

The early phases of innovation

Opportunities and challenges in public-private partnership

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Governments today recognize the need to promote innovations and fund innovative projects, particularly those where public sector institutions such as universities cooperate with specialized R&D institutions. This article discusses how cooperation between industry, academia and government may be utilized in the early phases of innovation to increase the innovative capability of firms in a given region or sector. It presents findings of two recent empirical surveys carried out at our institute. The focus of attention is the needs of small and medium-sized enterprises (SME) which, on account of resource constraints, are usually more dependent on cooperation than big firms.



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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 globalization. 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 to 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.

Governments¹ 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, 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 as a part of its "high-tech strategy."¹ The key areas "include health care, security, energy production, nanotechnology, biotechnology, as well as information and communications technologies."² Other European countries have set up similar programmes.

The attention is generally focused on certain industry sectors or on cer-

tain 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 (SME), which usually are a vital source of employment in many countries. The SMEs are hereby encouraged to forge cooperation with universities and specialized research and development (R&D) institutions.^b The funding is however not limited to SMEs alone; bigger concerns in developed as well as developing countries are also reported to receive financial and other support regularly for cutting-edge innovative projects.

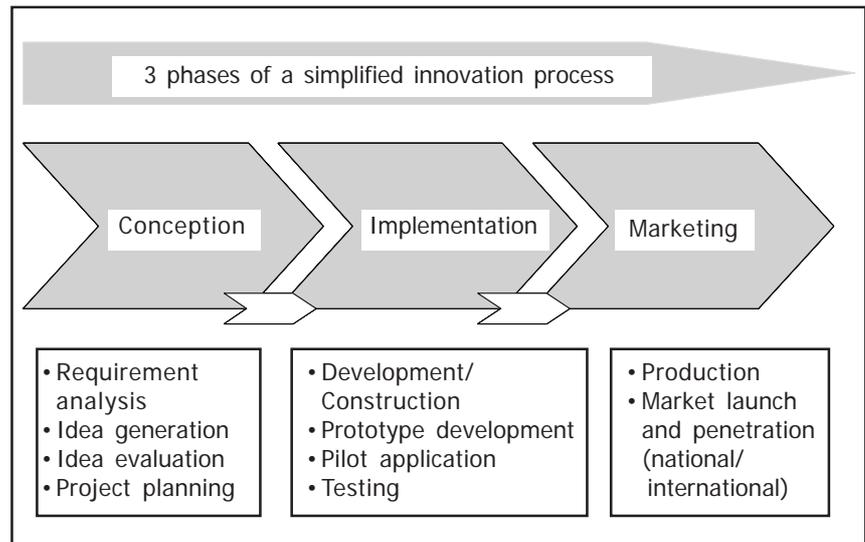
Some developing countries, notably China and India, have also started their own innovation-support programmes. For instance, in India a "National Innovation Foundation" has been established with government participation "to help India become an inventive and creative society and a global leader in sustainable technologies", according to the information provided on the foundation website.^c According to an OECD report, China is set to become the second-largest R&D investor by spending • 136 billion on R&D in 2006, overtaking Japan (• 130 billion) and way ahead of third-placed Germany (• 70 billion).³

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".⁴ In return, universities receive direct industrial funding for 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 - industry, government and the academia - so as to strengthen the innovation capacity of firms in a given country, geographic region or industry sector.

This article analyzes how cooperation among these players can work to remove barriers to innovation in early phases, which are crucial for the

Figure 1: Simplified version of an innovation process



purpose of idea generation, evaluation and selection. It uses the results of two recent empirical surveys carried out with the author's involvement at the 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 survey⁵ had 76 participants from the medical equipment manufacturing sector in Germany, and the second survey⁶ 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 or universities in order to compensate for the resources crunch. This article therefore places a special focus on SMEs, but the findings are, by and large, equally valid for bigger firms.

The next section introduces the concept of the innovation process and defines the "early phases of innovation". Section 3 introduces an "innovation coalition". Sections 4 and 5 deal respectively with the opportunities and challenges in cooperation. The final section gives a brief summary.

The innovation process and its early phases

Innovation may be defined as the invention of new, or the improvement of existing, products, processes or services.^d The innovation process encompasses systematic steps, beginning from an analysis of a problem or a requirement; proceeding to idea generation, idea evaluation, project planning, product development and testing; and ending with product marketing.^{7, 8} Some of these steps may overlap. The steps may be categorized into three broad phases, which represent a simplified innovation process (Figure 1).

This article focuses on the "early phases of innovation", which in academic literature are often referred to as the "fuzzy front-end of innovation", "pre-development" or "up-front activities".⁵ According to Khurana and Rosenthal⁹ 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 per cent of participants in a survey identified problems in the early phases as a "significant barrier to innovation" in their firm.⁶

Figure 2: The innovation coalition and its environment

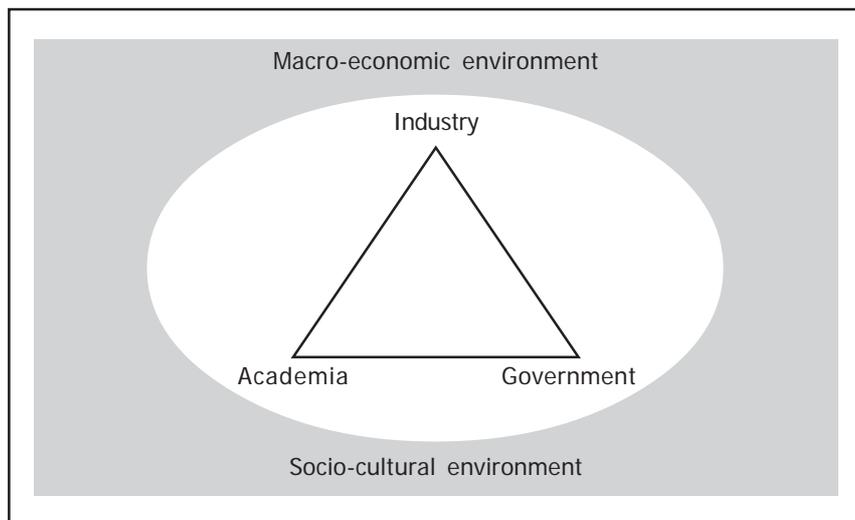
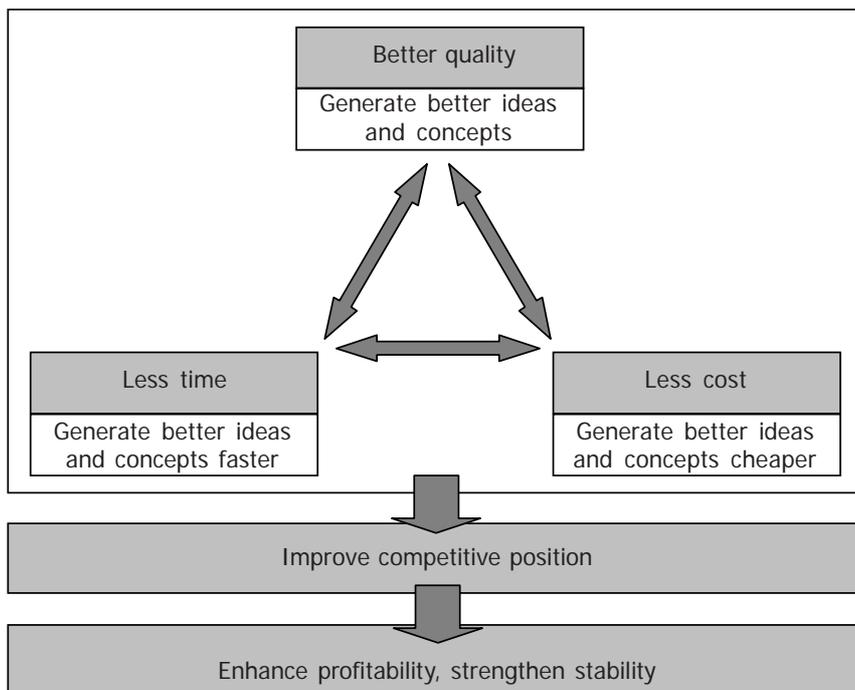


Figure 3: Objectives of cooperation in early phases of innovation



Source: Adapted in a slightly modified form from Napp, JJ, (2006)⁵

- This broad field - problem identification, opportunity assessment and idea generation, and evaluation - provides great scope for cooperation between the public and private sectors. The potential of this cooperation is, however, rarely utilized fully. As many as 33 per cent of the participants in a survey identified managing cooperation as a "significant barrier to innovation".⁶
- SMEs in particular, on account of their limited resources, are more dependent on cooperation to identify and evaluate opportunities as well as to reduce uncertainty in their innovation projects.

The innovation coalition

In practice, firms rarely innovate in isolation. They operate in a given macro-economic environment, which in turn is in-

fluenced by the socio-cultural environment of a particular region. In a market economy, firms often innovate "in collaboration and interdependence with other organizations"¹⁰, the reason being that such collaboration generally includes intra-industry cooperation, e.g. with customers, suppliers and competitors.⁶

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 or support spin-offs by 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.

This innovation coalition may be understood as a "system of innovation" in a given region, country or sector. Freeman¹¹ 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 Edquist¹⁰ 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 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.

Opportunities generated through 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.

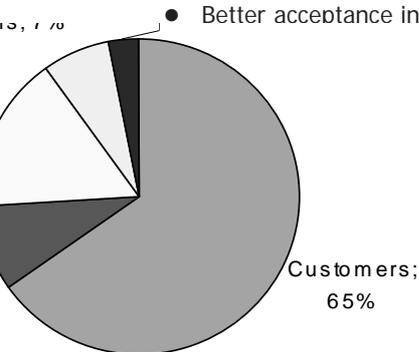
Figure 3 demonstrates the three main objectives that cooperation ideally seeks to achieve in early phases of innovation, i.e. to generate better ideas faster and cheaper.

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

Better quality

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

- Access to (complementary) know-how;
- Better knowledge of market (understanding of demand and supply side factors);
- A broader base for idea generation and evaluation;
- Access to physical resources (e.g. laboratories);
- Enhancement of product portfolio; and
- Better acceptance in the market.



stance, 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 potential for 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".³

Governments play a key-role by formulating innovation-friendly policies and promoting or restricting research in certain fields. The German government for example is committing • 280 million to finance an innovation project

Figure 4: Areas of cooperation in early phases of innovation

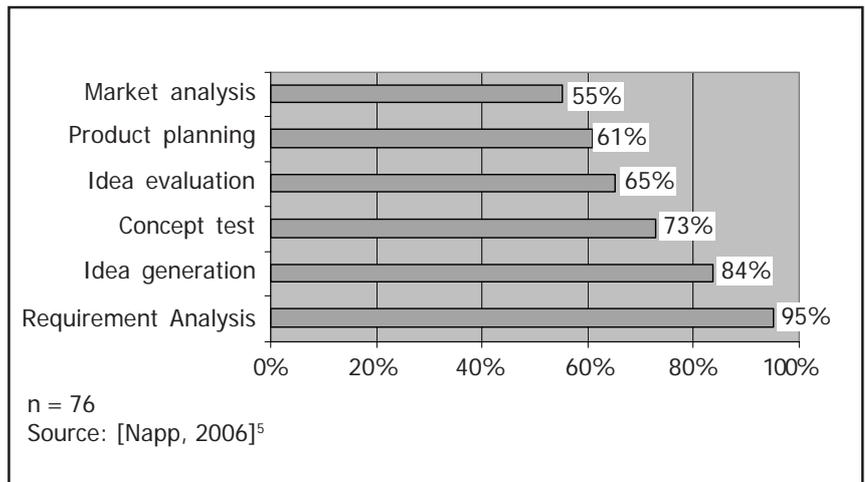
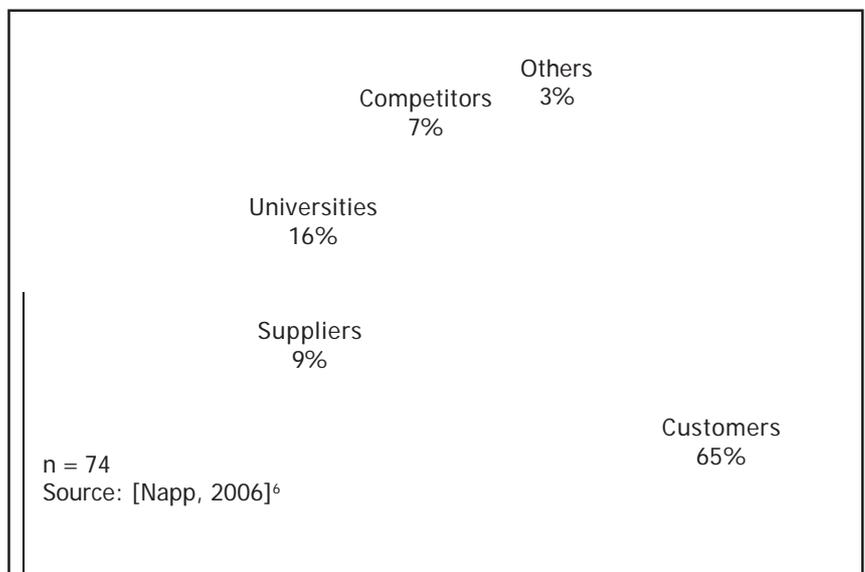


Figure 5: Most important partner in early phases of innovation



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 offer R&D services on cheaper (subsidized) rates.

In a survey of medical equipment manufacturer SMEs in Germany,⁵ 51 per cent of all participants reported cooperation-projects with universities. However, 74 per cent reported willingness to forge (further) cooperation with academic institutions.

Figure 4 shows the areas of cooperation in early phases of innovation. As many as 95 per cent of survey participants reported cooperation (with diverse partners) while analyzing requirements and 84 per cent while generating new ideas.⁵

Figure 5 shows who was regarded as the "single most important partner" in the early phases of innovation. Own customers (65 per cent) dominat-

Figure 6: Obstacles in cooperation with universities

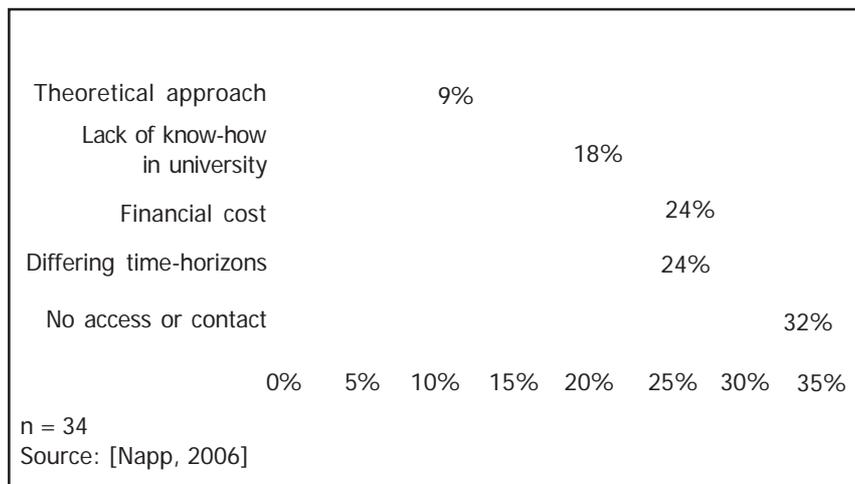
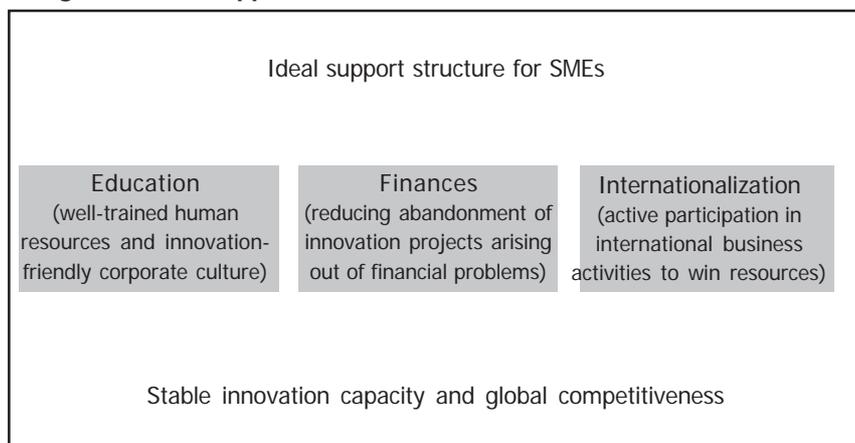


Figure 7: Ideal support structure for SMEs



ed the list. Universities (16 per cent) were second placed. The role of universities was thought to lie predominantly in enhancing the quality of the product concepts and in giving access to know-how (43 per cent each).

The above discussion shows that there are various potentials for cooperation, especially for 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.

Challenges of cooperation

Cooperation between two or more partners necessitates coordination, which can sometimes be a tedious task. The coordination between heterogeneous entities, e.g. firms and non-firms (i.e. between profit-oriented private sector

firm and non-for-profit public sector entities) is even more difficult to manage, owing to the different working styles of the parties concerned (Figure 6).

A survey in Hamburg⁶ found that SMEs face some typical problems while seeking cooperation with universities. Asked to identify cooperation partners with which they generally had a particular type of problem, SMEs scored universities unfavourably on the following counts⁶:

- Lack of effectiveness (50 per cent);
- Trouble finding the right partners (38 per cent);
- Lack of financial resources (27 per cent);
- Coordination troubles (26 per cent); and
- Communication problems, differing "time-horizons" (23 per cent).

Another Germany-wide survey of SMEs in the medical equipment man-

ufacturing sector returned comparable results.⁵

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 per cent of the surveyed SMEs in Hamburg reported "bureaucracy" as a major hurdle for their innovation activities.⁶

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 per cent of the surveyed SMEs reported aborting innovation projects in the "early phases" for financial reasons, over 50 per cent said they were not aware of state-run support programmes. On the other hand, in the same survey, firms with a turnover of over • 50 million did not report any finance-related project-abortions and called themselves "well-informed" about support programmes.⁶

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 article proposes a support structure for SMEs (Figure 7) that would reduce their problems in the early phases of innovation and generate resources to make them more competitive and stable.

The corner-stones of this structure are built by:

- Providing better education infrastructure, especially in technical fields;
- Installing a more efficient financial-support infrastructure; and
- Providing guidance and support to SMEs in internationalizing their business and gaining 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 reinforce one another, leading to a stable innovation capacity and the global competitiveness of domestic firms.

Summary

This article 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 industry, government and academia, that could enhance the innovation capacity of firms, especially SMEs, in a given region, country or industry sector. Using results from 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.

It also proposed a support structure for SMEs that can enhance their innovation capacity and thereby competitiveness in the larger interests of public welfare (e.g. via growth and employment opportunities) in a region.

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Notes

- a. The term "government" in this paper includes also quasi-governments like the European Commission.
- b. For the sake of simplicity, all academic institutions including universities and specialized R&D institutions are hereafter jointly referred to as "universities".
- c. <http://nifindia.org/mission.htm>, site consulted 21.12.2006.
- d. For detailed discussion on definition and scope of the term "innovation", see amongst others Biemens, 1992,¹³ and Dangayach et al, 2005.¹⁴
- e. Cooperation with competitors is particularly useful for innovative projects so as to define common standards. □

WIPO University Initiative

The World Intellectual Property Organization (WIPO) has launched a programme entitled the "WIPO University Initiative" aimed at assisting interested universities and R&D organizations in establishing IP information services through Intellectual Property (IP) Coordinators. IP Coordinators are contact persons or units, which provide information and advice on IP matter. Through the "WIPO University Initiative," participating universities will benefit from an exchange of information, best practices and/or university IP policy statements. The "WIPO University Initiative" will contribute to enhancing awareness about intellectual property matters among students and university academic, research and administrative staff.

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