universities".

society and a global leader in sustainable technologies", as per information provided on the foundation website.[3] According to an OECD report, China is set to become the second-largest R&D investor by spending 136 billion euros on R&D in 2006 overtaking Japan (130 billion euros) and way ahead of third-placed Germany (70 billion euros) [OECD, 2006].

Universities, too, play an important role in strengthening the innovativeness of firms by providing trained researchers who are "familiar with the latest research techniques and integrated in international research networks" [Pavitt, 2005]. In return, universities receive direct industrial funding of industrial research. Practice-oriented education and research also help universities in attracting (and eventually retaining) talents.

The resultant flurry of activities demands an efficient and goal-oriented coordination of support efforts from all players involved, i.e. the industry, the government and the academia, so as to strengthen the innovation capacity of firms in given country, geographical region or industry sector. This article analyzes the role of cooperation between these above mentioned players in removing barriers to innovation in early phases, which are crucial for the purpose of idea generation, evaluation and selection. The article makes use of the results of two recent empirical surveys carried out with the author's involvement at Institute of Technology and Innovation Management, Hamburg University of Technology. The surveys examined the role of cooperation for innovation in SMEs in Germany. The first survey [see, Napp, 2006] had 76 participants from the medical equipment manufacturing sector in Germany, the second survey [see, Herstatt et al, 2006] 70 SMEs from various technology-intensive industry sectors in the metropolitan area of Hamburg in Germany. The respondents were senior-level managers who answered a questionnaire on the issues concerned.

Even while providing the lion's share of employment in an economy, SMEs are generally more affected by resource-constraints than big firms. They therefore are often forced to seek cooperation with other firms/universities in order to compensate the resources-crunch. This article therefore places a special focus on SMEs, the findings are however by and large as valid for bigger firms.

The article is structured on following lines: Section 2 introduces the concept of the innovation process and defines the "early phases of innovation". Section 3 introduces an "innovation coalition". Sections 4 and 5, respectively, deal with opportunities and challenges of cooperation. The final section entails a brief summary.

[3] http://nifindia.org/mission.htm, site consulted 21.12.2006.

## 2. THE INNOVATION PROCESS AND ITS EARLY PHASES

Innovation may be defined as invention of new, or betterment of existing, products, processes or services.[4] The innovation process encompasses systematic steps, beginning from problem/requirement analysis to idea generation, idea evaluation, project planning, product development and testing to finally product marketing [Verworn et al, 2000/2006]. The steps may overlap each other. These steps may be categorised into 3 broad phases, which represent a simplified innovation process:

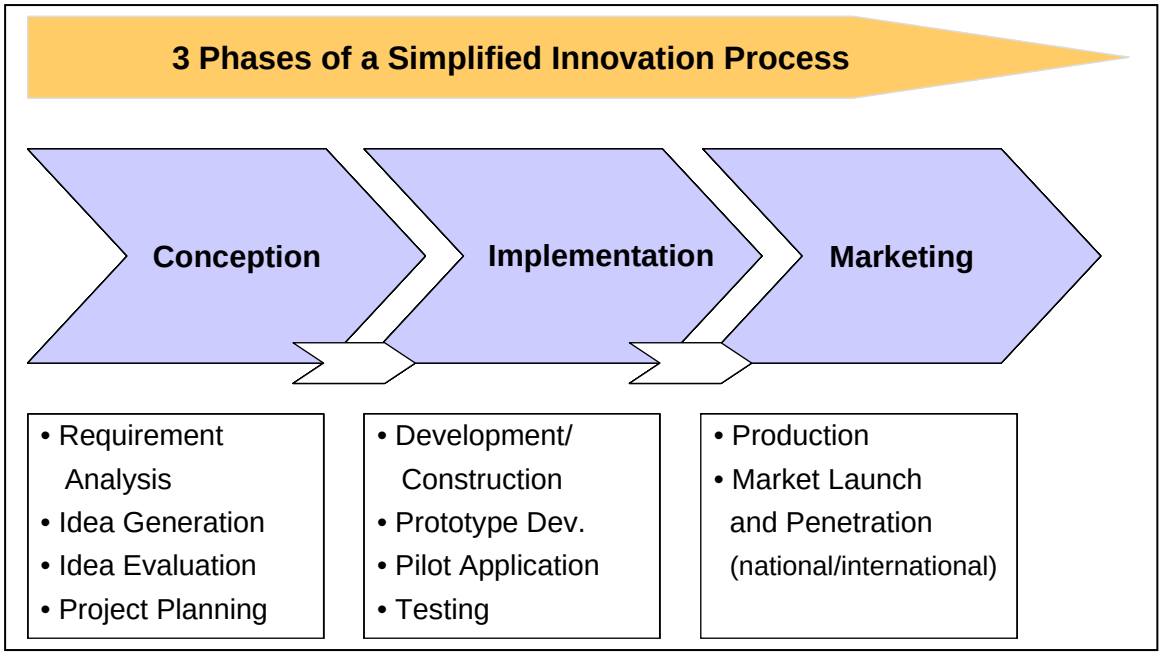


*Figure 1: Simplified version of an innovation process*

This article focuses on the "early phases of innovation", which in the academic literature are often referred to as "fuzzy front-end of innovation", "pre-development" or "up-front activities" [Napp, 2006]. According to Khurana and Rosenthal (1998) the front-end includes product strategy formulation and its communication, opportunity identification and assessment, idea generation, product definition and project planning etc. This phase is of particular importance to this article, since:

- Innovations are unlikely to succeed if the process of requirement analysis and/or idea generation/evaluation does not run satisfactorily. Not surprisingly, 30% participants of a survey identified problems in the early phases as a "significant barrier to innovation" in their firm [Herstatt et al, 2006].

[4] For detailed discussion on definition and scope of the term "innovation", see amongst others [Biemens, 1992] and [Dangayach et al, 2005].

- The broad field of problem identification, opportunity assessment and idea generation, evaluation provides a large scope for cooperation between public and private sectors. The potential of this cooperation is, however, rarely utilized fully. 33% participants of a survey identified managing cooperation as a "significant barrier to innovation" [Herstatt et al, 2006].
- Particularly SMEs, on account of their limited resources, are more dependent on cooperation to identify and evaluate opportunities as well as to reduce uncertainty of their innovation projects.

## 3. THE INNOVATION COALITION

In practice, firms rarely innovate in isolation. They operate in a given macro-economic environment, which in turn is influenced by the socio-cultural environment of a particular region. In a market economy firms often innovate "in collaboration and interdependence with other organizations" [Edquist, 2006], the reason being that such collaboration generally includes intra-industry cooperation, e.g. with customers, suppliers and competitors[5].

But there are also significant collaborations with non-firm entities such as universities and government. For instance, universities are a significant source of knowledge diffusion and technology transfer. They also may produce/support spin-offs by their students with new, innovative ideas. The government may, while acting in concert with the industry and academic experts, formulate rules and policies that are conducive to innovation in a given region or industry sector. Figure 2 demonstrates this "innovation coalition", in which the three partners influence the innovativeness of firms in a given region or industry sector.

[5] Cooperation with competitors is particularly useful for innovative projects so as to define common standards.

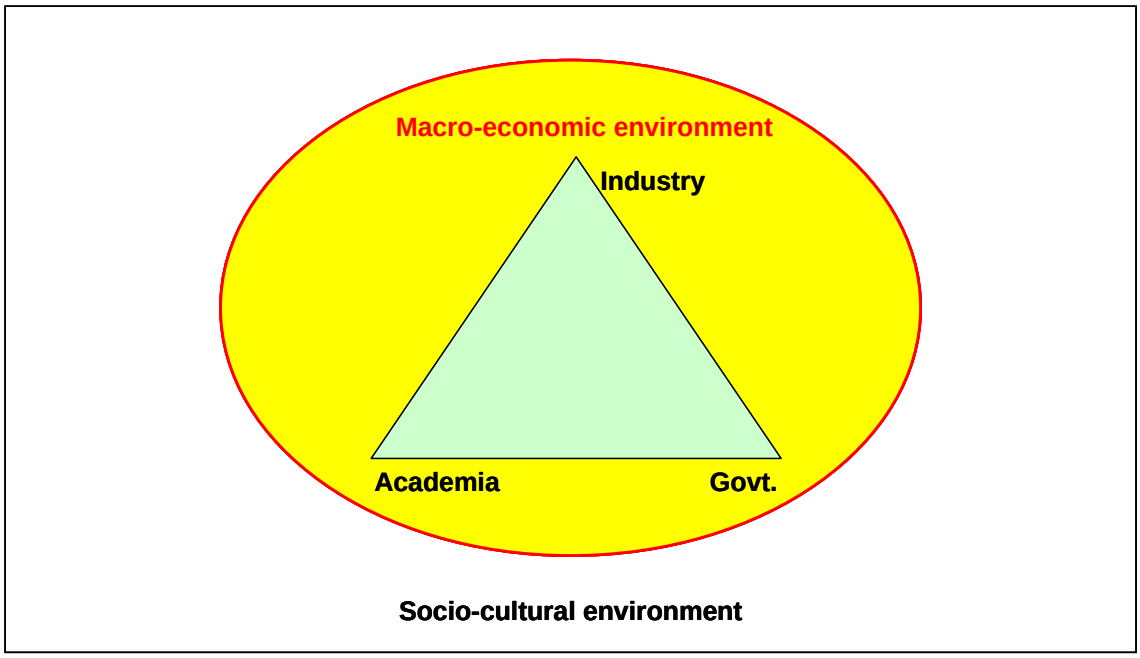


*Figure 2: The innovation coalition and its environment*

This innovation coalition may be understood as a "system of innovation" in a given region, country or sector. Freeman [1987] defined a "national system of innovation" as "the network of institutions in the public and private sectors whose activities and interaction initiate, import, and diffuse new technologies". This definition may however as well be adapted for a regional or sectoral system of innovation. According to Edquist [1997] these three viewpoints – national, sectoral and regional – may be grouped together as variants of a single generic "systems of innovation" approach.

Having understood the systems of innovation we may now turn our attention to the opportunities and challenges arising out of this collaboration. The next section discusses how cooperation may be utilized to strengthen innovations in the early phases.

## 4. OPPORTUNITIES GENERATED BY COOPERATION

Cooperation, be it within the industry or with other non-firm entities, provides certain opportunities and incentives for all partners. In the following we discuss how such cooperation may contribute to the innovativeness of firms, particularly SMEs, in the early phases of innovation. Figure 3 demonstrates the three main objectives that cooperation ideally seeks to achieve in early phases of innovation, i.e. to generate better ideas faster and cheaper.

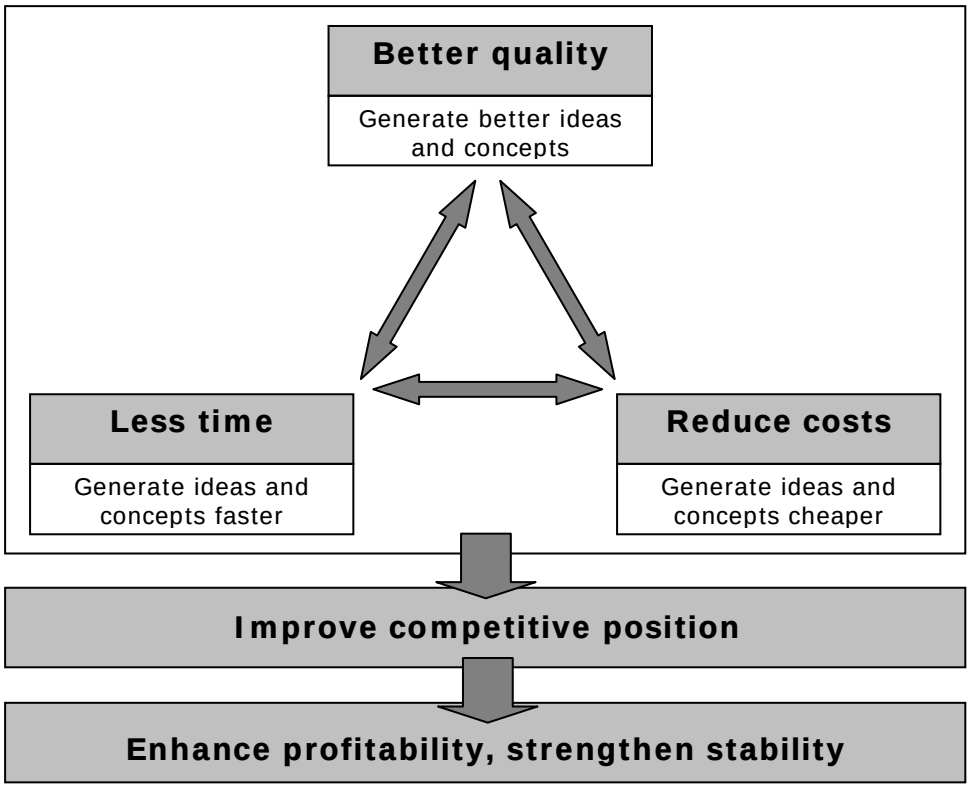


*Figure 3: Objectives of cooperation in early phases of innovation*

*Source: Adapted in a slightly modified form from [Napp, 2006, p. 36]*

In the following we may have a look at these aspects individually:

**Better quality**: the quality of ideas and concepts may be measured in the probability of their successful realisation and, at a later stage, successful marketing. In the case of process innovation it would also mean the probability of a successful implementation. Better quality in generation of ideas and concepts may be achieved via cooperation that may provide:

a) access to (complementary) know-how,
b) better knowledge of market (understanding of demand and supply side factors),
c) a broader base for idea generation and evaluation,
d) access to physical resources (e.g. laboratories),
e) enhancement of product portfolio
f) better acceptance in market

**Less time**: The innovation process may be accelerated, e.g. by saving time through division of labour and by access to complementary or specialized know-how.

**Reduce costs**: The cooperation between the academia, the industry and the government also has a significant financial advantage. For instance, the government may reduce the risk of

failure of an innovation project by providing a partial (or full) funding of a promising idea that has the potential of positively influencing public welfare in a region. It also might provide easier and cheaper access to capital. The government may also provide "support for high-tech start-ups and innovative SMEs through corporate tax reform and systematic reduction of bureaucracy" [GFG, 2006b].

Governments play a key-role by formulating innovation-friendly policies and promoting or restricting research in certain fields. The German government for example is financing with 280 million euros an innovation project to develop a next-generation search engine called "Theseus". On the other hand restrictions in many countries, including Germany, on research with cloning of human embryos are well known. Governments may also set up laboratories to do basic research, whose findings are made available to the (domestic) industry or the public-at-large for free or on subsidized rates.

Universities may provide complementary and/or specialized know-how and reduce development costs while sharing the possible profits in the event of success and thereby strengthen their own resources. Alternatively, they might also offer R&D services on cheaper (subsidized) rates. In a survey of medical equipment manufacturer SMEs in Germany [Napp, 2006], 51% of all participants reported cooperation-projects with universities. However, 74% reported willingness to forge (further) cooperation with academic institutions.

Figure 4 shows the areas of cooperation in early phases of innovation. 95% of survey participants reported cooperation (with diverse partners) while analyzing requirements and 84% while generating new ideas [Napp, 2006].

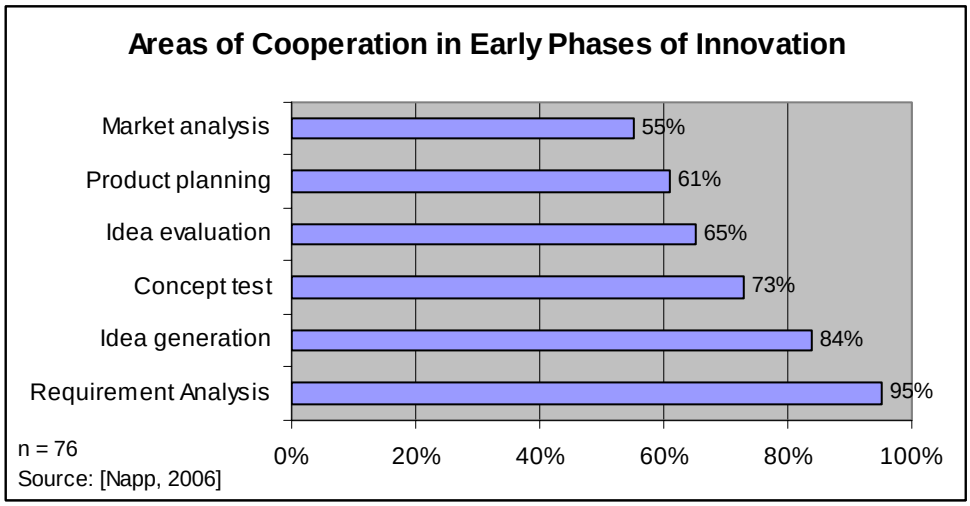


*Figure 4: Areas of cooperation in early phases of innovation*

Figure 5 shows who was regarded as the "single most important partner" in the early phases of innovation. Own customers (65%) dominated the list. With 16%, universities were second

placed. The role of universities was thought to be predominantly in enhancing the quality of the product concepts and access to know-how (each 43%).

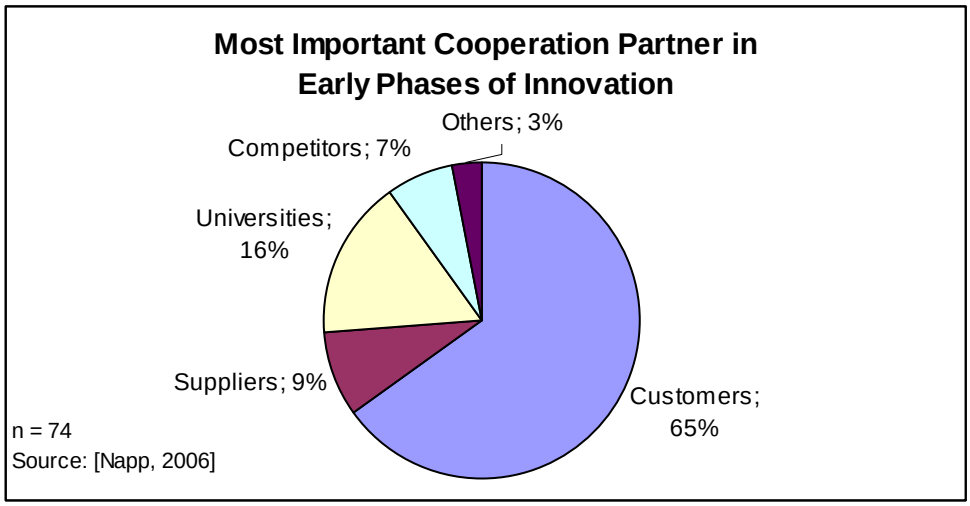


*Figure 5: Most important partner in early phases of innovation*

The discussion above shows that there are various potentials for cooperation, especially also for a public-private partnership, in the early phases of innovation. This potential remains largely untapped owing to certain problems that negatively affect the (readiness for) cooperation. We discuss these problems in the next section.

## 5. CHALLENGES OF COOPERATION

Cooperation between two or more partners necessitates coordination, which unto itself is a tedious task, sometimes. The coordination between heterogeneous entities, e.g. firms and non-firms (i.e. between profit-oriented private sector firm and non-profit oriented public sector entities) is even more difficult to manage, owing to different working styles of the parties concerned.

A survey in Hamburg [Herstatt et al, 2006] found that SMEs often have some typical problems while seeking cooperation with universities. Asked to identify cooperation partners with which they generally had a particular type of problem, universities scored unfavourably on following counts [Herstatt et al, 2006]:

a) lack of effectiveness (50%),
b) trouble finding right partners (38%),
c) lack of financial resources (27%),
d) coordination troubles (26%),
e) communication problems, differing “time-horizons” (23%).

Another Germany-wide survey of SMEs in the medical equipment manufacturing sector returned comparable results [Napp, 2006].

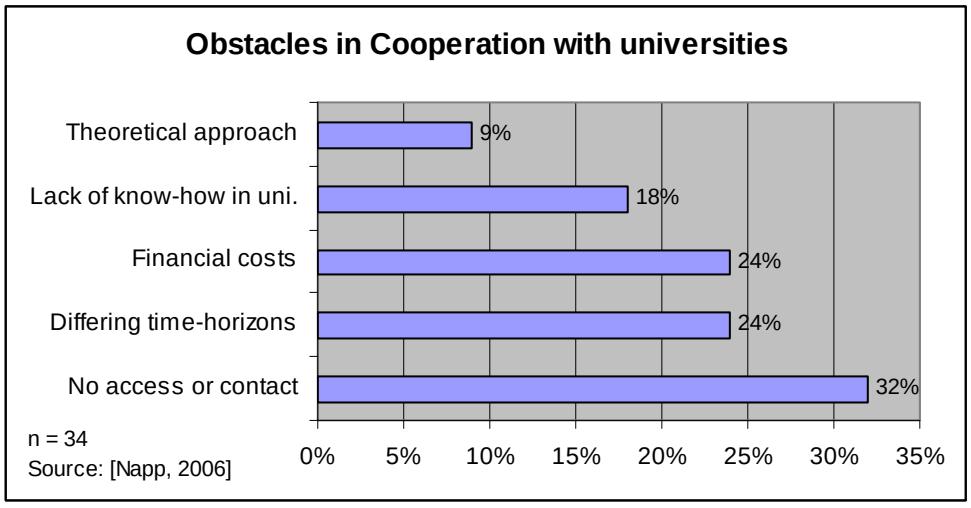


*Figure 6: Obstacles in cooperation with universities*

The problems in cooperation with governments may be seen in a similar light, e.g. trouble finding right partners and the differing work-style of governments. For instance, 47% of the surveyed SMEs in Hamburg reported "bureaucracy" as a major hurdle for their innovation activities [Herstatt et al, 2006].

Further, it was revealed that resource-constrained SMEs are usually not well-informed about various support programmes and rarely try to receive state funding. While 42% of the surveyed SMEs reported aborting innovation projects in the "early phases" owing to financial reasons, over 50% said they were not aware of state-run support programmes. On the other hand, in the same survey firms with a turn-over of over 50 million euros did not report any finance-related project-abortions and called themselves "well-informed" about support programmes [Herstatt et al, 2006].

The above facts point to certain deficits in the "innovation coalition" proposed above. The challenges however can be mastered with concerted action and effort on the part of the parties concerned. This paper proposes a support structure for SMEs (see Figure 7) that would reduce their problems in the early phases of innovation and generate resources to make them more competitive and stable.

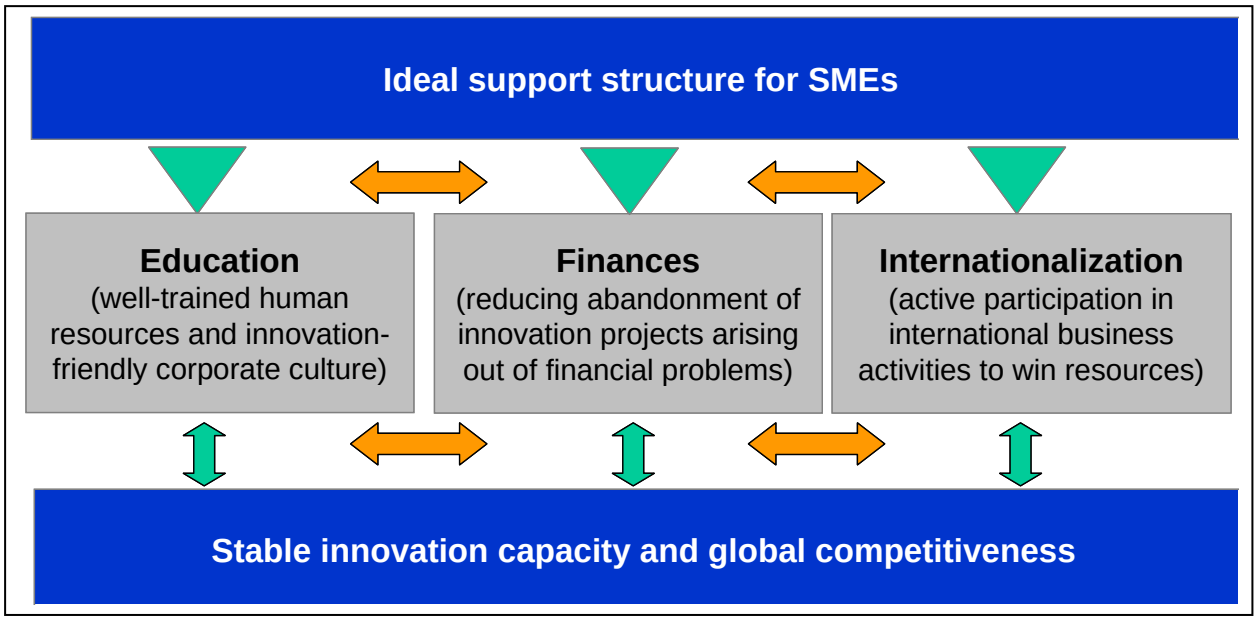


*Figure 7: Ideal support structure for SMEs*

The corner-stones of this structure are built by

a) providing better education infrastructure especially in technical fields,
b) installing a more efficient financial-support infrastructure, and by
c) providing guidance and support to SMEs in internationalising their business and gain access to global resources.

Each of these factors has a positive impact on improving the competitiveness of firms. But these factors also benefit from a certain interdependence and enforce each other leading to a stable innovation capacity and global competitiveness of domestic firms.

## 6. SUMMARY

This paper analyzed the role of cooperation in the so-called “early phases of innovation” (also known as “fuzzy front-end of innovation”) and proposed an “innovation coalition” comprising the industry, the government and the academia that could enhance the innovation capacity of firms, especially SMEs, in a given region, country or industry sector. Using results of two empirical surveys, conducted with the author’s involvement, it demonstrated the opportunities and challenges of such a public-private partnership in strengthening the innovativeness of firms.

Finally, it also proposed a support structure for SMEs that can enhance their innovation capacity and thereby competitiveness leading to a larger public welfare (e.g. via growth and employment opportunities) in a region.

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