Technology and
Innovation Management

Working Paper

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July 2007, Working Paper No. 49

This Paper has been published in the "Proceedings of the Second International Conference on Globally Distributed Work" held by Indian Institute of Management, July 25-27, Bangalore, pp. 451-465

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Innovation via Global Route: Proposing a Reference Model for Chances and Challenges of Global Innovation Processes

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ABSTRACT
Innovations have acquired a key-role in the growth and competition strategies of firms today. They are regarded as an essential tool to stimulate growth and enable firms to master the competition brought about by the forces of globalization. In developed countries they are thought to provide a vital buffer against challenges from low-cost producers from emerging countries.
At the same time, innovations in today's "globalized" world are hardly feasible in isolation. World-wide economic reforms and far-reaching technological advancements have brought to fore new economic powerhouses, such as China and India, which possess strong scientific capabilities. Products are marketed internationally which often necessitates adaptation to specific needs of targeted markets. All these developments are leading to the "globalization of innovation". Based on recent empirical studies conducted by the authors in Germany, this paper presents results from research-in-progress and proposes a reference model for chances and challenges of global innovation activities.

KEYWORDS: Global Innovation, Globalization of Innovation, Internationalization of R&D, Research and Development

This Paper should be referred to as following:

Tiwari, R., Buse, S. and Herstatt, C. (2007): "Innovation via Global Route: Proposing a Reference Model for Chances and Challenges of Global Innovation Processes", in: *Proceedings of the Second International Conference on Management of Globally Distributed Work*, Indian Institute of Management, Bangalore, July 25-27, pp. 451-465.

1. Introduction

The integration of world economies has opened an array of business opportunities as well as challenges for firms. The access to new markets is invariably coupled with increased competition on the home-turf. Firms are under constant pressure to perform better, cheaper and faster. This pressure has led to Business Process Outsourcing (BPO), whereby firms try to reduce their operational costs and achieve efficiency-gains by contracting out routine and standardized activities to an external entity that usually enjoys cost advantages on account of specialization and/or geographic location. BPO is generally defined as contracting-out of business processes which may also include associated information technology (IT) processes (Meyer, 2006).

Economists and business executives are, however, increasingly recognizing the shifting focus in business competition. Competitive advantage particularly for firms from developed, industrialized nations is increasingly – and almost compulsorily – innovation-driven, since they are often at a disadvantage to compete with low-cost producers from emerging markets. It is therefore natural when an overwhelming majority of business executives (over 80%) see innovations as a corner-stone of their growth and competition strategies, as a study by McKinsey suggests (Marwaha et al., 2005).The increasing importance of innovations in firm's success, is also discussed by IBM (2006) in a study on "global innovation outlook".

Nonetheless, innovation activities too generate costs which need to be minimized in order to compete with other "innovators", especially so since the outcome and the ensuing commercial success of innovation efforts remain to a large extent uncertain. A logical extension of the BPO trend has therefore resulted in Knowledge Process Outsourcing (KPO), whereby knowledge-intensive research & development work (R&D) is outsourced either to an external entity (e.g. contract R&D by a domestic or foreign-based firm) or to an offshore-subsidiary ("captive offshoring"). Primary motives of "offshore KPO" are thought to be, for instance, the availability of highly-skilled labor force, cost benefits, location of industry-specific clusters and/or the incentive to develop products designed to suit the specific needs of a target market physically and culturally distant from the home market of a firm.

1.1 Increasing Internationalization of R&D

Considering the discussion above, the potential advantages of "offshore" R&D seem to be obvious. Many multinational firms have established R&D centers abroad. For example, foreign subsidiaries of German firms spent an estimated amount of euros 11.9 billion for R&D efforts in year 2001 (Belitz, 2004). The United Nations Conference on Trade and Development (UNCTAD) has documented the increasing internationalization of R&D and the role of emerging countries in the innovation process (UNCTAD, 2005a; 2005b; 2005c).

According to UNCTAD, multinational firms spent on average 28% of their R&D budget outside their home country. European firms spent on average 41%, American 24%, and Japanese 15% of their R&D budget abroad. Two-thirds of all respondents foresaw a further increase in this expenditure. More than half (57%) of surveyed multinationals already had "an R&D presence in China, India or Singapore", and "Developing Asia is the most often mentioned location for further R&D expansion by firms", reveals UNCTAD (2005b). The same survey showed China as the most preferred R&D destination for next 5 years, followed by the US and India in second and third positions respectively.

The emerging markets of India and China have attracted substantial foreign direct investment (FDI) in R&D sector. India as a R&D location has reportedly attracted many Fortune 500 firms (Srinivasan, 2004). Over 100 of the Fortune 500 firms were conducting a part of their R&D activities in India by 2003 (GOI, 2003). Between 1998 and 2003 India received R&D investment worth USD 1.13 billion. Planned investments in the R&D sectors at the end of 2003 totaled to USD 4.65 billion. The largest investing country was the USA followed by Germany (TIFAC, 2006).

Domestic R&D expenditure in India and China increased substantially in recent years as both countries are undertaking concerted efforts to build cutting-edge scientific capabilities, see e.g. OECD (2006). The EU counts India and China among "major R&D performing countries in the world" (INNO METRICS, 2006). According to OECD, China's R&D expenditures surged from USD 17 billion in 1995 to USD 94 billion in 2004 in terms of purchasing power parity (PPP), registering an average growth of nearly 20% per annum. China was projected to become the second largest R&D investor worldwide by overtaking Japan in 2006 in PPP terms (Dyer, 2006; OECD, 2006). Also India's R&D expenditures increased to USD 24 billion in PPP terms , growing by nearly 8% p.a. on average between 1995 and 2004, making it the 8th largest R&D investor worldwide (OECD, 2006). In real terms China spent USD 15.6 billion on R&D in 2002, India USD 3.7 billion in 2001, according to figures available with UNCTAD (2005c).

It has emerged as a prominent R&D hub especially for Life Sciences industries, which according to a Deloitte study are set to witness an increasing role of offshore R&D in next 10 years (Wyke et al., 2006). Fabian (2006) delivers a detailed and in-depth study on India's emerging role in pharmaceutical R&D. Similar capabilities have been reported in IT sector.

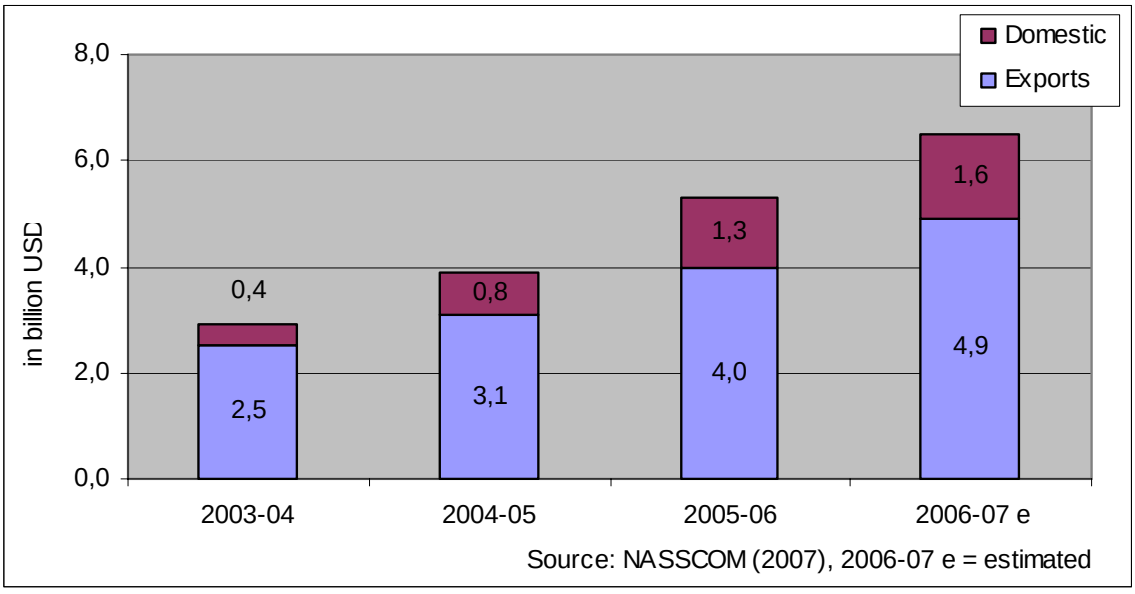

Figure 1: India's revenues with Engineering Services, R&D, & Software Development

The trend of offshore R&D is not limited to multinational concerns alone. Many small and medium-sized enterprises (SMEs) too have started to recognize the opportunities that the globalization enables not only in the production but also in R&D. In many instances, SMEs have set up R&D centers abroad. Even as a survey by the German Chamber of Commerce (DIHK) revealed that one-third (33%) of all German firms were engaged in offshore R&D as

of February 2005, it also brought to light the fact that over 25% of surveyed SMEs too engaged in offshore R&D. Many of them had their own R&D facilities abroad, while others forged cooperation with firms and R&D institutions abroad (DIHK, 2005). The survey had a sample base of over 1,600 firms; 77% of the respondents were SMEs.

1.2 Objectives and Structure

This paper discusses the chances and challenges presented by the "globalization of innovation". The term "innovation" hereby encompasses all steps of the innovation process, as discussed in section 2. A major part of it is however dedicated to R&D. The paper presents the findings of an empirical survey conducted by the authors in the Metropolitan Region of Hamburg in Germany; see Herstatt et al. (2007). The survey was conducted on behalf of Hamburg's State Ministry of Economic and Labor Affairs as a part of an EU-financed project "Regional Innovation Strategies".

The currently on-going project seeks to identify main "barriers to innovation" in SMEs from key industry-sectors in the Metropolitan Region of Hamburg and to work-out solutions for their elimination. One of the solutions the authors are working upon is the internationalization of innovation activities. We propose a reference model for chances and challenges that the globalization of innovation activities might offer in removing barriers to innovation, especially in SMEs. The model is derived by comparing the broadly discussed reasons, advantages, and challenges of global innovations with the prevalent barriers to innovations. The findings presented here are from a "research-in-progress", which is not yet completed. The model, therefore, has a preliminary character and is scheduled to be ascertained in a larger-scale study at a later stage.

The paper is structured as following: Following this introduction, we discuss in section 2 the "innovation process" and the reasons for the increasing globalization of innovation activities. Section 3 provides an overview over the barriers to innovation, identified during the empirical survey. Section 4 proposes briefly our preliminary reference model for chances and challenges of global innovation activities. Section 5 entails some implications and a brief summary.

2. Globalization of the Innovation Process

Innovation, according to Rogers (2003), is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption". This "newness" need not necessarily involve "new" knowledge thereby effectively implying that the "newness" may also concern advancement or modification of existing knowledge. Keeping in view this scope of innovation, we may define "innovation" as invention and commercialization of new, or betterment of existing, products, processes and/or services (Tiwari, 2007). For a detailed discussion on definition and scope of the term "innovation", see amongst others Fagerberg (2005) and Biemens (1992). The importance of innovation activities for SMEs is discussed by Dangayach et al. (2005), and Spielkamp and Rammer (2006).

The innovation process encompasses systematic steps, beginning from the problem/requirement analysis to idea generation, evaluation and selection, project planning, product development and testing to finally product marketing (Verworn et al., 2000/2006). The individual steps may overlap each other and may be categorized into 3 broad phases, which represent a simplified innovation process.

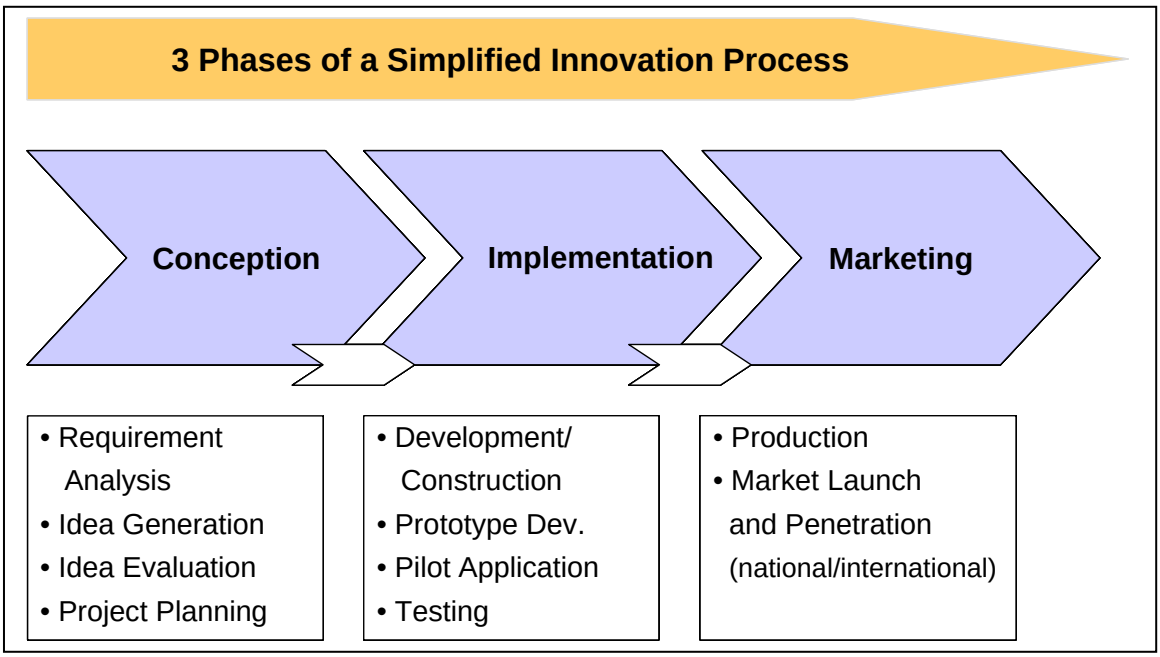

Figure 2: Three Phases of a Simplified Innovation Process

Ernst and Kim (2001) identified three forces that drive global production networks (GPN):

a) Institutional changes in the form of economic liberalization and free trade agreements
b) The impact of information and communication technologies (ICT)
c) Competition and the changing industrial organization (networks)

This model retains its validity even today and may be applied not only for GPN but also for "global innovation networks", which have been gaining ground in recent past. The economic reforms and the technological progress, especially in ICT, have made it easier to break the innovation process into several individual steps and to conduct innovation activities at various locations, even simultaneously if so required.

Various insights into the causes and effects of "global innovation" are delivered by Boutellier et al. (2000), UNCTAD (2005a; 2005b; 2005c), Ernst (2006), OECD (2006), KPMG (2007), and LTT Research (2007). The OECD report also contains useful data on the current status of "internationalization of R&D" including on major trends and their drivers as well as policy implications. Issues related to offshoring in general are discussed by Blinder (2006), who provides a good overview on its effects. In summary, global innovation activities are thought to provide firms the following advantages:

2.1 Access to global expertise and know-how

Many studies suggest that one of the most important drivers of global innovation is the "search for global expertise" (EIU, 2004). Whereas many Western countries are experiencing a decline in the number of science and technology (S&T) students, countries such as China and India are producing a large number of S&T graduates. In China, 61% of undergraduates are studying for a science or engineering degree. Also as far as the quality of the higher-education is concerned many emerging countries are able to produce world-level graduates. Three out of the top five Asian schools for S&T are located in India (EIU, 2004). Asian countries are thought by some to enjoy an edge in higher education (Guo, 2005). Moreover,

restrictive immigration policies in industrialized nations, especially in USA and Western Europe prompt firms to establish R&D centers abroad in order to tap global talent, see e.g. two reports by American Electronics Association (Kazmierczak and James, 2005/2007). In a concrete example Google Inc. cited troubles in obtaining work visas for its prospective employees as a reason to set up its "first engineering research and development centre" outside the US in Bangalore in India (The Hindu, 2003).

2.2 Reduce bottlenecks in the R&D pipeline and shorten time-to-market

Global innovation activities may ensure that work can be carried out simultaneously from multiple locations and on multiple projects if needed. Several independent modules of a single project may be worked upon at the same time to shorten time-to-market. Following the same logic, even a single step of a project may be worked upon round the clock in changing shifts the world-over whereby the data is transmitted electronically from one center to next. Such a step could be of crucial importance for time-critical projects, e.g. for Pharma firms while conducting clinical trials. The shortened time-to-market may be crucial to ensure large-scale competitive advantage (BCG, 2006).

2.3 Meet demand for localized products in external (fast-growing) markets

The number of the middle class consumers is growing rapidly in emerging countries particularly China and India. In India alone over 6 million new mobile phone subscribers are added per month. The middle class in India, comprising of estimated 200 to 250 million people, is believed to be one of the largest worldwide. More and more people in emerging economies are having financial resources to buy high-end products (EIU, 2004).

2.4 Relieving cost pressures

Global activities, particularly in emerging countries, may lead to significant reduction in the costs (EIU, 2004). According to a McKinsey study, a software developer costs 60 USD an hour in USA. A software developer with similar skill costs only one-tenth of this amount in India (McKinsey, 2003). The starting salary of a software developer working for the German software firm SAP in India was reported at 8,000 euros per annum in 2004, while the salary for a similarly qualified person at the headquarters in Germany was reported 5-times higher at 40,000 euros (Müller, 2004). The DIHK survey in Germany found out that 41% of all offshore R&D activities of German firms were motivated by the incentives of the lower costs abroad (DIHK, 2005).

2.5 Proximity to production centers

The globalization has moved production centers of many industries to emerging countries, where new industry clusters have grown up. Some industry-specific innovation activities, e.g. in Automotive sector, may require close interaction with the production department. It may be useful to locate R&D facilities in the proximity of the production center, unless other factors (e.g. availability of knowledge resources, affordable costs etc.) threaten to hamper the process. Especially German firms seem to locate their R&D activities in close vicinity of their production centers. Whereas many international studies found "access to knowledge-resources" as the leading reason for many international offshore R&D activities, the DIHK survey in Germany revealed that the "proximity to production centers" prompted German firms most often to offshore R&D (DIHK, 2005). Another study by KPMG (2007) also confirmed this finding.

2.6 Learning from "lead markets"

Unsaturated, emerging economies in Asia are rapidly taking over the role of "lead markets" by their openness for consumption and the willingness to spend money on technological innovation. The Asian consumers already play a key-role in the electronics industry, today. For a discussion on the role of "lead markets" see Beise (2001).

The above mentioned advantages may be translated into a "BCF" strategy, which enables a "better, cheaper and faster" development of products, process and/or services. The BCF factors may be regarded as characterizing the "goal model" of a modern, international firm.

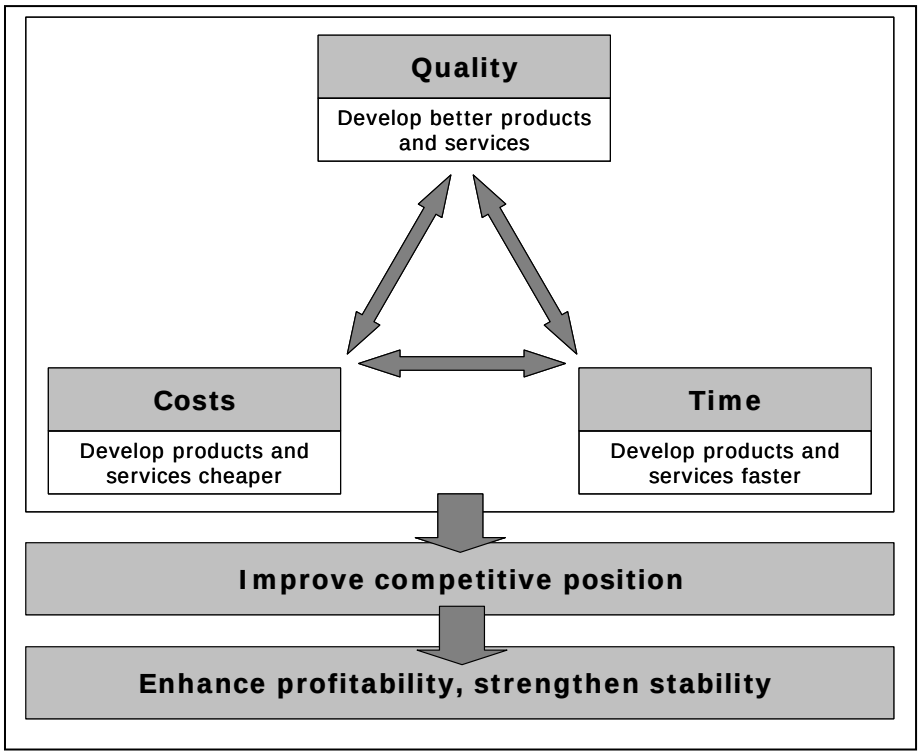

Figure 3: A "Goal Model" for Global Innovation Management

This goal model may be applied to each individual step of the innovation process.

3. Findings of an Empirical Survey

We conducted, as mentioned in section 1, an empirical survey to identify barriers to innovation in the Metropolitan Region of Hamburg in Germany. The target sample consisted of SMEs from selected key industry sectors. The participants were selected on a random basis from the catalogues of the State Ministry of Economic and Labor Affairs ("Behörde für Wirtschaft und Arbeit"). During this survey 70 SMEs from the fields of IT, Media, Civil Aviation, Electronics, Machinery Manufacturing, Maritime Economy, Medical Equipments, Logistics, and Services sector were interviewed in workshops regarding to barriers to innovation in their respective firms.

A modularized interview guide was used for this purpose. The guide entailed modules with questions regarding to the "early phases" (fuzzy front-end) of innovation, project management, internationalization activities, cooperation and technology transfer,

management of intellectual property rights (IPRs), marketing, bureaucratic hurdles, and financial constraints. The respondents, all senior-level managers, could choose to answer questions from modules which, in their opinion, were relevant for their individual firm. In keeping with the EU-definition, those enterprises were regarded as SMEs which employed 250 or less employees and whose annual sales did not exceed 50 million euros or whose balance sheet assets did not exceed 43 million euros.

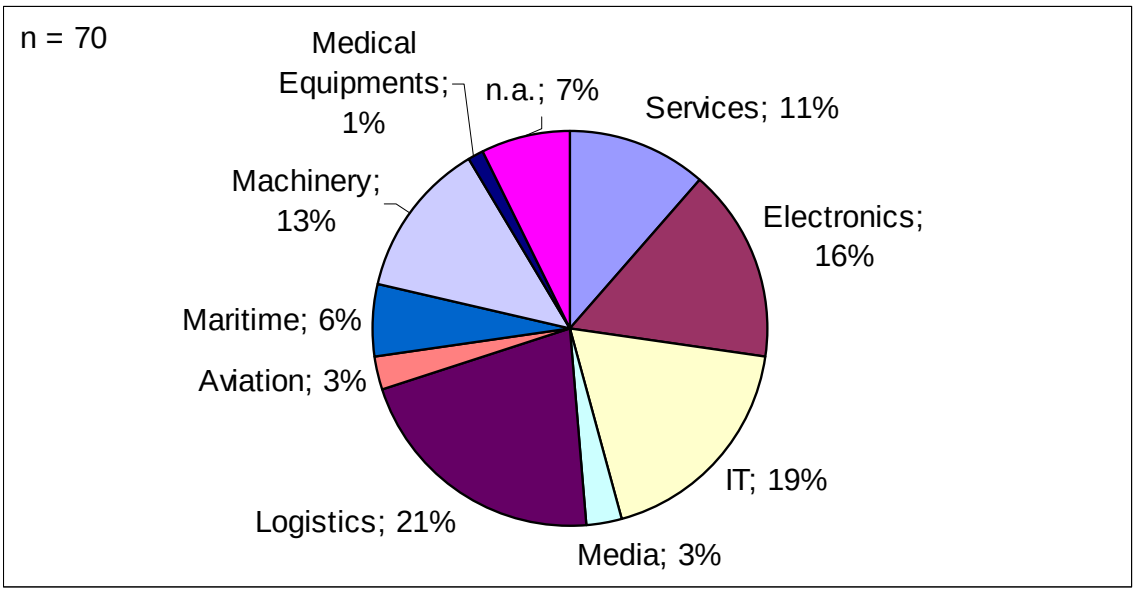

Figure 4: Representation of Industry Sectors in the Sample

In the following we present selected findings of this survey.

3.1 Barriers to Innovation

External Barriers to Innovation

Top "external" barriers to innovation, which owed their existence to external factors and as such could not be influenced in a significant manner by the firm concerned, included financing issues, the problems in finding suitable and qualified personnel, bureaucratic hurdles, and the trouble finding "right" cooperation partners, as seen in Figure 5.

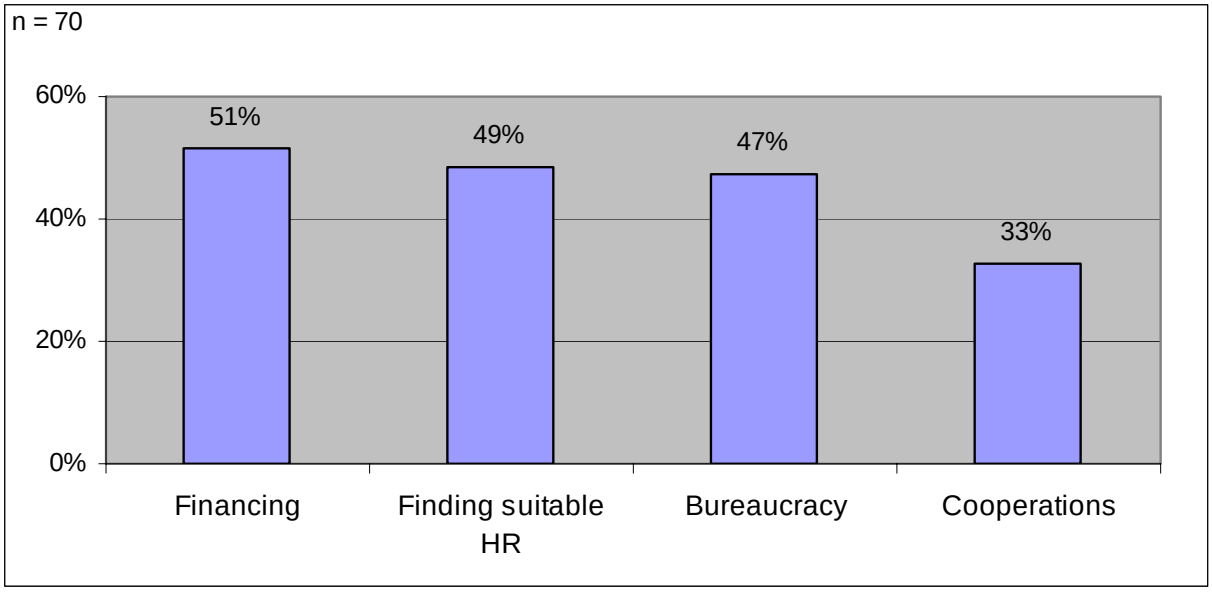

Figure 5: Top External Barriers to Innovation in Hamburg's SMEs of Selected Industries

The negative impact of these barriers can be gauged from the fact that the financial constraints alone were cited 22 times as having led to abandonment of one or more innovation projects in the surveyed SMEs within past 3 years. Whereas 42% of the project-abortions took place in the "early phases" of a project, the rest had to be aborted in an advanced stage of implementation (42%) or even marketing (16%), thereby suggesting a significant loss in the form of sunk costs and lost opportunities.

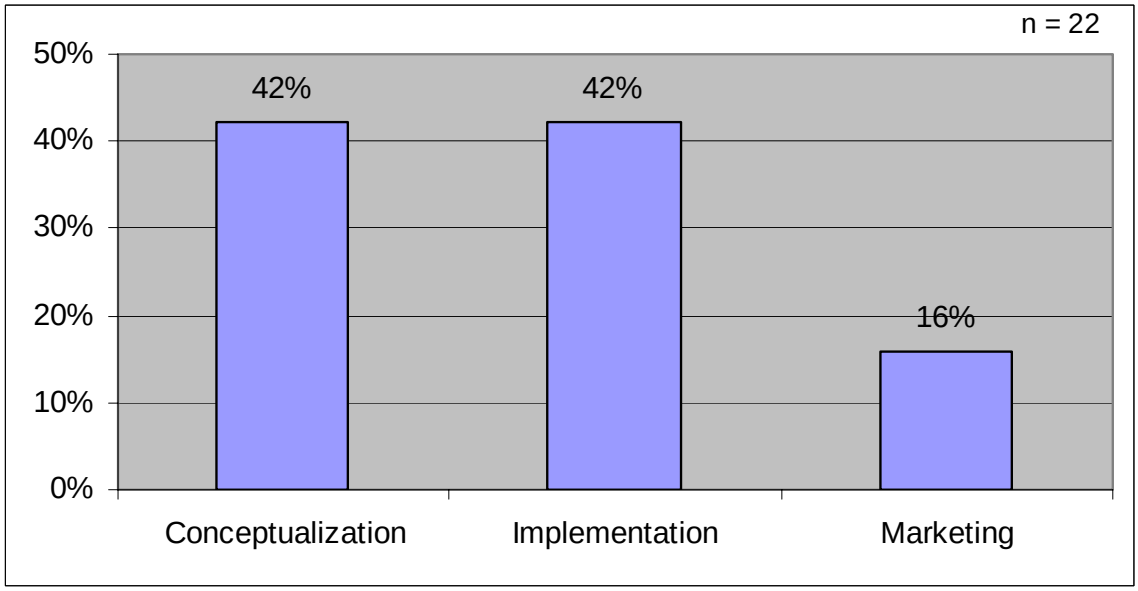

Figure 6: Abandonment of Innovation Projects owing to Financial Constraints

Availability of Skilled Labor

Another major hurdle faced by the survey respondents related to the difficulty in finding suitable, qualified personnel. In 33 instances, the firms cited vacant positions in past 3 years which could not be filled owing to a lack of suitable candidates. Almost all respondents who

cited such a problem reported the shortage of experienced engineers. However, experienced skilled labor was generally difficult to find.

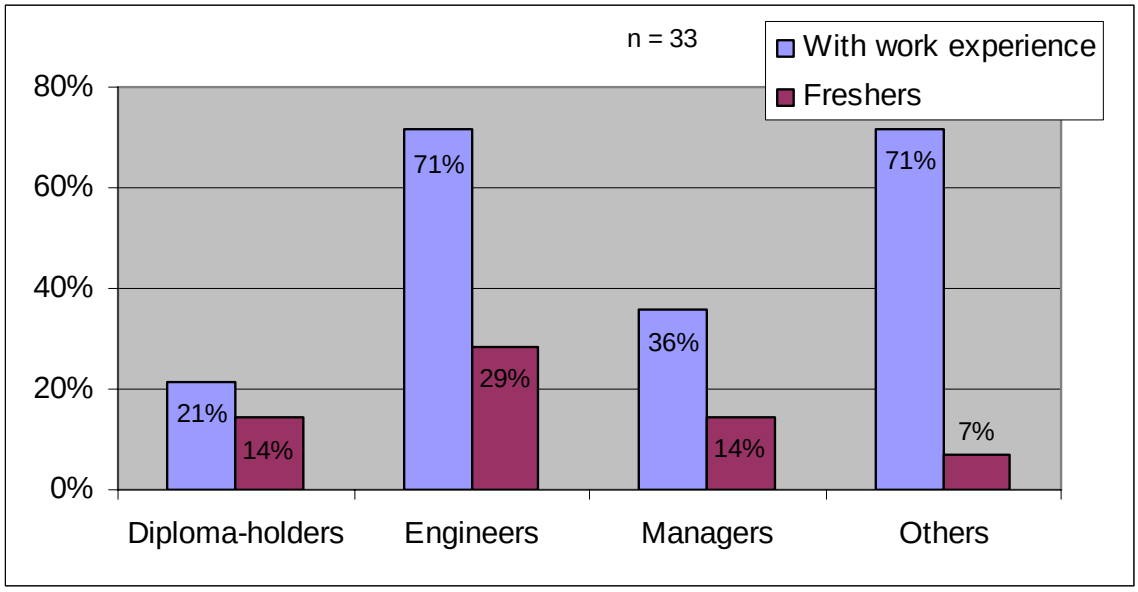

Figure 7: Lack of Qualified Human Resources as Barrier to Innovation

This problem is particularly interesting since both Germany and its Hamburg region endure substantial unemployment with an unemployment rate of nearly 10%. At the same time the industry is unable to fill vacant positions with skilled labor. Other studies, too, have pointed towards this discrepancy see e.g. (Rammer et al., 2005). Moreover, this problem may be expected to worsen further due to the aging population and the relatively low birth-rate in the society.

Bureaucratic Hurdles

There are several ways in which bureaucratic regulations may hamper the innovation activities of firms in a region. To cite an example closely related to the previous issue we can have a look at "restrictive" labor laws in Germany, which according to a McKinsey study cause many firms not to hire and thereby cause bottlenecks (Farrell, 2004). In the DIHK survey in Germany, 24% of firms with offshore engagement in R&D cited "less bureaucratic hurdles" at offshore locations as one of the reasons for their decision (DIHK, 2005).

Internal Barriers to Innovation

"Internal" barriers to innovation were reported, amongst others, in the areas of marketing, conceptualization of innovative products, internationalization, as shown in Figure 8.

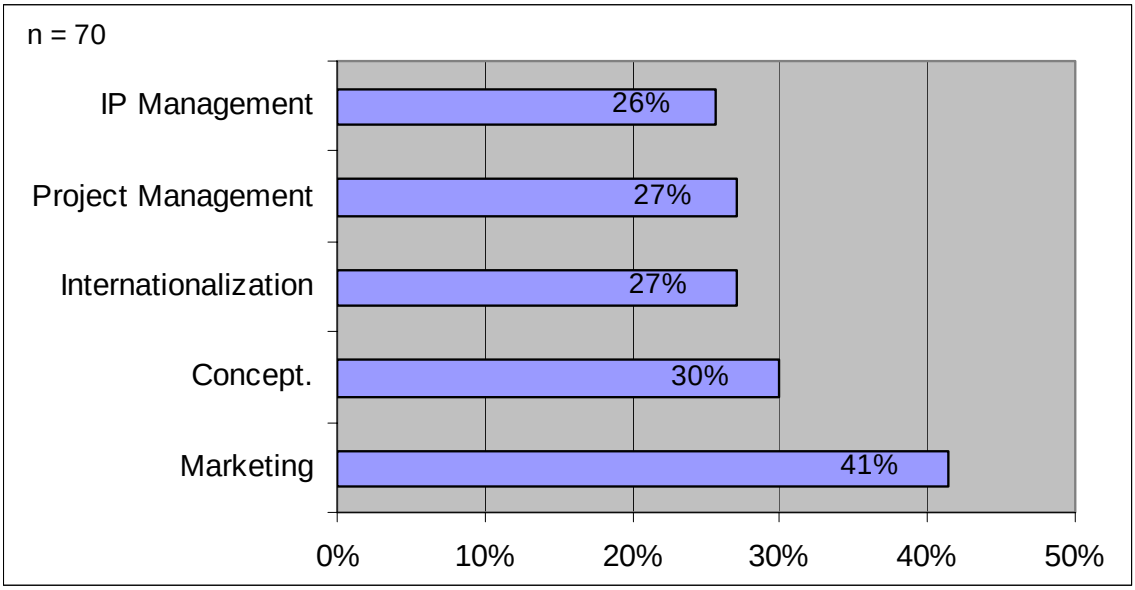

Figure 8: Top Internal Barriers to Innovation in Hamburg's SMEs

The extent to which an industry-sector was hit by certain barriers to innovations varied considerably. Figure 9 illustrates this point in an interesting manner. While the IT sector had relatively less trouble managing its projects, the tradition-rich machine-manufacturing sector faced more inconvenience with it. Also the shortage of suitable and qualified personnel though present in both the sectors to a significant extent, affected the latter more, reflecting the declining interest of the youth in studying Engineering and Natural sciences.

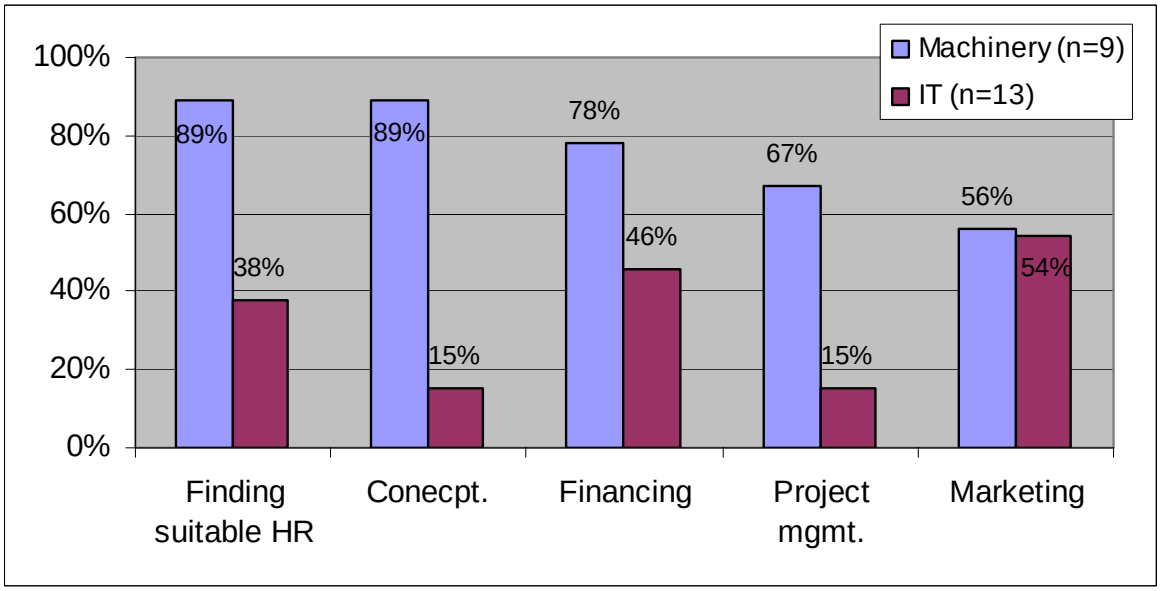

Figure 9: Barriers to Innovation in SMEs of Machinery and IT Sectors

3.2 Status Quo of Internationalization Efforts

The challenges of the internationalization are not mastered by many SMEs, as can be seen in Figure 10. Out of 56 respondents who chose to disclose the share of international sales in

their firm's annual turn-over, 38% reported purely domestic business; another 30% had a share of up to 15%.

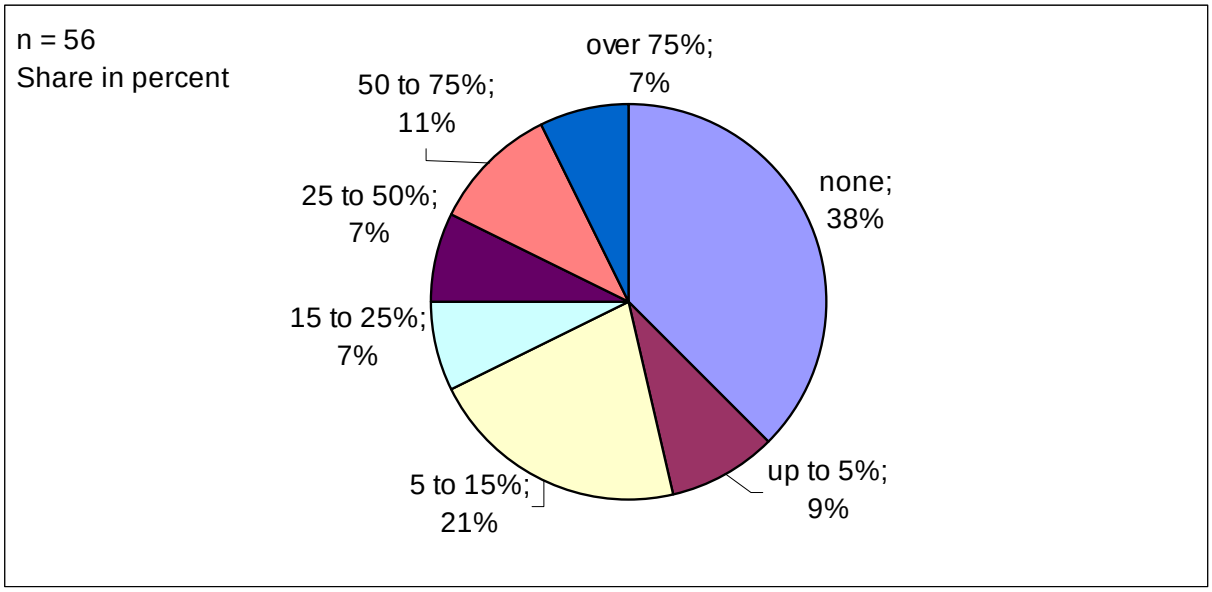

Figure 10: Share of International Sales in the Firm's Turn-over

Over one-fourth of all respondents characterized the failure of their firm to manage internationalization as a "significant" barrier to innovation. Many SMEs, probably owing to their limited resources and often missing know-how on international markets, seem to be particularly affected by the challenges of managing the "globalization". This problem affects, interestingly enough, both traditional and modern industry sectors, such as Machinery and IT, faced this problem.

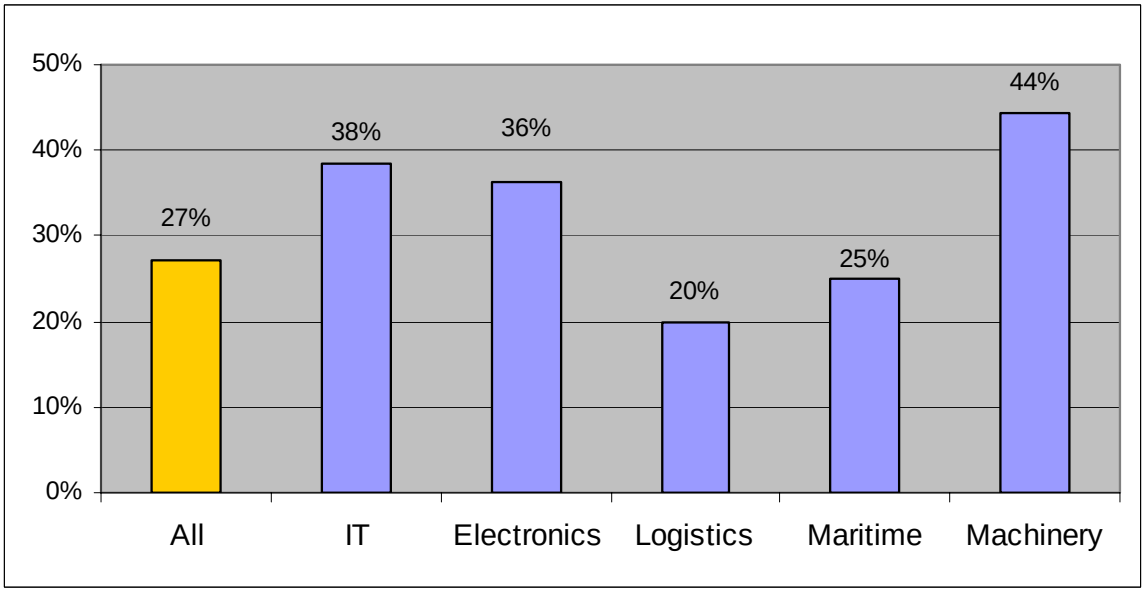

Figure 11: Failure to Internationalization as a Major Hurdle to Innovation

Reasons for Interest in Internationalization

In order to understand the importance attached to internationalization, the survey participants were asked about their motives for internationalization of innovation activities. For this purpose they were presented a set of possible motivations, the degree of importance could be stated on a scale of 1 (= very important) to 6 (= not important at all). Additionally, the respondents had the option of stating and evaluating motives other than those listed in the questionnaire.

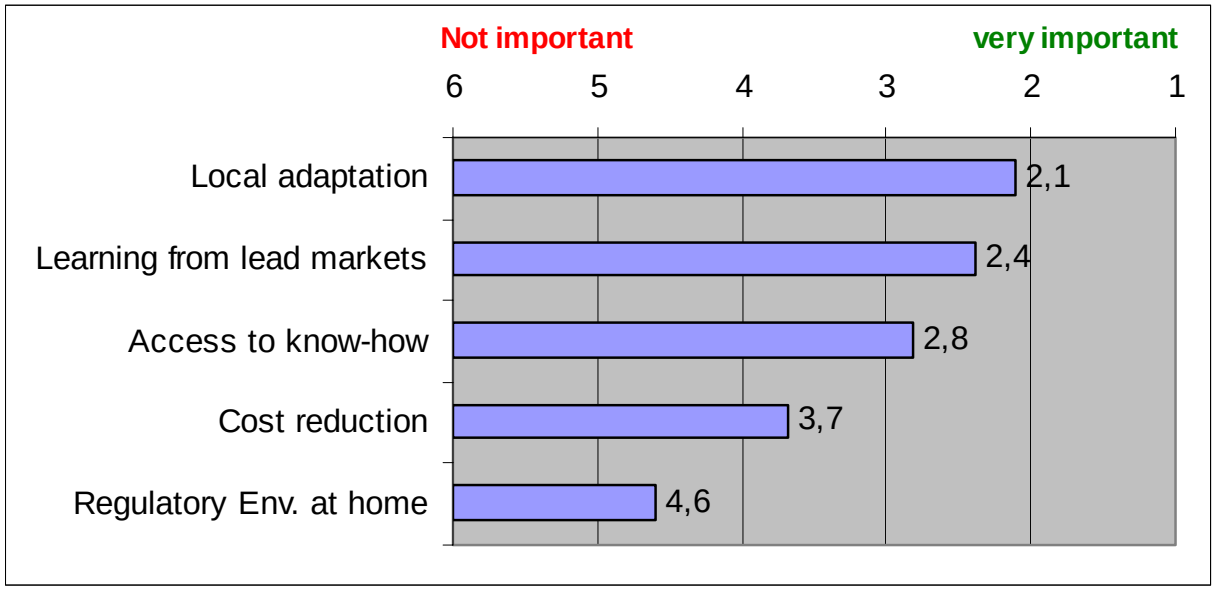

Figure 12: Motives for Internationalization in Hamburg's SMEs

As Figure 12 suggests, the desire to adapt their products to specific needs of the local target markets played a major role in the internationalization effort of the innovation activities by the participant firms. The aspiration to learn from "lead-markets" or to get access to knowledge-resources were found to be more important than, for instance, the desire to reduce costs by getting access to cheaper labor. Supposedly "unfavorable" regulatory conditions at home also did not play any worthwhile role in the decision to go international.

Challenges of Global Innovation

The desire to engage in international innovation activities however either did not materialize or did not run satisfactorily for many. The primary reasons cited, and evaluated on a scale of 1 (= very important) to 6 (= not important at all), were a general concentration on the "home market", lack of resources and know-how, and the fears relating to the legal uncertainties in the target markets including the potential danger of not being able to protect one's "intellectual property".

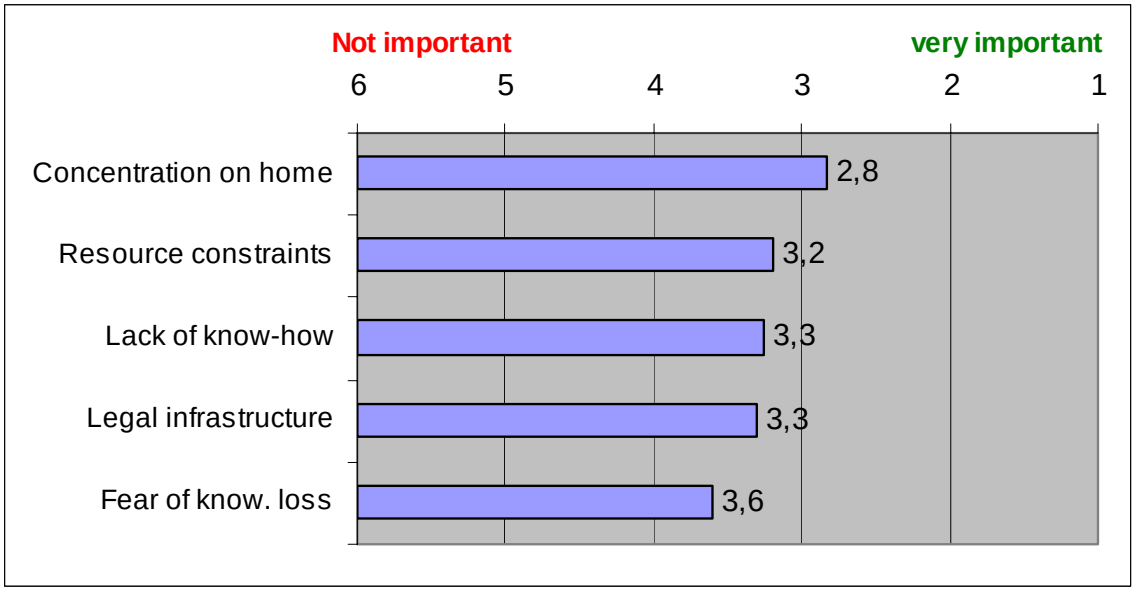

Figure 13: Difficulties Faced by SMEs in Internationalization Efforts

Problems in International Cooperation with Universities

Cooperation with universities and specialized R&D institutions (here jointly referred to as universities) are generally part and parcel of the innovation activities in industrialized economies. The participants of our survey were asked about their existing cooperation, and/or their willingness to cooperate, with universities abroad. Many survey participants expressed their desire to cooperate with universities on an international scale. Over one-third of all such SMEs however cited financial constraints as being a major hurdle for the cooperation. Significantly, but not surprisingly, over one-fourth of the survey did not know how to find a suitable academic partner abroad, especially in emerging countries.

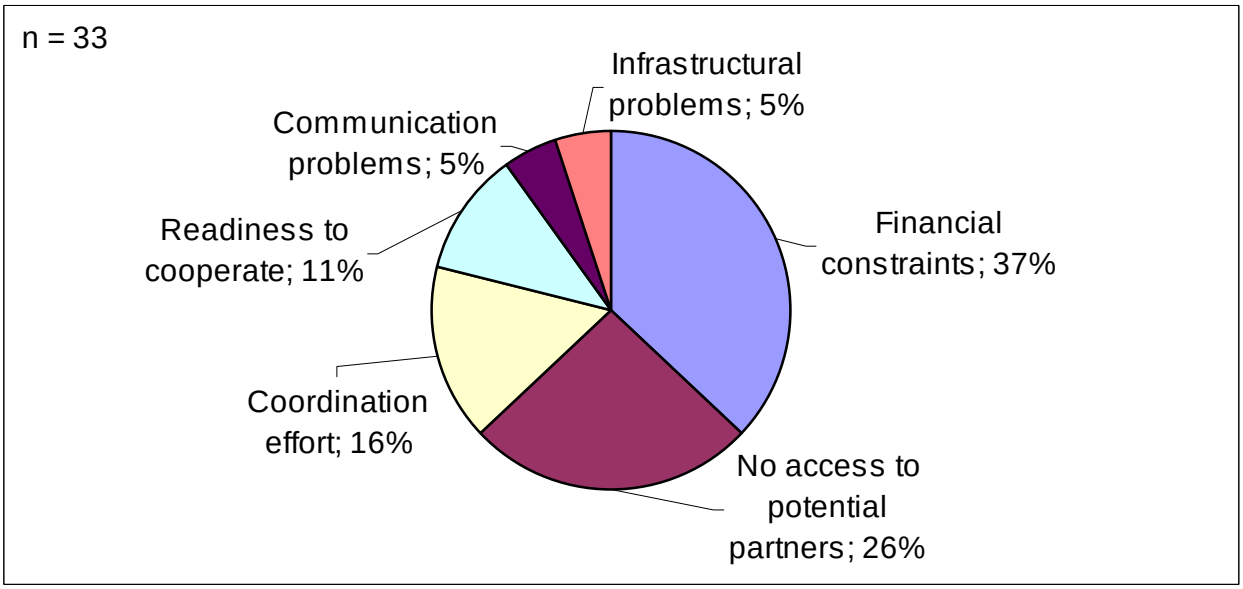

Figure 14: Problems in International Cooperation with Universities

The discussion above has brought to fore the chances and challenges that firms, especially SMEs from selected industry sectors in the Metropolitan Region of Hamburg, expect from the internationalization of their innovation activities. These expectations however often have a universal character and are not limited to SMEs or the Hamburg region alone. Other studies, too, have suggested similar patterns, see e.g. (Rammer et al., 2005; KfW, 1998). The European Center for Economic Research (ZEW), in a Germany-wide study of the innovation activities of SMEs, came to comparable conclusions, i.e. the financial constraints and a lack of qualified, skilled personnel present major hurdles to innovativeness of SMEs in Germany, see (Rammer et al., 2005). A comparable study of the motivation factors of Swiss firms into "relocating" their R&D activities at offshore sites is delivered by Arvanitis and Hollenstein (2006).

4. A Reference Model for Chances and Challenges of Global Innovation

The empirical survey has suggested that many firms, especially SMEs, suffer from barriers to innovation, which are caused either externally or internally. The primary barriers are:

a) Financial constraints
b) Finding qualified, suitable human resources
c) Finding suitable cooperation partners with knowledge resources
d) (International) Marketing of innovative products
e) Conceptualization of innovative products (The "Front-end" of innovations)

Based on the results of several studies and reports, it seems reasonable that global innovation activities may help overcome these problems. We have seen that global innovation activities, particularly when conducted in emerging, fast-growing markets such as China and India, offer tremendous opportunities, e.g. in the form of:

a) Vast pools of qualified human resources in science and technology
b) Cheaper costs of labor in emerging economies
c) A large number of knowledge institutions
d) Vast and growing number of middle class consumers with purchasing power and a penchant for global brands with local content
e) A growing presence of "lead markets" in Asia, particularly in electronics, owing to innovation-friendly consumer behavior ("early adapters")
f) An advantageous position of most emerging countries in the population structure (youth vs. old)

Keeping these factors in mind we propose a reference model for chances and challenges of globalization of innovation activities. The firms may hope to achieve access to knowledge, local adaptation for products, and to generate additional revenues while reducing costs by globalizing their innovation activities. The additional revenues may be pumped in further consolidation of innovation activities. The interplay of these factors strengthens the innovation capacity even further leading to global competitiveness.

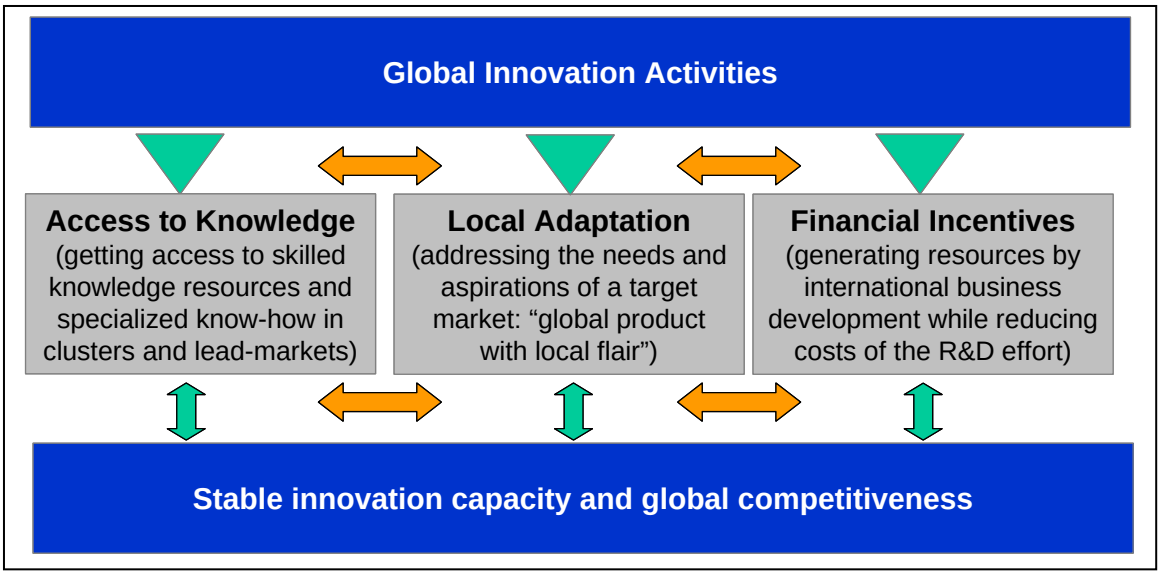

Figure 15: Reference Model for Chances and Challenges of Global Innovation Activities

The challenges of this model are also obvious:

i) The access to knowledge may be fraught with difficulties, as the "global war for talents" gets murkier. Even China and India are reportedly experiencing shortage of skilled labor with international knowledge standards. Wages in high-tech sectors in India are reportedly growing by 15 to 25% p.a. and many firms, including as reputed names as Google and Infosys, are complaining of a shortage of suitable candidates. This shortage leads to a high attrition-rate ("Job-hopping") in firms (Hirschfeld, 2005).

ii) The protection of IPRs remains a concern, even if to a varying degree, in most emerging countries, particularly when seen in conjunction with often delayed judicial processes and/or often prevalent corruption. Fabian and Schmidli (2005) report problems related to IPR protection and the fulfillment of contractual obligations in China.

iii) The local adaptation of products may cause financial constraints if the size of the target market does not provide scale effects. R&D efforts for local adaptation can only be justified in the presence of a large market. At the moment there are not many such markets if one excludes China and India, and probably some Eastern European countries. That effectively means that the global activities are actually "Asian" or "East European" activities. This problem may however be overcome by concentrating on regional markets, such as East Asia or Eastern Europe.

iv) It is possible that some firms, particularly SMEs, may not have sufficient financial resources to set up and operate an innovation center abroad. Hence, the financial effects of global innovation activities may not be equal for all firms. As a 2004 study by McKinsey suggests, German companies save 0.52 euro for every euro of corporate spending on IT jobs offshored to India, whereas their US counterparts save 0.58 cents for every dollar they spent on jobs in India. The higher costs for German firm's operations in India are caused by "differences in language and culture", which "raise the cost of coordinating offshoring projects" (Farrell, 2004).

v) Global innovation invariably involves multi-disciplinary teams of international backgrounds. The resultant disparity requires a high degree of social competences, and a sound understanding of cross-cultural interactions. For instance, Hirschfeld (2005) reports several incidences of inter-cultural nuisances in Indo-German

software development work. Fabian and Schmidli (2005) report similar problems in Sino-Swiss projects.

vi) The parent unit (headquarters) tend to interfere in the innovation work being carried out at the foreign location, which often limits the flexibility of the subsidiaries "to bring their innovation initiatives fully in line with host country best practices", as a large-scale empirical study by Softka (2006) revealed. Furthermore, some employees in the R&D units at the headquarters tend to see the new location as a potential threat to their job security leading to resentments, antagonism and even non-cooperation, as some managers confessed during our research interviews.

This discussion shows that the reference model enables many opportunities but also causes certain challenges for firms engaging in global innovation activities. To understand the actual impact and working of this model and in order to identify critical success factors a larger-scale study is necessary, so that this model currently possesses the character of a hypothesis.

5. General Implications and Summary

The enhanced competition spurred by the globalization as well as the technological advancements requires firms to engage in global innovation activities in order to gain, retain, and strengthen their competitive position. The pressure to go for global innovation is enhanced by the given socio-demographic factors in many industrialized countries.

The opportunities presented by the global innovation however seem to be fraught with challenges that require an efficient (global) innovation management. Based on the above discussed challenges we see following implications for firms, especially SMEs, while implementing a „global innovation strategy".

- To get access to local knowledge abroad, firms especially those which are facing financial or managerial constraints should initially focus on those forms of internationalization, which do not require a high level of capital investments. Potential strategies, for instance, could be:
  - Cooperative agreements with local research institutions and/or firms
  - Outsourcing of parts of the innovation process
  - To limit the financial burden of setting up and maintaining own international R&D facilities firms might consider sharing resources (facilities etc.) with partners. These partners might be other domestic firms with interest in global innovation, firms from other countries with an interest in the target country, or local firms and research institutions in the target country.
- In case of any kind of partnering the involved parties must find ways:
  - To protect their individual core competences
  - To share the intellectual property generated by such a joint venture, in a justified manner
- If companies enter foreign markets that require local adaptation of products (and therefore local R&D) they need to be sure that the potential of the target market is sufficient to achieve a favorable cost structure. If companies have reasons to expect problems in achieving needed experience curves (economies of scale and learning curve effects), they should reconsider the market entry.

- Firms need to pay attention to cultural aspects and should provide their employees involved in international activities with cross-cultural training. This sensitization to mutual cultural issues may play a key-role in the success of an international venture.
- The motivation (potential benefits) as well as the necessity behind global innovation activities (e.g. tapping new markets and reducing time-to-market) must be explained and discussed with existing R&D units so as to secure their benevolent cooperation with overseas operations.

The above discussed measures may play a crucial role in mastering the challenges of global innovation management. Exact modalities of global innovation activities, particularly for SMEs, however need further ascertainment and are set to be examined by our further research.

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