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Article

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Innovation Policy for SMEs Proves Successful

by Heike Belitz, Alexander Eickelpasch, and Anna Lejpras

The innovation policy of the German government and Länder provides small and medium-sized enterprises (SMEs) with a wide range of programs to promote their research and development (R&D) and focuses, in particular, on the transfer of knowledge. In recent years, the programs have been streamlined and funding substantially increased as part of the second economic stimulus package. SMEs have profited from this: the number of research performing SMEs has grown; they have increased their R&D expenditure and intensified their knowledge exchange with universities and research centers. Technology-neutral government funding is to remain at the current level—around ten percent of SMEs' R&D expenditure—thus providing more targeted support for knowledge transfer.

Over the past few years, the German government has made conceptual improvements to its funding of technology and innovation for small and medium-sized enterprises and the available budget for 2008 and 2009 was considerably increased as part of the second economic stimulus package, Konjunkturpaket II. This development significantly changed the funding landscape for innovative SMEs in Germany. Against this backdrop, the German Institute for Economic Research (DIW Berlin) conducted a study commissioned by the Federal Ministry of Economics and Technology (BMWi) on how to evaluate funding of technology and innovation for small and medium-sized enterprises in the period from 2005 to 2011 using macroeconomic criteria and proposed recommendations on how to develop the funding portfolio further.[1] The information is based, inter alia, on R&D as well as on the innovations of SMEs,[2] evaluation studies covering individual funding programs, and a written survey of SMEs receiving funding from the BMWi and the Federal Ministry of Education and Research (BMBF).

Research, Development, and Innovation in SMEs

SMEs account for 61 percent of jobs in the German economy as a whole and 44 percent of jobs in the manufacturing industry. In the crisis years 2008 and 2009, they had a stabilizing effect on employment.[3] Of the approximately 260,000 German companies with 5 to 249 employees, 29,800 continuously conducted R&D in 2010. In addition, there are approximately 27,000 SMEs which

1 H. Belitz, A. Eickelpasch, and A. Lejpras in cooperation with N. Barasinska and K. Toepel, Volkswirtschaftliche Bedeutung der Technologie- und Innovationsförderung im Mittelstand: Endbericht, Politikberatung kompakt, no. 67 (Berlin: DIW Berlin, 2012). Research project commissioned by the Federal Ministry of Economics and Technology.

2 Here SMEs are defined as companies with fewer than 250 employees.

3 R. Söllner, Ausgewählte Ergebnisse für kleine und mittlere Unternehmen in Deutschland 2009, Wirtschaft und Statistik (November 2011): 1086–1096.

Overview

Selected Programs of Government R&D and Innovation Funding for SMEs in Germany in 2011

Category	Program	Funding agency	Running since	Target group
Grants for:				
R&D projects				
Single-company projects	Central Innovation Programme for SMEs (ZIM) ZIM-SOLO	BMWi	2009	SMEs
Collaborative projects, R&D contracts	ZIM-KOOP and associated programs:	BMWi	2008	SMEs, R
	•Companies			
	•Companies and R&D centers			
	•R&D contracts			
	KMU-innovativ	BMBF	2007	SMEs, R
	Unternehmen Region with	BMBF	2001	SMEs, R
	•Innovative regional growth centers, with »Potenzial« module		2007	
	•Innovation fora		2001	
	•InnoProfile		2005	
Research infrastructure	Industrial Collective Research Program (Industrielle Gemeinschaftsforschung, IGF) with associated funding:	BMWi	1954	RA, R
	•ZUTECH		1999	
	•CORNET		2008	
	•Clusters		2009	
	•Leading Technologies for SMEs		2010	
	INNO-KOM-Ost (non-profit industrial research centers in eastern Germany) with the modules	BMWi	2009	IRC
	•Preliminary research			
	•Market-oriented R&D project			
	•Investment grant for technical infrastructure (model project)			
Consultancy and services	ZIM-DL (services)	BMWi	2008	SMEs
	»go-Inno« vouchers for consultation	BMWi	2011	Authorized consultancy company for SMEs
Network management	ZIM-NEMO	BMWi	2008	Networks with six companies
Low-interest loans for:				
Innovation projects	ERP (European Recovery Programme) – Innovationsprogramm	BMWi and KfW	2005	SMEs and larger companies

Explanatory notes: SMEs (according to EU definition), R: public research centers; RA: research associations which are members of the German Federation of Industrial Cooperative Research Associations (Arbeitsgemeinschaft industrieller Forschungsvereinigungen, AiF), IRC: non-profit external industrial research centers in East Germany; KfW: Germany's development bank, Kreditanstalt für Wiederaufbau
Programs for East Germany.

Source: compiled by DIW Berlin.

The government funds R&D and innovations through grants and low-interest loans.

only conduct occasional research.[4] They accounted for 5.1 billion Euros, or 11 percent of the entire internal R&D expenditure of companies in Germany. Between 2005 and 2010, despite the financial and economic crisis, R&D expenditure of SMEs increased by 35 percent, which represented more significant growth than among larger companies. Research-based and innovative SMEs are, therefore, key players in the German innovation system. Nevertheless, the R&D intensity of the SMEs is significantly lower than that of larger companies,[5] State in-

4 C. Rammer et al., Innovationsverhalten der deutschen Wirtschaft. Indikatorenbericht zur Innovationserhebung 2011 (Mannheim, 2012).

5 Datenreport 2011 (Essen: SV Wissenschaftsstatistik, 2011). For SMEs in the manufacturing sector, see also the analysis of the cost structure survey in the manufacturing industry by A. Eickelpasch, Research-Based Companies Perform Better, DIW Economic Bulletin, no. 10 (2012).

tervention in the R&D activities of an economy is justified by the economic theory concept of market failure.[6]

The aim of government funding is to raise private sector R&D expenditure to an optimal macroeconomic level. Market failure can take different forms. It is not only the company conducting the research that profits from the new knowledge gained because third parties (for example, other companies) cannot be prevented from using it too (knowledge spillover) and the company conducting the research, therefore, risks not being able to reap the full benefit. Market imperfections also result from information asymmetries in risk assessment and from the fact that it is not possible to divide up R&D projects which have to be a certain minimum size. SMEs also face further disadvantages compared to large companies. For instance, it is more difficult for SMEs to obtain credit. Moreover, due to their limited absorptive capacity, they are less able to make use of knowledge spillovers and frequently only achieve the required level of R&D capacity by cooperating with other companies. Unlike large companies, they cannot spread the innovation risks across multiple projects and face greater difficulties introducing innovations onto the market.

To compensate for market imperfections, the government can provide direct funding for R&D by SMEs and facilitate knowledge transfer with a suitable research infrastructure. R&D policy for small and medium-sized enterprises in Germany is primarily the responsibility of the BMWi. But the BMBF, the individual Länder and the European Union (EU) also support SMEs through special programs.

The BMWi funds the R&D activities of SMEs by providing grants to cover the costs of individual or collaborative projects as well as low-interest loans for innovative projects. This funding is not restricted to particular fields or areas of technology. This means that all SMEs are entitled to apply, irrespective of their sector. These programs are known as »technology-neutral« (see Overview). Moreover, SMEs are also eligible to receive funding through the generally accessible specialized programs run by the central government (»technology-specific funding«), for instance, for bioengineering or energy supply technology. Here funding of R&D collaborative ventures and of innovative networks of companies and research institutes is of key importance. This is intended to ensure that scientific findings can also be quickly exploited by SMEs for the development of new products.

The government's technology and innovation policy for SMEs has been further developed since 2005 (see Box).

Box

Development Trajectories of Technology and Innovation Policy for SMEs

1. Concentration of BMWi technology-neutral funding in the Central Innovation Program for SMEs (ZIM) with components for funding single-company projects (ZIM-SOLO), R&D collaborative and consortia projects (ZIM-KOOP) as well as networks of innovative SMEs (ZIM-NEMO). Grants can cover 35 to 50 percent of an R&D project's costs.

2. Opening up of BMBF's specialized technology-specific programs with the introduction of a new entry program, KMU-innovativ, covering eight technologies and simplifying access to the BMBF's traditional specialized programs. Here, funding can be awarded for up to 70 percent of project costs.

3. A stronger focus of research conducted primarily in public or non-profit research centers on projects with the greatest potential for commercial exploitation. The most important funding programs in this context are the BMWi's Industrial Collective Research Program (IGF) and non-profit industrial research centers in eastern Germany (INNO-KOM-Ost).

Sharp Increase in Government Funding for SMEs

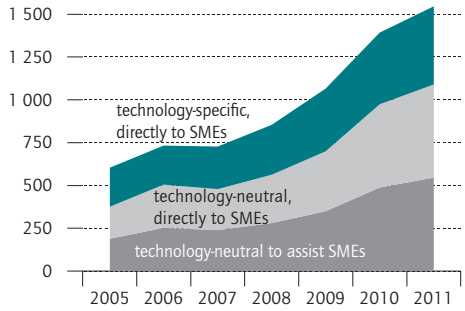
Total funding provided through the government's technology-neutral and technology-specific programs are either granted directly to SMEs or used to finance the SME-specific research infrastructure amounted to just over 1.5 billion Euros in 2011 (see Figure 1). Compared to 2005 (602 million Euros), funding therefore more than doubled. Technology-neutral funding provided by the BMWi accounted for just over a billion Euros (71 percent of total funding) in 2011. Around half of this went directly to the SMEs, while the other half was used to finance the SME-related research infrastructure. Technology-neutral funding increased much more dramatically than technology-specific funding. The increase in funding provided by the Central Innovation Programme for SMEs (Zentrales Innovationsprogramm Mittelstand, ZIM) as part of the second economic stimulus

6 B. Peters et al., Ökonomische Bewertung von staatlichen Investitionen in Forschung und Innovation, Studien zum deutschen Innovationssystem, no. 15 (Mannheim, 2012).

package played a central role here. To counteract the effects of the global financial and economic crisis, another 900 million Euros were made available for ZIM as part of the second economic stimulus package in 2008 and 2009 in addition to the 626 million Euros originally planned.

Figure 1

Government Funding for SMEs[1]



1 "To assist SMEs": funding to research centers, mainly as part of collaborative projects, benefiting SMEs directly.

Sources: Bundesbericht Forschung und Innovation 2012, p. 387 and 2010, p. 397 (2005 and 2006); calculations by DIW Berlin.

Over two-thirds of the current annual funding for SMEs of 1.5 billion Euros are awarded for technology-neutral projects.

R&D activities of SMEs are not only funded by the central government but also the individual Länder. Since no consistent official information on the amount of funding provided at regional level was available, DIW Berlin requested this data from the federal state ministries. According to the information received, the Länder contributed 420 million Euros to R&D grants going predominantly to SMEs in 2010 and so only about half as much as the central government (905 million Euros) (see Figure 2).

Broad Technology-Neutral Funding Particularly in Demand

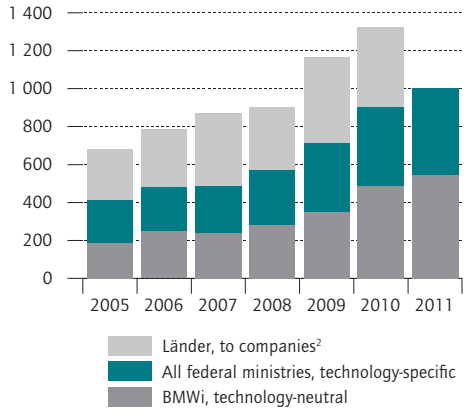
Not only in terms of amount of funding provided but also the number of companies funded, ZIM is by far the most important program. From mid-2008 to the end of 2011, according to the funding agency, over 9,000 SMEs were awarded grants through ZIM. The approval rate for applications for R&D funding was 70 percent for ZIM-SOLO (funding for single-company projects) and 75 percent for ZIM-KOOP (collaborative and consortia projects). This indicates that the target groups are being successfully reached.

In order to get an overall picture of the utilization of the various programs, DIW Berlin surveyed companies which were awarded grants through the BMWi and BMBF's SME-focused funding programs in the years 2005 to 2011. The survey was conducted in summer 2011. Of the just under 12,000 funded SMEs contacted, around 3,000 companies provided responses that could be used for the analysis. The survey shows the crucial importance of ZIM and of other technology-neutral funding programs. Almost 90 percent of the SMEs funded received technology-neutral grants (see Figure 3). 63 percent of the SMEs applied to ZIM-KOOP (or its predecessor programs) and 40 percent used ZIM-SOLO. 46 percent of the SMEs applied to the technology-specific specialized programs run by the BMBF, the BMWi, other ministries, and the EU.

Figure 2

Government and Länder Funding—Directly to SMEs[1]

In million Euros



1 Assumption: 50% of the technology-neutral funding goes directly to SMEs.
2 Länder funding: All companies, not including North Rhine-Westphalia and Schleswig-Holstein for 2005, not including North Rhine-Westphalia for 2006.

Sources: 2012 Federal Report on Research and Innovation (BUFI) 2012 and 2010, Länder; calculations by DIW Berlin.

Government funding has been continuously increasing since 2005.

DIW Berlin's survey shows that just over half of the SMEs funded only applied to the technology-neutral

programs (primarily ZIM and precursors). 34 percent accessed both funding lines. Only a small proportion (12 percent) only used technology-specific programs (see Figure 4). Therefore, technology-neutral programs form the basis of SME funding, supplemented by the specialized technology-specific programs run by the BMBF and BMWi, in particular.

There is also some overlap between funding from the central government and the individual Länder. Länder funding of single-company and regional R&D collaborative projects may, in some cases, be similar to central government funding. It is not possible to completely avoid these overlaps because the Länder pursue their own structural policy goals and also allocate R&D and innovation funding for this purpose. In view of the limited financial resources of many Länder, it is to be expected, however, that they would be more likely to design their R&D funding as complementary in type and scope if there was more certainty in the medium-term regarding the structure and budget of the central government's funding programs for SMEs.

SMEs which were only awarded technology-neutral funding differ from SMEs which were also or only awarded technology-specific funding in the following respects (see Table 1):

Two-thirds of these SMEs are in the manufacturing industry (mainly research-intensive branches) and a quarter in the knowledge-intensive service industries. The share of those companies also or only applying to specialized programs which fall in the knowledge-intensive service sector is considerably higher.

Companies only receiving technology-neutral funding tend to be smaller than the other companies. They have an average of 30 employees. Companies which receive grants from both types of programs or only specialized ones are normally considerably larger.

Among those companies receiving technology-neutral funding, the share of spin-offs from research centers or universities is considerably lower (6 percent) than for those receiving technology-specific funding (20 percent).

Evaluation of Research Funding Overwhelmingly Positive

The central aim of the government's technology and innovation policy should be to stimulate further R&D activities in SMEs and thus also a knowledge spillover to other companies (for example, through imitation, mobility of skilled labor, collaborative partnerships, etc.) in order to maximize the contribution R&D makes to macroeconomic growth. With the aim of examining the extent to which the existing system of technology and innovation funding fulfills this objective, recent evaluation studies covering the most important funding programs were analyzed.[7] The importance of R&D funding for the SMEs receiving support was also examined using DIW Berlin's survey.

Table 1

Features of SMEs Receiving Funding
In percent

	Company received funding from... programs		Total
	Only technology-neutral	Technology-neutral or technology-specific	
Total			
Manufacturing	66.0	55.3	61.1
Knowledge-intensive branches*	42.7	34.8	39.1
Less knowledge-intensive branches*	23.3	20.4	22.0
Knowledge-intensive service industries*	26.1	35.6	30.4
Other branches of industry	7.9	9.2	8.5
Companies with... employees			
1 to 4	9.4	8.2	8.8
5 to 9	20.9	14.5	18.0
10 to 49	53.8	47.1	50.7
50 to 249	15.6	24.8	19.8
Company formed from...			
a university	4.3	13.3	8.4
a research center	1.9	6.5	4.0
Greater region...			
West Germany	64.8	63.4	64.2
East Germany	35.2	36.6	35.8

* Definition according to the lists of knowledge and technology-intensive goods and industries (NIW/ISI/ZEW) based on the 2008 classification of economic activities (WZ 2008).

Source: Survey by DIW Berlin.

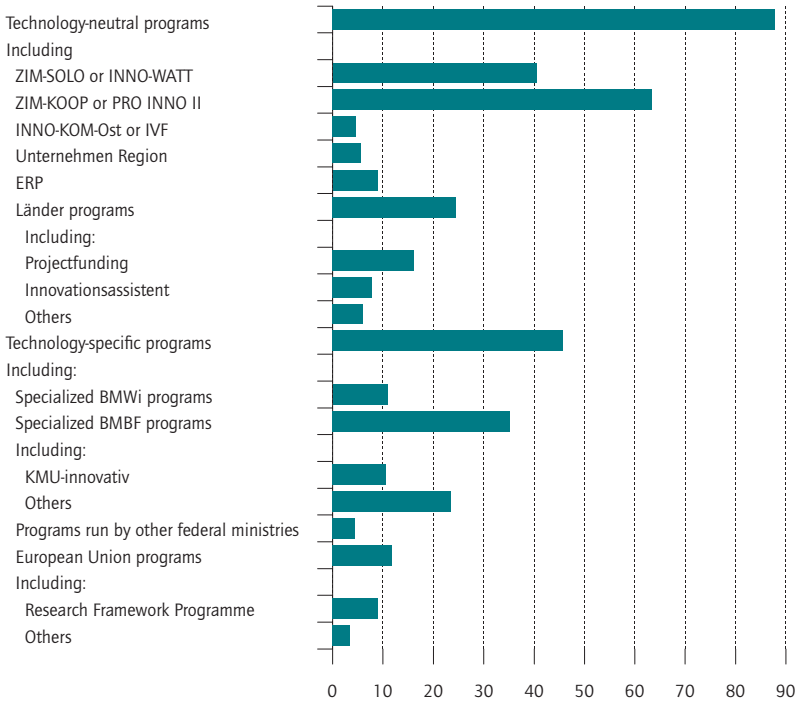
SMEs receiving technology-neutral funding tend to be smaller.

The evaluation reports provide evidence that the BMWi and BMBF funding programs have increased the volume and improved the quality of R&D activities. The deadweight effects are minimal. Predominantly as a result of the further development and expansion of the German government's range of funding programs, particularly

7 The study analyzed, inter alia, evaluations of the following funding programs: BMWi: ZIM, IGF, HighTech-Gründerfonds, ERP-Innovationsprogramm, SIGNO, INNO-WATT, PRO INNO and InnoNet as well as BMBF: KMU-innovativ, research grants, and InnoRegio.

Figure 3

SMEs Making Use of Programs for R&D and Innovation in 2005 to 2010
Survey results in percent



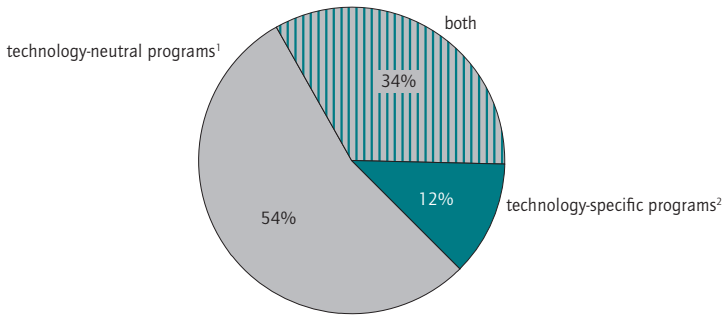
N = 3010.

Source: survey by DIW Berlin.

The Central Innovation Programme for SMEs (ZIM) and its predecessors are used the most.

Figure 4

Number of SMEs Which Received Technology-Neutral or Technology-Specific Grants in 2005 to 2010
In percent



1 ZIM and precursor programs, programs run by the KfW development bank and the Länder.
2 Specialized BMWi programs, programs run by the BMBF, other federal ministries and the EU.

Source: survey by DIW Berlin.

Technology-neutral funding is particularly popular.

ZIM and KMU-innovativ, many SMEs were awarded funding for the first time. For the majority of SMEs, the funding they received enabled them to expand their company's technological base and recruit additional R&D personnel. Furthermore, the continuity of project funding provides SMEs with planning certainty. There is also evidence that projects funded through both ZIM and KMU-innovativ have provided more positive stimulus for the companies' R&D activities.[8]

The exchange of knowledge between SMEs, large enterprises, and research centers is particularly stimulated by funding of collaborative R&D projects and strengthening of the SME-specific research infrastructure.[9]

The evaluation findings provide very little information about the impact of funding on the economic performance of the SMEs. This is the result of major methodological inadequacies which are primarily due to insufficient data, the problems of creating a suitable control group, and also the requirements of econometric techniques. Furthermore, business innovations involve complex and multifaceted processes which make it difficult to identify the effects of isolated factors, particularly when there is a very long time span between R&D and market launch.

DIW Berlin's Survey Confirms Positive Impact Based on Program Evaluations

The analysis conducted on the basis of DIW Berlin's survey indicates that government funding does not replace a company's own R&D investment but rather complements it. This applies to both SMEs that have only accessed technology-neutral programs and those that have also or only been awarded technology-specific funding. The funding helps to build technological capacity. Also, from the point of view of innovation performance, companies receiving technology-neutral grants are comparable to those receiving both technology-neutral and technology-specific funding (see Table 2). However, the economic performance indicators of SMEs only receiving technology-neutral funding are less favorable. This is primarily likely to be due to the smaller size of these companies.

8 See C. Rammer, B. Aschhoff et al., Begleit- und Wirkungsforschung zur Hightech-Strategie. Systemevaluierung „KMU-innovativ". Abschlussbericht, (Mannheim and Berlin, December 13, 2011).

9 On knowledge transfer in SMEs receiving funding see A. Eickelpasch, Mittelstandsförderung: Wissenstransfer stärkt Unternehmen, Wochenbericht des DIW Berlin, no. 49 (2012).

Table 2

Selected Performance Indicators Of SMEs Surveyed

	Funding awarded		Total	N
	Technology-neutral funding only	Both technology-specific and technology-neutral funding		
Employees per company (number) in 2010	30	66	47	2,976
Sales in 2010 of new or significantly improved products, that... (% of sales volume)	64.6	42.4	56.5	2,491
are completely new to the market	25.9	22.6	23.6	
were already available from competitors	38.8	19.8	32.9	
Companies with process innovations that were... (% of companies)				
implemented	54	59	56	1,637
not implemented	46	41	44	1,271
Exports in 2010 (% of sales volume)	30.3	39.4	36.2	2,568
Only companies with data for 2005 and 2010:				
Sales volume in 2010, compared with 2005 (%)	34.4	40.3	38.4	2,398
Exports in 2010, compared with 2005 (%)	37.2	48.6	45.2	2,214
Employees in 2010, compared with 2005 (%)	16.3	21	19.4	2,261

Source: survey by DIW Berlin.

In 2010, products new to the market made up almost a quarter of SMEs' sales volume.

The successful commercial exploitation of the results of a company's funded R&D activities also depends on the prevailing external circumstances. Above all, this includes demand, the economic environment, investment financing conditions, competition on the product markets, and the availability of skilled personnel.

During the global financial and economic crisis, the share of companies launching innovations plummeted and overall expenditure on innovation in Germany also fell accordingly, whereas the R&D expenditure of SMEs in fact increased. This is because investment in innovative projects lends itself more to short-term adjustments than expenditure for R&D personnel which represents the lion's share of R&D costs.[10] Furthermore, government measures such as the expansion of R&D project funding for SMEs as part of the second economic stimulus package, as well as the introduction of the short-time allowance contributed that SMEs did not cut R&D expenditure between 2007 and 2009. This had not been the case during previous periods of economic downturn.

In DIW Berlin's survey, the companies receiving funding were also asked to assess the prevailing external conditions for R&D and innovation. The majority of the companies surveyed considered market factors as well as financing conditions and access to information to be of central importance (see Figure 5). The following conditions were considered to carry most weight: the self-financing capacity, customers' openness towards proposed innovations, and information about government funding as well as new technologies. In almost all categories, most companies that considered a factor to be of high importance also tended to rate that factor positively. The availability of skilled personnel and R&D tax incentives (not yet introduced in Germany) are exceptions to the rule.

Conclusion

Analyses of DIW Berlin's report lead us to propose the following recommendations regarding technology policy for SMEs:[11]

The German government needs a mid to long-term technology and innovation policy for SMEs which includes a clear range of funding measures.

ZIM should be continued to provide basic technology-neutral funding for SMEs in Germany. Subsidies

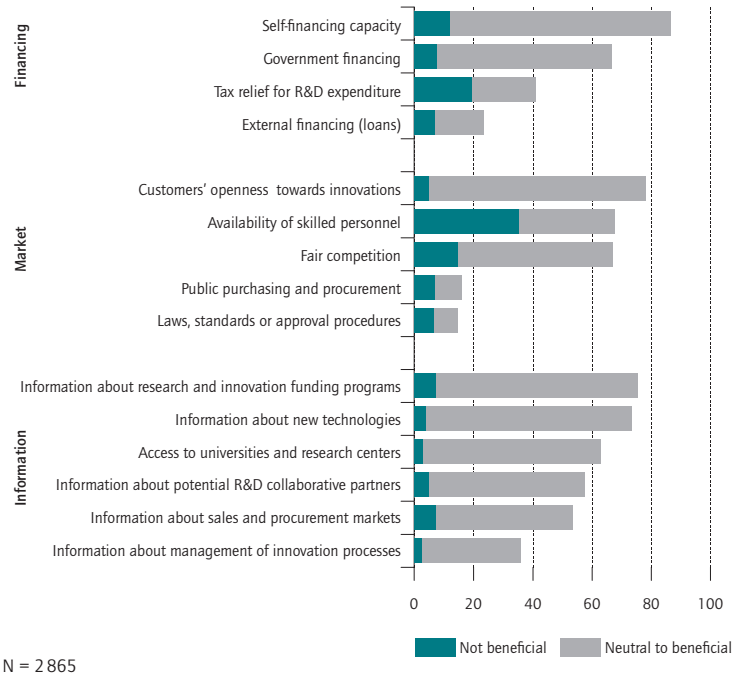
10 See C. Rammer, Auswirkungen der Wirtschaftskrise auf die Innovationstätigkeit der Unternehmen in Deutschland, Vierteljahrshefte zur Wirtschaftsforschung 80 (3) (2011): 13–33.

11 H. Belitz, A. Eickelpasch, and A. Lejpras in cooperation with N. Barasinska and K. Toepel, Volkswirtschaftliche Bedeutung der Technologie- und Innovationsförderung im Mittelstand: Endbericht, Politikberatung kompakt, no. 67 (Berlin: DIW Berlin, 2012).

Figure 5

Companies' Assessment of External Conditions for R&D and Innovation

In percentage of companies assigning major importance to the factor



N = 2 865

Source: survey by DIW Berlin.

According to the companies surveyed, the availability of skilled personnel has the greatest scope for improvement.

should cover approximately ten percent of SMEs' research expenditure.[12]

Funding for R&D projects that are conducted by research centers and tailored towards the needs of SMEs should also be continued. With this in mind, the IGF and INNO-KOM-Ost programs should hone their focus on cross-industry and cross-technology projects. SMEs should be consulted on new research projects already at the planning stage.

The specific focus on funding innovations in SMEs in eastern Germany should be continued and the corresponding funding bonuses offered under the ZIM program should also be maintained.

When it comes to funding (regional) research and innovation networks, greater emphasis should be placed on dovetailing with direct project funding than has been the case to date.

During the economic crisis, larger SMEs (with up to 1,000 employees) received funding under the second economic stimulus package from the ZIM program. This funding has now been phased out but, given the importance of these companies for Germany's technological performance, it should be reinstated and evaluated.[13]

Measures, tested with KMU-innovativ, to simplify SMEs' access to technology-specific funding programs should be extended to similar programs run by other departments.

A review of the European Recovery Program (ERP) should be carried out to ascertain whether access to this credit line could also be made easier for SMEs.[14]

12 In 2010, this was approximately 500 million Euros which corresponded with the federal government's estimated budget for ZIM.

13 In July 2012, the funding program was extended to SMEs with up to 500 employees (as long as the company was not majority owned by a larger company). This initially ran until the end of 2013. An evaluation is being carried out in parallel, see www.zim-bmwi.de.

14 See also H. Belitz and A. Lejpras, Innovationsfinanzierung im Mittelstand: Zugang zu Krediten erleichtern! Wochenbericht des DIW Berlin, no. 49 (2012).

For SMEs too, the internationalization of R&D and innovation is of increasing importance. However, their funding applications to the EU's Seventh Framework Program for Research (FP7) have limited chances of success. Therefore, the German government should—based on its experiences with SME funding in Germany—lobby for the conditions for SME access to EU funding programs to be eased. Furthermore, participation in project applications as part of international research consortia should be supported nationally, as is already the case in other countries.

Technology and innovation funding can incentivize an increase in R&D activities and a change in innovation behavior. However, to what extent this can be translated into economic results is largely dependent on other external circumstances. SMEs constantly refer to the shortage of skilled personnel as the main obstacle. When it comes to recruiting from the scarce pool of qualified employees, they lose out to large enterprises in particular. In this context, the BMWi should ensure that the pool of skilled personnel in SMEs can be put to more effective use.

Finally, the conditions for the evaluation of government funding of R&D and innovation should also be improved. To quantify the short and long-term, direct and indirect impact of funding measures and their reciprocal effects the available funding data from all funding institutions should be collected and combined with enterprise data.

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