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Innovation in Germany – Results of the German CIS 2006 to 2010

Background Report on the Innovation Surveys 2007, 2009 and 2011 of the Mannheim Innovation Panel

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Report to the Federal Ministry of Education and Research (BMBF)

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1 Introduction

Innovation is regarded as a key driver of productivity and market growth and thus has a great potential for increasing wealth. Surveying innovation activities of firms is an important contribution to a better understanding of the process of innovation and how policy may intervene to maximise the social returns of private investment into innovation. Over the past three decades, research has developed a detailed methodology to collect and analyse innovation activities at the firm level. The Oslo Manual, published by OECD and Eurostat (2005) is one important outcome of these efforts. In 1993 both organisations have started a joint initiative, known as the Community Innovation Survey (CIS), to collect firm level data on innovation across countries in concord (with each other). The German contribution to this activity is the so-called Mannheim Innovation Panel (MIP), an annual survey implemented with the first CIS wave in 1993. The MIP fully applies the methodological recommendations laid down in the Oslo Manual. It is designed as a panel survey, i.e. the same gross sample of firms is surveyed each year, with a biannual refreshment of the sample. The MIP is commissioned by the German Federal Ministry of Education and Research (BMBF) and conducted by the Centre for European Economic Research (ZEW) in cooperation with the Fraunhofer Institute Systems and Innovation Research (ISI) and the Institute for Applied Social Science (infas).

This publication reports main results of the MIP surveys conducted in the years 2007, 2009 and 2011. These surveys were the German contribution to the CIS for the reference years 2006, 2008 and 2010.

The purpose of this report is to present descriptive results on various innovation indicators for the German enterprise sector. The report focuses on twelve thematic areas:

1. Innovation performance which is measured by the share of firms that introduced product or process innovations and the type of innovation activities conducted by firms.
2. Expenditure for product and process innovation and the number and size of innovation projects.
3. Direct economic returns from innovations in terms of sales generated by new products and cost savings due to process innovation.
4. Innovation strategies, measured by the importance of different aims which should be achieved by innovation, the combination of product and process innovation, the degree of novelty of process innovation, and the impact of organisational and marketing innovation.
5. Financing of innovation and the relevance of limited internal financial resources for restricting firms' innovation activities.

6. Innovation networks, revealed by co-operations, by the sources of information used for innovation projects, and by joint development of product and process innovations.
7. Barriers to innovation that hamper firms' efforts to develop and introduce new products and processes.
8. Internationalisation of innovation activities of German enterprises.
9. Protection mechanisms used to safeguard the returns from investment in innovations.
10. Marketing and organisational innovation as types of innovation that go beyond the traditional concept of technological innovation.
11. Environmental innovations as a special type of innovation activity.
12. Innovation and investment, i.e. the role of innovation in a firm's total activities to build up a stock of tangible and intangible capital.

Note that the first nine thematic areas refer to product and process innovation only, while the last three themes apply a wider concept of innovation.

Each thematic focus is presented in a separate chapter. Tabulated results for each theme are presented in the Annex to this report. But before presenting results on innovation indicators, methodological issues of the 2007, 2009 and 2011 surveys of the MIP are set forth in the first chapter. This includes information on sampling, survey techniques, data processing, non-response treatment and weighting.

All values presented in tables and figures in this report – except when stated otherwise – are weighted results based on MIP survey data. The results are thus representative for the entire population of German enterprises. Results are broken down by sector, size class, and region (Eastern and Western Germany). With respect to industry most results are broken down by four main sectors which are defined as follows:

- *R&D-intensive manufacturing* includes manufacture of chemical and pharmaceutical products, electronics and electrical equipment as well as machinery and transport equipment (divisions 20-21, 26-30 of NACE rev. 2).
- *Other manufacturing* comprises all manufacturing sectors apart from the R&D-intensive manufacturing sectors as well as mining, energy and water supply and waste management (divisions 5-19, 22-25, 31-39).
- *Knowledge-intensive services* include publishing, audiovisual and broadcasting activities, telecommunications, IT and other information services, banking and insurance, engineering offices, technical laboratories, consultancy and advertising and scientific R&D (divisions 58-66, 69-73).
- *Other services* entail wholesale trade, transportation incl. travel agencies, postal services, graphic design and photography, cleaning, security, provision of staff, office services and other support services (divisions 46, 49-53, 74, 78-82).

2 The German Innovation Surveys 2007, 2009 and 2011

This chapter describes the main characteristics of the methodology of the MIP surveys conducted in the years 2007, 2009 and 2011. The chapter discusses the sector coverage, sampling methods, response rates, questionnaire (especially with respect to extensions to the harmonised CIS questionnaires), field work, data processing including item non-response treatment, and methods used for unit non-response correction and weighting of data.

2.1 Coverage and Sampling

The German innovation survey is designed as a panel survey (called Mannheim Innovation Panel, MIP) and is conducted annually. In line with the Oslo Manual (OECD and Eurostat, 2005), the survey is based on a stratified random sample of firms that covers enterprises with five or more employees from a wide area of economic activities. Based on an initial sample drawn in 1993, the same sample of firms is surveyed every year. In a biennial rhythm, the sample is refreshed to compensate for panel mortality and to account for the foundation of new firms. Panel mortality includes firms that ceased business as well as small and medium-sized firms (up to 499 employees) that did not respond in four consecutive survey waves. Large firms remain in the sample irrespective of their response behaviour. The same holds true for any firm that leaves the target population by either changing its main economic activity to one outside the core sectors or by shrinking below the five-employee threshold. Peters and Rammer (2013) provide details on panel mortality and firm participation over time.

The sector coverage of the MIP has changed over time. The first survey wave (conducted in 1993) included mining, manufacturing, energy and water supply, and construction as well as a few service sectors (wholesale trade, real estate, computer activities, management consulting, engineering, sewage and refuse disposal). In 1995, the panel was expanded to cover retail trade, sale and repair of motor vehicles, renting activities, and business-related services. From 2001 onwards, film and broadcasting were surveyed as well. In 2005, construction, retail trade, sale and repair of motor vehicles, real estate and renting activities were excluded from the target population as there was little demand for analyses of these sectors while the large number of enterprises in the population required a substantial share of the survey's resources. However, firms from these discarded sectors that had responded to the survey before 2005 still remained in the panel sample after 2005 and were contacted in later survey waves. For the sector composition of the MIP over time see Peters and Rammer (2013).

The MIP sample is stratified by sector, size class, and region. The number of cells varies by year owing to changes in the sector coverage and sector classification schemes. Until 2008, sector sampling was basically based on divisions (2-digit codes) of NACE rev. 1. From 2009 onwards, divisions of NACE rev. 2 are used for sector stratification. The change to the new classification had little impact on sampling in 2009 as a major refreshment of the MIP sample that took place in 2005 already responded to upcoming changes in the sector classification. For some groups (3-digit codes) of NACE rev. 1, which have become separate divisions in NACE rev. 2, separate strata had been introduced.[1] This procedure allowed us to re-stratify the 2007 and 2008 surveys to calculate weighted results using the NACE rev. 2 classification used for stratification from 2009 onwards which consists of 896 strata: 55 divisions and 1 group of NACE rev. 2 (all divisions of sections B, C, D, E, H, J, K plus divisions 46, 69, 71, 72[2], 73, 74, 78, 79, 80, 81, 82 and group 70.2), 8 size classes (5 to 9, 10 to 19, 20 to 49, 50 to 99, 100 to 249, 250 to 499, 500 to 999, 1,000 and more employees) and 2 regions (Western and Eastern Germany, the latter including Berlin).

The MIP sample is disproportionally drawn, i.e. the drawing probability varies by cell. Higher drawing probabilities are applied to cells from larger size classes, cells from Eastern Germany and cells with a high variation of innovation activities. A minimum of ten enterprises per cell are drawn. Firms with 500 or more employees are all sampled. In the absence of access to official business registers, the MIP sample was drawn from a firm data base called the Mannheim Enterprise Panel (MEP).[3] The MEP is also used as the database for refreshing the sample.

Data on the total number of firms in the target population of the survey are taken from the Business Register of the Federal Statistical Office (FSO). In Germany, business register data first became available in 2008, providing data for the current

1 This applied to NACE (rev. 1.1) 15.9, 22.1, 24.4, 36.1, 64.1, 64.3, all groups of 74, 92.1, 92.2.

2 Note that division 72 (R&D) does not include public research organisations such as Helmholtz Centres, the Max Planck Society, the Fraunhofer Society, Leibniz Institutes or other publicly owned or publicly financed research organisations. For weighting purposes, data on these organisations are excluded from total population figures.

3 This panel is a joint effort of ZEW and Creditreform, Germany's largest credit rating agency. The MEP includes literally all economically active enterprises in Germany, though some enter the database only some years after foundation. A comparison of the MEP with the Business Register of the Federal Statistical Office shows a very high compliance both in terms of the number of enterprises and the size and sector distribution. The MEP is constructed by ZEW through merging twice a year a copy of the current state of Creditreform's enterprise data with previous copies of this data, including data cleaning for multiple entries and identification of firm closures. The MEP contains, amongst otheprs, data on an enterprise's economic activity (NACE 5-digit), location and number of employees.

NACE (rev. 2) classification back to 2006. Before, the firm population was estimated using data of various official statistics for the different sectors covered by the MIP. Since sector statistics rarely reported enterprise data in such detail and definition as needed for establishing total population figures (e.g. many statistics did not cover small firms with less than 20 employees), ZEW had to estimate incomplete data. The transfer to business register data resulted in a break in series for total population figures and correspondingly for weighted innovation data.

The MIP also includes a sample of enterprises that have received public funding from government agencies for R&D and innovation activities. These enterprises were drawn from a database on recipients of public R&D grants provided by the Federal Ministry of Research and Education (BMBF). The main purpose of including publicly funded firms is to generate a database for evaluation purposes (see for empirical applications Aschhoff, 2008; Czarnitzki and Fier, 2002, 2003). These firms are not considered for weighting purposes, unless a publicly funded enterprise has entered the MIP through random sampling.

The total population of enterprises in the target sectors and size classes of the MIP was 264,709 for the 2007 survey wave. This figure represents the number of economically active enterprises during the year 2006 (yearly average) based on data from the Business Register. For the 2009 survey, total firm population rose to 273,907. ZEW estimated the total firm population for 2010 to be 269,459 since no official data for this year was released by mid-2012. The core sample of the MIP covers 7.5 per cent of the total enterprise population in Germany (including firms outside the sector coverage and firms with less than 5 employees). From all enterprises with 5 or more employees, 45 per cent are within the sector coverage of the MIP. In 2010, the firms within the coverage of the MIP employed about 14.5 million people and generated sales of more than €4.7 trillion.

The sample size of the MIP increased during the three survey years covered by this report. In 2007, 25,862 enterprises from the core coverage were sampled (9.6 per cent of the total population). This figure was expanded to 31,048 in 2009 and 31,945 in 2011, representing 11.1 and 11.6 per cent of the total population. The main reason for increasing the sample size was to counter the falling response rate that resulted in a lower absolute number of responses, which also lowered the sampling rate (relation between responding firms and total population) and therefore increased the average weight a firm receives.

In addition to the core sample, a further 2,549 (2007), 2,474 (2009) and 2,187 (2011) firms from outside the core coverage which have responded to previous waves were added, including firms from sectors not considered for weighted data, and firms with less than 5 employees within the core sectors. The sample was enlarged by another 1,593 (2007), 1,800 (2009) and 1,550 (2011) firms which have received public funding for R&D or innovation by the Federal Ministry of Education and Research in the past years but were not part of the random sample. The total number of firms in the gross sample was therefore 30,004 (2007), 35,322 (2009) and 35,682 (2011). Table 1 shows the absolute number of firms for the total population, the gross sample and the net sample broken down by sector, size class, and region.

Table 1. Total population and sample size of MIP surveys 2007, 2009 and 2011 by sector, size class and region

Number of	*Total population*			*Gross sample*			*Neutral Losses*[a)]			*Net sample*[b)]			*Add. large firms*[c)]			*NR interviews*[d)]		
firms	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*
Sector group																		
10-12	18,359	17,846	17,681	1,286	1,852	1,870	98	223	425	189	323	330	19	26	38	232	280	435
13-15	2,877	2,692	2,400	965	1,099	1,311	73	151	431	140	203	221	3	4	7	138	166	257
16-17	5,173	5,015	4,729	929	1,086	1,078	42	115	252	147	221	208	7	14	11	121	160	276
20-21	2,448	2,464	2,396	1,157	1,237	1,220	75	195	290	187	232	230	44	44	53	172	179	305
22	5,026	5,102	4,876	925	917	897	57	103	158	186	219	210	8	12	10	159	138	264
23	3,896	3,740	3,590	805	792	758	47	93	153	138	155	147	11	11	11	145	122	197
24-25	21,233	22,216	20,867	1,857	2,084	1,967	122	223	380	362	467	417	23	34	39	326	335	549
26-27	7,802	7,927	7,594	1,924	2,240	2,181	114	297	420	340	482	463	39	51	57	313	315	591
28	10,702	10,761	10,221	1,636	1,888	1,676	107	234	319	284	397	341	40	58	53	330	287	448
29-30	2,316	2,316	2,227	997	1,052	1,057	55	147	269	128	188	173	49	54	71	155	149	249
31-33	13,787	14,463	14,408	1,425	1,826	1,969	74	186	347	240	420	383	9	15	21	282	366	615
5-9, 19, 35	2,509	2,373	2,689	1,142	1,154	1,260	63	148	307	228	289	272	39	36	44	163	143	265
36-39	4,703	4,809	4,445	1,146	1,259	1,482	82	191	394	251	347	359	7	10	9	155	146	294
46	38,273	39,296	38,211	1,560	1,512	1,367	158	277	337	224	236	248	16	30	31	183	171	280
49-53, 79	31,252	32,418	31,310	1,973	2,557	2,841	179	485	881	392	499	504	17	34	52	259	303	567
18, 58-60	9,048	8,929	8,280	1,367	1,730	1,825	110	311	527	215	308	288	15	21	16	207	219	402
61-63	11,529	12,498	13,176	1,394	1,940	2,108	183	366	622	228	335	331	15	24	32	225	278	462
64-66	6,241	6,696	6,932	1,327	1,368	1,430	114	237	301	212	241	234	45	68	77	173	183	301
69-70, 73	30,805	31,317	31,184	1,263	2,178	2,096	138	488	570	162	321	358	1	6	8	167	224	407
71-72	14,877	16,006	16,206	1,966	2,126	1,975	255	392	433	401	486	487	3	6	9	305	263	503
74, 78, 80-82	21,853	25,023	26,037	1,378	2,128	2,440	164	448	746	212	349	353	15	32	33	157	215	462
other sectors				1,582	1,297	874	127	203	118	370	343	294	2	9	7	158	188	278

Table 1. continued

	Total population			*Gross sample*			*Neutral Losses*[a)]			*Net sample*[b)]			*Add. large firms*[c)]			*NR interviews*[d)]		
	2007	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*
Size class																		
0-4				1,198	1,397	1,507	171	210	244	318	456	490	0	0	0	277	271	510
5-9	108,314	110,798	110,348	4,342	5,454	5,927	572	1,083	1,797	654	957	1,041	0	0	0	658	719	1,229
10-19	69,613	71,548	70,200	4,526	5,805	6,066	393	901	1,413	851	1,243	1,322	0	0	0	741	881	1,422
20-49	48,309	51,174	50,056	5,106	6,600	6,618	394	955	1,552	999	1,390	1,396	0	0	1	856	952	1,640
50-99	18,559	19,553	18,952	4,216	5,017	4,838	294	685	1,206	729	1,028	867	0	1	2	626	609	1,208
100-249	12,748	13,398	12,690	4,456	5,202	4,782	266	653	1,181	738	966	832	2	7	10	666	730	1,197
250-499	4,110	4,274	4,138	2,500	2,168	2,193	141	248	481	399	412	385	7	18	25	348	337	574
500-999	1,758	1,795	1,744	1,734	1,763	1,760	97	326	410	248	281	236	36	59	80	201	199	356
1,000	1,298	1,367	1,331	1,926	1,916	1,991	109	452	396	300	328	282	382	514	571	152	132	271
Region																		
Western G.	226,197	225,651	221,629	21,761	25,800	25,845	1,732	4,014	6,167	3,480	4,862	4,655	365	532	608	3,252	3,465	6,059
Eastern G.	38,512	48,256	47,830	8,243	9,522	9,837	705	1,499	2,513	1,756	2,199	2,196	62	67	81	1,273	1,365	2,348
Total	264,709	273,907	269,459	30,004	35,322	35,682	2,437	5,513	8,680	5,236	7,061	6,851	427	599	689	4,525	4,830	8,407
outside core[e)]				*2,549*	*2,474*	*2,311*	*274*	*363*	*383*	*624*	*730*	*666*	*2*	*9*	*7*	*409*	*417*	*750*
funded firms[f)]				*1,593*	*1,800*	*1,550*	*151*	*238*	*267*	*342*	*450*	*397*	*0*	*3*	*4*	*271*	*294*	*476*
Total for weighting	*264,709*	*273,907*	*269,459*	*25,862*	*31,048*	*31,821*	*2,012*	*4,912*	*8,030*	*4,270*	*5,881*	*5,788*	*425*	*590*	*682*	*3,845*	*4,119*	*7,181*

a) Firms not existing at the time of survey, double entries and newly drawn firms outside the size and sector coverage of the target population.
b) Firms that returned a completed questionnaire
c) Large firms for which data were collected from other sources, including split up of large multi-sector firms by business segments.
d) Firms that provided information in the non-response survey.
e) Firms that are smaller than 5 employees or in 'other sectors'; excluding funded firms added deliberately to the sample.
f) Firms that received public funding for innovation and that were added deliberately to the sample.

2.2 Questionnaire, Field Work and Response

The 2007 innovation survey was the first MIP survey to apply the newly established concept of innovation introduced by the 2005 edition of the Manual (see OECD and Eurostat, 2005). This edition extended the concept of innovation to organisational and marketing innovations. While the MIP survey applies all the basic concepts and definitions of the harmonised CIS questionnaires of the respective years, it includes a number of questions that go beyond the standard questionnaire:

- More detailed questions on direct economic outcomes of innovations, including success indicators for process innovations;
- Questions on planned innovation activities in the year of the survey and the following year, including estimates of planned innovation expenditure;
- Additional questions on innovation-related activities, including financing of capital investment and innovation activities (in 2007), the link between marketing, organisational, product and process innovation (in 2007), the number of innovation projects (in 2009 and 2011), the link between the macroeconomic environment and innovation (2009), internationalisation of innovation (2011), firm capabilities relevant for innovation (2011), and protection of intellectual property, licensing and the management of trademarks (2011);
- Indicators of a firm's market environment, including the type of competition and a firms' market share;
- A considerably extended set of questions on firm characteristics, including financial data on exports, expenditure on material/purchased services, personnel, training and marketing, gross capital expenditure, the stock of fixed assets and the profit margin (pre-tax profits over sales).

MIP questionnaires follow a common structure while the exact list of questions alters from year to year. There is a set of questions, however, that are used in exactly the same way every year to allow panel analysis for the corresponding variables. Table 2 provides an overview of the questions contained in the three survey waves 2007, 2009 and 2011. The questionnaires also include a list of examples for product and process innovation organised by four sector groupings (manufacturing, trade and transport, financial intermediation, business services/computing/media) in order to guide responding firms and facilitate a common understanding of innovation. The Appendix of this report contains English translations of the questionnaires used in the survey years 2007, 2009 and 2011.

In line with the harmonised CIS questionnaires, the MIP questionnaires include a set of questions that are only to be answered by firms with innovation activities. This filter applies to any firm that has introduced a product innovation or a process innovation or has ongoing or abandoned/stopped product/process innovation activities in the three years previous to the survey year. The choice of a three year observation period for innovation activities is in line with the recommendations of the Oslo Manual and allows the identification of innovative firms in markets where firms may sustain an innovation-based competitive strategy even if innovating is only infrequent. Such markets are often characterised by long product life cycles or technology cycles. A multiannual reference period also enables observing related innovation activities that are spread over different calendar years, e.g. in case of a long duration of innovation projects. It is also beneficial to accurately capturing outputs and effects of innovations, such as sales with new products or effects on competition, growth or profitability. A drawback of a three-year reference period for a panel survey is, however, that the same innovation activity of a firm may be reported up to three times in consecutive survey waves which complicates the identification of the factors that may influence a firm's decision to innovate, as well as the link between innovation activities and performance.

Table 2. Content of MIP 2007, 2009 and 2011 questionnaires

	2007	*2009*	*2011*
General business information (sales, employees)	i	i	i
Characteristics of the market environment	x	x	x
Product and process innovation	i	i	i
Ongoing, abandoned and planned innovation* activities	i	i	i
Total innovation* expenditure, incl. planned expenditure	i	i	i
Innovation* activities and expenditure by type		x	
Number of innovation* projects		i	i
Research and experimental development activities	i	i	i
Public support to R&D and innovation*	i	i	i
Financing of investment and innovation*	x		
Co-operation on innovation*		i	i
Information sources for innovation*		x	
Objectives of innovation*		x	
Internationalisation of innovation* activities			x
Macroeconomic environment and innovation*		x	
Obstacles to innovation*	x		x
Marketing and organisational innovation	i	i	i
Link between marketing/organisational and product/process innovation	x		
Firm capabilities for innovation			x
Environmental innovations		x	
Protection of IP, licensing, management of trademarks			x
Financial data	i	i	i

i: Question used in identical form in each survey.
x: Question used in specific form in the respective survey year.
* Innovation refers to technological innovation (product and process innovation) only.

In 2007, only a printed version of the questionnaire was used. In 2009 and 2011, online versions were also available. All firms were able to choose between the paper and the online version. Access to the online version was provided through a firm identification number and password which were communicated to the firm on a cover letter sent along with the questionnaire.

In each year, the questionnaire was sent to firms in late February. For most firms, contact data of individuals responsible for responding to the survey are available from earlier waves, facilitating the distribution of questionnaires and increasing comparability of data across different survey waves. At the end of March or beginning of April, non-responding firms received a reminder. In 2007, the reminder was sent by postal mail whereas in 2009 and 2011, all non-responding firms were contacted by phone, followed by sending another copy of questionnaire by postal mail except for firms that refused on telephone to participate in the survey. Firms that did not respond until six weeks after having received the second copy of the questionnaire were reminded a second time by telephone.[4] In case firms were still willing to participate, another copy of the questionnaire was sent to them. Firms that refused participation on telephone were asked to participate in a non-response (NR) survey (see below for more details).

During the field work, information has been received on firms that ceased business or were not able to be contacted for other reasons.[5] In 2007, 2,437 neutral losses have been recorded (= 8.1 per cent of the gross sample). This figure rose to 5,513 firms in 2009 (= 15.6 per cent of the gross sample) owing to the expanded telephone contacts to firms, including manual research on firms with false addresses or telephone numbers. In 2011, the number of neutral losses further increased to 8,680 (= 24.3 per cent). On the one hand, this high figure was due to many firm exits during and after the sharp economic crisis that hit Germany in 2009. On the other, a programming error in the sample refreshing procedure for 2011 resulted in the inclusion of 2,873 firms to the 2011 sample that were not economically active at the time of sampling. Corrected for these false entries, the number of neutral losses in 2011 was 5,807 (= 16.3 per cent of the gross sample).

The number of received completed questionnaires was 5,236 in 2007, 7,061 in 2009 and 6,851 in 2011, which equals a response rate (share in gross sample net of neutral losses) of 19.0, 23.7 and 25.4 per cent, respectively. The increase in the response rate in 2009 and 2011 compared to 2007 can mainly be attributed to the larger efforts to remind firms via telephone, which proved to be more effective than a written reminder. In addition, the option to fill in the questionnaire online may have also added to a higher response rate. In 2009, 1,108 firms used the online option (= 15.7 per cent of all responses). In 2011, the online share in total responses rose to 27.9 per cent. An analysis of online responders showed that these firms are on average larger, more innovative and more often come from research and knowledge intensive industries. The past participation behaviour in the MIP had no significant impact on the probability to respond online. In particular, offering an online option did not result in a higher response of firms which refused to participate in prior survey waves.

The low response rate in the MIP, which is typical for voluntary enterprise surveys in Germany, raises the issue of a potential non-response (NR) bias in terms of innovation activities. In order to identify whether and to what extent such a bias

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4 In 2007, only two third of non-responding firms could be contacted by telephone due to budget restrictions. In 2009 and 2011, all non-responding firms were contacted.

5 This includes firms that could not be reached by telephone despite at least five trials at different times of the day and different days during the week.

exists, a comprehensive non-response survey was performed. This survey was designed in two parts. As mentioned above, a first round of non-response interviews was conducted during the telephone reminder. Considering the responses by strata of the first round, a stratified random sample of non-responding firms was drawn for the second round of NR interviews. For each stratum, a minimum number of NR interviews had been defined. In order to attain this number in case of firms refusing to participate in the NR survey, substitutes from the same strata of refusing firms were drawn. The NR survey was conducted by telephone and contained four yes/no questions on product innovation, process innovation, ongoing innovation activities and abandoned/stopped innovation activities as well as a question on in-house R&D activities (with the answering options no, occasional and continuous). In addition, firms were asked to report the total number of employees and shortly describe their main product group. This information was used to check the sector and size class assignment of the firm. The total number of NR interviews was 4,525 in 2007 and 4,830 in 2009. In 2011, the number of NR interviews almost doubled to 8,407 as a result of a higher target number of interviews per strata in order to increase the accuracy of NR correction (see next section for more details).

Adding questionnaire responses and NR interviews gives the total number of firms for which information on their innovation activities has been collected. The respective response rate was 35.4 per cent in 2007, which rose to 39.9 per cent in 2009 and 56.6 per cent in 2011.

In order to increase representativeness of data particularly with regard to indicators that relate to expenditure, employment or sales figures, a special effort was undertaken to survey as many large firms as possible. Large firms were defined as enterprises employing more than 5,000 people at German locations, or being one of the three largest enterprises within a sector. In order to determine this group of firms, information from the MEP as well as other publicly available company data was used. Out of this group of firms, about one of five returned a completed questionnaire. For all other firms, key survey data (including information on product and process innovation, innovation expenditure and R&D activity as well as employment and financial data) was collected using financial reports and other company publications as well as data from other available sources, including the MEP. In case of missing data, longitudinal imputation using firm information from previous years was applied (see the next section for more details on imputation methods used in MIP).

In addition, an attempt was made to differentiate data from large multi-product enterprises which have main economic activities in more than one sector (as defined by NACE divisions by sector). For some large enterprises this was done by addressing the questionnaire to individual business units representing activities in a certain sector. For other enterprises, enterprise data were broken down by sector data using segment reporting information from company reports or similar sources. One should note that this procedure concerned only a small number of enterprises since most large corporations have organised their business activities in a network of subsidiaries which typically represent single-sector enterprises.

These activities resulted in additional observations that were used for extrapolating figures to the target population. In 2007, 427 additional large firm observations were taken into account. This figure rose to 599 in 2009 and 689 in 2011. The number of firm observations used for weighting had increased by 8.2 per cent in 2007, 8.5 per cent in 2009 and 10.1 per cent in 2011. More importantly, economic activities of firms in the largest size class (1,000 and more employees) are almost completely covered by firm observations in the MIP, resulting in weights close to 1.0 for this size class in most sectors.

Table 2 reports key response characteristics of the surveys. The gross sample of the 2007 wave represented about 9.6 per cent of the total population when firms outside the core coverage and not randomly drawn firms had been excluded from the gross sample. The drawing quota rose to 11.1 and 11.6 per cent for the 2009 and 2011 surveys. High drawing quotas were applied for medium-sized and large firms and for most manufacturing sectors, while the metal industry, wholesale trade, transportation, consultancy/advertising and other business services show particularly low drawing quotas, reflecting the high share of small firms and a low variation in innovation intensities in these sectors. A drawing quota of more than 100 per cent for the largest size class reflects the deliberate addition of business units of large multi-sector enterprises to the sample as well as some discrepancy between the Business Register and the MEP. The share of neutral losses is high in service sectors, particularly transportation, computer services, technical services and consultancy/advertising, and among small firms. Response rates do not vary substantially among sectors and size classes, except for very small firms below the 5 employee threshold since this size class includes only firms that responded in some of the previous survey waves.

The sample rate, which is the sum of responses (including additional observations for large firms, but excluding responses from outside the core coverage and from deliberately added funded firms) as a share of the total population, was 1.8 per cent in 2007 and rose to 2.4 in both 2009 and 2011. This means that the average weight a firm in the net sample receives was about 55 in 2007 and about 40 in 2009 and 2011. For weighted results, not only the net sample is used but also information from NR interviews is critical since NR results may significantly change weights (see next section for more detail). The extended sample rate including NR observations was 3.2 per cent in 2007, 3.9 per cent in 2009 and 5.0 per cent in 2011 which means that in 2011 about 1 out of 20 firms in the total population have been surveyed. Sample rates are high for manufacturing sectors (more than 20 per cent in 2011 for chemicals/pharmaceuticals and vehicles) and low for most service sectors (1.5 per cent for wholesale in 2011, and 2.1 per cent for consultancy/advertising). For firms with more than 1,000 employees the extended sample rate 63 and 69 per cent in 2007 and 2009, respectively, and increased to 83 per cent in 2011.

Table 3. Drawing quote, response rate and sampling rate of MIP surveys 2007, 2009 and 2011 by sector, size class and region (per cent)

	Drawing quota[a)]			*Share of losses[b)]*			*Response rate[c)]*			*Response rate, incl. NR interviews*			*Sample rate[d)]*			*Sample rate, incl. NR interviews*		
	2007	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*
Sector group																		
10-12	6.7	9.9	10.1	7.6	12.0	22.7	15.9	19.8	22.8	35.4	37.0	52.9	1.1	1.9	2.0	2.3	3.4	4.3
13-15	31.4	37.7	51.3	7.6	13.7	32.9	15.7	21.4	25.1	31.2	38.9	54.3	4.4	6.8	8.5	8.7	12.1	18.2
16-17	16.8	20.3	21.6	4.5	10.6	23.4	16.6	22.8	25.2	30.2	39.2	58.6	2.7	4.3	4.3	4.8	7.3	9.8
20-21	41.9	43.2	43.8	6.5	15.8	23.8	17.3	22.3	24.7	33.2	39.4	57.5	8.6	10.2	10.4	14.9	16.5	21.4
22	17.1	16.6	17.0	6.2	11.2	17.6	21.4	26.9	28.4	39.7	43.9	64.1	3.6	4.1	4.1	6.4	6.7	9.1
23	19.0	19.0	19.4	5.8	11.7	20.2	18.2	22.2	24.3	37.3	39.6	56.9	3.6	3.9	4.1	6.9	6.7	8.9
24-25	7.9	8.5	8.5	6.6	10.7	19.3	20.9	25.1	26.3	39.7	43.1	60.9	1.7	2.1	2.0	3.0	3.5	4.4
26-27	20.6	23.5	24.0	5.9	13.3	19.3	18.8	24.8	26.3	36.1	41.0	59.9	4.0	5.7	5.9	7.3	8.9	12.4
28	12.2	14.4	13.6	6.5	12.4	19.0	18.6	24.0	25.1	40.2	41.4	58.1	2.5	3.5	3.3	5.1	5.8	7.0
29-30	38.0	39.4	40.8	5.5	14.0	25.4	13.6	20.8	22.0	30.0	37.2	53.6	7.0	9.4	10.0	12.9	15.1	20.2
31-33	9.2	11.2	12.3	5.2	10.2	17.6	17.8	25.6	23.6	38.6	47.9	61.5	1.6	2.7	2.5	3.3	4.8	6.3
5-9, 19, 35	40.2	43.1	41.8	5.5	12.8	24.4	21.1	28.7	28.5	36.2	42.9	56.3	9.4	12.2	10.3	15.4	17.7	19.3
36-39	22.7	24.3	31.1	7.2	15.2	26.6	23.6	32.5	33.0	38.2	46.2	60.0	4.9	6.6	7.4	8.0	9.4	13.4
46	3.8	3.5	3.2	10.1	18.3	24.7	16.0	19.1	24.1	29.0	33.0	51.3	0.6	0.6	0.7	1.0	1.0	1.3
49-53, 79	5.9	7.4	8.5	9.1	19.0	31.0	21.9	24.1	25.7	36.3	38.7	54.6	1.2	1.5	1.6	1.9	2.4	3.3
18, 58-60	14.1	18.1	20.8	8.0	18.0	28.9	17.1	21.7	22.2	33.6	37.1	53.2	2.3	3.4	3.3	4.4	5.6	7.7
61-63	10.4	13.5	14.1	13.1	18.9	29.5	18.8	21.3	22.3	37.4	38.9	53.4	1.8	2.5	2.4	3.5	4.4	5.4
64-66	19.5	18.6	18.5	8.6	17.3	21.0	17.5	21.3	20.7	31.7	37.5	47.4	3.8	4.3	4.0	6.3	6.9	8.0
69-70, 73	3.6	6.3	6.0	10.9	22.4	27.2	14.4	19.0	23.5	29.2	32.2	50.1	0.4	0.9	0.9	0.9	1.5	2.1
71-72	10.7	10.6	9.7	13.0	18.4	21.9	23.4	28.0	31.6	41.3	43.2	64.2	2.2	2.4	2.4	3.8	3.6	4.9
74, 78, 80-82	5.9	8.0	8.8	11.9	21.1	30.6	17.5	20.8	20.8	30.4	33.6	48.1	1.0	1.4	1.3	1.6	2.2	3.0
other sectors				8.0	15.7	13.5	25.4	31.4	38.9	36.3	48.5	75.7	1.1	1.9	2.0	2.3	3.4	4.3

Table 3. continued

	Drawing quota[a)]			*Share of losses[b)]*			*Response rate[c)]*			*Response rate, incl. NR interviews*			*Sample rate[d)]*			*Sample rate, incl. NR interviews*		
	2007	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*	*2007*	*2009*	*2011*
Size class																		
0-4				14.3	15.0	16.2	31.0	38.4	38.8	57.9	61.2	79.2						
5-9	3.6	4.5	5.1	13.2	19.9	30.3	17.3	21.9	25.2	34.8	38.3	55.0	0.5	0.8	0.9	1.1	1.4	1.9
10-19	5.9	7.5	8.2	8.7	15.5	23.3	20.6	25.3	28.4	38.5	43.3	59.0	1.1	1.6	1.7	2.1	2.7	3.6
20-49	9.5	11.9	12.4	7.7	14.5	23.5	21.2	24.6	27.6	39.4	41.5	59.9	1.8	2.5	2.5	3.5	4.2	5.5
50-99	20.5	23.6	23.7	7.0	13.7	24.9	18.6	23.7	23.9	34.5	37.8	57.1	3.4	4.7	4.1	6.5	7.5	9.9
100-249	30.6	34.4	33.9	6.0	12.6	24.7	17.6	21.2	23.1	33.5	37.3	56.3	4.8	6.1	5.7	9.3	10.8	14.0
250-499	49.4	40.1	44.0	5.6	11.4	21.9	16.9	21.5	22.5	31.7	39.0	56.0	7.4	7.4	7.6	14.3	13.4	18.9
500-999	92.7	92.1	95.1	5.6	18.5	23.3	15.1	19.6	17.5	27.4	33.4	43.9	15.4	18.7	17.9	26.6	29.4	37.9
1,000	114.1	99.6	105.1	5.7	23.6	19.9	16.5	22.4	17.7	24.9	31.4	34.7	51.4	60.6	62.9	62.9	69.9	82.6
Region																		
Western G.	8.2	9.9	10.2	8.0	15.6	23.9	17.4	22.3	23.7	33.6	38.2	54.4	1.4	2.0	2.1	2.7	3.4	4.4
Eastern G.	17.6	16.7	17.9	8.6	15.7	25.5	23.3	27.4	30.0	40.2	44.4	62.0	3.8	3.8	3.9	6.5	6.2	8.0
Total	9.6	11.1	11.6	8.1	15.6	24.3	19.0	23.7	25.4	35.4	39.9	56.5	1.8	2.4	2.4	3.2	3.9	5.0
outside core				10.7	14.7	14.4	27.4	34.6	38.4	45.4	54.3	77.7						
funded firms				9.5	13.2	17.2	23.7	28.8	30.9	42.5	47.6	68.0						
Total for weighting	9.6	11.1	11.6	7.8	15.8	25.3	17.9	22.5	24.0	34.0	38.3	54.2	1.8	2.4	2.4	3.2	3.9	5.0

a) Gross sample (excluding firms from outside coverage and deliberately added funded firms) as a percentage of total population.
b) Neutral losses as a percentage of gross sample.
c) Responding firms as a percentage of gross sample net of neutral losses.
d) Responding firms (including non-responding large firms for which data have been collected from other sources) excluding firms from outside coverage and deliberately added funded firms as a percentage of total population.

2.3 Data Processing, Non-response Correction and Weighting

Data Processing

Raw data are checked for logical consistency and likely typing errors, especially with respect to statements on financial data. In order to correct likely inconsistencies and errors, firm data from previous survey waves are consulted. Sometimes, firms are contacted by telephone for clarification purposes. The MIP survey nowadays refrains from follow-up contacts to fill in item non-response. Past experience showed that contact persons find it very difficult to add missing information after some time has passed since filling in the questionnaire originally and can only rarely provide accurate data on variables for which no data was provided in the questionnaire. For weighting purposes, imputation methods are used to estimate firm-specific values in case of item non-response, applying both longitudinal and cross-section imputation methods.

Longitudinal imputation rests on firm-specific data from previous survey waves. Two different methods are employed. For missing variables that directly relate to other non-missing variables, the respective firm-specific relation in the most recent survey wave (within the last five waves) for which both variables are positive is used to impute the missing value. For variables not directly related to any other variable, or in case no pair of positive observations is available for related variables within the last five survey waves, the last positive value reported by the respective firm is used and weighted with a trend for this variable to estimate the current value. The trend is calculated as the mean change in the respective variable based on all firms belonging to the same sector as the firm with missing value and that provided positive data for the respective variable both in the current wave and in the wave for which the most recent data is available for the firm with missing value. In case of quantitative data, which typically vary by firm size such as innovation expenditure, imputation is based on size-related indicators (e.g. innovation expenditure per unit of sales) in order to control for changes in variables due to firm growth or decline.

Cross-section imputation is used for variables that were either not surveyed in previous waves or for which too little information is available to perform longitudinal imputation. Cross-section imputation substitutes missing values by the mean value in a firm's strata.

Non-response Correction

Information from the NR survey is used to identify a potential response bias between innovating and non-innovating firms and to adjust weights accordingly. For this purpose, the realised non-response sample is regarded as being representative for all non-responding firms in the gross sample.

For extrapolating numbers to the target population, non-response correction factors are calculated in each stratum separately for innovators and non-innovators by applying the following procedure.

n_h is the number of firms in stratum h of the gross sample, consisting of the number of responding firms $n_{R,h}$, and the number of non-responding firms, k_h:

$$n_h = n_{R,h} + k_h$$

Among the number of non-responding firms k_h, a subsample of non-responding firms is surveyed in the non-response survey labelled $n_{NR,h}$ (with $n_{NR,h} \leq k_h$).

The number of innovating firms in the response and in the non-response sample is $inno_{R,h}$ and $inno_{NR,h}$, respectively. The share of innovators p in both samples is thus given by

$$p_{R,h} = \frac{inno_{R,h}}{n_{R,h}} \quad \text{and} \quad p_{NR,h} = \frac{inno_{NR,h}}{n_{NR,h}} \, .$$

Assuming that the results of the non-response survey represent all non-responding firms of the gross sample, the number of innovators in stratum h can be calculated as

$$inno_h = inno_{R,h} + p_{NR,h} \cdot k_h \, .$$

The share of innovators in stratum h is thus given by

$$p_h = \frac{inno_h}{n_h} = \frac{inno_{R,h} + p_{NR,h} \cdot k_h}{n_{R,h} + k_h} = p_{R,h} \cdot \frac{n_{R,h}}{n_h} + p_{NR,h} \cdot \frac{k_h}{n_h} \, .$$

As a results, the non-response correction term for innovators ($korr_{h,1}$) and for non-innovators ($korr_{h,0}$) in stratum h can be calculated as follows:

$$corr_{h,1} = \frac{p_h}{p_{R,h}} \quad \text{and} \quad corr_{h,0} = \frac{1 - p_h}{1 - p_{R,h}} \, .$$

Weighting

Weighting aims at estimating parameters for the population based on parameters observed for the sample. The population N represents all firms out of which n firms of the gross sample have been drawn. The MIP applies simple weights for qualitative variables such as the number of innovators and bounded weights for quantitative variables such as innovation expenditure or sales with new products (see Cochran, 1972; Rendtel, 1987). Simple weighting implies that only information from the sample is used to estimate the unknown parameter in the population. In contrast, bounded weighting methods use auxiliary information about the population in order to estimate unknown population parameters based on sample information. For instance, if innovation expenditure is correlated with turnover, the estimation of the innovation expenditure in the population can be improved if we do not only take into account information about the innovation expenditure in the sample but if we additionally use known information about the turnover in the population (external auxiliary information). In the following, we explain both methods and their implementation in the MIP in more detail.

Simple weights (w) are equal to the inverse of the sample rate π of firm i in stratum h (N being the number of firms in the population and n the number of firms in the net sample):

$$w_{hi} = \pi_{hi}^{-1} = \pi_h^{-1} = \frac{N_h}{n_h} \text{ for } i \in h,$$

Since the sample rate π is identical for all firms in stratum h, we can neglect subscript i. For a variable Y in the population, for instance the number of innovators, we can get an unbiased estimate $\hat{Y}$ by calculating

$$\hat{Y} = \sum_{h=1}^{H} \sum_{i=1}^{n_h} w_{hi} \cdot y_{hi} = \sum_{h=1}^{H} \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi},$$

with y_{hi} being the variable value of firm i in stratum h and H being the number of strata.

Actually, the calculation of simple weights w in the German CIS data has been refined by additionally distinguishing two stages. The first stage accounts for the (inverse) probability of firm i being in the gross sample while the second stage considers the responding behaviour of firms in the gross sample (for the additional non-response correction, see below). Weights are derived as the product of the inverse of the gross sample rate and the inverse of the response rate:

$$w_{hi} = \frac{1}{\pi_{hi}} \cdot \frac{1}{\tau_{hi}} = \frac{1}{\pi_h} \cdot \frac{1}{\tau_h} = \frac{1}{\frac{n_h}{N_h}} \cdot \frac{1}{\frac{m_h}{n_h}} = \frac{1}{\frac{m_h}{N_h}} = \frac{N_h}{m_h} \quad \text{for all firms } i \in h.$$

$\pi_{hi} = \frac{n_h}{N_h}$ denotes the gross sample rate of firm i in stratum h and $\tau_{hi} = \frac{m_h}{n_h}$ is the response rate of firm i in stratum h. m_h measures the number of responding firms in stratum h ($=n_{R,h}$).

When calculating the response rates, the MIP considers a potential distortion because of differences in the response behaviour of innovators and non-innovators. This implies that the inverse response rate of innovators in stratum h is calculated as the inverse average response rate in stratum h multiplied by the non-response correction term for innovators in stratum h ($corr_{h,1}$). An analogue definition is applied for the inverse response rate of non-innovators.

These preliminary weights are then adjusted to the number of firms in stratum h in the total population N_h. As a result, simple (i.e. firm-based) weights for innovators ($k=1$) and non-innovators ($k=0$) in stratum h are defined as follows

$$w_{hi,k} = w_{h,k} = \frac{1}{\pi_h} \cdot \frac{1}{\tau_h} \cdot corr_{h,k} \cdot \frac{N_h}{\sum_{k=0,1} \sum_{i=1}^{m_{h,k}} \frac{1}{\pi_h} \cdot \frac{1}{\tau_h} \cdot corr_{h,k}} = \frac{N_h}{m_h} \cdot corr_{h,k} \cdot \frac{N_h}{\sum_{k=0,1} \sum_{i=1}^{m_{h,k}} \frac{N_h}{m_h} \cdot corr_{h,k}}$$

$$= \frac{N_h}{m_h} \cdot corr_{h,k} \cdot \frac{N_h}{\frac{N_h}{m_h} \sum_{k=0,1} \sum_{i=1}^{m_{h,k}} corr_{h,k}}$$

$$= N_h \cdot \frac{corr_{h,k}}{m_{h,0} \cdot corr_{h,0} + m_{h,1} \cdot corr_{h,1}},$$

with $m_{h,1}$ and $m_{h,0}$ being the number of innovators and non-innovators in the response sample in stratum h.

Bounded weights are calculated based on auxiliary information about either turnover (*wt*) or the number of employees (*we*) in the population in stratum h. More precisely, a bounded weight is calculated by multiplying the simple weight in stratum h with the inverse of a correction term (*factor*) for each stratum h. The correction factor is the ratio of the weighted sum of turnover (weighted sum of number of employees) derived from using the simple weights to the sum of turnover (sum of number of employees) in the population. For instance, the bounded weight based on turnover (*wt*) in stratum h is defined as:

$$wt_h = w_h \cdot \frac{1}{factor_h},$$

which implies

$$wt_h = \frac{N_h}{m_h} \cdot \frac{1}{\frac{\frac{N_h}{m_h} \sum_{i=1}^{m_h} x_{hi}}{\sum_{i=1}^{N_h} X_{hi}}} = \frac{N_h}{m_h} \cdot \frac{1}{\frac{\frac{N_h}{m_h} \sum_{i=1}^{m_h} x_{hi}}{X_h}} = \frac{N_h}{m_h} \cdot \frac{1}{\frac{N_h}{m_h} \sum_{i=1}^{m_h} x_{hi}} \cdot X_h = \frac{1}{\sum_{i=1}^{m_h} x_{hi}} \cdot X_h$$

with X_h being the sum of turnover of firms in stratum h in the population and x_{hi} denoting turnover of responding firm i in stratum h. It follows that

$$\hat{Y} = \sum_{h=1}^{H} \left(wt_h \cdot \sum_{i=1}^{m_h} y_{hi} \right) = \sum_{h=1}^{H} \left(\frac{1}{\sum_{i=1}^{m_h} x_{hi}} \cdot X_h \cdot \sum_{i=1}^{m_h} y_{hi} \right) = \sum_{h=1}^{H} \left(\frac{\sum_{i=1}^{m_h} y_{hi}}{\sum_{i=1}^{m_h} x_{hi}} \cdot X_h \right).$$

Taking non-response correction terms into account, bounded weights *wt* for innovators *(k=1)* and non-innovators *(k=0)* in stratum h can be calculated as

$$wt_{h,k} = \frac{1}{\pi_h} \cdot \frac{1}{\tau_h} \cdot corr_{h,k} \cdot \frac{1}{\frac{\sum_{k=1,0} \left[\sum_{i=1}^{m_{h,k}} \left(\frac{1}{\pi_n} \cdot \frac{1}{\tau_h} \cdot korr_{h,k} \cdot x_{ih} \right) \right]}{X_h}} = \frac{corr_{h,k}}{corr_{h,0} \cdot \sum_{i=1}^{m_{h,0}} x_{ih} + corr_{h,1} \cdot \sum_{i=1}^{m_{h,1}} x_{ih}} \cdot X_h$$

and thus an estimate of variable Y in the population is given by

$$\hat{Y} = \sum_{h=1}^{H}\left[\sum_{k=1,0}\left(wt_{h,k}\cdot\sum_{i=1}^{m_{h,k}} y_{ih}\right)\right] = \sum_{h=1}^{H}\left[wt_{h,0}\cdot\sum_{i=1}^{m_{h,0}} y_{ih} + wt_{h,1}\cdot\sum_{i=1}^{m_{h,1}} y_{ih}\right]$$

$$= \sum_{h=1}^{H}\left[\sum_{k=1,0}\left(\frac{corr_{h,k}}{corr_{h,0}\cdot\sum_{i=1}^{m_{h,0}} x_{ih} + corr_{h,1}\cdot\sum_{i=1}^{m_{h,1}} x_{ih}}\cdot\sum_{i=1}^{m_{h,k}} y_{ih}\right)\cdot X_h\right].$$

3 Introduction of Innovations and Innovation Activities

The Mannheim Innovation Panel covers both technical and non-technical innovations. While technical innovations refer to the introduction of new products or new processes, non-technical innovations include the introduction of new marketing methods or new ways of organising a firm's internal processes or external relations. While technical innovations have been surveyed from the beginning of the MIP on an annual base using consistent definitions over time, non-technical innovations were measured based on varying definitions and were surveyed infrequently. For this reason, no consistent time series data on non-technical innovations in the German business enterprise sector can be established yet.

This chapter focuses on technological innovations and presents both innovation output indicators and indicators on firms' activities to develop product and process innovations for the past decade (2000-2010). Results on non-technological innovations -marketing and organisational innovations- can be found in chapter 10.

Innovation output indicators depict how many firms were able to introduce innovations within a certain period of time. A standard innovation output indicator is the 'innovator rate' which measures the share of firms that introduced product and/or process innovations within the past three years and which can be broken down by the two types of technological innovations. Against the background that product and process innovations are a main driver of productivity growth, this indicator is important for assessing the extent to which firms follow an innovation-based competitive strategy.

Indicators on innovation activities report the number of firms that engage in certain activities that are intended to lead to product or process innovations, though such activities do not necessarily end up in innovations. Innovation activities may be stopped or abandoned before completion, or firms decide to refrain from introducing newly developed innovations because of lacking customer response, an earlier introduction of innovations by competitors or an unforeseen technological change that outdates the firm's innovation. One important activity indicator is the share of firms that conduct research and development (R&D). Since R&D is an activity that produces new technological knowledge, R&D performing firms can be expected to generate a technological advantage and accelerate technical progress in an economy.

Both innovation output and activity indicators use a three-year reference period, following the recommendations of the Oslo Manual and the harmonised CIS questionnaire. The choice of a three-year reference period is motivated by different facts. First, the time to develop innovations often exceeds one calendar year (see chapter 3 for more details), and different innovation activities may be conducted at different times between the start and the end of an innovation project. In order to capture all the different activities firms engage in for developing and introducing innovations, a multiannual period is needed, particularly for firms with only one or a few ongoing innovation projects. Secondly, firms may pursue innovation activities and introduce innovations only occasionally despite following an innovation-based competitive strategy. Disruptive innovation behaviour is likely to occur in sectors with long product life cycles or long technology cycles and for firms with only one or a few products. Under such circumstances, firms will only introduce new products or processes if the existing products and processes are outdated. A multiannual reference period can help to identify this group of firms as innovators and to get more accurate information on the share of firms that compete in markets based on innovations. Thirdly, measuring benefits of innovations requires a longer reference period since economic effects of innovations such as sales of new products or cost savings from new processes are likely to reach their full impact not in the year of introduction, but some time later.

Applying a multiannual reference period also has some drawbacks for measuring and interpreting innovation activities and output of firms. It complicates analyses on the persistence of innovation (see Peters, 2009) and on business cycle effects on innovation (see Heger, 2004).

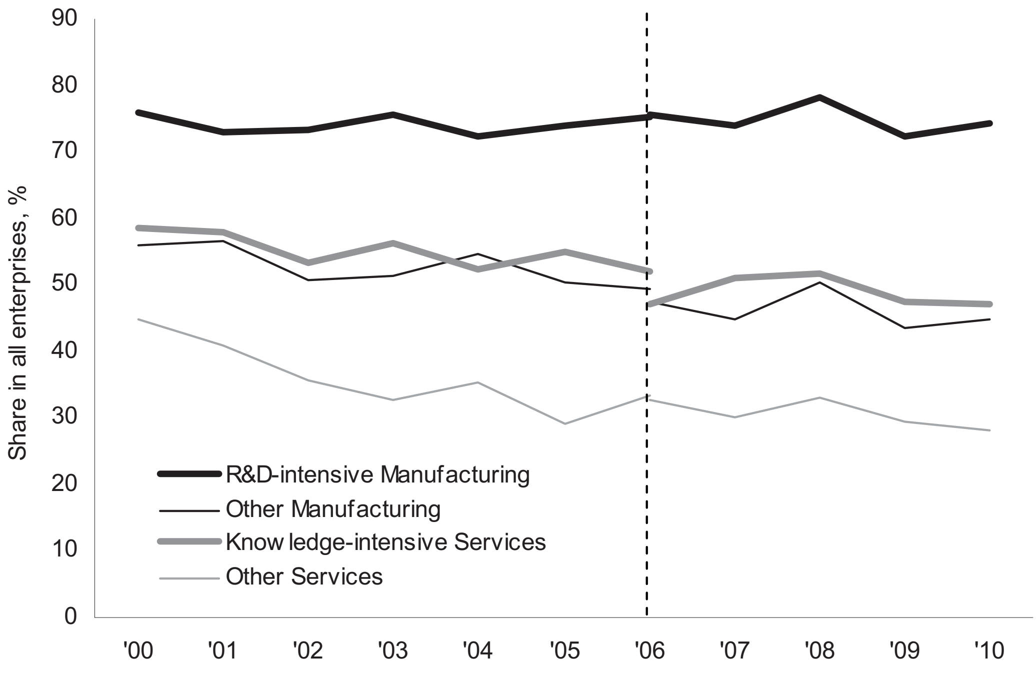
3.1 Innovator Rate

The decade from 2000 until 2010 is characterised by a downward trend in the share of German firms implementing product or process innovations within the previous three-year period (innovators, see box “Innovators/Innovations”) for the majority of sector groups included in the innovation survey (see box “Sector groupings”). Although there is a robust share of innovators in R&D-intensive manufacturing, which fluctuates between 70 per cent and 80 per cent, the share of innovators in other manufacturing declined in the same period, dropping from 56 per cent in 2000 to 45 per cent in 2010. Also, the proportion of innovators in service sectors declined. While it dropped by 11 percentage points in knowledge-intensive services, other service sectors experienced a more pronounced downswing. The share of innovators fell from about 45 per cent in 2000 to only 28 per cent in 2010 (Figure 1).

Especially interesting for this report is the 5-year period from 2006 to 2010. While the total share of innovators was about 46 per cent in 2006, it dropped slightly to 43.6 per cent in 2007 before mounting up to the highest value in this period of 47.2 per cent in 2008. One reason for this upswing may relate to the fact that firm profits significantly increased in 2006 and 2007, accompanied by a dynamic development of international markets that led to favourable conditions for both product and process innovation projects. The years 2009 and 2010 show the impact of the financial crisis, which lead to a drop in the total share of innovators to 42.4 per cent in 2009 and further down to 42.1 per cent in 2010.

Innovators / Innovations
Innovators are firms that introduced at least one innovation in the previous three-year period (i.e. in the case of 2010, a firm introduced at least one innovation between 2008 and 2010). Whether or not another firm has already implemented the same innovation is not considered; the assessment of the innovation from the perspective of the firm in question is the essential point.
Product innovations are new or significantly improved products and/or services which are brought onto the market by a firm. Process innovations are new or have significantly improved production, delivery or distribution methods, including methods to provide services, which are introduced by a firm.
Innovative firms are firms that engage in any kind of innovation activities in the observed year, i.e. that allocate funds to innovation projects, regardless of whether the projects have been completed. The definitions correspond to those of Eurostat and the OECD, which are established in the Oslo Manual.

Figure 1. **Share of innovators 2000-2010, by main sector**



Note that values for each year refer to the preceding three-year period (i.e. `00 refers to 1998-2000, etc.).

When looking at the sector groups, we only find notable deviations from the general pattern for this period in the knowledge-intensive services and in the manufacturing sectors. The knowledge-intensive services display an increase in the share of innovators from 47 per cent to 51 per cent from 2006 to 2007. In the R&D-intensive as well as in the other manufacturing sectors the share of innovators slightly increased from 2009 to 2010. This observation indicates that manufacturing firms tend to shift the introduction of innovations– in particular the introduction of newly developed products – to a period of economic upswing.

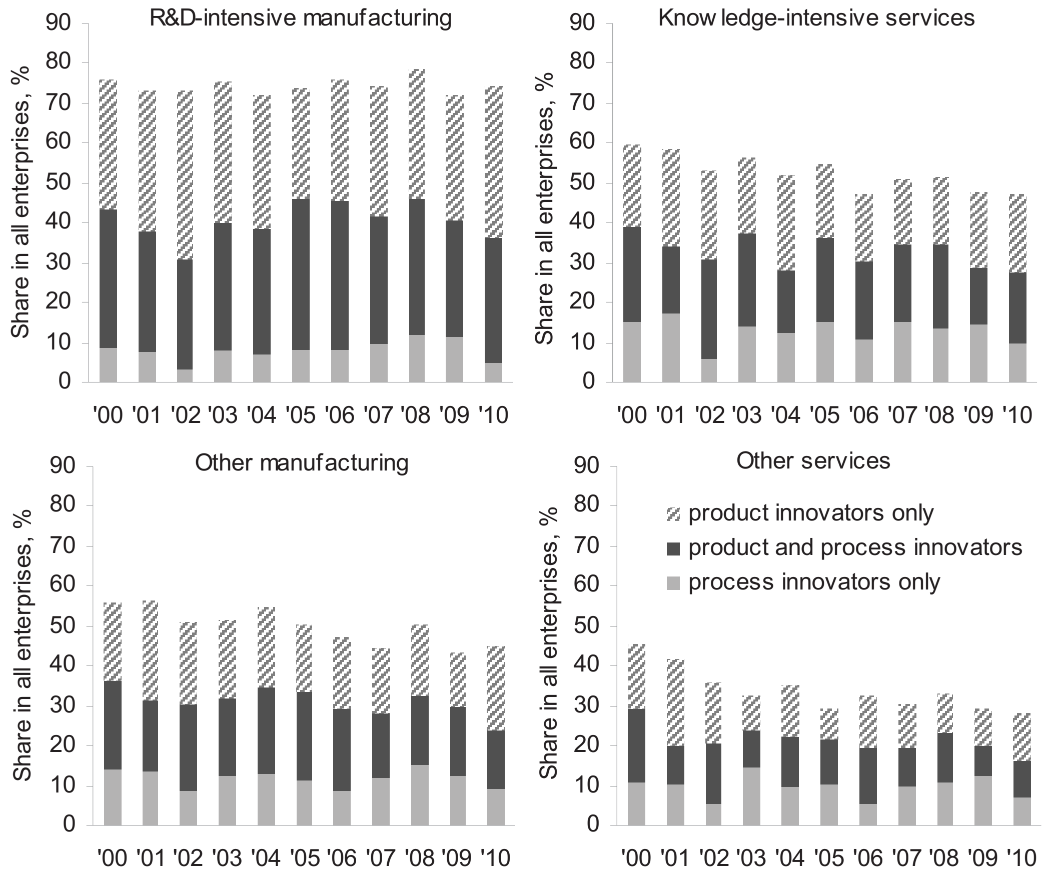
3.2 Product and Process Innovations

Innovation activities can be intended to introduce either products that are new to the firm or new processes for production, service provision or distribution. Many of the innovators – in the manufacturing industries more than in services – implemented both product and process innovations (Figure 2).

Across all sector groups there are frequent changes in the composition of innovators, i.e. whether firms introduce merely product or process innovations or both. These changes are very pronounced in R&D-intensive manufacturing. Here, it is notable that the share of innovators who introduce a mere process innovation generally does not exceed 10 per cent but in 2008 and 2009 the numbers increase to about 12 per cent and 11 per cent respectively, followed by a sharp drop to 5 per cent in 2010. Such a drop in the share of mere process innovators – even though not as sharp – is also observable in 2002. Note that in both years 2002 and 2010, the share of mere product innovating firms increased considerably compared to the previous year, which is why the overall innovator rate does not decline. In 2002 about 42 per cent of the firms introduced only product innovations in the preceding three years compared to 35 per cent in 2001. In 2010 about 38 per cent of the firms indicate being mere product innovators compared to 32 per cent in 2009. Many firms introduce both product and process innovations. This is especially apparent in the year 2000 and the period from 2005-2008 when these firms account for the largest share of innovators.

Compared to R&D-intensive manufacturers, other manufacturing sectors exhibit a generally higher share of innovators introducing merely process innovations. Their share is typically larger than 10 per cent with the exceptions of 2002, 2006 and 2010 however, in which it is about 9 per cent. But unlike the R&D-intensive manufacturing industries, the drop in the share of mere process innovators is not compensated by an increase in the share of product innovators. That implies a decline in the overall innovator rate compared to the previous year. 2010 is an exception, as the share of mere product innovators increases to 21 per cent from 14 per cent in 2009. In addition the overall innovator rate also rises. The highest proportion of innovators in this sector group is usually represented by firms which introduce both process and product innovations in the previous three-year period. Their share accounts for about 17 to 22 per cent of all firms with the exceptions of the years 2007 (16 per cent) and 2010 (14 per cent), in which they are exceeded by the share of mere product innovators. Also, in 2001 the share of mere product innovators (25 per cent) exceeds the share of combined innovators (18 per cent).

Figure 2. Share of product and process innovators 2000-2010, by main sector



Note that values for each year refer to the preceding three-year period (i.e. `00 refers to 1998-2000, etc.).

Considering service firms, the composition of innovators is more volatile. This is due to larger fluctuations in the combined share of mere product innovators and innovators which introduced both a new product and a new process within the previous three years. In the knowledge-intensive services there is a relatively stable share of mere process innovators, fluctuating from 13 per cent to 17 per cent. As in the manufacturing sector groups, the years 2002 (6 per cent), 2006 (11 per cent) and 2010 (10 per cent) exhibit significantly lower values, however. In these periods we also observe a decline in the overall innovator rate. Although the share of firms introducing both product and process innovations in the previous three-year period increases considerably in 2002 and 2010 and the proportion of mere product innovators remains nearly constant compared to the previous year, the strong decline in the share of mere process innovators is not compensated. Innovators which introduce both new products and new processes typically account for the largest share of the innovators in knowledge-intensive services, i.e. their share fluctuates between about 14 and 25 per cent. Exceptions can be found in the years 2001, 2004, 2009 and 2010, in which the majority of the innovators are mere product innovators (2001: 24 per cent, 2004: 24 per cent, 2009: 19 per cent, and 2010: 20 per cent).

The other service sectors display the lowest overall share of innovators of all sector groups considered, fluctuating around 30 per cent since 2005. The innovator composition follows the pattern shown by knowledge-intensive services, i.e. a relatively stable share of mere process innovators (about 10 per cent) with exceptionally low values in 2002 (6 per cent), 2006 (5 per cent) and 2010 (7 per cent) combined with more volatile shares of firms introducing merely new products or both new products and processes. The largest proportions of mere product innovators are observed in the three-year period from 2000 to 2002 with values of 16 per cent, 21 per cent and 15 per cent. In the years afterwards, the share falls significantly from around 13 per cent in 2006, to 10 per cent in the period from 2007 to 2009 and 12 per cent in 2010. The share of combined product and process innovators develops similarly. High values in the beginning of the decade (19 per cent in 2000, 15 per cent in 2002) are followed by lower values towards the end of the decade. The period from 2006 on is highly unsteady. In 2006 the share of combined product and process innovators is 14 per cent, drops to 10 per cent in 2007, increases to 13 per cent in 2008, falls to 8 per cent in 2009 and slightly rises to per cent in 2010.

Throughout the decade the indicators show that across all sector groups the proportion of mere product innovators on average largely equals the proportion of product and process innovators. Hence, the magnitude of the combined proportion is differing from about two thirds of the firms in R&D-intensive manufacturing and nearly 40 per cent in other manufacturing and knowledge-intensive services to a quarter in the other services. The minority of firms concentrates on the introduction of mere process innovations. In R&D-intensive manufacturing share averages 8 per cent, while it is higher in the other sectors, being 12 per cent in the other manufacturing, 13 per cent in the knowledge-intensive services and 10 per cent in the other services.

Regardless of their sector affiliation, one can observe that firms reacted differently to the periods of economic downturn in 2002/2003 and 2008/2009. The different reaction may be due to the fact that the recent crisis hit almost everywhere in the world at the same time, while this was not the case for the crisis in the beginning of the decade.

In 2002 and 2003 the real growth of the GDP was positive for the EU25, the US and Japan, while it was about zero and negative respectively for Germany. The decreasing national demand could hence be compensated with international demand. Nevertheless, the overall share of innovators fell in 2002 in all sector groups with the exception of the R&D-intensive industries, mostly due to a drop in the share of mere process innovators. The combined share of mere product innovators and innovators which introduced product as well as process innovations increased (R&D-intensive manufacturing, knowledge-intensive services) or remained largely constant (other manufacturing, other services). In 2003 the overall innovator rate increased again with the exception of the other services. This increase was again largely due to a strong increase in the share of mere process innovators. Therefore, during the downturn in 2002/2003 German firms chose to delay introducing innovations and if they decided to introduce then it was rather a product than a process innovation.

In the recent economic downturn, the real GDP growth was negative in 2008 for the US and Japan while it was almost zero for the EU25, but still positive (+1.1 per cent) for Germany. In 2009, all of these nations recorded a negative real GDP growth. The share of mere process innovators increased in 2008 for most sector groups during which the overall innovator rates increased as well. In 2009 the share of mere process innovators increased again in the service sectors, while it fell slightly for manufacturers. The overall innovator rate also decreased. In the service sectors this was due to a drop in the proportion of firms, which introduced both product and process innovations. The innovator rate also dropped in the R&D-intensive manufacturing sector while it remains constant for the other manufacturing industries. Here the share of mere product innovators dropped significantly. Thus in the recent crisis, German firms did not delay the introduction of innovations and focussed on the introduction of process innovations to stay competitive.

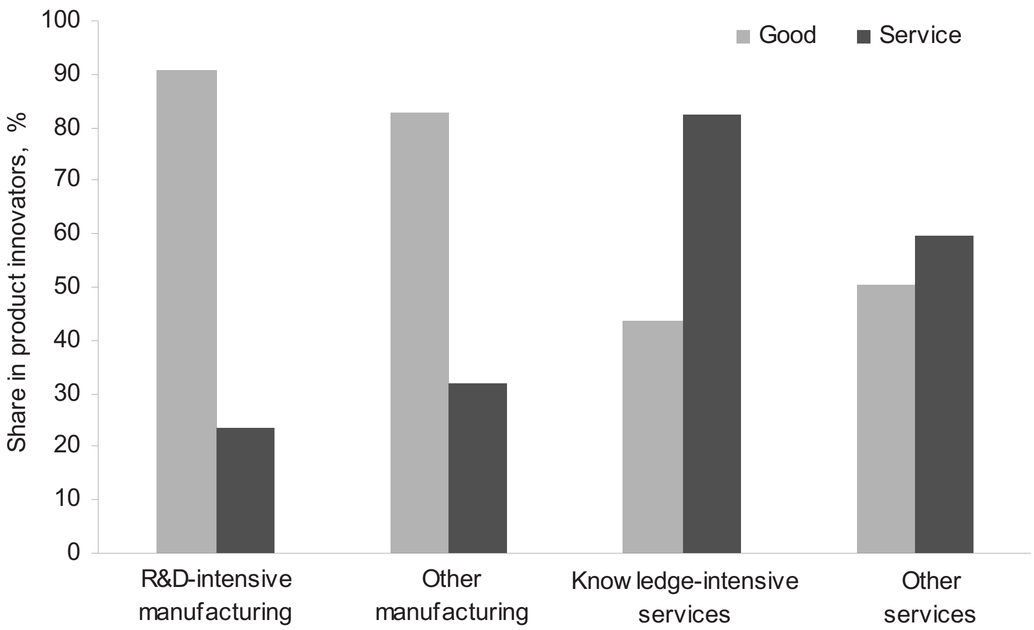
3.3 Type of Product Innovations

The German innovation survey 2009 includes an additional question on the type of product innovation, i.e. whether the new product is a good or a service (Figure 3). The product innovators from the manufacturing sectors introduce considerably more new goods than services while the reverse is true for the service sectors. In the R&D-intensive manufacturing sector group 91 per cent of the product innovators introduce a new good while 24 per cent of the innovators indicate they have introduced a new service. Other manufacturers record a share of product innovators introducing a new good of 83 per cent while 32 per cent introduce a new service.

A similar but inverse pattern is observed for the service sectors. In the knowledge-intensive service sectors there are 82 per cent of the innovators introducing a new service compared to 44 per cent who have introduced a new good. In the other services that share is 51 per cent, i.e. more than half of the product innovators indicate the introduction of a new good while 60 per cent of the innovating firms introduce a new service.

The result of the other service sectors is mainly driven by the wholesale sector where the share of product innovators that introduced a new good is as high as in R&D-intensive manufacturing with 91 per cent. A typical example for a product innovation in that sector is the preparation of bundles including different sorts of a certain raw material, e.g. coal, which match customer needs better than bundles consisting of a single sort. Therefore this finding highlights that in service sectors, product innovations are often linked to tangible products.

Figure 3. Product innovators by type of product innovation 2006-2008, by main sector

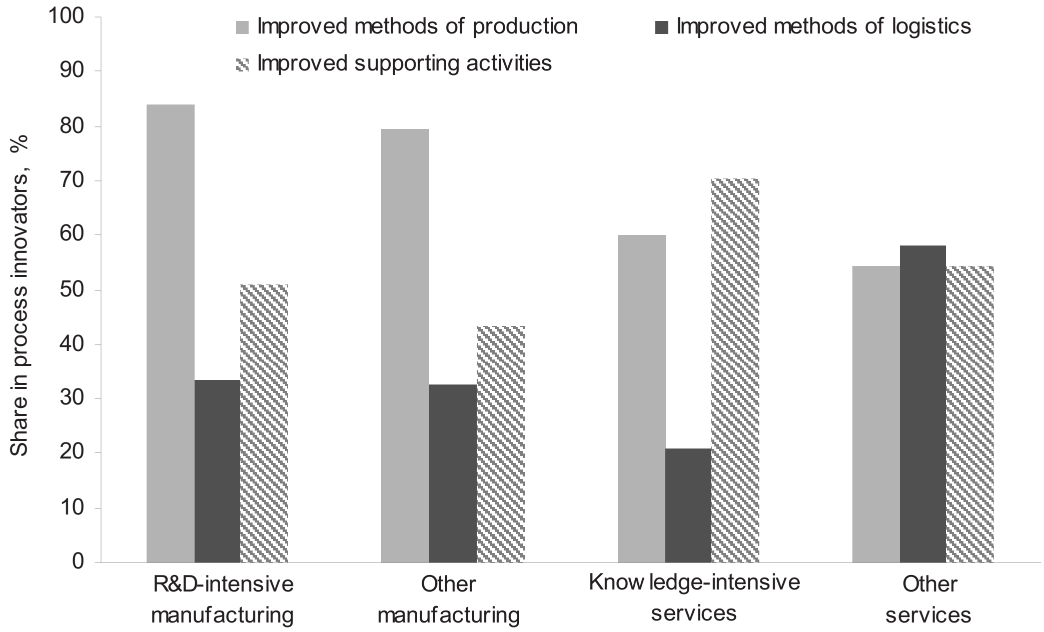


3.4 Type of Process Innovations

Besides the question on the nature of the product innovation, the German innovation survey 2009 also includes a question on the type of process innovation. Here firms were asked to specify whether a newly introduced process in the years 2006 to 2008 improved methods of production, of logistics or distribution or supporting activities, e.g. maintenance, accounting or IT support. We observe that for both the R&D-intensive as well as the other manufacturing sectors there is a similar pattern in the types of process innovations (Figure 4). The vast majority of innovative manufacturing firms undertake process innovations in order to improve production processes (84 per cent of the process innovators in R&D-intensive manufacturing and 80 per cent in other manufacturing) while a significantly lower share of process innovators introduce improved supporting activities (51 per cent of the process innovators in R&D-intensive manufacturing compared to 43 per cent in other manufacturing). About a third of the process innovators in both manufacturing sector groups indicate the improvement of their logistics and distribution methods (34 per cent in R&D-intensive and 33 per cent in other manufacturing).

In contrast to the manufacturing sectors, there are clear differences in the types of process innovations undertaken by knowledge-intensive service firms and other service firms. Although the different types of process innovations are almost equally important for process innovators in other service firms, the process innovators in knowledge-intensive services concentrate on improving supportive activities (70 per cent) and production methods (60 per cent). 21 per cent of the process innovators in this sector improve logistics and distribution methods.

Figure 4. Process innovators by type of process innovation 2006-2008, by main sector



3.5 Type of Innovation Activity

In the year 2009 the German Innovation survey included a question on the different kinds of innovation activities the firms may engage in during the time period from 2006 to 2008. The various activities to develop and introduce new products and processes can be grouped as follows:

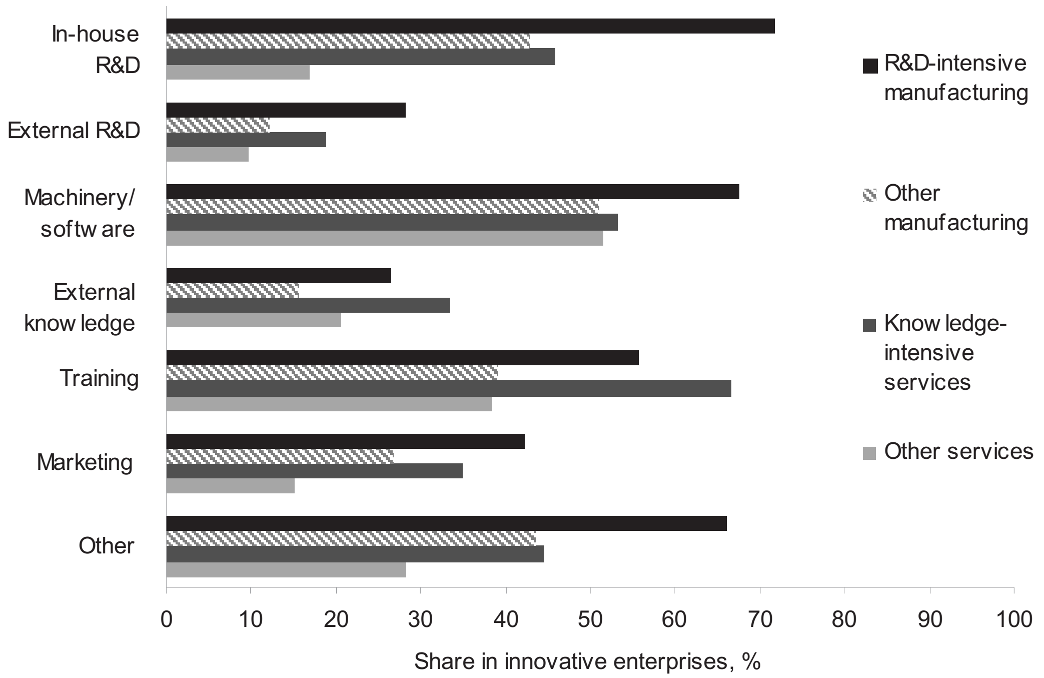
- Research and development (R&D) is generally carried out at the start of an innovation project. R&D comprises systematic creative work to expand existing knowledge as well as the utilization of the attained knowledge for the development of new products and processes. R&D activities can be carried out in-house or externally (contract R&D). R&D expenditure can include outlay for personnel and material but also investments into buildings, machinery, equipment and software if necessary for conducting R&D.
- The acquisition and implementation of machinery, equipment, tangible assets and software in order to realise innovation projects can occur for both process and product innovations and generally constitutes the major part of investments related to innovation projects. While investments for product innovations may include the installation of production facilities for new products or equipment for providing new services, process innovation investments entail the implementation of new production methods, new logistic methods or IT support.

- The acquisition of external knowledge, for instance patents, unpatented inventions, trademarks and other intellectual property rights, is an investment in intangible assets. Mostly, these investments enable the integration of externally developed technologies into own innovation projects.
- Internal or external training for personnel covers training and qualification activities which are specific for the development or the introduction of new or improved products and processes. This can include e.g. training for new production technologies or training of sales staff with regard to new product characteristics.
- Activities for market introduction comprise internal or external activities aiming at the positioning of new or improved products in a market. Such activities may include market research, advertisement for the launch of new products and road shows for customers or retailer. These activities are often connected to new products but they may relate to process innovations as well, for instance if an enhanced product quality requires additional marketing activities.
- Other activities comprise all actions that are carried out in order to implement new or improved products and processes but cannot be grouped into one of the above mentioned categories. That includes e.g. design, feasibility studies, testing, routine software development, tooling up or industrial engineering.

We observe a considerable amount of heterogeneity between the four main sector groups regarding the different innovation activities (Figure 5). The most frequent type of innovation activity across all sector groups is the category of the other innovation activities. That includes very different activities such as the conduction of feasibility studies, testing, routine software development, tooling up or industrial engineering. This is an indication that enterprises are engaged in a variety of innovation activities which are not classified under one of the other categories but at the same time are important and necessary in order to introduce new products or processes. The high share of small enterprises applying this kind of innovation activity hints that most of these activities do not require a lot of financial resources, are easy to implement and have an immediate impact (Figure 6). Having said this, other innovation activities are also important for larger firms since they very often have a higher number of ongoing innovation projects on average which are supported by innovation activities falling into this category. Thus, it does not come as a surprise that this category is the most frequent choice across all sector groups and all firm sizes.

Among the R&D-intensive manufacturers a large share of firms is engaged in internal R&D (72 per cent) which is the most frequent type of innovation activity in this sector grouping. More than half of the innovating firms in this sector also engage in the acquisition of machinery, equipment or software for innovation projects (68 per cent) and in other activities such as design and preparatory work (66 per cent). In general, this sector is characterised by a high participation rate of firms in the different kinds of innovation activities. When compared to the other sectors, the R&D-intensive manufacturers provide the highest share of innovating firms in each innovation activity category, except training for innovative activities and the acquisition of external knowledge. For these two activities, firms from knowledge-intensive services report a higher share.

Figure 5. Type of innovation activities 2006-2008, by main sector



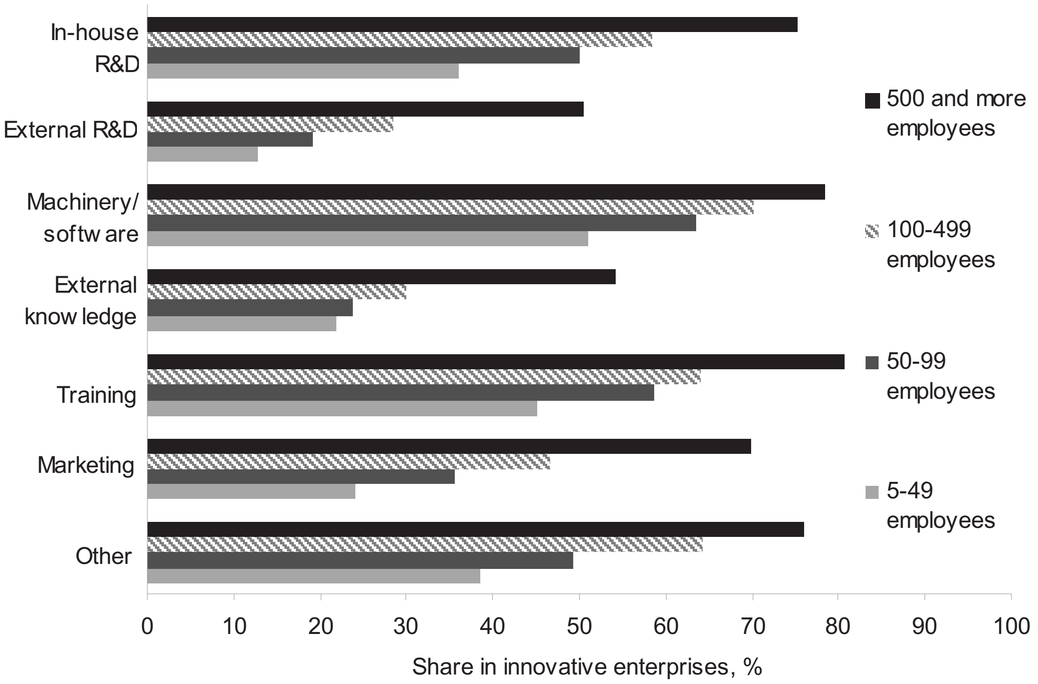
One reason for the high shares of R&D-intensive manufacturing may be found in the higher number of innovation projects per firm in this sector, making it more likely that a firm reports different activities (see chapter 3). In addition, innovation projects often have to meet high technological demands and are thus more radical, i.e. a newly developed process or product is a novelty to the market. However, it is surprising that innovators engage relatively little in training for innovation activities. One reason may be the relatively high level of education among the staff. Another reason is that in service industries the product depends more on the personnel than in manufacturing industries. In fact services often involve both consumer and supplier. Hence it is crucial for firms introducing new or significantly improved services to properly educate and train their employees who eventually provide the service to customers. The difference in training engagement between R&D-intensive manufacturers and knowledge-intensive service firms may also be explained with a more frequent on-the-job-adaption of the employee's skills to the demands of innovation projects.

The most frequent innovation activity of other manufacturers after the "other" category is the acquisition of machinery, equipment and software with 51 per cent of the innovating firms engaging in this activity. This is due to the high importance of process innovations in this sector group in combination with the application of relatively capital intensive production methods. Therefore both product and process innovations often require an adaption of the production processes and thus the acquisition of new machinery or equipment. The use of external partners – may it be to contract external R&D or to acquire knowledge – is not very pronounced in this sector with shares of 12 per cent for the engagement in external R&D and 16 per cent for the engagement in the acquisition of external knowledge.

For the latter activity, the share of innovators engaged in this activity is the lowest across all sectors. This indicates that other manufacturers generally prefer to conduct their innovation projects independently from other partners.

In knowledge-intensive services, the most widespread innovation activities are training measures for innovation projects which are conducted by more than two thirds of the innovating firms (67 per cent). 51 per cent of the knowledge-intensive service innovators engage in the acquisition of machinery, equipment and software. The share of firms applying training for innovation projects in this sector group is the highest across all sector groups. This highlights the decisive role of human capital in this sector group as the personnel is very often directly involved in the provision of a service.

Figure 6. Type of innovation activities 2006-2008, by size class



In contrast to the high significance in the knowledge-intensive services sectors, training measures for innovation projects do not seem to have a high importance in other service firms. Merely 38 per cent of the innovating firms in this sector are engaged in this activity, the lowest share across all sector groups. A general pattern emerges across the different kinds of innovation activities, with innovators in this sector recording the lowest shares across all sector groups. The acquisition of machinery, equipment and software with 51 per cent of the innovators engaged in this activity is relatively important. This can be explained by the fact that both process as well as product innovations in this sector group are often linked to process technologies, e.g. ICT or transportation and logistics systems. Of course, such systems need to be developed and adjusted to meet the individual demands of the innovating firm. Hence it is not surprising that the acquisition of external knowledge plays a more pronounced role than in the other sector groups because the introduction or the change of ICT or logistics systems often needs a certain amount of customization.

Considering the size of the enterprises we observe a strictly increasing relationship between the size of firms and the share of firms applying the respective activity (Figure 6). That is, the larger the innovating firm the more likely it is that the respective innovation activity is applied. This observation is straight forward since larger enterprises have a bigger portfolio of innovation projects which makes it more likely that more different kinds of activities are involved. In contrast small firms have few resources at their disposal which forces them to focus on particular activities.

3.6 Research and Development Activities

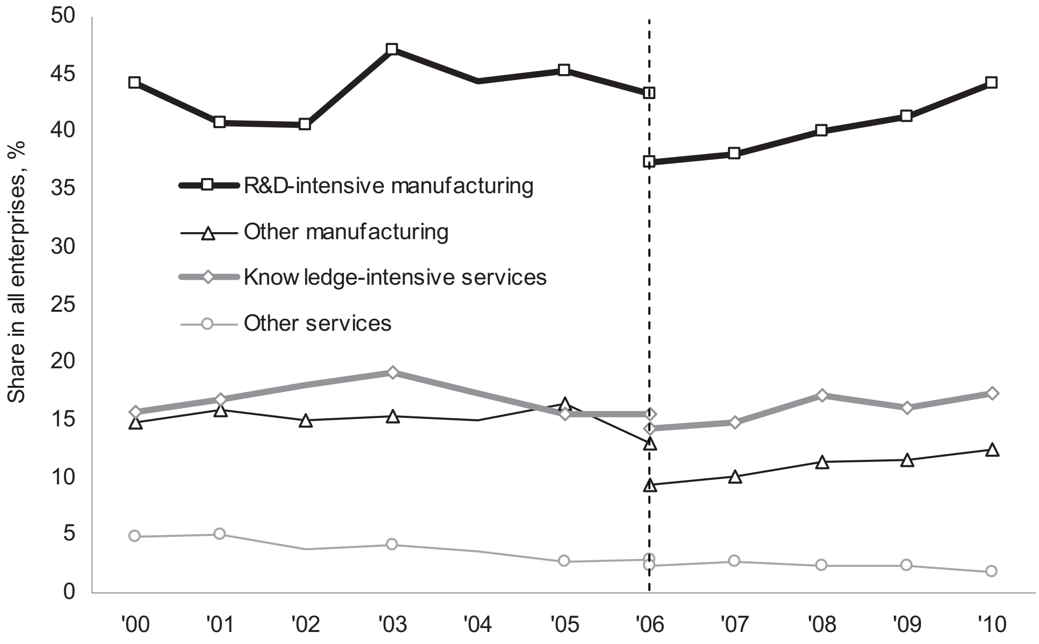
The engagement in R&D is usually carried out at the beginning of an innovation project and is often a precondition to innovate (see also box “R&D activities). With the exception of the other service sector, the share of firms researching and developing on a continuous base is growing steadily throughout the last 5 years (Figure 7). This development results in 2010 in the highest share of firms carrying out permanent R&D with about 34,000 active enterprises. That refers to about 12.6 per cent of the enterprise population.

With 44 per cent in 2010, we constantly observe the highest share of firms across the sector groups continuously doing R&D as to be active in R&D-intensive manufacturing. The share of other manufacturers which continuously engages in R&D is considerably lower with 12 per cent in 2010. The service sectors exhibit a similar pattern. Here the share of firms permanently doing R&D is 17 per cent in knowledge-intensive services in 2010, while in the other service sectors the share is quite stable at around 2 per cent since 2006.

R&D activities
Research and development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, and the use of this stock of knowledge to devise new applications, such as new or markedly improved products and services or processes and methods (including software development). This definition corresponds to that which is presented in the Oslo Manual and thereby also complies with the OECD's Frascati Manual on surveying research and experimental development. Continuous R&D refers to internal R&D activities which are carried out permanently. That is, the enterprise maintains an organisational unit or employs personnel, which is explicitly dedicated to R&D. In contrast enterprises with occasional R&D engage in non-permanent R&D activities.

Note that the share of firms continuously carrying out R&D activities is increasing with firm size (see also section 1.3). Most of the large enterprises are engaged in R&D on a permanent base. Hence the share of employees who work for enterprises researching continuously is relatively high, being 44 per cent in 2010. In the same year the share of employees working for continuously researching and developing firms in R&D-intensive manufacturing is about 83 per cent while it is 19 per cent for other service sector firms.

Figure 7. Firms with continuous in-house R&D activities 2000-2010, by main sector



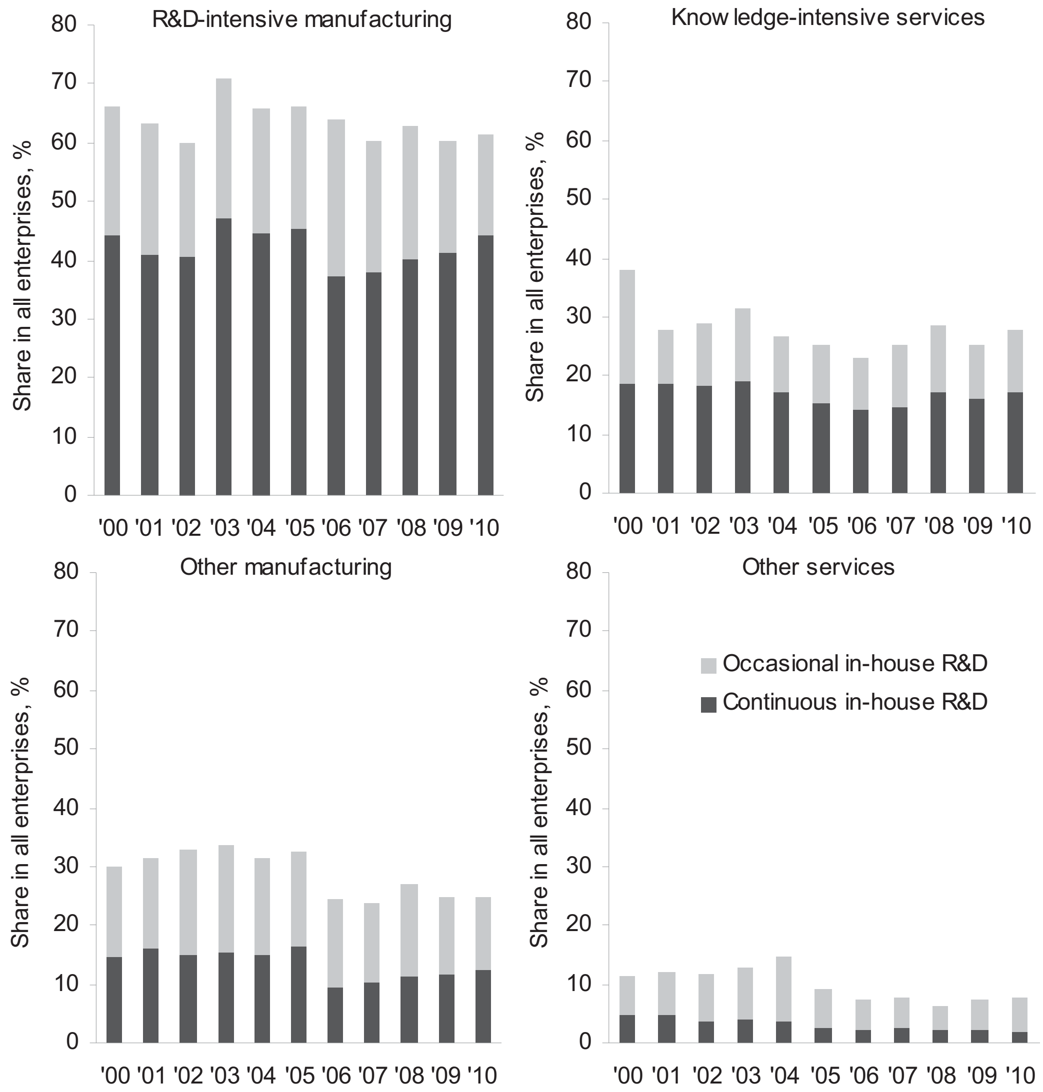
Note that values for each year refer to the preceding three-year period (i.e. `00 refers to 1998-2000, etc.)

In addition to the continuously researching firms, there is a considerable amount of enterprises which carries out R&D on an occasional basis (Figure 8). In 2010, their overall share is 10 per cent, nearly the average share of firms from 2006 to 2010 occasionally performing R&D. In R&D-intensive manufacturing about 17 per cent of the firms in 2010 conducted R&D occasionally, while in the same year the share of firms doing R&D on occasion is 12 per cent in the other manufacturing sector, 10 per cent in the knowledge-intensive services and 6 per cent in the other services.

Apart from the R&D-intensive manufacturers and the other services, the sector groups display an overall share of firms conducting R&D fluctuating between 20 and 40 per cent. In the other manufacturing as well as in the other services, the share of occasional R&D performers is frequently exceeding those of the continuous R&D performers. Such differences in R&D participation are a good indication about how important R&D is as a dimension of competition. To highlight this further, note that in 2010, in the manufacturing of chemicals and pharmaceuticals almost 75 per cent of the firms conducted R&D with 62 per cent doing it continuously. In the manufacturing of electronics around two thirds of the firms conducted R&D with 48 per cent doing it permanently. A high participation in

R&D activities is also observable in the manufacturing of machinery, in IT and telecommunication services and in the manufacturing of vehicles. In contrast, in the transportation and postal services as well as the producer services and wholesale sector the R&D participation of the firms is below 10 per cent in 2010.

Figure 8. Continuous and occasional in-house R&D activity 2000-2010, by main sector



Note that values for each year refer to the preceding three-year period (i.e. `00 refers to 1998-2000, etc.)

Note that different from the innovation output indicators of product and / or process innovators, the share of R&D performers remains largely constant even in times of economic downturn. This is due to the fact that there are high entry costs attached to R&D and in particular to the technical equipment. Additionally, R&D costs are fixed to a large extent, with salaries and material costs being its major components. As the returns of an R&D project are generated in the future, the firms have to make sure that R&D costs are financed in advance and bearable regardless of the economic situation. Eventually the project may result in a competitive advantage because of lower costs or a new or significantly improved product if completed successfully. Hence the majority of firms performing R&D continue to do so, even in case of economic downturns.

4 Expenditure for Innovation

Innovation expenditure includes all expenses of both in-house and externally purchased activities that aim at the development and introduction of innovations, regardless whether these innovations have been introduced yet. They also include expenses for innovation activities that were stopped before completion (see OECD and Eurostat, 2005: 19). In the practice of innovation surveys, expenditure data are surveyed for product and process innovation only, with no attempt so far being made to obtain information on expenditure for organisational or marketing innovations in the context of the CIS or similar surveys outside Europe. The MIP follows this approach and collects data on expenditure for product and process innovation activities only.

Expenditure for innovation comprises current and capital expenditure. Current expenditures cover labour costs and other current costs, including externally purchased goods and services. Capital expenditures for innovations are composed of gross expenditures on machinery, instruments and equipment, land and buildings, computer software and other intangible assets that can be capitalised (e.g. patents, trademarks). Innovation expenditures can relate to the following activities to develop and introduce product or process innovation (see also chapter 2):

- In-house R&D;
- Purchased R&D services (external R&D);
- Acquisition of machinery, equipment, software, building and land;
- Acquisition of intellectual property and other external knowledge such as the purchase or licensing of patents, trademarks or other IP rights;
- Training;
- Marketing and market research;
- Engineering, design, preparatory, conceptual and other activities.

Innovation expenditures are an important indicator to determine the amount of resources that firms provide for carrying out innovation activities. Along with output measures on innovation (see Chapter 4), they can be used to calculate returns on innovation (see Peters, 2008). However, information on innovation expenditures is normally not contained as separate items in a firm's financial accounts. Firms may thus face difficulties in providing an accurate estimate of their total innovation expenditure. The CIS has responded to this situation by confining the question on innovation expenditure on just four items from CIS 4 on: in-house R&D, acquisition of external R&D, acquisition of machinery, equipment and software, and acquisition of external knowledge, particularly of intellectual property.

The MIP deviates from this practice by continuing to collect data on total innovation expenditure. The total is broken down by two dimensions: (a) the type of expenditure, i.e. current and capital expenditure; (b) the content of expenditure, i.e. R&D (both in-house and externally acquired) and non-R&D expenditure. In addition, firms are asked to estimate the likely amount of innovation expenditure for the year during which the survey is conducted (i.e. one year after the reference year of the survey) and the following year. All innovation expenditure data are collected annually, which allows for analysing their development over time.

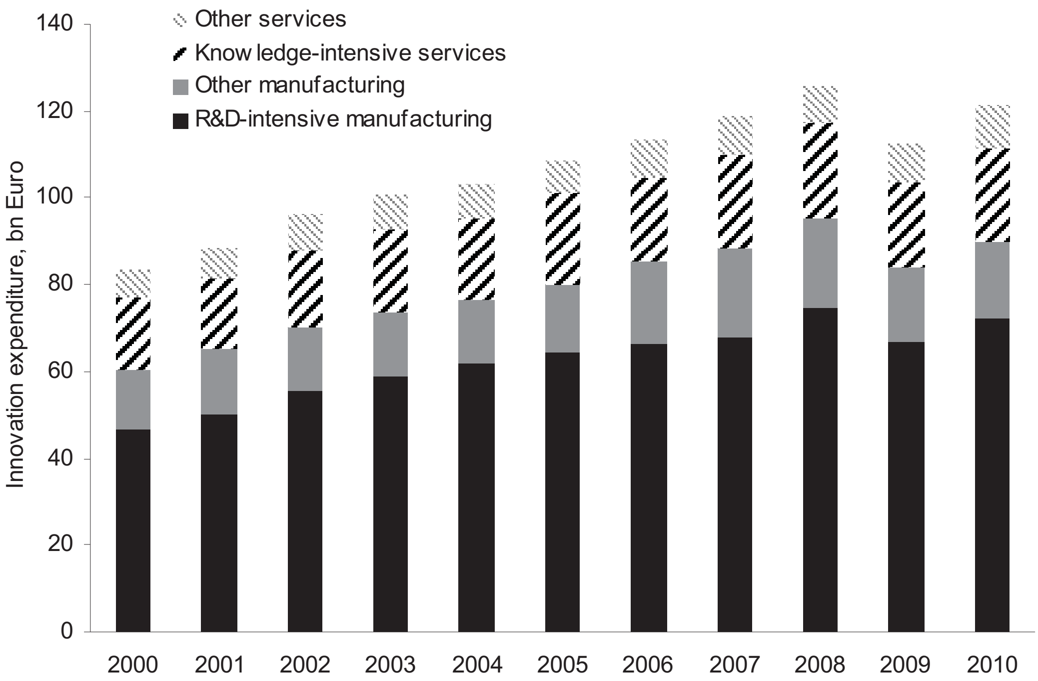
In addition to expenditure data, the MIP started to collect information on the number of innovation projects upon which these expenditures are allocated. In 2009 and 2011, the questionnaire contained a question on the number of newly started, completed, or stopped innovation projects during the previous three year period as well as on the number of ongoing projects at the end of this period. Based on this information, the average size of innovation projects, the relation of completed to abandoned projects, and a rough estimate of the average duration of innovation projects can be calculated.

4.1 Innovation Expenditure 2000-2010

In 2010, enterprises in Germany spent €121.3 billion on innovation. Innovation expenditure increased steadily over the past decade except for 2009. In this year, as a consequence of the sharp crisis experienced by the German economy, innovation expenditure felt by 11 per cent compared to 2008, when spending for product and process innovation reached €125.9 billion. The largest contribution to the economy's total innovation expenditure is made by R&D-intensive manufacturing, including the manufacture of vehicles, machinery, electrical equipment, electronics, instruments, pharmaceuticals, and chemicals. In 2010, this sector spent 59.3 per cent of total innovation expenditure. Knowledge-intensive services - computer programming, telecommunication and information services, architectural and engineering activities, R&D services, financial intermediation, legal and accounting activities, consulting, advertising, publishing, and film and broadcasting - account for 18.0 per cent, other manufacturing (including mining, energy and water supply, and sewage and recycling) for 14.6 per cent, and other services (wholesale, transport and storage, postal and courier services, cleaning, private security, employment services, and other business-oriented services) for 8.1 per cent. Over the past ten years, the sector distribution of innovation expenditure did not change significantly.

The significant growth of innovation expenditure from 2000 to 2010 by 47 per cent - which equals an average annual rate of 3.8 per cent - partly reflects increases in input costs. About two thirds of total innovation expenditure is current costs (see section 4.2), and these mainly comprise personnel expenses for in-house staff and purchased services, which again mainly consist of personnel expenses. Salaries of employees in Germany grew by an annual rate of 2.1 per cent in manufacturing and 2.4 per cent in services over the past decade. One third of innovation expenditure is capital expenditure, mostly for machinery and equipment. Prices for capital goods remained almost stable from 2000 to 2010 with an annual rate of growth of just 0.2 per cent. Using the two price developments to deflate innovation expenditure, the constant rate of growth was 2.1 per cent for 2000 to 2010. In constant Euros, innovation expenditure in 2010 was 27 per cent above the level of the year 2000.

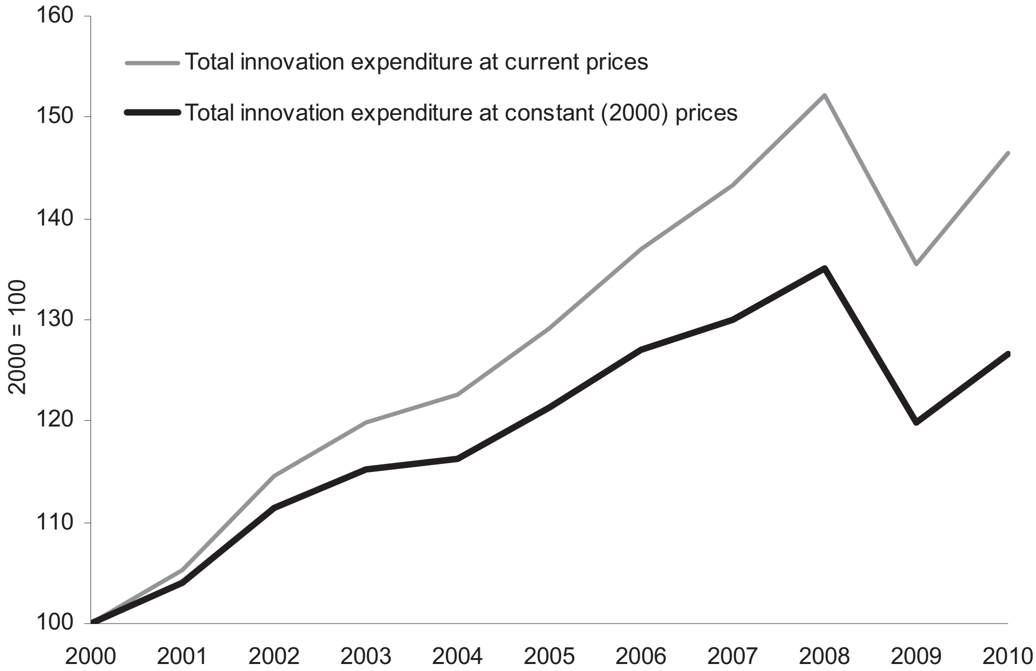
Figure 9. Innovation expenditure 2000-2010, by main sector



Note: 2006 break in series.

Another source for increasing innovation expenditure over time may be the increasing use of external knowledge, technology and services and potential double counting of expenditure for innovation activities that are purchased from others. Since innovation expenditure includes both in-house and purchased activities, expenditure for purchased services may be counted as innovation expenditure not only by the purchasing enterprise, but also by the enterprise producing the purchased activity. For example, when a firm introduces a product innovation and purchases services for market research and launch advertising, these services may be an innovation from the viewpoint of the service provider, if they were newly developed or significantly improved compared to the existing range of services. A similar case can be made for training related to product and process innovation by external service providers, or for purchased R&D, engineering and design activities. In case of acquisition of machinery, equipment, software or other external knowledge, the purchased items may also result from innovation activities at the side of suppliers.

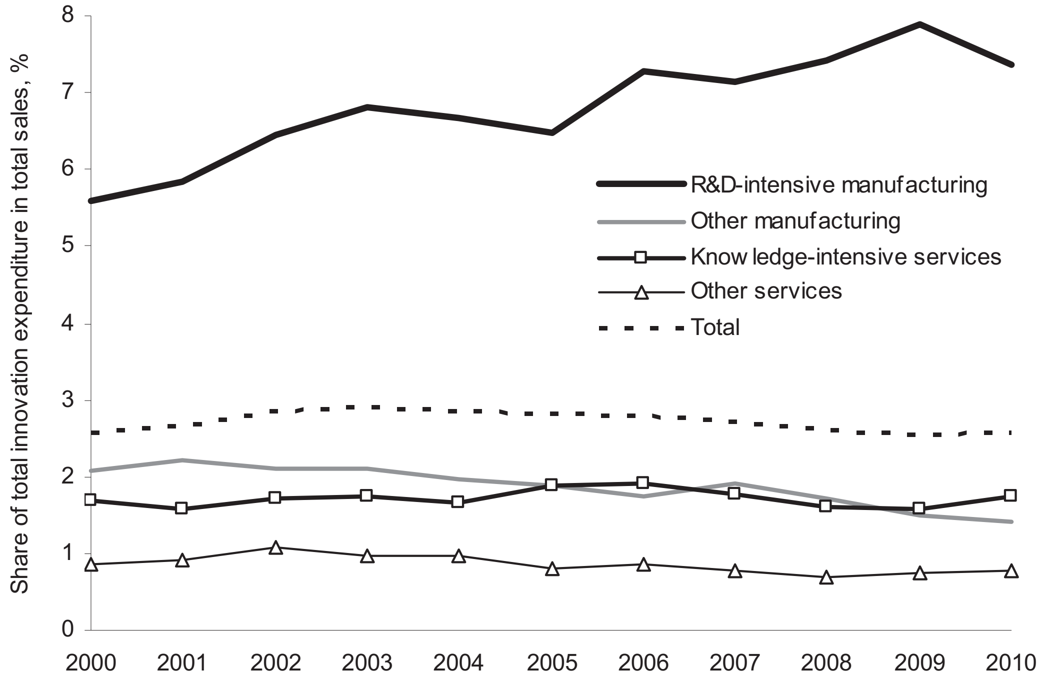
Figure 10. Innovation expenditure 2000-2010 at current and constant prices



Note: 2006 break in series.

Innovation expenditure was equal to 2.6 per cent of the enterprises' total sales in 2010, the same as in 2000. This 'innovation intensity' of the German enterprise sector grew to 2.9 per cent in 2003 and gradually felt back to 2.6 per cent in 2008. R&D-intensive manufacturing reports the highest innovation intensity (7.4 per cent) and shows a clear upward trend since this indicator was only 5.6 per cent in 2000. Innovation intensity in knowledge-intensive services is significantly lower (1.7 per cent in 2010), which is mainly driven by financial intermediation services. In this industry, though allocating significant resources to product and process innovation (€5.4 billion in 2010), innovation intensity is very low (0.6 per cent in 2010) due to extremely high sales figures which are measured by gross interest income and gross premiums written. Innovation intensity in knowledge-intensive services remained rather stable over the past decade, with a peak in 2005/06 when the indicator reached 1.9 per cent. In other services, innovation intensity is low. In 2010, only 0.8 per cent of total sector sales are spent for innovation, a figure which did not change significantly in recent years. Other manufacturing allocated 1.4 per cent of its sales in funding innovation activities, which is the lowest figure in the past ten years. In 2001, innovation intensity was 2.2 per cent in this sector.

Figure 11. Innovation intensity 2000-2010, by main sector



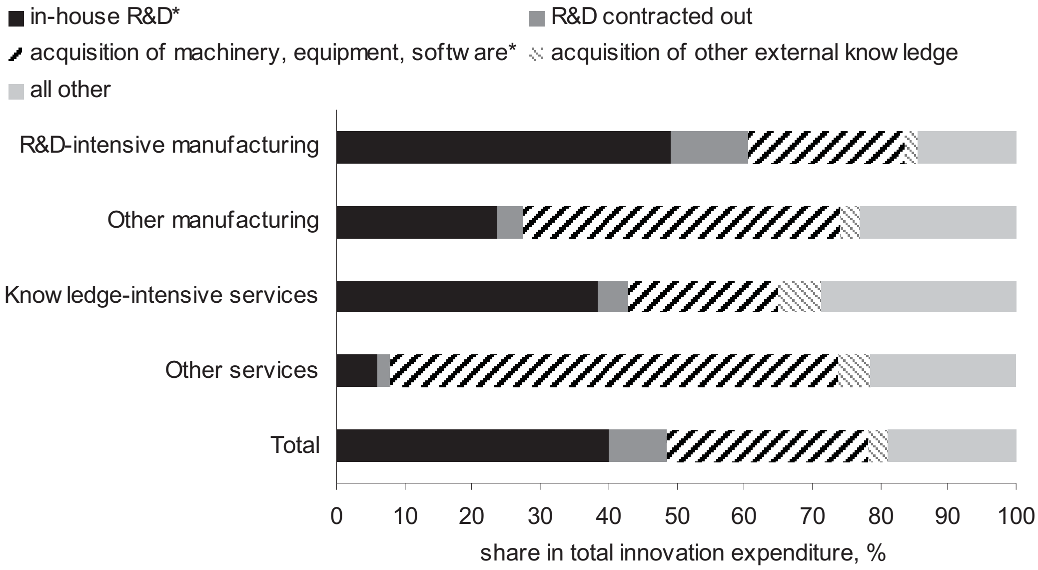
Note: 2006 break in series.

4.2 Innovation Expenditure by Type of Activity

The single largest expenditure category of innovation costs is in-house R&D. In 2008, 40 per cent of the enterprises' total innovation budget was related to in-house R&D. A further 8 per cent was spent for purchasing R&D services from other enterprises and institutions. Acquisition of machinery, equipment, software, building and land accounted for 30 per cent of total innovation expenditure. Just 3 per cent were spent for the acquisition of external knowledge such as patents. For other innovation activities including marketing, training, design and engineering 19 per cent of total innovation budgets were allocated.

The share of in-house and externally purchased R&D is particularly high in R&D-intensive manufacturing and close to the average share in knowledge-intensive services. Other manufacturing industries devote less than 30 per cent of their innovation budget for R&D, while R&D is of very little significance for innovation expenditure in other services. In the latter sector, two thirds of total expenditure is for the acquisition of machinery, equipment, software, land and building. This high share is strongly driven by the transport and wholesale industries. The other manufacturing industries also spend the largest fraction of their innovation expenditure - 47 per cent in 2008 - for the acquisition of machinery, equipment and software. Innovation expenditure other than R&D and the acquisition of capital goods is particularly important in knowledge-intensive services. In 2008, this sector spent 29 per cent of total innovation expenditure for this category.

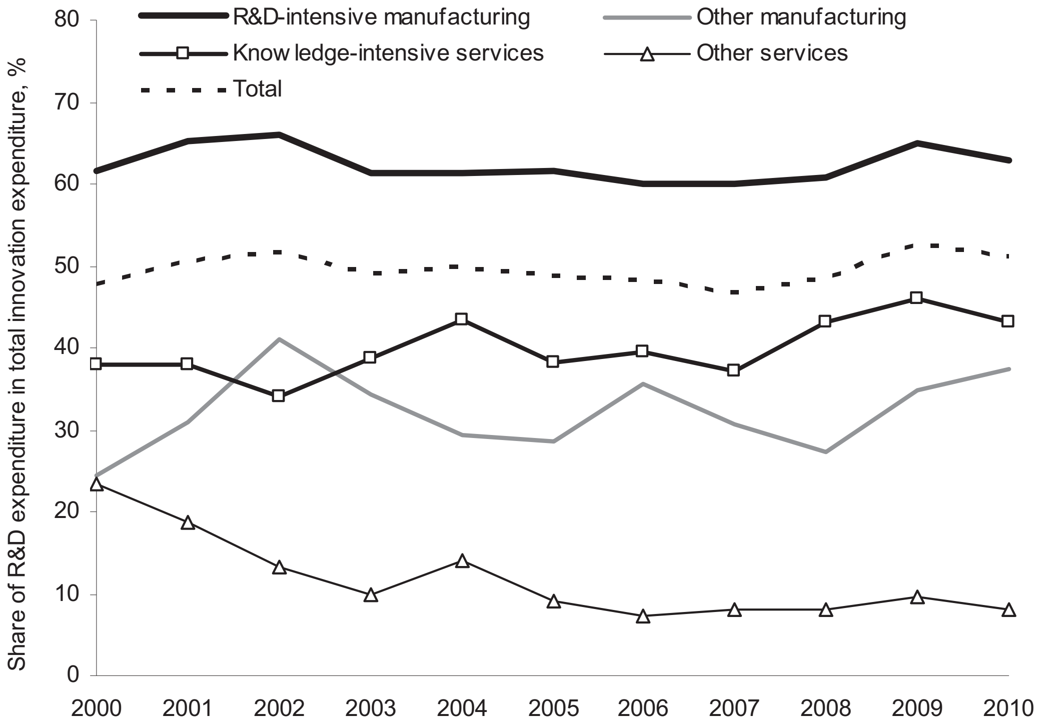
Figure 12. Innovation expenditure 2008 by type of activity, by main sector



* Acquisition of machinery, equipment, software for R&D is counted under in-house R&D.

The MIP records a breakdown of innovation expenditure by the categories shown in Figure 12 only every fourth year, with most recent data collected for 2008. On an annual base, MIP obtains data on total R&D expenditure (in-house plus purchased R&D) and total capital expenditure for innovation (machinery, equipment, software, land, building, IP; including capital expenditure for R&D). Over the past decade, some trends in the significance of different types of innovation expenditure emerge. In knowledge-intensive services, the share of R&D in total innovation expenditure tends to increase over time, though variations between individual years are substantial. From 2000 to 2003, between 34 and 39 per cent of the total innovation budget in this sector was used for in-house and purchased R&D, while this share increased to 43 to 46 per cent for the three most recent years. Other manufacturing rather shows a cyclical development, and R&D-intensive manufacturing reports a rather stable share between 60 and 63 per cent, with peaks in 2001/02 and 2009 at around 65 per cent. Other services spend less than 10 per cent of total innovation expenditure on R&D in most years, with an exception being the early 2000s. At this time, new opportunities of internet-based services tend to spur R&D activities in these industries, often related to the development of new software applications.

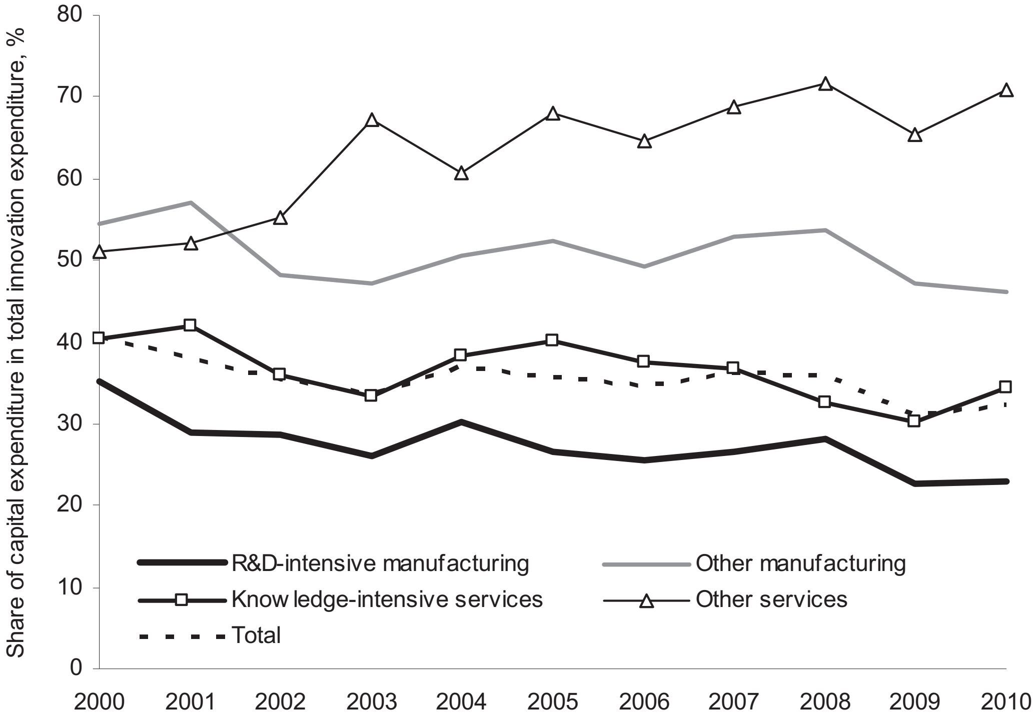
Figure 13. Share of R&D in total innovation expenditure 2000-2010, by main sector



Note: 2006 break in series.

Capital expenditure represented nearly a third of total innovation spending in 2010. Compared to 2000, when 41 per cent of total innovation expenditure was used to purchase tangible or intangible capital goods, a downward trend becomes evident. This trend is most pronounced in R&D-intensive industries, with a decline in the share of capital expenditure from 35 per cent in 2000 to 23 per cent in 2010. Other manufacturing also reports a falling share, from 54 per cent in 2000 to 46 per cent in 2010. In both sectors, this trend is interjected by years with increasing significance of capital expenditure in innovation budgets, particularly in years of economic recovery such as 2004/05 and 2007/08. In knowledge-intensive services, the share of capital expenditures was also lower in 2010 (34 per cent) than in 2000 (40 per cent). In this sector, the share tends to go down in times of recessions (2002/03, 2009), while in periods with significant economic growth, enterprises in this sector tend to spend an increasing share of their innovation budget on acquiring capital goods. The other services show a different development for this indicator. Over the past year, capital expenditure clearly gained in importance in total innovation spending. Its share grew from 51 per cent in 2000 to 71 per cent in 2010.

Figure 14. Share of capital expenditure in total innovation expenditure 2000-2010, by main sector



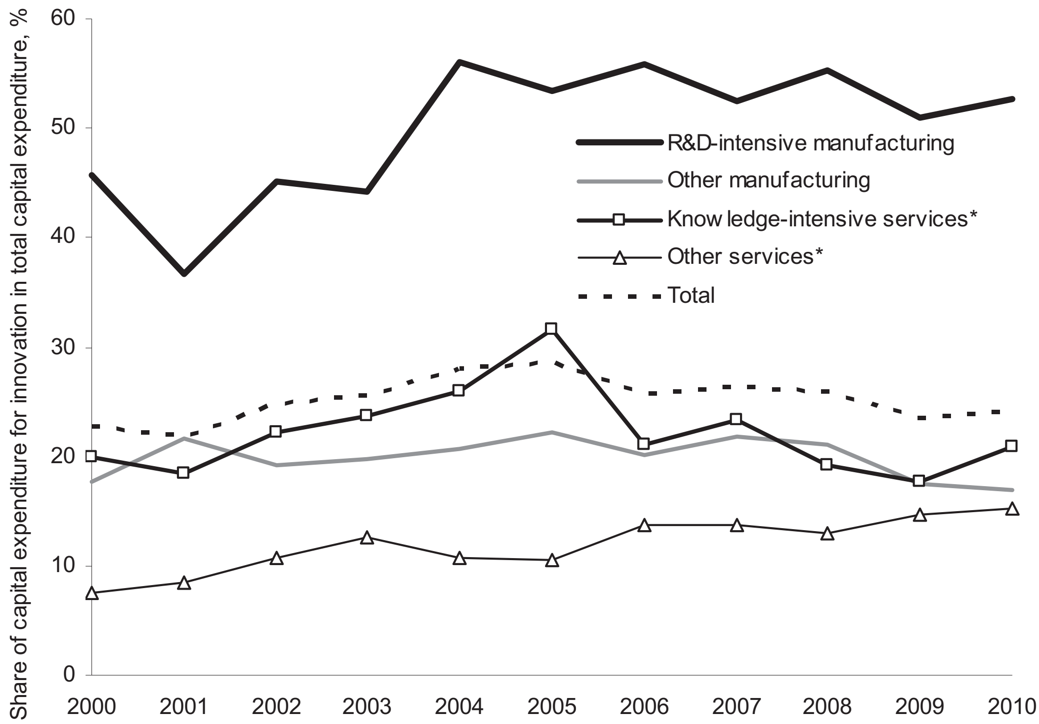
Note: 2006 break in series.

Capital expenditure for product and process innovation represents about a quarter of total capital expenditure of the sectors of the German enterprise sector that are covered by the Innovation Survey.[6] In R&D-intensive manufacturing, about a half of total capital expenditure is used to develop and implement new products and processes, while this share is around 20 per cent in other manufacturing and knowledge-intensive services (except for a higher share in the latter sector from

6 To calculate the share of innovation-related capital expenditure in total capital expenditure, weighted data from the MIP are related to capital expenditure for fixed assets (machinery, equipment, building, land) and other assets (software, some IPRs) from the national accounts statistics of the Federal Statistical Office. Since for NACE rev. 1.1, industry breakdown of national accounts is less detailed for service sectors than the industry breakdown used in the MIP, the sector aggregates for knowledge-intensive and other services have to be slightly re-defined. The share of innovation-related capital expenditure in total capital expenditure is somewhat underestimated since MIP data do not include enterprises with less than 5 employees, while these enterprises are included in national accounts data. Underestimation is likely to be negligible for manufacturing sectors while it might be more significant for service sectors. On the other hand, MIP data includes innovation-related capital expenditure on all types of IPRs while national accounts statistics only captures copyright expenditure for audiovisual media which results in an overestimation of the share of innovation-related capital expenditure in total capital expenditure (see chapter 13 for more details).

2003 to 2005) and between 10 and 15 per cent in other services. The higher share in R&D-intensive manufacturing reflects the fact that this sector is generally more innovation oriented. Investment in capital goods to replace outdated assets or to expand production is more often linked to innovative efforts. The relatively low share representing knowledge-intensive services may be explained by the fact that many innovation projects are rather based on investing in creativity and skills of employees or in organisational capital rather than in fixed assets. Moreover, the majority of capital goods used in this sector are related to IT, which tends to be more flexible for the adaption to new uses and the production of new services compared to fixed assets in manufacturing. Consequently, innovations in knowledge-intensive services demand specific investment in new hardware to a lesser extent.

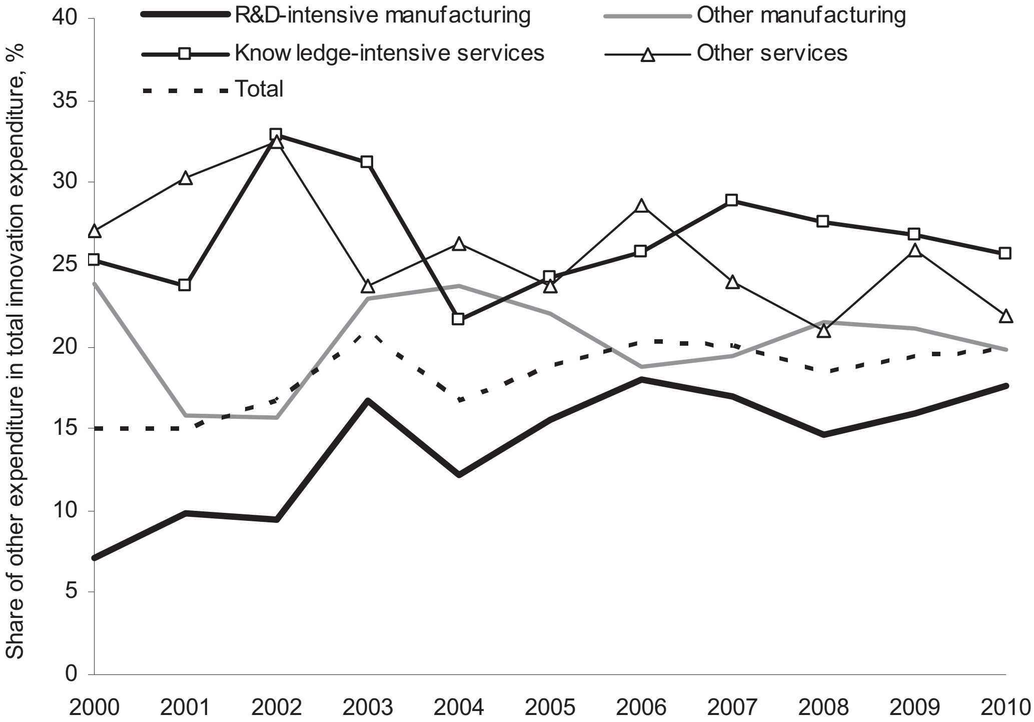
Figure 15. Approximate share of innovation-related capital expenditure in total capital expenditure 2000-2010, by main sector



Note: 2006 break in series.
* For 2000-2006, knowledge-intensive services include other business-related services (NACE rev. 1.1 groups 74.5 to 74.8) and exclude film and broadcasting while other services exclude other business-related services and sewage (NACE rev. 1.1 division 90).

There is a slight upward trend for this indicator from 2000 to the mid-decade, increasing from 21 per cent in 2001 to 29 per cent in 2005. This trend is most prominent for knowledge-intensive services and was strongly driven by higher innovation-related capital expenditure in computer services and telecommunications. R&D-intensive manufacturing increased its share of innovation-related capital expenditure in the early 2000s while the indicator value remained more or less constant afterwards. Other manufacturing does not show a clear trend. In other services, the share of innovation-related capital expenditure increased in the early 2000s and is still significantly higher in 2010 (15 per cent) than in 2000 (10 per cent).

Figure 16. Share of other innovation expenditure 2000-2010, by main sector



Note: 2006 break in series.

Based on data on total innovation expenditure, R&D expenditure and capital expenditure for innovation, one can estimate the amount of spending for other innovation activities if one considers the overlap between R&D and capital expenditure, i.e. the amount of capital expenditure devoted to R&D activities. This amount is reported both in R&D and capital expenditure data. While the MIP does not collect data on the amount of capital expenditure for R&D purposes, the R&D survey does. This survey is conducted by the *Stifterverband für die Deutsche Wissenschaft* and collects such data every second year (see Kladroba and Hellmich, 2011, for the most recent survey results). Using the share of capital expenditure in total R&D expenditure by industry from this survey and interpolating data for years for which no such data have been obtained, one can determine the share of other innovation expenditure in total innovation expenditure. This share increased during the past decade in the German enterprise sector, from 15 per cent in 2000 to 20 per cent in 2010. This trend is clearly driven by R&D-intensive manufacturing. This sector spent 18 per cent of its total innovation budget on other innovation activities, compared to only 7 per cent in 2000. For the other three main sectors, no trend for this indicator is evident.

4.3 Planned Innovation Expenditure

Deviating from the standard CIS, the MIP also collects data on planned innovation expenditure. Following the question on total expenditure on innovation in the reference year of the survey, firms were asked to report whether their total innovation expenditure will increase, decrease or remain stable (+/- 1 per cent) in the current year of the survey (which is one year after the reference year) and the following year, including the option "do not know". In addition, firms were asked to provide an estimate of the amount of innovation expenditure in these two years. Since the survey is sent to firms at the end of February of each survey year and most responses are received between March and June, the firm's plans on innovation expenditure are based on the information available to the firms in the second quarter (Q2) of the survey year.

Since planned innovation expenditure cannot be derived from a firms account, this raises the issue of a firm's ability to provide accurate information. When looking at the share of item non-response on both questions (direction of change of innovation expenditure and amount of planned innovation expenditure), a high share of firms is able to provide information. In the past five MIP surveys, between 84 and 89 per cent of all firms could provide information on whether their innovation expenditure will increase, decrease or remain unchanged in the year of the survey as compared to the reference year. For the year following the survey year, about 80 per cent of firms could give this information. These shares include non-innovative firms that plan to stay non-innovative, i.e. current and future innovation expenditures are zero.

Table 4. Item response on planned innovation expenditure in the MIP 2007-2011

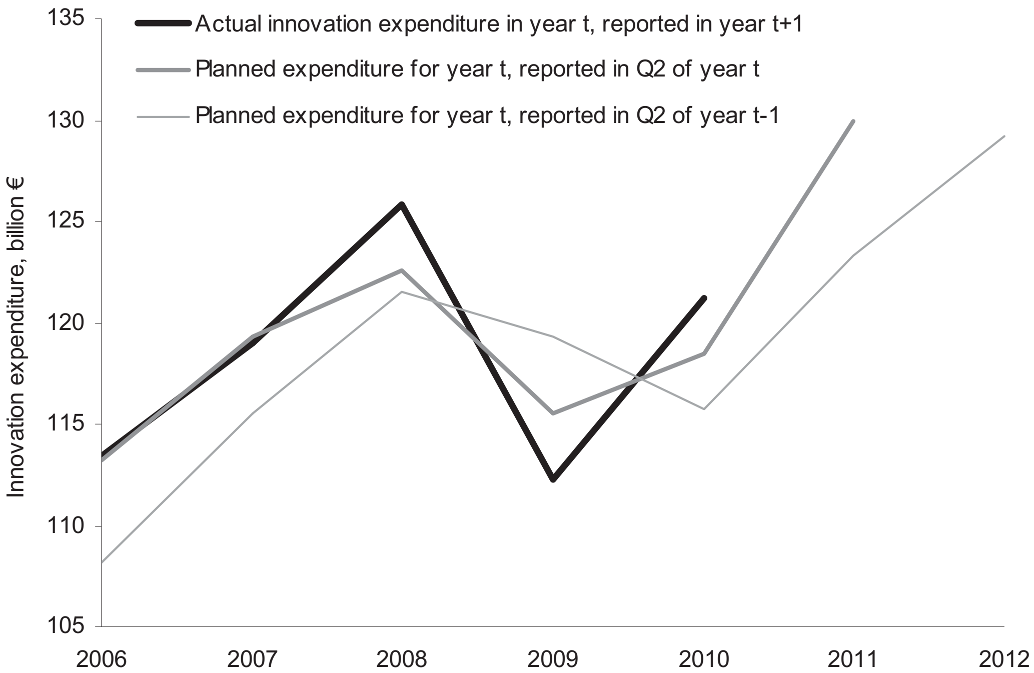
Year of survey (t)	Share of firms that could state the direction of change of their total innovation expenditure (%)		Share of firms that could provide data on the amount of total innovation expenditure (%)		
	in t	in t+1	in t-1	in t	in t+1
2007	85	81	90	81	73
2008	84	80	91	80	76
2009	88	81	88	79	75
2010	89	81	90	82	75
2011	84	79	84	76	72

Note: Non-weighted figures.

The share of firms that can provide data on the amount of planned innovation expenditure is somewhat lower. Depending on the year of survey, between 76 and 82 per cent of firms give an estimate of the amount of money they will spend on innovation during the year in which the survey is conducted, and between 72 and 76 per cent can provide this figure for the following year. One should bear in mind, however, that a noticeable share of firms is not able or willing to provide such data for the reference year. Item response rate for innovation expenditure in the previous year of the survey is between 84 and 91 per cent. Item non-response shares on planned innovation expenditure were higher in the most recent (2011) survey, maybe reflecting a particularly uncertain market environment in that year.

Whether the estimates on planned innovation data are accurate or not is difficult to determine. When looking at aggregated, weighted figures and comparing planned innovation expenditure for a certain year with the amount that was actually spent in this year, ones sees a rather good fit for planned figures that refer to the year of the survey (which were reported in Q2 of that year). In 2006 and 2007, actual innovation expenditure almost perfectly matched the planned figures while plans underestimated actual expenditure in 2008 and overestimated them in 2009 by 3 per cent each. In 2011, planned data were 2 per cent below actual expenditure. The deviation in recent years is most likely linked to the more uncertain market environment, including the severe recession starting at the end of 2008, which was not foreseen by analysts or by decision makers in firms, and the rapid recovery of the German economy in 2010 and 2011, which was a surprise, too.

Figure 17. Actual and planned innovation expenditure 2006-2012



Planned data for the year following the survey year tend to be much more conservative and underestimate the actual development in times of increasing and overestimate the actual figure in times of declining expenditure. In particular, plans for the following year seem to be unable to project marked changes in expenditure behaviour but rather extrapolate plans for the current year. With this pattern in mind, one may expect a strong increase in innovation expenditure of the German enterprise sector in 2011 and - given the rather favourable prospects for 2012 - a further increase in 2012.

4.4 Innovation Projects

Innovation activities in firms are typically organised as projects. An innovation project is a dedicated activity based on a plan that defines the objectives, the approach to achieve these objectives, and the resources and time needed. Innovation projects may refer to an entire product or process innovation, starting from generating the idea up to market introduction. However, some firms may split innovations into several projects, each representing a certain stage in the development and implementation of an innovation. For instance, the research needed to solve a certain technical problem may be defined as a separate project which feeds into successive development and design activities. For this reason, there may be firms with completed innovation projects that did not introduce any product or process innovation in the same period of time. In addition, firms may complete innovation projects in terms of finding a technological solution to a certain innovative idea but refrain from using this finding to introduce a new product or process because of unfavourable market conditions or a lack in funds. On the other hand, firms may introduce some product or process innovations without related innovation projects, for example if innovations are rather incremental and are introduced as part of routine activities in production or marketing. For all these reasons, the number of innovation projects will not relate to the actual number of innovations (i.e. new products and new processes) and should not be confused with it.

In the three years 2008 to 2010, firms in Germany conducted a total of about 756,000 different innovation projects. Roughly 396,000 of these projects have been completed successfully within this period, approximately 96,000 were stopped before completion, and about 264,000 were still ongoing at the end of 2010. About half of these projects (360,000) were started within the three year period. In the three year period from 2006 to 2008, the total number of innovation projects in German firms was slightly lower (736,000), but the number of successfully completed projects was higher (437,000), while fewer projects were stopped before completion (69,000). The number of ongoing projects at the end of 2008 was 230,000. Interestingly, significantly more projects -541,000- were started during the three year period. These figures indicate that in 2006 to 2008 more short-term projects were conducted, and more of them could be completed than in the 2008 to 2010 period. The latter period was strongly influenced by the sharp economic crisis which broke out in autumn 2008 and heavily affected the firms' financial situation in 2009. It seems that the crisis reduced the number of newly started innovation projects, increased the number of projects that were stopped before completion and lengthened project durations so that more projects were still ongoing at the end of 2010.

On average, an innovative firm conducted 5.3 projects during 2008 and 2010, compared to 5.1 during 2006 and 2008. Size differences in the number of innovation projects per firm are considerable (see Table 5). Large firms with 1,000 or more employees run an average 120 different innovation projects within a three-year period with up to several thousand projects in very large international corporations. Yet medium-sized firms manage also project portfolios of 5 to 15 projects.

Small innovative firms with less than 20 employees focus their innovative efforts on just 2 to 3 projects on average. Differences between manufacturing and services are less pronounced and mainly represent the fact that the significance of very large firms is higher in manufacturing than in the service sectors. In manufacturing, the average number of innovation projects per firm was 6.4 (2006-08) and 6.7 (2008-10) while innovative service firms report 3.9 and 4.1 projects in average.

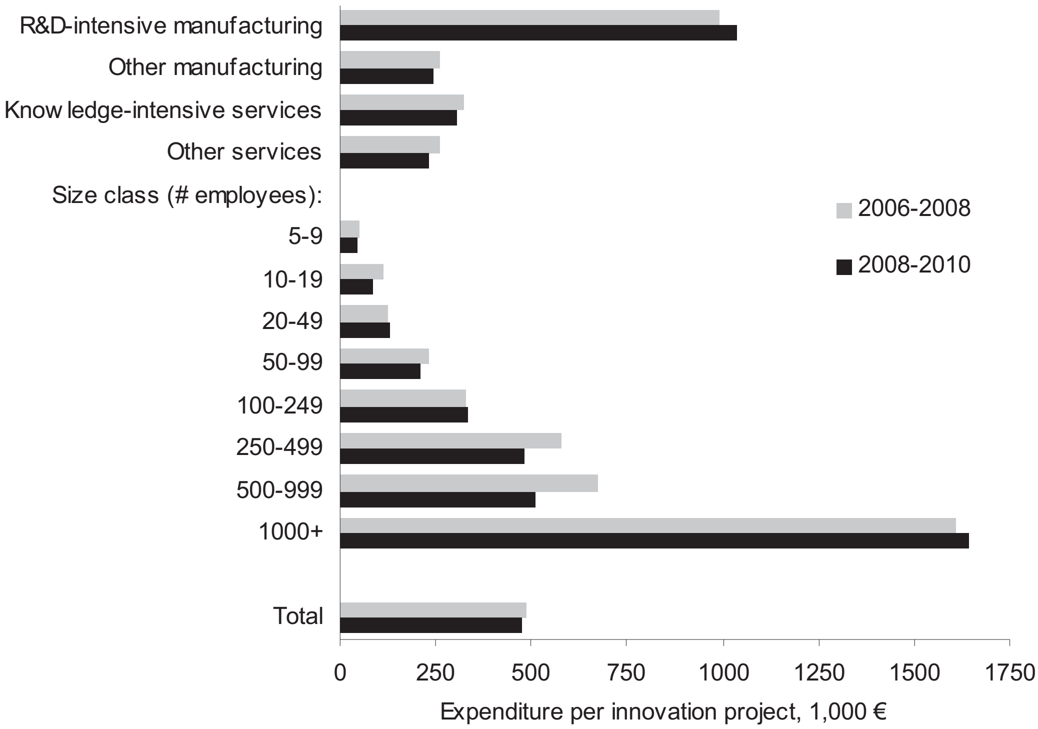
Table 5: **Number of innovation projects per innovative firm, by size class**

	2006-2008			*2008-2010*		
	Total	*Manufacturing*	*Services*	*Total*	*Manufacturing*	*Services*
5-9	2.7	2.7	2.7	2.6	2.8	2.4
10-19	3.1	3.5	2.9	3.3	3.8	3.0
20-49	3.9	4.7	3.2	4.2	4.8	3.7
50-99	5.6	6.2	4.8	5.3	6.0	4.5
100-249	8.9	10.4	6.5	9.1	10.1	7.7
250-499	11.7	15.2	5.8	14.6	16.9	11.0
500-999	22.1	24.1	18.9	28.7	31.0	25.1
1,000+	117.9	138.9	89.4	120.3	143.7	89.5
Total	5.1	6.4	3.9	5.3	6.7	4.1

The average expenditure per innovation project in the German enterprise sector is about €0.5 million. This figure had not changed significantly between the two periods for which data are available, 2006-08 and 2008-10. The average expenditure per innovation project was calculated by dividing the total expenditure for innovation in these three years by the total number of innovation projects pursued during these three years (including stopped and still ongoing projects). As no project-specific expenditure data have been collected, no information can be provided on the distribution of project size. The average project size differs considerably by firm size and sector. Large firms with 1,000 or more employees spend about €1.6 million on average per project while small firms with 5 to 9 employees conduct innovation projects with about €50 thousand per project. Firms in R&D-intensive manufacturing have significantly larger innovation projects on average (about € 1.0 million) than firms from the other three main sector groupings. The difference can partly be explained by the higher share of very large enterprises in this sector. However, small firms from R&D-intensive manufacturing also report higher average project size compared to firms from other sectors.

The high average project size in R&D-intensive manufacturing implies that the high amount of innovation expenditure in this sector is allocated on a comparatively smaller number of projects than in the other sectors. In fact, the number of innovation projects is rather equally distributed across the four main sectors. In 2008-10, about 205,000 of the total 756,000 innovation projects were conducted by firms from R&D-intensive manufacturing. A similar number (208,000) were executed in knowledge-intensive services. The other manufacturing sector had a total of 228,000 different innovation projects in that period. Only other services fall behind in terms of the number of innovation projects, with 115,000 projects performed between 2008 and 2010.

Figure 18. Expenditure per innovation project 2006-2010, by main sector and size class

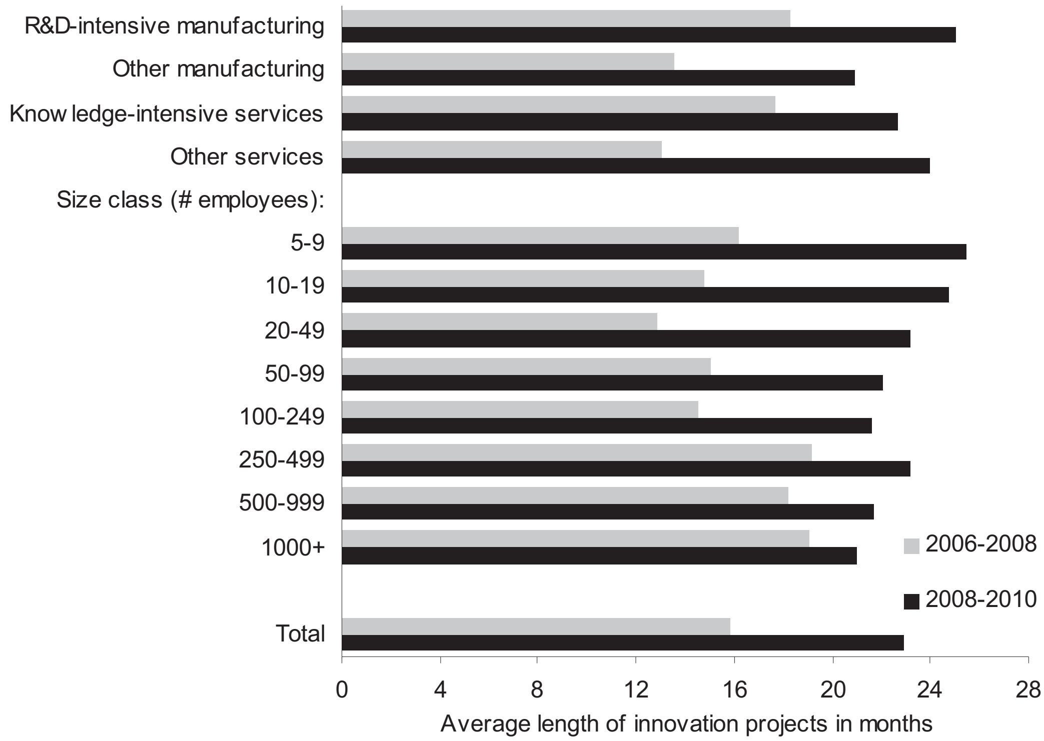


The information collected on the number of completed, stopped, ongoing and newly started projects within a three year period can be used to produce a rough estimate of the average duration of innovation projects when assuming that starting, completing and stopping projects is evenly distributed over the three year time period and that project duration does not change during this period. Under these assumptions, the relation of ongoing projects at the end of the period -ipo(t_n)- to the annual number of projects that have been completed or stopped during this 3-year period -ipcs(t_o,t_n)/3- will give the average project duration. In the same way, the relation of ipo(t_n) to the annual number of projects that have been newly started during this 3-year period -ipn(t_o,t_n)/3- should give the same duration figure (as long as the assumptions hold). Since in fact the assumptions are not entirely realistic, there is some deviation in the results for both calculations. Hence, we use the averages of both figures to arrive at a somewhat realistic estimate of the average length of innovation projects.[7] For the 2006-08 period the average duration of an innovation project in the German enterprise sector was 16

7 In the 2010 survey wave, a separate question on the average length of innovation projects was added to the questionnaire, offering six response categories. The results largely confirm the present calculation.

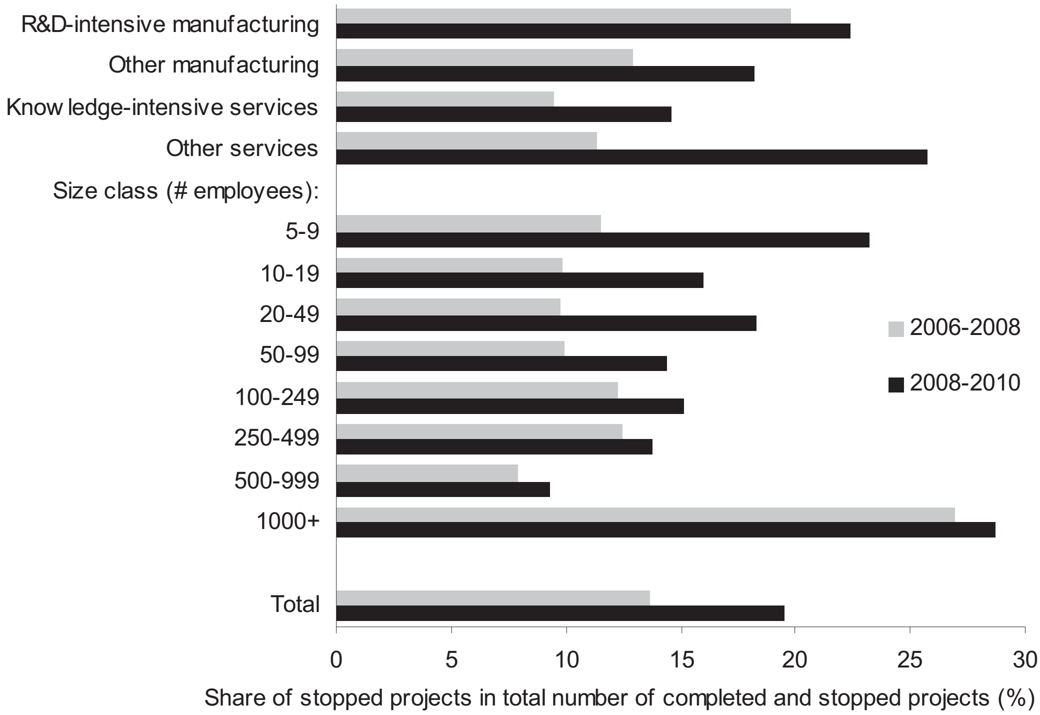
months. This figure rose to 23 months for the 2008-10 period. This increase in average project length was largely driven by the other services and other manufacturing. One explanation of this finding may be a lengthening of projects during the economic crisis, either because of a lack of funding or because firms waited for a better business climate to introduce innovations to the market. Another explanation is certainly that the number of ongoing projects at the end of 2010 may not reflect the typical number of ongoing projects in innovative firms but is biased upwards. During the economic crisis, it is likely that many firms refrained from starting new projects and waited until the economic situation had improved. For this reason, many projects may have been started in 2010 that would otherwise (i.e. in the absence of the economic crisis) have been started earlier and completed before the end of 2010.

Figure 19. Estimated average length of innovation projects 2006-2010, by main sector and size class



Interestingly, size differences in the duration of innovation projects are small. At the level of main sector groupings one can also find only little differences in the time it takes until an innovation project is completed or stopped. Differences are more pronounced at the level of individual industries (see Table 19 in the Appendix). Industries such as manufacturing of machinery and equipment, water supply, sewerage and waste management, transportation and storage or engineering and R&D activities show average project lengths of two years and more, while the manufacturing of textiles, apparel and leather and the manufacturing of rubber and plastics products, innovation projects tend to need less than one and a half year in average. One should not forget, however, that firms that are faced with a rather long time span between the initial project idea and the time an innovation is introduced to a market may divide this process into several individual projects in order to ease the management of innovation activities and have more control over the consumption of financial and personnel resources. This may be the case, for instance, in the pharmaceutical industry, where the development of a new drug may be split into several R&D projects as well as different projects for the phases of clinical trials.

Figure 20. Share of stopped innovation projects 2006-2010, by main sector and size class



Between 2008 and 2010, 19 per cent of all innovation projects that ended during that period were stopped before completion. This share is higher in very small firms (23 per cent) and very large firms (29 per cent) and smallest in medium-large firms (500 to 999 employees: 9 per cent). While the high share for small firms most likely results from the low number of innovation projects these firms conduct (meaning that just one stopped project will represent a high share in all ended projects), the high figure for very large firms indicates a stronger focus on stopping unsuccessful or unpromising projects before completion. The share of stopped projects in total significantly increased since the 2006-08 period, which most likely reflects involuntary project stops during the economic crisis caused by the need to cut costs and adjust firm activities to limited funding options. Particularly smaller firms and firms from other services increased the share of stopped projects, indicating that they were more vulnerable to adverse impacts of the economic crisis on innovation. Stopping projects before completion need not necessarily indicate a failure of innovation efforts but can also indicate an efficient project management by refraining from projects that do not deliver and focussing resources on more promising ones (see Klingebiel and Rammer, 2013).

5 Indicators on Innovation Success

Germany's economic situation in the early 2000s can be characterised by an enduring stagnation. Growth rates of GDP and labour productivity were low. Germany's competitiveness struggled to keep up with other nations. Lack of innovative activities has been considered as key factor for Germany's and, more generally, Europe's weak growth performance when compared to the US. For instance, the Sapir report, written on behalf of the European Commission, views Europe's weakness as symptom of its failure to transform in an innovation-based economy. At mid-decade, Germany's economy has been picking up with accelerating growth rates. Production in manufacturing and some service sectors has, however, plummeted to the level of 2005 during the financial and economic crisis in 2008/09. The knowledge-intensive services have solely succeeded in expanding production during the crisis.

These developments stress the importance of knowledge- and innovation-intensive activities to retain competitiveness. The growing productivity rates in the midst of the 2000s can, similarly, be attributed in large parts to the use of new information and communication technologies in R&D-intensive industries and knowledge intensive services. Thereby, it becomes apparent that sectors with high R&D intensities achieved the largest productivity gains (Report on Germany's technological performance 2007). Expenditures for R&D indicate the extent to which resources were used for creating new knowledge. New knowledge and ideas can lead to new combinations of production factors, i.e. to innovative products or processes.

The global marketplace for R&D-intensive products is not an exclusive domain for established industrialised countries anymore. They become increasingly challenged by emerging economies (Expert Commission on Research and Innovation, 2012). Leveraging their comparative advantages in cost-effective and highly efficient production techniques will be crucial for the sustainable competitiveness of established countries, like Germany. Innovation in new products or processes generates such competitive advantages. This chapter retraces to which degree German firms have been successful in their innovation activities during the 2000s.

5.1 Product Innovation Success

Successful innovation activities are an important competitive dimension for knowledge-based economies. From a technological point of view, innovation can be defined as introducing new products or processes.[8] Innovations can consequently improve economic production and welfare via different channels.

Product innovations introduce new varieties to the market. A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. It should therefore become more likely that consumers are provided with a variety that fits their preferences (Lancaster, 1966). Furthermore, the changed or significantly improved product characteristics are intended to satisfy customer needs better than predecessor generations of similar products. Such significant improvements could occur through changes in materials or components that enhance product performance. Successful innovations should therefore be accompanied by a larger customer valuation due to, for instance, improved user friendliness of the product or improved availability of the service innovation. Innovating firms should therefore be able to achieve higher mark-ups as the risky business of innovation is conducted, ultimately, in order to improve company performance.

Product innovations differ in their economic impacts. Some radically new product innovations create major and disruptive changes to markets and economic activities (Christensen, 1997). New markets can be created or existing products can be rendered obsolete. The minimum requirement for a product innovation is, however, that the product must be new or significantly improved *to the firm*. This does not imply that the product is new to the market or new to the world. Product innovations differ, consequently, in their degree of novelty. Market novelties are these goods or services that have been provided in the market for the first time and that have not already been implemented by other firms. The driving force for the process of innovation is firms that develop innovations first. However, a main characteristic of innovation activities is the associated uncertainty over their outcomes. They frequently take place under great uncertainty regarding future developments in technology and demand (Rosenberg, 1994). Introducing market novelties therefore comes along with a high failure risk. On the hand, market novelties have the potential for high growth and profit rates in the case of success.

The introduction of new ideas or of new combinations of existing knowledge gains social and economic importance by the diffusion process (Hall, 2005). Innovations are evaluated on whether they are clearly better than existing solutions. Innovations are adopted and replace older technologies and products if they show a higher (expected) performance. Diffusion comprises, however, not only learning, adoption and imitation. It is also an intrinsic part of the innovation process as learning about different uses of the innovation facilitates a feed back to improvements in the original innovation. The introduction of technologically new-to-the-world innovations can start such a process. The acceptance rate of inventions varies widely, however (Rosenberg, 1972). Failure of market novelties is thus not uncommon. Market novelties that become imitated succeeded in demonstrating their

8 The notion of innovation has been expanded recently in the Oslo Manual to non-technological marketing and organisational innovations (OECD and Eurostat, 2005). See also chapter 9.

superiority. Product imitations by other firms then indicate that older technologies have been replaced and that new technology is eventually improved. The process of learning, adopting and improving is slow. Productivity improvements due to new technologies evolve slowly (z. B. Brynjolfsson and Hitt, 2000, 2003). Furthermore, they are notoriously hard to measure by balance sheet data. Survey data such as the MIP can fill in this gap. It provides quantifiable measures on the degree to which German firms have been successful in innovation.

Product innovations can also differ in their novelty with respect to their relation to the established product portfolio of the innovating firm. Product-range novelties are new or significantly improved goods or services that have no predecessor in the innovating firm. They enlarge the product portfolio that the firm offers and allow addressing new customer needs or market segments. Diversified product ranges can be encountered especially in knowledge-intensive businesses as an effective exploitation of new knowledge or technologies requires broad product portfolios (Pavitt et al., 1989). Broadly applicable knowledge which is difficult to transfer across firm boundaries can create further value when shared across different businesses (Teece 1980, 1982; Markides and Williamson, 1994; Palich et al., 2000). The benefits of economies of scope could be reaped by diversifying into related businesses. These businesses may be related because the knowledge is applicable to similar products offered to different customers or because related principles of the basic knowledge are implemented in product innovations (Miller, 2006).

Market novelties, product imitations and product-range novelties
Market novelties ("new-to-the-market products") are new or significantly improved products and/or services that a firm has introduced onto the market prior to any competitor. Product imitations are new or significantly improved products and/or services introduced by a firm onto its market which were already offered by competitors at the time of introduction. The relevant market is defined from the firm's own perspective. Product-range novelties are new or significantly improved products and/or services that have no predecessors in the innovating firms. Such innovations thus enlarge the product range of a firm and allow it to address customer demand not covered by a firm's products and services so far. Product range novelties can be market novelties or product imitations at the same time, too.

In the year 2000, the economic upturn from the preceding years slowed down. Product and process innovation activities declined on a high international standard. The general regression in innovation activity during 2000 was led by small and medium sized enterprises and hit the traditionally innovative sectors in manufacturing and business-oriented services. A shrinking demand left capacities under-utilised. Needs to introduce improved processes were consequently alleviated. However, there were relatively more product innovators in the years 2001/02 than process innovators. German firms at that time have apparently used difficult economic conditions to modernise their product portfolios by replacing outdated products with product innovations. Incentives to introduce market novelties have, however, eroded in business oriented services in the beginning of the 2000s. The bursting ‘New Economy’ bubble has induced many young firms to offering new-to-the-market ICT services to leave the market. Furthermore, the number of firms introducing market novelties declined in entire business oriented services during that period.

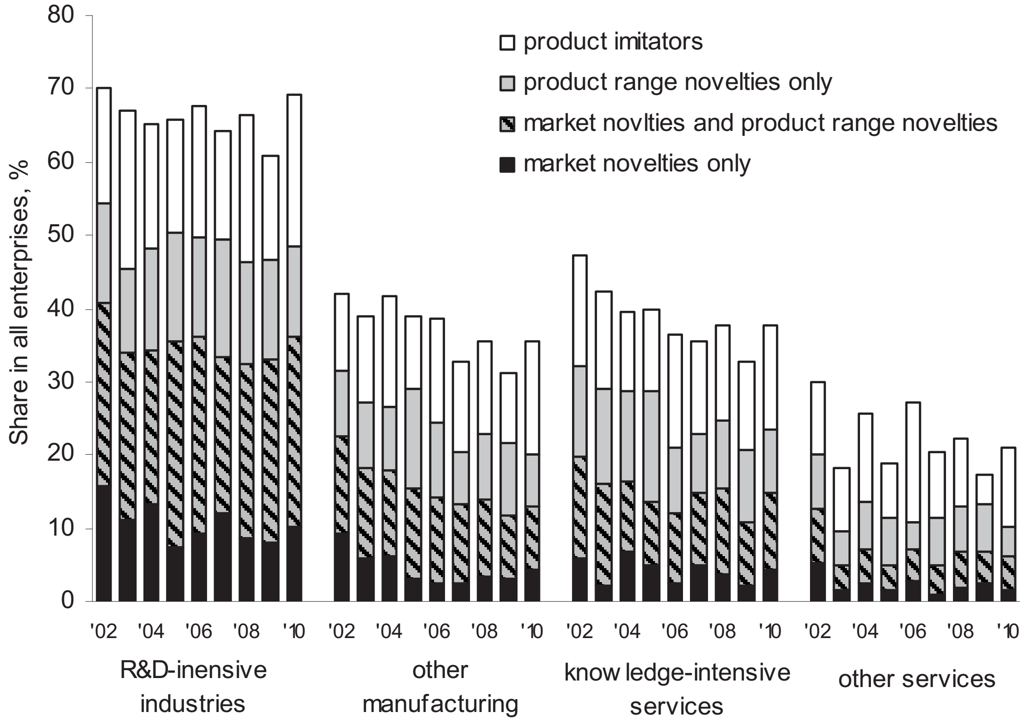
In the following years, Germany’s economy has been characterised by an enduring stagnation with a temporary recovery in 2004. The temporary increase of product innovating firms in 2004 was not on a sustained basis. Product innovation activities of the German economy have rested in particular on export oriented sectors, like mechanical engineering or chemicals. In contrast, the enduring internal economic stagnation has left significant impressions on product innovation activities of business-related services. This reflects the distinct importance of dynamic demand as a stimulant of the introduction of new products and services into the market (cf. Acemoglu and Linn, 2004). Although the importance of innovation has been acknowledged by policymakers by putting it on the top of their agenda, this has not been reflected by increased innovative activities of German firms in 2005.

Conditions for innovation activities improved noticeably from 2006 onwards. Demand from Germany and abroad increased Output and profits have grown in almost all industries. The focus of firm’s innovation activities have been increasingly put on production innovations. The scale of the economic upturn in 2006, however, came as something of a surprise to many enterprises as it appears that they have failed to make the best of the improved economic climate by not introducing innovations immediately. Defensive product innovations which imitate improvements have grown in all major sector groupings in these years. However, the number of product innovators that have introduced market novelties has also risen for the first time in 2006 since new information technologies have given impetus to original product innovation in the years 1999-2001.

Innovation activities have not been unaffected by the profound financial and economic crisis 2008/09. Innovation activities decreased markedly in 2009. Knowledge-intensive services have been hit, in particular. Decreasing numbers of innovators that introduced market novelties and product range novelties can be attributed in large parts to reduced innovation activities in knowledge-intensive services. In R&D-intensive manufacturing however, the number of product innovators with market or product range novelties has edged upwards. As the economy recovered in 2010, product innovation activities increased in all major sector groupings. The high number of innovations in market novelties has been especially gratifying. Apparently, many enterprises have used free capacities during the crisis to develop new products which could have been placed successfully on the market in the economic upturn.

Figure 21 retraces the distribution of product innovations among German firms in manufacturing, knowledge-intensive services and other service sectors during the 2000s. Figures start from the year 2002 because this was the first year the German innovation survey distinguishes product innovations amongst market and product range novelties. Please note that comparability of figures before and after 2006 is limited due to methodological changes in the extrapolation procedures, due to changes in sector classification from NACE rev. 1.1 to NACE rev. 2 and due to changes in available information from the German statistical office regarding the universe of German firms.

Figure 21. Product innovators by degree of novelty 2002-2010, by main sector



Note: 2006 break in series.

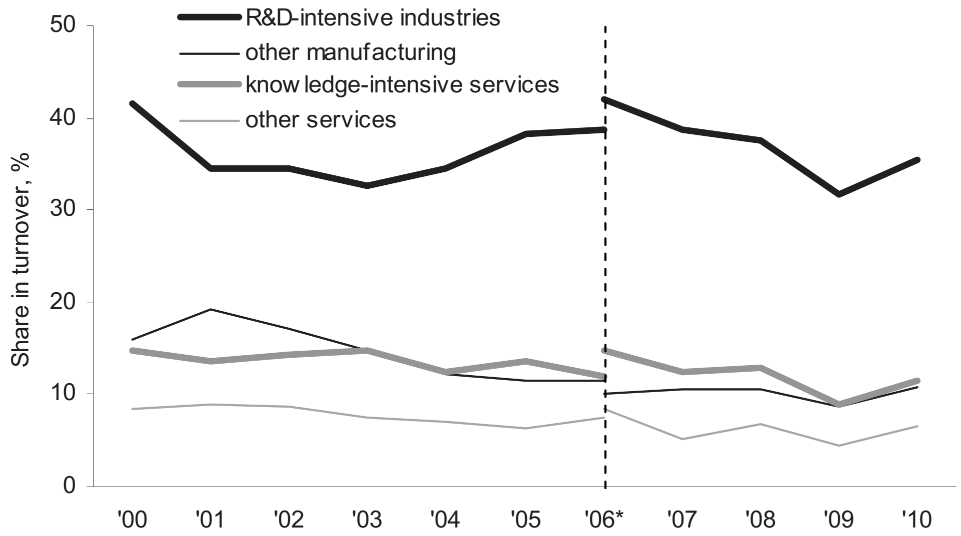
Most frequently, German firms are product innovators in R&D-intensive manufacturing sectors. In most of the 2000s, the respective share of product innovators ranges between 65 and 70 per cent. An exception is 2009. Here, the share of product innovators has fallen to 61 per cent. In 2010, the product innovator share has recovered to 69 per cent, although the high shares at the end of the 1990s (with shares around 80 per cent) have not been reached again. Apart from R&D-intensive manufacturing, the remaining sectors clearly show a falling trend in product innovation activity. In other manufacturing sectors, the share of product innovators fell from 60 per cent at the end of 1990s to 45 per cent in 2010. During the same period, the share of product innovators in knowledge-intensive services decreased from 65 per cent to 47 per cent. In other service sectors, the share of product innovators lowered from 45 per cent to 28 per cent in the period 2000-2010.

Firms that introduce market novelties can be regarded as drivers of the innovation process. This is especially true for firms that simultaneously introduce market and product range novelties. Those firms are the most prevalent in Germany in R&D-intensive industries. During periods of frequent product innovation activities, approximately 25 per cent of firms in these sectors can be regarded as `radical' product innovators, i e. as firms that introduce market as well as product range novelties. This share reaches its minimum at 21 per cent in the years 2004/07 and its maximum at 28 per cent in 2005/06. Product innovators that introduce market novelties only are more seldom in R&D-intensive industries. 16 per cent of firms introduced market novelties only in 2002. This share declined in 2005 to 7 per cent before recovering to 10 per cent in 2010. Product innovators that introduce market novelties are also common in knowledge-intensive services, although not as frequent as in R&D-intensive industries. In 2002, 14 per cent of firms in knowledge-intensive services can be characterised as radical product innovators. Their prevalence reached its minimum in 2005 and 2009 with 9 per cent before partly recovering in 2010 by reaching 10 per cent. The share that introduces market novelties only is also lower in knowledge-intensive service sectors. 6 per cent of them introduced market novelties only in 2002. This share collapsed in 2003 to 2 per cent. In 2010, 4 per cent of knowledge-intensive service firms introduced market novelties only. This falling trend of firms introducing market novelties can also be observed for firms in other manufacturing and other service sectors, albeit on a lower level.

The highest shares of firms that introduce product range novelties only can also be observed in R&D-intensive industries and knowledge-intensive service sectors. Their share ranges between 12 and 16 per cent in R&D-intensive industries and between 8 and 15 per cent in knowledge-intensive services, respectively, whereby the trend for the latter is clearly falling. Contrarily, the share imitating firms has not shown a falling trend in knowledge-intensive services. It ranges here between 11 and 17 per cent during 2002-2010. The same is true for R&D-intensive industries. Here, the share of purely imitative product innovators ranges between 16 and 22 per cent. Apparently, the relative importance of imitations has increased during the last decade, whereas firms introducing market novelties have become less frequent, in particular in knowledge-intensive services.

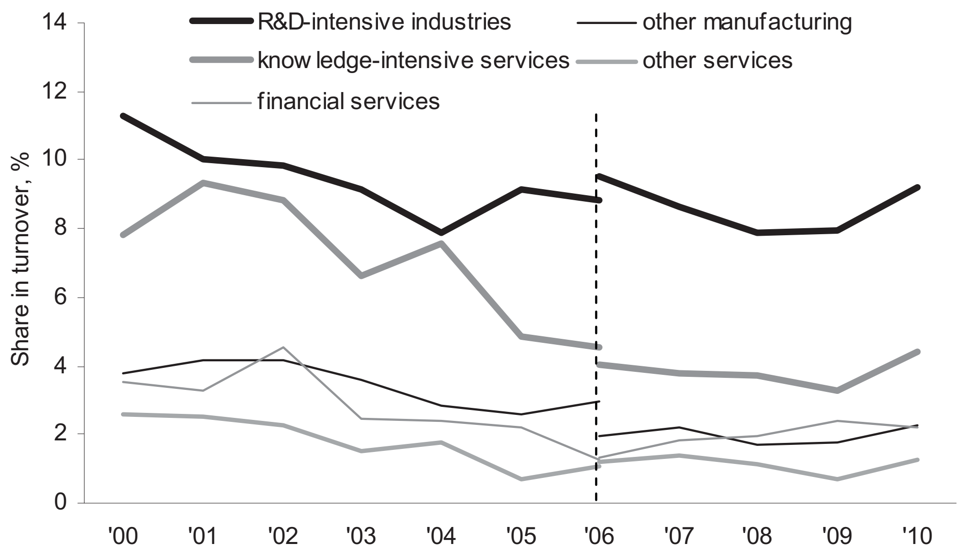
The direct economic success of product innovations can be measured using the share of turnover brought in by newly-launched products. One should bear in mind that some time can pass between the introduction of an innovation and the appearance of clear innovative success. To account for this, products introduced in the last three years are considered to be “new” when calculating this indicator. The development of the turnover share due to new products during the 2000s is depicted in Figure 22. New information technologies have raised this indicator to very high levels in all major sector groupings at the end of the 1990s. These high levels have not proven to be sustainable. Especially in knowledge-intensive services, the share of turnover due to new products has fallen markedly from 43 per cent in 1998 to 15 per cent in 2000. Also, in other service sectors the share dropped from 23 per cent in 1999 to 9 per cent in 2000. Despite these low levels, the turnover share due to product innovations has declined further in all major sector groupings, although figures show a rising tendency at the current edge in 2010. Only firms in R&D-intensive industries have succeeded in significantly expanding their innovation success temporarily during the years of economic boom in 2006-2008.

Figure 22. Share in turnover due to product innovations 2000-2010, by main sector



Note: 2006 break in series.

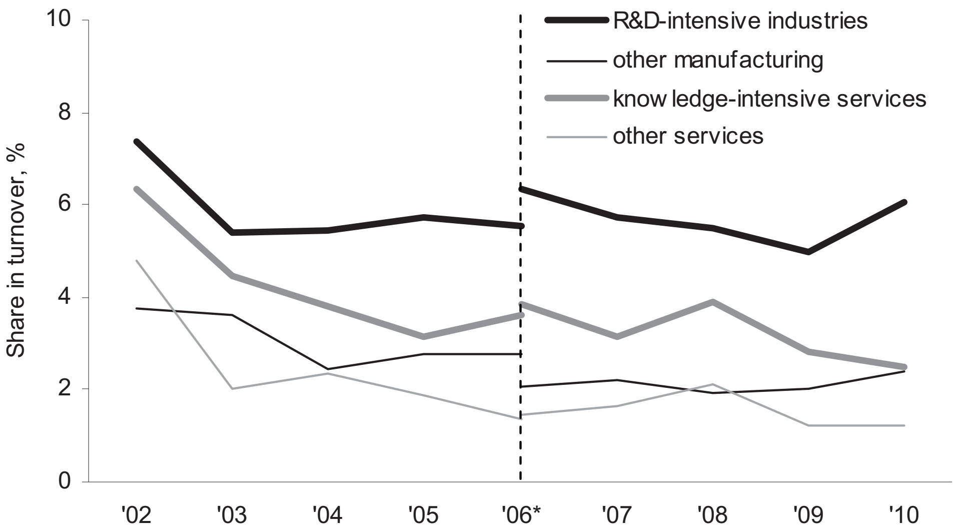
Figure 23. Share in turnover due to market novelties 2000-2010, by main sector



Note: 2006 break in series.

Successful market novelties can have long-standing impacts for incumbent and innovating firms. The share of turnover due to market novelties is one indicator for their success to reveal their potential for `creative destruction'. Figure 23 retraces the development of this figure during the 2000s. It depicts a similar picture as for the share of turnover due to overall product innovations. The high levels at the outset of the decade have not proven to be sustainable. Figures drop, in particular after 2002, the last year in which the introduction of new ICT-related products that have been introduced during years of the New Economy until 2000 were regarded as product innovations within the 3-year window. Regarding widely held views that innovation and knowledge-based activities are key for Germany's long-term competitiveness, the declining importance of market novelties for firms in knowledge-based services might give rise to concerns. The same is true for the importance of product range novelties (see Figure 24). Their share is steadily declining, too, especially in knowledge-intensive services. Comparing the absolute numbers for the share of turnover due to market and product range novelties to the overall share of turnover due to product innovations reveals that much of the product innovation success is due to imitative innovations. Interestingly, this is particularly the case R&D-intensive industries which might cause further concerns regarding Germany's transformation in a knowledge-based economy.

Figure 24. Share in turnover due to product range novelties 2000-2010, by main sector

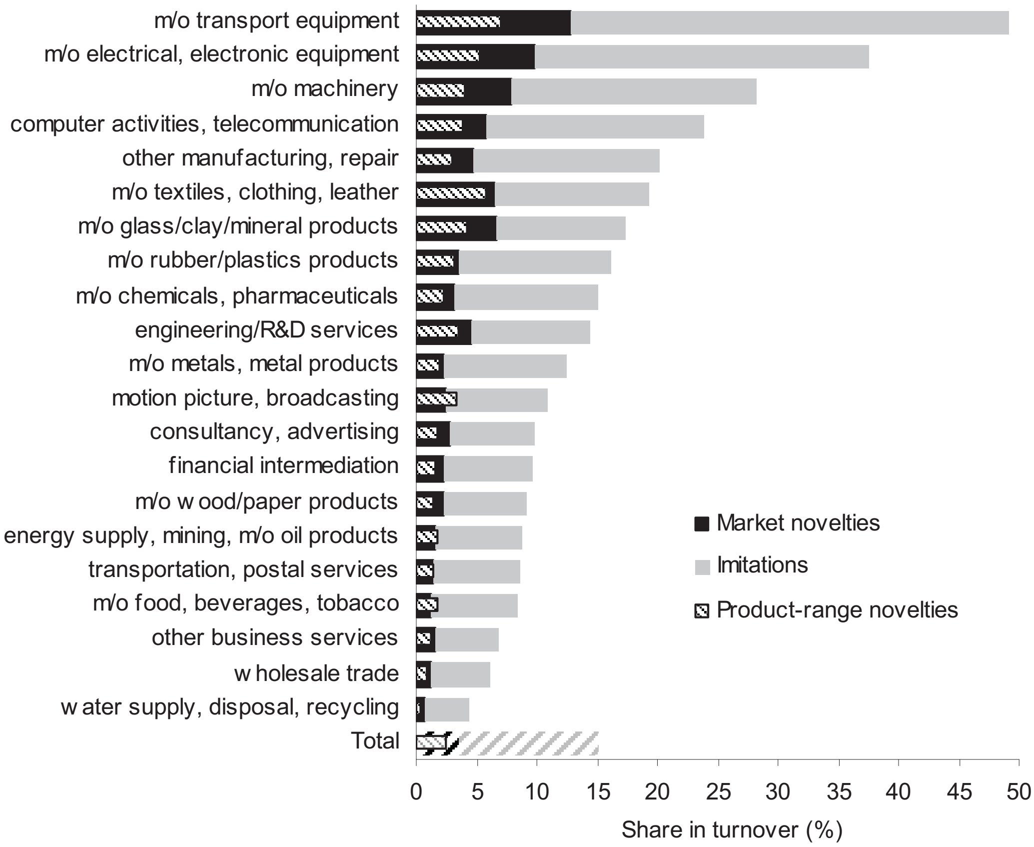


Note: 2006 break in series.

Innovation indicator values vary greatly from industry to industry. Figure 25 depicts the shares of turnovers due to product innovations with different degrees of novelty in various sectors in the years 2002 and 2010, respectively. The innovation success figures range from 5 (6) per cent in wholesale trade to 49 (50) in transport equipment in 2002 (2010). Large parts of the turnover due to new products in the German economy are due to the automotive industry. 23 per cent of the German economy's sales revenue from product innovations originated from this particular industry in 2002. In the course of the 2000s, the automotive sector has succeeded in even expanding this share to 27 per cent in 2010. Other industries with high absolute sales revenue from innovation are banking/insurance, electronics, mechanical engineering, chemicals and even wholesale trade. However, these large amounts do not all account for correspondingly large shares of industry turnover. While electronics (38 and 50 per cent) and mechanical engineering (26 and 28 per cent) achieve a considerable proportion of turnover with new products in

2002 and 2010, respectively, the share is smaller in chemicals (13 and 15 per cent), banking/insurance (12 and 10 per cent and wholesale trade (5 and 6 per cent). The instruments industry and IT/telecommunications (29 and 24 per cent in 2002 and 2010, respectively) also have large shares of turnover due to product innovations.

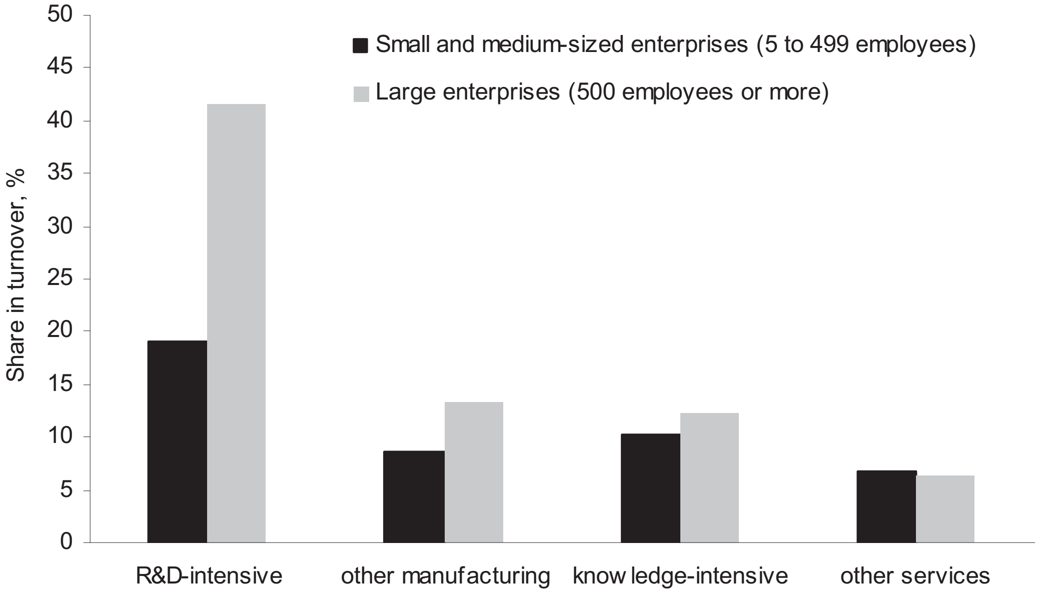
Figure 25. Product innovation success 2010, by industry



During the 2000s, electronics, mechanical engineering and the glass industry have succeeded in expanding their product innovation success disproportionally, whereby this expansion was also due to market novelties in the glass industry. In contrast, in electronics and mechanical engineering, the increasing product innovation success is largely due to imitative product innovations. Despite an overall trend towards increasing innovation success, product innovation success declined in metal, wood and textiles during the 2000s. The other indicators for success with product innovations show a similar pattern for various industries. The highest share of turnover from market novelties has been achieved in the automotive industry (12 per cent), electronics (10 per cent) and mechanical engineering (8 per cent) in 2010, followed by glass and textiles as well as IT/communications (each 6 per cent). In 2002, electronics reached the highest share of turnover from market novelties (18 per cent), followed by the automotive industry and IT services (each 12 per cent) and R&D-related services (10 per cent). These industries also achieve high shares of turnover due to product-range novelties in the respective years. It must be mentioned that sector differences between the success rates of market and product-range novelties are not that pronounced as between imitative and market novelties.

It is important to note that the share of sales generated by product innovations is determined to a great extent by the sector's average product life cycle. It is for this reason that the chemical and pharmaceutical industry, for example, is somewhat behind in terms of product innovation rates. Its products are often on the market for 10-20 years, compared to product life cycles that are often no more than 2-5 years for IT and communications technologies. In some sectors (for instance, mining) technological peculiarities of production processes might, furthermore, render product innovation activities difficult. Product innovation rates are further affected by differences in technological opportunities between sectors (cf. Geroski, 2000; Gilbert, 2006). Frequent introductions of market novelties in IT/communications and other sectors at the beginning at the 2000s can consequently be attributed in large parts to new product opportunities due to emerging information technologies.

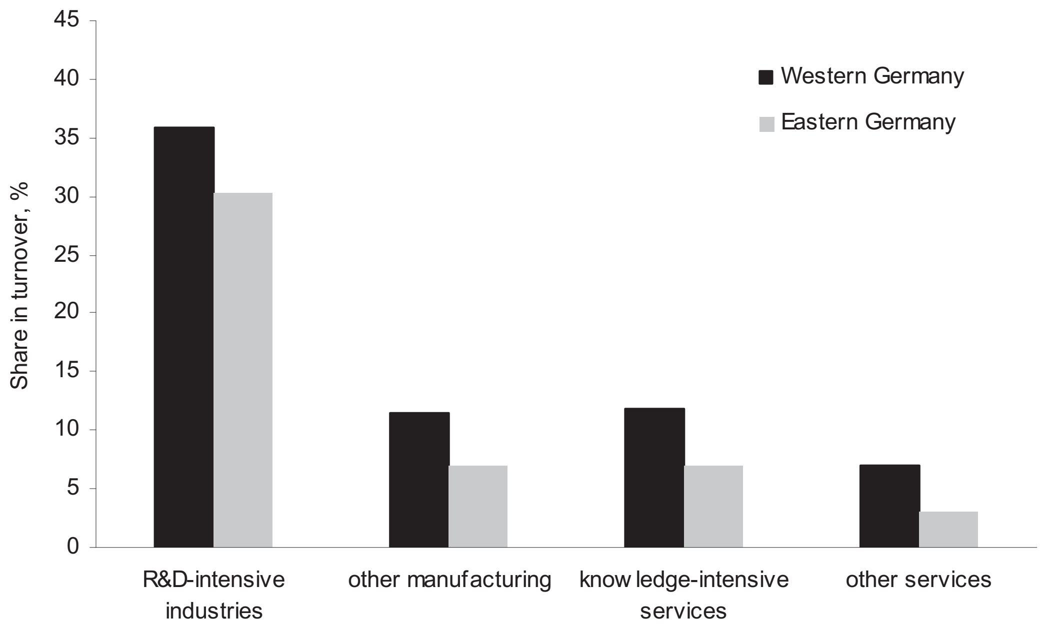
Figure 26. Share in turnover due to product innovations 2010, by size class and main sector



Innovations result from firm's long-term investment in its knowledge base and are usually exploited through firm's own output. Due to these features of the innovation process, large firms are more active in innovation (Cohen and Klepper, 1996). Larger firms can spread the large fixed (and to large extent sunk) costs of R&D and innovation over more output units during the innovation process. They are, consequently, considered as being advantaged in innovative activities. Apart from indivisibilities and fixed cost considerations, internal funds are frequently used for innovation projects, which smaller firms may lack. This shortage can hardly be compensated by turning to external capital markets, since required rate of returns from externally funded innovation are often higher than corresponding rates on internally funded ones (Hall, 2010). In view of large fixed costs, limited internal funds in conjunction with uncertainty and risk regarding the outcome of innovation projects, smaller firms are frequently more reluctant to engage in innovation than larger firms. Lower innovation rates and size disadvantages of smaller firms are also reflected in the innovation success figures of German firms.

Figure 26 correspondingly reveals that sales of small and medium-sized enterprises to a lesser extent originate from innovative products than sales of large enterprises. This is true for all major sector groupings in 2000 and 2010. One exception is the other service sector in 2010. Here, small and medium-sized enterprises achieve 6.8 per cent innovative sales in comparison to 6.4 per cent of their large counterparts. The differences of innovation success between smaller and large firms are especially pronounced in R&D-intensive industries. In the year 2000, 19 per cent of SMEs' turnover has originated from product innovations in comparison to 48 per cent for large enterprises. The differences between SMEs and large enterprises have diminished in 2010. This is, however, due to declining rates of innovation success of large enterprises.

Figure 27. Share in turnover due to product innovations 2010 in eastern and western Germany



Innovation activities are widely considered the key for the aspired convergence of economic conditions between Eastern and Western Germany. Policymakers have therefore focused transfers to Eastern Germany on innovation, research and development (Czarnitzki and Licht, 2006). The large expenditures for innovation of East German firms are, however, not reflected in higher rates of innovation success. The effectiveness of innovation processes in Eastern Germany lags behind Western Germany. Figure 27 depicts the innovation success rates for firms in

Eastern and Western Germany. Despite a convergence in innovation participation, the gap in innovation success remains open in 2010. Compared to figures of 2000, the gap even widened for firms in many sectors. However, in R&D-intensive industries the gap has closed to some extent, which is mainly due to declining overall success rates in this sector.

5.2 Process Innovation Success

Product innovations introduce new varieties with the aim to satisfy customer needs in an improved manner. Process innovations constitute another channel by which innovations improve economic prosperity and welfare. They include new or significantly improved production technologies or delivery methods. Production methods involve techniques, equipment and software, that are used to produce goods or services. Delivery methods thereby concern the logistics of inputs, intermediate outputs and final products.

Cost savings and improvements in quality
Cost saving process innovations are new or significantly improved production, delivery or distribution methods that lead to a reduction in the average unit costs of production or service delivery. They are a mean to increase a firm's price competition.
Quality improving process innovations are new or significantly improved production, delivery or distribution methods that increase the quality of a product or service. They are often linked to product innovations. Improved quality typically enhances a firm's sales opportunities. Information on quality improving process innovations is registered in the innovation survey since 2002.

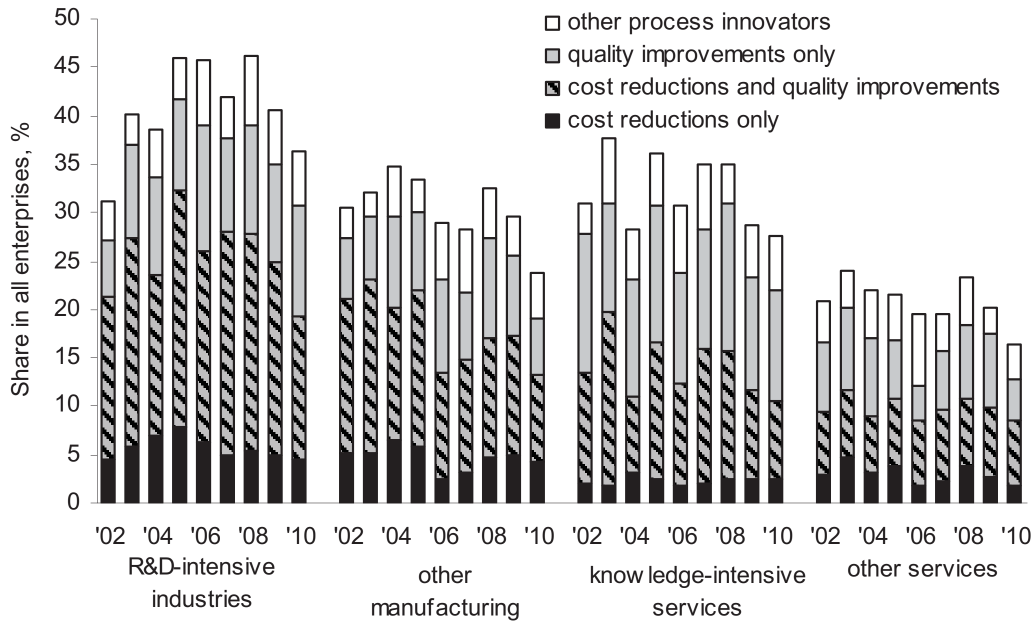
Process innovations can be introduced for several purposes. They may accompany product innovations by installing new technologies in order to be able to produce a new commodity. Moreover, process innovations may aim to improve the quality of goods and services by implementing new or significantly improved production, delivery, or distribution methods. Quality-improving process innovations are often linked to product innovations, since both aim to satisfy customer needs in an improved manner. Increasing productivity is another major purpose of process innovations. Cost saving process innovations or rationalization innovations, respectively, are new or significantly improved processes that are intended to reduce average unit costs of production or delivery. Productivity enhancing process innovations provide competitive advantages to the innovator by allowing higher mark-ups and/or increasing demand by lowering prices. From a theoretical viewpoint, the effect of rationalization innovations on macroeconomic employment is ambiguous.[9] In the short run, firm's ability to produce the same amount of

[9] For an overview on the debate of technological progress' impact on employment, see Petit (1995) and Freeman and Soete (1997).

output with less input should decrease labour input. Still, this static displacement effect may be compensated by a dynamic demand increase, which can result from price reductions made possible by process innovations. The empirical evidence indeed indicates that negative displacement effects of process innovations may be compensated (König et al., 1995; Harrison et al., 2008).

Figure 28 shows the development of the process innovator rate during the 2000s. It starts from 2002, the first year for which the distinction between cost-reducing and quality-improving process innovation is surveyed. The share of process innovators apparently fluctuates more over the years than that of product innovators. This indicates that process innovations have a short-term focus. Such innovations often involve investing in new plant equipment or IT solutions and are often implemented over a short period of time.

Figure 28. Process innovators by purpose of process innovations 2002-2010, by main sector

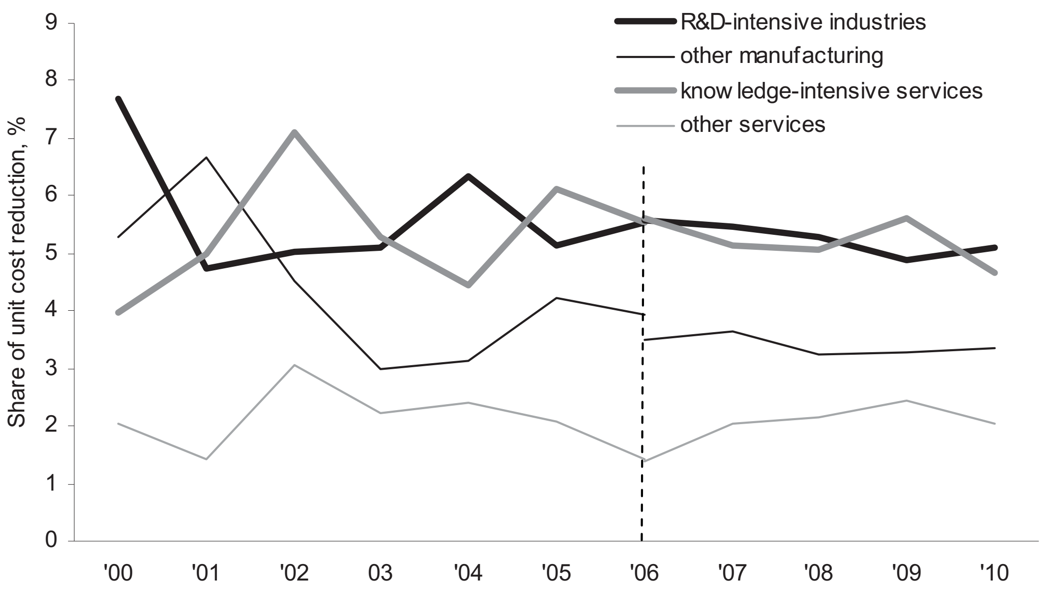


Note: 2006 break in series.

The difficult economic conditions in Germany at the beginning of the2000s left their mark on firm's process innovation activities. Low degrees of capacity utilization, low cash-flows and difficulties to source external funds have led to declining process innovation rates. From 2003 onwards, process innovation activity has increased despite the initially still adverse macroeconomic environment. Apparently, firms cannot abstain from their rationalisation innovations for too long without endangering their competitive positions. Indeed, the competitiveness of the German economy depends essentially on cost-efficient, high yield production. Consequently, this increase in process innovation rates has in large parts been due to the manufacturing sector in which many firms compete on the global marketplace. In service sectors, cost-reducing process innovations are less prevalent. Process innovations have, however, initially rested rather on less cost-intensive possibilities of process optimisation - through organisational measures in conjunction with the implementation of new information technologies as well as continued improvements based on installed technologies– than on large investments in new process technologies.

Quality improvements through process innovations are more important for German firms than mere cost reductions. This is especially the case for R&D-intensive industries. Here, between 70 and 78 per cent of process innovators aim at quality improvements. The respective shares are also high in knowledge-intensive services. They range between 71 per cent in 2004 and 82 per cent in 2008, although overall process innovation activities are lower. Large parts of process innovation activities of German firms thus resemble product innovation by aiming at improved satisfaction of customer needs. At the current edge in 2010, process innovation activities that aim at quality-improvements decline markedly in most of the sector groupings. Only in knowledge-intensive services is the decline not quite as pronounced. Quality-improving process innovations do not, however, reach levels of the beginning 2000s in knowledge-intensive services. Quality improvements have been the most prevalent in service sectors in 2008. During these favourable cyclical conditions, the proportion of firms conducting process innovations that neither yielded cost reductions nor quality improvements has been especially high. In a large number of these cases the innovations in question have been new processes necessary for the manufacture of new products. This reflects the increased focus on product innovations on this period.

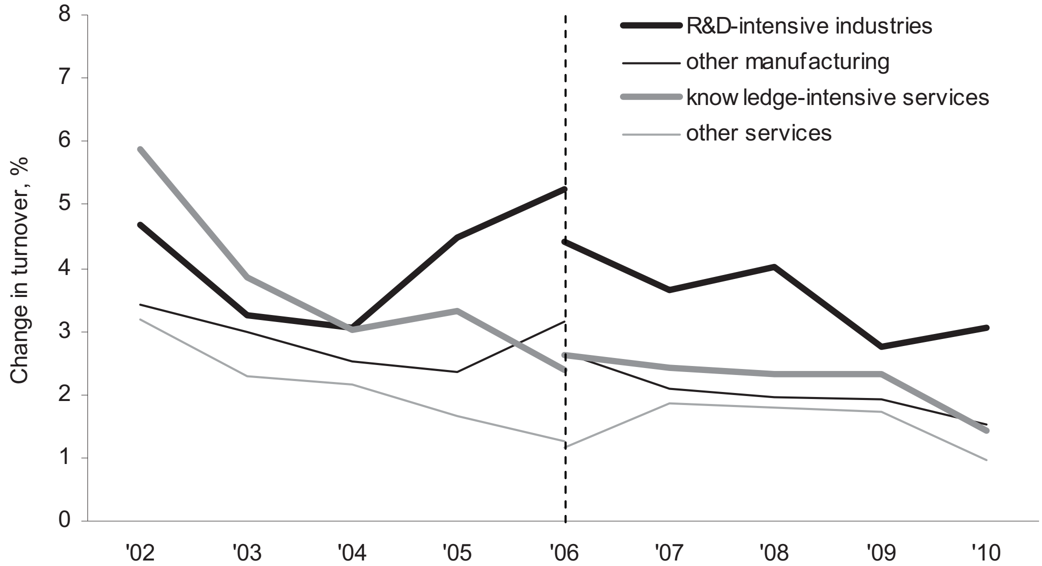
Figure 29. Cost reductions due to process innovations 2000-2010, by main sector



Note: 2006 break in series.

The results presented in Figure 28 overwhelmingly reflect the innovation behaviour of small and medium-sized firms since they constitute the major part of firms in the German enterprise sector. Figures 29 and 30 depict quantitative measures for the economic success due to process innovations, which are mostly driven by large enterprises, since they account for the major proportion of cost savings and economic benefits from quality improvements. Figure 29 reveals the high levels of unit cost reductions in German manufacturing at the end of the 1990s. During the subsequent phase of economic stagnation, process innovations have frequently been postponed. This is also reflected in declining rates unit cost reductions. When economic conditions improved from 2004 onwards, productivity improvements increased, too, in German manufacturing. These cost reduction levels have been maintained in preceding years without reaching the high levels of the beginning 2000s. Productivity-enhancing cost reductions are especially prevalent in German R&D-intensive industries and knowledge-intensive services. Initially high levels in other manufacturing sectors have not been sustained. In other service sectors, their quantitative impact is of subordinate level.

Figure 30. Increase in sales due to quality-improving process innovations 2002-2010, by main sector

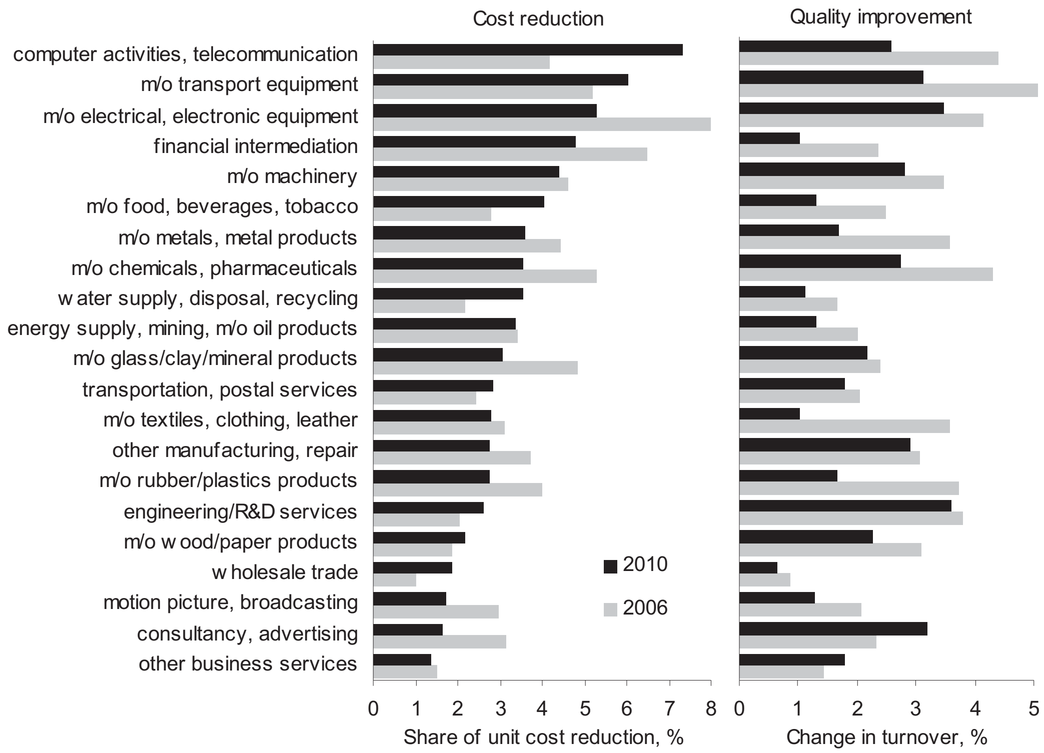


Note: 2006 break in series.

Quantitative effects of quality-improving innovations are measured by the resultant increase in turnover from 2002 onwards. During the enduring stagnation, process innovations were mainly based on cost-effective possibilities of process optimisation through organisational and ICT-related measures on the basis of installed technologies. Sales increases due to quality-improving process innovations were correspondingly high in 2002. With continuously difficult economic conditions, their quantitative impact declined until 2004. Subsequently, their impact on stimulating demand has increased in German manufacturing until 2006. Their quantitative effects in R&D-intensive industries have surpassed success rates in knowledge-intensive services before starting to decrease again. Over the 2000s, sales increases due to quality-improving process innovations declined in all major sector groupings. Especially worrisome is the resulting continuous decline in knowledge-intensive services, although the high rates in 2002 might partially reflect one-time effects due introductions of new information technologies.

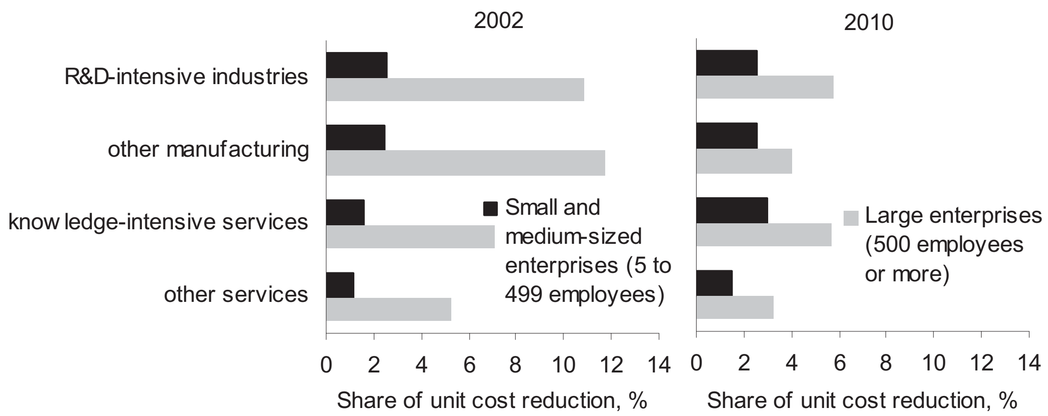
A comparison of process success indicators between 2006 and 2010 confirms a large ICT component in the high rates of unit cost reduction. Corresponding rates grew in the computer activities and telecommunications industry from 4.2 per cent in 2006 to 7.4 per cent in 2010. In contrast, sales increase due to quality improvements fell in this industry from 4.4 per cent in 2006 to 2.6 per cent in 2010. In engineering services and consultancy/advertising, both further important industries within knowledge-intensive services, sales increases due to quality improvements were significantly higher in 2010 compared to 2006 while unit cost reductions remained at a low level (engineering services) or declined (consultancy/advertising). The increasing focus on product innovations in the past years has led to decreases in process innovation success in many manufacturing industries. Marked declines in unit cost reduction can also be observed in the manufacture of metals, chemicals/pharmaceuticals, electrical/electronic equipment and glass, clay and mineral products. The manufacture of metals, chemicals, machinery, transport equipment, and rubber/plastics products experienced a marked decrease of the sales level changes due to quality improvements.

Figure 31. Process innovation success 2006 and 2010, by industry



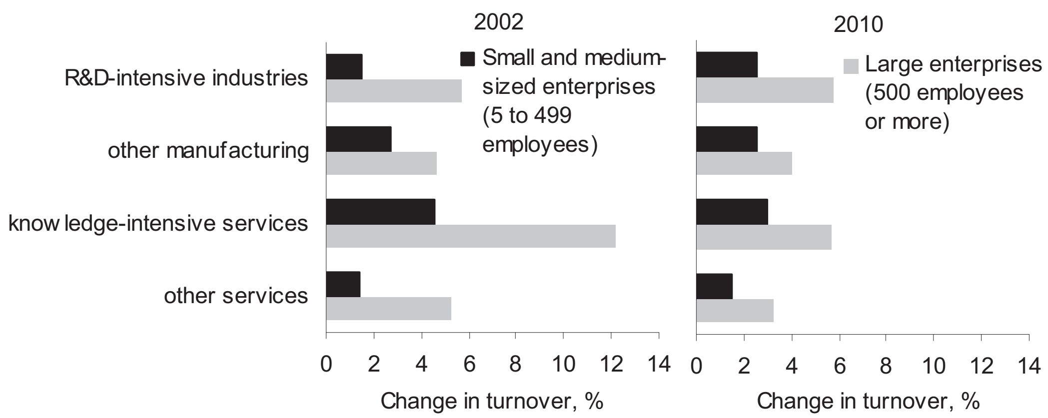
The success rates of process innovations are mainly driven large enterprises with more than 500 employees. Performance differences between SMEs and large enterprises are even more pronounced than for product innovations. Cost spread-ing advantages of large enterprises are higher for process innovations than for product innovation. They are less saleable in disembodied form and generate less growth (Cohen and Klepper, 1996b). Initial size therefore matters to a higher extent. The decreasing success rates of process innovations in the 2000s are consequently mainly due to large enterprises. Quality-improvements declined especially in large manufacturing enterprises. Small firms in knowledge-intensive services even succeeded in improving their success rates due to quality improvements. Reductions in unit costs declined overwhelmingly in large firms of knowledge-intensive services. However, productivity improvements also declined in other service sectors and among small and medium-sized knowledge-intensive service providers.

Figure 32. Cost reductions due to process innovation 2002 and 2010, by firm size



Note: 2002 and 2010 values not fully comparable due to break in series.

Figure 33. Increase in sales due to quality improving process innovations 2002 and 2010, by firm size



Note: 2002 and 2010 values not fully comparable due to break in series.

6 Financing of Innovation

Financing innovation activities is subject to particular forms of market failure that can form major obstacles for the successful introduction of innovations. In addition to the well-known challenges of reaching a socially optimal level of investment such as *moral hazard* and *asymmetric information*, innovation investments share characteristics such as particularly risky outcomes, unstable cash-flows of returns and an intangible nature, each widening the "funding gap", the spread between internal cost of capital and external.

Due to the imperfect financial market, firms are likely to switch to internal funding of innovation projects. However, the availability of retained earnings is limited in its nature, especially for small or new enterprises. In more severe cases, the lack of possibilities to finance innovation activities by debt may even bring firms to abandon otherwise profitable projects completely.

Nevertheless, the social benefits of these innovation activities can be substantial. That is why the issue of innovation financing comprises important implications for policy makers. The following chapter presents theoretical considerations on the financing of innovation activities and provides empirical evidence of the 2007's version of the Mannheim Innovation Panel (MIP). The MIP contains a specially designed survey question on the relevance of different sources for financing innovation, the presence of financial constraints firms face, and the role of external funding for innovation activities.

6.1 Sources of Financial Constraints

Investors, willing to engage in financing innovative projects, face a multitude of economic difficulties (Hall and Lerner, 2009). Firms usually possess insider information about the risk profile and the expected return of their projects. This fact creates a situation of *asymmetric information* for investors. Without informative signals at hand, they are at risk always of encountering bad projects, denoted as "lemons" (Akerlof, 1970) in the literature. In the better case, information asymmetries increase interest rates for innovators, which leads to a distortion from the socially optimal rate of investment. However, if this premium for the risk of investing in a "lemon" is too high compared to the profitability of other opportunities firms with actually good projects have, the market possibly shuts down completely. In any case, asymmetric information drives the gap between the costs of internal and external funding.

Equity holders, such as, for example, venture capital investors, are equipped with more control and information rights which reduce the information costs. In addition, other than creditors, they participate fully in the positive returns of a project. The asymmetrical distribution of returns for creditors is a severe problem in acquiring loans (Müller and Zimmermann, 2009). In case of failure, investors lose their entire invested capital, whereas, in case of success, they only obtain a fixed interest payment.

An adjacent problem is the unobservable actions of funded innovative firms once investors have decided to engage in a project. The literature denotes this familiar topic as *moral hazard,* or principal agent problem. Agents, who conduct the innovation project, might be less risk-averse than the principal due to the specific structure of payment contracts. For example, if managers were compensated only in the case of success, they would probably induce very risky actions in terms of potential loss, just to promote their success probability. Oftentimes, this is not in the interest of investors or firm owners, who would risk the total deficiency of their invested capital, risk premium of funding in the first place increase, often to an unsustainable level.

These phenomena are not exclusive to innovation, but rather a general problem in finance. Nevertheless, investments in innovation share certain characteristics that intensify the problems, especially of debt financing. One feature is the great amount of uncertainty inherent in innovation activities. Traditional finance models, which motivate the behaviour of investors, rely on well-specified notions of risk such as distributions of future profits. Risk becomes analytically tractable because of the well-defined moments of these distributions, most importantly the mean and variance (e.g., in the capital asset pricing model). For innovation projects, uncertainty can not only be very high but may also not follow standard stochastic processes, which makes the assessment of risk a difficult task.

The specific nature of investments in innovative technologies is another complicating factor. Ideas for new products or new processes and the technological aptitude to transfer these ideas into actual innovations are non-physical goods. Since human capital plays a dominant role in this process, wages of highly skilled workers account for a main part of expenditures in innovation projects. The created know-how is very specific to certain projects and to the specific environment in which it is created. Thus, investments in innovation do not provide collateral in the way, for example, a credit for new production facilities does. The assets created by innovation activities are intangible. It is difficult to liquidate them in the case of bankruptcy, which worsens the credit crunch.

Future cash-flows of innovative projects are usually very unstable and left-skewed. A debt-service with normal payments by instalments is therefore difficult to realise. Contracts that would induce optimal agent's behaviour might be unfeasible to this extent. External funding by loans becomes more costly.

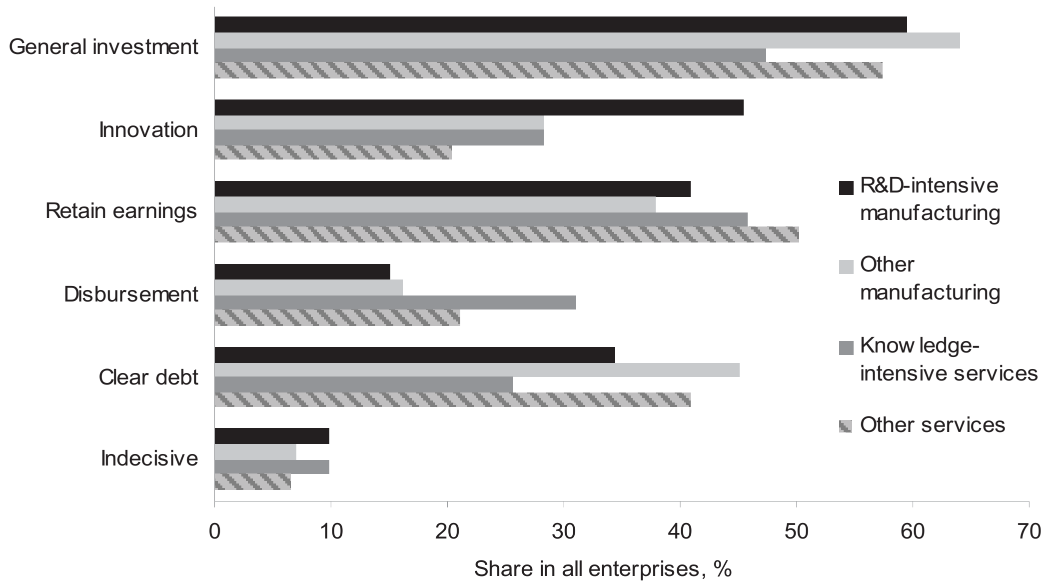
For all the mentioned reasons, innovative firms are likely to be credit constrained. A natural solution is to rely on internal funding and to cover investments by current cash-flows, if available. The problem is most severe for small and young firms. On the one hand, the smaller a firm, the more specific its market segment usually is. The intangibility of the innovation assets thus becomes even more pronounced. On the other hand, small and medium-sized enterprises' (SME) internal financial resources can easily be exhausted by extensive research projects. Especially for younger firms, the problem of asymmetric information and moral hazard increases. They do not have a business history that could inspire confidence by investors, as well as lacking established business relationships with investors.

6.2 Extent of Financial Constraints for Innovation

In 2007, the MIP contained a survey question that was designed to answer the question whether firms suffer from credit constraints to their innovation projects. Hall (2008) proposes an ideal experiment to test the hypothesis of financially limited innovators. If firms would be given additional liquidity exogenously, and they would react by investing this additional cash in new innovation activities, it would be clear evidence for constraints on the financial side. Since the exogeneity assumption renders natural experiments difficult, the survey contains a thought experiment in which firms should indicate how they would spend unexpected excess liquidity of 10 per cent of their previous year's turnover.

Figure 34 displays the percentage of positive answers for different purposes of use. More than 20 per cent of firms in all sectors would also invest in additional innovation projects. In the R&D-intensive manufacturing sector, this share even accounts for 45 per cent. Although this possibility is not the most prominent, it nevertheless is an indication for innovation projects that lie in the firm's drawers due to insufficient funding.

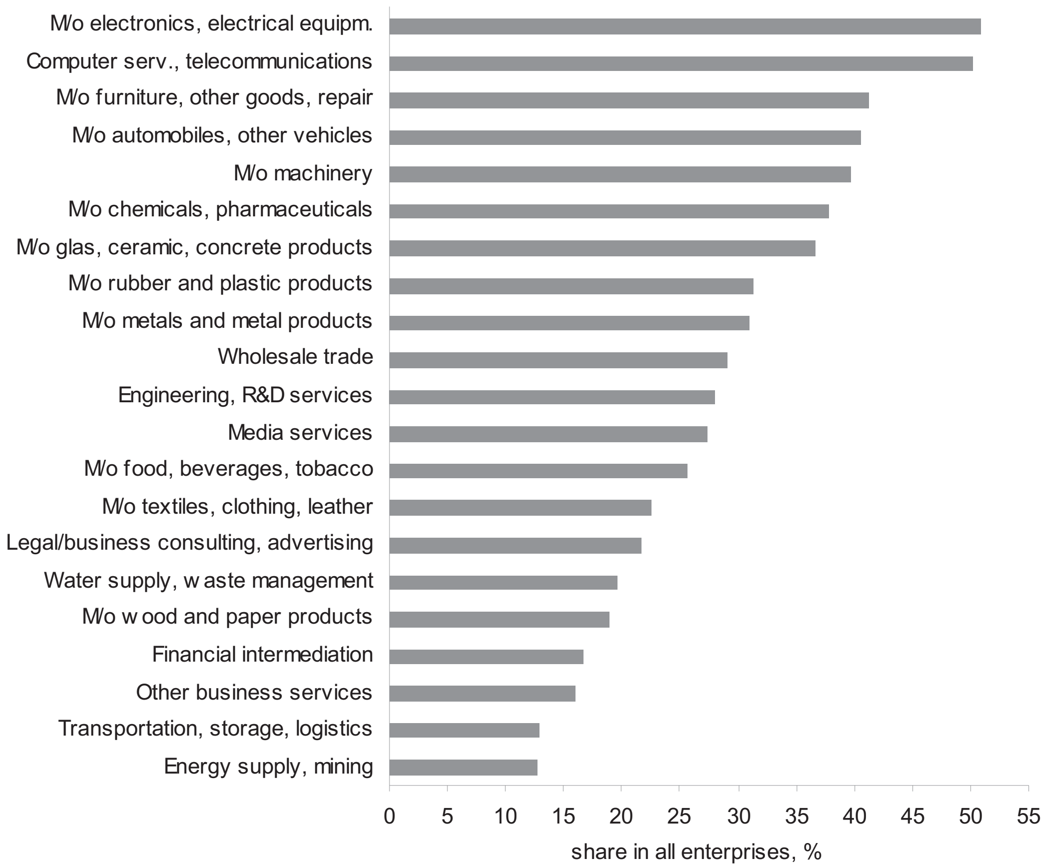
Figure 34. Use of additional financial resources, by main sector



Response of firms on the question what they would do if they unexpectedly receive additional cash of 10 per cent of their last year's turnover. Multiple answers allowed.

Not surprisingly, the results for additional innovative activities vary substantially by industry. There is a clear pattern that more R&D and knowledge-intensive sectors are more sensitive to additional liquidity. Figure 34 shows the share of firms that would use additional cash (among others) to finance innovation. More than 50 per cent of the firms in the electrical and electronics industry would engage in innovation projects if they experienced an unexpected positive liquidity shock. Firms in less dynamic environments, with regard to innovativeness, would rather spend the money otherwise.

Figure 35. Additional innovation activities in case of a positive liquidity shock, by industry

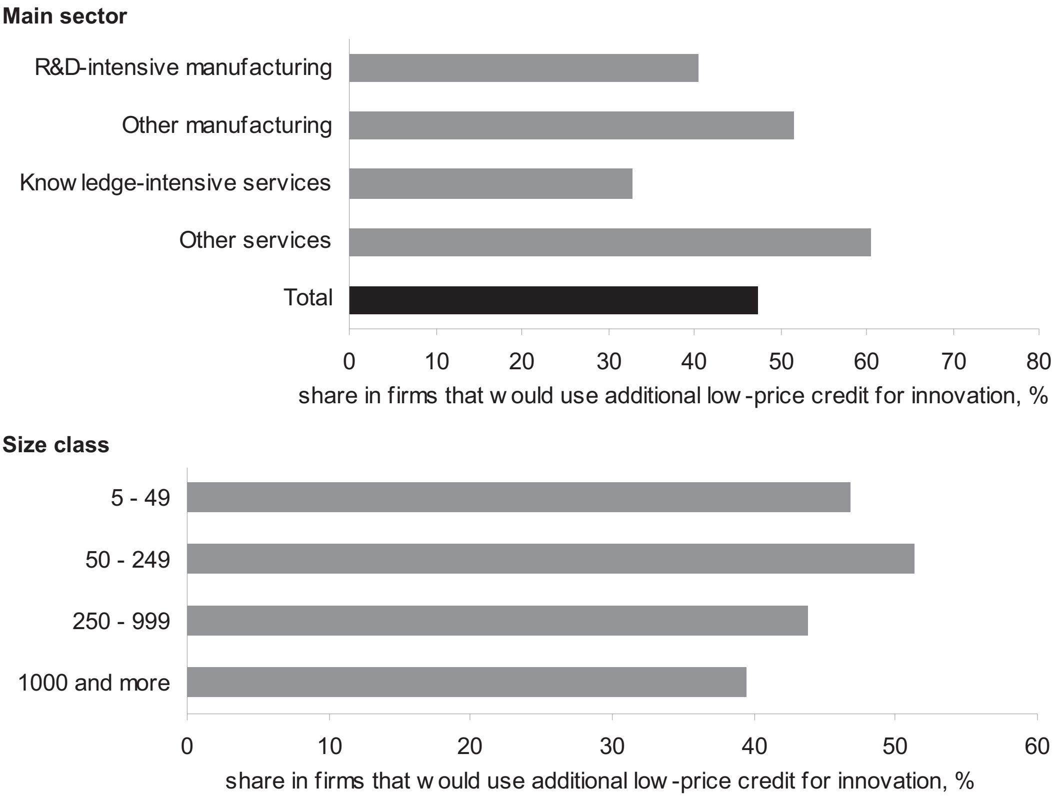


Enterprises that would use unexpected additional cash (10 per cent of last years' turnover) to finance innovation activities.

However, the analysis of a reaction to a "financial gift" could be misleading. Firms are potentially inclined to spend this costless liquidity on very risky projects that they would otherwise ignore. As to refine the assessment of credit constraints, firms were therefore asked whether they would stick to their decisions in case the excess liquidity would be provided by a loan with low interest rates. The question had to be answered only by firms that would use additional cash to fund either general investments or innovations. An additional engagement in innovation activities financed by a bank loan would be a strong indicator that firms are in possession of worthy projects, but that they are unable to acquire reasonable priced funds for them; thus, strong evidence for credit constraints.

In general, 47 per cent of the firms that engage in additional innovation activities would also continue to do so if liquidity would be provided by a bank loan at reasonable costs and in case additional cash is available. Grouping according to industry sectors shows that the share is the highest among firms form other (i.e. not knowledge-intensive) services and other (i.e. not R&D-intensive) manufacturing (Figure 36). Since the positive response to both a liquidity shock and a loan strongly indicates the presence of credit constraints, it can be argued that these sectors are particularly disadvantaged. This is probably due to non-established credit relationships with banks since innovation projects are less common in both sectors. However, in the R&D and knowledge-intensive sectors a substantial share of firms also seem to be credit constrained in their innovation activities.

Figure 36. Additional innovation activities also in case of availability of reasonably priced loans, by main sector and size class



Share of firms that would also invest in additional innovation activities in case that liquidity would not be provided as additional cash, but through a reasonable priced bank loan.

According to size, there is no notable dispersion among firms. Very large firms would most likely use reasonably priced loans to fund additional innovation projects. Small firms seem to be credit constrained more often than medium-sized and medium-large firms. This result is somewhat in contradiction to the theory that it is particularly the SMEs that suffer most from financing constraints. The high share of very large enterprises with more innovation activities in case of better loan financing conditions points to the fact that these firms often have a large number of ideas for innovative activities while limited resources only allows to pursue the most promising ones. An increase in resources in these firms would result in testing a larger number of innovative ideas.

The results presented here are in line with the more detailed study of Hottenrott and Peters (2012). They employ an econometric framework that is capable of showing the severity of credit constraints for innovation investments. According to their conclusion, firms with a high innovative potential, due to a skilled work force, are very likely to be financially constrained. Investors do not appropriately account for this higher capability and these firms are therefore forced to underinvest. Additionally, firms with low financial resources were the least likely to invest in innovation. However, they are prone to invest the additional funds in physical capital. Thus, the pattern for general investments and innovation activities seem to differ substantially.

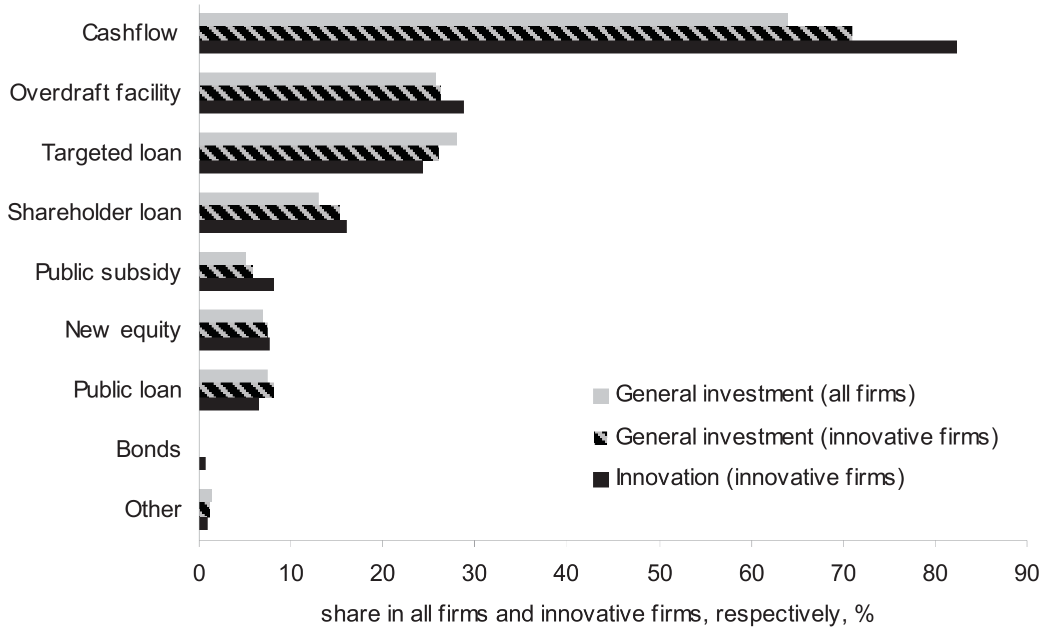
6.3 Funding Sources for Innovation

If firms are credit constrained, they are likely to switch to non-debt financing of their innovation projects. In the 2007 MIP, firms reported the types of funding sources they use to finance general investment (e.g. for fixed assets) or innovation activities. To limit response burden, only information on whether a certain funding source was used within the 2006 to 2008 period was collected, but no information on the share of each source in total investment or total innovation expenditure. For this reason, sources that are used only occasionally or that provide only a small contribution to total funding needs are overrated when looking at the share of firms that have used a particular source.

Figure 37 shows that cash flow is the most important funding source both for general investment and for innovation. Innovative firms more often rely on cash flow for funding general investment compared to non-innovative firms. A higher share of innovative firms uses cash flow to finance innovation compared to financing general investment. For the other funding sources, there is little dispersion between the sources used for general investment and for innovation projects, and there are only minor differences between innovative and non-innovative firms when financing general investment.

With respect to debt financing, targeted credit lines and overdrawing firm's bank accounts are the most common sources. Especially the latter is popular among small firms which only need limited amounts of money to cover their investment needs (such as purchasing new IT equipment or small-scale machinery). Although this source is very costly, firms value its flexibility (Peters and Westerheide, 2011). Overdraft facility is used by 26 per cent of firms to fund general investment, and by 29 per cent to fund innovation. The respective shares for targeted loans are 28 and 24 per cent, and for shareholder loans 13 and 16 per cent.

Figure 37. Sources of funding for general investment and innovation activities 2006-2008



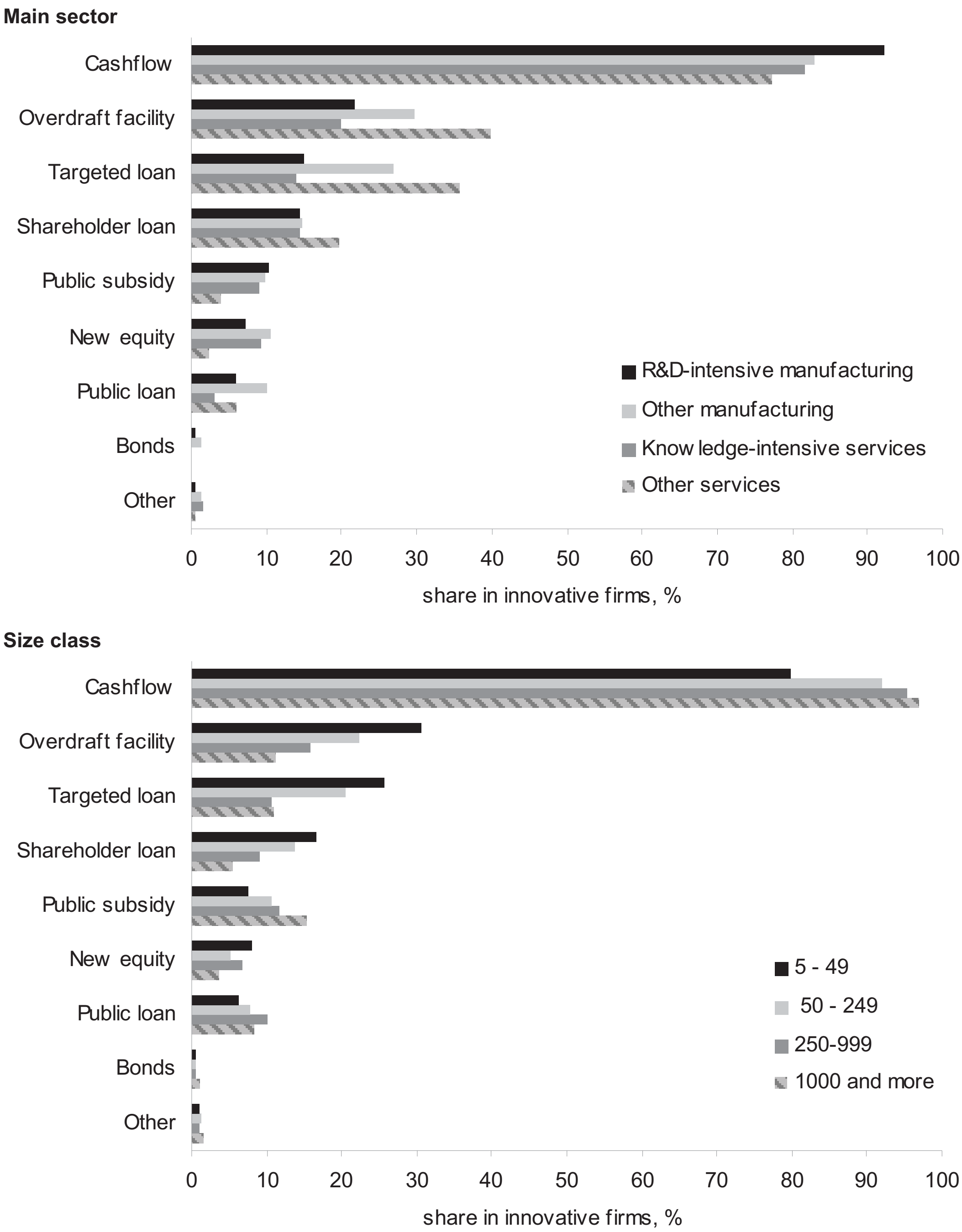
Firms that used the source to fund general investment and innovation activities, respectively.

Public money is rather rarely used to finance investment or innovation. 5 per cent of all firms use public subsidies to finance at least parts of their general investment, and 8 per cent of innovative firms use subsidies for innovation financing. For public loans, the shares are quite similar (8 and 7 per cent, respectively). Especially for small firms the cost of applying for subsidies or public loans seems to be too high or the specific know-how to get to these sources is simply absent. For larger firms these problems appear to be mitigated, however, as only 9 per cent of the largest firms in the data set use public loans to promote innovations. Public subsidies seem to play a slightly more dominant role in Germany.

New equity by shareholders or by new investors such as venture capitalists is used by 7 to 8 per cent of firms to finance investment or innovation. The issuing of bonds to finance investment or innovation is nearly absent, even in large firms. Cash flow tends to be more important in R&D-intensive manufacturing to finance innovation activities. More than 90 per cent of innovative firms use this source (Figure 38). In other services and in other manufacturing, a higher share of innovative firms uses overdraft facilities and targeted credits to fund innovation. While public subsidies are used by about 10 per cent of innovative firms in R&D-intensive and other manufacturing as well as in knowledge-intensive services, public loans are primarily a funding source in other manufacturing and in other services.

Innovative firms of all sizes predominantly use internal funds (Figure 38). Nevertheless, the limits of this source of funding seem to be within more narrow limits for smaller firms. 80 per cent of small innovative firms, compared to 96 per cent of large innovative firms, use their cash flow to finance innovation. For somewhat larger innovation projects, costs can easily exceed the annual income of SMEs and complicates financing from cash. In addition, many small firms are in the markets with strong price competition that leaves little room for profits. As a consequence, there is no choice other than to rely on external sources such as bank loans. For this reason, small firms report a significantly higher share that use overdraft facilities, targeted loans and shareholder loans to finance their innovation activities. Larger firms more often use public subsidies to co-fund at least some of their innovation projects.

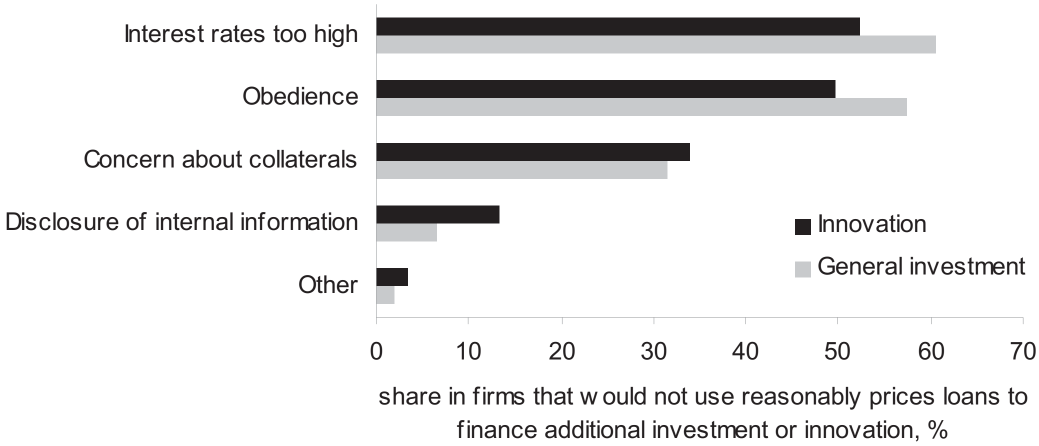
Figure 38. Sources of funding for innovation activities 2006-2008, by main sector



6.4 Reasons for refraining from debt financing

The survey also asked for the reasons why debt could be less popular among firms to finance innovation even in case of reasonably priced loans. Especially the disclosure of sensitive project details to investors might be a reason of concern in the context of innovations. However, only 13 per cent of the firms that would engage in additional innovation activities when given extra liquidity through cash flow would refrain from funding additional innovation by a low-priced loan according to this reason (Figure 39). High interest rates are the most dominant obstacle, which confirms the hypothesis of increased interest rates due to asymmetric information. 34 per cent of the respondents indicated concerns about the collateral demanded by banks. Especially smaller firms should have problems to provide adequate securities for risky innovation projects. In addition, especially owner-managed firms usually have a strong preference against losing control rights to potential investors (Peters and Westerheide, 2011). The distaste for dependence on an external creditor is of concern for 50 per cent of firms that refrain from using loans instead of cash flow for financing additional innovation activity.

Figure 39. Reasons for avoiding loans as source of funding for innovation and for general investment



Multiple answers allowed.

Compared to the reasons why firms would avoid loan financing of additional general investment, disclosure of information is a more important obstacle when it comes to financing additional innovation through loans, while too high interest rates and dependence play a less prominent, though still dominating role.

In conclusion, empirical evidence suggests that a large share of firms could be motivated to invest in more innovation activities if they would obtain additional financial resources. Especially highly innovative firms in research dependent industries would become more innovative. Since this effect remains if firms were to obtain liquidity via reasonably priced loans, one can conclude that they suffer from credit constraints on the financial market.

Internal funds are by far the most favoured source of financing additional innovation projects. If firms underinvest in innovation, there is room for public policy to raise investments to a social optimum. To promote innovative behaviour, cash-flow based elements should be the first choice. Public loans would have a much smaller effect, especially because smaller firms, usually those that have the most difficulties with acquiring external loans, are most likely to be prevented by the administrative costs of requesting public funds.

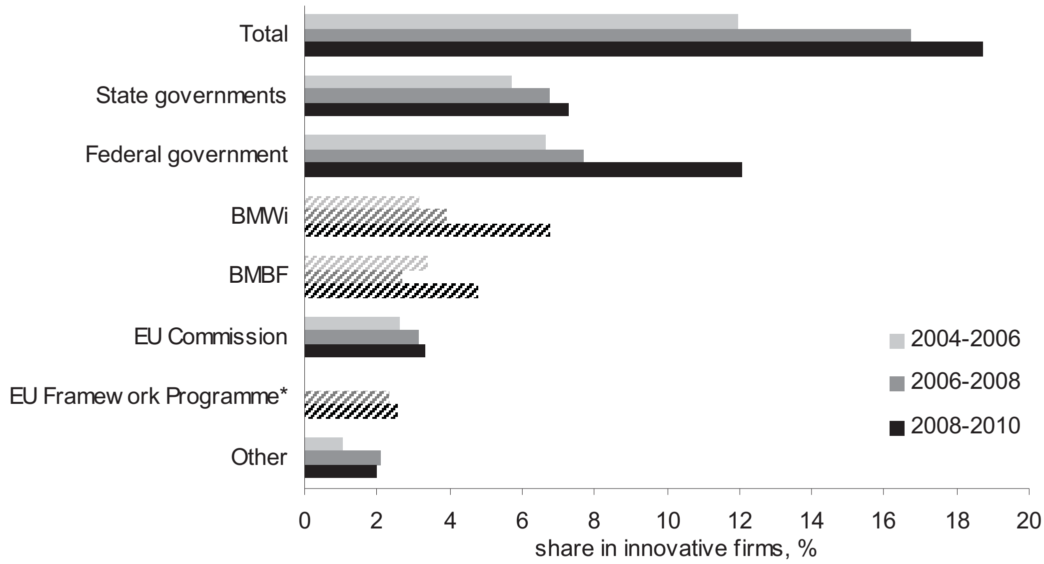
Another implication is that innovation activities are highly dependent on the business cycle. The current cash flow of a firm varies strongly with the overall activity in an economy. Innovation projects, financed by retained earnings, therefore behave very sensitively to it.

6.5 Public Financial Support to Innovation

Though public subsidies and loans play a rather minor role as a funding source for innovation in the German business enterprise sector, these sources can be particularly attractive for firms as they provide additional cash (in case of subsidies) or access to low-cost debt (in case of loans) which relieves a firm's financial situation and reduces the risk exposition of innovation activities. Over the past six years, the share of innovative firms that received financial support for their innovation activities from the government has significantly increased. In the 2004-2006 period, 12 per cent of innovative firms received public financial support. This share rose to 17 per cent in 2006-2008 and 19 per cent in 2008-2010 (Figure 40). The federal government increased its funding activity substantially, the share of innovative firms receiving grants or subsidised loans from a federal ministry increased from 6.7 per cent (2004-06) to 12.2 per cent (2008-10). In absolute terms, the number of funded firms doubled between the two periods. The most important funding body at the federal level is the Federal Ministry of Economics and Technology (BMWi). In 2008-2010, 6.7 per cent of all innovative firms in Germany (in absolute terms, these were more than 10,000 different firms) received funding from one of the BMWi's funding programmes of which the Central Innovation Programme for SMEs (ZIM) is the single most important one. The other main actor at the federal level is the Federal Ministry of Education and Research (BMBF), which runs a number of technology programmes, including a special programme for SMEs (SME Innovative). In 2008-10, 4.8 per cent of all innovative firms (which equals more than 7,000 different enterprises) received BMBF funding.

Funding by the federal states is the second most important funding source. In 2008-10, 7.3 per cent of all innovative firms received funding from one of the 16 state governments. This share was 6 per cent in 2004-06. Funding by the EU Commission also became more significant. In 2004-06, 2.6 per cent of innovative firms received grants or loans from EU bodies. In 2008-10, this share increased to 3.3 per cent. Most of EU funding is distributed through the Framework Programme for Research and Technological Development. Other funding bodies, which include public foundations and foreign governments, also gained in importance. In 2008-10, 20 per cent of innovative firms received funding from this source.

Figure 40. Public financial support to innovative firms 2004-2010 by public funding body

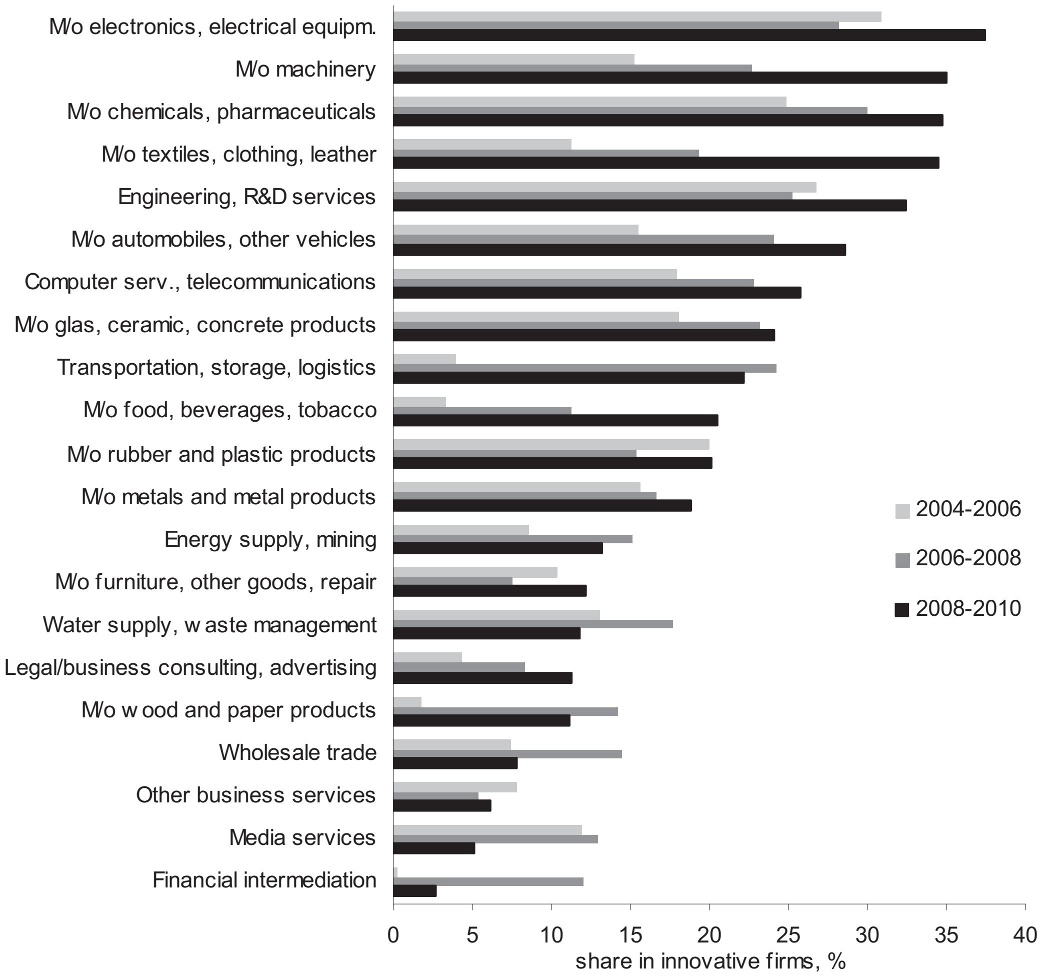


Firms may have received public funding from more than one funding body. * Funding through the EU Framework Programme not surveyed as a separate category for 2004-2006.

The share of innovative firms receiving public financial support varies significantly across industries (Figure 41). Firms from R&D-intensive manufacturing industries such as electronics/electrical equipment, machinery and chemicals/-pharmaceuticals report the highest share of funded firms (35 to 37 per cent). Further industries, where more than 25 per cent of innovative firms receive public funding for at least some of their innovation projects, include manufacture of textiles, clothing and leather, manufacture of automobiles, engineering and R&D services, and computer services and telecommunications. Industries with a share of publicly funded innovative firms of less than 10 per cent include wholesale trade, other business services, media services and financial intermediation. For most industries, the share of innovative firms with public financial support increased over the past six years.

The largest increase in the share of innovative firms receiving public financial support for their innovation activities took place in R&D-intensive manufacturing. Both BMWi and BMBF substantially increased the number of funded firms in this sector between 2006-08 and 2008-10. This greater funding activity was mainly driven by a significant increase in budget for the ZIM programme in 2009 and 2010 financed by a federal recovery programme to combat the severe recession in 2009. At the side of BMBF, the new funding scheme SME Innovative contributed to a net increase in the number of funded firms from 2008 onwards (see Aschhoff et al., 2012). The share of innovative firms from R&D-intensive manufacturing that received funding from state governments or the EU Commission increased as well, though at a lower extent compared to federal funding.

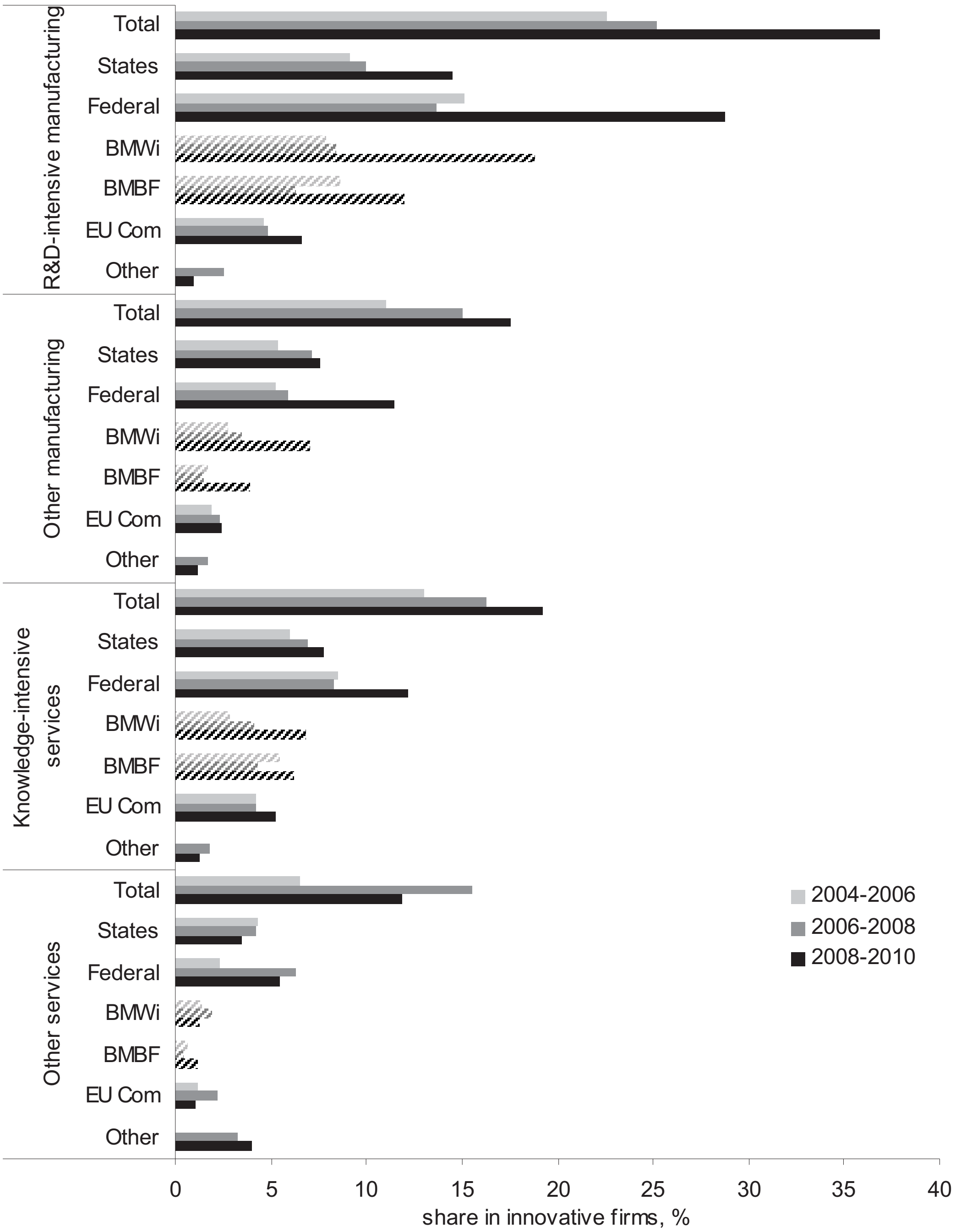
Figure 41. Public financial support to innovative firms 2004-2010, by industry



In other manufacturing, the increased share of funded firms is almost entirely due to a higher funding activity of federal government agencies. Again, both the BMWi and the BMBF increased the number of funded firms in this sector substantially. A similar pattern emerges in knowledge-intensive services. The higher share of funded firms in this sector resulted primarily from higher funding activities of the BMWi, while the BMBF's expansion in the number of funded firms in this sector was less significant. Innovative firms in this sector also profited from larger funding activities during 2008-2010 by state governments and the EU Commission.

In other services, most funding bodies decreased the number of funded firms in the 2008-2010 period compared to 2006-2008. Innovation activities in this sector are often out of the scope with funding programmes that target specific high-tech areas or focus on collaborative projects involving public science organisations.

Figure 42. Public financial support to innovative firms by public funding body 2006-2010, by main sector

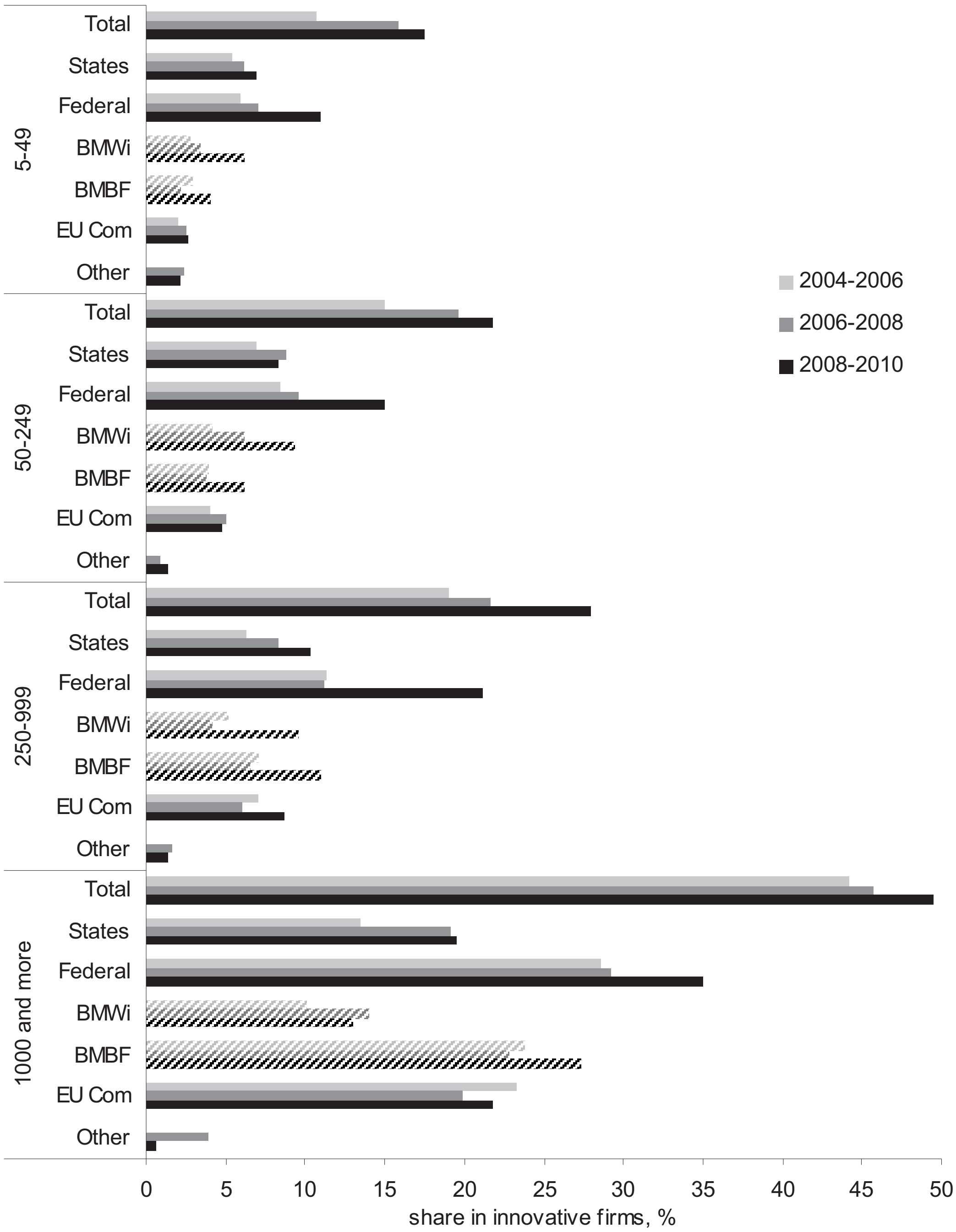


Firms may have received public funding from more than one funding body.

Smaller firms use public funds less frequently to finance at least parts of their innovation activities. Among innovative firms with 5 to 49 employees, 18 per cent received public funding during 2008 and 2010, compared to 22 per cent for innovative firms with 50 to 249 employees and 28 per cent for the size class 250 to

999 employees (Figure 43). Among very large innovative firms, 49 per cent used public funding to finance at least one of their many innovation activities. A growing share of funded firms by size class can be found for each public funding body.

Figure 43. Public financial support to innovative firms by public funding body 2006-2010, by size class



Firms may have received public funding from more than one funding body.

Funding by the EU Commission and the BMBF is targeted comparatively more at larger firms than funding by BMWi and state governments. One should note, however, that in small firms that receive public funding, a significantly higher share of their total innovation expenditure is financed through public sources while for large firms, public funding typically covers only a very small share of their total innovation expenditure. For this reason, government contribution to total innovation expenditure in the group of small firms is substantially higher than for the group of large enterprises (see Peters et al., 2006).

Over the past six years, the share of firms receiving public funding increased in all size classes. For small and medium-sized firms, the increase was particularly pronounced between 2004-06 and 2008-10, while the number of medium large firms with 250 to 999 enterprises receiving public funding mainly grew between 2006-08 and 2008-10. The latter development reflects increased funding activities of firms from this size class in the ZIM programme in the years 2009 and 2010. In these two years, the programme extended the group of firms entitled to apply for funding to this size class. The recent increase in the share of very large firms (with 1,000 or more employees) receiving public grants for innovation projects is primarily due to greater funding activity of the BMBF, particularly in context of new initiatives such as the Cutting-edge Cluster Programme or the Innovation Alliances.

7 Innovation Strategies

The rise of the informational age and the liberalization of trade, labour and financial markets have been challenging for innovating firms for the last 20 years. To keep pace, firms' innovation activities have relied on innovation strategies that have been adapted to this fast-moving environment frequently (Teece, 2010). An innovation strategy constitutes the framework for innovation projects where it basically consists of three pillars – the determination of aims of innovations, the competitive positioning and the acquisition and allocation of resources and assets (Spielkamp und Rammer, 2006).

According to Freeman (1982) there are six different types of innovation strategies. Firms that pursue an *offensive strategy* are usually aimed at becoming the technical and the market leader. They want to be first mover with their innovations and are noted for being resistant competitors. They are R&D-intensive, on in-house R&D relying firms, which are embedded in the technological-scientific community strongly. In contrast, *defensively-oriented* innovators basically differ from offensively-oriented innovators only in their reluctance to introduce innovations at first. An *imitative innovator* is satisfied to follow way behind the leaders in established technologies. Thus, their technological know-how and ambitions are not as pronounced as in the above mentioned cases. Firms that pursue a *dependent strategy* do not have any R&D facilities and do never imitate or invent unless their customers or – if they are departments of a larger firm – parent request an innovation. *Traditional* firms, which Freeman (1982) calls the *"peasants of industry"*, are actually non-innovating firms. Their products and processes rarely change. The unique characteristic of the last, the *opportunistic*, strategy is the occupation of a niche (at least initially). In fast moving markets opportunistic firms identify a new opportunity, in the sense of a new product with demand potential and develop it. Though these firms possess tight linkages to the scientific community, they do not necessarily rely on in-house R&D.

While Freeman (1982) labels and characterises the different strategy types, Teece (1986) stresses the importance of strategy for profiting from innovations and breaks it down into two pillars – the *appropriability regime* and *complementary assets*. The former refers to the degree of ease for competitors to imitate, which is determined by the nature of the technology and the efficacy of protection mechanisms. The latter refers to a firm's need for specific assets – such as distribution networks, brand-name reputation, competitive manufacturing – to implement its innovation on the market successfully. Firms can either buy (contracting) or build (integrating) the required assets.

Which strategy is to be chosen is contingent on the appropriability regime (Pisano, 2006): In a tight appropriability regime (imitation is difficult), where the access to complementary assets does not really matter, firms pursuing an offensive or defensive strategy should profit from their innovations at most. Firms operating in a weak regime (normal case) face far more problems.[10] They depend on an (exclusive) access to complementary assets to fully profit from their innovations. Innovators profit more than imitators unless imitators are better positioned regarding the complementary assets needed. Consequently, in a weak regime an offensive strategy bears the largest profit risk, followed by a defensive-oriented firm. A weak setting is comfortable for opportunistic innovators, also called *disruptive* innovators (Christensen, 1997). Accordingly, they profit from other's innovations by building the complementary specialised assets needed to enter the market (Pisano, 2006). The choice of the right strategy could thus be decisive for firms to profit from their innovation investment.

This chapter provides a short overview of the different aspects of an innovation strategy. First, we highlight firms' objectives of innovations. Second, we focus on two aspects of resource allocation and positioning of product innovations. The third section deals with process innovators as first movers, while section four addresses effects of non-technological innovations.

7.1 Objectives of Innovations

Over the course of decision to finance innovation projects and which strategy to pursue, firms should be aware of the goals they want to achieve. The MIP 2009 questionnaire contained a question on the importance of potential objectives of innovations, following the harmonised CIS questionnaire, though expanding the list of potential objectives by a few items. Firms should indicate whether the respective objective had a low, middle or high importance for their innovation activities during 2006 and 2008 or whether the firm would classify the respective objective as being irrelevant. Since this question was targeted at firms with product or process innovation activities only, the following analysis is restricted to this group of firms.

The most frequently assigned objective for conducting innovations is the improvement of the quality of products/services (93 per cent; Figure 44). The broadening of products/services supply (89 per cent) as well as the increase of production/service flexibility (89 per cent) are also widely stated. 86 per cent of firms pursue the aims of opening up new markets and the increase of the market share in existing markets. Only slightly fewer firms (83 per cent) try to increasing their production/service capacity or want to replace outdated products or processes. Still, a high percentage of innovative firms aims at reducing labour unit costs (77 per cent). Following with some distance are the reduction of material/energy unit costs (70 per cent), the fulfilment of standards (70 per cent) as well as the fulfilment of laws/regulations (69 per cent). In comparison, the increase in health secu-

[10] More details can be found in Teece (1986, 2006) and Pisano (2006).

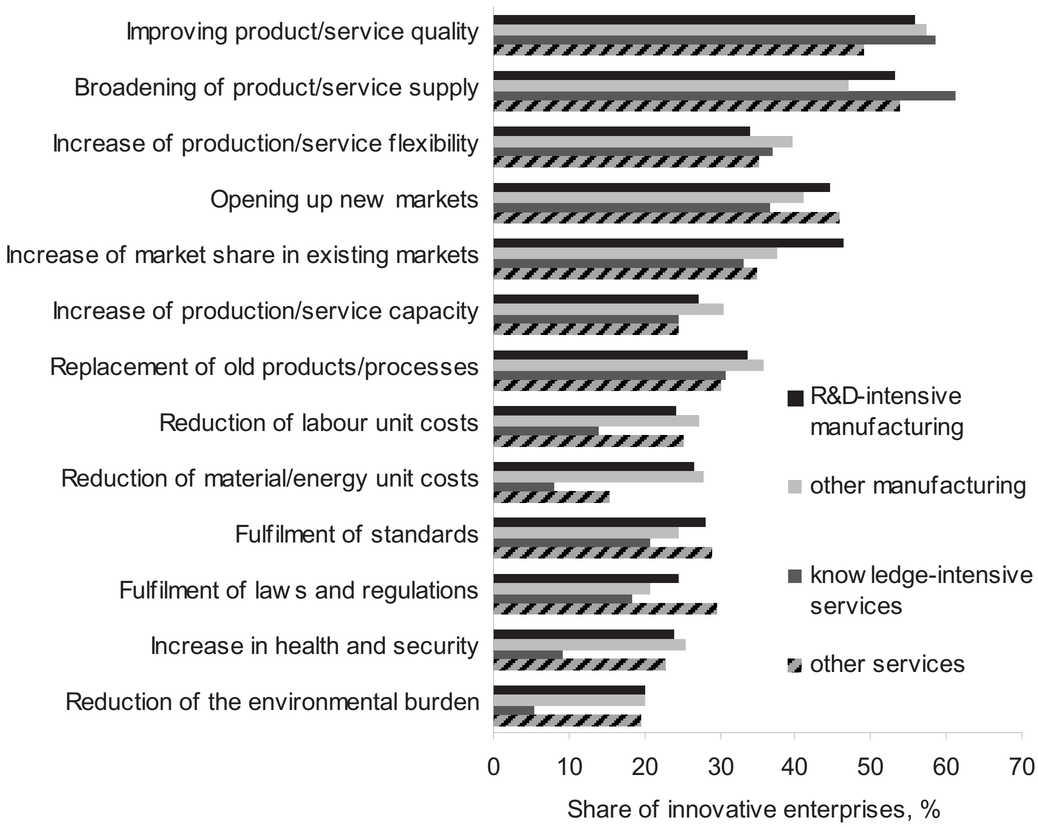
rity (63 per cent) and the reduction of the environmental burden (62 per cent) are pursued less frequently.

Figure 44. Importance of objectives of innovations 2006-2008

Although the majority of firms pursue a number of given objectives for their innovation projects, most of these aims do not show a high importance among innovative firms. Indeed, only two objectives are marked as highly important and show a share of more than 50 per cent. That is the improvement of products/services quality (55 per cent) and the broadening of products/services supply (53 per cent). Less important objectives are the opening up of new markets (41 per cent), the increase of production/service flexibility (37 per cent) and the increase of the market share in existing markets (37 per cent). At least the replacement of old product/processes (33 per cent), the increase of production/service capacity (27 per cent), the fulfilment of standards (25 per cent) and the reduction of labour unit costs as well as the fulfilment of laws/regulations (both 23 per cent) show a share of more than 20 per cent while being classified as highly important. Only the increase in health security (20 per cent), the reduction of material/energy unit costs (19 per cent) and the reduction of the environmental burden (16 per cent) seem to be less strongly pursued among the highly important objectives.

Overall, differentiating by sector groupings discloses only small changes in the ranking of the proportions of highly important objectives (Figure 45). Among all sectors, the improvement of product/service quality and the broadening of product/service supply still rank among the two most frequently stated objectives, followed by the opening up of new markets, the increase of production/service flexibility and the increase in market shares in existing markets. Firms of the knowledge-intensive service sector show the two largest as well as the two smallest shares of highly important objectives. More precisely, the improvement of product/service quality (59 per cent) and the broadening of product/service supply (61 per cent) are the largest shares, while the reduction of the environmental burden (5 per cent), the reduction of energy/material unit costs (8 per cent) and the increase in health security (9 per cent) are the two smallest shares.

Figure 45. Highly important objectives of innovations 2006-2008, by main sector



Differentiating by size (Figure 46) reflects the same ranking as discussed above. Apart from that, firms with more than 49 employees show large and more fluctuating shares regarding highly important objectives of innovations, relative to smaller firms. That is, the shares of small firms (5-49 employees) range from 20-38 per cent the respective shares of medium firms (50-249 employees) range from (16-61 per cent), those of large firms (250-999 employees) appear to be between 16 and 54 per cent and those of very large firms (more than 1,000 employees) appear to lie in the interval of 20 and 60 per cent.

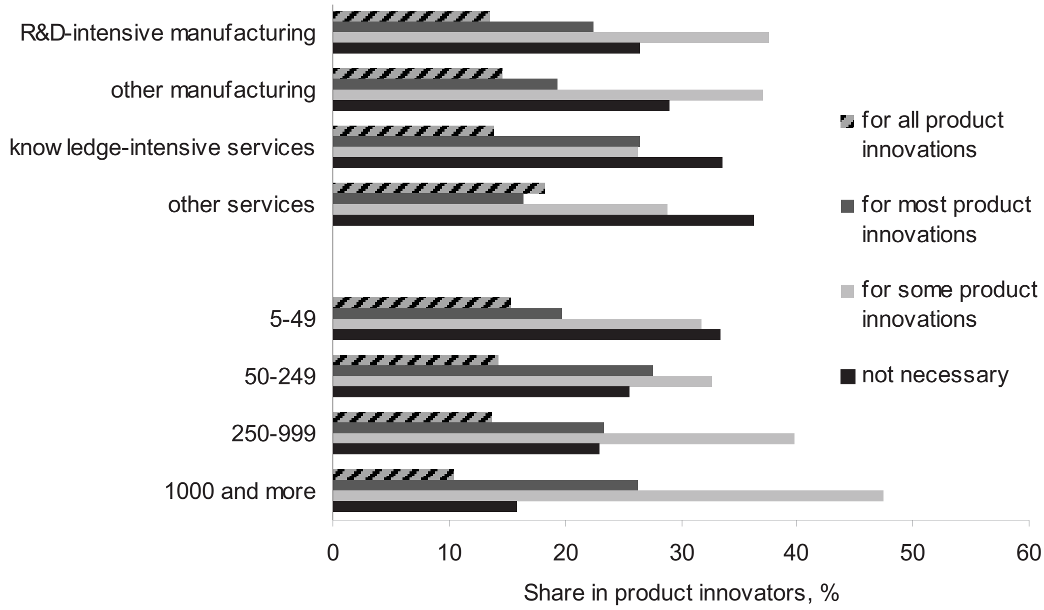
Figure 46. Highly important objectives of innovations 2006-2008, by size class

7.2 Combining Product and Process Innovations

After a firm has decided to invest in innovation efforts and which aims to pursue, the next step would be to consider the implementation of innovations. There might be further investment required to launch the planned innovation projects. According to Teece (1986), an innovator might also require additional investments in complementary assets to successfully introduce its innovation on the market or in the company. The MIP 2009 questionnaire covers this issue for firms which introduced product innovations between 2006 and 2008. Firms were asked whether all, most, several or none of their product innovations had been reliant on new or further development of process technology. Unfortunately, it is not visible whether they had acquired or built the required technology.

In general, the necessity to use advanced process technology to implement product innovations relates negatively to firm size (Figure 47, upper panel). While about 16 per cent of very large product innovators do not show any dependence on advanced process technology, this share increases step-by-step with decreasing firm size. That is, the product innovations of 23 per cent of large enterprises, 26 per cent of medium enterprises and 33 per cent of small enterprises do not depend on advanced process technology. The same relationship qualitatively applies to firms whose product innovations do not depend entirely on more sophisticated process technology.

Figure 47. Necessity for new or further development of process technology for product innovations introduced 2006-2008, by main sector and size class



A different pattern holds for firms whose product innovations relied only in several cases on advanced process technology. These shares increase steadily from 32 per cent (small enterprises) to 47 per cent (very large enterprises). Compared to the previously mentioned cases, there is no visible relationship between firm size and product innovations that were most often reliant on new or further development of process technology.

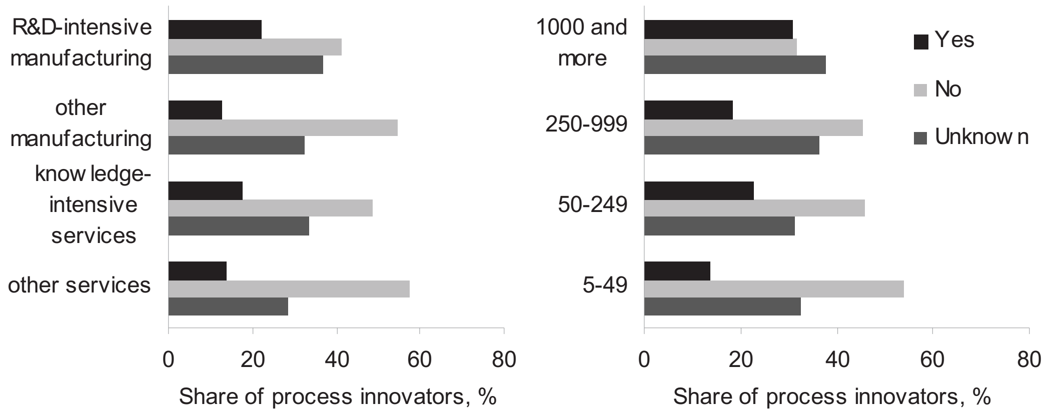
Among sectors, 27 per cent of R&D-intensive manufacturing firms indicated that none of their product innovations had been in need of advanced process technology (Figure 47, lower panel). This share is smaller than the respective one of other manufacturing firms (29 per cent), of firms in the knowledge-intensive service sector (33 per cent) and of other services firms (36 per cent). This implies that firms in R&D-intensive manufacturing relied more frequently on technology progress to launch/introduce product innovations than firms of other sectors. Accordingly, R&D-intensive manufacturing firms indicated relative frequently that advanced process technology had been necessary for all product innovations (14 per cent), for most product innovations (22 per cent) and for several product innovations (38 per cent). These shares are only surpassed in three cases. This applies to firms of the other manufacturing/services sector whose product innovations had always relied on advanced technology (15 per cent/18 per cent) and to firms of the knowledge-intensive service sector whose product innovations had mostly relied on advanced technology (26 per cent).

7.3 Novelty of Process Innovations

The 2009 Mannheim innovation panel also included the question whether a process innovating firm, which had implemented one or more process innovations in 2006-2008, had been a first mover. As there remains some sort of uncertainty regarding the knowledge about being a first mover or not, firms could also indicate a lack of knowledge.

Across all sectors, the majority of process innovating firms were not first movers (Figure 48, left panel). Among these, 41 per cent of R&D-intensive manufacturing firms, 55 per cent of other manufacturing firms, 49 per cent of knowledge-intensive service firms and 57 per cent of other service firms implemented already existing process innovations. Only a small proportion of process innovators had been a first mover that implemented process innovations new to the market. In numbers, 22 per cent of R&D-intensive manufacturing firms, 13 per cent of other manufacturing firms, 18 per cent of knowledge-intensive service firms and 14 per cent of other service firms had been first movers.

Figure 48. First mover with process innovations 2006-2008, by main sector and size class



Differentiating by size discloses a negative relationship between firm size and the probability of being a first mover (Figure 48, right panel). The proportion of firms being a first mover decreases steadily from small firms (54 per cent), over medium firms (46 per cent) and large firms (45 per cent), to very large firms (31 per cent). Similar to sector differentiation, the share of firms that was a first mover in 2006-2008 is approximately 20 per cent unless the firms were not larger 999 employees. In this case, the share is 31 per cent. Taking into account the mere 31 per cent probability for very large firms of not being a first mover, it seems to be a strong signal for these firms to have a considerable impact on the market with their process innovations.

For the sake of completeness, it should be mentioned that almost every third firm did not have any idea about being a first mover or not. This takes on the above mentioned issue to what extent firms are capable to know whether they are first mover or not. This knowledge requires a rather high degree of cross-linkage and/or transparency in the market or a manageable size of the market. These might be reasons why small and medium firms are more likely to determine whether they are a first mover or not.

7.4 Geographical Markets of Market Novelties

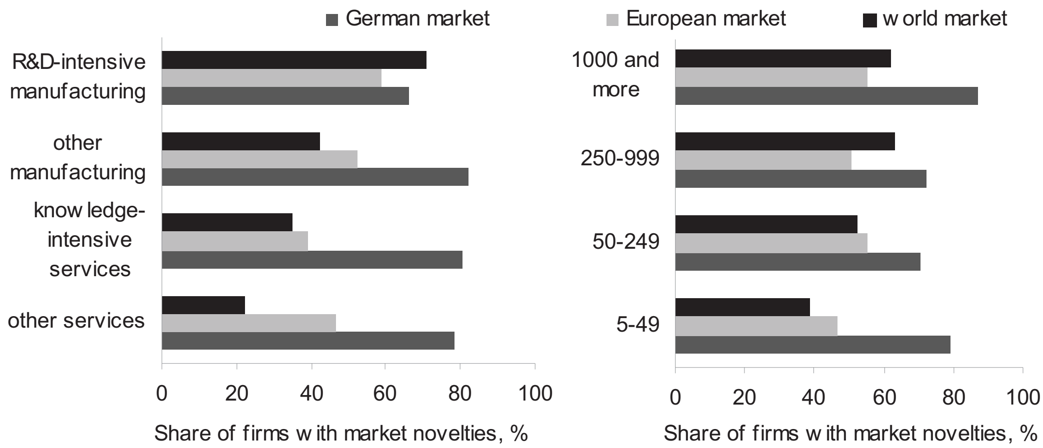
Another dimension of a firm's innovation strategy relates to the geographical markets which are targeted by new products. This choice is particularly important for market novelties as the geographical market indicates the extent to which the novelty will compete with prior innovations and other potential innovators. In order to identify the relevance of different geographical markets for market novelties, the 2011 questionnaire contained a question for the first time which asked firms to indicate whether their market novelties were new to the German, the European or the World market. Firms were allowed to tick all three items in case they had several market novelties which target different geographical markets. It is important to note, however, that firms with a new-to-the-world innovation are not automatically classified as having a new-to-Europe or new-to-Germany novelty.

The results show that 77 per cent of all firms that introduced market novelties between 2008 and 2010 targeted the German market. 49 per cent of firms with market novelties introduced new products that were new to the European market, and 43 per cent of firms with market novelties had new-to-the-world innovations. Related to all product innovators (including product innovators without any market novelty), 17 per cent had new-to-the-world and 19 per cent new-to-Europe innovations. These shares are equal to 6 and 7 per cent of all firms in the German business enterprise sector.

Differentiating by sector shows that new-to-the-world novelties are most frequent in R&D-intensive manufacturing, followed by other manufacturing, knowledge-intensive services and other services (Figure 49). This ranking is in line with the general geographical market orientation of these sectors. High transportation costs in many of the other manufacturing industries and limited tradability of services restrict the world-market orientation of firms in these sectors, which is also reflected in their innovation strategies. The share of firms with market novelties that only targeted the German market is significantly higher in these three sectors compared to R&D-intensive manufacturing. The importance of the European market as target market for market novelties is lowest in knowledge-intensive services.

Large firms with market novelties are more likely to target the world market compared to small and medium-sized firms. With regard to the European market, only small firms with market novelties show a lower share of innovations that were new to Europe. The propensity of firms with market novelties to target the German market does not vary significantly by firm size. The somewhat higher share for very large firms mainly reflects the fact that these firms introduce a large number of different innovations during a three year time period which makes it more likely that at least one innovation will only target the German market, while others target European or world markets.

Figure 49. Geographical markets of market novelties introduced 2008-2010, by main sector and size class



7.5 Strategies of Non-technological Innovators

While this chapter so far has been focusing on firms' strategies linked to product and process (technological) innovations, the present section examines to the strategies that firms pursue with so called "non-technological innovations".[11] According to the third edition of the Oslo Manual, -technological innovations are organisational and marketing innovations. In a general sense, the former refers to the creation or adoption of an organisational method new to the firm, the latter refers to the creation or adoption of a marketing concept or strategy new to the firm (OECD and Eurostat, 2005).[12] Non-technological innovations are mostly considered as complementary to the impact of technological innovations on firm and innovation performance (Schmidt and Rammer, 2007; Mothe and Nguyen Thi, 2010; Evangelista and Vezzani, 2011).

In the 2009 questionnaire, firms were requested to provide information about the effects of marketing and organisational innovations of 2006-2008. On the one hand, firms should evaluate the importance of three effects of marketing innovations – entry in new geographic markets, approach new customer groups and increase or maintain market shares in existing markets. On the other hand, firms should assess the relevance of five effects of organisational innovations – reduce response time, improve ability to develop technological innovations, improve

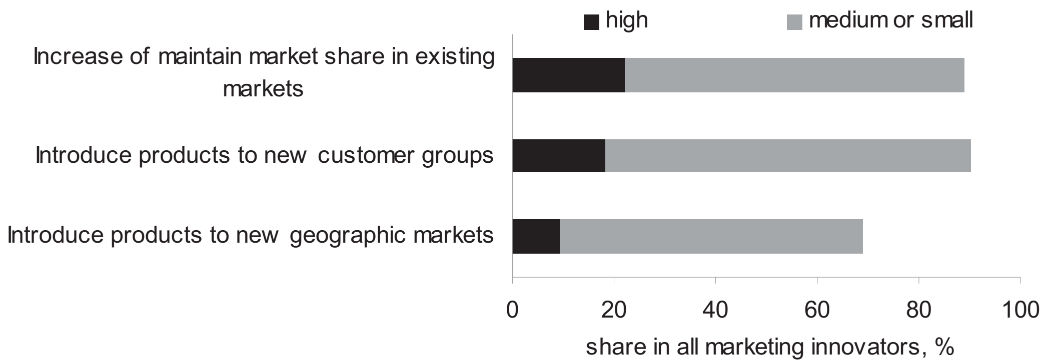
[11] Chapter 10 gives a more detailed insight into non-technological innovations.

[12] The academic literature has not yet agreed on a common definition of the term "organisational innovation" (Lam, 2005).

product quality, reduce costs, and improve communication and information sharing. This information can be used to discuss the underlying strategies of these types of innovation.

Marketing innovations are primarily used to increase or maintain market shares in existing markets and to approach new customer groups. Entering new geographic markets is a less important strategy linked to marketing innovations (Figure 50). While 69 per cent of marketing innovators indicated that the entry in new geographic markets was a relevant effect of their marketing innovations, 89 and 90 per cent, respectively, indicated that increasing or maintaining market shares and approaching new customer groups were relevant effects. When only looking at firms that reported highly important effects, the same ranking of effects occurs.

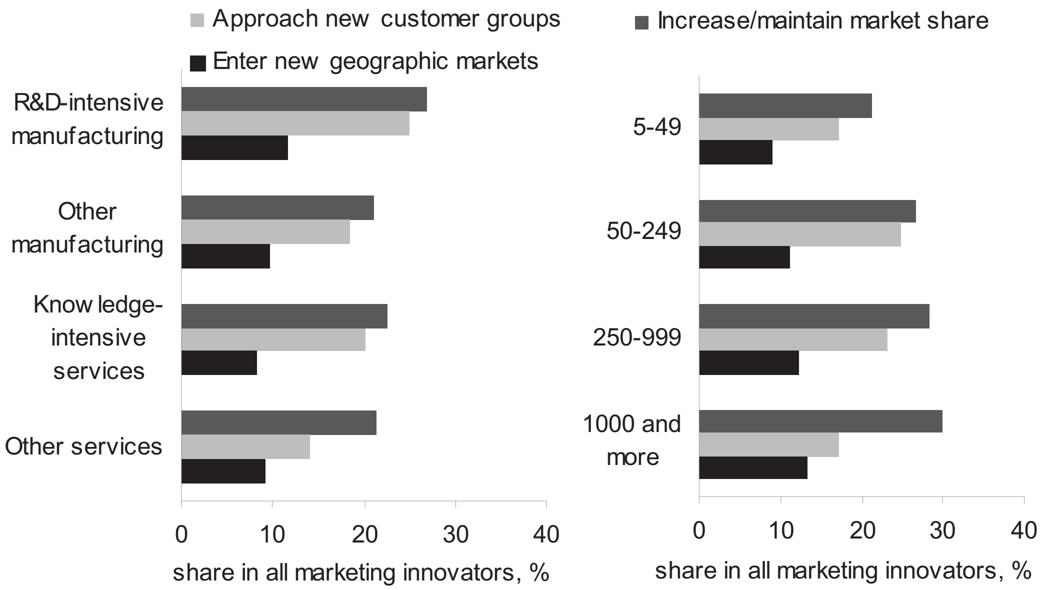
Figure 50. Importance of effects of marketing innovations 2006-2008



In R&D-intensive manufacturing, the share of marketing innovators that reports high importance is higher than in the other three sectors for all three effects of marketing innovations (Figure 51, left panel), indicating that marketing innovations are more effectively used to improve a firm's market position. 27 per cent of marketing innovators in this sector indicated a high effect of increasing or maintaining market shares in existing markets, 25 per cent indicated a high effect of approaching new customer groups, and 12 per cent indicated a high effect of entering new geographic markets. In the other services sector, entering new geographic markets through marketing innovations is -when compared to the other sectors- relatively more important while approaching new customers is less important, though the latter is still more often a highly important effect of marketing innovations than the former.

With respect to firm size, smaller firms less often report highly important effects of marketing innovations, which mainly reflects the situation that they typically introduce a smaller number of marketing innovations than large firms, which reduces the probability that a certain effects may occur. When looking at the relative importance of each of the three effects within each size class it becomes evident that large firms use marketing innovations more often to increase or maintain their market share in existing markets, e.g. by raising the entry costs of potential entrants. For medium sized firms, approaching new customer groups is as important as increasing or maintaining market shares.

Figure 51. Highly important effects of marketing innovations 2006-2008, by main sector and by size class

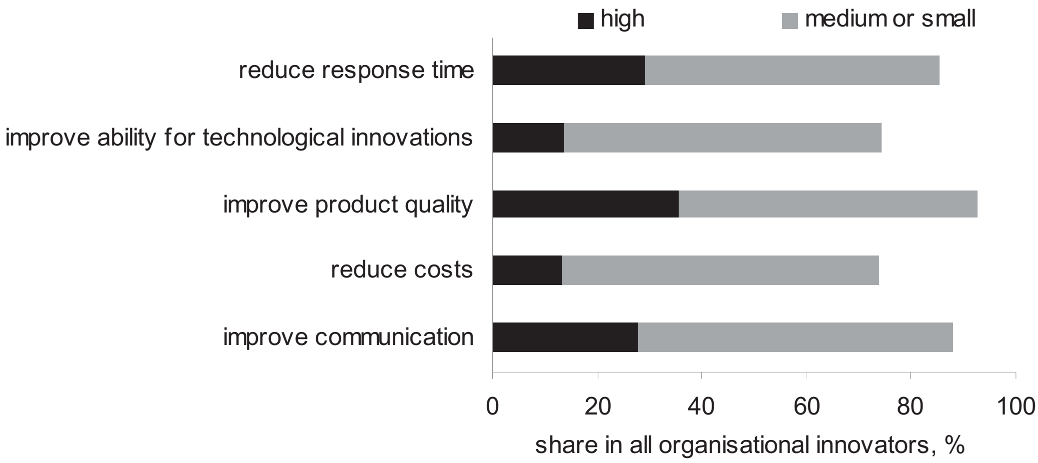


The most important effect of organisational innovations is to improve the quality of goods and services while reducing costs is of least importance (Figure 52). Other important effects are also rather linked to improving quality of operations, namely reducing the time to response to customer or supplier needs, and improving communication and information sharing within the own organisation and with other organisations or individuals. Improving the ability to develop new products or processes is also a less important effect of organisational innovations. The closer link of organisational innovations to product quality does not imply that these innovation activities are closer linked to product innovation since quality improvement is also an important objective and effect of process innovation (see chapter 4).

13 per cent of organisational innovators indicated a high effect of organisational innovations on reducing costs, 14 per cent on improving the ability to develop new products/processes, 28 per cent on improving communication, 29 per cent on reducing the time to respond to customer or supplier needs, and to 38 per cent on improving product quality. The share of firms that indicated a small and medium effect is quite similar for all five effects at about 60 per cent.

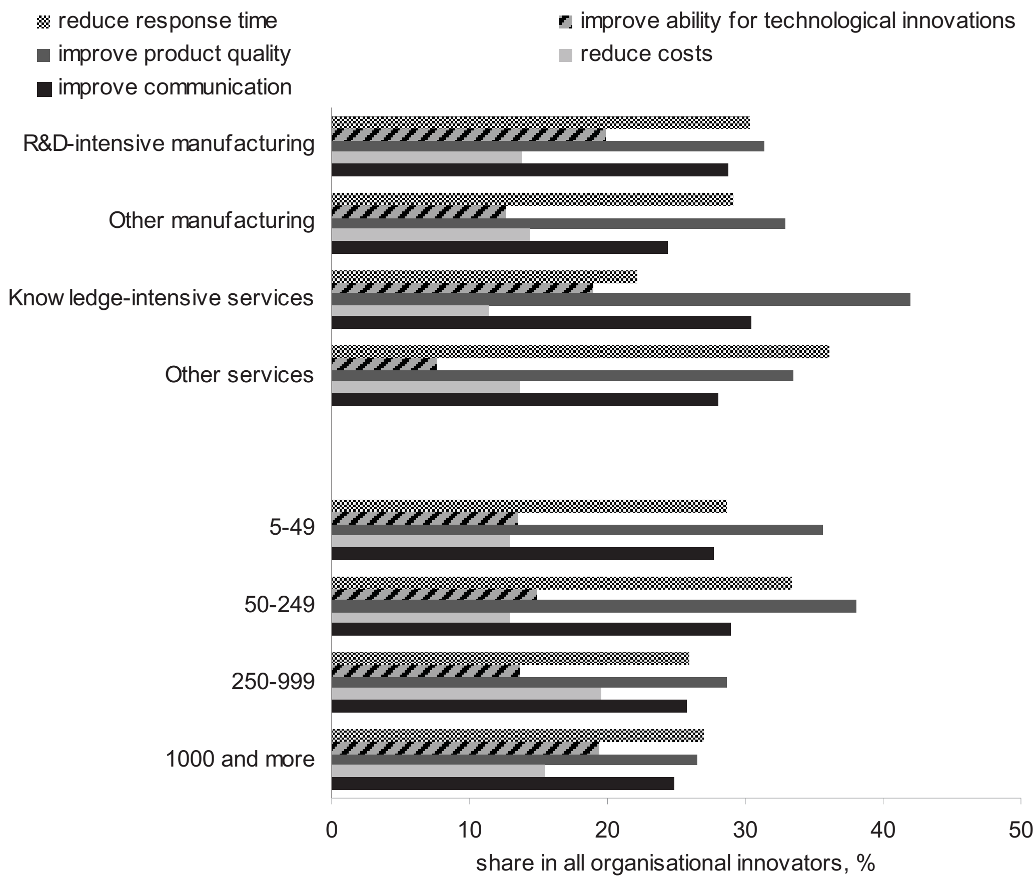
Improving product quality through organisational innovations is particularly important for organisational innovators in the knowledge-intensive services (Figure 53, upper panel). In other services, reduction of response time is the most important effect of organisational innovations. Improving the ability for technological innovations is an effect of organisational innovations that is most often highly important in R&D-intensive manufacturing and in knowledge-intensive services, while it is rarely a strategy for organisational innovations in other services. 42 per cent of organisational innovators in knowledge-intensive firms and the 33 per cent in other services benefited most frequently from the improvement of firms' product quality while in R&D-intensive manufacturing and in other manufacturing this share was 32 and 31 per cent, respectively. Reducing the time to respond to customer or supplier needs was a highly important effect for 36 per cent of organisational innovators in other services, for 30 per cent in R&D-intensive manufacturing, for 29 per cent in other manufacturing and for 22 per cent in knowledge-intensive services. Improving communication and informational flows is a highly important effect for 30 per cent in knowledge-intensive services, 29 per cent in R&D-intensive manufacturing, for 28 per cent in other services, and 24 per cent of organisational innovators in other manufacturing. Between 11 per cent (knowledge-intensive services) and 14 per cent (all other sectors) of organisational innovators report the reduction of costs as highly important effect. The respective shares for improving a firm's ability to develop technological innovations range from 8 per cent (other services) and 13 per cent (other manufacturing) to 19 per cent (knowledge-intensive services) and 20 per cent (R&D-intensive manufacturing).

Figure 52. Importance of effects of organisational innovations 2006-2008



The improvement of firms' product quality is a more important strategy of organisational innovators in small and medium-sized firms (36 and 38 per cent, respectively) than for large and very large firms (29 and 26 per cent, respectively). The same is true for reducing response time, which is a highly important effect for 33 per cent of medium-sized and 29 per cent of small firms, compared to 26 to 27 per cent for large firms. Improving communication and information flows is also a somewhat more important effect of organisational innovations in small and medium-sized firms (28 to 29 per cent, compared to 25 to 26 per cent for large firms). Very large firms tend to put more emphasis of organisational innovations' effects on improving their ability to develop technological innovations, though this effect still only ranks fourth among the five effects in this size class. The reduction of costs is also relatively more important in larger than in small and medium-sized firms.

Figure 53. Highly important effects of organisational innovations 2006-2008, by main sector and by size class



8 Innovation Networks

Knowledge is a key factor for generating innovations, which in turn ensure firms' competiveness. The need for knowledge has increased in the face of more complex innovation processes, shorter innovation cycles, and increased international competition. Moreover, the necessity for knowledge increases with the degree of novelty. Since valuable knowledge increasingly arises outside a firm, firms do not only rely on knowledge or capabilities within the firm. Instead firms also draw on external knowledge (Tidd et al., 2000; von Hippel, 1988).

Through interaction with third parties, on the one hand, firms can better estimate the demand and align their innovation activities to the needs and requirements of the market. On the other hand, the technology push can be fostered by complementing own capabilities and knowledge with external competences. Connecting external knowledge sources with in-house activities is crucial for firms to fully exploit their R&D and innovation programmes (Laursen and Salter, 2006). In the literature, the opening up of the innovation process is also known as open innovation (Chesbrough, 2003).

In this chapter, we provide an overview of three aspects regarding firms' external links: (1) the *information sources* that firms use for their innovation projects, (2) the involvement of firms in *innovation cooperation* as a specific and important type of interaction, and (3) the extent to which firms' *innovations* are finally the *result of collaboration* with external partners.

Innovation relies on the access to information. But internal information is often not sufficient. Thus, firms draw on knowledge from both internal and external sources. In order to assess the extent to which firms seek knowledge from specific sources we use a corresponding question from the questionnaire in 2009. Firms were asked to indicate the use and the importance of 12 different information sources for generating innovative ideas or for improving innovation projects.

External information can be acquired through a broad variety of different channels, including joint research projects, consulting and contract research, licensing contracts, personnel exchange, and informal interaction between scientists of different firms or institutions (D'Este and Patel, 2007; Schartinger et al., 2002). In case external knowledge is not accessible, transferable or needs adjustments, a formal way to exchange knowledge and thus, to complement own knowledge is through cooperation in innovation projects. Simultaneously, outflows of own knowledge are controlled. Cost and risk-sharing are two other important input-related motives for cooperation (Hagedoorn, 1993; Cassiman and Veugelers, 2002). In a cooperative project two or more parties jointly work on a specific topic with a defined goal. Usually the partners agree beforehand about the inputs and tasks of each partner and predetermine the ownership of the results. Cooperative agreements in innovation are a common and important type of interaction (Hagedoorn, 2002). Several studies provide evidence for the positive effect of (specific) cooperation on firms' innovation output (Aschhoff and Schmidt, 2008; Belderbos et al., 2004a; Tether, 2002). Besides, in all industrialised countries, public support policies explicitly encourage cooperation in R&D and innovation projects between different actors, in particular between enterprises and science. The questionnaires in 2009 and 2011 include the same question about a firm's involvement in R&D and innovation cooperation. After indicating whether a firm cooperates overall, firms were asked about the type of partner such as suppliers or universities and about the location of the partner. Moreover, the firms specified the most valuable type of partner for the firm's innovation activities.

As a consequence firm's innovations are not necessarily developed by the firm itself but might be developed in collaboration with third parties. In the last section of this chapter, we review to what extent firms' product and process innovations, respectively, are finally due to collaboration with third parties. Thereby collaboration is not restricted to formal cooperation but also includes more loose type of interactions. A corresponding question is included in the questionnaires 2007, 2009 and 2011.

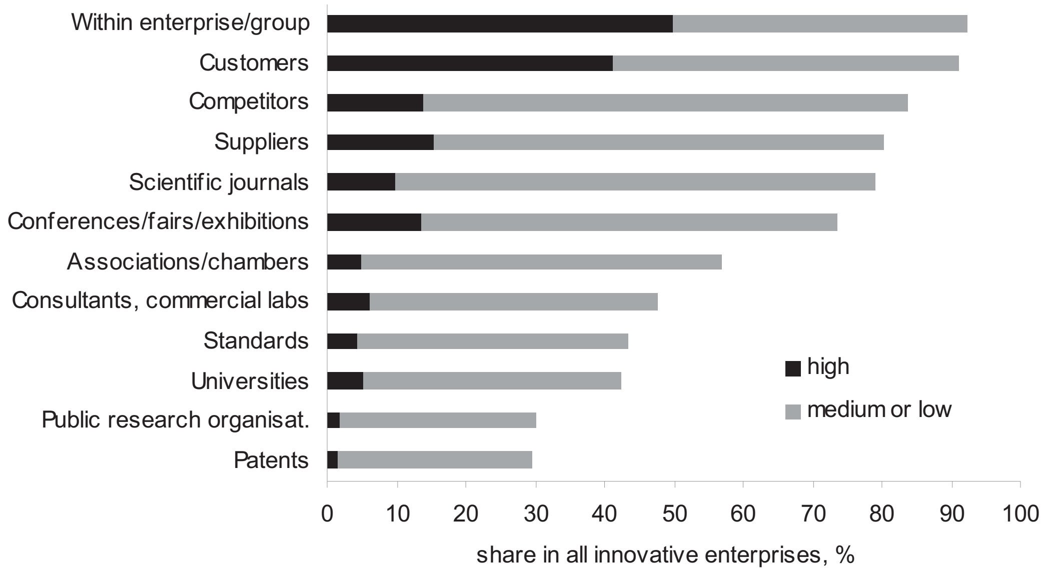
8.1 Use of Information Sources for Innovation

Information is essential for innovation and can be retrieved from a broad range of sources. In the questionnaire 2009 the firms were asked about the following 12 sources which can be split into four groups: (1) internal sources: within enterprise or enterprise group, (2) market sources: customers/clients, suppliers, competitors, consulting firms/commercial R&D service providers, (3) institutional sources: universities/universities of applied sciences, public research organisations, and (4) other sources: conferences/trade fairs/exhibitions, scientific journals/trade/technical publications, associations/chambers, patent specifications, standardisation committees/documents. The firms should indicate for each source whether it had a low, middle or high importance for the generation of ideas for new innovation projects or the conduct of innovation projects during 2006 and 2008 or whether the firm did not use the respective source. The question is only directed at firms with innovation activities.

Innovative enterprises most frequently use information available within their own enterprise or enterprise group for their innovation projects (92 per cent; Figure 54). Market sources are also widely used. Nine in ten firms use customers and clients as information sources. 84 per cent of the firms use information from competitors and 80 per cent information from suppliers. Only slightly fewer firms retrieve information from scientific journals and trade publications (79 per cent) and on conferences and trade fairs (74 per cent).This is followed by associations and chambers (57 per cent) and consultants and commercial R&D service providers (48 per cent) as information sources. Institutional sources are used less frequently. 43 per cent of the firms consider universities as information sources. Three in ten firms use information from public research organisations.

Although innovative enterprises use a large variety of information sources the contribution of specific sources to innovation projects is limited. Two sources seem to be most effective. 50 per cent of innovative enterprises declare internal sources as highly important. Customers and clients play a highly important role for 41 per cent of firms. These two sources were also most widely used. All other sources seem to be far less important for innovation and their use appears to be less efficient. Between 10 per cent and 15 per cent of the firms get highly important information from competitors, suppliers, scientific journals and conferences, respectively, although between 74 per cent and 84 per cent of the firms used these sources. Less than 7 per cent of the firms appreciate associations, consulting firms, standardisation and patent information, respectively, as highly important source. The institutional sources universities and public research organisations serve as an important source for 5 per cent and 2 per cent of the firms. It seems that knowledge of the science sector is usually rather far from actual application and not ready to use in firms' innovation projects.

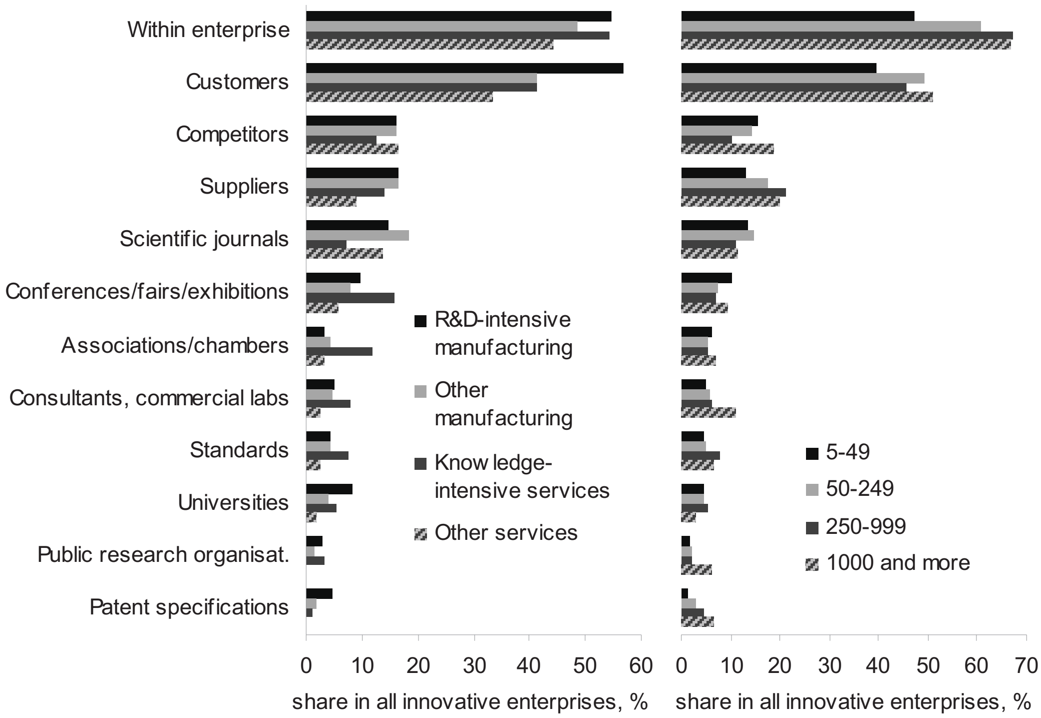
Figure 54. Importance of information sources for innovation activities 2006-2008



Overall, the ranking of highly important information sources remains rather stable for different sector groups and size classes (Figure 55). All subgroups rank the own enterprise and customers as most important information sources. Due to the larger need for information, firms in R&D-intensive manufacturing use a broader range of information sources compared to other manufacturing firms. R&D-intensive manufacturing firms score most sources as highly important more often compared to other manufacturing firms. The same pattern holds for knowledge-intensive firms in comparison to other service firms. Notable exceptions are suppliers and conferences as information sources. Other service firms more frequently use suppliers and conferences and score them more often as important compared to R&D-intensive service firms.

The larger the enterprise the more often useful information is provided by the enterprise itself. While about two-thirds of firms with 250 employees or more assess internal sources as highly important, this share equals 47 per cent for firms with less than 50 employees. This relationship also holds for customers and competitors as highly important information sources. The larger the firms the more likely firms retrieve information from customers and from competitors and other enterprises in the sector. In addition, large firms seem to have the capability to make use of information provided by institutional sources. Compared to smaller firms, firms with 1,000 and more employees declare universities and public research institutions as highly valuable information source about twice as often.

Figure 55. Highly important information sources for innovation activities 2006-2008, by main sector and by size class

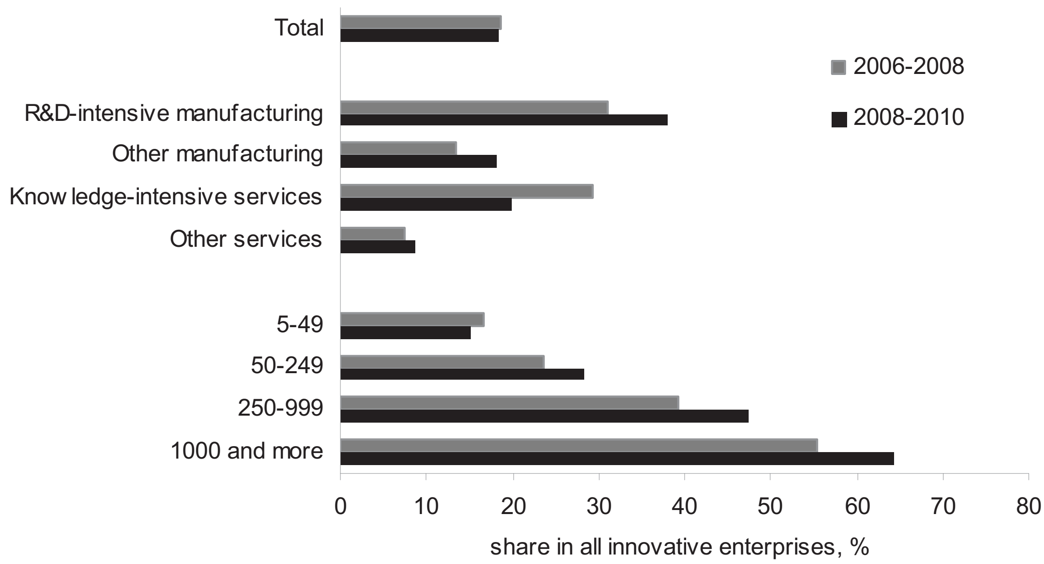


8.2 Innovation Cooperation

Compared to gathering information from different sources, cooperation implies a formalised and more target-oriented exchange of knowledge. Moreover, external knowledge is being adjusted to the firm's needs. In the questionnaire, innovation cooperation is defined as an active participation with other enterprises or institutions on innovation activities. Thereby, both partners do not need to commercially benefit from the collaboration. Pure contracting out of work with no active cooperation is excluded. Only enterprises with innovation activities answer the question.

During 2008 and 2010, 18 per cent of all enterprises with innovation activities cooperated with at least one partner on any of their innovation activities (Figure 56). In particular, firms in R&D-intensive manufacturing have a high need for external knowledge and are more likely to cooperate with other enterprises or institutions. The share of cooperating firms in R&D-intensive manufacturing (38 per cent) is almost twice as high as the share in knowledge-intensive services (20 per cent) and other manufacturing (18 per cent). Cooperation is least common for firms in other services (9 per cent). The larger the firm the more likely the firm is involved in cooperation. While 64 per cent of firms with 1,000 employees and more engage in cooperation, this share equals 15 per cent for firms with less than 50 employees.

Figure 56. Involvement in innovation cooperation, 2006-2010

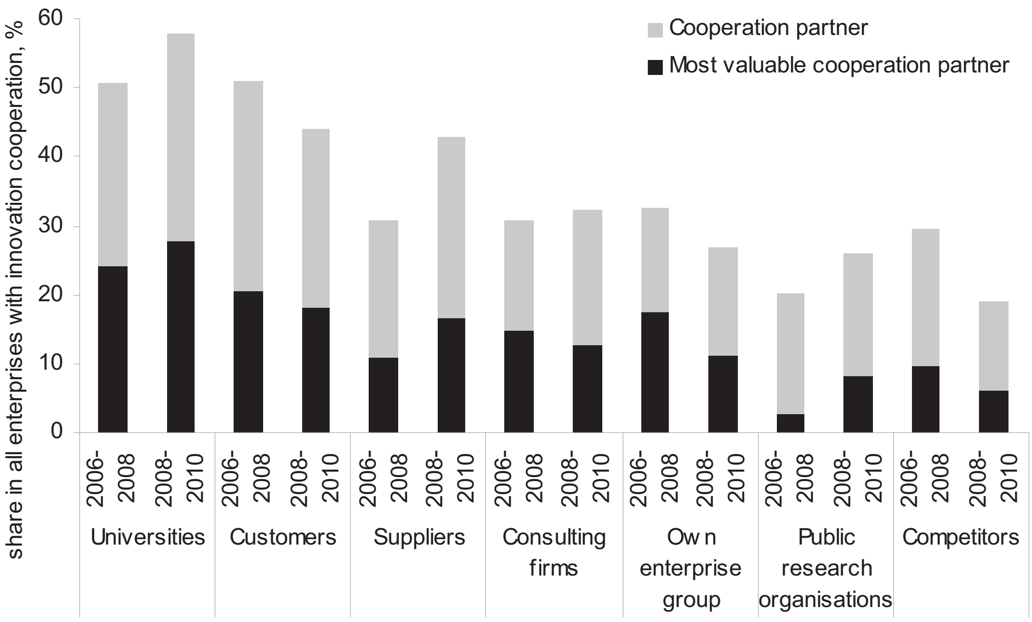


Overall, the share of innovative firms that were engaged in innovation cooperation remained stable between the two three year periods 2006-2008 and 2008-2010. Nevertheless, temporal changes occurred for some subgroups. While firms in the manufacturing sector increased their engagement in cooperation, knowledge-intensive service firms significantly decreased their involvement. The share of cooperating firms remained constant in other services. With regards to firm size, the group of smallest firms slightly reduced their engagement in cooperation while all other firms expanded their involvement.

Firms were also asked to indicate the type of cooperation partner. The question considers seven possible cooperation partners: other enterprises within own enterprise group, customers, suppliers, competitors and other enterprises in the sector, consulting firms and commercial R&D service providers, universities, and public research organisations. Firms may cooperate with more than one type of partners.

Universities gained importance as cooperation partner in 2008-2010 compared to 2006-2008 and became the most frequently used cooperation partner (Figure 57). 58 per cent of the firms that were involved in innovation cooperation chose universities as partners. Thus, a strong link exists between enterprises and universities. Customers are chosen less frequently as partner in the second period while suppliers became more attractive. Both types are equally often chosen during 2008 and 2010. About 44 per cent of the cooperating firms are engaged in cooperation with customers and suppliers, respectively. The cooperation rate with consulting firms remained stable. Nearly one third of the firms cooperate with consulting firms or commercial R&D service providers. Cooperation with enterprises within the own group decreased by 5 percentage points between the two periods. During 2008 and 2010 about one out of four cooperating firms cooperate with other units of the own enterprise group. Basically the same rate applies to public research institutions due to an increase in this rate between the two three year periods. Co-opetition, i.e. cooperation with competitors (Brandenburger and Nalebuff, 1996), considerably decreased from 30 per cent in 2006-2008 to 19 per cent in 2008-2010 and became the least common cooperation partner.

Figure 57 Type of partner and most important f partner in innovation cooperation, 2006-2010



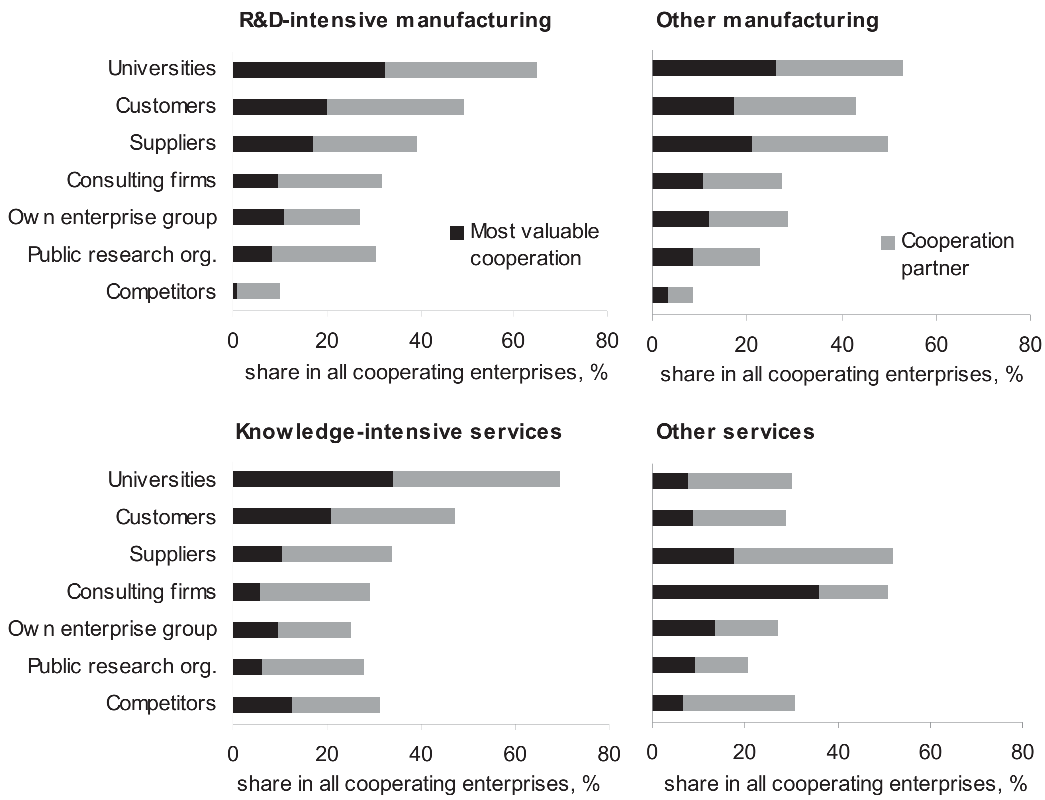
Cooperation partner: multiple answers possible; most valuable cooperation partner: single choice.

The order of the most valuable partners is the same as the order of the frequency with which the types are chosen as cooperation partners. Besides being the most widely-used cooperation partner, universities are also declared as the most valuable cooperation partner for the enterprise's innovation activities most often. 28 per cent of the firms that are involved in cooperation evaluated universities as the most valuable. Customers and suppliers follow as most valued partners with

18 per cent and 17 per cent. The temporal development regarding the most valuable partner shows the same pattern as the development regarding the involvement in cooperation with specific partners.

With regards to universities these findings might contradict the results regarding highly important information sources at first glance. On the one hand, universities are far less frequently used as information sources and are considered less often as highly important compared to the own enterprise group and to other market participants, namely customers, suppliers and competitors. On the other hand, universities are more often chosen as cooperation partner than other types of partners and are declared more often as most valuable partner. However, this pattern supports the view that knowledge from the science sector is usually not ready to use and easy to apply. It needs to be further developed and adjusted in order to satisfy firms' needs. But once this is done, the knowledge is very valuable for firm's innovation activities (Aschhoff and Schmidt, 2008; Belderbos et al., 2004b; Siegel, 2004).

Figure 58. Type of partner and most important partner in innovation cooperation 2008-2010, by main sector



Cooperation partner: multiple answers possible; most valuable cooperation partner: single choice.

The pattern of chosen cooperation partners varies to some degree by the sector (Figure 58). Cooperating firms in R&D-intensive manufacturing and knowledge-intensive services show a similar pattern during 2008 and 2010 – with universities being the far most frequent partner (65 and 69 per cent) followed by customers (49, 47 per cent) and then by suppliers (40, 34 per cent). For firms in other manufacturing the cooperation rate with these three partners is more balanced and lies between 43 and 53 per cent. In contrast, other services firms clearly favour cooperation with suppliers (52 per cent) and consulting firms and commercial R&D service providers (51 per cent). Universities and customers are far less important as cooperation partner for this group.

Figure 59. Location of innovation cooperation partner, 2006-2008

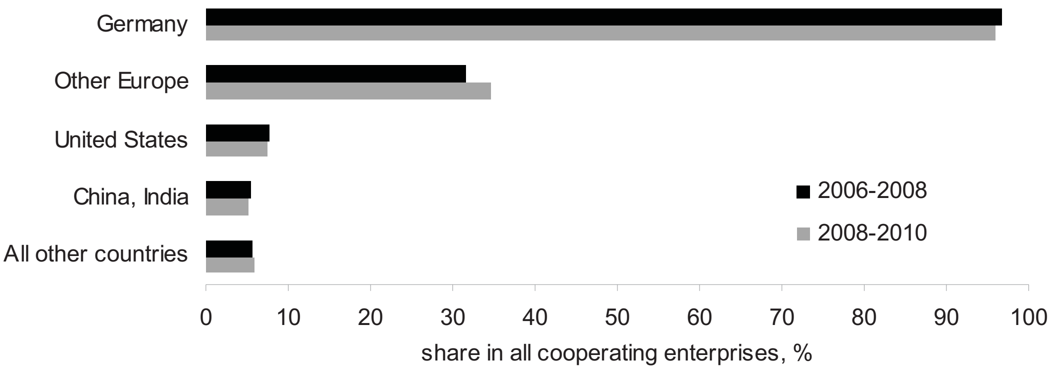
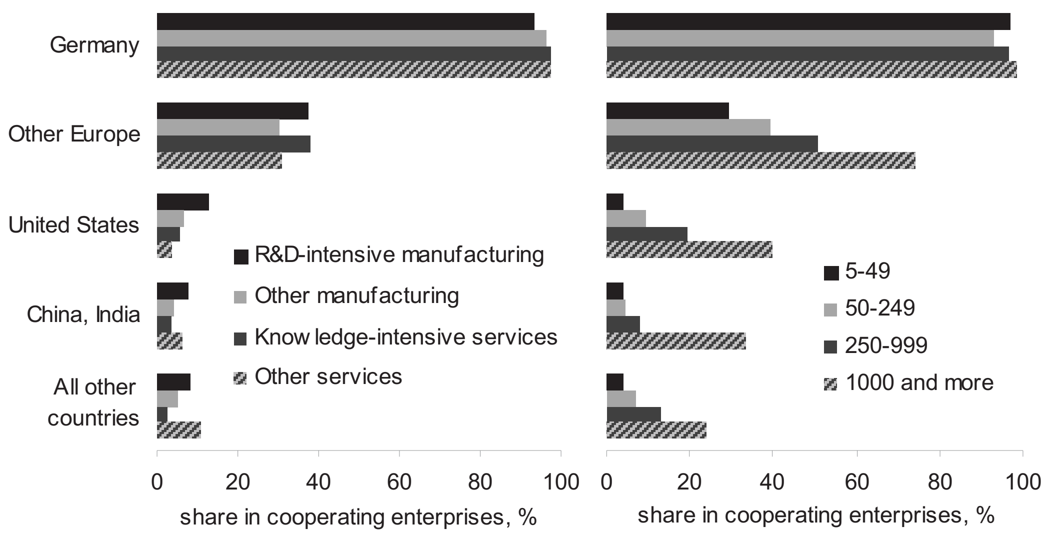


Figure 60. Location of innovation cooperation partner 2008-2010, by main sector and by size class



Almost all of the cooperating firms have partners that are located in Germany (Figure 59). Additionally, about one third of the firms have cooperation partners from other European countries. This share slightly increased from 2006-2008 to 2008-2010. Non-European cooperation partners are far less common and no trend towards cooperation with partners from these countries is observed. 8 per cent of cooperating firms have partners from the United States, 5 per cent from China or

India. 6 per cent are engaged in cooperation with partners from all remaining countries.

In all sectors and size classes, cooperating firms are intensively involved in cooperation with domestic partners (Figure 60). Firms in R&D-intensive manufacturing seem to be slightly more internationalised than other manufacturing firms. Compared to other service firms, knowledge-intensive service firms are more oriented towards other European countries and the United States. In contrast, other service firms are more likely to be engaged with partners from China or India and the rest of the word than knowledge-intensive firms. International cooperation clearly increases with firm size. The larger the firm, the more likely the firm is involved in cooperation with partners from each of the listed regions.

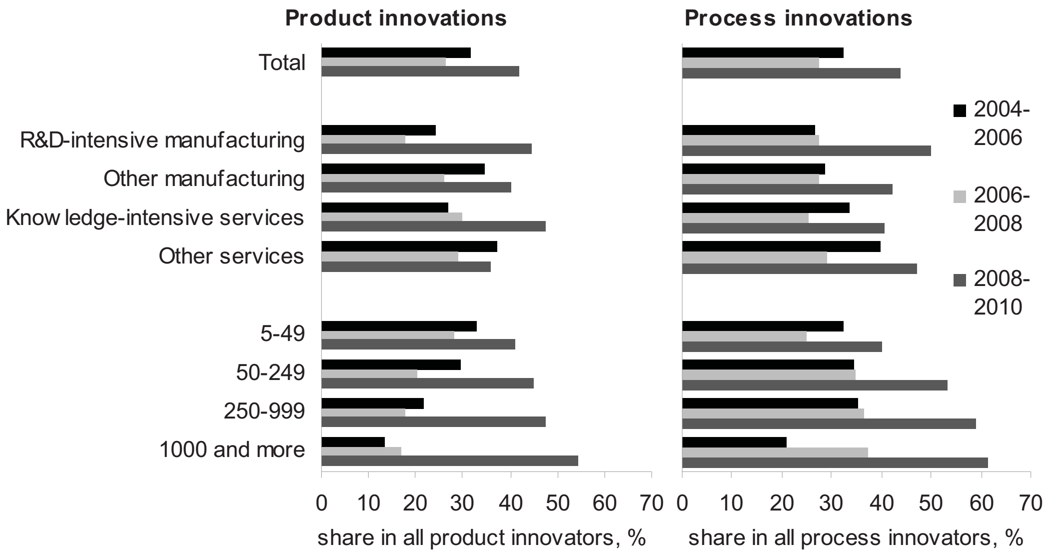
8.3 Product and Process Innovation Based on Collaboration

In order to determine to which extent collaboration finally contributes to a firm's innovation output, innovative firms were asked to indicate whether the product and process innovations that they introduced in the previous three year period had been developed in collaboration with other enterprises or institutions. Collaboration is not restricted to formal cooperation but also captures other types of interactions, e.g., the use of customer inputs for the development of new products, close interaction with technology providers to adjust firm's innovation processes and informal exchange of knowledge with academic scientists to solve a specific problem. In 2011, the following four response items were given: own enterprise by itself, own enterprise together with third parties, other enterprises/institutions, own enterprise by adapting products developed by others. Multiple answers were possible.

42 per cent of product innovations that were introduced between 2008 and 2010 were developed in collaboration with other enterprises or institutions (Figure 61). Among the sectors, the share of jointly developed product innovation is highest in knowledge-intensive services (47 per cent) and lowest in other services (36 per cent). The larger the firm, the more likely a product innovation is developed with third parties. This also reflects the high tendency of larger firms to cooperate with third parties.

Interestingly, the overall share of jointly developed innovations is even slightly higher for process innovation. 44 per cent of process innovations introduced between 2008 and 2010 were developed in collaboration with third parties. This share lies above average in R&D-intensive manufacturing and other services and is also higher than the corresponding shares for product innovation. Process innovations in larger firms are more likely to be jointly developed. Again, these shares are higher for process innovation than for product innovation. While between 53 and 61 per cent of process innovation in firms with 50 employees and more are based on collaboration, the corresponding share lies between 45 per cent and 55 per cent for product innovation.

Figure 61. Development of product/process innovation in collaboration with others 2004-2010



The question in the questionnaire 2011 differs from the question in the questionnaires 2007 and 2009. In the two former questionnaires, the question just included the first three response items and firms were asked to specify the primary developer and hence, had to make a single choice. In the survey 2011, the firms were asked about the developer and could give multiple answers. Thus, the temporal comparability of the question is limited. The shares of jointly developed product and process innovations were probably smaller in the periods 2004-2006 and 2006-2008 due to the changed question. With regards to the joint development of product innovations the increased share for larger firms seems to (partly) be a size effect because larger firms tend to a have more new products of which some are developed together with other firms. For 2004-2006 and 2006-2008 the relationship is the other way around, i.e. joint development of product innovation decreases with firm size so that overall, only a few product innovations were primarily based on collaboration in larger firms.

9 Barriers to Innovations

Innovative firms tend to be more productive (see Griffith et al., 2006; Peters, 2008) and yield higher economic success (see Czarnitzki and Kraft, 2010). Productivity gains from innovation may arise from cost reductions, quality improvements, and larger mark-ups for product novelties. So what hampers firms from innovating and becoming more productive and more successful? The answer to this question could be extremely useful for policy makers to encourage innovation by reducing barriers. It might also be useful for management with the objective to avoid problems with on-going innovation projects as well as to decide about the initiation of some potential innovation projects.

The development of a product or process innovation requires various indispensable resources. The innovation literature focuses to a large extend on the lack of financial resources that hamper innovation activities which would actually be profitable and lead to under-investment in knowledge capital (Hall, 2002; Hall and Lerner, 2010; Hottenrott and Peters, 2012). Financial constraints may occur through a lack of internal or external funding. External funding of innovation projects are considered riskier than physical investment projects because intangibles are of low resale value in the event of bankruptcy. Consequently, innovation activity is mostly financed by internal resources (for an overview see Hall, 2002).

Firms are not solely hampered by financial constraints. Mohnen et al. (2008) find empirical evidence that financial constraints increase the "probabilities of prematurely stopping, seriously slowing down and not starting a project, but not on that of abandoning a project". They state further, that economic risk and market uncertainty become relevant when the firm is not financially constrained. D'Este et al. (2012) also analyse cost, knowledge, market, and regulation factors as constraints to innovation activities. They find particularly strong deterring effects for innovation activities from market barriers. Hölzl and Janger (2011) carry out a comparison of hampering factors to innovation in 18 European countries. They provide evidence that shows firms are most hampered by financial constraints in countries with low technological intensity and so called catching-up countries. Hampering factors like lack of skilled labour, lack of innovation partners, and the lack of knowledge are, according to them, more important for firms in countries close to the frontier.

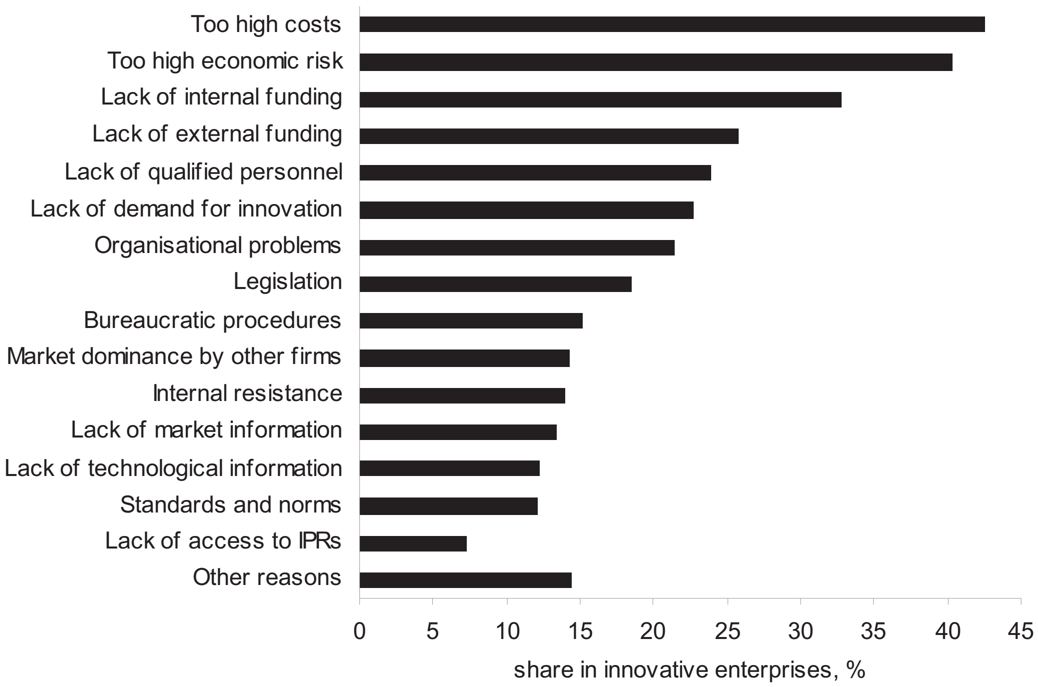
As part of the MIP surveys in 2007 and 2011, firms were asked to indicate the impact of a number of obstacles on their innovation activity. The question is based on the obstacles question in the harmonised CIS questionnaire but deviates from this question in two respects. First, it includes additional obstacles such as legislation, administrative procedures, and lack of access to IPRs, standards and norms and phrased some other items somewhat differently (e.g. lack of demand for innovations instead of uncertain demand of innovations). Secondly, firms were asked to report whether each hampering factor caused certain consequences for the firm's innovation activities in terms of delaying projects, stopping projects or resigning from starting projects. A firm is considered to be affected by a certain obstacle if this obstacle caused at least one of the three consequences. The question on hampering factors for innovation was addressed to all firms, regardless of their innovation status. The following analysis focuses on firms with product or process innovation activity ('innovative enterprises'). The next section presents the ranking of different obstacles regardless of the consequences these obstacles had. The final section investigates the ranking of obstacles for each of the three consequences these obstacles may have had.

9.1 Obstacles for Innovation

For the years 2008 to 2010, 72 per cent of innovative enterprises reported that some of their innovation activities were affected by obstacles and some innovation activities were delayed, had to be stopped or were not started at all. Obstacles that most commonly impeded innovation activities in innovative enterprises were too high costs, too high risk and a lack of funding (Figure 62). The obstacle reported most frequently is that costs of an innovation project are too high (43 per cent), which hardly comes as a surprise: Each innovation project has to be assessed in whether its expected benefits exceed the costs. In cases where costs become too high the project should indeed not be initiated or even aborted, if the project has already started. A project's too high economic risk hampers 40 per cent of innovative firms. The economic risk of failure captures another dimension of economic hampering factors. The acceptable risks and benefits of each project have to be weighted versus the foreseen economic impact of a project failure. As a result, even a profitable project might not be induced. The lack of internal (33 per cent) or external funding (26 per cent) seems to be more problematic, since from the management perspective these projects should be conducted.

The lack of qualified personnel obstructs 24 per cent of the innovative enterprises while a lack of demand for innovations negatively affected innovation activity in 23 per cent of innovative enterprises. Organisational problems within the enterprise are reported by 21 per cent as an obstacle to innovation. Legislation and time-consuming bureaucratic procedures were mentioned by 18 and 15 per cent of innovative enterprises, respectively. Internal resistance against innovation projects hinders 14 per cent of innovative enterprises. The same share is reported for market dominance of other enterprises as a barrier. A lack of market information was a hampering factor for 13 per cent of innovative enterprises while 12 per cent reported a lack of technological information and standards and norms. Out of the list of obstacles presented to the firms, lack of access to necessary intellectual property rights (e.g. patents) is the least important barrier, cited by only 7 per cent of innovative enterprises. Other reasons that are not specified in more detail encumber 14 per cent of the innovative enterprises.

Figure 62. Obstacles for innovation 2008-2010 in innovative enterprises



Obstacles that caused innovative firms to delay, stop or resign some of their innovation activities.

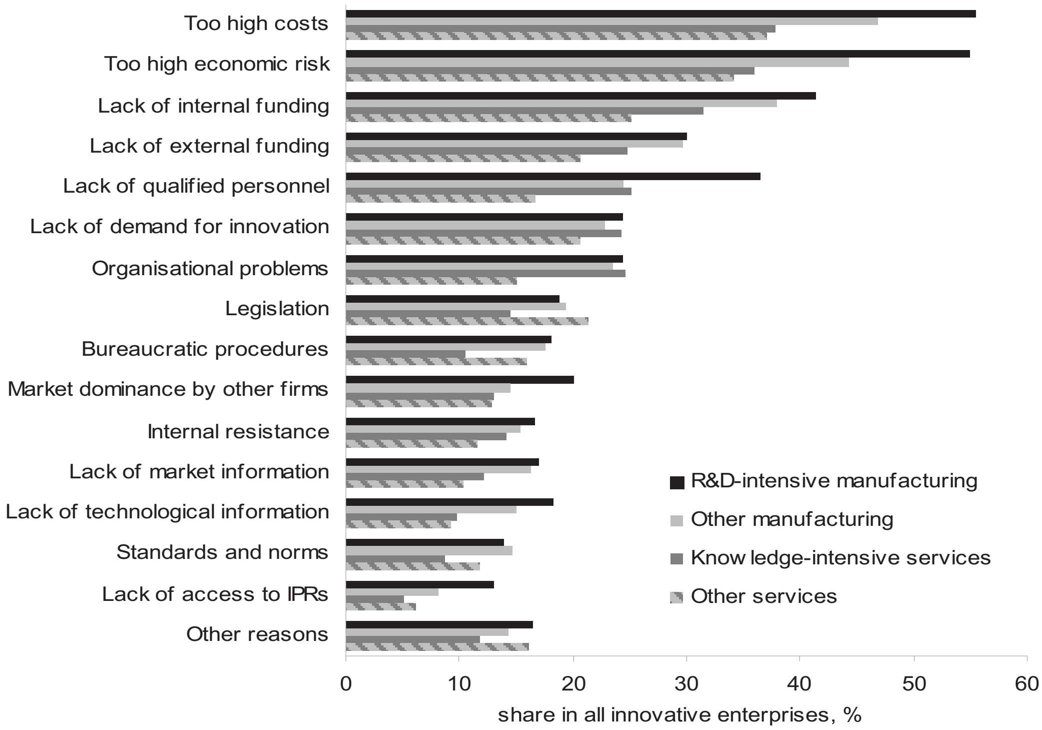
The ranking of hampering factors is pretty stable for different sector groups and size classes (Figure 63). It occurs that R&D-intensive manufacturing firms are usually more affected than other manufacturing firms, which are more affected than knowledge-intensive service firms. The lowest shares of innovative enterprises reporting obstructing factors are shown by other service firms. Sector differences are small for the share of innovative enterprises that report legislation or bureaucratic burden as barriers to innovation. Lack of demand for innovation is also reported by as similar share of firms in all four sectors.

The size classes mostly follow a simple pattern: the larger the firm the more frequently it is impeded. One interesting exception from this pattern is found for lack of external financing. Smaller firms report this barrier more often than large firms. With respect to internal funding, medium-sized firms report the lowest shares. No size differences can be found for bureaucratic burdens and only small size differences occur for market dominance of other firms.

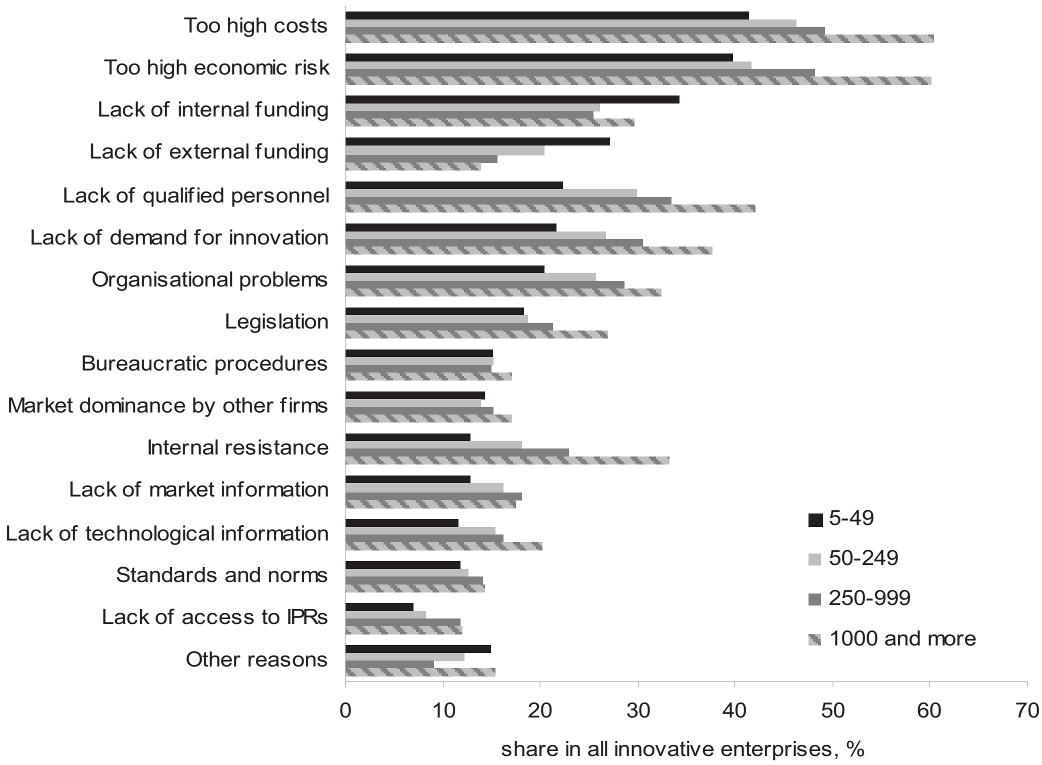
Unfortunately, it is not possible to conclude that R&D-intensive manufacturing and large firms are actually more hampered in their innovation activities than other firms since the range of different innovation activities that firms pursue is not taken into account. Larger firms as well as firms from R&D-intensive manufacturing firms may be involved in a wider range of innovation activities and hence are more likely to experience a certain barrier at least for one innovation project (Hall, 2011).

Figure 63. Obstacles for innovation 2008-2010 in innovative enterprises, by main sector and size class

Main sector



Size class

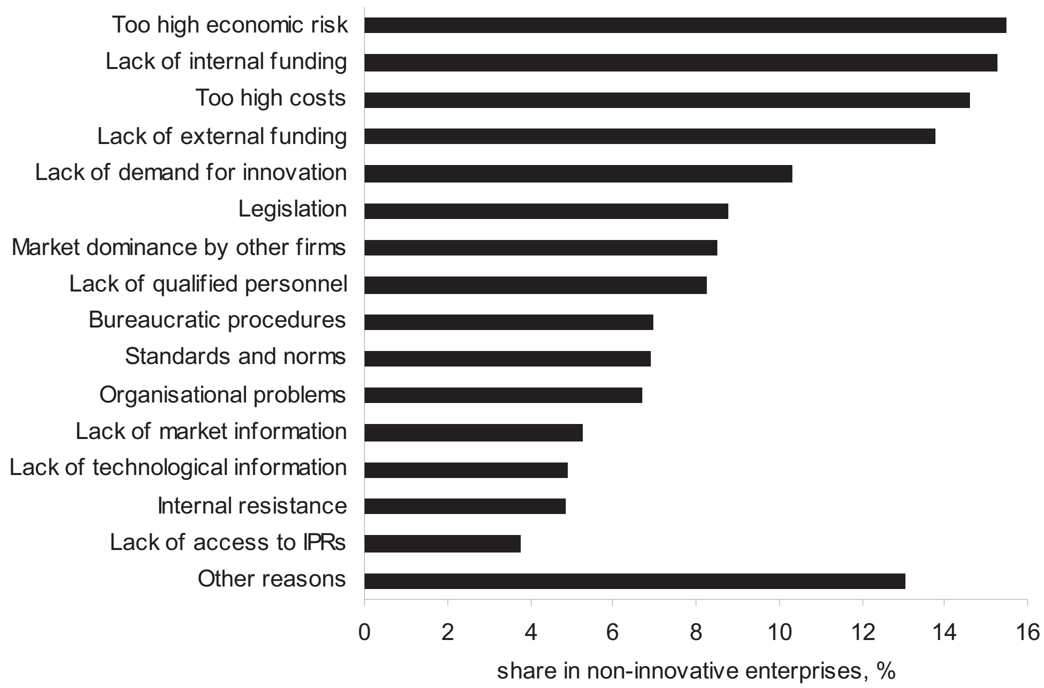


Obstacles that caused innovative firms to delay, stop or resign some of their innovation activities.

9.2 Innovation barriers in non-innovative firms

33 per cent of firms without innovation activity during 2008 and 2010 experienced obstacles that prevented them from conducting innovation activities while the remaining 67 per cent did not innovate for other reasons, such as no need because of prior innovations or no demand for innovations. As a result, non-innovative firms report all obstacles for innovation less frequently than innovative firms. Similar to innovative firms, too high risk, too high costs and lack of funding are the most important hampering factors for non-innovative enterprises (Figure 64). In contrast to innovative firms, a lack of qualified personnel is a less significant barrier for non-innovative firms while lack of demand for innovation is relatively more important. Lack of market or technological information, internal resistance and lack of access to IPRs only play a minor role for hindering enterprises to engage in innovation activities.

Figure 64. Obstacles for innovation 2008-2010 in non-innovative enterprises

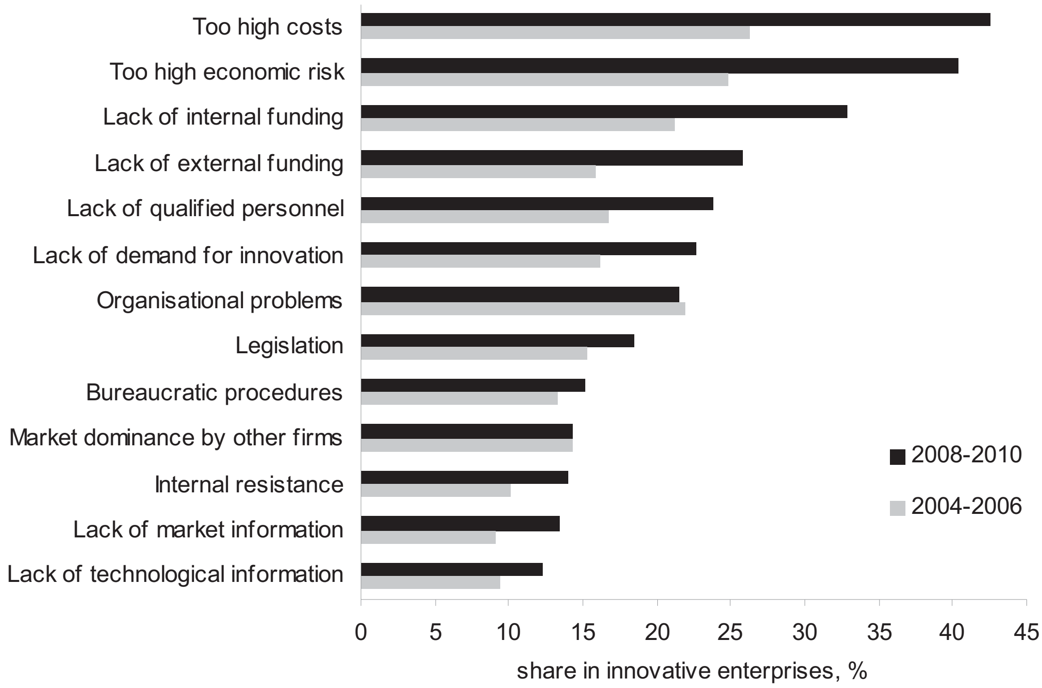


Obstacles that caused non-innovative firms to resign from any innovation activities.

9.3 Innovation barriers before and after the 2008/09 crisis

Most hampering factors that have been captured in the 2011 survey of the MIP were also included in the 2007 survey using a very similar design of the question[13] which allows for analysing changes in the significance of individual obstacles. While the 2011 survey captures innovation activities during the economic and financial crisis of 2008/09, the 2007 survey collected data for 2004 to 2006, which was a period of modest growth of the German economy. In fact, the share of innovative enterprises that reported that some of their innovation activities were hampered by obstacles was much higher for the 2008-2010 period (72 per cent) than for the 2004-2006 period (60 per cent).

Figure 65. Obstacles for innovation 2004-2006 and 2008-2010 in innovative enterprises



Obstacles that caused innovative firms to delay, stop or resign some of their innovation activities.

13 There is some deviation in the design of the questions in so far that the 2007 survey used a filter at the start of the topic on obstacles by asking whether any innovation project was delayed, stopped or not started due to hampering factors. Only firms stating yes to at least one of the three events were asked to respond the question on individual obstacles. This filtering may reduce the number of firms responding to the obstacles question compared to the 2011 survey which did not use any filter question ahead. On the other hand, the 2007 survey contained less items since the obstacles ‚standards and norms', ‚lack of access to IPRs' and ‚others' were not listed which may lead to higher responses for the remaining items compared to the 2011 questionnaire.

For most hampering factors, the share of innovative firms that reported the respective obstacle increased between the two periods, except for organisational problems and market dominance of other firms (Figure 65). Obstacles that gained in importance considerably include too high costs and too high risk as well as a lack of internal or external funding. This results show that the economic and financial crisis affected innovation activities particularly by complicating financing of innovation and by increasing the relative costs and risk of innovation activities due to less promising commercialisation perspectives.

The share of non-innovative enterprises that refrained from innovation activities because of obstacles also clearly increased between the two periods 2004-2006 and 2008-2010 from 13 to 33 per cent, though some of this increase may be attributed to the change in the design of the question (see footnote 14). While each hampering factor was cited more often in 2008-2010, particularly strong increases were reported for lack of internal and external funding sources and for bureaucratic procedures.

9.4 Consequences of Obstacles for Innovation

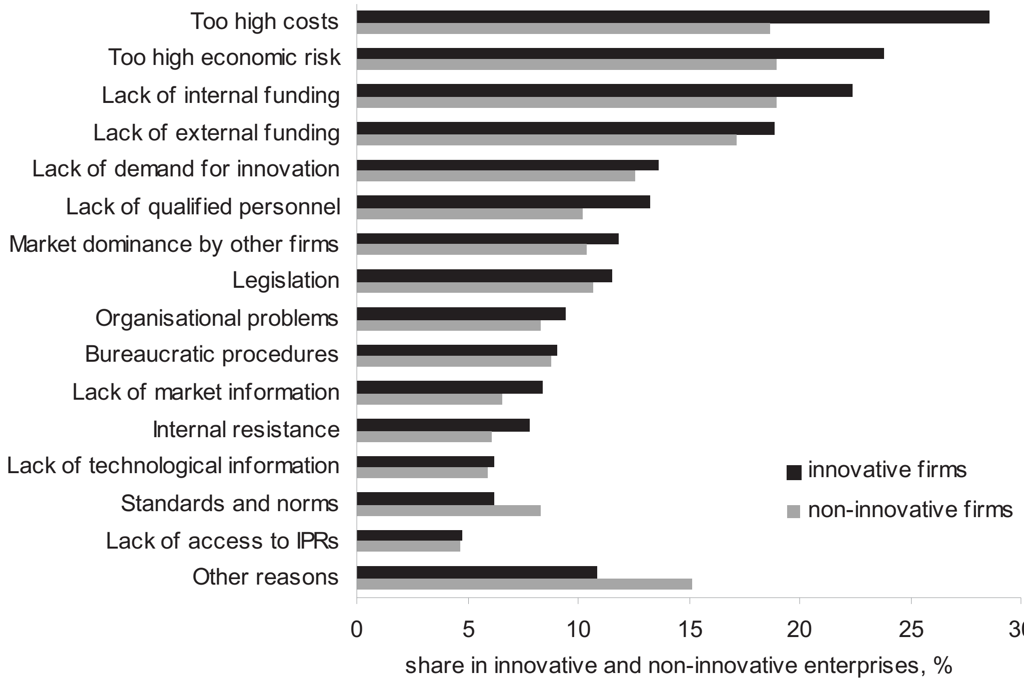
Obstacles for innovation can produce different results in firms. In the MIP survey, three types of consequences are distinguished. First, firms can resign from conducting certain innovation projects due to hampering factors. Secondly, firms can stop ongoing projects. Thirdly, obstacles may delay ongoing innovation projects and cause higher costs.

Resigning from innovation projects

Innovation projects typically start from an idea for a new product or process. While firms tend to generate many ideas for innovation, not all of them will be transferred into innovations projects and will receive funding to realise the idea. While many ideas will be filtered out due to unpromising commercialisation perspectives or difficulties in technical realisation, some ideas will not make it owing to certain obstacles. Decision to start innovations projects have to be taken by all firms, innovative enterprises and non-innovative ones. It turns out that the ranking of obstacles for resigning from innovation projects is quite similar for both types of firms (Figure 66). Some differences are worth mentioning: First, high risk and costs and a lack of funding are the most frequently cited hampering factors for the initiation of an innovation project for all firms, but there is no clear ranking in the case of non-innovators (all around 19 per cent).

For innovative firms a clear ranking emerges: 29 per cent are hampered by too high costs, 24 per cent too high risk, 22 per cent by a lack of internal funding, and 19 per cent by a lack of external funding. Secondly, standards and norms are an obstacle that more often impedes non-innovative enterprises from taking up innovation activities than motivates innovative enterprises from abandoning some of their projects. Thirdly, non-innovative enterprises are considerably more often hampered in initiating an innovation project by "other reasons" (15 per cent) which indicates that the list of obstacles presented in the questionnaire does not adequately capture the hampering factors that play a relevant role for non-innovative enterprises.

Figure 66. Obstacles for resigning innovation activities during 2006-2008 by innovative status



Obstacles that caused innovators to resign some of their innovation activities, and non-innovative firms to resign from any innovation activity, respectively.

Among the remaining factors, lack of demand for innovation and lack of qualified personnel caused 13 to 14 per cent of innovative firms to withdraw from putting an innovative idea into practice. Innovative firms are also hindered from initiating innovation projects if the market is dominated by other enterprises (12 per cent).

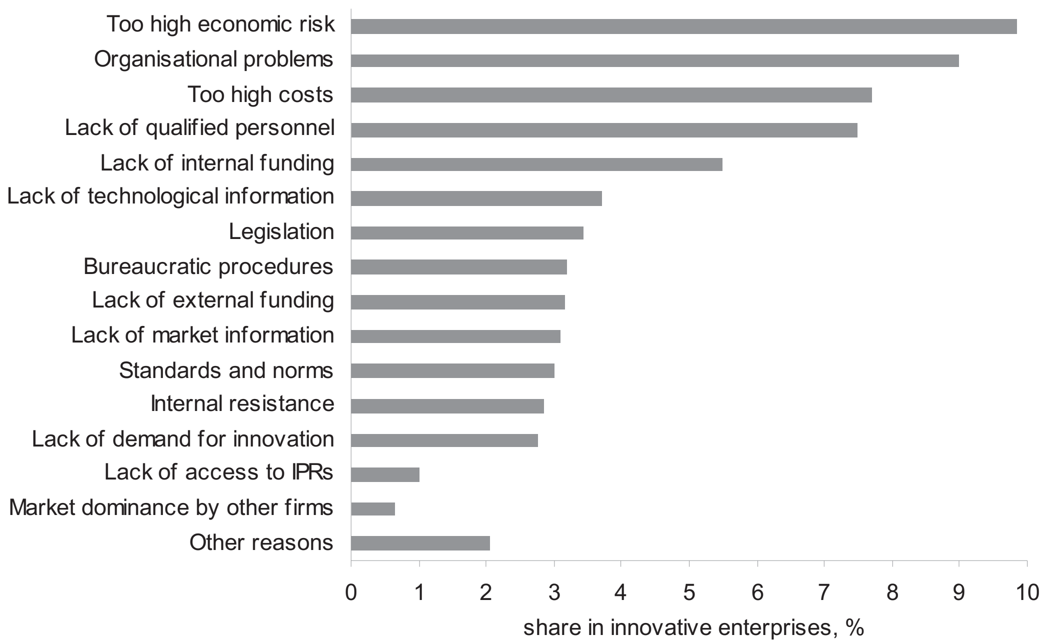
Overall, innovative firms cite most of the obstacles more frequently than non-innovative firms as a source for resigning innovation projects. This is in line with findings of other studies (Arundel, 1997; Baldwin and Lin, 2002, Mohnen and Röller, 2005). Baldwin and Lin (2002) emphasise that "innovators face hampering factors because of their innovation activity" and thus they are "more likely, not less likely, to report many types of impediments." They suggest that these hampering factors are not "impenetrable barriers", rather "indicate areas where successful firms face and solve problems."

Delay of innovation projects

Once the enterprise has initiated an innovation project (and has thus achieved the status of being an innovative firm), the focus shifts to other hampering factors. As a consequence of these factors, the finalisation of an innovation project might be delayed (Figure 67), thereby delaying the implementation of a new product or process and possibly increasing costs.

In this regard the economic risk (10 per cent) and too high cost factors (8 per cent) most frequently cause an extension of an innovation project. In addition, organisational problems within the firms turn out to hamper a significant portion of innovative firms (9 per cent) and result in longer project duration. Lack of qualified personnel is another relevant obstacle that delays innovation activities (7 per cent. All other hampering factors were cited by less than 4 per cent of innovative enterprises as a cause for project delay.

Figure 67. Obstacles delaying innovation projects in innovative enterprises during 2006-2008

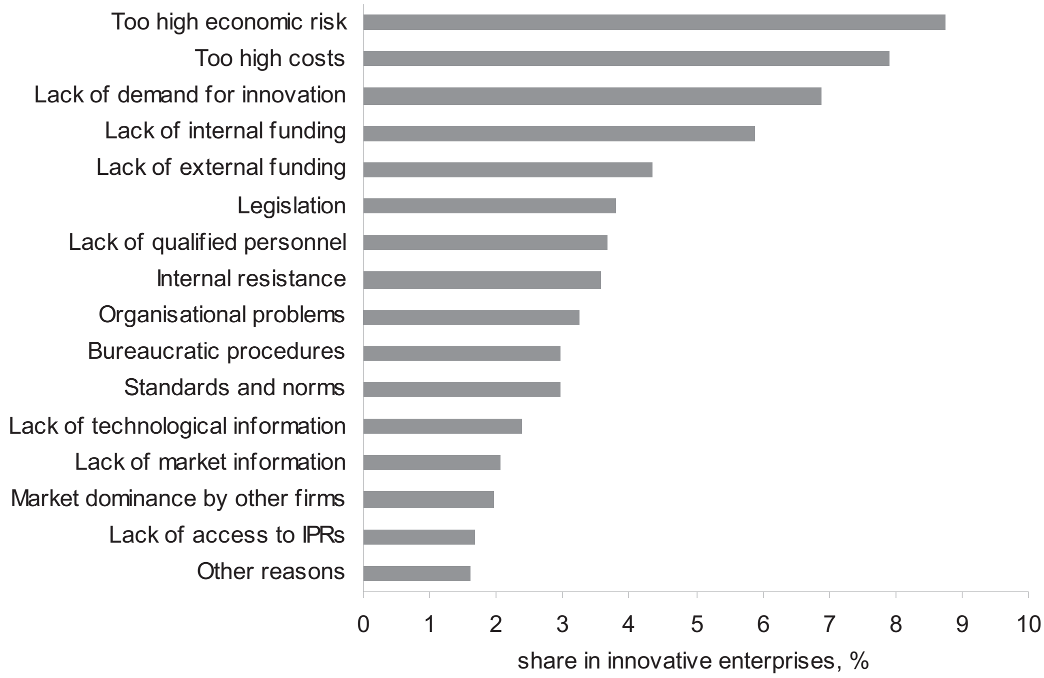


Obstacles that caused innovative firms to delay some of their innovation activities.

Stopping of innovation projects

Beside the effect of extending project duration, obstacles can also have more drastic consequences and result in the cancellation of the entire project (Figure 68). Again, too high risk and too high costs are two prominent factors for such events. In addition, a lack of demand for innovation is another important obstacle that leads firms to end projects before completion. 7 per cent of innovative enterprises report that some of their innovation activities were stopped because of insufficient customer demand. Further relevant factors include a lack of internal funding (6 per cent) and a lack of external funding (4 per cent). All other obstacles -including 'other factors'- were reported by less than 4 per cent of innovative firms.

Figure 68. Obstacles for stopping innovation projects in innovative enterprises during 2006-2008



Obstacles that caused innovative to stop some of their innovation activities.

10 Internationalisation of Innovation Activities

Increased globalisation and competition caused more and more firms to relocate part of their R&D activities to foreign countries. The surge of firms globalising their innovation activities in general and R&D in particular has been one of the most intriguing phenomena in the past 15 years in international business (UNCTAD, 2005). This phenomenon can be observed for both large multinational firms (MNEs) and international SMEs (Rammer and Schmiele, 2008). This means that an increasing share of firms have located innovation activities abroad or have increased their foreign innovation budgets. This observed trend to internationalise innovation has developed from export to production and other market-related business processes. Foreign subsidiaries of MNEs do not act as prolonged sales entities of their mother company anymore but as units that often have implemented whole value chain processes including own R&D activities. This increase in foreign R&D capabilities either results from partly shifting existing domestic R&D facilities abroad, building up additional R&D laboratories in existing foreign subsidiaries or acquiring foreign enterprises with R&D laboratories.

The international business literature offers three *motives* to explain why firms expand their innovation and R&D activities to foreign countries around the world (e.g. Kuemmerle, 1997; Florida, 1997; Granstrand et al., 1993).

– *Market-related motives*: Foreign R&D labs allow firms to be closer to local customers and they enable them to react faster to local customers' needs. Foreign R&D activities are thus often a requirement of attractive markets in order to serve them with appropriate technologies and designs in time. Such demand-oriented motives result from the necessity to customise certain products to different foreign preferences, requirements or legal regulations. By tailoring products to local requirements, firms aim to enlarge their market size and generate higher profits by leveraging innovation outcomes across borders (exploitation strategy). While Porter proposed the Triad regions as the most important destinations for a global competitive firm in the 1980s, today firms emphasise the importance of the BRIC countries in their market portfolio. The BRIC markets are among the fastest growing ones and are thus of growing interest for western firms as they face the stagnation in developed countries' markets at the same time.
– *Cost-related motives*: A second motive of why firms shift R&D abroad is that they want to exploit cost advantages in other countries in order to reduce innovation costs (Sachwald, 2008). In particular, this implies that firms relocate their R&D to locations with relatively low costs for R&D personnel. This argument might play an important role for setting up R&D laboratories in coun-

tries like BRICs (Brazil, Russia, India, and China) or more general in Eastern Europe and Asia. In addition, firms may aim to reduce production costs in foreign subsidiaries by establishing a geographically close connection between R&D and production.

– *Technology-related motives:* Finally, firms want to make use of resources at foreign locations that are not available in the same quality or quantity as in the home country. In particular, resources such as knowledge and skilled employees drive firms' decision to perform R&D activities abroad (Couto et al., 2006; Lewin und Peeters, 2006; Lewin et al., 2009). Absorbing knowledge from abroad is aimed at enhancing firms' innovativeness and consequently their competitiveness. The increasing technological complexity of products and processes and the speeding up of technological progress have led firms to source knowledge outside their boundaries in order to complement internal knowledge. This includes the use of globally available resources to foster their innovation outcomes (Kotabe, 1990). Having R&D departments in multiple countries enables firms to benefit from participating in international knowledge sharing. Foreign subsidiaries are usually embedded in local networks with customers, suppliers and competitors and are therefore linked to local knowledge, ideas and know-how (McEvily and Zaheer, 1999). Proximity to foreign knowledge sources enables foreign subsidiaries that carry out innovation activities to integrate the knowledge from the foreign business environment into their own innovation process either through co-operations or through incoming knowledge spillovers (Frost, 2001). *Absorptive capabilities* (Cohen and Levinthal, 1989) and *knowledge sharing infrastructure* allow firms to assimilate the foreign knowledge and enhance the learning process of the whole organisation (Zahra and Hayton, 2008).

In the Mannheim Innovation Panel, questions related to the internationalisation of innovation activities were first asked in the 2006 survey. The 2011 survey again collects information of the internationalisation of innovation activities for the period 2008-2010. It additionally asks firms about their motives and management of innovation activities abroad.

This chapter provides a short overview of the internationalization pattern of German firms' innovation activities. In the next section we present general figures on foreign business and innovation activities of German enterprises in the period 2008-2010, followed by an analysis on the existence of different types of innovation activities abroad. Furthermore, we shed light on different motives of foreign innovation activities and explore to which extent these goals have been achieved. Finally, we look at how German firms manage their foreign R&D ventures by analysing to which degree foreign subsidiaries are autonomous in their innovation decisions and which kind of knowledge transfer mechanisms German enterprises employ to foster knowledge exchange between domestic and foreign R&D laboratories.

10.1 Foreign Business and Innovation Activities

As already mentioned, the trend to internationalise innovation has developed from export to production and other market-related business processes. In order to evaluate the degree of foreign innovation activities, we start with a description of the involvement in foreign business activities in Figure 69 and Table 56 in the appendix. Having a foreign business activity either means that the firm *exports* to at least one foreign country or that is has at least one *foreign location*. The latter is closely related to having foreign direct investment.[14] This definition further implies for instance that using foreign suppliers or cooperating with foreign partners do *not* count as foreign business activity in the following.

According to the definition, 56 per cent of all firms with innovation activities[15] are involved in foreign business activities whereas 44 per cent do not engage in any of these activities. Compared to the period 2003-2005, this share has increased by 5 percentage points, which reflects the still ongoing process of globalization. Not surprisingly, the more prevalent business activity is exporting. 51 per cent of all innovative firms sell their products to foreign customers (+6 percentage points). Roughly 19 per cent of all firms with innovation activities or every third firm with foreign business activities produces at foreign locations, a share that is slightly less than in the reference period. Nearly every fourth firm with foreign business activities is simultaneously engaged in both exporting and production abroad. This corresponds to 13 per cent of all innovative enterprises. In contrast, 38 and 6 per cent of them are only involved in exporting and production abroad, respectively.

The degree of internationalization widely differs between sectors. In R&D-intensive manufacturing sectors the highest share of innovative firms with foreign business activities can be observed (87 per cent), followed by other manufacturing sectors with about 61 per cent. Nearly all innovative firms from R&D-intensive manufacturing are exporters (86 per cent) and 27 per cent have at least one foreign production location. Among R&D-intensive manufacturing firms chemical and pharmaceutical firms are the most internationalised firms (93 per cent), followed by electronics (91 per cent), vehicles (83 per cent) and machinery (75 per cent). Service firms are in general less engaged in foreign activities than manufacturing firms. This is mainly due to lower export activities whereas only small differences can be observed with respect to foreign locations, in particular between other manufacturing firms and service firms.

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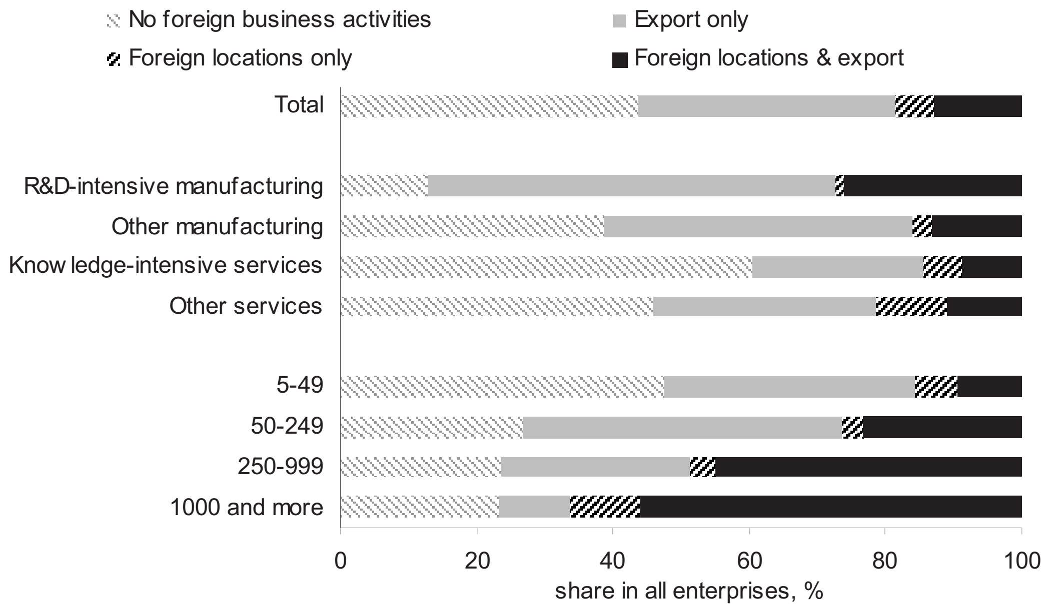
14 Note that in the MIP foreign business activities are recorded for firms with headquarters in Germany and for German subsidiaries of companies with headquarters abroad. Foreign locations thus comprise subsidiaries of German firms or locations of the foreign parent company.

15 The expressions „firms with innovation activities" and innovative firms are used interchangeably. Firms with innovation activities are firms that have introduced new products or processes or that have still ongoing or abandoned innovation projects in the period 2008-2010.

Small firms with less than 50 employees are less engaged in foreign business activities than medium or large enterprises. But nevertheless, the majority of small innovative firms are internationally engaged (53 per cent). Surprisingly, there are only small differences in the overall existence of foreign business activities between firms with more 50 and more employees. However, the structure of activities differs. Larger firms with more than 1,000 employees are by far more often in involved in both exporting and foreign production (56 per cent) than firms with 250-999 employees (45 per cent) or medium-sized firms with 50-249 employees (23 per cent).

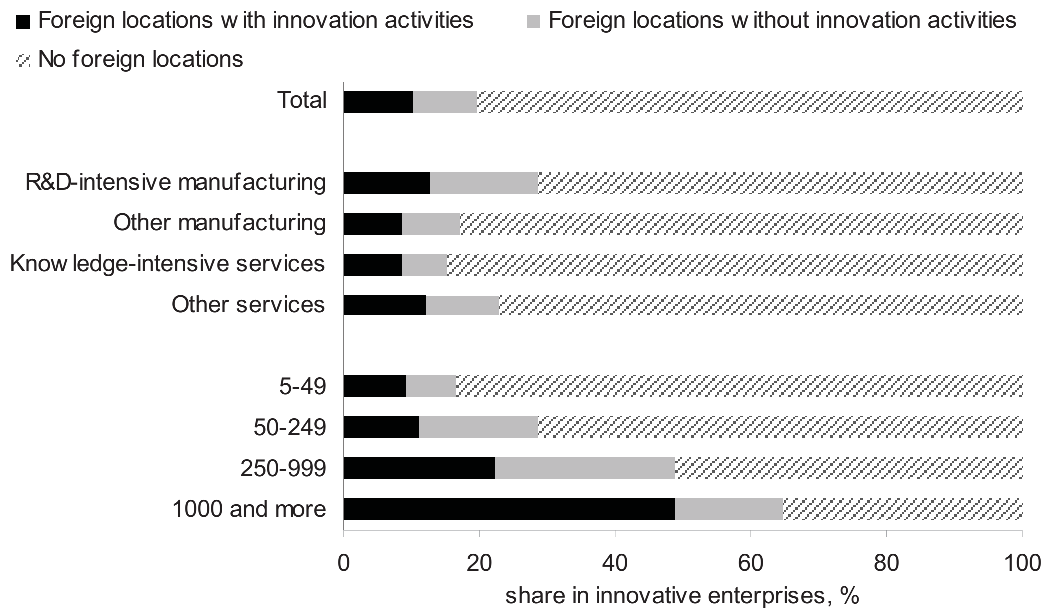
Figure 69. Foreign business activities 2008-2010, by main sector and size class



The tasks performed at foreign locations can of course differ. Figure 70 and Table 57 in the Appendix determines whether firms perform innovation activities at their foreign locations or not. Innovation activities are defined in the spirit of the Oslo manual and thus comprise not only R&D activities but also the construction, design and preparation of new products and processes, the production of new processes and services or the introduction of process innovations at foreign locations. This broad definition also allows us to cover foreign innovation activities of firms in sectors where R&D plays a subordinate role for innovation like in services or other manufacturing.

Though innovation activities have increasingly been globalised in the past, they still show the least degree of internationalisation of all business processes. 10 per cent of all innovative firms perform innovation activities at foreign locations. Surprisingly, this proportion has sharply decreased compared to the period 2003-2005 (18 per cent) and might in part reflect the consequences of the worldwide economic crisis. This corresponds to 18 per cent of all innovative firms with foreign business activities. Taking into account that only every fifth innovative company has foreign locations at all, this implies that every second firm that possesses foreign locations also uses them for performing innovation activities. Interestingly, R&D-intensive manufacturing firms have the highest share of firms performing innovation activities abroad (13 per cent), followed by other services (12 per cent) and knowledge-intensive services (9 per cent) and other manufacturing (8 per cent). However, relating this figure to the number of firms with foreign locations in each sector, R&D-intensive manufacturing firms use their foreign locations less for innovation activities (45 per cent) than any other sector (49 per cent in other manufacturing, 53 per cent in other services and 57 per cent in knowledge-intensive services).

Figure 70. Foreign innovation activities 2008-2010, by main sector and size class



Huge differences exist between firms of different size. Nearly every second large firm with 1,000 and more employees performs innovation activities abroad (49 per cent). This implies that 3 out of 4 innovative firms with foreign locations also use them for performing innovation activities. Among small firms with 5-49 employees this share amounts to 55 per cent. Surprisingly, this proportion is larger than for small-medium (50-249 employees) and medium-sized (250-999 employees) firms where only 39 and 46 per cent of innovative firms with foreign locations are engaged in innovation activities abroad.

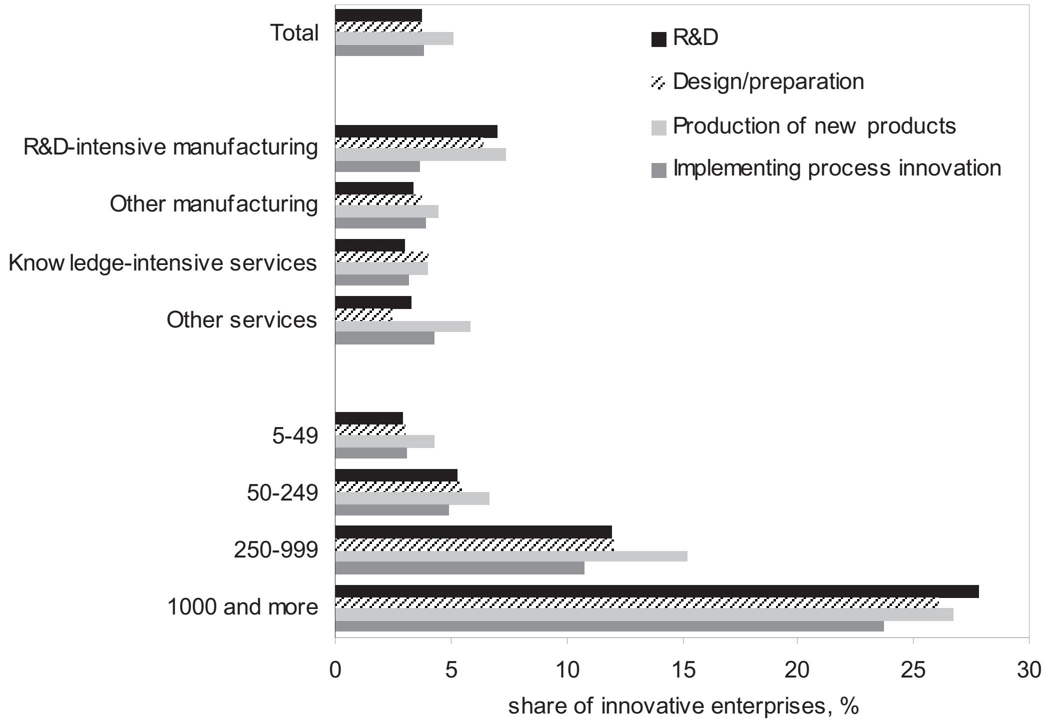
10.2 Types of Foreign Innovation Activities

In this section we take a closer look at different types of innovation activities that take place in foreign locations. As already explored in the previous section we distinguish four different types of innovation activities:

- R&D
- Design and preparation
- Production of new products
- Implementation of new production technologies (process innovation)

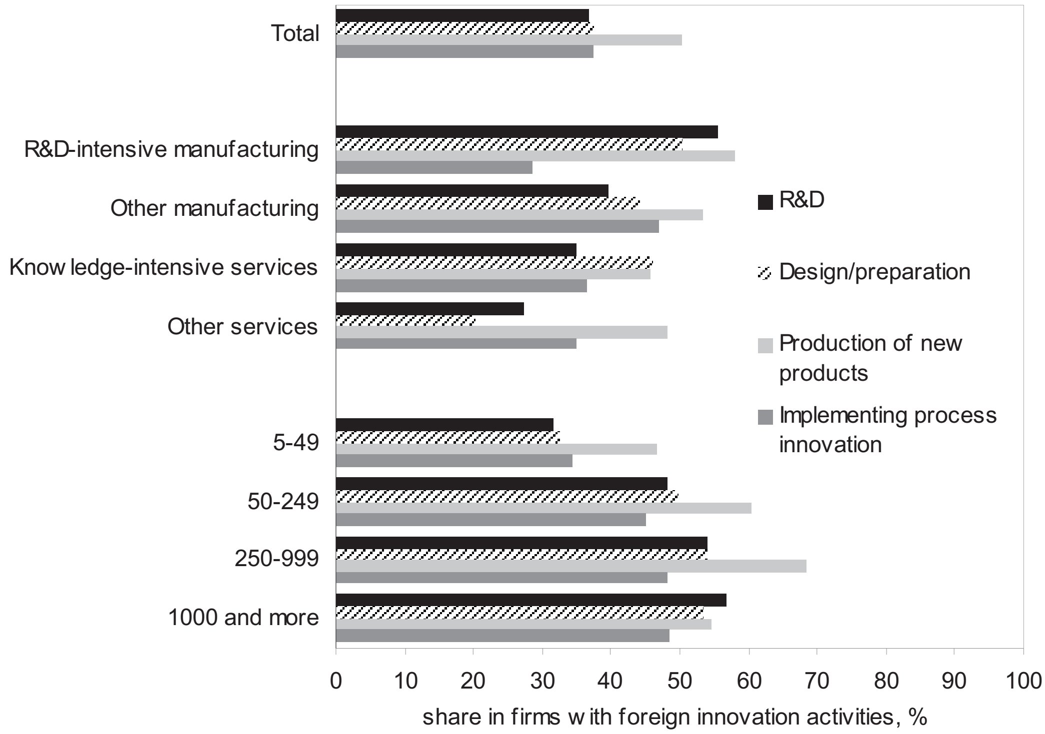
Figure 71 and Figure 72 illustrate what types of innovation activities enterprises have performed at their foreign locations in the period 2008-2010. The most frequent innovation activity at foreign locations is the production of new products. 5 per cent of innovative enterprises produce new products in their locations abroad. This implies that every second firm with innovation activities abroad is engaged in the production of new products. Compared to the period 2003-2005 this share has significantly increased by 9 percentage points (2003-2005: 41 per cent of firms with foreign innovation activities).

Figure 71. Type of foreign innovation activities of innovative enterprises 2008-2010, by main sector and size class



We also observe a convergence between different types of innovation activities abroad. In the period 2003-2005, even 43 per cent of enterprises with foreign innovation activities performed design, construction, preparation and other conceptual activities at their foreign locations while only 20 per cent were engaged in R&D and investments in new production processes abroad. In the period 2008-2010, however, no significant differences have been found between R&D, design/preparation and process innovation activities. 37 per cent of firms with innovation activities abroad perform these types of activity.

Figure 72. Type of foreign innovation activities 2008-2010, by main sector and size class



This pattern of foreign innovation activities is particularly driven by small and medium enterprises. The production of new products is the most frequent innovation activity abroad for all of them, ranging from 46 per cent for small enterprises to 69 per cent for medium enterprises. For small enterprises with less than 50 employees, the implementation of new processes was the second most important foreign innovation activity. In contrast, international research was done by just 32 per cent of small enterprises with foreign innovation activities and by 54 per cent of medium enterprises. For large enterprises with more than 1,000 employees, however, R&D is even the most frequent innovation activity abroad. 57 per cent of large firms carry out research projects in their foreign locations, closely followed by the production of new products (55 per cent), design and preparation activities (53 per cent) and process innovation (48 per cent).

Not surprisingly, we found foreign research activities to be more important for industry than for services. In R&D-intensive manufacturing, 7 per cent of innovative firms or 55 per cent of firms with foreign innovation activities carry out R&D. Among R&D-intensive industries, electrical engineering and vehicles show the highest share of firms with foreign R&D (65 per cent) closely followed by plastics (64 per cent) and the chemical industry (62 per cent). In other manufacturing, 3 per cent of innovative firms or 40 per cent of firms with foreign innovation activities perform foreign R&D. Together this implies that about 2,950 manufacturing firms make use of foreign research. In services, about 2,750 firms are engaged in international research activities. This corresponds to 35 and 27 per cent of knowledge-intensive and other service firms with foreign innovation activities, respectively.

We can furthermore ascertain that in all four industries the production of new products is the most frequent foreign innovation activity. In other manufacturing and other services this is followed by investments in new production technologies abroad. However, in knowledge-intensive services the second most important foreign innovation activity is design and preparation. R&D and process innovation are of equally little importance in this sector. In R&D-manufacturing, R&D comes second, closely followed by design and preparation. Investment in new production technologies is in fourth place. Only 28 per cent of R&D-intensive manufacturing firms with foreign innovation activities invest in process innovation. This is less than in all three other sectors.

10.3 Locations of Foreign Innovation Activities

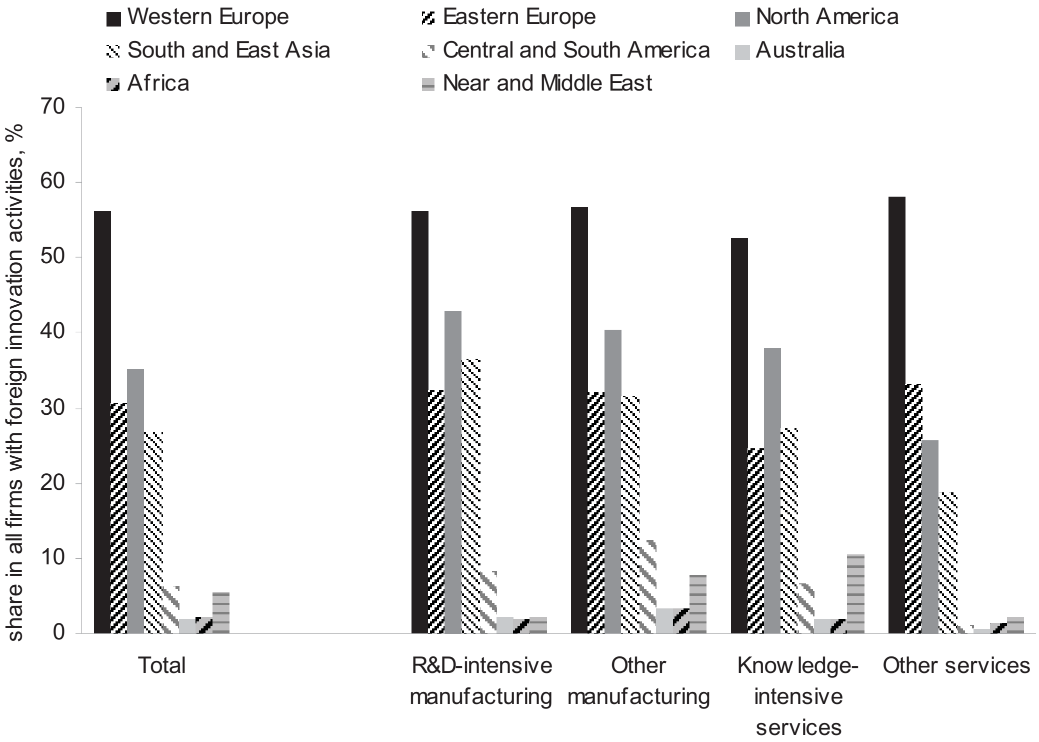
In addition to the type of foreign innovation activities, the MIP 2011 survey furthermore asked firms to indicate the countries in which they undertake these activities. Due to rather low absolute numbers for some single countries, we summarise them as the following seven regions (only countries are listed that were mentioned as location of foreign innovation activity):

- *Western Europe* (EU15 excluding Germany, EFTA countries, Malta, Cyprus)
- *Eastern Europe* (Albania, Bulgaria, Bosnia and Herzegovina, Lithuania, Latvia, Estonia, Croatia, Macedonia, Moldavia, Montenegro, Poland, Romania Russia, Serbia, Slovakia, Slovenia, Czech Republic, Ukraine, Hungary, Belarus, Georgia, Azerbaidzhan)
- *Near/Middle East* (Turkey, Saudi Arabia, Lebanon, Egypt, United Arab Emirates, Iran, Israel, Dubai, Qatar, Oman)
- *South and East Asia* (China, India, Japan, South Korea, Pakistan, Vietnam, Taiwan, Singapore, Malaysia, Sri Lanka, Indonesia, Hong Kong, Mongolia, Thailand, Philippines, Macao)
- *North America* (USA and Canada)
- *Central and South America*
- *Australia* (including New Zealand)
- *Africa*

Note that in the following we use location counts that do not take into account the size of innovation activities at a certain location.[16] That is, a firm performs innovation activities in a specific region, if it innovates in at least one of the countries belonging to the region. We also do not take into account in how many different countries a firm innovates within a region or how many locations a firm uses within one country. A further limitation is that the 2011 survey does not allow us to distinguish the types of innovation activities by country.

[16] Of course, all numbers are extrapolated to the target population.

Figure 73. Location of foreign innovation activities 2008-2010, by main sector



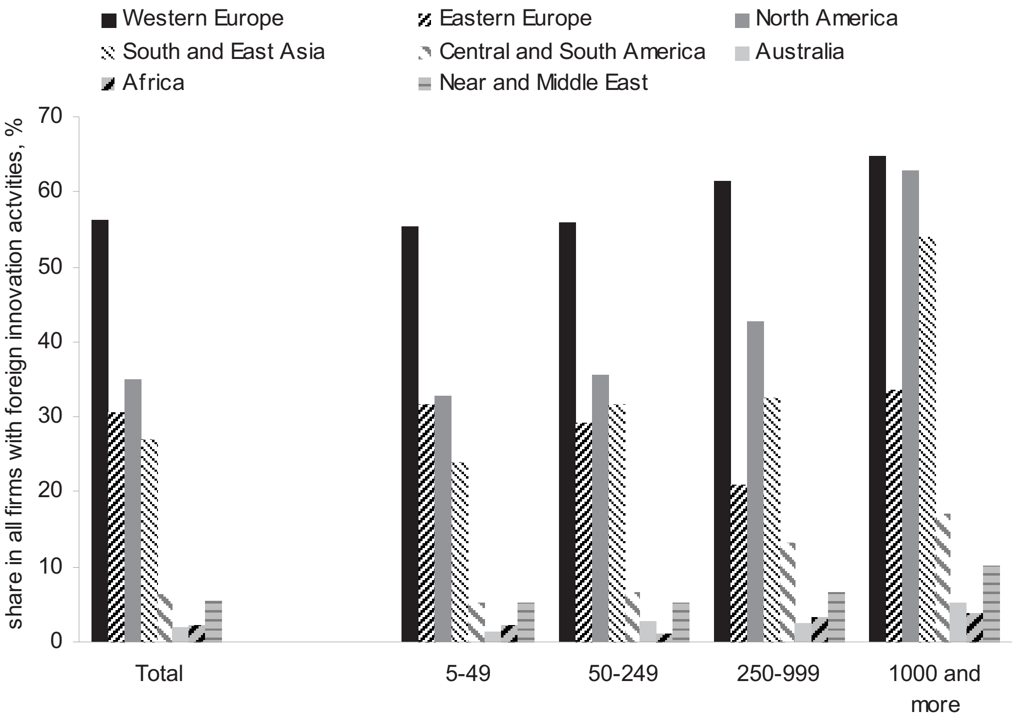
In all sectors and in all size classes, firms predominantly locate their foreign innovation activities in Western Europe as can be seen in Figure 73 and Figure 74. Between 2008 and 2010, 56 per cent of all enterprises with foreign innovation activities conducted them in Western Europe. Although not directly comparable with Rammer and Schmiele (2008), this figure is similar to that of the period 2003-2005.[17] The figures furthermore reveal that the variation across sectors and size is surprisingly small, ranging from 53 per cent in knowledge-intensive to 58 per cent in other services, and 55 per cent for small and 65 per cent for large enterprises, respectively. In all sectors except for other services, North America comes second with about 40 per cent. In R&D-intensive manufacturing, Asia act as the third most important region for foreign innovation activities (37 per cent), followed by Eastern Europe (32 per cent). The same pattern can be observed in knowledge-intensive services though at a lower level (27 per cent in Asia and 25 per cent in Eastern Europe). In other manufacturing, innovation activities equally take place in Asia and East Europe (32 per cent). In contrast, Eastern Europe is the second most frequent location for foreign innovation activities in other services, followed by North America and Asia.

[17] Rammer and Schmiele (2008) report the proportion of firms performing innovation activities in Western Europe in the period 2003-2005 separately for each type of foreign innovation activities. The corresponding shares vary between 48 per cent (production of new products) and 67 per cent (investment in new processes)

Overall, 35 and 27 per cent of firms with foreign innovation activities perform them in North America and Asia. Compared to the period 2003-2005, these numbers have significantly increased. In the reference period, about 20 per cent of firms with foreign innovation projects carried them out in North America and Asia, respectively. This rise illustrates the enormous globalization dynamics of foreign innovation activities in recent years.

In general, the four other regions turn out to be less important locations for foreign innovation activities. For each region, the share of firms undertaking innovation there is 6 per cent or below. If at all, we observe that South America is relatively important in other manufacturing (12 per cent) while other countries are somewhat important locations for firms in knowledge-intensive services (10 per cent).

Figure 74. Locations of foreign innovation activities 2008-2010, by size class

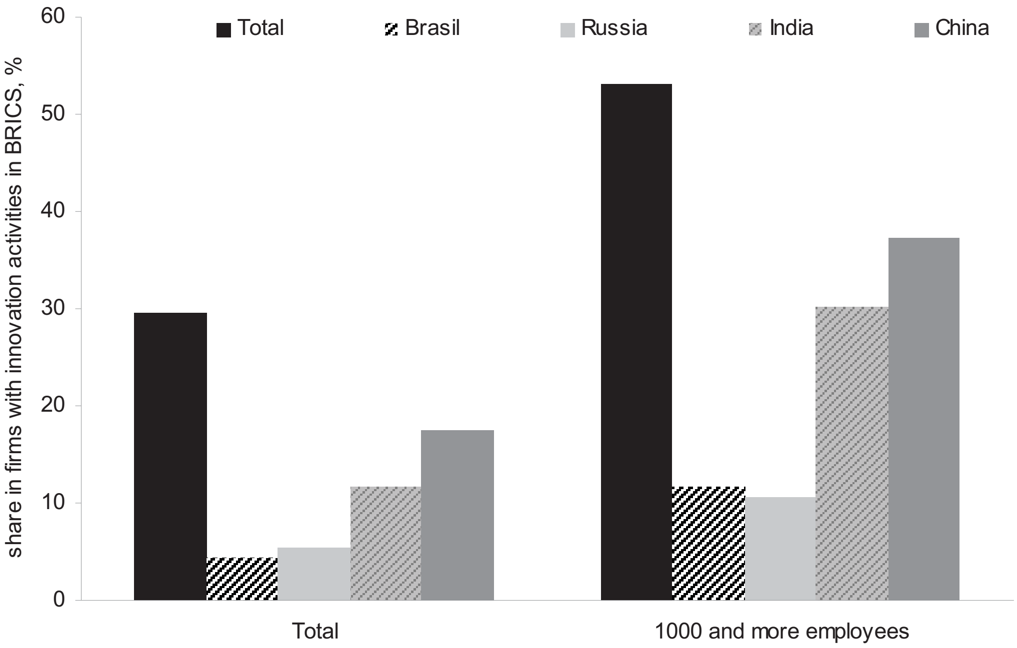


The regional distribution reveals more heterogeneity with respect to firm size (see Figure 74). One obvious reason is that larger firms exhibit a higher likelihood of having multiple foreign locations. In particular, we can distinguish between large firms with 1,000 and more employees and SMEs. For firms with less than 1,000 employees a very similar pattern emerges. Western Europe is the most frequent location for foreign innovation and far ahead of North America that comes second, followed by Asian countries for small-medium and medium firms and Eastern European countries for small firms. For large enterprises, however, North American countries (63 per cent) are nearly as important as countries in Western

Europe (65 per cent). In addition, more than half of the large enterprises with foreign innovation activities innovate in Asian countries (54 per cent).

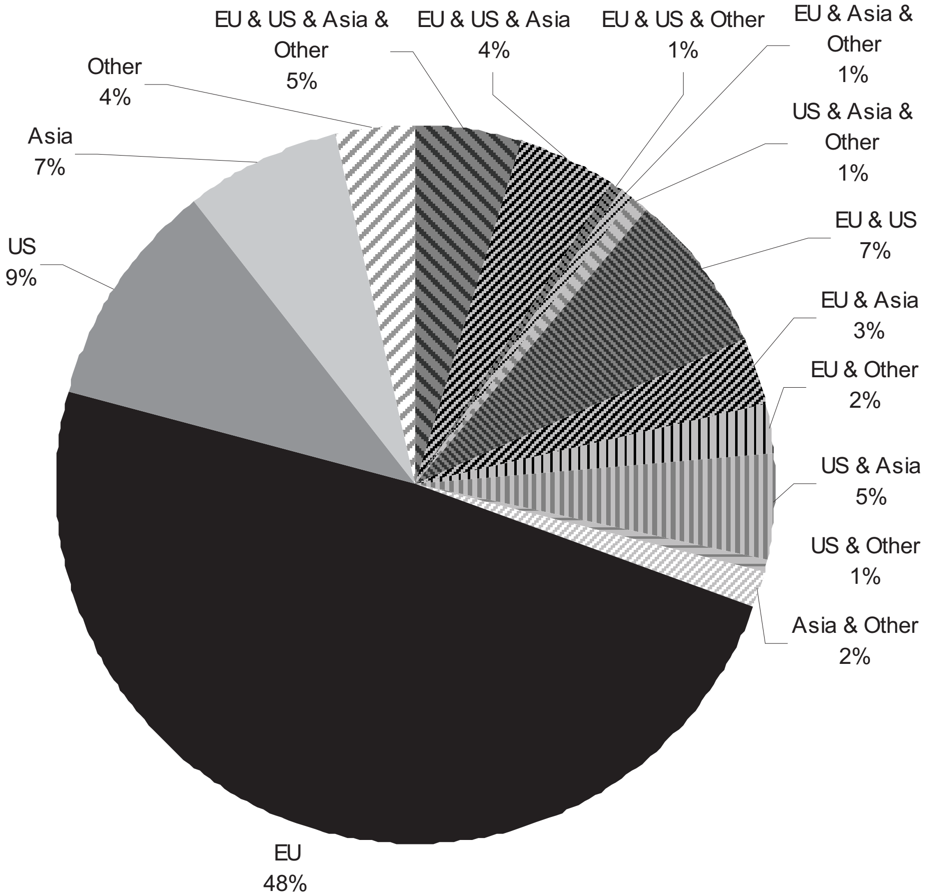
In recent years, China, India, Brazil and Russia, the so called BRIC countries, have shown particularly high growth rates and are thus of focal interest both in the international business literature and in policy debates. Figure 75 depicts the share of firms with foreign innovation activities that carry out innovation projects in one of these four countries. Overall, 30 per cent of these firms carry out innovation in at least one of the four BRIC countries. Among the BRIC countries, China is the most frequent location for foreign innovation activities (17 per cent), followed by India (12 per cent), Russia (5 per cent) and Brazil (4 per cent). Compared to the period 2003-2005, China has sharply increased (+ 5 percentage points) its position as location for innovation activities. The engagement in innovation activities in China is particularly common in sectors such as motor vehicles (47 per cent), plastics (46) and chemicals and pharmaceuticals (41). India on the other hand is most frequently chosen as innovation location by firms belonging to plastics (37 per cent), motor vehicles (33 per cent) and the IT and telecommunication sector (21 per cent). Among large firms, more than every second enterprise with foreign innovation activities already carries out innovation in at least one of the BRIC countries (53 per cent). China is again the most frequent innovation location abroad (37 per cent).

Figure 75. Foreign innovation activities in BRIC countries 2008-2010



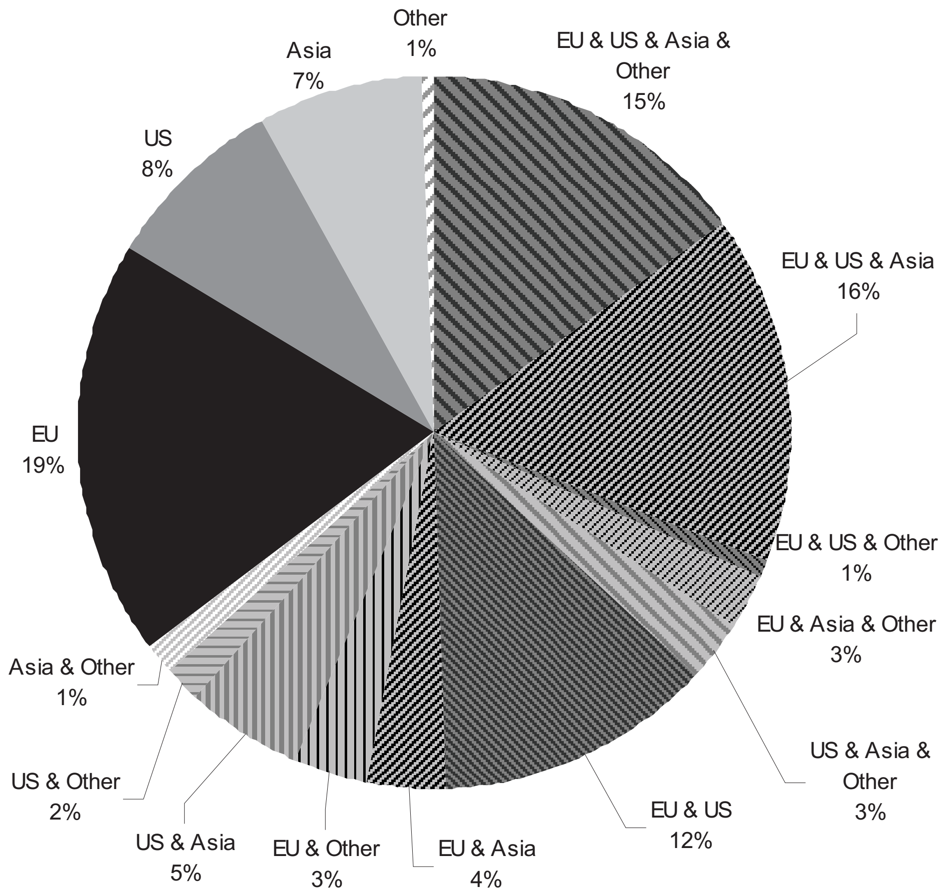
As already pointed out, enterprises might have multiple innovation location abroad in different regions. Figure 76 highlights the spread of foreign innovation activities across regions. For the sake of clarity, we only distinguish between four regions in the following: Europe, the US, Asia and other regions (including Canada). Overall, 69 per cent of firms with foreign innovation activities are present just in one region. Predominantly, they are only innovating in Europe (49 per cent). 10 per cent of the firms with foreign innovation activities have chosen the US as their only location for foreign innovation activities, 7 per cent Asia and 4 per cent one of the other regions. On the contrary, 31 per cent have decentralised their innovation activities across two or more regions. Among them, 19 per cent carry out innovation projects in at least two regions, 6 per cent in three regions and 5 per cent in all four regions. If firms are present in two regions, Europe and the US are the most frequent combination (7 per cent), surprisingly followed by the US and Asia (5 per cent). EU and Asia comes third.

Figure 76. Regional distribution of foreign innovation activities 2008-2010



Decentralization of innovation activities across different regions is much more distinctive among large enterprises (see Figure 77). 15 per cent of all large firms with foreign innovation activities indicate that they innovate in all four regions. Another 22 and 28 per cent are present in three and two regions, respectively. Taken together, this implies that 65 per cent of the large enterprises have decentralised their innovation activities across two or more regions. Only 35 per cent of them perform innovation activities only in one of the four regions. The ranking of the regional combinations, however, is the same as in the overall sample of firms.

Figure 77. Regional distribution of foreign innovation activities of large enterprises 2008-2010



10.4 Motives of Foreign Innovation Activities

Firms may pursue quite different goals with their foreign innovation activities. The 2009 survey therefore also poses questions on the motives of foreign innovation activities. According to the three main motives explored in the introduction, the MIP questionnaire breaks down the *market-related motives* into the following three items:

- Acquiring new customers,
- Adaptation of products and processes to customer needs and
- Contact to innovation leading customers and markets.

Regarding *cost-related motives*, the survey asked firms about the importance of the following two motives for performing innovation abroad

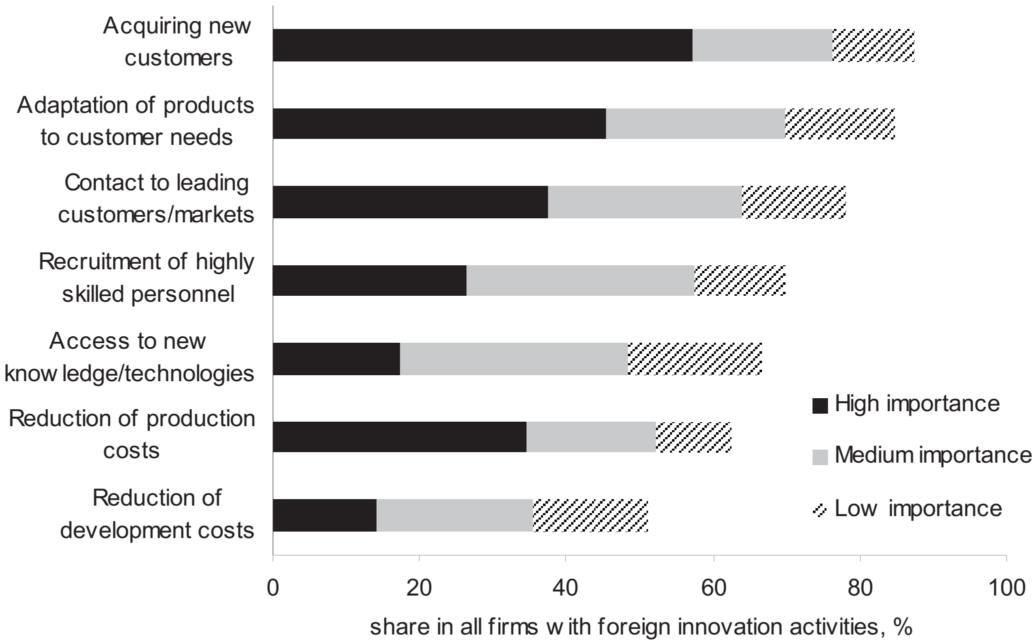
- Reducing development costs and
- Reducing production costs.

Finally, the survey distinguished between the following two *technology-related motives*:

– Recruitment of highly-skilled personnel and
– Access to new knowledge/technology.

Figure 78 illustrates the importance of different motives of foreign innovation activities. A clear pattern emerges from this figure. Demand or market-related motives are by far the most important motives for firms starting innovation activities abroad. 88 per cent of all enterprises with foreign innovation activities regard the acquisition of new customers as an important goal of their foreign innovation projects; among them 57 per cent viewed this item as highly important. 85 per cent of the enterprises aimed at adapting their products and processes to specific local customer needs, preferences or regulations. This exploitation strategy of products and processes developed in Germany in order to gain market shares was ranked as highly important by 46 per cent of firms. Contact to foreign customers or markets that can be viewed as innovation leaders drive 78 per cent of the enterprises into foreign innovation activities. 38 per cent deem this motive to be highly important. All in all, these demand and market-related goals also explain why an increasing number of firms have set up R&D facilities in BRIC countries.

Figure 78. Motives of foreign innovation activities 2008-2010

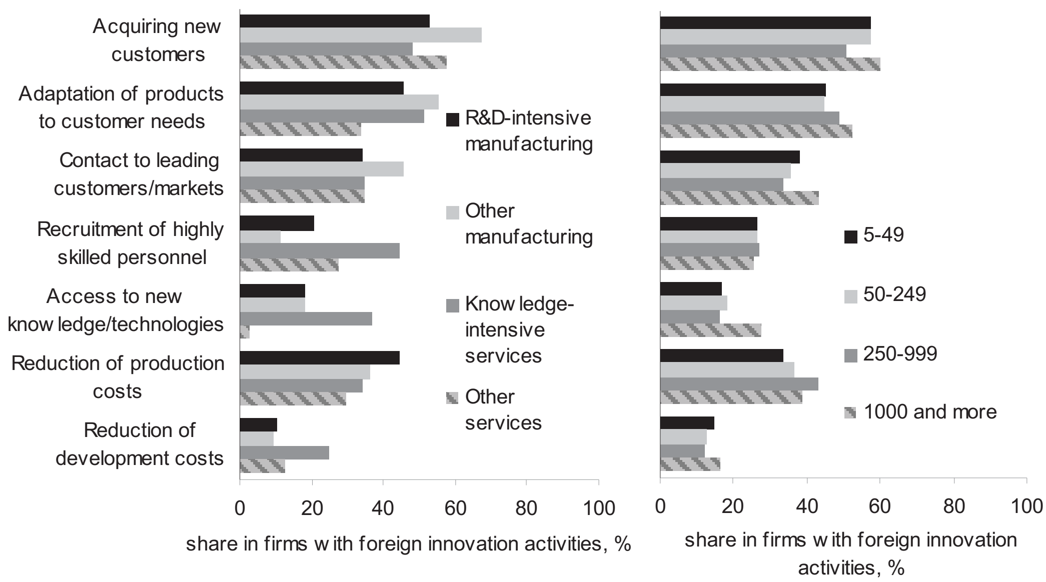


Clearly, technology-related motives are of lesser relevance than demand-driven goals, both in terms of overall importance and high importance. 70 per cent of the enterprises with foreign innovation activities start innovation projects abroad in order to recruit highly skilled personnel. 26 per cent of the firms with foreign innovation activities viewed the lack of highly qualified personnel as an important driver for their international innovation strategy. Thus, the scarcity of highly educated researchers acts as a geographic disadvantage. Easier access to new technologies or to knowledge that is available abroad played a role for 67 per cent of the enterprises with foreign innovation activities. But only 17 per cent of the firms say that this is a highly relevant motive.

Cost-related motives are in third place. The reduction of production and development costs matters for 62 and 51 per cent of the enterprises with foreign innovation activities, respectively. But only 35 and 14 per cent viewed this motive as highly important for their decision to internationalise their innovation activities. But note that in terms of high importance the reduction of production costs is even more relevant than the access to new knowledge or the hiring of highly skilled researchers.

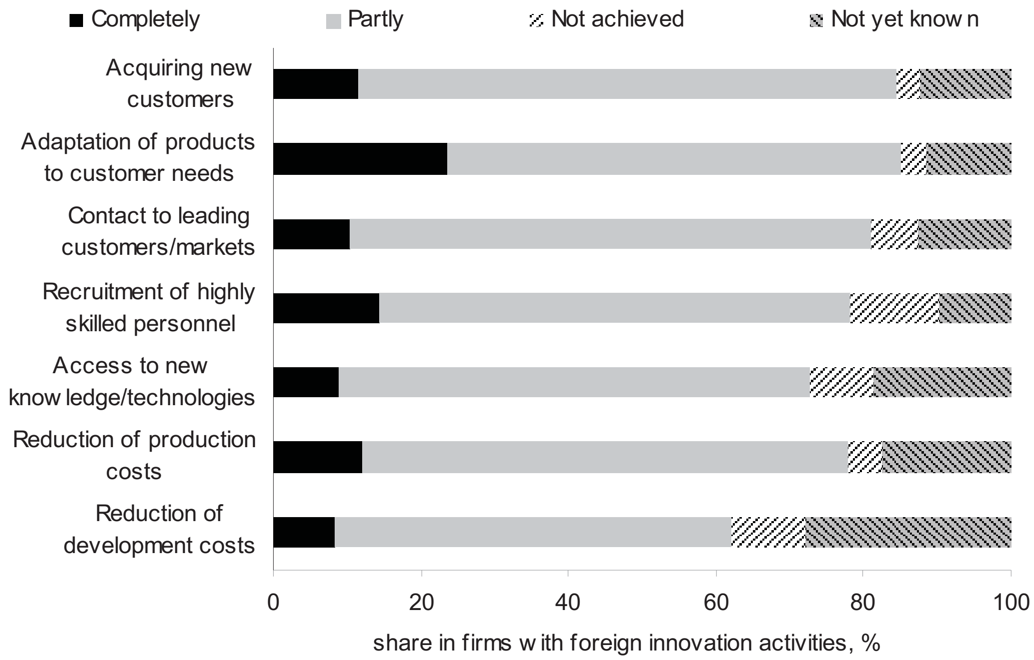
This pattern is homogenous across firms of different size (see Figure 79). It can also be observed in all four sectors with one exception. In knowledge-intensive services, the lead of market-related motives over technology-related motives is less pronounced. The hiring of highly-skilled personnel and the access to new knowledge or technologies is even more important than establishing contacts to new innovation leaders. Interestingly, this result is mainly driven by technical and R&D services whereas in industries such as IT, telecommunication, financial services, consultancy and advertising, market-related motives also clearly dominate technology arguments.

Figure 79. Highly important motives of foreign innovation activities 2008-2010, by main sector and size class



In addition to the motives of foreign innovation activities, the 2009 survey furthermore asked firms to evaluate to what extent they have achieved their goals. Firms could choose between the options completely, partly or not achieved and not yet known. Figure 80 shows that for all objectives only a small fraction of firms have indicated that they have completely reached their target. 24 per cent of firms have been successful in adapting their products and processes to customer needs. For all targets this percentage varies between 8 (reduction of development costs) and 14 per cent (recruitment of highly skilled personnel). The majority of firms have only been partly successful in reaching their goals. Taking both categories together, market-relevant motives also show the highest success rate with 85 (acquiring new customers, adaptation) and 81 per cent (contact to innovation leading customers) of all enterprises to which the corresponding goal was of importance.

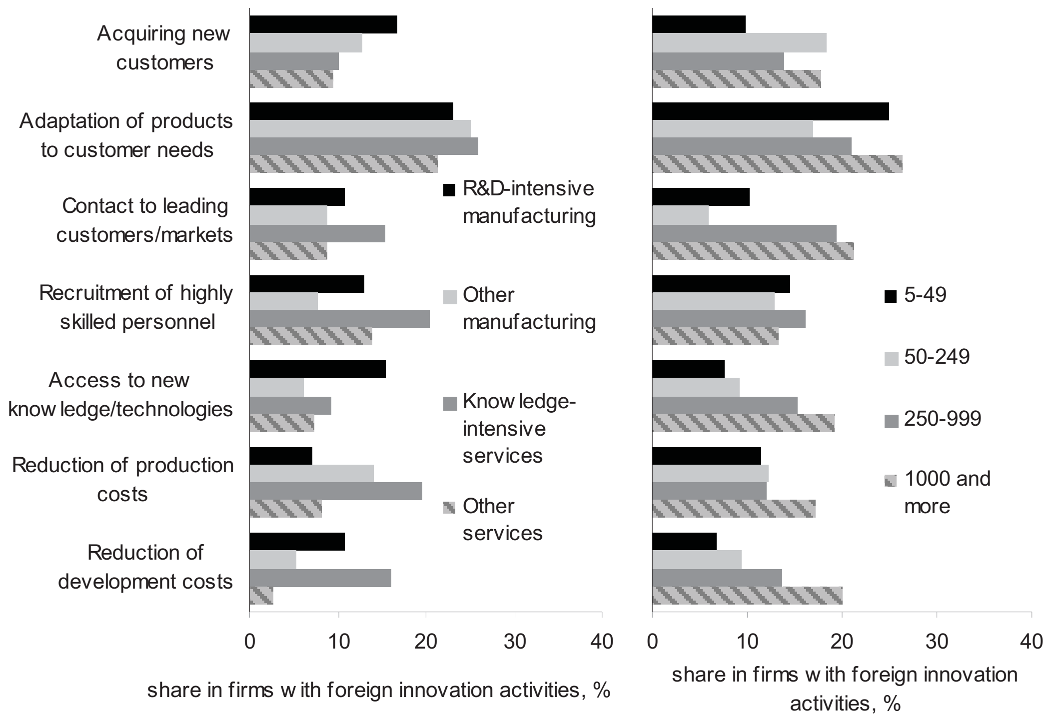
Figure 80. Achievement of goals of foreign innovation activities 2008-2010



Furthermore there is evidence that firms experience a slightly higher success rate with respect to technology goals than with cost goals. On the one hand, 78 and 73 per cent of the firms stated that they have been successful in hiring highly skilled researchers and in gaining access to new technologies or knowledge. On the other hand, 78 and only 62 per cent successfully cut production or development costs. The largest difficulties have arisen in the recruitment of highly skilled personnel. 12 per cent of the firms for which this goal was important were not able to hire highly skilled researchers. Since knowledge is mainly embodied in persons, it is not surprising that 9 per cent of the firms for which access to new knowledge was important indicated that they did not achieve their goal. 10 per cent of the firms that perform foreign innovation activities also in order to reduce their production costs did not reach this target. A significant amount of firms still do not know whether their foreign innovation activities will be successful (with respect to the initial goal). This is particularly true for whether they will be able to reduce development costs. Nearly every third firm that aims at reducing development costs is still uncertain about the outcome (29 per cent). One reason for this evidence might be that shifting R&D abroad might initially disproportionately increase monitoring, transaction and coordinating costs. Uncertainty is also still quite high for assessing whether firms will be successful in getting access to new knowledge or technologies (19 per cent) and reducing production costs (18 per cent).

For all industries, the highest and a similar success rate (in terms of complete achievement) can be found for the adaptation of new products and processes. In R&D-intensive industries, firms were also relatively successful in acquiring new customers, the access to new knowledge, and the recruitment of highly-skilled personnel (see Figure 81). In addition to adaptation, knowledge-intensive service firms furthermore exhibit the highest success rates in recruiting highly-skilled personnel and in cutting production and development costs. While access to new knowledge was also stated as particularly important in knowledge-intensive services, it turns out that the success rate is rather low with respect to this target. In other manufacturing, the second and third most successful targets are the acquisition of new customers and the reduction of production costs.

Figure 81. Complete achievement of goals of foreign innovation activities 2008-2010, by main sector and size class



Large enterprises with 1,000 or more employees are more successful than SME in achieving their goals of foreign innovation activities, except for the recruitment of highly skilled personnel. This objective is most often met by medium-sized enterprises. However, the differences between the size groups are small. The gap between large enterprises and SME is particularly evident for establishing contacts to innovation-leading customers, gaining access to new technologies, and reducing of development costs. On the other hand, small firms are nearly as successful in adapting their products and processes to customer needs and preferences as large enterprises.

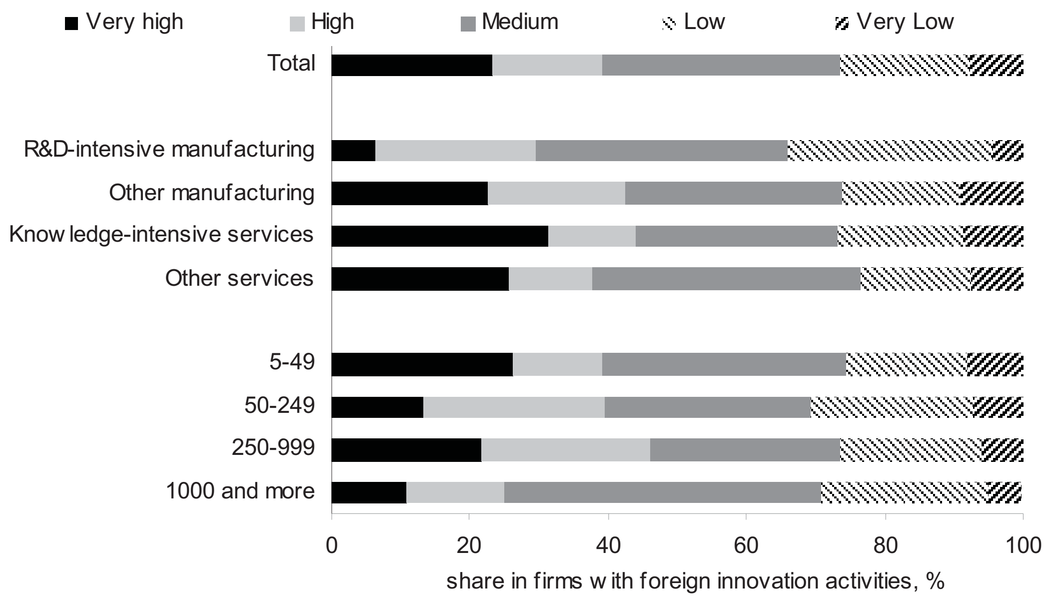
10.5 Decision Autonomy of Foreign Subsidiaries

The following two sections deal with the question of how German firms organise and manage their foreign R&D ventures. Of course, this is a broad topic that we narrow down to two aspects. First, we analyse to which degree foreign subsidiaries are autonomous in their innovation decisions. And second, we investigate which kind of knowledge transfer mechanisms German enterprises employ in order to stimulate knowledge exchange between domestic and foreign R&D laboratories.

If firms have decentralised their innovation activities across different locations, the question remains whether headquarters still fully decide on all innovation projects or whether and to what extent foreign locations possess decision autonomy with respect to innovation. The question whether firms should grant full decision autonomy to their subsidiaries is ambiguous in the literature. Some scholars argue that central R&D decisions are the better R&D organisation. The international decentralisation of a firm's R&D organisation demands not only the management of corporate innovation efforts between the headquarters and subsidiaries but also across country borders. This involves the risk that knowledge is lost when it is transferred between R&D units (Szulanski, 1996) or that innovation projects are duplicated in different R&D units (Gassmann and von Zedtwitz, 1999). The increase in transactions due to the internationalisation is likely to drive the costs as proposed by the transaction cost theory (Coase, 1937; Williamson, 1985). Opponents argue that decentralised R&D decisions reduce managerial opportunism at a single R&D centre and empower divisions which are closer to markets and specific demands (von Hippel, 1988; Williamson, 1985).

Figure 82 shows that 34 per cent of all enterprises with foreign innovation activities and thus the majority of firms have chosen the happy medium. In nearly every fourth firm with foreign innovation activity (23 per cent) foreign subsidiaries possess a very high autonomy with respect to innovation decisions. On the contrary, just 8 per cent insist on high decision autonomy for the German headquarter and grant only very low decision rights to the foreign locations. The figure furthermore reveals that there are only small differences across sectors and firm size, with two notable exceptions: First, the share of firms that grant medium decision autonomy to their subsidiaries is particularly high among large firms (46 per cent). Second, R&D-intensive manufacturing firms are more reluctant to give decision rights to their subsidiaries than other sectors. Only in 6 per cent of the firms, subsidiaries can exert very high decision rights. In further 23 per cent of R&D-intensive manufacturing firms subsidiaries have been granted high autonomy.

Figure 82. Decision autonomy of foreign locations with respect to innovation activities 2008-2010



10.6 Mechanisms of Knowledge Transfer

Finally, the 2009 survey asked firms about the mechanism they employ in order to stimulate the knowledge exchange between the domestic and foreign locations. To fully benefit from international innovation activities, knowledge should be transferred in both directions, from headquarters and domestic R&D departments to foreign locations and vice versa. In particular, the latter aspect has gained importance in recent years in international business as technology-related motives have become more relevant. It has been argued that the usage of the potential global know-how does not depend on the presence of R&D labs in many parts of the world per se but more importantly on the internal firm mechanisms to integrate knowledge across R&D organisations (Singh, 2008). Leveraging the capabilities and resources of subsidiaries across divisions and locations has been put forward to be essential for the global success of firms (Bartlett and Ghoshal, 1989; Birkinshaw et al., 1998; Frost et al., 2002; Nobel and Birkinshaw, 1998). The integration of the foreign R&D labs is on the one hand fostered by personnel contacts and exchanges between home and overseas R&D centres. On the other hand, the integration of the outcomes of R&D performed abroad requires a certain stage of R&D activeness of the recipient firm in the home country. Firms should carry out R&D continuously to keep up with technological developments (Tilton, 1971) and hereby develop their ability to identify and absorb new information from overseas R&D subsidiaries (Cohen and Levinthal, 1989).

Figure 83 and Figure 84**Fehler! Verweisquelle konnte nicht gefunden werden.** depict the knowledge transfer mechanisms employed by German enterprises with foreign innovation activities in order to foster the exchange of knowledge between domestic and foreign locations. The majority of mechanisms are short-term oriented. 79 per cent of them use personal meetings, followed by a system of regular reporting of which 70 per cent make use of telephone or video conferences employed by 63 per cent. Short or long-term exchanges of employees are used far less. 46 per cent of firms with foreign innovation activities send employees of German locations to foreign locations for a short-term exchange of less than three months. Only every third firm delegate employees from foreign subsidiaries to Germany in order to stimulate knowledge transfer. Long-term exchanges of more than 3 months take only place in 14 (from Germany to foreign locations) and 10 per cent (from foreign locations to German locations) of firms with foreign innovation activities. So far, the figure reveals that in terms of direction knowledge transfer is stronger from German enterprises to their foreign locations than the other way round. For instance, only 12 per cent of enterprises with foreign innovation activities licence foreign subsidiaries' patents.

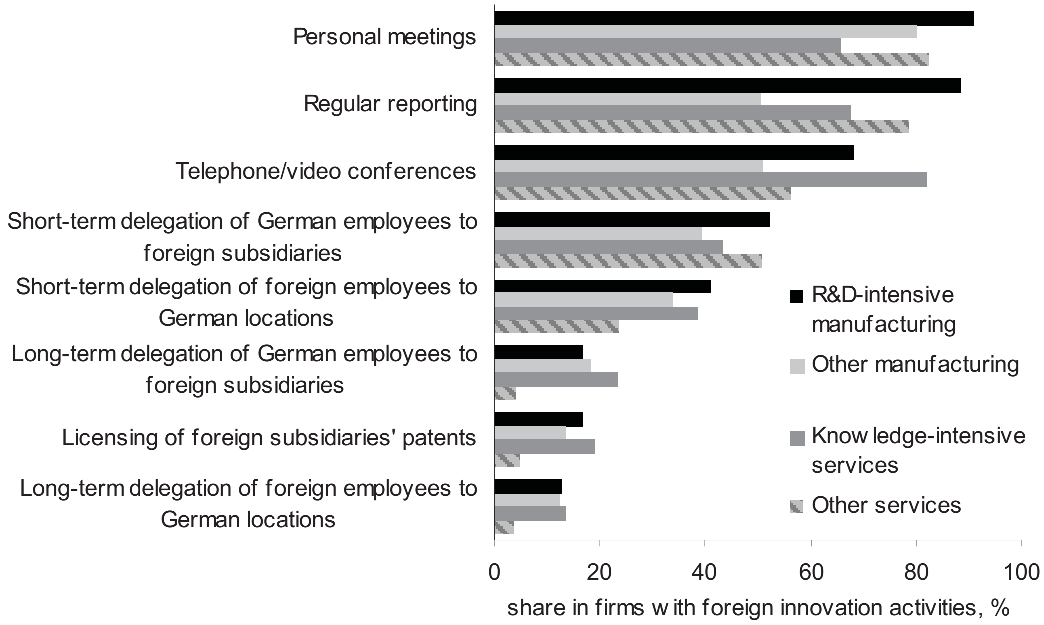
Figure 83. Knowledge transfer mechanisms between domestic and foreign locations of innovation activities 2008-2010

Figure 84 reveals that the overall pattern of knowledge transfer mechanisms is similar across sectors. Two notable exceptions can be detected in services. In knowledge-intensive services, telephone and video conferences are the most frequently used knowledge transfer mechanism, followed by regular reporting and personal meetings. Second, each of the three long-term oriented instruments is particularly seldom employed in other services.

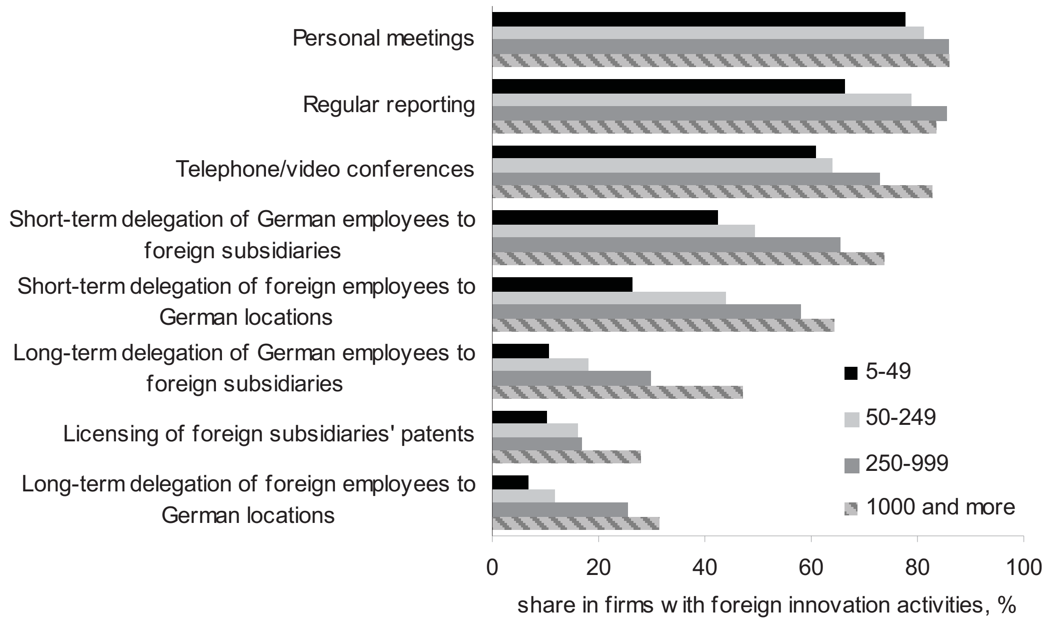
Differences across firm size in the use of knowledge exchange instruments can be seen in the lower part of Figure 84. Large enterprises use all instruments more frequently than small and medium enterprises. Whereas the gap in the usage is relatively small for personal meetings and regular reporting, large enterprises employ short- and long-term delegations by far more often than SMEs.

Figure 84. Knowledge transfer mechanisms 2008-2010, by main sector and size class

Main sector



Size class



11 Protection Mechanisms for Intellectual Property

Why do some firms capitalise on their innovative activities and others do not? This fundamental puzzle has become a major topic in innovation economics and innovation and R&D management. Already in the 1980s, Teece (1986) stressed that generating economic value from new technologies not only depends on having valuable technology (in the sense that customers display a willingness to pay) and being able to establish dominant designs and complementary assets, but also requires an effective appropriability regime.

In his understanding the appropriability regime is more than just formal intellectual property rights in any case, but extends to domains relating to the technology determining: for example, spill-over potentials as well as non-formal protection mechanisms.

This idea has been taken up and tested empirically many times, where the focus usually was on analysing how firms combine different protection mechanisms (Hurmellina-Laukkanen and Puumalainen, 2007; Blind et al., 2006). Early studies Levin et al. (1987) show that in particular lead-time plays an important role. Patents on the contrary only are of greater importance in some sectors, partly due to the fact that patents also have an information-disclosing effect and thus can even stimulate invent-around imitation. However, in some sectors, patents can be of enormous value. As Arora (1997) shows firms from the chemical industries have made great virtues of joining secrecy for some parts of the technology in combination with formal patent rights on others in deterring new firm imitation.

At the same time patenting is not always meant to secure temporary monopoly profits for a commercialised technology, but may also serve other purposes. Blockade motives have become of increasing importance, where firms seek either actively or passively to block competitors from accessing certain technological paths (Blind et al. 2006; Neuhäusler, 2009).

At the same time Hanel (2008) argues that patents grant firms certain powers in technological agreements with competitors. In that sense a mutual infringement of competitors' technologies is often present and may be tolerated by both sides simply because of the reciprocal threats that the other party's patents resemble. Likewise, firms can use patent rights as trading values in license agreements or in the formation R&D collaborations or technological alliances.

With respect to the establishment of dominant designs –a dominant design being a specific configuration of particular product resulting in the vanishing of alternatives– patents have received a further economic significance. Under some circumstances patents can be declared standard-essential, leading to situations where a standardised product (e.g. certain computer interfaces as USB 2.0 or communication standards such as GSM) makes use of a particular patented technology that by the standard-essential patent becomes a key-technology. These standard-essential patents can be of immense economic value to its owner (Berger et al., 2012). Therefore patents may be strong enough even to determine and shape dominant designs.

As indicated above, the significance of protection mechanisms varies among sectors. In particular, research on service innovation, points out that these activities follow different and diverse patterns (Miles, 2001; Hipp and Grupp, 2005). In addition, services are hard to be protected from imitation. Hence, intellectual property protection mechanisms differ from those in manufacturing (Howells, 2001: 56). In regard to knowledge-intensive services, current research focused on trademarks to indicate innovation activities (Gotsch, 2012; Gotsch and Hipp, 2011). In addition, firm size has been detected as an important influencing factor on how firms utilise appropriation methods (Arundel, 2001; Leiponen and Byma, 2009).

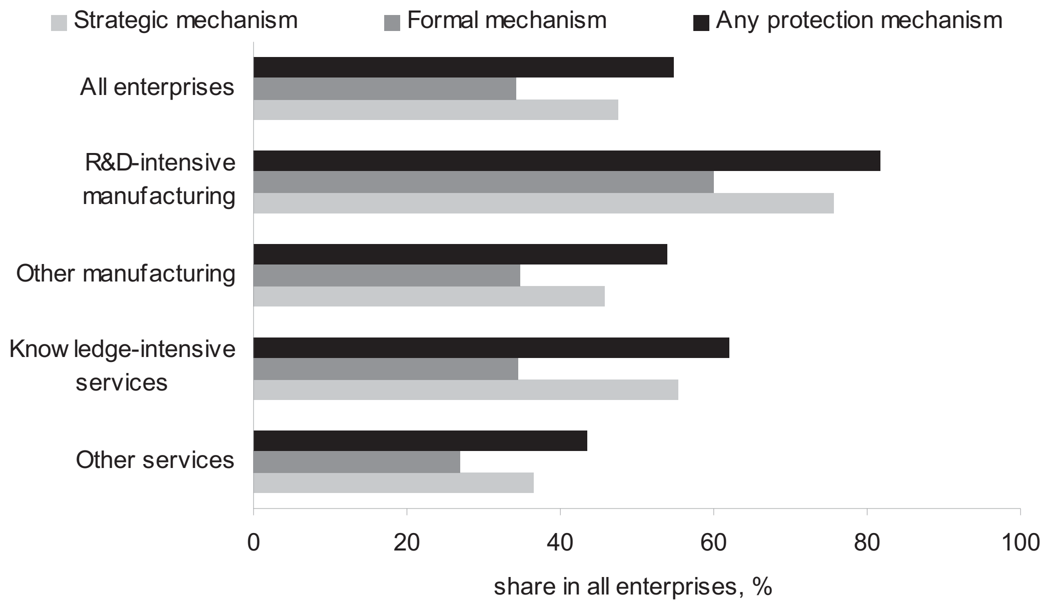
In the following the implementation of formal and informal, i.e. strategic, protection methods will be analysed among German enterprises behind the background of major determinants like economic sector and firm size. In addition, the relevance of the implemented protection measures will be considered.

11.1 Use of Protection Mechanisms

The questionnaire of the MIP 2011 asked whether enterprises used protection mechanisms during the three-year period 2008 to 2010 to protect their intellectual property (IP) from being used by others. The question contained five items on formal protection mechanisms: patent application, utility model application, registration of a design, registration of a trademark, copyright enforcement, as well as three informal protection mechanisms: secrecy, complexity and lead-time. For each item, firms were asked to state whether the mechanism was used and if yes, how effective the mechanism was to protect their IP. The question was addressed to all enterprises.

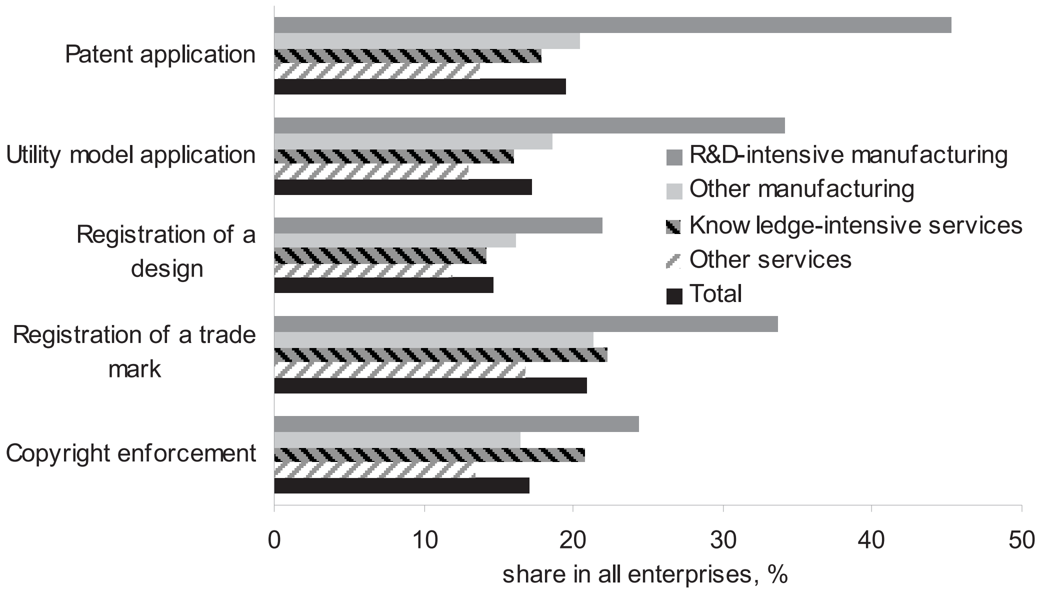
As Figure 85 shows, 34 per cent of all enterprises used at least one formal protection measure. Strategic protection methods are more widely used as 47 per cent of all enterprises utilised these measures. The differentiation by main sectors reveals that specific differences prevail. Enterprises in R&D-intensive manufacturing in general, are more likely to perform technological innovation activities and to protect the result of these activities. . 8 per cent of enterprises in R&D-intensive manufacturing performed technological innovation activities, and 60 per cent used formal protection mechanisms, and 76 per cent employed strategic measures. 82 per cent either used formal or strategic measures. With regard to other manufacturing and knowledge-intensive services, a similar pattern emerges. About 60 per cent of firms perform technological innovation activities and approximately 35 per cent of enterprises utilised formal protection mechanisms to protect their IP. The only main difference between these sectors refers to the implementation of strategic mechanisms. While 55 per cent of knowledge-intensive service firms protected their intellectual property this way, the share among other manufacturing is smaller at about ten percentage points. Less than half of the other service firms performed technological innovation activities (47 per cent) and only 28 per cent of enterprises reported successful technological innovation activities. Formal protection mechanisms are implemented by 27 per cent of enterprises while informal mechanisms are reported by 36 per cent of enterprises. In general, these results confirm that formal protection mechanisms are more relevant for manufacturing firms than for service firms and in particular for knowledge-intensive service firms.

Figure 85. Mechanisms used to protect intellectual property 2008-2010



To analyse the differences between specific protection methods in more detail, Figure 86 and Figure 87 differentiate between different types of formal and informal protection mechanisms. With regard to formal protection mechanisms it is noticeable that in all five categories R&D-intensive manufacturing firms reached the highest shares. Distinctive differences occur in particular with regard to patent applications: while 45 per cent of R&D-intensive manufacturing firms applied for a patent between 2008 and 2010, the shares among the other sectors are distinctively lower. Registration of a design is the category which appears to be least important for R&D-intensive manufacturing firms with only 22 per cent of enterprises. While figure 85 indicated that other manufacturing firms and knowledge-intensive service firms implemented formal protection mechanisms at the same level (34 per cent of enterprises), it becomes now clear that specific differences prevail with regard to particular protection mechanisms: the shares of other manufacturing firms are higher with regard to patent application, utility model application and registration of a design, on the other hand, registration of a trademark and copyright enforcement appear to be relevant for higher shares of knowledge-intensive service firms. Only a small part of other service firms seem to implement formal protection mechanisms. The results range between 12 per cent (for registering a design) and 17 per cent (for enterprises registering a trademark).

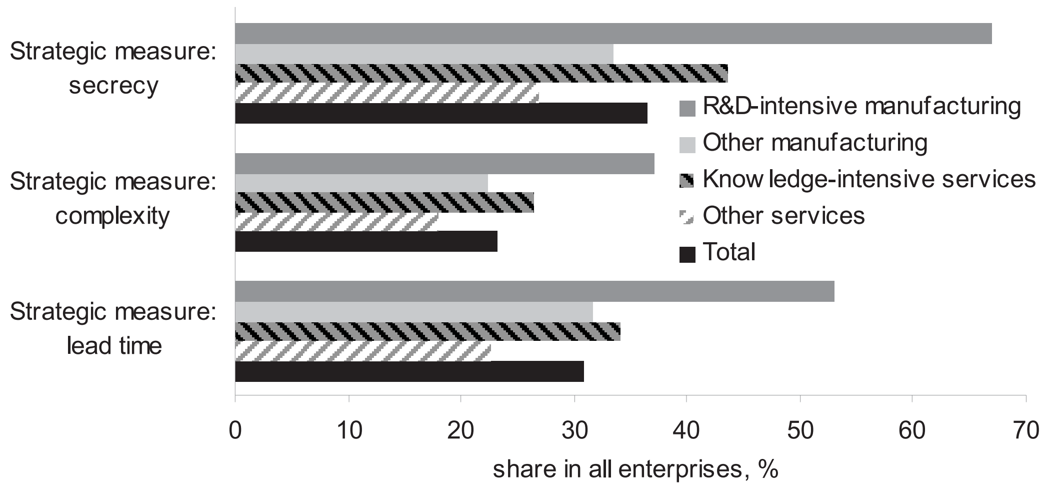
Figure 86. Use of formal protection methods 2008-2010, by main sector



Looking at the implementation of strategic mechanisms, Figure 87 reveals that secrecy is the most important method among the three mechanisms covered in the survey for all four sectors. 37 per cent of all enterprises use this approach to protect their IP. Lead time advantage is the second most important strategic measure, (used by 31 per cent) while employing a complex design is only used by 23 per cent. Again, R&D-intensive manufacturing firms utilise informal methods more often than firms from other sectors. As indicated above, all three measures are more important for knowledge-intensive service firms than for other manufacturing firms.

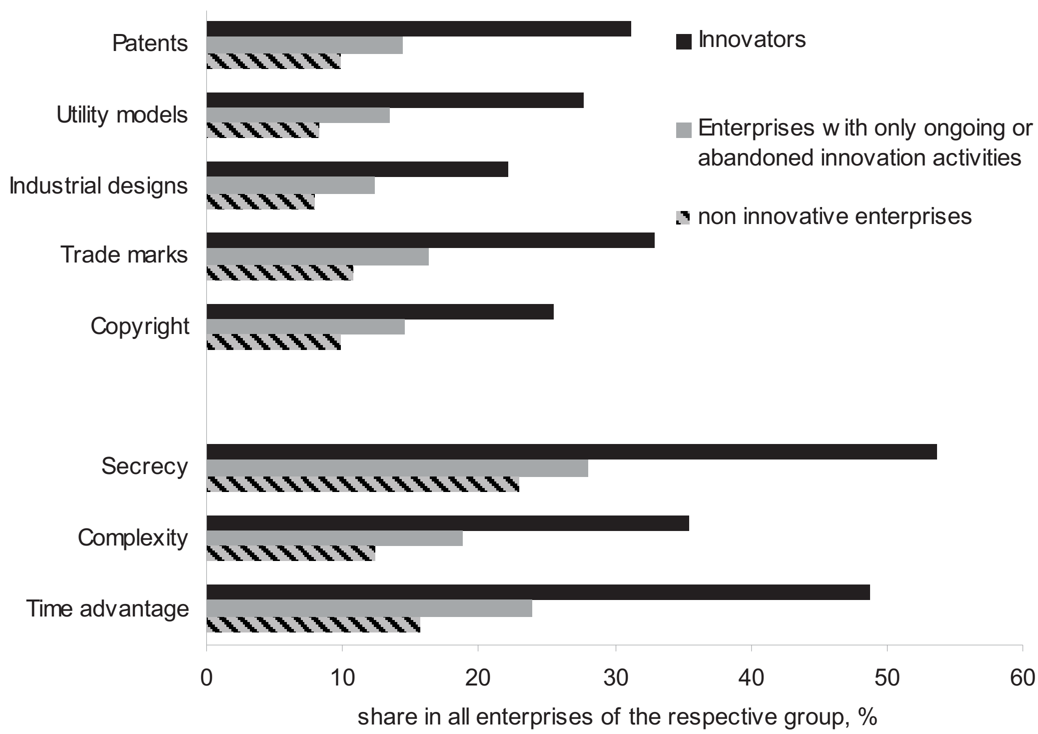
The fact that service firms and in particular knowledge-intensive service firms utilise strategic protection methods more widely than formal mechanisms to protect their intellectual property underlines that the detection of innovative activities among these firms requires different approaches than in the case of manufacturing firms. As indicated above, patent applications in particular fall within the domain of R&D-intensive manufacturing firms. In line with the literature, it has been demonstrated that trademarks are the formal protection mechanism, which is most relevant for knowledge-intensive service firms. But still, the share of R&D-intensive manufacturing firms which registered a trademark is higher than in the case of knowledge-intensive service firms.

Figure 87. Use of strategic protection methods 2008-2010, by main sector



Another aspect refers to the relationship between protection mechanisms and innovation activity. Figure 88 shows that firms that introduced product or process innovations during 2008 to 2010 (innovators) show a higher propensity to protect their IP by such methods for each formal and strategic measure. Firms with only ongoing or abandoned innovation activities during 2008 to 2010 tend to use each protection mechanism significantly less frequently.

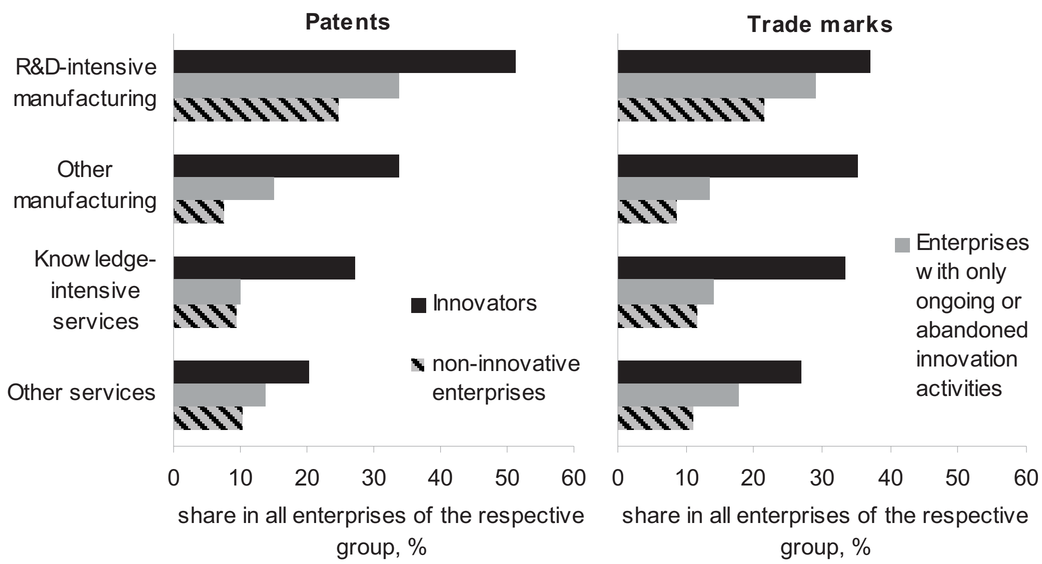
Figure 88. Use of protection mechanisms by innovation status 2008-2010



Firms without innovation activities rarely use formal protection methods (8 to 11 per cent of all non-innovative enterprises, depending on the type of protection method). They employ strategic measures somewhat more frequently (23 per cent use secrecy and 16 per cent use lead time advantage) though the share of non-innovative enterprises that use strategic measures is still significantly lower than the respective share of innovative enterprises. These findings demonstrate that both formal and strategic protection mechanisms for IP are particularly important to protect the results of innovation activities and are less important for protecting IP that originated from other activities.

Differences between innovators and non-innovative enterprises in the use of protection mechanisms also hold for each sector. Figure 89 shows the share of enterprises that use patents and trademarks by the firms' innovation status for each main sector. It is rather obvious that patents are used more regularly by innovators in the manufacturing sector due to the nature of patents, which protect new technological knowledge typically used for producing goods.

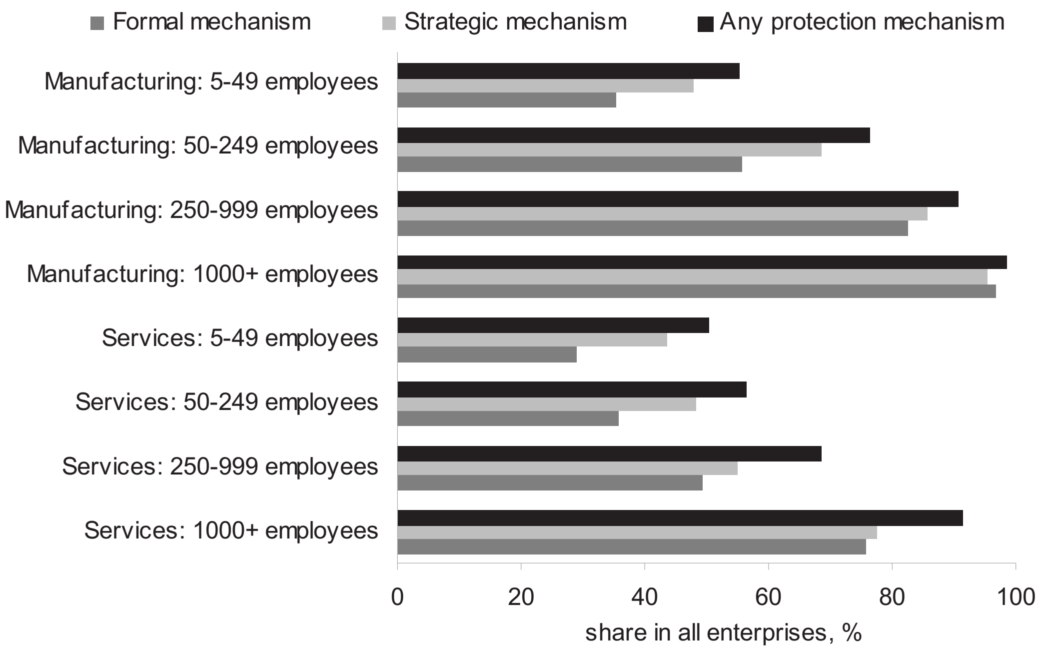
Figure 89. Use of patents and trademarks by innovation status of enterprises 2008-2010, by main sector



11.2 Firm Size and the Use of Protection Mechanisms

This section investigates the relationship between firm size and the implementation of protection methods for IP. Figure 90 confirms that firm size is strongly related to the propensity to implement formal or informal protection mechanisms. Almost all manufacturing enterprises with more than 1,000 employees combine formal and informal methods to protect their intellectual property. In the case of service firms, more than 90 per cent of the enterprises utilise protection measures. However, opposed to large manufacturing firms, there are large service firms which either implemented strategic or formal protection mechanisms as the individual shares of the two forms are about 75 per cent, i.e. a greater share of firms does not combine formal and informal methods. While the difference between the shares of formal and informal mechanisms is small in this size class, strategic mechanisms are more widely implemented in smaller size classes, e.g. in the case of service firms with five to 49 employees, 44 per cent of enterprises employed informal protection measures, while the share of formal protection mechanisms is 15 percentage points less. One explanation for this finding might be that the efforts for utilizing formal protection mechanisms are high so that especially small firms abstain. In part, the enterprises seem to implement either informal or formal protection mechanisms.

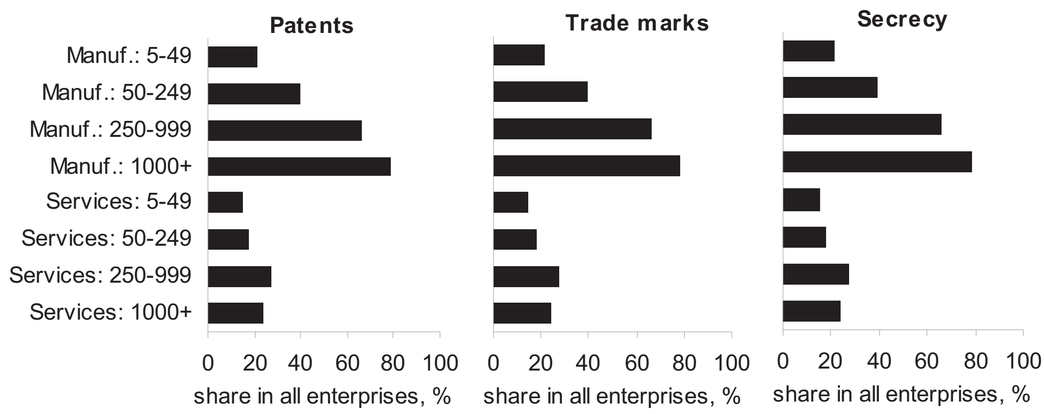
Figure 90. Use of protection mechanisms by manufacturing and service firms 2008-2010, by size class



In order to investigate the relationship between size and the implementation of protection mechanisms in more detail, the following analyses focus on those protection methods which appeared to be widely spread among manufacturing or service firms, i.e. patent application, registration of a trademark and secrecy.

As Figure 91 reveals, patent applications mainly fall in the domain of large manufacturing firms as almost 80 per cent of manufacturing firms with more than 1,000 employees applied for one or several patents during 2008 and 2010. In case of manufacturing enterprises with less than 50 employees the share is only 21 per cent. An interesting observation can be made with regard to service firms. The highest share of 28 per cent is reached by enterprises with 250 to 1,000 employees. In general, in the case of service firms, the influence of size appears not to be as significant as in the case of manufacturing. Although not shown here in more detail, observations can be made with regard to utility model application and registration of a similar design.

Figure 91. Use of patents, trademarks and secrecy by manufacturing and service firms 2008-2010, by size class



Among the formal protection mechanisms for service firms, registration of a trademark proved to be most important. As the following figure shows, 40 per cent of service firms with more than 1,000 employees registered one or several trademarks between 2008 and 2010. Still, large manufacturing firms reach higher shares (almost 65 per cent of enterprises). Also in this case, size influences the propensity to opt for this protection mechanism.

With regard to strategic protection methods, the analysis presented above showed that secrecy is the most widely utilised measure. More than 80 per cent of large manufacturing enterprises protect their intellectual property through secrecy. In the smallest size class with five to 49 employees, the share is comparatively high with 36 per cent. Among service firms the difference between size classes is rather small ranging between a third of enterprises in the smallest class and 43 per cent of large enterprises.

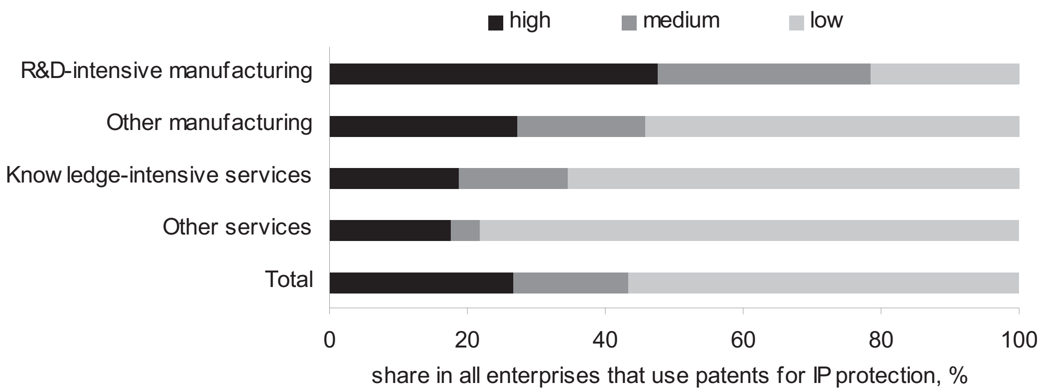
The analysis above focused on the spread of protection mechanisms. While it has been shown that large manufacturing enterprises are the ones utilizing formal protection measures and in particular patent application most widely, the question remains whether enterprises from different sectors assess protection measures similarly. The following analysis will focus on this question.

11.3 Importance of Protection Mechanisms

In the MIP wave 2011, enterprises which indicated having implemented a protection mechanism were asked to evaluate its importance in terms of effective protection of their IP as either being high, middle or low. The following analyses will focus on the assessment of specific mechanisms, i.e. on the relevance of patent application, registration of a trademark and secrecy, differentiated in four sectors.

Figure 92 shows that among those enterprises which applied for a patent this mechanism is most important for R&D-intensive manufacturing firms. Other manufacturing firms assess the significance as not important. In general, compared to manufacturing firms, service firms consider patent applications as to be less relevant. While 18 per cent of knowledge-intensive service firms applied for a patent, only 3 per cent opine that this mechanism is highly significant to protect their intellectual property. Among other service firms the share of firms which assess the importance of the patent application as low is comparatively high with almost 80 per cent of firms which applied for a patent. This finding underlines the finding that patents may serve other purposes, especially in case of service firms.

Figure 92. Importance of patents as a protection mechanism 2008-2010, by main sector



Looking at the trademarks among those firms which registered a trademark, a different picture occurs (Figure 93). Among all four sectors the shares of firms which assess the registration as being highly important are equally high. Compared to patent applications all sectors except for R&D-intensive manufacturing firms assess the registration of a trademark as being more important to protect their intellectual property.

Figure 93. Importance of trademarks as a protection mechanism 2008-2010, by main sector

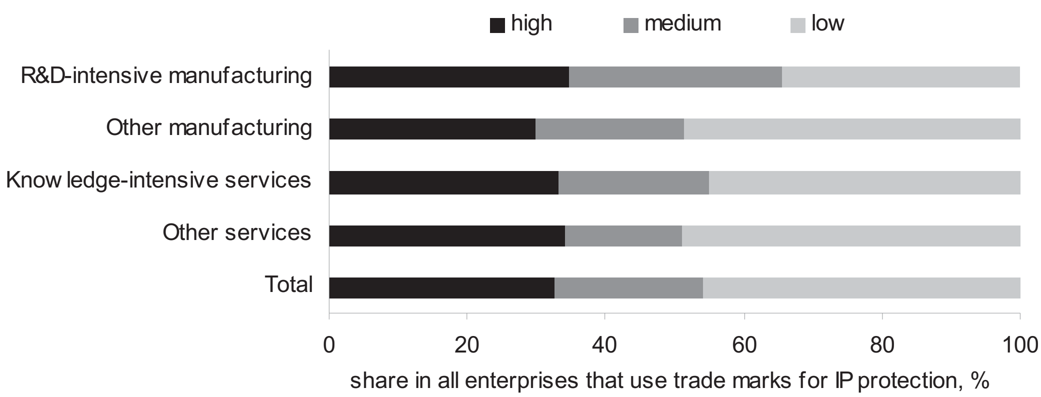
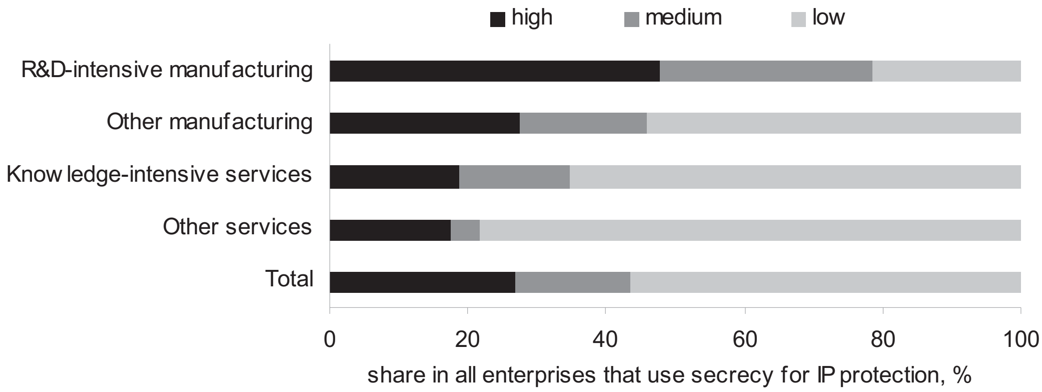


Figure 94 focuses on the assessment of secrecy as an informal protection method. The assessment among R&D-intensive manufacturing firms and knowledge-intensive service firms is equally spread. Only a small fraction of those firms which try to protect their intellectual property in this way state that this mechanism has a low importance. For other manufacturing and other service enterprises secrecy is also an essential mechanism, yet compared to the other two sectors it is less important. Further analyses showed that with regard to the importance of protection methods for protecting IP, no major difference exists between innovators and non-innovators.

Figure 94. Importance of secrecy as a protection mechanism 2008-2010, by main sector



All in all, the findings presented above show that enterprises implement formal and informal protection mechanisms to protect their intellectual property. At the same time, differences in the utilization of protection mechanisms are influenced by the economic sector and size. Differences do not only prevail between manufacturing and services in general, but also between R&D-intensive manufacturing and knowledge-intensive services on the one hand and the remaining sectors on the other. In general, formal protection mechanisms are more important for manufacturing firms than for service firms, which prefer to protect their intellectual property by informal methods. On the topic of size the general picture is that large firms are more likely to implement protection measures. Yet, with regard to service firms, this pattern appeared to be less clear than in the case of manufacturing. Furthermore, depending on the specific protection mechanism in question, the analysed types of firms assess the importance of protection mechanisms differently.

12 Marketing and Organisational Innovations

Schumpeter (1934, 1943) already had a broad understanding of innovation. While he differentiated between the constituent acts of invention and implementation, he did so by not only referring to technological innovations in the sense of improved products or processes, but he realised at an early stage that, for example, opening new markets or establishing new customer or supplier relations would also constitute important aspects of innovative activity.

His broad interpretation has laid the foundations for our modern measurement conceptualization of innovation, which since the 3rd revision of OSLO-Manual (OECD, 2005) defines innovation not only in terms of product and process innovation, but also in terms of marketing and organisational innovations.

Since this data has become available in the Community Innovation Surveys in 2005, 2007, 2009, and 2011, a couple of analyses have examined the relationship between product and process innovation (often called technological innovations) and marketing and organisational innovations (also called non-technological innovations). The question of the complementarity of technological and non-technological innovations has become particularly important. Here Rammer et al. (2009) were able to demonstrate that under certain conditions organisational innovations can substitute technological innovation, particularly in small firms. At the same time, Schubert (2010) shows that marketing innovations causally tend to increase the success of product innovations, the latter highlighting the importance of non-technological innovations for the regular innovation process.

In any case, in many instances technological innovations are strongly intertwined with non-technological adjustments. For example, the introduction of a new process might often call for the adjustment of work organisation (Evangelista und Vezzani, 2010). Likewise it is reasonably obvious that new products will be accompanied by changes in the marketing strategy.

Although the term organisational innovation is not used often, the open innovation paradigm (Chesbrough, 2003) with its implications for producer-supplier and producer-user interactions (von Hippel, 1988) is closely related. Implying a reorganisation of a firm's environmental connections, this strand of the literature highlights the increasing importance of conducting innovations in open networks. For instance Chung and Kim (2003) have demonstrated the positive effects both on innovative performance and cash-flow rates.

These selected results demonstrate the significance of a broad understanding of innovation that goes beyond purely technological considerations.

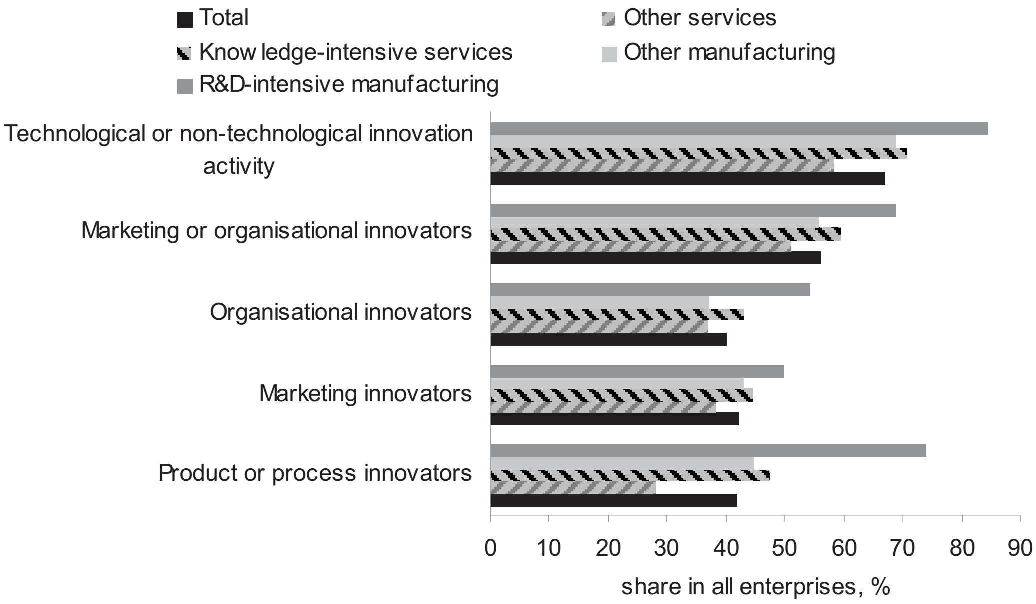
In the following we will give a descriptive account of the interplay of technological and non-technological innovations as could be observed for firms in Germany.

12.1 Prevalence of Non-technological Innovations

Marketing and organisational innovations are of central significance for the innovation processes performed by German firms. This also holds in relation to technological product and process innovations. While roughly 57 per cent of the firms in the German economy introduced product or process ('technological') innovations in the years 2008-2010, about the same share (56 per cent) have introduced marketing or organisational ('non-technological') innovations (Figure 95). 42 per cent have introduced marketing innovations and about 40 per cent organisational innovations. 66 per cent of firms are innovators in a broad sense, meaning that they have introduced any kind of innovation, be it technological or non-technological.

While this demonstrates that in terms of prevalence non-technological innovations are as common as technological ones, there are important differences between the services and manufacturing and technology levels.

Figure 95. Innovator shares by type of innovation 2008-2010, by main sector



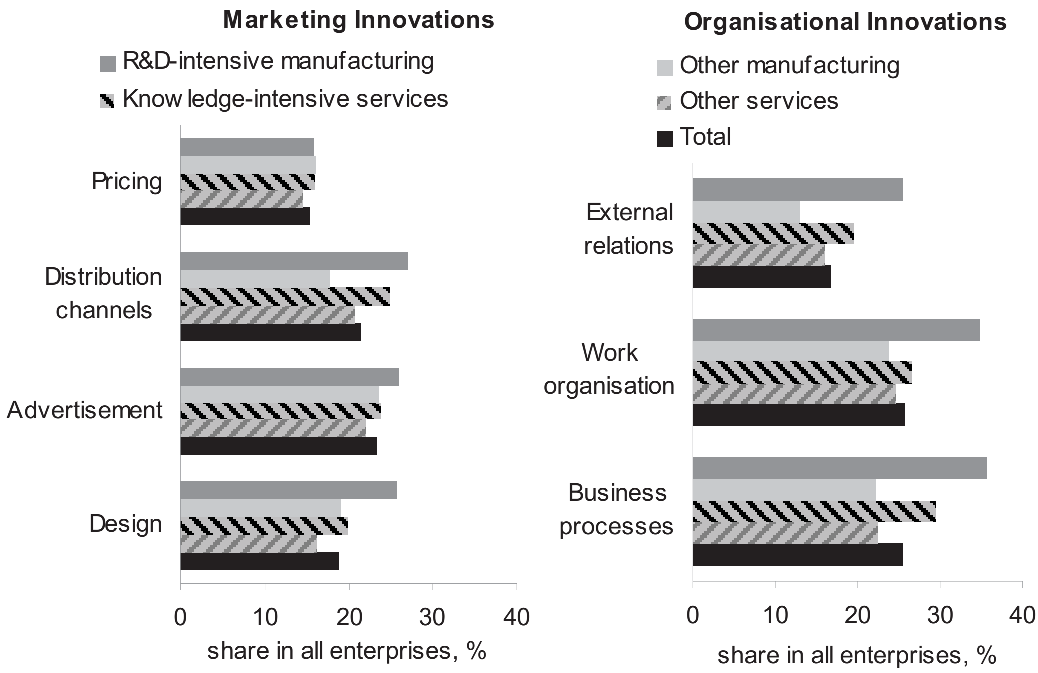
As Figure 95 highlights, the R&D-intensive industries have the largest innovator shares, irrespective of the type of innovation. They are followed by the knowledge-intensive services, the other industry sectors, and finally the other services. However, the size of differences between the sectors depends on the type of innovation and this is crucial. While the R&D-intensive industries have significantly higher shares of innovators concerning technological innovations (74 per cent for R&D-intensive industries and only 28 per cent for other services), the differences with respect to non-technological innovations are much smaller. In fact, while 49 per cent of the R&D-intensive firms are marketing innovators, 38 per cent belong to other services as well. With respect to organisational innovations, we find 54 per cent of the R&D-intensive industry firms to be innovators, while 37 per cent belong to industries, 42 per cent to knowledge-intensive services and 36 per cent to other services.

This demonstrates an important feature of the innovation process. While the propensity to introduce new products or services differs highly between sectors and technology-levels, the differences concerning non-technological innovations (in particular marketing innovations) are much smaller. It seems reasonable to argue that while technological innovations depend highly on how important they are for the sectors and their competitive environment (e.g. demand or product characteristics), non-technological innovations are much more equally distributed across sectors and therefore seem to have relatively equal importance irrespective of sector specifics.

We will now look at the non-technological innovations more closely. Organisational innovations can be further disentangled into changes to business processes, work organisation, or external relations. Marketing innovations on the other hand consist of changes to design, advertisement, changes to distribution channels as well as changes to price politics.

Considering Figure 96, for R&D-intensive services the most common marketing innovation was changes to distribution channels (27 per cent), followed by advertisement and design changes, both at 26 per cent. Only 16 per cent changed their pricing politics. The same ranking can be observed for knowledge-intensive services. The ranking for other industries and other services, where advertisement is significantly more important than changes to distribution channels, is a little different.

Figure 96. Innovator shares by type of marketing and organisational innovation 2008-2010, by main sector

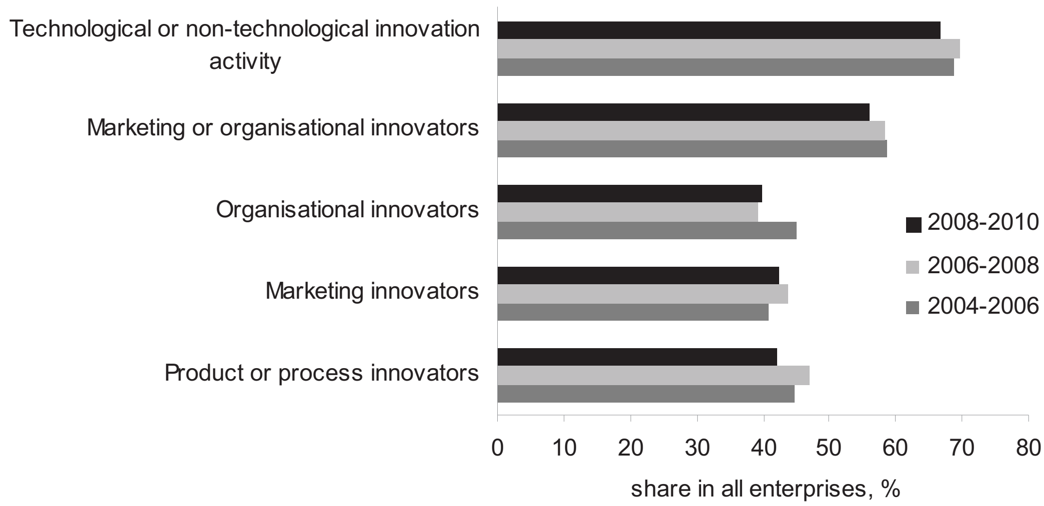


With respect to organisational innovations, we see that business processes have been changed by 36 per cent, while 34 per cent changed their work organisation and 25 per cent worked on their external relations e.g. to their suppliers. This ranking is the same for knowledge-intensive services, while both other industry firms as well as other services consistently rank work organisation more important than changes of the business processes.

This suggests that by following the pattern of importance rankings, knowledge-intensive services and R&D-intensive firms are in fact quite close concerning their use of marketing and organisational innovations, while on the other hand other services and other industry share similarities. One explanation is that marketing and organisational innovations and their specific use go hand in hand with the introduction of technological innovations. Because both knowledge-intensive services and R&D-intensive manufacturing have considerably higher propensities to introduce technological innovation into their patterns of use of specific non-technological innovations, they share the observable similarities.

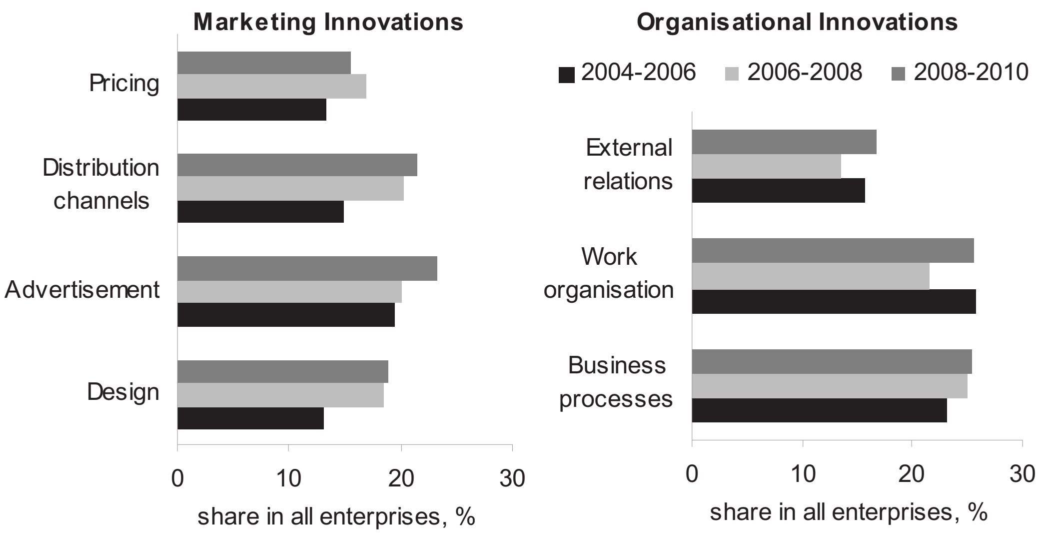
R&D-intensive manufacturing shows the highest shares of innovators for all types of marketing and organisational innovations except for new pricing methods.,Marketing innovations in the field of pricing are most frequentin other manufacturing (introduced by 16,1 per cent of all firms), followed by R&D-intensive manufacturing and knowledge-intensive services. Both sectors report a share of 15,8 per cent. In other services, 14,5 per cent of all firms introduced this type of marketing innovation. This suggests that the implementation of new pricing methods is not linked to a sector's general innovativeness. Furthermore, while for all other types of marketing and organisational innovation a large part of the variance between firms seems to be related to the sector technology levels, this is not the case here. Obviously, the factors explaining changes in pricing are less related to the technology levels.

Figure 97. Innovator shares by type of innovation 2004-2010



When analysing the innovator shares over time, we see that there have not been larger changes concerning the share of firms that introduced innovations in the time periods 2004-2006, 2006-2008 and 2008-2010. As Figure 97 highlights, the share of firms which have introduced either marketing or organisational innovations has remained relatively stable between 58 and 56 per cent. This can be partly explained by the fact that the propensity to introduce marketing innovations has slightly increased between 2004-2006 and 2008-2010 from 40 to 42 per cent while in the same period the share of organisational innovators has gone down from 45 to 40 per cent. The share of product or process innovators first climbed from 45 per cent to 47 per cent and then fell to 42 per cent in the last observational period. In fact, this finding is largely consistent with a fundamental observation in innovation economics, namely that innovation propensities are very time persistent and do not change quickly. As such, innovation activities are often also relatively robust to economic shocks.

Figure 98. Innovator shares by type of marketing and organisational innovation 2004-2010

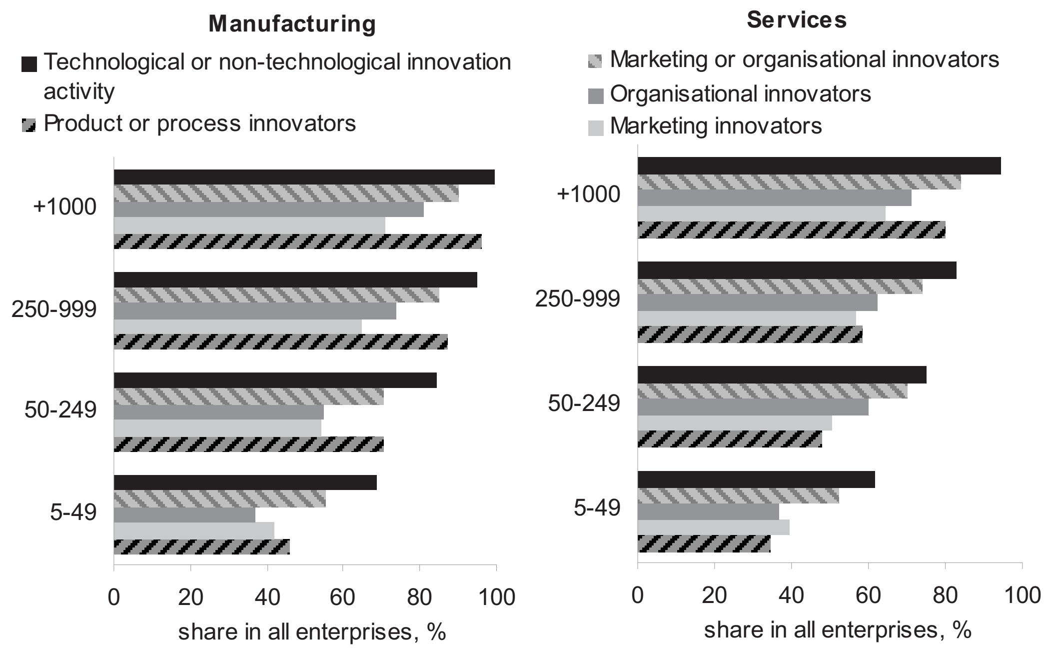


When looking at the changes by type of marketing and organisational innovation between 2004 and 2010 (Figure 98), we see larger fluctuations at this lower level of aggregation. While design, advertisement and changes to distribution channels have become considerably more frequent over all three periods, changes to pricing and changes to pricing politics experienced its peak in 2006-2008 and then fell in the following period. Concerning organisational innovations we see that with the exception of changes in the work organisation, the highest shares of innovators can be observed in the last period. Together with finding that the overall share of organisational innovators has decreased, this implies that more firms have engaged in simultaneously introducing several organisational changes. Nonetheless, the changes over time do not seem to be extraordinarily large. In fact, the experience from the crises has shown that firms indeed tried to keep their innovation expenditures relatively stable, even for example those firms , in the automobile industry that have experienced drastic reductions in turnover.

Despite sector differences, size of the company is also an important determinant of innovative activities. In particular when focusing on indicators of whether a firm is an innovator or not, the probability of having introduced innovations in a given period increases sharply with size.

As Figure 99 demonstrates, this observation can also be made with respect to the firms in Germany, both in manufacturing industries as well as services. For all types of innovation, the shares of innovators is consistently higher when the size of the firm increases. For example, while 55 per cent of the firms in industries below 50 employees and 52 per cent of the firms in services have introduced marketing or organisational innovations, 89 per cent of the industry firms with more than 1,000 employees and 83 per cent of the service firms. In fact, the probability of having introduced any kind of innnovation is over 99 per cent for firms with more than 1,000 employees.

Figure 99. Innovator shares by type of innovation 2008-2010, by size class



One should note that size differences with respect to non-technological innovations are less prominent compared to technological innovations. For technological innovations, the share of innovators increases from the smallest to the largest size class from 46 per cent to 95 per cent in manufacturing, and from 34 per cent to 80 per cent in services. All in all, it seems to be the case that those variables possessing high explanatory power for technological innovation activities possess much less with respect to non-technological innovation activities. Thus, while firms in different sectors and with different sizes vary strongly in their technological innovation behaviour, they do less so with respect to non-technlogical innovations.

12.2 Link Between Technological and Non-technological Innovations

So far we have mainly discussed the prevalence of non-technological innovations in isolation and their dependence on sector and size differences. However, it is a well-established fact that non-technlogical innovations are a necessary follow-up of technological innovation activities. For example, when a firm introduces a new product, changes in marketing are often necessary- Alternatively, if a firm introduces a new production process, this will often require further organisational adaptions, e.g. changes in the work flow become necessary. While this argues for a complementary relationship, substitutive relationships are also possible. This is the case when a firm substitutes the development of a new product, for example, by merely changing the design or the advertising strategy. Lastly, technological and non-technological innovations can be completely unrelated, in the sense that conducting one does not have a causal influence on the conditional probability of doing the other. Indeed, evidence exists for both complementary and substitutive relationships. While Schubert (2010) finds evidence that particular marketing innovations make technological innovations more successful, Rammer et al. (2009) are able to show that small or medium-sized firms can use a combination of non-technological innovations to substitute technological ones.

While a co-occurence of technological and non-technological innovations in one firm is not full proof of a complementary relationship, it is still instructive to analyse how often this occurs. As Figure 100 shows, 58 per cent of the firms in R&D-intensive industries introduce technological and non-technological innovations at the same time. The share for other industries is 32 per cent. For knowledge-intensive services it is 36 per cent and for other services it is 21 per cent. The important question with respect to the relationship between technological and non-technological innovations is whether this is more (complementary relationship) or less (substitutive relationship) than would be expected under the independence of technological and non-technological innovation activities.

Table 6 gives a tentative answer to this important question . If technological and non-technological innovations are independent of each other, then the probability that they co-occur would equal the product of the two individual probabilities. The shares (probabilities) for technological and non-technological innovators are given in column 1 and 2. The product reflecting the prediction under independence is given in column 3, the observed values in column 4. What we see is that the observed values for all sectors are consistently above the predictions, implying that firms that have introduced one type of innovation are considerably more likely to also introduce another. This suggests that there is a strong complementary relationship between technological and non-technological innovations. Of course, this does not preclude that non-technological innovations may be used to substitute for technological ones, but it is not a dominant pattern in the data.

Figure 100. Non-technological innovations in relations to product and process innovations 2008-2010, by main sector

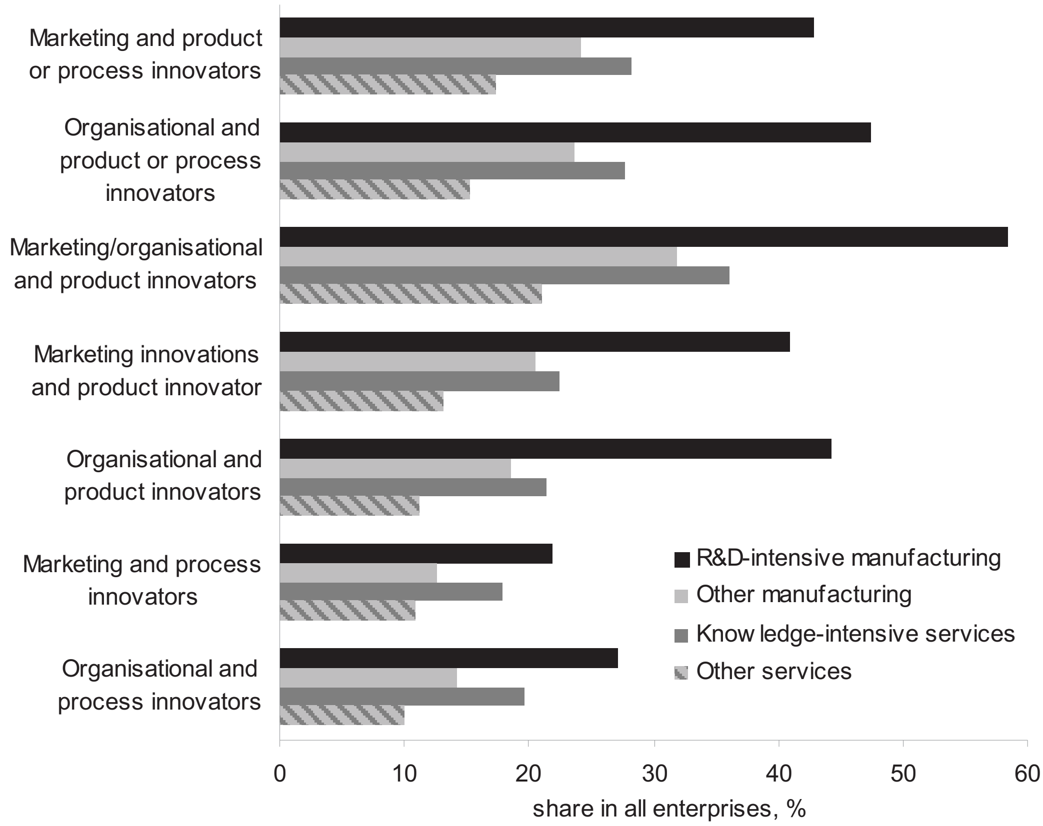


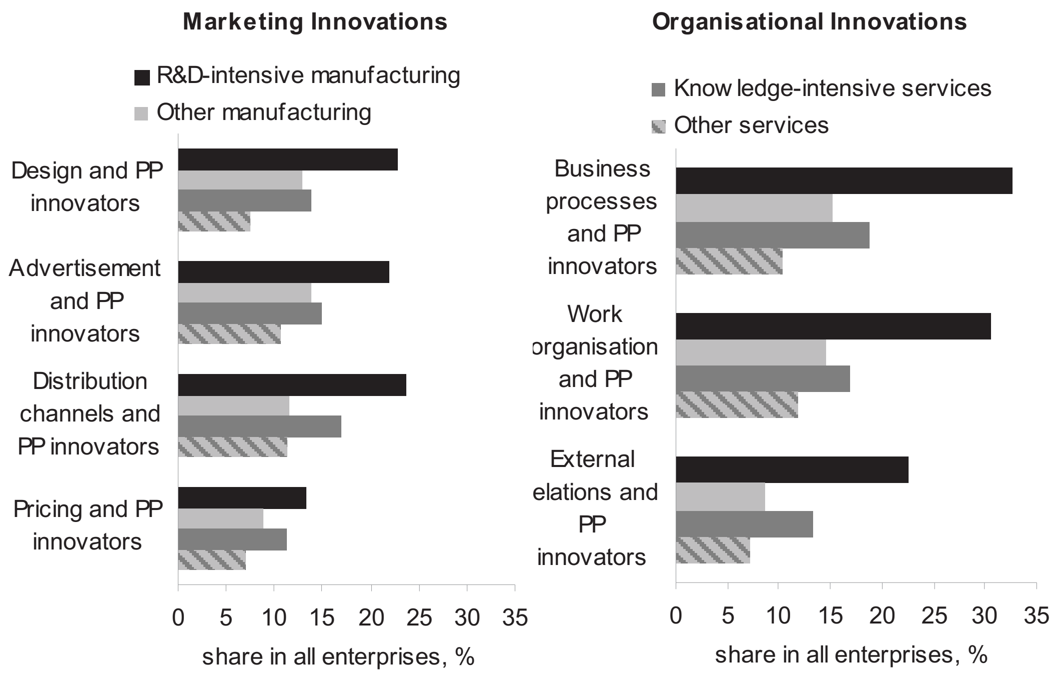
Table 6. Relationship between technological and non-technological innovators 2008-2010

all figures give the percentag in all enterprises	*Technological innovators*	*Non-techno-logical innovators*	*PP and MO (expected for independence)*	*PP and MO (observed)*
R&D-intensive manufacturing	74	69	51	58
Other manufacturing	45	56	25	32
Knowledge-int. services	47	59	28	36
Other services	28	51	14	21

PP: product or process (technological) innovators; MO: marketing or organisational (non-technological) innovators

By looking more closely at what types of non-technological innovations firms combine with technological ones (Figure 101), we see that for R&D-intensive industries, knowledge-intensive services, and other services changes to distribution channels are the most frequent marketing innovations to be combined with product or process innovations. For other industries it is the combination of advertising and technological innovations. Concerning organisational innovations, in all sectors except other services, the introduction of new products or processes is accompanied by changes to the business processes. Instead, other services combine technological innovations more frequently with changes to the work flow.

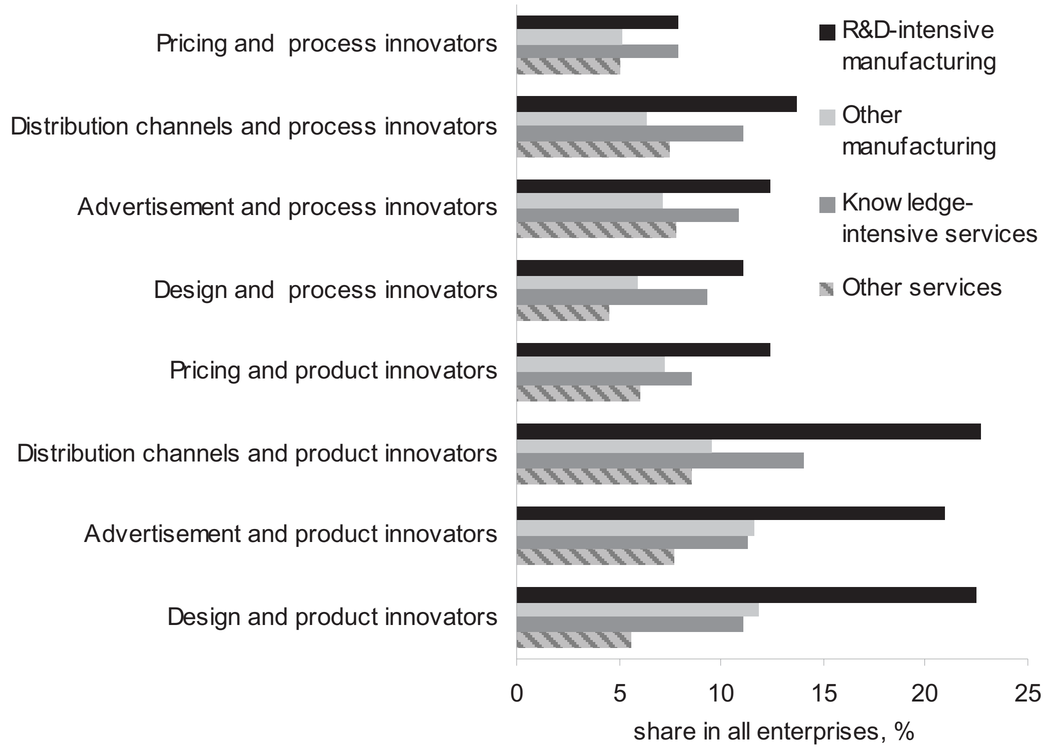
Figure 101. Types of marketing and organisational innovations in relation to product or process innovations 2008-2010



Interestingly, while we observed earlier that with regard to frequencies of types of innovation knowledge-intensive services and R&D-intensive industries are similar while differing considerably from other services and other industries, we can see here that, although the similarity for the two high-tech sectors remains, other services and other industries seem less similar. In fact, other industry firms behave more like high-tech firms concerning the simultaneous introduction of organisational technological innovations, while other services firms are more like the two tech sectors with respect to marketing innovations.

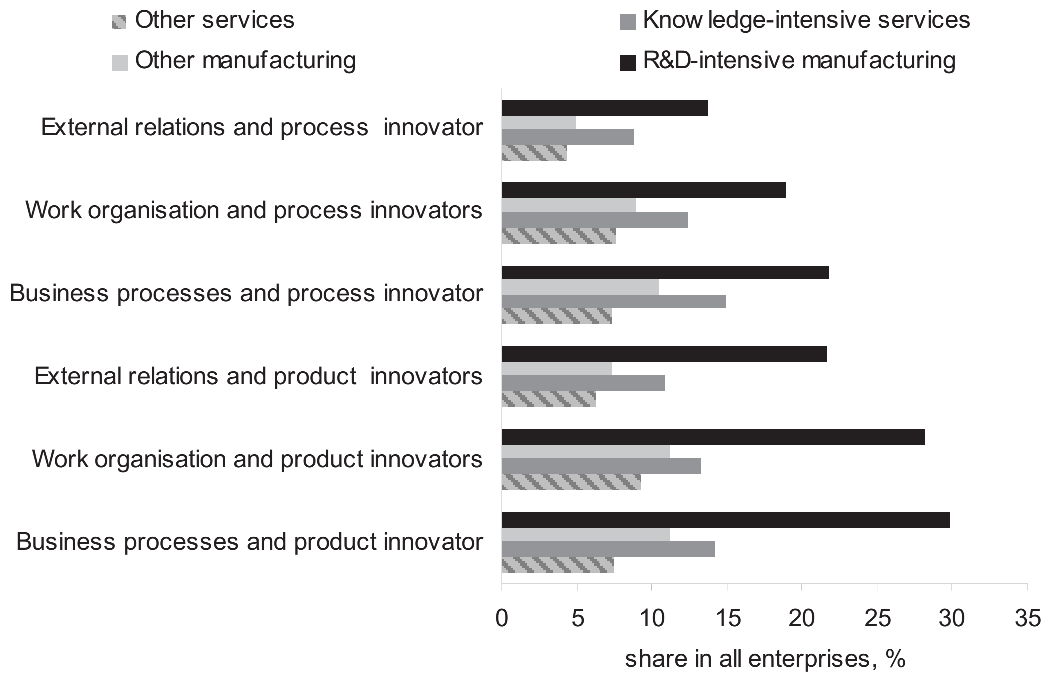
In addition, when we separate technological innovations into product and process innovations, a few other interesting patterns emerge (see Figure 102 and Figure 103). In R&D-intensive industries as well as in other industries the combination of non-technological innovations with product innovations is quite frequent. On the contrary, combinations between process innovations and non-technological innovations are less so. This basically holds for all different types of organisational and marketing innovations.

Figure 102. Type of marketing innovation in relation to product and process innovation 2008-2010, by main sector



Knowledge-intensive and other service firms differ sharply in this respect. For both groups, product and process innovations are distributed much more evenly. This seems to suggest that in the industry, the complementarity might be due to the link between technological and product innovations, while the complementarity in services might also stem from the simultaneous introduction of non-technological and process innovations.

Figure 103. Type of organisational innovation in relation to product and process innovation 2008-2010, by main sector



13 Environmental Innovations

The understanding of driving forces and implementation processes of environmental innovations has been an ongoing topic in practitioner and academic discussion since the late 1980s. Environmental innovations are expected to help finding sustainable solutions for the “grand challenges” such as global warming, tightening supplies of energy, water and food, or public health. The determinants and characteristics of environmental innovation at the firm level is a topic that has been addressed repeatedly by the Mannheim innovation panel (MIP) as well as in the Community Innovation Survey, e.g. in the panel wave of 2001 and 2009. This chapter addresses various aspects of environmental innovation in firms.

In general understanding, environmental innovations consist of product-, process-, marketing- or organisational-innovations that markedly reduce environmental damage (Kemp and Arundel, 1998) and may be developed with or without an explicit aim of reducing environmental harm (Beise and Rennings, 2005; Kemp and Arundel, 1998). Additionally, they depend on firm characteristics such as size, sector, resources and organisational and management capabilities, on market forces – supply- and demand-side mechanisms as well as market size – and on framework conditions shaped by governments and institutions such as environmental policy measures (Carraro et al., 2010; Horbach, 2007; Horbach et al., 2012).

In short, determinants of environmental innovations include firm specific factors, technology push and market pull as well as environmental policy measures (Horbach et al., 2012). The rationales for policy intervention in these respects lie in the occurrence of the different externalities, which can be associated with (environmental) innovations (see Carraro et al., 2010, for a detailed discussion). Thus, respective policy measures have been implemented over the years to address these externalities and to stimulate the firms’ aptitude towards environmental innovations. These policy measures consist of present and anticipated regulations (Khanna et al., 2009), standards, subsidies, public support, monitoring activities or others. However, not only the existence of such measures seems to be important, the stringency of environmental policy seems to have an impact as well (Frondel et al., 2008). Enterprises respond differently to policy measures. In particular, the most and the least innovative enterprises seem to be the ones that are driven by regulatory requirements the most (Kesidou and Demirel, 2012).

Additionally, soft or voluntary environmental measures like environmental accounting systems or eco-audits may contribute to environmental innovations at the firm level (Rennings et al., 2005). However, the implementation of environmental accounting and management systems appears to be affected by environmental product and process innovations and consequently, a complex interrelationship seems to be likely (Ziegler and Seijas Nogareda, 2009).

Consequently, the questionnaire of the MIP wave 2009 covers the aforementioned aspects. Environmental innovations are addressed in four different questions, aimed to gather information about the types of environmental innovations as implemented by firms, motivations and drivers to perform environmental innovations, the kind of environmental impacts that occur, implementation as well as the use of environmental management systems. The answering options of each question reflect the complex nature of environmental innovation since the response categories embrace arguments related to an intra-mural as well as extra-mural perspective of environmental innovation in firms – policy measures and market demand in particular.

Based on these dimension this chapter addresses the following firm related aspects of environmental innovation: (i) environmental benefits from innovations that occur in the innovating firm (environmental process innovations), (ii) environmental benefits through the usage of products (environmental product innovations), (iii) drivers for introducing environmental innovations, and (iv) the use and implementation of environmental management and auditing systems.

The affinity to introduce environmental innovations depends to a certain degree on the sector affiliation and on the size of the firm. Small and medium sized enterprises show special characteristics regarding the management of environmental innovation due to limited financial resources, their organisational structure, short term orientation, limited environmental awareness, lower ability to obtain highly radical innovation etc. (del Brío and Junquera, 2003). As a consequence, data are analysed according to firm size and sector affiliation, where applicable.

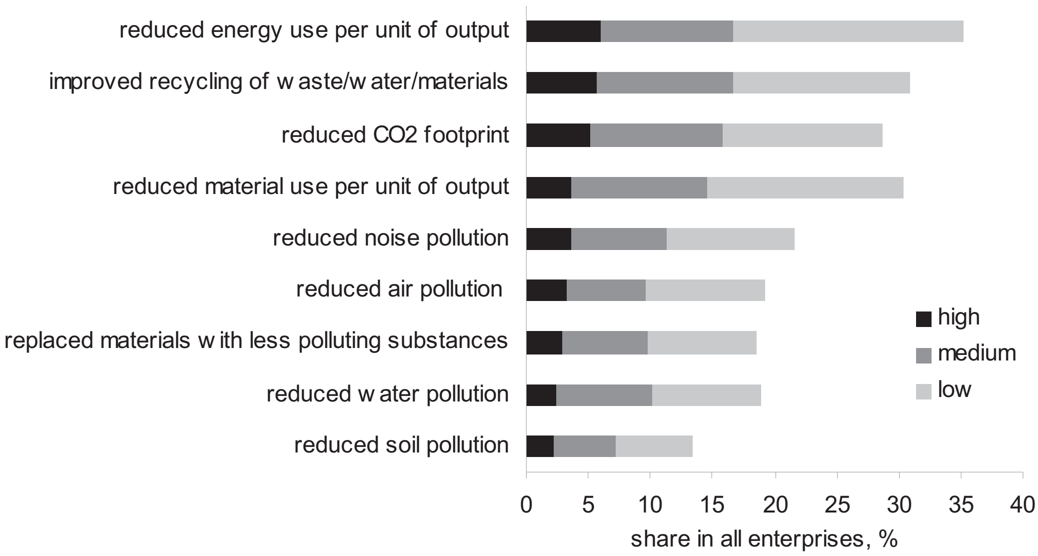
13.1 Environmental Process Innovations

As already mentioned, environmental benefits of innovations can be manifold. In the 2009 wave of the MIP firms were asked about the types of environmental benefits from innovations that occurred within their firm. Nine different types have been detailed in the questionnaire in order to cover the most important dimensions. This list includes the following items: reduced material use per unit of output, reduced energy use per unit of output, reduced CO2 footprint, reduced air pollution (e.g. SOx or NOx), reduced water pollution, reduced soil pollution, reduced noise pollution, replaced materials with less polluting or hazardous substances, and finally improved recycling of waste, water and materials. All of these items address the impacts, directly occurring to the firm itself. Furthermore, firms were asked to indicate whether the environmental benefits (if any) had been high, medium or low. Alternatively they could indicate that no particular benefits occurred from their innovation activities.

The share of enterprises with either product, process, marketing, organisational or environmental innovations during 2006-2008 amounts to 81 per cent. The share of enterprises with at least one environmental innovation during 2006-2008 reaches 56 per cent of all enterprises and is thus somewhat lower.

Figure 104 displays the share of enterprises that have implemented innovations with environmental benefits of a certain type during 2006-2008. More than 35 per cent of the firms have implemented innovations leading to a reduction of energy consumption. Increasing energy prices affect a broad range of sectors and might be considered to be the drivers. Innovations, leading to improved recycling of materials, waste and sewage are implemented by more than 30 per cent of the enterprises. Almost the same share of firms (29 per cent) introduced innovations leading to a reduction of material consumption or a reduction of CO2 emissions. Thus, the list is headed by innovations that primarily lead to a reduction of costs simultaneously associated with the production of goods and services and positive environmental effects.

Figure 104. Innovations with environmental benefits in the innovating firm 2006-2008 by environmental impact

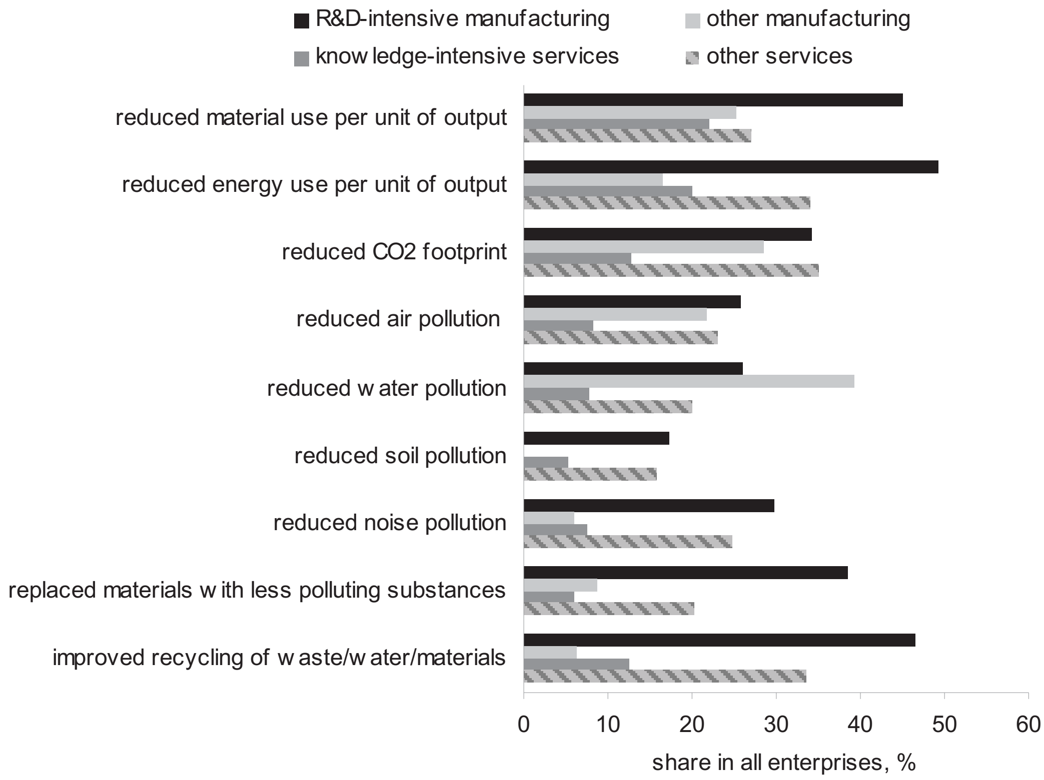


A slightly lower share of enterprises has implemented innovations that led to a reduction of noise pollution (22 per cent), a reduction of air pollution (19 per cent), a reduction of water pollution (19 per cent) or a substitution of dangerous substances (19 per cent). Innovations leading to a reduction of soil pollution are introduced by a low share of enterprises (13 per cent).

Figure 105 also shows that although positive environmental effects are induced by certain innovations, their actual impacts differ greatly. In most of the cases the associated impacts are classified as being either low or medium. Nevertheless, there is also some evidence of innovations having high environmental impacts.

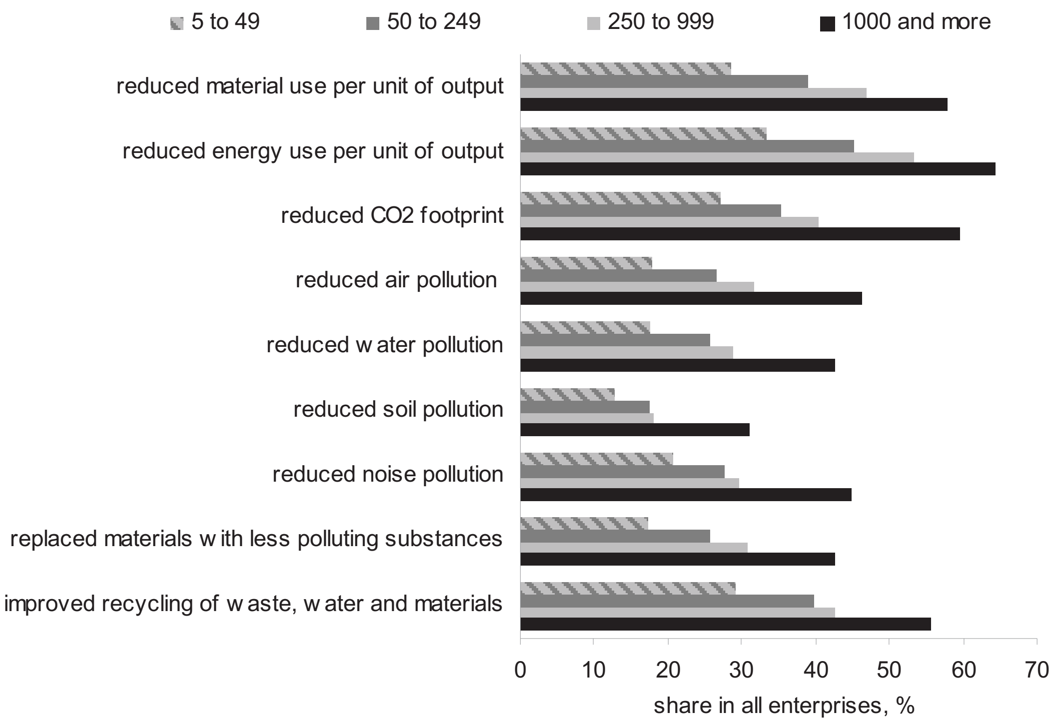
Differentiating by sector, as regards the implementation of environmental innovations, reveals certain differences (see Figure 105). In general, the share of firms implementing innovations with environmental benefits is highest in the sector of R&D-intensive manufacturing and lowest in the knowledge-intensive service sector. This holds, with a minor exception (reduced CO2 footprint), for all types of environmental innovations listed here. The other two sectors always rank in between, whereas the share of firms from the other manufacturing sector having introduced environmental innovations is in most of the cases higher than in the remaining sector of other services; exceptions being reduced air pollution and a reduced CO2 footprint.

Figure 105. Innovations with environmental benefits in the innovating firm 2006-2008, by main sector



The implementation of environmental innovations varies according to firm size (see Figure 106). Generally, it can be stated that the share of enterprises that have been implementing environmental innovations increases with the size class. For example, more than 64 per cent of the enterprises with more than 1,000 employees have introduced innovations that reveal environmental benefits which reduce the energy use per unit of output (as compared to 53 per cent, 45 per cent and 33 per cent in the size classes below) and more than 50 per cent of the enterprises with more than 1,000 employees have introduced innovations concerning a reduced CO2 footprint and reduced material use per unit of output (as compared to 40 per cent/35 per cent/27 per cent and 47 per cent/39 per cent/29 per cent respectively for the smaller size classes). Finally, in the group of enterprises with 5 to 49 employees, the share of enterprises that come up with innovations with environmental benefits is the lowest in all categories of environmental benefits.

Figure 106. Innovations with environmental benefits in the innovating firm 2006-2008, by size class

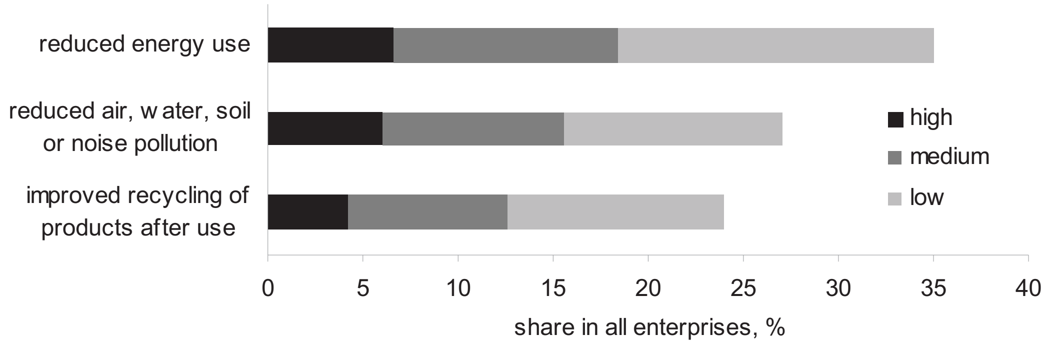


13.2 Environmental Product innovations

Besides the implementation of innovations with environmental benefits directly at the implementing firm, environmental benefits can likewise occur at the level of the users of a firm's product, too. In the questionnaire enterprises were asked to specify whether newly implemented products and services (during 2006 and 2008) led to certain environmental benefits experienced by the use of the product or service. About 35 per cent of all enterprises indicated that end- users have benefited from newly implemented products and services in form of reduced energy use (Figure 107). User benefits in form of reduced air, water, soil or noise pollution were reported by 27 per cent of enterprises and 24 per cent of the enterprises reported user benefits in form of improved recycling of products after use.

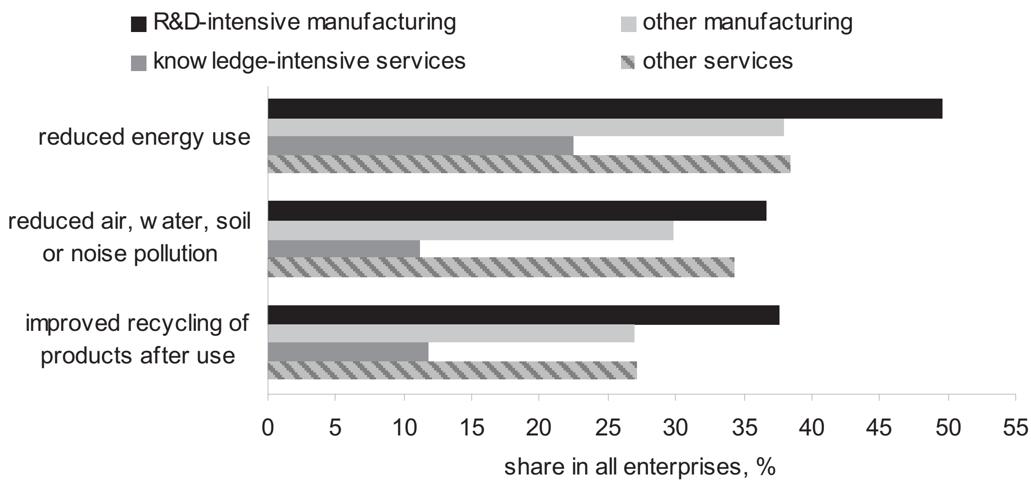
As in the case of environmental benefits occurring directly in the implementing firm, it can be stated, that in most of the cases the reported environmental benefits from the use of products and services by users are classified as being either low or medium. However, in certain cases the innovations are considered of having a high environmental impact.

Figure 107. Environmental benefits from the use of products 2008-2010 by type of environmental impact



User benefits likewise vary across sectors (Figure 108). Whereas user benefits are highest for products from R&D-intensive manufacturing (49 per cent for reduced energy use, 38 per cent for improved recycling, 37 per cent for reduced pollution), environmental benefits of services by firms from the knowledge-intensive service sector are the lowest (22 per cent for reduced energy use, to 12 per cent and 11 per cent for improved recycling and reduced pollution). User benefits for customers from the other two sectors rank between. This result mainly reflects that knowledge-intensive services tend to produce little environmental externalities and therefore offer little room for environmental product innovations that reduce the services' environmental effects.

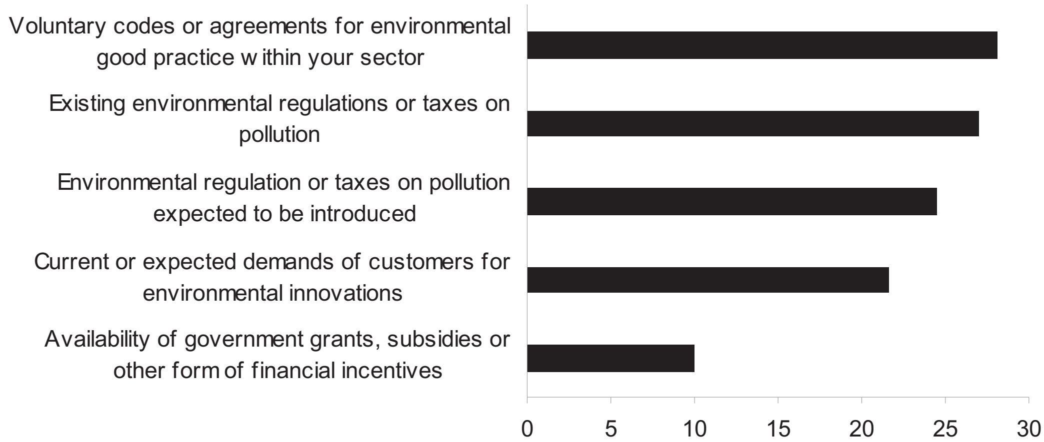
Figure 108. Types of environmental benefits from the use of new products, by main sector



13.3 Motives to Introduce Environmental Innovations

Firms were additionally asked to indicate the motivations behind the introduction of environmental innovations. The questionnaire considers five different motives: existing environmental regulations or taxes on pollution, environmental regulation or taxes on pollution expected to be introduced, availability of government grants, subsidies or other form of financial incentives, current or expected demands of customers for environmental innovations, and voluntary codes or agreements for environmental good practice within your sector. Firms were asked to indicate whether or not the respective motive was a driver for the introduction of environmental innovations. The question only applies to firms with environmental innovations in place. Figure 109 displays the results.

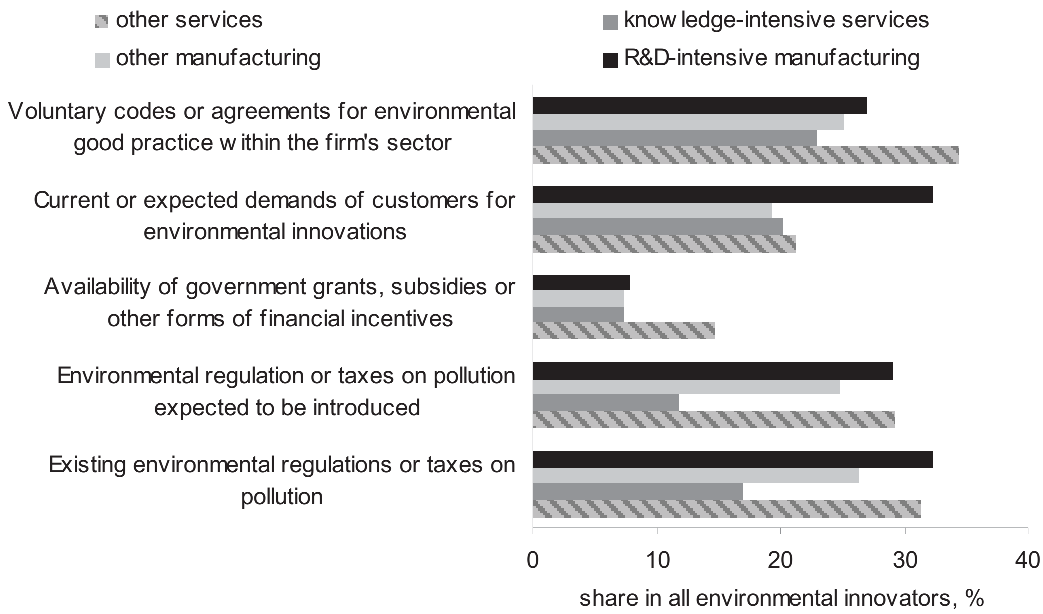
Figure 109. Motives to introduce environmental innovations 2006-2008



Altogether 28 per cent of the enterprises with environmental innovations state that voluntary codes or agreements for environmental good practice within their sector are a driving force for environmental innovations. The share of firms with environmental innovations that claim existing environmental regulations to be a motivation ranks second (27 per cent) in the list, closely followed by environmental regulations that are expected to be introduced (24 per cent). Current or expected demands of customers for environmental innovations are a motivation for 22 per cent to introduce environmental innovations, whereas the availability of government grants, subsidies or other form of financial incentives is found at the bottom of the list. Less than 10 per cent of enterprises with environmental innovations report those to be a motivation. Consequently, market forces and environmental regulations are the most prominent factors for environmental innovations in Germany.

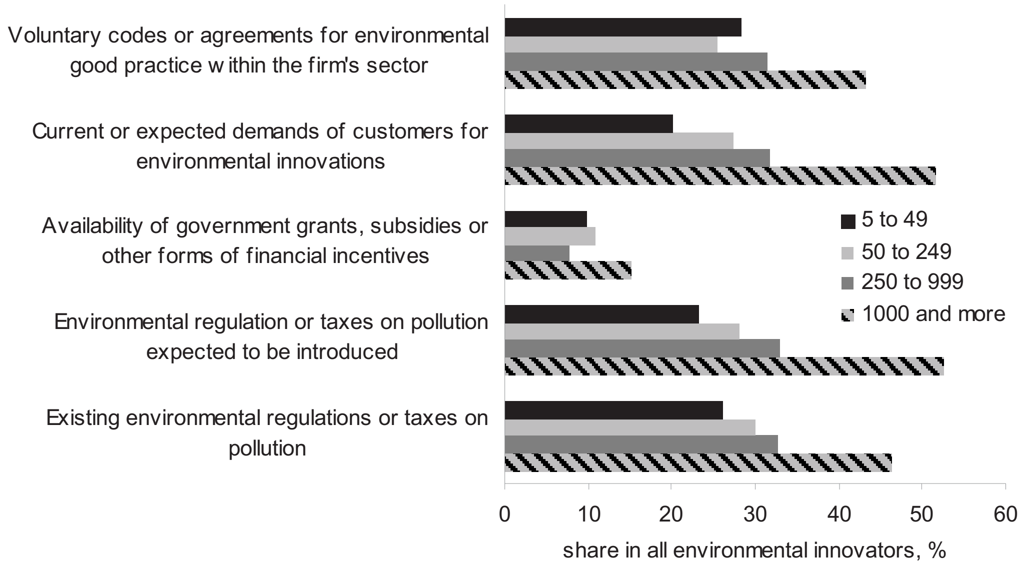
The key factors behind implementing environmental innovations vary to some degree by sector (see Figure 110). For enterprises from the R&D-intensive manufacturing sector, existing environmental regulations as well as current or expected demands of customers are the most prominent drivers (both reach 32 per cent). For enterprises from the service sectors (apart from knowledge-intensive services) voluntary codes or agreements are an important motive for engaging in environmental innovations (34 per cent), followed by existing environmental regulations (31 per cent). Enterprises from the knowledge-intensive services sectors agree to the most with voluntary codes or agreements for environmental innovations (23 per cent). The highest share of agreement from enterprises from other manufacturing sectors get existing environmental regulations or taxes on pollution (26 per cent).

Figure 110. Motives to introduce environmental innovations 2006-2008, by main sector



Differentiating the motives by size class reveals that small enterprises with environmental innovations most often introduced these innovations in response to voluntary codes or agreements and existing regulations, while very large environmental innovators most often responded to expected regulation and customer demand. While environmental innovations in larger enterprises tend to be driven by a larger variety of factors -which primarily reflects the larger variety of products and processes in these firms resulting in greater opportunity for different environmental innovations- only small size differences can be found for the availability of government funding for environmental innovations. In relative terms, this motive is more important for small and medium-sized firms than for large ones.

Figure 111. Motives to introduce environmental innovations 2006-2008, by size class



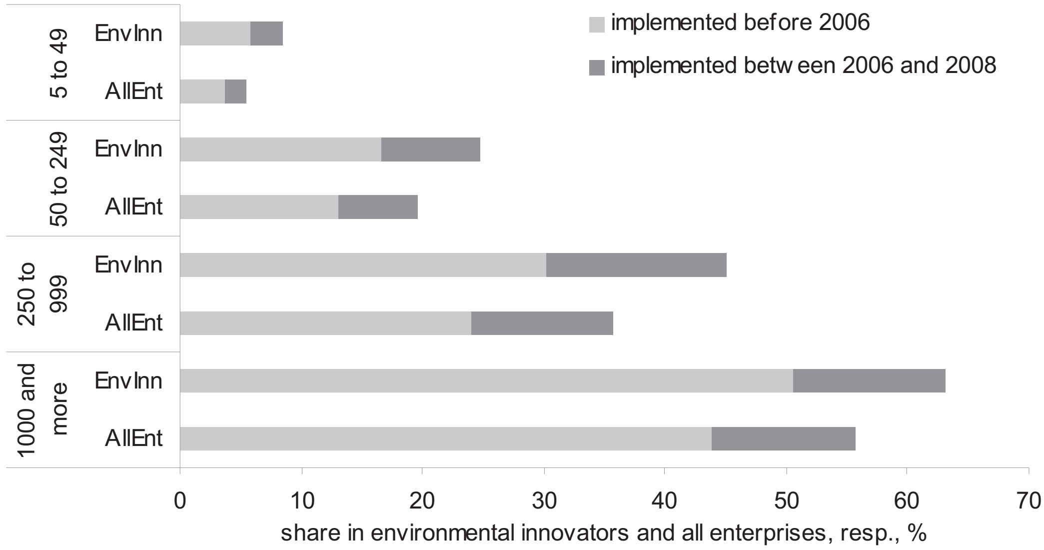
13.4 Implementation of Environmental Management and Auditing Systems

In the 2009 questionnaire firms were asked to indicate whether or not they have implemented or make use of environmental management and auditing systems. Firms could state that they introduced such instruments either before 2006, during 2006 and 2008 or not at all. In order to promote a joint understanding of the term environmental management and auditing systems the questionnaire specifies the expression and enlists practical examples, such as environmental certifications according to the ISO 14001 standards, the EMAS (Eco-Management and Audit Scheme) as developed in Europe, voluntary environmental management practices such as the establishment of internal standards, goals, and policies for environmental performance improvement or regular environmental reports.

The share of environmental innovators that have already implemented environmental management systems by the beginning of 2006 was quite low. 92 per cent of environmental innovators did not use such tools at this time. During the three year period 2006 to 2008, 4 per cent of environmental innovators introduced environmental management systems for the first time. Among firms without environmental innovations, the use of environmental management systems is very rare. By the beginning of 2006, only 1.7 per cent of these firms had implemented such tools. Until the end of 2008, another 0.9 per cent introduced environmental management systems, meaning that still more than 97 per cent had no such procedures in place.

The implementation of environmental management and auditing systems varies significantly by firm size (see Figure 112). In the group of environmental innovators with more than 1,000 employees, 63 per cent did use such instruments by the end of 2008. Most have them have introduced environmental management systems before 2006. Among small firms (5-49 employees), the share of environmental innovators having environmental management and auditing systems in place is only 8.5 per cent. 25 per cent of environmental innovators with 50-249 employees, and 45 per cent of environmental innovators with 250-999 employees used environmental management and auditing systems by the end of 2008. This pattern of decreasing use of instruments to monitor and manage environmental impacts of firm activities by size class can also be found for firms without environmental innovations. Among small and medium-sized enterprises, the share of firms that introduced such instruments during 2006 and 2008 is significantly higher than for very large enterprises.

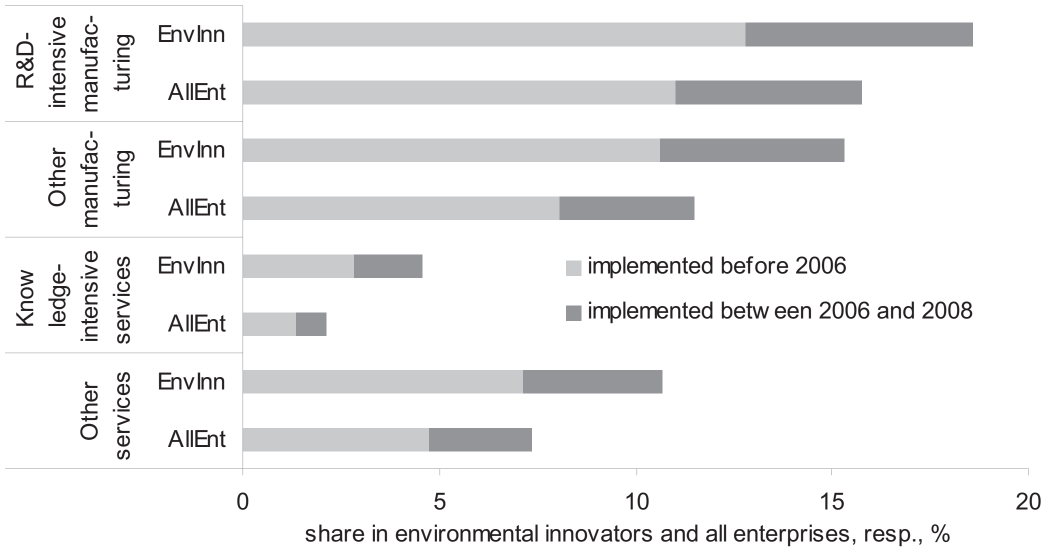
Figure 112. Implementation of environmental management and auditing systems, by size class



EnvInn: environmental innovators; AllEnt: all enterprises

Not surprisingly, the implementation of environmental management and auditing systems also varies by sector, though the differences are much smaller than for size classes. As displayed in Figure 113, the share of environmental innovators with environmental management and auditing systems in place is highest in R&D manufacturing and lowest in knowledge-intensive services. The sector ranking primarily represents the different levels of environmental externalities that originate from economic activities in the different sectors. In knowledge-intensive services, the main input to production is human capital and knowledge. Since both production factors tend to produce few environmental externalities, there is also limited demand for monitoring and management systems to reduce these externalities. In manufacturing as well as in other services (which include transport services), energy and material represent a major input to the production of good or services.

Figure 113. Implementation of environmental management and auditing systems, by main sector



14 Innovation and Investment

Innovation activities are a particular way of how firms can invest to generate future profits. Other related types of investment are capital expenditure and investment in intangibles. Common to all these activities is that they build up a capital stock which creates benefits in future periods. So far, these different types of capital spending have mostly been treated in separate statistics and analyses. Capital expenditure for tangible assets (property, plant, equipment) has gained much attention in economics. As being part of national account statistics, tangible capital is regularly used in productivity analyses. Studies on investment in intangibles were limited to the role of software for a long time (as part of investment in information technology, see Brynjolfsson, 1993; Triplett, 1999; Brynjolfsson and Hitt, 2000). A more comprehensive treatment of intangibles that also takes into account expenditure on R&D and other creative efforts and on acquiring economic competencies such as brand equity, human capital and organisational resources has only recently received greater attention as a separate category of capital spending (see Brynjolfsson et al., 2002; Corrado et al., 2005, 2006). Analysis of innovation-related investment has so far been restricted to R&D data since the lack of time series data on total innovation expenditure limits the calculation of an innovation capital stock.

Only few studies analysed the link between innovation and other capital spending. Most empirical work that considers other investment categories beyond tangible capital employs R&D data or patent data to estimate knowledge capital stocks (see Griliches, 1981, 1994). Little work has yet been done to link innovation data and tangible capital spending though CIS data provides some opportunity for such an exercise, since it separates between capital expenditure for innovation, R&D-related innovation expenditure and other expenses. This information can be used to estimate the share of innovation-related capital expenditure in total capital expenditure and determine the role of innovation for fixed capital formation. In a pilot study on a dedicated survey of U.K. businesses Awan et al. (2010) investigated the link between innovation and intangible investment.

This chapter aims to provide a quantitative estimate of the significance of innovation expenditure in total investment in tangible assets and intangibles for the German enterprise sector. For this purpose, we need to estimate the total volume of tangible plus intangible capital spending. While official statistics provides accurate data on capital expenditure on tangible assets and capitalised software, data on other spending for intangibles other than R&D is not available. We use information collected in the MIP to fill at least a part of this gap. In contrast to the standard CIS, the MIP questionnaire includes a section on general financial data where firms are asked to provide data, among others, on branding and reputation building expenditure (which mainly includes advertising, market research and other types of product promotion) and training expenditure (continuing and further education of employees and other activities in human capital development).

14.1 Innovation and the Concept of Intangibles

Capital spending of firms is traditionally separated in two classes: capital spending for tangible assets and capital spending for intangibles. While tangible (or fixed) asset is a well-established concept that refers to a firm's investment in equipment and building, the notion of intangibles is rather blurred. From a theoretical perspective, all activities that generate assets other than fixed assets are intangible investment. These activities are often related to the creation of knowledge or intellectual capital. In recent years, a classification of intangibles proposed by Corrado et al. (2005) has become generally accepted. Corrado et al. (2005, 2006) distinguish three main groups of intangibles:

- Computerised information, particularly software and databases;
- Innovative property, particularly knowledge produced by R&D and other creative or inventive activities;
- Economic competencies, particularly brand equity/reputation and firm-specific human and organisational resources.

It is evident that innovation activities (as defined in the Oslo Manual) are closely related to the concept of intangibles. Basically all innovation expenditure for other items than fixed assets will qualify as capital spending for intangibles. However, expenditure for intangibles also includes activities that would not qualify as innovation activities. This is true for advertising, market research and reputation building expenditure on non-innovative products, for training and other types of human capital development not related to innovation, for software and database development not linked to innovation, and for most activities in the context of organisational development since such activities are not regarded as process innovation in the Oslo Manual (but rather as organisational innovation, see Chapter 10).

Table 7 summarises the coverage of spending for intangibles in innovation expenditure as defined by the Oslo Manual. By definition, all expenditure for R&D is both intangible and innovation expenditure. The same is true for expenditure for other creative work as such work such lead to an innovative property according to Corrado et al. (2005). Expenditure for intellectual property rights such as patents, brand names or industrial designs may also be linked to non-innovative activities though it is very likely that the largest fraction of such expenditure is used for product or process innovation as defined by the Oslo Manual.

Measuring intangibles is complicated by the fact that the different types of spending are treated differently in business accounting. Some spending such as purchase and in-house development of software or intellectual property rights (including brand names) qualify as capital expenditure in accounting policies and can be capitalised as intangible assets in the balance sheet. Some part of R&D expenditure may also be capitalised if certain requirements are met (which applies to certain technological development). Other spending for intangibles are current costs and do not enter a firm's balance sheet. This includes expenditure for advertising, market research, reputation building, training and organisational development as well as research, design, engineering and other creative work.

Table 7: Coverage of intangibles in innovation expenditure

Expenditure for intangible assets	*Innovation expenditure*		
	R&D	*capital - expenditure*	*other*
Expenditure for software and databases		(x)	(x)
Expenditure for R&D	x	x	
Expenditure for other creative work other than R&D			x
Expenditure for intellectual property rights		(x)	
Expenditure for brand equity and reputation building			(x)
Expenditure for training			(x)
Expenditure for organisational development/business process improvement			0

x: (almost) completely covered; (x): only partially covered; 0: mostly uncovered

Since there is no dedicated survey on expenditure for intangibles in place, most studies that tried to estimate its volume had to rely on rough estimates, based on the pioneering work of Corrado et al. (2005) for the U.S. Estimates on a country level have been produced, among others, for Finland (Javala et al., 2007), Canada (Baldwin et al., 2008), the Netherlands (van Rooijen-Horsten et al., 2008) and Japan (Fukao et al., 2007). Results on sector levels are rather rare (see Awano et al., 2010; Gil and Haskel, 2010, for the U.K.). For Germany, some first estimates were produced under EU funded projects (Hao et al., 2008; Crass et al., 2009), though no breakdown by industries was provided. In the following, we present a first estimate on the amount of intangible investment by industry in the German enterprise sector based on data collected by the MIP and compare the result with the amount of tangible investment. In addition, the share of innovation-related expenditure in total capital spending is given.

14.2 Measuring Intangible Investment and the Innovation Share in Total Investment

Data on tangible investment by industry in the German enterprise sector is readily available from business and national account statistics. National account statistics also include data on intangible investment in software. Data on R&D expenditure - including a breakdown by in-house and external as well as by current and capital expenditure - is provided by the R&D statistics (see Kladroba and Hellmich, 2011). Data on firms' expenditure for training were collected as part of the EU's Community Vocational Training Survey (CVTS) for two years (1999 and 2005).

For all other expenditure on intangibles, including brand equity and creative work other than R&D, no industry data is available from existing statistics.

In order to estimate the total amount of tangible and intangible investment and the share of innovation in these totals for individual industries of the German business enterprise sector, we combine three data sources: the MIP, national accounts, and R&D statistics. Data from the MIP is used to calculate industry totals for the following six expenditure categories:

1. Capital expenditure for machinery, equipment and buildings ('capex for tangibles')
2. Expenditure for advertising, market research, marketing innovation and other types of product promotion ('promotion/branding expenditure')
3. Expenditure for continuing and further education of employees and other activities in human capital development ('training expenditure')
4. R&D expenditure (in-house plus external)
5. Current innovation expenditure for creative work other than R&D such as design, engineering, conceptual and preparatory work, not capitalised software development outside of R&D ('other innovation expenditure')
6. Capital expenditure for intellectual property rights (IPRs) in the context of innovation activities ('capex for IPRs')

Note that categories 1 to 3 refer to expenditure for both innovative and non-innovative purposes and include expenditure by non-innovative firms. Data on capex for tangibles and R&D expenditure are taken from the MIP despite their availability in existing statistics in order to guarantee consistency of industry data with other investment items since industry assignment of large corporations differs between official investment statistics, R&D statistics and the approach used in the MIP. Total figures for both expenditure items derived from the MIP are highly consistent with totals from official statistics.

The sum of all six categories covers all capital spending on tangible assets and most categories of expenditure for intangibles. It excludes, however, expenditure on IPRs outside of innovation activities as well as expenditure for software and for organisational development such as business process improvement. Information on capital expenditure on software is obtained from national account statistics and added to category 1 (capex for tangibles). Costs of software development that have not been capitalised may be included in R&D expenditure or other innovation expenditure as long as they are part of innovation activities. Current costs of software development outside of innovation activities cannot be covered since no data on such expenditure are available.

National account statistics provides capital expenditure on IPRs only for two sub-categories, copyrights for audiovisual media and pool test in mining. We add this data to category 6 (capex for IPRs) as long as it exceeds capital expenditure for IPRs in the context of innovation activities, which is basically the case for three sectors only (mining, film production, broadcasting). Any other expenditure on IPRs outside of innovation activities is missing in this analysis.

Data on costs of business process improvement that qualify as intangible investment is neither available from the MIP nor from any other survey in Germany that would allow for computing weighted results by industry. Hence, this category of intangibles cannot be included in this analysis on intangible investment.

When summing up R&D expenditure and capex for tangibles and software, double counting of capital expenditure for R&D will occur since R&D expenditure data include both current spending and capital expenditure on tangibles and software. To avoid such double counting, data on capital expenditure for R&D from the R&D survey are taken to deduct capital expenditure from total R&D expenditure. Note that development costs that are capitalised as intangible assets remain part of R&D expenditure and are not included in capital expenditure categories.

In order to determine the share of innovation-related expenditures in total tangible and intangible investment, capex on tangibles and software, promotion/branding expenditure and training expenditure need to be split up in an innovation and a non-innovation fraction.[18] For capex on tangible assets and software, the MIP directly collects the amount of this expenditure made in the context of innovation activities which allows for the calculation of the respective innovation share. Unfortunately, no separation can be made between tangibles and software since the MIP -following the CIS questionnaire- surveys only the total of the two types of capital expenditure as an innovation expenditure category. With respect to capital expenditure on IPRs, no innovation share can be calculated since no total (innovative plus non-innovative) expenditure data are available.

The straightforward way to determine the innovation share of promotion/branding and training expenditure would be to collect this information in the MIP. While this has been done in some earlier survey waves, in more recent waves the corresponding questions have been skipped in order to reduce response burden for firms. Currently, only the total of innovation-related current expenditure for advertising, market research, reputation building, training, design, engineering and other conceptual and preparatory activities for developing and introducing product or process innovation is collected (i.e. category 5 in the list above). This total is separated into the three components promotion/branding, training and others at the firm level by using three types of information: (a) whether a firm has conducted any of the three activities in the context of innovation (if this is not the case, the expenditure for the respective component can be set to zero), (b) the firm's total expenditure for advertising, market research, marketing innovation etc. and for training; and (c) the significance of innovation results in the firm's total output. The latter is used to calculate two indexes of innovativeness which are used to weight total expenditure for promotion/branding and for training to derive an estimate of innovation-related expenditure for each of the two categories. For promotion/branding expenditure, the innovativeness index sums up the share of sales generated by market novelties, product-range novelties and product imitations (i.e. new products that are only new to the firm; see Chapter 4 on details), but weights sales share of the two novelties with 1.25 to represent higher efforts for advertising, market research and other activities of reputation building for new

[18] Note that R&D expenditure is by definition part of innovation expenditure.

products with a higher degree of novelty. The index ranges from zero (for firms without new products) to 1. For training expenditure, the innovativeness index also takes process innovation success into account (measured by the share of cost savings through process innovation and sales growth due to quality improvements) as such innovations often require additional training efforts.

Table 8 presents the main categories of total tangible and intangible investment used in this analysis, the data source for each category and whether a breakdown by innovation is possible. Such a breakdown can be done only for one reference year (2008), however, since only the 2009 MIP survey (with 2008 as reference year for expenditure data) contained a breakdown of capital expenditure for innovation by tangible assets/software and IPRs and collected information on advertising/market research and training in the context of innovation activities which is needed to estimate the innovation share of these expenditures. The first reference year for which full information on all investment categories is available in the MIP is 2006 since it was the 2007 survey that included a question on promotion/branding expenditure for the first time.

Table 8: Categories of tangible and intangible investment and data sources

	Data source	*Innovation breakdown*
1a. Capex on tangibles	MIP	yes
1b. Capex on software	NAS	
2. Promotion/branding expenditure	MIP	yes
3. Training expenditure	MIP	yes
4. R&D expenditure[2)]	MIP, RDS	/
5. Other innovation expenditure	MIP	/
6. Capex on IPRs[1)]	MIP, NAS	no

1) Only for innovation, except for copyright for audiovisual media; 2) excluding capital expenditure for tangibles and software.
NAS: national account statistics; RDS: R&D survey

Compared to other empirical work on intangibles, the following expenditure categories are not covered in the present analysis:

- Current costs of software development not for innovation
- Costs for databases and other computerised knowledge not for innovation
- Costs for creative work other than R&D that is not used for product or process innovation (e.g. design for packaging or presentation of products, which is part of marketing innovation)
- Expenditure on IPRs not for innovation other than copyrights for audiovisual media
- Expenditure on organisational development and business process improvement

It is difficult to assess the extent of undercoverage of total intangible investment due to these missing categories. With respect to the latter category, the U.K. survey on intangibles by Awano et al. (2010) showed that expenditure for business process improvement was about 3.5 per cent of total expenditure for intangibles.

The amount of current costs of software development not for innovation may be significantly higher than the amount of capital expenditure for software. The amount for the latter was €21.5 billion for the German economy in 2010, which is rather close to total sales of software programming firms in Germany (€22.5 billion in 2010, though parts of these sales go to private households and customers abroad, which may be balanced by imports of software) and may indicate that most of capitalised software is purchased software. The U.K. survey mentioned above shows that about two thirds of total software costs are in-house costs. If this ratio would also apply for the German enterprise sector, then the largest part of in-house software costs would not be covered by the present data. The extent of creative activities outside of product and process innovation that would qualify as intangible investment is largely unknown. One relevant item of such 'non-innovative' creative activity is (re-)design work on established products and services to reshape their appearance or presentation. The Oslo Manual regards such work as part of marketing innovation. In the 2007 MIP survey, a pilot question on the expenditure for marketing innovation revealed that they represent about 10 per cent of a firm's total budget for advertising, market research, marketing innovation and other types of product promotion (see Rammer and Köhler, 2008). Since product design activities are only one out of four marketing innovation activities and only half of all marketing innovators engage in product design (see Chapter 10), design expenditure outside of product and process innovation are likely to be less than 5 per cent of firms' total promotion/branding expenditure. In regard to expenditure on IPRs not for innovation, it is fair to assume that the major part of purchasing IPRs from others takes place in the context of innovation activities. IPRs like patents or trademarks typically represent novel assets for the purchasing firm and their use will most likely constitute an innovation from the purchasing firm's point of view.

14.3 Tangible and Intangible Investment by Industry

This section presents the main findings on the level and composition of tangible and intangible investment in the German business enterprise sector. It provides a breakdown by industry and discusses the share of innovation-related investment in total investment. Since detailed results are only available for the year 2008, this section focuses on data for that year. Developments over time are presented in the following section.

In 2008, German enterprises (within the sectors covered by the MIP and with 5 or more employees) spent €304 billion on tangible and intangible investment. Investment in tangible assets (machinery, equipment, buildings) was €151.0 billion (Table 9). The figure is slightly lower than capex on tangibles as reported in national account statistics for those industries that are covered by the MIP (€155 billion). The difference mainly reflects that the MIP does not cover enterprises with less than 5 employees. In addition, industry assignment of large enterprises with main activities in different industries deviates in the MIP from national account statistics. While the latter assigns the entire enterprise to one industry, the MIP splits up some of the very large enterprises by industries. The share of tangible assets in total investment was 49.6 per cent of total investment and is certainly overrated since some parts of intangible investment is missing in total investment.

Table 9: Tangible and intangible investment 2008, by main sector

billion €	*R&D-intensive manufacturing*	*Other manufacturing*	*Knowledge-intensive services*	*Other services*	***All sectors***
1a. Capex on tangibles	38.7	51.5	26.0	34.7	***151.0***
1b. Capex on software	4.0	3.2	8.4	2.2	***17.7***
2. Promotion/branding expenditure	20.4	10.2	13.1	7.4	***51.1***
3. Training expenditure	2.1	1.4	2.3	1.3	***7.1***
4. R&D expenditure[1)]	42.7	5.1	8.8	0.6	***57.2***
5. Other innovation expenditure	4.2	3.4	3.9	1.0	***12.6***
6. Capex on IPRs[2)]	1.4	0.8	5.0	0.4	***7.6***
Total investment	**113.5**	**75.7**	**67.5**	**47.7**	***304.4***

1) Excluding capex for tangibles and software; 1) only for innovation, except for copyright for audio-visual media.

Source: ZEW calculation based on data sources given in Table 8.

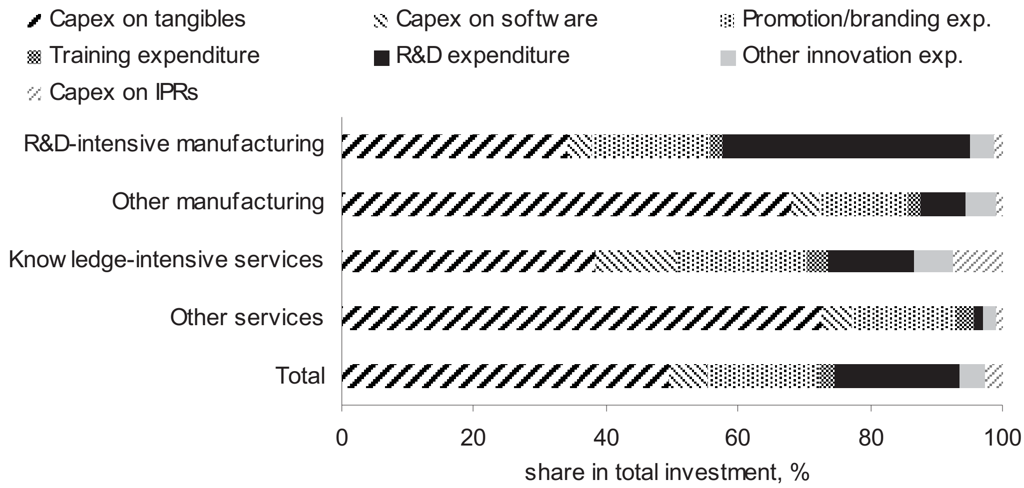
Total intangible investment (excluding missing categories of intangibles) was €153.4 billion. The largest part of intangible investment is R&D. In 2008, €57.2 billion (or 37 per cent of total intangible investment) was spent on in-house or external R&D (excluding capital expenditure for tangibles or software). The figure compares quite well with the official R&D data, which report about €56 billion of R&D expenditure (excl. capex) for the industries covered by the MIP. The small difference may result from an overrating of software development costs in the MIP data due to different definitions of R&D in the MIP/CIS and the R&D survey. Expenditure for promotion and branding were of similar size as R&D expenditure and amounted to €51.1 billion in 2008, which is 33 per cent of total intangible investment. Capital expenditure for software was €17.7 billion in 2008 which is 12 per cent of total intangible investment. Other current innovation expenditure was €12.6 billion in 2008 (8 per cent of total intangible investment), and capital expenditure on IPRs was €7.6 billion (5 per cent). Training expenditure was €7.1 billion in 2008. This figure is slightly lower than the training expenditure in the German enterprise sector as obtained from the CVTS in 2005, which was about €8.0 billion for the sectors and size classes surveyed in the MIP. Though a fall in training expenditure may not be excluded it is more likely that the figures obtained from the MIP somewhat underrate the wage costs of employees while they are undergoing training.

R&D-intensive manufacturing industries spent €113.5 billion on tangible and intangible investment in 2008 which is 37.3 per cent of total investment of the sectors covered by the MIP. Other manufacturing industries invested a total of €75.7

billion (24.9 per cent). Knowledge-intensive services came in close behind with total investment of €67.5 billion (22.1 per cent). Other services spent €47.7 billion (15.7 per cent) on tangible and intangible assets.

The significance of the main investment categories varies substantially by main sector (Figure 114). In R&D-intensive manufacturing, R&D expenditure is the most important category (37.6 per cent of total investment), followed by capital expenditure on tangible assets (34.1 per cent) and promotion/branding (18.0 per cent). In all other three sectors, expenditure on tangible assets is the most important category. In other manufacturing and other services, 68.1 per cent of total investment falls in this category. In knowledge-intensive services, it is only 38.5 per cent. This sector shows the highest share for software investment and IPRs investment (the latter is strongly driven by the film and broadcasting industry). Knowledge-intensive services also report the highest share for other current innovation expenditure. Training expenditure is of little significance in all four sectors, though service sectors show a higher share (2.7 to 3.4 per cent) than manufacturing sectors (1.9 per cent).

Figure 114: Composition of total investment 2008, by main sector

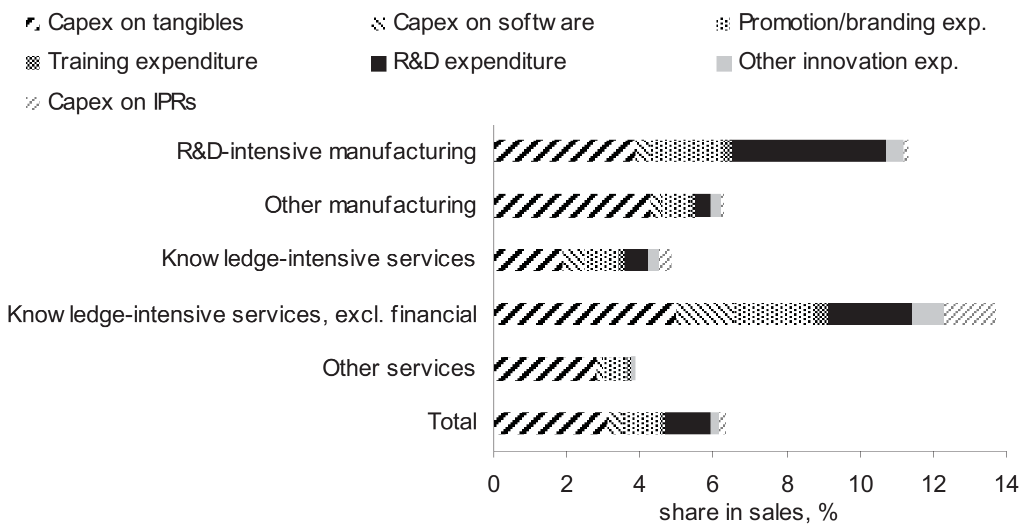


R&D expenditure excludes capex for tangibles and software; capex on IPRs only for innovation, except for copyright for audiovisual media.

Source: ZEW calculation based on data sources given in Table 8.

The share of total investment in total sales is 6.3 per cent for the German enterprise sector (Figure 115). The highest share is reported for R&D-intensive manufacturing (11.3 per cent) while knowledge-intensive services spent just 4.9 per cent of their total sales on tangible or intangible assets. This low ratio is entirely driven by financial intermediation and is mainly caused by high sales figures of this particular sector. As sales mainly comprise gross interest income and gross premium written, sales figures are not directly comparable to those of other service sectors. When excluding financial intermediation from knowledge-intensive services, it turns out that the share of expenditure on tangible or intangible assets exceeds that of R&D-intensive manufacturing, reaching 13.7 per cent. This higher ratio mainly results from the relatively higher capital expenditure on software and IPR as well as the higher share of other innovation expenditure in sales. Capital expenditure on tangible assets in relation to sales is also higher in knowledge-intensive services than in R&D-intensive manufacturing. Knowledge-intensive service investment in this category is mainly driven by capital expenditure on IT and telecommunication infrastructure. As R&D-intensive manufacturing unites all those manufacturing industries that have a high share of R&D expenditure in sales, it is evident that this sector reports the highest investment to sales ratio for this category. Other manufacturing stands out for a relatively high share of tangible capital investment, though spending 4.3 per cent of sales on this investment category is still lower than for knowledge-intensive services (when excluding financial intermediation). Investment in all other categories in other manufacturing is relatively lower than for the German business enterprise sector as a whole. Other services spend only 3.9 per cent of their total sales on tangible or intangible investment, with a clear focus on tangible investment, though their share of 2.8 in sales is lower than for any other sector.

Figure 115: Total investment by category as a percentage of total sales 2008, by main sector



R&D expenditure excludes capex for tangibles and software; capex on IPRs only for innovation, except for copyright for audiovisual media.

Source: ZEW calculation based on data sources given in Table 8.

41 per cent of total investment in tangible assets and intangibles takes place as part of innovation activities (see Table 10). While all R&D and other current innovation expenditure qualify for innovation, the innovation share is rather low for training expenditure (35 per cent), capital expenditure on tangible assets and software (24 per cent), and promotion/branding expenditure (17 per cent). The low innovation share of expenditure for building up brand equity and reputation results from two facts. First, many firms do not have any product innovation which means that all their expenditure on advertising and market research is for non-

innovative products. Secondly, firms that have introduced new products generate, on average, the largest part of their sales with non-innovative products. As investment in brand equity and reputation is not only needed when introducing a product to the market for the first time but also in later stages of the product life cycle, most of the product innovators expenditure on advertising and market research aims at their older products.

Table 10: Share of innovation-related expenditure in total tangible and intangible investment 2008, by main sector

Innovation-related expenditure in total expenditure (%)	*R&D-intensive manufacturing*	*Other manufacturing*	*Knowledge-intensive services*	*Other services*	***All sectors***
1. Capex on tangibles/software	46	18	16	15	***24***
2. Promotion/branding expenditure	27	9	14	6	***17***
3. Training expenditure	53	26	30	24	***35***
Total investment[1)]	**66**	**27**	**33**	**18**	***41***

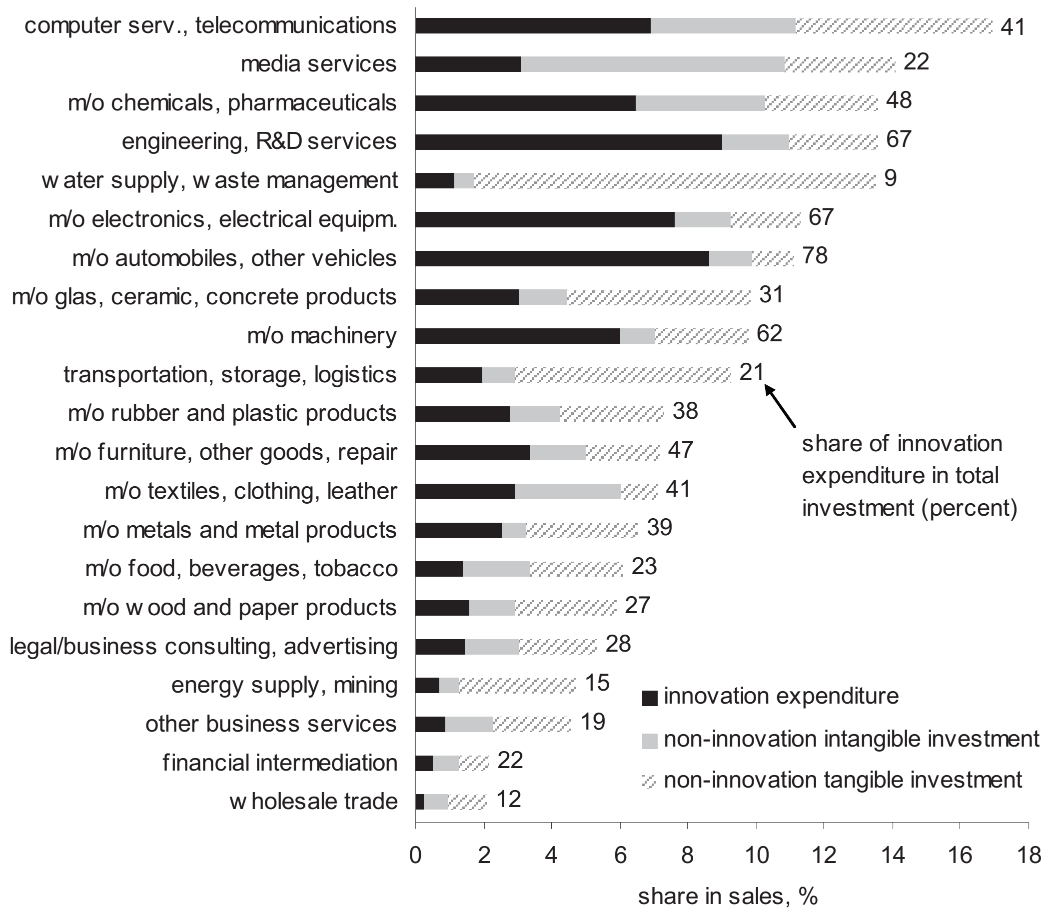
1) Including R&D and other current innovation expenditure as well as capital expenditure on IPRs (the innovation share of all these components is, by definition, 100 per cent) and capital expenditure on audiovisual copyrights/pool test not for innovation (0 per cent innovation share).

Source: ZEW calculation based on data sources given in Table 8.

In R&D-intensive manufacturing, two thirds of total investment is for innovation. This high share is strongly driven by high R&D expenditure of this sector which represents a major part of their total investment. But also capital expenditure for tangible assets and software as well as training expenditure are often related to innovation activities. In knowledge-intensive services, a third of total investment is spent for innovation while other manufacturing devotes 27 per cent of all investment to innovation, and other services just 18 per cent. In all three sectors, 15 to 18 per cent of total capital expenditure for tangible assets and software is used for product or process innovation, which is a substantially lower share than in R&D-intensive manufacturing.

A ranking of industries by the ratio of their total investment in sales produces a significantly different result than a ranking solely based on innovation expenditure. Figure 116 shows the respective ranking by splitting up total investment three categories: innovation expenditure, non-innovation intangible investment and non-innovation tangible investment. The two industries with the highest share of total investment in sales are computer services (incl. programming activities) and telecommunications (16.9 per cent), and media services (incl. film and broadcasting, publishing, printing; 14.0 per cent). Computer services and telecommunications invest quite strongly in all three categories. Innovation expenditure represents 6.9 per cent of sales (which is rank 4 across the 21 industries considered), intangibles outside of innovation 4.3 per cent (rank 2) and tangibles outside of innovation 5.8 per cent (rank 3). Media services show particularly high investment in non-innovation intangibles (7.7 per cent) but medium investment in the two other categories. Ranking third is manufacturing of chemicals and pharmaceuticals. This industry reports a rather high share of investment in intangibles not related to innovation, which primarily reflects high expenditure for promotion and branding since major parts of this industry manufacture consumer products (drugs, detergents, cosmetics), for which branding is essential.

Figure 116: Total investment as a percentage of total sales 2008, by industry



Source: ZEW calculation based on data sources given in Table 8.

The three sectors which rank first for the share of innovation expenditure in sales -engineering and R&D services, manufacturing of automobiles and other vehicles, and manufacture of electronics and electrical equipment- fall somewhat behind because of rather low non-innovation investment. The automotive and other vehicles industry spent 78 per cent of their total investment in 2008 on innovation. For the other two industries, this share was 67 per cent.

There are some industries with very low innovation expenditure in sales that show a high share of total investment in sales owing to high tangible investment outside of innovation. This is particularly true for water supply and waste management (incl. recycling activities). This industry spent 11.7 per cent of their sales in 2008 on tangible assets that are not related to any innovation activity. Consequently, only 9 per cent of their total investment goes to innovation. Other industries with a very low share of innovation expenditure in total investment include wholesale trade (12 per cent), energy supply and mining (15 per cent) and other business services (19 per cent). Industries with a high share of non-innovation tangible investment include transportation, storage and logistics (6.4 per cent), and manufacture of glass, ceramics and concrete products (5.4 per cent). A high share of intangible investment not related to innovation is reported for manufacturing of textiles, clothing and leather (3.1 per cent) and manufacturing of food, beverages and tobacco (2.0 per cent). Both sectors primarily produce consumer goods which require high spending for promotion and branding also for non-innovative products.

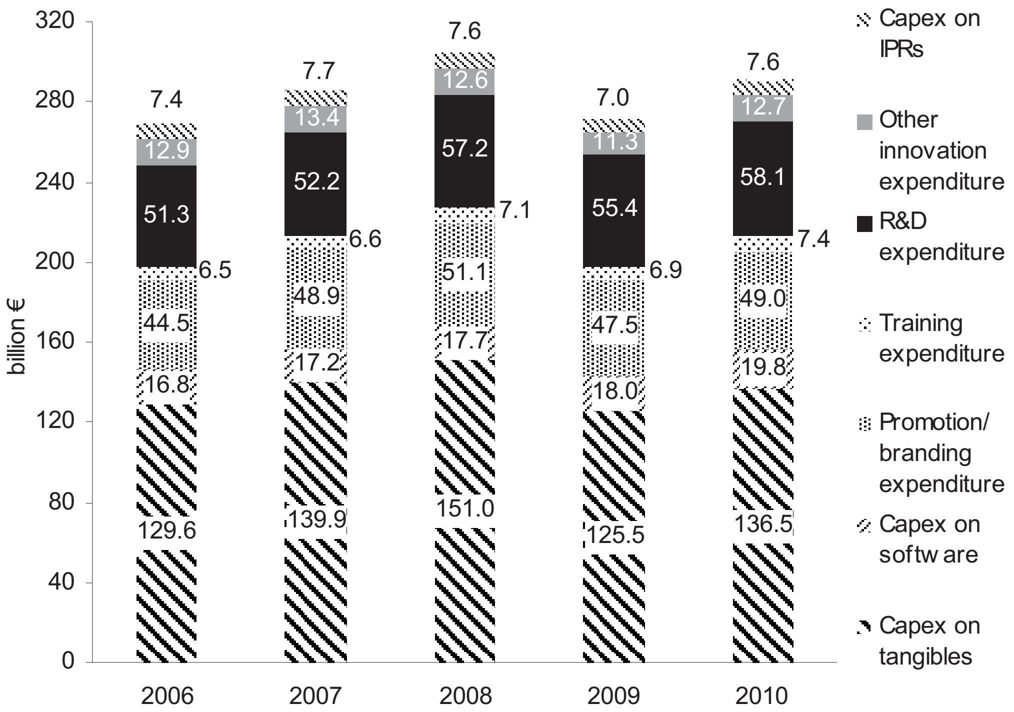
14.4 Total Investment 2006 to 2010

MIP data allows estimating the volume of total investment in the German enterprise sector for the years 2006 to 2010 based on some assumptions on the share of innovation-related expenditure in total promotion/branding and training expenditure, and on the share of innovation-related capital expenditure of IPRs in total innovation-related capital expenditure. These shares need to be known in order to calculate the amount of other innovation expenditure and the amount of capital expenditure for IPRs. While the 2009 wave of the MIP provided sufficient information to determine these shares for the reference year 2008, the other MIP surveys do not include this information. We therefore use the shares for the reference year 2008 and apply them for the other years.

Based on this assumption, total investment in the German business enterprise sector was €269.0 billion in 2006 and rose to €285.8 billion (+6.3 per cent) in 2007 (Figure 117). After peaking at €304.4 billion in 2008 (+6.5 per cent compared to 2007) total investment fell by 10.8 per cent to €271.6 billion in 2009, reflecting the sharp economic crisis in that year. 2010 saw an increase by 7.2 per cent to €291.2 billion.

Although the composition of total investment by main spending categories remained unchanged over the past five years, changes in expenditure by category varied considerably (Figure 118). Capital expenditure for software increased steadily from 2006 and 2010. 2010 expenditure on capitalised software was 18 per cent higher than in 2006. Training expenditure also shows a strong growth over the past five years, exceeding the 2006 level in 2010 by 14 per cent. In 2009, however, training expenditure slightly decreased. A similar development can be observed for R&D expenditure which was 13 per cent higher in 2010 compared to 2006 but showed a small decrease in 2009. Expenditure on promotion and branding grew strongly in 2007 and 2008, followed by a sharp decline in 2009 (-7 per cent) and only a moderate increase in 2010. Capital expenditure on tangible assets shows a similar trend. The decline in expenditure in 2009 was even sharper (-17 per cent), though investment in fixed assets increased significantly in 2010 again (+9 per cent). Capital expenditure on IPRs in 2010 was only slightly above the 2006 level. A substantial decline in 2009 (-8 per cent) has been fully compensated in 2010. The same is true for other innovation expenditure which remained rather stable in 2007 and 2008 and strongly decreased in 2009 (-11 per cent), followed by a 7 per cent increase in 2010.

Figure 117: Total investment 2006 to 2010, by main spending category

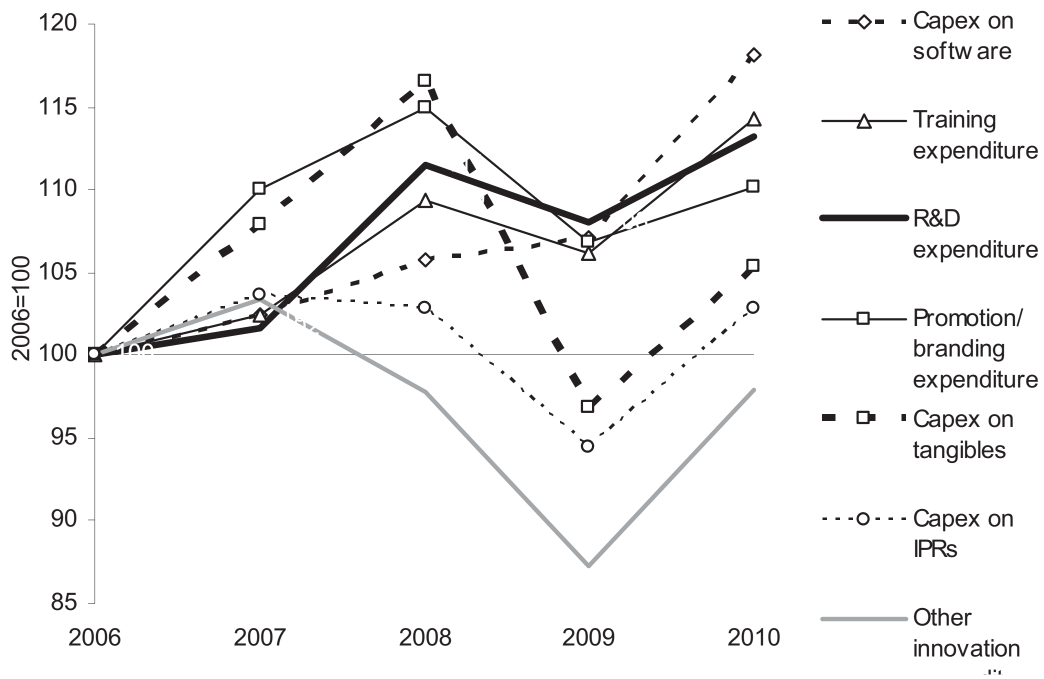


Note that other innovation expenditure and capex on IPRs are estimated for 2006, 2007, 2009 and 2010. R&D expenditure excludes capex for tangibles and software; capex on IPRs only for innovation, except for copyright for audiovisual media.

Source: ZEW calculation based on data sources given in Table 8.

The share of innovation expenditure in total investment did not change significantly over the past five years. It was 41.2 and 41.3 per cent in 2006 and 2008, respectively, and between 40.2 and 40.6 per cent in the three other years. One should bear in mind the consistency of the results partly reflects the assumptions made on a stable innovation share of promotion/branding and training expenditure as well as the share of IPR-related capital expenditure in total innovation-related capital expenditure. However, the main drivers of the share of innovation in total investment are R&D expenditure and capital expenditure for innovation, which are both known and not affected by any assumptions made.

Figure 118: Development of total investment 2006-2010, by main spending category



Note that other innovation expenditure and capex on IPRs are estimated for 2006, 2007, 2009 and 2010. R&D expenditure excludes capex for tangibles and software; capex on IPRs only for innovation, except for copyright for audiovisual media.

Source: ZEW calculation based on data sources given in Table 8.

When looking at the trends in total investment by spending category between 2006 and 2010, some significant changes across main sectors become evident (Table 11). In R&D-intensive manufacturing, total investment increased at an annual rate of 1.3 per cent which was mainly driven by promotion/branding expenditure (+3.8) R&D expenditure (+3.2) and training expenditure (+2.7) while capital expenditure on tangibles, software IPRs as well as other innovation expenditure declined over the four-year period. In other manufacturing, the increase in total investment of 1.5 per cent per year resulted from a somewhat faster expansion of training expenditure (+2.3 per cent) and capital expenditure on tangibles (+1.9 per cent) while R&D expenditure and other innovation expenditure slightly declined.

Knowledge-intensive services increased their total investment at an annual rate of 2.9 per cent. Particularly high rates of growth are reported for capital expenditure on software (+6.5), R&D expenditure (+5.5) and training expenditure (+3.6). Capital expenditure on tangibles and on IPRs show the lowest growth rates, though still positive ones. In other services, the increase in total investment of 3.1 per cent per year between 2006 and 2010 is driven by a rapid expansion of capital expenditure on software (+9.2 per cent) and substantial growth in expenditure for training (+5.4) and R&D (4.4) as well as capital expenditure on tangible assets (+3.9). Promotion and branding expenditure and other innovation expenditure decreased.

Table 11: Change in total investment by spending category 2006 to 2010, by main sector

Average annual rate of change (%)	*R&D-intensive manufacturing*	*Other manufacturing*	*Knowledge-intensive services*	*Other services*	***All sectors***
1a. Capex on tangibles	-2.0	1.9	0.9	3.9	***1.3***
1b. Capex on software	-0.5	1.0	6.5	9.2	***4.3***
2. Promotion/branding expenditure	3.8	1.5	3.0	-1.2	***2.4***
3. Training expenditure	2.7	2.3	3.6	5.4	***3.4***
4. R&D expenditure[1)]	3.2	-0.3	5.5	4.4	***3.2***
5. Other innovation expenditure	-0.5	-0.7	3.0	-6.0	***-0.5***
6. Capex on IPRs[2)]	-1.4	0.4	1.2	0.4	***0.7***
Total investment	**1.3**	**1.5**	**2.9**	**3.1**	***2.0***

1) Excluding capex for tangibles and software; 2) only for innovation, except for copyright for audio-visual media.

Source: ZEW calculation based on data sources given in Table 8.

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16 Annex: Tables

16.1 Introduction of Innovations and Innovation Activities

Table 12. Product and process innovations 2004-2010

	Product or process - innovations			*Product innovations*			*Process innovations*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector									
10-12	51	52	39	48	39	34	31	33	18
13-15	57	58	54	47	47	48	32	31	24
16-17	44	50	49	35	39	43	26	29	21
20-21	74	84	81	68	75	77	42	55	35
22	56	63	61	49	42	52	36	44	29
23	47	54	47	36	34	43	34	37	21
24-25	38	50	44	28	33	28	24	34	30
26-27	81	79	79	75	72	72	43	41	39
28	74	78	70	63	61	66	51	48	34
29-30	69	74	71	65	62	66	34	46	36
31-33	57	52	51	52	40	43	25	26	25
5-9, 19, 35	35	36	37	19	17	28	29	29	22
36-39	35	34	26	23	21	17	22	24	16
46	38	36	32	34	24	25	18	22	17
49-53, 79	29	31	23	25	20	19	18	26	13
18, 58-60	53	50	53	34	34	43	39	36	30
61-63	72	78	77	65	67	68	43	48	39
64-66	47	58	46	34	41	35	35	40	32
71-72	55	56	49	41	47	41	36	37	26
69, 70.2, 73	34	37	33	24	20	22	24	28	21
74, 78, 80-82	28	31	28	19	22	18	24	23	19
R&D-int. mf.	76	78	74	68	66	69	46	46	36
Other mf.	47	51	45	39	35	36	29	33	24
Knowl.-int. s.	47	52	47	36	38	38	31	35	28
Other services	33	33	28	27	22	21	19	23	16
Size Class									
5-49	42	44	39	34	31	31	25	28	20
50-249	59	59	59	48	46	47	39	45	39
250-999	74	73	73	62	60	64	57	59	54
1,000+	88	89	89	81	81	81	79	81	80
Region									
Western G.	45	47	43	38	34	34	28	31	24
Eastern G.	41	45	39	31	32	32	26	30	21
Total	45	47	42	37	34	34	28	31	23

Share in all enterprises (%).

Table 13. Type of product and process innovations 2006-2008

	Product innovations		*Process innovations*		
	Goods	*Services*	*Methods for producing goods or services*	*Logistics, delivery or distribution methods*	*Supporting activities for processes*
Sector					
10-12	32	12	26	11	16
13-15	42	15	25	9	14
16-17	34	13	21	14	14
20-21	68	16	44	19	25
22	37	9	41	11	13
23	34	2	31	3	6
24-25	26	12	28	12	14
26-27	67	15	35	16	21
28	48	18	32	11	22
29-30	51	13	33	17	23
31-33	41	6	24	12	11
5-9, 19, 35	11	11	16	11	15
36-39	10	13	19	6	11
46	22	5	10	16	13
49-53, 79	2	20	14	17	14
18, 58-60	16	25	24	16	21
61-63	52	42	28	17	39
64-66	1	41	27	12	30
71-72	19	43	21	6	25
69, 70.2, 73	6	20	17	2	19
74, 78, 80-82	5	20	16	5	10
R&D-int. mf.	60	16	38	15	23
Other mf.	29	11	26	11	14
Knowl.-int. s.	16	31	21	7	24
Other services	11	13	13	14	13
Size Class					
5-49	20	17	19	9	15
50-249	35	21	32	20	27
250-999	41	28	43	24	32
1,000+	56	44	62	39	50
Region					
Western G.	23	18	21	12	18
Eastern G.	21	15	20	8	13
Total	22	18	21	11	17

Share in all enterprises (%).

Table 14. Product or process innovation activities and in-house R&D activities 2004-2010

	Product or process innovation activities			*Continuous in-house R&D activities*			*Occasional in-house R&D activities*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector									
10-12	58	62	54	5	6	9	12	13	9
13-15	61	71	68	14	18	21	18	27	12
16-17	49	58	63	7	12	11	13	17	11
20-21	85	89	86	53	58	62	18	20	11
22	61	68	73	19	19	24	24	20	20
23	50	59	67	18	19	21	10	14	19
24-25	48	62	63	12	13	13	15	16	14
26-27	86	84	87	46	49	48	24	20	19
28	82	85	84	31	31	38	30	26	18
29-30	71	78	77	20	32	39	28	21	13
31-33	67	66	63	11	12	13	18	16	12
5-9, 19, 35	40	44	53	5	10	7	12	6	8
36-39	44	47	42	4	6	4	11	18	8
46	47	45	53	2	3	2	7	4	8
49-53, 79	34	37	44	2	2	1	4	3	3
18, 58-60	61	63	62	5	10	9	17	15	13
61-63	76	86	83	36	42	39	16	21	17
64-66	57	64	59	13	10	8	5	12	6
71-72	61	74	63	24	29	29	15	14	10
69, 70.2, 73	40	44	48	3	3	5	4	5	8
74, 78, 80-82	38	37	40	3	3	2	3	4	6
R&D-int. mf.	83	84	85	37	40	44	26	23	17
Other mf.	56	62	60	9	11	12	15	16	12
Knowl.-int. s.	53	61	60	14	17	17	9	11	10
Other services	40	40	47	2	2	2	5	4	6
Size Class									
5-49	49	53	55	8	10	10	10	10	10
50-249	66	67	71	18	22	25	18	14	14
250-999	77	81	78	42	39	42	11	12	9
1,000+	90	92	93	62	66	65	6	8	6
Region									
Western G.	53	56	58	10	12	12	11	11	10
Eastern G.	46	54	54	12	14	14	10	11	10
Total	52	56	57	11	12	13	11	11	10

Share in all enterprises (%).

Table 15. Type of innovation activities of innovative enterprises 2006-2008

	Type of innovation activity						
	A	*B*	*C*	*D*	*E*	*F*	*G*
Sector	40	6	42	13	35	26	40
10-12	57	23	49	18	30	37	50
13-15	40	14	55	20	43	24	44
16-17	83	34	64	28	47	53	63
20-21	55	16	67	17	50	39	62
22	45	16	44	20	34	33	47
23	48	15	54	14	37	22	44
24-25	78	25	69	27	58	50	72
26-27	62	25	63	28	55	34	60
28	63	30	73	22	56	38	61
29-30	33	10	50	16	47	37	43
31-33	30	21	59	22	39	29	36
5-9, 19, 35	43	15	57	12	36	21	38
36-39	15	11	51	22	33	22	28
46	18	12	53	23	45	12	27
49-53, 79	39	21	65	23	49	24	45
18, 58-60	73	26	59	34	65	51	61
61-63	32	11	44	25	63	33	48
64-66	61	24	70	31	74	35	52
71-72	24	10	39	36	64	25	28
69, 70.2, 73	18	4	51	15	40	8	31
74, 78, 80-82	72	28	68	27	56	42	66
R&D-int. mf.	43	12	51	16	39	27	44
Other mf.	46	19	53	33	67	35	45
Knowl.-int. s.	17	10	51	21	38	15	28
Other services							
Size Class	36	13	51	22	45	24	39
5-49	54	23	67	27	60	39	55
50-249	62	35	68	32	71	55	68
250-999	81	63	86	71	87	81	84
1,000+							
Region	39	15	54	23	49	27	42
Western G.	42	15	53	22	44	29	43
Eastern G.	39	15	54	23	48	27	42
Total	40	6	42	13	35	26	40

Share in innovative enterprises (%).

A: In-house R&D
B: External R&D
C: Acquisition of machinery, equipment and software
D: Acquisition of external knowledge
E: Training for innovative activities
F: Market introduction of innovations
G: Other (e.g. feasibility studies, testing, routine software development, design, tooling up, industrial engineering, preparatory work)

16.2 Expenditure for Innovation

Table 16. Innovation expenditure 2006, 2008 and 2010

	Total innovation expenditure (billion €)			*Innovation expenditure as a percentage of sales*			*Share of capital expenditure in total innovation expenditure (%)*		
	2006	*2008*	*2010*	*2006*	*2008*	*2010*	*2006*	*2008*	*2010*
Sector									
10-12	2.5	2.5	2.1	1.6	1.4	1.1	54	46	39
13-15	0.6	0.8	0.7	2.1	2.9	2.8	35	32	22
16-17	1.3	1.0	0.9	2.3	1.6	1.5	63	62	52
20-21	11.7	12.6	12.9	7.5	6.5	6.3	19	19	18
22	1.8	1.9	1.7	2.8	2.8	2.4	40	43	42
23	1.0	1.3	1.0	2.7	3.1	2.6	42	44	37
24-25	5.4	6.1	4.5	2.7	2.5	2.2	39	63	45
26-27	15.4	14.3	13.6	8.3	7.6	7.0	27	28	22
28	11.2	13.7	11.8	5.8	6.0	6.0	27	30	23
29-30	28.2	34.0	33.7	7.4	8.6	8.8	27	31	25
31-33	2.0	2.7	2.8	2.8	3.4	3.4	35	44	35
5-9, 19, 35	2.7	3.0	3.2	0.7	0.7	0.6	76	64	70
36-39	0.7	0.6	0.4	1.4	1.2	0.8	61	56	64
46	3.2	2.3	2.8	0.4	0.3	0.3	56	55	60
49-53, 79	5.0	5.5	6.1	2.2	2.0	2.4	73	81	78
18, 58-60	2.0	2.6	2.0	2.6	3.1	2.3	42	36	37
61-63	8.9	10.4	10.5	6.6	6.9	7.2	40	37	39
64-66	5.8	5.1	5.4	0.8	0.5	0.6	37	30	31
71-72	2.4	3.9	3.4	7.3	9.0	7.2	29	24	21
69, 70.2, 73	0.9	1.0	1.0	1.4	1.5	1.5	49	40	38
74, 78, 80-82	0.7	0.7	0.8	1.0	0.9	0.9	43	54	50
R&D-int. mf.	66.5	74.6	72.0	7.3	7.4	7.4	25	28	23
Other mf.	18.9	20.5	17.7	1.7	1.7	1.4	49	54	46
Knowl.-int. s.	19.2	22.3	21.8	1.9	1.6	1.7	38	33	34
Other services	8.8	8.5	9.8	0.8	0.7	0.8	65	72	71
Size Class									
5-49	11.6	11.6	10.5	1.8	1.6	1.4	41	48	49
50-249	12.7	16.2	13.3	1.5	1.7	1.4	43	41	34
250-999	15.2	13.1	15.8	1.8	1.2	1.5	38	36	29
1,000+	73.9	85.0	81.6	4.2	4.2	4.2	32	33	30
Region									
Western G.	104.7	115.3	112.9	2.8	2.6	2.6	34	36	32
Eastern G.	8.7	10.6	8.4	3.5	2.6	2.1	45	39	36
Total	113.4	125.9	121.3	2.8	2.6	2.6	35	36	32

Table 17. Share of R&D in total innovation expenditure 2006, 2008 and 2010, innovation expenditure by type of expenditure category 2008

	Share of capital expenditure in total innovation expenditure (%)			*Share of expenditure category in total innovation expenditure in 2008 (%)*				
	2006	*2008*	*2010*	*in-house R&D*	*external R&D*	*a/o machinery/ software*	*a/o other external knowl.*	*other innov. exp.*
Sector								
10-12	32	26	40	23	3	40	2	32
13-15	46	28	44	25	3	27	3	41
16-17	23	24	28	22	2	57	3	15
20-21	64	68	69	56	12	15	1	16
22	41	35	42	32	3	36	2	27
23	37	34	48	28	6	27	10	29
24-25	50	26	43	23	4	56	2	16
26-27	58	62	65	52	9	20	2	16
28	58	56	61	50	7	25	1	18
29-30	60	59	61	45	14	27	2	12
31-33	47	39	47	34	5	36	3	22
5-9, 19, 35	12	21	22	16	6	59	2	17
36-39	22	12	14	8	4	51	2	33
46	12	12	13	10	2	44	9	35
49-53, 79	3	6	5	4	2	78	2	14
18, 58-60	14	12	17	9	3	24	11	53
61-63	40	47	43	43	4	27	5	22
64-66	34	33	34	30	3	19	9	39
71-72	70	63	72	55	8	15	3	18
69, 70.2, 73	20	31	27	27	4	24	9	36
74, 78, 80-82	20	12	11	9	3	43	7	37
R&D-int. mf.	60	61	63	49	12	23	2	14
Other mf.	36	27	38	24	4	47	3	23
Knowl.-int. s.	40	43	43	38	5	22	6	29
Other services	7	8	8	6	2	66	4	22
Size Class								
5-49	41	33	34	38	8	32	3	19
50-249	36	42	49	43	10	30	2	16
250-999	41	40	48	49	12	23	2	14
1,000+	53	53	54	26	4	42	3	24
Region								
Western G.	49	49	52	40	9	29	3	18
Eastern G.	39	43	47	38	5	31	3	23
Total	48	49	51	40	8	30	3	19

Table 18. Approximate share of innovation-related capital expenditure in total capital expenditure 2006, 2008 and 2010

share in %	*2006*	*2008*	*2010*
Sector			
10-12	27	22	15
13-15	27	32	25
16-17	31	20	23
20-21	33	32	31
22	27	27	29
23	24	26	21
24-25	30	40	28
26-27	58	56	51
28	48	45	41
29-30	75	74	74
31-33	35	46	40
5-9, 19, 35	17	13	15
36-39	4	3	3
46	27	14	24
49-53, 79	11	13	14
18, 58-60	12	14	10
61-63	25	26	31
64-66	30	18	19
71-72	22	21	16
69, 70.2, 73	9	8	11
74, 78, 80-82	11	11	12
R&D-intensive manufacturing	56	55	53
Other manufacturing	20	21	17
Knowledge-intensive services	21	19	21
Other services	14	13	15
Total	26	26	24

Table 19. Characteristics of innovation projects conducted during 2006-08 and 2008-10

	No. of innovation projects per innovative firm		*Innovation expenditure per project (thousand €)*		*Average length of innovation project (months)*		*Share of stopped projects (%)*	
	2006-2008	*2008-2010*	*2006-2008*	*2008-2010*	*2006-2008*	*2008-2010*	*2006-2008*	*2008-2010*
Sector								
10-12	4.0	5.2	181	162	11	19	13	19
13-15	5.5	7.3	209	168	12	17	11	13
16-17	4.5	4.3	281	219	11	20	24	18
20-21	17.6	17.4	938	1045	20	24	20	20
22	5.7	4.7	282	324	15	17	14	16
23	5.6	6.3	288	216	16	22	11	26
24-25	4.4	4.5	306	271	15	25	11	16
26-27	11.8	11.3	556	549	18	25	13	15
28	6.7	6.9	618	638	17	28	16	14
29-30	19.4	21.6	2640	2666	21	22	42	51
31-33	4.9	5.0	162	184	12	22	12	19
5-9, 19, 35	13.0	9.1	704	748	21	19	20	26
36-39	4.0	4.3	234	166	20	30	11	17
46	3.0	2.8	178	150	12	24	15	30
49-53, 79	2.8	3.4	503	479	14	28	11	31
18, 58-60	4.0	3.9	316	337	16	17	10	10
61-63	4.9	5.1	561	550	16	22	11	16
64-66	9.4	10.9	463	358	12	19	8	12
71-72	4.8	5.5	186	192	19	29	9	14
69, 70.2, 73	3.3	3.3	65	67	23	23	8	17
74, 78, 80-82	2.9	3.2	89	78	14	20	5	13
R&D-int. mf.	10.8	11.0	990	1038	18	25	20	22
Other mf.	4.7	5.0	263	243	14	21	13	18
Knowl.-int. s.	4.8	5.1	323	307	18	23	10	15
Other services	2.9	3.1	258	233	13	24	11	26
Size Class								
5-49	3.2	3.2	95	86	15	24	10	19
50-249	7.0	6.9	285	278	15	22	11	15
250-999	14.9	19.0	623	495	19	22	10	12
1,000+	117.9	120.3	1609	1645	19	21	27	29
Region								
Western G.	5.4	5.6	512	503	16	23	14	20
Eastern G.	3.8	3.9	307	286	16	23	9	15
Total	5.1	5.3	487	475	16	23	14	19

16.3 Indicators on Innovation Success

Table 20. Firms with successful product and process innovations 2004-2010

	Product innovations						*Process innovations*					
	Market novelties			*Product range novelties*			*Cost reduction*			*Quality improvement*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector												
10-12	17	12	10	28	20	17	11	19	12	19	26	13
13-15	24	30	19	30	21	26	19	16	14	21	21	14
16-17	11	13	9	19	20	12	13	13	10	18	25	17
20-21	31	41	45	44	54	47	24	34	21	29	42	19
22	23	26	29	29	29	29	24	25	21	27	28	17
23	14	18	22	14	19	23	19	14	13	24	30	10
24-25	11	12	10	14	18	11	12	20	16	20	23	16
26-27	40	37	38	48	42	43	29	28	20	32	31	28
28	36	28	32	34	33	32	26	26	16	35	34	26
29-30	27	26	34	39	27	33	18	33	26	28	34	23
31-33	20	18	16	31	22	16	11	14	11	20	17	16
5-9, 19, 35	4	3	12	10	9	16	15	13	14	12	11	11
36-39	5	4	3	8	9	5	12	12	6	12	15	9
46	8	8	9	8	11	13	10	7	10	9	15	11
49-53, 79	8	4	4	9	7	5	7	12	8	11	12	9
18, 58-60	7	15	16	22	22	24	16	14	12	24	27	17
61-63	25	30	29	44	40	39	15	16	15	36	41	32
64-66	11	11	14	19	24	17	19	22	17	28	26	20
71-72	15	20	18	20	28	21	14	17	10	23	30	22
69, 70.2, 73	6	7	7	8	8	10	9	13	8	16	24	14
74, 78, 80-82	3	6	3	8	14	5	8	11	7	12	17	14
R&D-int. mf.	36	32	36	40	38	37	26	28	19	33	34	26
Other mf.	14	14	13	22	19	16	14	17	13	21	23	15
Knowl.-int. s.	12	15	15	18	21	19	12	16	11	22	28	20
Other services	7	6	6	8	11	8	9	10	8	10	15	11
Size Class												
5-49	11	11	11	16	16	14	10	13	9	17	20	13
50-249	21	19	22	29	28	24	22	22	23	26	32	25
250-999	30	30	31	38	39	38	38	38	38	40	41	37
1,000+	56	56	55	60	61	58	66	69	69	60	64	66
Region												
Western G.	13	13	13	18	18	16	13	16	12	18	22	16
Eastern G.	13	11	12	16	19	16	13	14	10	20	22	15
Total	13	13	13	18	18	16	13	15	11	19	22	16

Share in all enterprises (%).

Table 21. Share of sales with product innovations 2006, 2008 and 2010

	All product innovations			*Market novelties*			*Product range novelties*		
	2006	*2008*	*2010*	*2006*	*2008*	*2010*	*2006*	*2008*	*2010*
Sector									
10-12	8.8	12.7	8.4	1.5	1.7	1.2	2.3	2.9	2.1
13-15	22.7	26.9	19.2	7.3	5.0	6.5	2.6	5.2	7.0
16-17	8.8	10.4	9.1	2.2	1.5	2.2	3.1	3.6	1.6
20-21	16.4	19.6	15.1	4.2	5.2	3.2	3.8	3.0	2.7
22	15.7	14.3	16.1	4.4	3.9	3.6	5.1	3.4	3.9
23	13.3	14.8	17.4	2.9	5.5	6.6	2.3	3.8	5.1
24-25	10.5	12.5	12.4	2.9	1.6	2.3	2.2	1.8	2.2
26-27	45.0	38.3	37.5	9.5	9.8	9.8	6.8	6.0	6.3
28	29.5	29.4	28.3	7.2	5.5	7.9	5.3	4.0	4.8
29-30	57.7	51.0	49.0	12.9	9.6	12.8	7.7	7.3	8.4
31-33	23.1	18.1	20.2	4.3	3.0	4.8	4.2	3.2	3.5
5-9, 19, 35	6.4	6.0	8.8	0.3	0.7	1.6	0.6	0.5	2.0
36-39	3.4	4.8	4.3	0.6	0.3	0.6	1.8	1.1	0.5
46	9.0	6.6	6.1	1.1	1.1	1.2	1.2	2.3	1.0
49-53, 79	6.4	7.1	8.6	1.5	1.0	1.4	1.7	1.5	1.7
18, 58-60	13.0	12.2	10.9	3.7	1.9	2.5	3.9	2.4	4.0
61-63	25.7	29.2	23.8	5.0	5.2	5.8	5.0	6.7	4.7
64-66	13.4	11.0	9.6	1.3	1.9	2.2	3.6	3.7	1.9
71-72	14.4	12.7	14.4	5.8	4.4	4.5	5.5	4.9	4.3
69, 70.2, 73	10.2	8.0	9.8	2.2	1.4	2.7	2.6	1.9	2.1
74, 78, 80-82	7.2	6.3	6.9	1.1	1.6	1.5	3.4	2.0	1.4
R&D-int. mf.	42.1	37.7	35.5	9.5	7.9	9.2	6.4	5.5	6.1
Other mf.	10.0	10.6	10.8	2.0	1.7	2.2	2.0	1.9	2.4
Knowl.-int. s.	14.9	13.0	11.6	2.1	2.3	2.8	3.8	3.9	2.5
Other services	8.3	6.7	6.6	1.2	1.1	1.3	1.5	2.1	1.2
Size Class									
5-49	9.4	7.4	8.7	1.4	1.5	2.4	1.5	1.7	1.9
50-249	13.0	11.4	10.0	2.2	1.6	2.1	3.4	3.0	1.5
250-999	10.2	10.0	10.1	2.3	2.4	2.8	2.6	2.9	2.7
1,000+	27.3	24.4	22.7	5.5	4.6	5.2	4.3	4.2	4.1
Region									
Western G.	18.3	16.3	15.5	3.6	3.1	3.7	3.3	3.3	3.0
Eastern G.	14.3	12.0	10.1	2.6	2.3	2.1	3.6	3.1	2.0
Total	18.0	15.9	15.1	3.5	3.0	3.6	3.3	3.3	2.9

Share of sales with product innovations introduced in the preceding three year period in total sales (%).

Table 22. Firms with successful product and process innovations 2004-2010

	Share of unit cost reduction due to process innovation (%)			*Growth in sales due to quality - improvement based on process - innovations (%)*		
	2006	*2008*	*2010*	*2006*	*2008*	*2010*
Sector						
10-12	2.8	3.9	4.0	2.5	2.3	1.3
13-15	3.1	1.9	2.8	3.6	1.2	1.0
16-17	1.9	2.1	2.2	3.1	2.9	2.3
20-21	5.3	3.8	3.6	4.3	2.3	2.7
22	4.0	3.5	2.7	3.7	1.3	1.7
23	4.8	3.3	3.1	2.4	1.6	2.2
24-25	4.4	3.4	3.6	3.6	2.2	1.7
26-27	8.0	5.6	5.3	4.1	3.7	3.5
28	4.6	3.5	4.4	3.5	3.4	2.8
29-30	5.2	7.0	6.1	5.1	5.3	3.1
31-33	3.8	2.5	2.7	3.1	2.0	2.9
5-9, 19, 35	3.4	3.1	3.4	2.0	1.6	1.3
36-39	2.2	3.4	3.6	1.7	2.4	1.1
46	1.0	2.1	1.9	0.8	1.7	0.6
49-53, 79	2.5	2.4	2.9	2.1	2.0	1.8
18, 58-60	3.0	2.9	1.7	2.1	1.6	1.3
61-63	4.2	6.3	7.4	4.4	4.0	2.6
64-66	6.5	5.4	4.8	2.3	2.0	1.0
71-72	2.0	2.7	2.6	3.8	3.8	3.6
69, 70.2, 73	3.1	1.6	1.7	2.3	3.3	3.2
74, 78, 80-82	1.5	1.5	1.4	1.4	2.0	1.8
R&D-int. mf.	5.6	5.3	5.1	4.4	4.0	3.0
Other mf.	3.5	3.3	3.4	2.7	2.0	1.5
Knowl.-int. s.	5.6	5.1	4.7	2.6	2.3	1.4
Other services	1.4	2.1	2.0	1.2	1.8	0.9
Size Class						
5-49	1.0	2.0	1.1	1.5	2.1	0.9
50-249	2.3	2.0	2.6	1.5	2.0	1.0
250-999	3.9	3.8	3.2	2.2	1.6	1.2
1,000+	5.7	5.4	5.3	3.9	3.2	2.5
Region						
Western G.	4.0	4.0	3.9	2.7	2.5	1.7
Eastern G.	3.4	2.8	2.2	2.2	2.2	1.8
Total	4.0	3.9	3.7	2.7	2.4	1.7

16.4 Financing of Innovation

Table 23. Sources for financing general investment 2004-2006

	Sources for financing general investment in all enterprises								
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Sector									
10-12	63	13	13	2	44	43	13	6	1
13-15	72	3	8	0	26	20	8	5	2
16-17	69	5	7	3	37	55	27	9	3
20-21	92	6	19	0	22	23	13	11	1
22	84	4	16	0	24	27	12	10	1
23	67	15	16	1	19	30	15	4	2
24-25	71	6	14	0	32	42	12	11	3
26-27	93	6	19	0	33	20	7	8	1
28	85	4	16	0	19	21	12	11	2
29-30	73	15	19	1	18	19	7	9	2
31-33	67	19	17	0	33	39	15	8	1
5-9, 19, 35	80	3	9	2	22	45	12	6	2
36-39	85	2	12	0	23	45	15	13	1
46	68	4	26	0	37	30	4	2	1
49-53, 79	62	10	8	0	26	49	9	5	0
18, 58-60	73	8	11	0	29	43	15	12	2
61-63	89	18	22	0	25	6	2	8	1
64-66	94	11	4	0	7	2	0	0	0
71-72	82	6	13	0	32	19	6	9	2
69, 70.2, 73	69	7	10	0	21	32	3	1	0
74, 78, 80-82	64	3	12	0	30	19	5	2	7
R&D-int. mf.	86	7	17	0	23	22	11	11	1
Other mf.	71	9	14	1	33	41	14	9	2
Knowl.-int. s.	78	9	13	0	23	21	4	4	1
Other services	65	6	16	0	32	34	6	3	2
Size Class									
5-49	70	8	15	0	30	32	8	5	1
50-249	85	7	15	0	26	33	11	12	3
250-999	89	8	12	1	17	21	10	10	1
1,000+	90	4	7	2	12	14	10	13	2
Region									
Western G.	72	8	15	0	29	31	8	4	2
Eastern G.	74	8	15	0	27	34	11	16	1
Total	72	8	15	0	29	32	8	6	2

Share in all enterprises (%).

A: Cash flow
B: New equity
C: Shareholder loan
D: Bonds
E: Overdraft facility
F: Targeted loan
G: Public loan
H: Public subsidy
I: Other

Table 24. Sources for financing general investment by innovative enterprises 2004-2006

	Sources for financing general investment in innovative enterprises								
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Sector									
10-12	68	15	15	2	38	31	11	5	1
13-15	72	4	8	0	22	17	9	5	0
16-17	70	6	7	3	40	41	9	10	5
20-21	95	4	18	0	24	22	14	12	1
22	90	6	16	1	25	27	10	11	2
23	70	20	20	2	16	27	18	5	4
24-25	77	4	15	0	30	38	12	10	4
26-27	94	7	21	0	32	21	6	9	1
28	89	5	16	0	17	19	10	9	1
29-30	82	18	22	1	22	21	5	7	2
31-33	78	20	20	0	30	31	12	6	0
5-9, 19, 35	79	4	12	1	19	45	11	7	5
36-39	87	4	12	0	25	46	19	15	1
46	71	2	28	0	37	29	4	2	1
49-53, 79	54	3	7	0	36	52	10	3	1
18, 58-60	83	10	13	0	26	42	17	14	3
61-63	87	14	25	0	28	6	2	8	1
64-66	98	12	3	0	6	1	0	0	0
71-72	80	8	15	0	35	17	8	10	2
69, 70.2, 73	67	12	13	0	12	30	7	1	0
74, 78, 80-82	55	3	9	0	32	25	7	2	0
R&D-int. mf.	89	7	17	0	23	22	10	10	1
Other mf.	77	10	16	1	30	34	12	9	2
Knowl.-int. s.	80	11	15	0	21	17	5	5	1
Other services	63	2	18	0	35	34	6	2	1
Size Class									
5-49	73	8	17	0	29	28	8	5	1
50-249	87	7	16	0	25	28	11	10	3
250-999	90	7	12	1	16	20	10	10	1
1,000+	91	4	7	2	12	14	10	13	2
Region									
Western G.	75	8	17	0	29	28	8	4	1
Eastern G.	81	8	15	0	24	29	13	21	1
Total	76	8	16	0	28	28	9	6	1

Share in innovative enterprises (%).

A: Cash flow
B: New equity
C: Shareholder loan
D: Bonds
E: Overdraft facility
F: Targeted loan
G: Public loan
H: Public subsidy
I: Other

Table 25. Sources for financing innovation activities 2004-2006

	Sources for financing innovation activities								
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Sector									
10-12	76	16	16	3	42	28	7	4	0
13-15	89	5	12	0	19	13	5	13	0
16-17	79	9	9	7	43	31	10	13	9
20-21	97	5	17	0	22	11	10	11	1
22	95	5	11	1	24	18	8	11	1
23	73	21	17	0	9	22	13	8	3
24-25	85	4	12	0	31	32	11	13	2
26-27	93	8	16	1	26	12	6	14	0
28	93	4	14	0	17	15	5	10	1
29-30	86	19	22	1	20	18	5	8	1
31-33	79	20	19	0	32	25	9	8	0
5-9, 19, 35	83	4	10	0	17	32	9	6	0
36-39	88	5	10	0	22	35	13	13	2
46	83	1	32	0	40	34	3	4	0
49-53, 79	61	4	5	0	43	46	14	5	1
18, 58-60	89	8	13	1	18	28	15	10	1
61-63	90	8	23	1	28	3	2	16	3
64-66	100	10	2	0	6	1	0	0	0
71-72	81	11	14	0	31	9	8	18	2
69, 70.2, 73	68	9	13	0	11	30	1	1	0
74, 78, 80-82	84	3	12	0	35	26	2	3	0
R&D-int. mf.	92	7	14	1	22	15	6	10	0
Other mf.	83	11	15	1	30	27	10	10	1
Knowl.-int. s.	82	9	14	0	20	14	3	9	1
Other services	77	2	20	0	40	36	6	4	0
Size Class									
5-49	80	8	17	1	31	26	6	7	1
50-249	92	5	14	0	22	20	8	11	1
250-999	95	7	9	1	16	11	10	12	1
1,000+	97	4	6	1	11	11	8	15	1
Region									
Western G.	82	7	16	1	29	25	6	6	1
Eastern G.	87	8	14	0	24	22	10	20	1
Total	82	8	16	1	29	24	7	8	1

Share in innovative enterprises (%).

A: Cash flow
B: New equity
C: Shareholder loan
D: Bonds
E: Overdraft facility
F: Targeted loan
G: Public loan
H: Public subsidy
I: Other

Table 26. Use of additional cash by enterprises in 2007

	Use of additional cash by all enterprises						*Use of additional cash by innovative enterprises*					
	A	*B*	*C*	*D*	*E*	*F*	*A*	*B*	*C*	*D*	*E*	*F*
Sector												
10-12	51	26	31	12	50	8	57	28	43	12	37	37
13-15	56	22	41	12	53	10	65	33	47	6.7	46	46
16-17	67	19	30	20	51	9	53	25	43	7.3	64	64
20-21	57	38	36	20	34	14	46	31	49	4.5	48	48
22	67	31	42	18	35	11	52	20	37	13	39	39
23	67	37	36	26	37	9	46	20	23	31	34	34
24-25	76	31	40	17	44	7	47	19	44	10	46	46
26-27	55	51	37	14	38	9	43	36	42	4.7	48	48
28	68	40	47	14	37	5	36	19	49	12	33	33
29-30	58	41	29	20	19	20	63	51	37	7.7	62	62
31-33	64	41	36	12	59	5	68	43	21	3.2	72	72
5-9, 19, 35	51	13	43	33	29	8	69	27	31	10	67	67
36-39	55	20	36	21	26	9	69	28	30	4.6	67	67
46	57	29	52	21	46	7	56	31	37	8.6	51	51
49-53, 79	57	13	48	16	40	5	67	23	26	13	72	72
18, 58-60	52	27	51	23	35	6	66	27	35	5.8	45	45
61-63	50	50	39	23	21	6	20	33	52	16	38	38
64-66	26	17	62	30	21	12	29	16	57	30	20	20
71-72	55	28	50	33	32	5	36	21	55	6.8	42	42
69, 70.2, 73	48	22	43	33	25	13	56	21	43	12	35	35
74, 78, 80-82	60	16	50	28	34	7	63	23	43	20	42	42
R&D-int. mf.	60	45	41	15	34	10	46	31	38	10	44	44
Other mf.	64	28	38	16	45	7	54	25	40	9.1	48	48
Knowl.-int. s.	47	28	46	31	26	10	42	24	49	13	37	37
Other services	57	20	50	21	41	7	61	27	35	13	54	54
Size Class												
5-49	57	26	44	21	39	8	53	25	41	11	46	46
50-249	60	33	48	21	34	9	54	28	34	14	48	48
250-999	55	38	44	27	31	12	50	30	41	18	35	35
1,000+	53	38	43	32	22	14	64	49	50	34	34	34
Region												
Western G.	55	28	44	23	37	8	53	27	40	11	46	46
Eastern G.	67	24	44	12	42	7	52	20	41	12	46	46
Total	57	27	44	22	38	8	53	26	40	11	46	46

Share in all enterprises and innovative enterprises, respectively (%).

A: General investment
B: Innovation
C: Retain earnings
D: Disbursement
E: Clear debt
F: Indecisive

Table 27. Use of additional low-price credit instead of additional cash for financing general investment of innovation by enterprises in 2007

	Use of additional low-price credit, all enterprises[1)]				*Use of low-price credit by firms that use additional cash for innovation*[2)]			
	A	*B*	*C*	*D*	*A*	*B*	*C*	*D*
Sector								
10-12	57	28	43	12	44	37	46	10
13-15	65	33	47	7	63	46	31	5
16-17	53	25	43	7	83	64	12	1
20-21	46	31	49	5	49	48	36	5
22	52	20	37	13	60	39	26	14
23	46	20	23	31	44	34	15	35
24-25	47	19	44	10	50	46	43	7
26-27	43	36	42	5	40	48	38	5
28	36	19	49	12	32	33	42	17
29-30	63	51	37	8	62	62	28	6
31-33	68	43	21	3	59	72	18	4
5-9, 19, 35	69	27	31	10	79	67	17	4
36-39	69	28	30	5	65	67	19	5
46	56	31	37	9	60	51	29	3
49-53, 79	67	23	26	13	75	72	16	3
18, 58-60	66	27	35	6	47	45	38	8
61-63	20	33	52	16	19	38	44	12
64-66	29	16	57	30	14	20	42	35
71-72	36	21	55	7	34	42	46	7
69, 70.2, 73	56	21	43	12	43	35	39	16
74, 78, 80-82	63	23	43	20	46	42	33	20
R&D-int. mf.	46	31	38	10	41	44	35	12
Other mf.	54	25	40	9	52	48	35	8
Knowl.-int. s.	42	24	49	13	33	37	42	14
Other services	61	27	35	13	61	54	27	6
Size Class								
5-49	53	25	41	11	47	46	36	9
50-249	54	28	34	14	51	48	29	13
250-999	50	30	41	18	44	35	37	16
1,000+	64	49	50	34	39	34	38	21
Region								
Western G.	53	27	40	11	47	46	35	9
Eastern G.	52	20	41	12	52	46	32	13
Total	53	26	40	11	47	46	35	10

1) share in all enterprises that would use additional cash for general investment and/or innovation (%)
2) share in all enterprises that would use additional cash for innovation (%)

A: General investment very likely
B: Innovation very likely
C: Neither investment nor innovation likely
D: Indecisive

Table 28. Reason for refraining from loan financing for general investment and for innovation in 2007

	Reasons for refraining from loan financing for general investment					*Reasons for refraining from loan financing for innovation*				
	A	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*
Sector										
10-12	62	63	3	27	0	45	60	3	23	1
13-15	65	60	3	16	4	70	51	3	17	7
16-17	69	72	1	32	1	45	72	7	25	0
20-21	56	49	5	28	6	62	42	9	34	8
22	60	62	8	32	2	48	55	5	31	6
23	55	62	10	33	4	35	41	33	23	2
24-25	62	62	14	23	1	58	64	25	34	2
26-27	63	72	6	26	3	61	52	10	40	8
28	54	62	4	25	1	50	57	24	34	3
29-30	57	54	3	29	4	63	48	6	30	5
31-33	72	55	11	26	0	64	52	17	48	0
5-9, 19, 35	45	71	4	14	2	43	56	1	12	0
36-39	40	70	1	19	2	35	64	7	23	0
46	52	62	11	41	0	49	43	14	28	0
49-53, 79	54	65	4	28	1	42	48	7	28	5
18, 58-60	65	65	1	30	0	64	59	5	28	1
61-63	64	61	2	40	4	58	54	2	46	3
64-66	47	55	14	17	5	42	51	22	10	8
71-72	54	67	9	40	0	57	65	23	52	1
69, 70.2, 73	51	60	3	38	1	36	46	11	35	1
74, 78, 80-82	59	44	6	34	9	42	50	19	42	13
R&D-int. mf.	62	62	5	24	3	59	50	19	38	5
Other mf.	61	63	7	26	1	51	59	13	29	2
Knowl.-int. s.	54	61	5	37	2	49	53	11	39	2
Other services	55	58	7	35	3	45	46	14	32	5
Size Class										
5-49	57	60	6	33	2	49	51	13	37	3
50-249	58	68	6	23	3	55	63	13	22	4
250-999	54	60	9	17	7	44	56	13	16	8
1,000+	48	59	11	15	7	41	48	20	15	7
Region										
Western G.	58	60	6	31	2	50	52	14	34	3
Eastern G.	55	66	6	34	3	47	58	12	31	3
Total	57	61	6	31	2	50	52	13	34	3

Share in all enterprises that would use additional cash for general investment or innovation, repsectively (%)

A: Interest rates too high
B: Obedience
C: Concern about collaterals
D: Disclosure of internal information
E: Other

Table 29. Public funding for product and process innovation activities 2004-2010 (part I)

	Public funding total			*Funding by state governments*			*Funding by federal government*			*Funding by EU Commission*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector												
10-12	3	11	20	3	4	13	2	7	12	2	2	2
13-15	11	19	34	3	7	7	8	11	25	1	3	4
16-17	2	14	11	1	7	3	1	7	7	1	1	2
20-21	25	30	35	13	15	13	18	18	28	7	6	10
22	20	15	20	6	9	5	13	5	16	1	4	1
23	18	23	24	11	14	10	7	11	14	2	4	8
24-25	16	17	19	9	9	8	8	5	12	3	3	3
26-27	31	28	37	11	9	15	21	15	28	6	6	7
28	15	23	35	6	10	13	10	12	28	2	3	6
29-30	15	24	29	7	10	12	9	11	20	7	8	5
31-33	10	8	12	4	5	6	5	2	9	0	1	1
5-9, 19, 35	9	15	13	2	8	3	3	6	10	5	4	4
36-39	13	18	12	7	5	5	4	9	8	3	1	1
46	7	15	8	4	6	4	3	0	2	1	3	0
49-53, 79	4	24	22	3	3	4	1	18	12	0	1	1
18, 58-60	12	13	5	4	7	4	3	2	1	2	0	0
61-63	18	23	26	9	9	7	10	12	16	5	6	7
64-66	0	12	3	0	5	0	0	0	1	0	7	2
71-72	27	25	32	9	12	14	23	16	24	7	6	11
69, 70.2, 73	4	8	11	4	3	6	0	4	6	3	2	2
74, 78, 80-82	8	5	6	6	2	2	2	2	3	2	2	2
R&D-int. mf.	23	25	37	9	10	15	15	14	29	5	5	7
Other mf.	11	15	18	5	7	8	5	6	11	2	2	2
Knowl.-int. s.	13	16	19	6	7	8	9	8	12	4	4	5
Other services	7	16	12	4	4	3	2	6	5	1	2	1
Size Class												
5-49	11	16	18	5	6	7	6	7	11	2	3	3
50-249	15	20	22	7	9	8	8	10	15	4	5	5
250-999	19	22	28	6	8	10	11	11	21	7	6	9
1,000+	44	46	49	13	19	20	29	29	35	23	20	22
Region												
Western G.	10	15	17	4	5	6	5	6	11	2	3	3
Eastern G.	23	28	29	15	17	15	15	14	19	5	5	5
Total	12	17	19	6	7	7	7	8	12	3	3	3

Share in innovative enterprises (%).

Table 30. Public funding for product and process innovation activities 2004-2010 (part II)

	Funding by BMWi			*Funding by BMBF*			*Funding by EU FP[1)]*		*Funding by other public bodies*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector											
10-12	0	4	4	0	0	4	1	1	0	0	1
13-15	7	6	19	6	4	9	2	3	0	4	4
16-17	0	6	3	1	1	1	1	1	0	0	0
20-21	8	7	14	11	9	15	5	8	1	4	2
22	11	2	13	1	1	4	2	1	3	0	2
23	3	6	8	4	4	8	3	8	3	2	3
24-25	4	3	9	2	1	4	1	2	0	2	2
26-27	10	8	18	12	8	14	5	5	1	5	1
28	6	8	19	5	5	10	3	5	0	1	1
29-30	4	8	12	5	4	9	6	5	1	2	0
31-33	0	1	7	4	2	2	0	0	2	0	0
5-9, 19, 35	2	4	7	2	3	2	4	3	3	1	0
36-39	2	5	4	1	1	3	0	1	1	2	1
46	3	0	0	1	0	1	3	0	2	5	1
49-53, 79	0	5	2	0	1	2	0	1	0	2	11
18, 58-60	1	0	1	1	0	1	0	0	6	5	2
61-63	4	7	8	8	5	10	4	5	0	0	2
64-66	0	0	0	0	0	1	7	1	0	0	0
71-72	7	8	15	14	8	12	5	10	4	2	2
69, 70.2, 73	0	1	4	0	2	2	1	1	0	3	0
74, 78, 80-82	0	2	2	1	1	1	2	0	0	0	0
R&D-int. mf	8	8	19	9	6	12	4	5	1	3	1
Other mf.	3	4	7	2	2	4	1	2	1	2	1
Knowl.-int. s	3	4	7	5	4	6	4	4	1	2	1
Other services	1	2	1	1	0	1	2	1	1	3	4
Size Class											
5-49	3	3	6	3	2	4	2	2	1	2	2
50-249	4	6	9	4	4	6	4	4	1	1	1
250-999	5	4	10	7	7	11	5	7	1	2	1
1,000+	10	14	13	24	23	27	15	20	0	4	1
Region											
Western G.	2	3	5	3	2	5	2	2	1	2	2
Eastern G.	9	9	14	5	4	6	3	3	0	2	1
Total	3	4	7	3	3	5	2	3	1	2	2

Share in innovative enterprises (%).

1) Framework Programme for Research and Technological Development, data for 2004-2006 not available.

16.5 Innovation Strategies

Table 31. Objectives of product and process innovation activities 2006-2008

	Objectives of product and process innovations												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	85	75	80	87	93	83	80	82	82	80	78	76	74
13-15	97	89	95	92	98	96	91	94	89	75	74	66	67
16-17	76	83	87	92	94	92	81	90	88	82	80	74	75
20-21	91	87	92	91	92	88	82	80	86	76	78	78	79
22	88	95	90	95	96	88	91	82	85	80	74	68	79
23	98	89	99	97	96	94	87	90	89	83	82	78	80
24-25	90	87	94	93	94	91	91	86	86	71	75	67	69
26-27	96	93	95	93	95	89	83	82	85	77	71	75	81
28	85	86	91	89	94	90	88	81	81	79	81	77	80
29-30	90	90	95	97	97	93	93	94	93	84	71	74	80
31-33	90	83	93	91	93	94	89	79	83	74	74	66	75
5-9, 19, 35	73	67	71	74	76	76	68	71	70	73	70	76	72
36-39	76	75	64	64	89	80	77	71	75	82	76	83	82
46	95	80	90	89	92	92	82	76	74	65	60	76	74
49-53, 79	79	75	71	73	97	92	75	68	78	83	77	69	69
18, 58-60	93	90	92	91	94	86	82	79	69	61	56	52	58
61-63	96	87	91	90	96	94	84	71	53	39	38	58	58
64-66	90	81	88	93	92	92	77	75	48	29	37	81	76
71-72	91	82	84	80	91	85	80	65	55	47	57	68	75
69, 70.2, 73	91	77	73	68	92	85	83	71	26	13	20	53	44
74, 78, 80-82	88	75	85	85	90	87	80	76	65	64	67	69	71
R&D-int. mf.	89	89	93	91	94	89	87	84	86	80	76	77	82
Other mf.	88	84	88	90	94	89	86	82	83	76	77	71	73
Knowl.-int. s.	92	82	83	81	93	88	81	70	45	32	37	60	59
Other services	88	77	83	83	93	91	79	74	73	70	67	72	72
Size Class													
5-49	89	81	85	84	93	88	82	75	67	60	61	67	68
50-249	91	88	89	91	96	93	89	87	82	72	73	77	80
250-999	93	93	89	94	96	92	87	88	82	72	72	80	80
1,000+	93	91	88	92	96	90	87	89	81	76	77	84	83
Region													
Western G.	89	83	86	85	94	90	83	76	70	63	63	69	70
Eastern G.	88	77	84	87	92	86	82	78	69	60	62	66	69
Total	89	82	86	86	93	89	83	77	70	62	63	69	70

Firms with innovation activities that pursued the corresponding objective, as a share in all firms with innovation activities (%).

A. Increase range of products
B. Replace outdated products or processes
C. Enter new markets
D. Increase market share in existing markets
E. Improve quality of products
F. Improve flexibility of production
G. Increase capacity of production
H. Reduce labour costs per unit of output
I. Reduce material/energy costs per unit of output
J. Reduce environmental impact
K. Improve health and safety
L. Comply with laws and regulations
M. Comply with standards

Table 32. Highly important objectives of product and process innovation activities 2006-2008

	Objectives of product and process innovations												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	44	33	29	34	68	44	33	29	34	24	36	29	31
13-15	57	49	44	50	50	44	18	31	26	16	14	9	15
16-17	42	35	46	37	47	35	16	20	22	25	25	25	31
20-21	62	34	53	52	50	22	22	14	23	27	26	31	29
22	45	40	36	36	53	43	28	30	28	9	15	11	25
23	78	37	68	47	58	30	23	23	29	25	20	13	12
24-25	43	38	51	40	60	41	35	34	29	21	24	15	24
26-27	63	38	44	52	58	28	19	21	23	15	16	21	28
28	47	30	44	41	55	42	34	25	24	21	30	23	26
29-30	45	39	38	55	64	35	29	31	36	20	17	26	24
31-33	52	26	37	40	51	31	32	25	23	15	26	19	22
5-9, 19, 35	35	28	29	24	32	33	19	20	17	12	19	37	29
36-39	33	33	29	21	37	22	19	18	26	28	25	34	24
46	58	29	53	38	46	30	24	30	12	4	17	27	29
49-53, 79	44	31	31	29	44	28	27	20	21	34	21	25	22
18, 58-60	62	45	46	42	59	43	30	19	24	14	12	18	17
61-63	70	38	49	43	55	34	17	15	7	5	6	11	14
64-66	50	16	35	43	59	33	14	20	7	2	2	37	27
71-72	59	32	41	34	49	38	23	17	14	13	21	18	27
69, 70.2, 73	58	26	21	18	70	39	36	9	3	0	5	20	19
74, 78, 80-82	58	30	51	36	61	52	22	23	15	29	35	39	38
R&D-int. mf.	53	34	45	46	56	34	27	24	27	20	24	24	28
Other mf.	47	36	41	37	57	40	30	27	28	20	26	21	24
Knowl.-int. s.	61	31	37	33	59	37	25	14	8	5	9	18	21
Other services	54	30	46	35	49	35	24	25	15	20	23	29	29
Size Class													
5-49	53	42	45	42	52	44	39	37	35	35	37	40	41
50-249	55	36	45	48	61	37	31	27	23	16	20	22	21
250-999	54	42	42	51	53	38	28	31	27	16	17	27	24
1,000+	53	47	44	55	60	32	22	33	30	26	28	35	31
Region													
Western G.	54	33	42	36	56	38	27	23	19	16	20	23	26
Eastern G.	53	29	41	38	53	34	24	21	18	14	18	20	22
Total	53	33	41	37	55	37	27	23	19	16	20	23	25

Firms with innovation activities that cited the corresponding objective as highly important, as a share in all firms with innovation activities (%).

A. Increase range of products
B. Replace outdated products or processes
C. Enter new markets
D. Increase market share in existing markets
E. Improve quality of products
F. Improve flexibility of production
G. Increase capacity of production
H. Reduce labour costs per unit of output
I. Reduce material/energy costs per unit of output
J. Reduce environmental impact
K. Improve health and safety
L. Comply with laws and regulations
M. Comply with standards

Table 33. Linking product and process innovations, and novelty of process innovations 2006-2008

	Process innovation by product innovators (as a share in all product innovators, %)				*Novelty of process innovations (as a share in all process innovators, %)*		
	A	*B*	*C*	*D*	*E*	*F*	*G*
Sector							
10-12	10	9	42	39	7	68	25
13-15	5	26	36	32	25	35	40
16-17	12	20	39	29	22	58	20
20-21	6	14	42	38	20	37	42
22	14	35	35	16	13	45	43
23	19	16	39	26	24	34	42
24-25	16	20	42	22	13	49	39
26-27	12	24	41	23	22	32	45
28	18	26	33	24	21	49	30
29-30	16	18	44	23	22	37	41
31-33	18	18	26	38	16	60	24
5-9, 19, 35	8	15	47	30	6	66	28
36-39	21	15	23	42	12	41	47
46	7	19	18	57	20	59	21
49-53, 79	18	13	49	20	12	54	34
18, 58-60	18	43	21	18	14	55	31
61-63	13	38	27	22	23	39	38
64-66	22	8	22	47	24	40	36
71-72	13	20	36	31	22	54	24
69, 70.2, 73	13	19	17	51	10	54	35
74, 78, 80-82	41	16	24	18	7	60	33
R&D-int. mf.	14	22	38	27	22	41	37
Other mf.	15	19	37	29	13	55	33
Knowl.-int. s.	14	26	26	33	18	49	34
Other services	18	16	29	36	14	57	29
Size Class							
5-49	15	20	32	33	14	54	32
50-249	14	28	33	26	23	46	31
250-999	14	23	40	23	19	45	36
1,000+	10	26	47	17	31	31	38
Region							
Western G.	14	21	32	32	16	51	33
Eastern G.	19	21	33	27	14	57	30
Total	15	21	32	31	16	52	32

Firms with innovation activities that cited the corresponding objective as highly important, as a share in all firms with innovation activities (%).

A: for all product innovations
B: for most product innovations
C: for some product innovations
D: all product innovations without process innovations
E: with process innovation new to the industry
F: without process innovation new to the industry
G: degree of novelty of process innovations not known

Table 34. Objectives of marketing innovations 2006-2008

	Objectives of marketing innovations					
	pursued			*highly important*		
	A	*B*	*C*	*A*	*B*	*C*
Sector						
10-12	92	64	16	16	15	10
13-15	91	82	21	21	22	18
16-17	89	62	21	21	19	11
20-21	92	75	36	36	21	12
22	93	71	25	25	23	4
23	91	83	29	29	20	8
24-25	90	73	30	30	24	14
26-27	93	81	26	26	24	11
28	93	73	22	22	25	10
29-30	93	80	30	30	26	13
31-33	91	75	21	21	17	6
5-9, 19, 35	79	55	24	24	19	15
36-39	73	52	8	8	6	6
46	90	69	27	27	15	11
49-53, 79	87	70	19	19	13	6
18, 58-60	92	75	19	19	17	9
61-63	92	70	29	29	33	13
64-66	95	61	26	26	9	1
71-72	97	75	20	20	18	9
69, 70.2, 73	83	49	19	19	17	6
74, 78, 80-82	76	65	13	13	13	10
R&D-int. mf.	93	78	27	27	25	12
Other mf.	90	69	21	21	18	10
Knowl.-int. s.	89	62	23	23	20	8
Other services	85	68	21	21	14	9
Size Class						
5-49	88	67	21	21	17	9
50-249	91	74	27	27	25	11
250-999	94	71	28	28	23	12
1,000+	91	70	30	30	17	13
Region						
Western G.	90	69	23	23	19	9
Eastern G.	84	63	16	23	21	12
Total	89	90	69	22	18	9

Firms with marketing innovations that pursued the corresponding objective, and that cited the corresponding objective as highly important, respectively, as a share in all firms with marketing innovations (%).

A: Increase of maintain market share
B: Introduce products to new customer groups
C: Introduce products to new geographic markets

Table 35. Objectives of organisational innovations 2006-2008

	Objectives of organisational innovations									
	pursued					*highly important*				
	A	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*
Sector										
10-12	81	85	96	89	84	27	11	35	19	19
13-15	84	94	94	89	91	29	13	26	15	25
16-17	74	63	73	84	66	30	11	24	7	28
20-21	92	88	91	83	90	25	28	37	18	24
22	90	81	97	84	91	23	17	40	13	16
23	95	81	91	78	85	23	13	28	10	17
24-25	86	79	93	89	91	39	19	43	18	29
26-27	94	91	97	87	92	31	15	30	9	31
28	88	74	94	78	92	32	17	31	16	31
29-30	94	91	95	94	97	36	18	40	15	29
31-33	90	70	87	81	87	18	6	25	14	22
5-9, 19, 35	79	54	68	73	85	21	13	22	9	32
36-39	75	55	83	71	89	21	10	27	12	26
46	87	56	88	70	90	36	7	22	9	30
49-53, 79	83	68	93	67	83	32	5	38	17	22
18, 58-60	87	82	95	87	94	31	14	30	12	23
61-63	97	95	97	59	95	26	31	44	6	30
64-66	89	71	91	69	88	26	10	36	24	32
71-72	80	85	89	63	87	24	25	38	7	30
69, 70.2, 73	77	66	98	62	87	18	14	44	11	31
74, 78, 80-82	94	83	98	77	88	40	11	50	18	33
R&D-int. mf.	90	86	94	84	92	30	20	31	14	29
Other mf.	85	76	91	84	86	29	13	33	14	24
Knowl.-int. s.	83	77	95	64	89	22	19	42	11	30
Other services	87	66	92	71	87	36	8	33	14	28
Size Class										
5-49	84	72	92	72	87	29	13	36	13	28
50-249	91	84	94	82	93	33	15	38	13	29
250-999	91	82	93	84	92	26	14	29	20	26
1,000+	91	90	94	86	95	27	19	26	15	25
Region										
Western G.	85	75	94	74	88	30	14	37	14	28
Eastern G.	21	17	21	18	21	24	11	31	10	26
Total	86	74	93	74	88	29	14	36	13	28

Firms with organisational innovations that pursued the corresponding objective, and that cited the corresponding objective as highly important, respectively, as a share in all firms with organisational innovations (%).

A: Reduce time to respond to customer or supplier needs
B: Improve ability to develop new products or processes
C: Improve quality of goods or services
D: Reduce costs per unit of output
E: Improve communication or information sharing within the enterprise or with others

Table 36. Geographical market of market novelties 2008-2010

	Geographical market to which market novelties refer to					
	share in firms with market novelties (%)			*share in product innovators (%)*		
	A	*B*	*C*	*A*	*B*	*C*
Sector						
10-12	99	17	2	29	5	1
13-15	75	74	47	34	34	22
16-17	66	71	66	14	15	14
20-21	72	63	70	43	38	42
22	82	69	44	48	40	26
23	78	49	55	40	25	29
24-25	77	47	47	32	19	19
26-27	70	57	76	37	30	41
28	65	57	68	33	28	34
29-30	64	62	47	34	33	25
31-33	75	76	64	26	26	22
5-9, 19, 35	90	41	25	39	18	11
36-39	80	56	37	18	12	8
46	79	41	30	29	15	11
49-53, 79	67	65	10	16	16	2
18, 58-60	92	36	35	37	15	14
61-63	86	40	42	37	17	18
64-66	100	0	0	40	0	0
71-72	53	63	43	24	29	20
69, 70.2, 73	92	29	29	29	9	9
74, 78, 80-82	91	38	13	21	9	3
R&D-int. mf.	66	59	71	35	31	38
Other mf.	82	52	42	31	20	16
Knowl.-int. s.	80	39	35	33	16	14
Other services	78	47	22	23	14	7
Size Class						
5-49	79	47	39	29	17	14
50-249	71	55	52	33	26	25
250-999	72	51	63	36	26	32
1,000+	87	55	62	59	37	42
Region						
Western G.	77	48	42	30	19	16
Eastern G.	80	50	45	31	20	18
Total	77	49	43	30	19	17

Note that firms could provide multiple answers to the three categories, German, European and world market. Responses to more than one category could either refer to one and the same product innovation (e.g. if a firm has introduced a new product that is a market novelty for the European market, this innovation would also qualify as a market novelty for the German market) or to different product innovation (e.g. if a firm has introduced two new products, one being a market novelty for the European market while the other is a market novelty only for the German market).

A: Novelty for the German Market
B: Novelty for the European Market
C: Novelty for the World Market

16.6 Innovation Networks

Table 37. Information sources for innovation activities 2006-2008

	Information source for innovation											
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*
Sector												
10-12	86	82	72	78	43	22	21	72	65	59	20	30
13-15	92	96	85	85	45	39	36	88	77	56	38	34
16-17	75	92	72	71	41	34	32	78	84	63	30	35
20-21	96	98	84	88	49	70	49	87	83	58	57	55
22	96	95	87	87	39	37	27	82	75	50	35	42
23	97	97	89	92	38	48	29	88	86	70	41	66
24-25	94	92	87	87	43	46	30	75	80	50	39	52
26-27	97	99	89	87	46	61	52	90	86	55	55	67
28	92	95	87	89	47	54	41	88	83	64	52	61
29-30	95	99	79	87	54	54	42	87	81	66	48	61
31-33	92	97	91	84	42	40	35	88	74	55	36	41
5-9, 19, 35	96	84	77	90	64	47	40	67	70	74	35	59
36-39	90	82	68	74	57	44	34	67	77	60	26	46
46	95	90	91	80	43	24	20	72	68	47	27	44
49-53, 79	83	82	78	74	56	31	37	65	85	54	15	25
18, 58-60	90	89	85	88	42	29	13	76	75	53	12	28
61-63	96	98	71	92	48	51	32	79	81	49	25	37
64-66	99	92	70	93	65	43	26	59	63	72	12	22
71-72	95	91	75	76	44	70	48	80	90	60	39	60
69, 70.2, 73	94	85	63	83	61	50	14	37	88	63	10	29
74, 78, 80-82	92	94	85	90	46	32	21	78	82	68	25	47
R&D-int. mf.	94	97	87	89	49	59	48	88	85	62	57	65
Other mf.	90	90	83	83	43	37	28	78	75	56	31	42
Knowl.-int. s.	95	91	70	84	53	54	29	64	84	58	22	38
Other services	90	89	85	81	48	28	25	71	76	54	23	39
Size Class												
5-49	91	90	79	82	46	39	27	72	79	55	26	41
50-249	96	96	84	90	53	57	40	83	80	63	41	52
250-999	98	94	85	91	63	71	51	81	87	74	55	64
1,000+	96	94	83	94	75	75	60	80	84	77	58	70
Region												
Western G.	92	91	80	84	48	40	28	73	78	56	28	42
Eastern G.	91	91	79	82	46	49	36	77	82	59	33	46
Total	92	91	80	84	48	43	30	74	79	57	30	43

Firms with innovation activities that used the corresponding information source for innovation projects, as a share in all firms with innovation activities (%).

A: Sources within enterprise or enterprise group
B: Customers or principal
C: Suppliers
D: Competitors or other enterprise in industry sector
E: Consulting firms, commercial R&D service providers
F: Universities, universities of applied science
G: Public research organisations
H: Conferences, fairs, exhibitions
I: Scientific journals, specialty publications
J: Associations and chambers
K: Patent specifications
L: Standardisation committees/documents

Table 38. Highly important information sources for innovation activities 2006-2008

	Information source for innovation											
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*
Sector												
10-12	44	40	14	15	9	2	1	18	6	5	0	2
13-15	62	49	17	13	0	6	1	18	8	4	1	1
16-17	42	34	12	11	2	8	6	30	3	4	1	11
20-21	66	57	15	11	3	6	2	12	12	5	8	2
22	46	50	16	10	1	3	2	22	5	1	3	5
23	47	53	21	17	3	5	2	16	14	2	5	2
24-25	57	40	18	17	4	5	1	18	6	1	3	5
26-27	57	61	16	19	2	7	4	18	13	3	5	10
28	50	54	17	13	4	5	2	13	8	4	4	8
29-30	52	54	18	24	3	6	1	18	10	3	2	5
31-33	49	44	16	24	3	4	4	23	11	11	1	4
5-9, 19, 35	39	20	15	18	14	8	4	8	6	9	0	5
36-39	44	26	13	10	6	8	0	6	7	11	1	4
46	49	38	25	9	3	0	0	12	3	0	0	1
49-53, 79	40	29	9	14	4	5	0	11	11	7	0	4
18, 58-60	45	40	15	18	3	1	0	13	14	3	0	2
61-63	55	56	14	17	6	9	2	7	9	2	0	4
64-66	68	42	13	29	21	4	1	5	5	17	0	2
71-72	61	42	13	14	3	14	7	10	22	9	4	13
69, 70.2, 73	43	29	11	9	22	4	3	5	19	8	0	2
74, 78, 80-82	40	31	10	4	3	4	1	20	4	2	0	1
R&D-int. mf.	55	57	16	16	3	5	3	15	10	4	5	8
Other mf.	48	41	16	16	4	5	1	18	8	4	2	4
Knowl.-int. s.	54	41	13	14	12	8	3	7	16	8	1	5
Other services	44	33	16	9	3	3	0	14	6	2	0	2
Size Class												
5-49	47	40	16	13	6	5	2	14	10	5	1	4
50-249	61	49	14	17	5	6	2	15	7	5	3	5
250-999	67	46	10	21	5	6	2	11	7	8	5	5
1,000+	67	51	19	20	7	11	6	11	9	6	6	3
Region												
Western G.	50	42	16	14	7	4	2	14	9	5	1	4
Eastern G.	48	38	13	14	3	8	3	14	13	5	2	4
Total	50	41	15	14	6	5	2	14	10	5	2	4

Firms with innovation activities for which the corresponding information source was highly important for their innovation projects, as a share in all firms with innovation activities (%).

A: Sources within enterprise or enterprise group
B: Customers or principal
C: Suppliers
D: Competitors or other enterprise in industry sector
E: Consulting firms, commercial R&D service providers
F: Universities, universities of applied science
G: Public research organisations
H: Conferences, fairs, exhibitions
I: Scientific journals, specialty publications
J: Associations and chambers
K: Patent specifications
L: Standardisation committees/documents

Table 39. Involvement in innovation cooperation 2006-2008 and 2008-10 by partner

	Cooperation partner															
	Total		*A*		*B*		*C*		*D*		*E*		*F*		*G*	
	06-08	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*
Sector																
10-12	5	11	2	3	2	3	2	3	2	0	1	2	3	7	1	1
13-15	18	34	5	10	7	14	8	18	4	4	7	15	8	16	5	17
16-17	14	11	6	4	3	5	5	7	1	1	2	4	9	5	2	0
20-21	45	40	17	16	22	22	12	14	8	6	10	14	28	27	12	22
22	20	36	7	9	12	13	10	19	1	3	5	7	8	15	4	5
23	17	32	5	9	6	13	2	13	5	4	4	8	12	18	5	7
24-25	16	16	5	3	10	10	7	7	4	0	4	4	6	8	2	4
26-27	29	43	12	12	17	20	8	17	6	5	7	10	16	25	8	11
28	28	33	8	7	19	17	11	14	5	2	6	11	18	21	8	10
29-30	25	32	12	16	13	13	12	12	7	5	5	12	14	26	7	12
31-33	12	16	7	7	4	7	5	11	3	2	4	6	5	10	3	2
5-9, 19, 35	19	18	14	9	8	6	10	8	8	8	4	7	14	15	6	6
36-39	16	16	4	4	4	3	6	6	3	0	4	7	11	10	3	5
46	7	7	3	2	5	1	4	4	3	0	4	4	2	2	2	1
49-53, 79	4	9	3	2	3	3	1	4	2	4	1	4	1	3	0	2
18, 58-60	11	10	6	5	4	3	5	7	8	3	4	4	2	2	1	0
61-63	30	25	8	4	18	12	9	8	8	9	9	5	18	19	3	6
64-66	24	10	17	5	9	0	8	3	3	2	14	6	8	3	1	1
71-72	38	34	8	8	19	18	8	12	9	9	8	8	26	26	11	12
69, 70.2, 73	26	11	3	4	10	5	2	4	17	4	13	6	9	7	5	3
74, 78, 80-82	12	12	5	3	2	6	5	7	2	5	4	6	3	3	1	4
R&D-int. mf.	31	38	12	10	19	19	11	15	6	4	7	12	19	25	9	12
Other mf.	13	18	5	5	6	8	6	9	3	2	4	5	7	10	2	4
Knowl.-int. s.	29	20	7	5	14	9	6	7	11	6	10	6	15	14	5	6
Other services	7	9	3	2	4	3	3	5	2	3	3	4	2	3	1	2
Size Class																
5-49	17	15	4	3	9	7	5	6	5	3	6	4	8	8	3	4
50-249	24	28	9	9	11	12	8	12	5	5	5	11	12	17	5	7
250-999	39	47	22	25	19	22	16	22	7	11	10	19	25	32	9	15
1,000+	55	64	47	49	39	37	37	44	20	23	24	35	46	51	32	33
Region																
Western G.	17	16	5	4	9	7	5	7	5	3	5	5	8	9	3	4
Eastern G.	24	26	6	6	10	10	7	9	7	4	7	8	15	17	7	9
Total	19	18	6	5	9	8	6	8	6	3	6	6	9	11	4	5

Share in innovative enterprises (%).

1 A: Other enterprises within own enterprise group
B: Customers
C: Suppliers
D: Competitors or other enterprises from the same industry
E: Consulting firms, commercial R&D service providers
F: Universities, universities of applied science
G: Public research organisations

Table 40. Most valuable cooperation partner 2006-2008 and 2008-2010

	Cooperation partner													
	A		*B*		*C*		*D*		*E*		*F*		*G*	
	06-08	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*	*06-08*	*08-10*
Sector														
10-12	24	16	12	9	9	11	15	0	7	18	31	45	0	0
13-15	4	15	36	8	25	22	6	0	2	11	12	21	16	23
16-17	42	6	14	23	23	40	2	3	7	5	11	22	0	0
20-21	20	11	15	20	9	8	7	0	8	10	36	31	5	19
22	22	15	33	13	16	41	0	5	7	3	16	20	5	3
23	14	15	11	14	0	11	23	3	11	21	31	27	10	9
24-25	20	6	21	32	18	11	7	1	11	13	22	24	1	13
26-27	21	11	22	18	10	18	10	1	9	13	20	30	8	10
28	9	10	29	23	9	21	7	1	7	5	33	31	5	10
29-30	18	13	30	13	6	7	11	1	5	12	27	49	2	4
31-33	35	16	15	17	9	30	12	6	4	10	21	20	3	0
5-9, 19, 35	34	11	9	4	14	13	7	11	0	2	36	59	0	0
36-39	10	5	1	9	26	22	8	0	6	18	49	37	0	9
46	8	20	38	2	24	10	6	0	5	57	16	10	2	0
49-53, 79	36	17	19	1	18	20	17	16	0	23	7	7	2	16
18, 58-60	39	39	6	0	7	23	17	25	31	12	0	1	0	0
61-63	10	5	34	18	15	15	7	17	13	3	19	36	2	7
64-66	56	35	8	0	2	16	13	9	20	31	1	9	0	0
71-72	9	8	22	27	3	5	12	5	8	6	45	46	1	4
69, 70.2, 73	14	9	7	21	2	13	11	22	50	6	13	17	2	13
74, 78, 80-82	31	3	0	24	32	24	9	5	16	24	11	5	0	14
R&D-int. mf.	16	11	24	20	10	17	9	1	7	10	28	32	6	8
Other mf.	20	12	19	17	14	21	9	3	10	11	24	26	3	9
Knowl.-int. s.	16	9	20	21	6	10	11	13	22	6	25	34	1	6
Other services	22	14	20	9	27	18	9	7	8	36	13	7	1	10
Size Class														
5-49	16	9	22	21	9	16	11	7	18	11	23	28	2	9
50-249	17	14	17	12	16	19	8	4	7	18	31	27	4	5
250-999	29	20	19	12	14	16	6	3	5	13	22	29	5	7
1,000+	40	24	17	14	11	19	5	4	3	11	19	25	5	4
Region														
Western G.	17	11	21	19	11	18	10	7	17	13	22	25	2	7
Eastern G.	15	11	18	15	10	12	10	4	10	12	32	35	4	11
Total	17	11	20	18	11	17	10	6	15	13	24	28	3	8

Share in enterprises with innovation cooperation (%).

A: Other enterprises within own enterprise group
B: Customers
C: Suppliers
D: Competitors or other enterprises from the same industry
E: Consulting firms, commercial R&D service providers
F: Universities, universities of applied science
G: Public research organisations

Table 41. Involvement in innovation cooperation 2006-2008 and 2008-2010, by location of cooperation partner

	Location of cooperation partner									
	2006-2008					*2008-2010*				
	A	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*
Sector										
10-12	93	37	10	0	6	94	31	11	0	0
13-15	91	11	8	0	0	91	32	7	9	4
16-17	98	54	6	0	4	96	43	8	1	18
20-21	95	42	18	10	10	97	54	23	14	12
22	92	35	10	5	2	93	26	2	0	1
23	93	41	8	1	14	100	22	6	6	3
24-25	99	14	3	1	6	99	24	4	3	1
26-27	94	35	17	14	15	96	31	11	9	8
28	97	38	11	10	4	91	39	10	4	8
29-30	100	41	21	17	13	100	32	11	15	10
31-33	79	31	19	32	3	96	38	10	9	14
5-9, 19, 35	88	66	11	1	1	100	51	12	0	0
36-39	83	24	0	1	1	100	3	0	0	0
46	100	64	6	3	15	100	36	0	0	0
49-53, 79	90	59	4	2	6	92	45	6	14	18
18, 58-60	100	11	0	0	0	90	56	17	20	19
61-63	94	40	12	1	7	99	27	5	4	3
64-66	100	23	6	3	4	100	16	2	0	9
71-72	99	29	4	4	7	100	46	10	5	2
69, 70.2, 73	100	22	2	1	0	89	47	0	1	0
74, 78, 80-82	100	4	0	8	0	99	11	6	6	16
R&D-int. mf.	96	36	16	13	9	93	37	13	8	8
Other mf.	94	29	7	5	4	96	30	7	4	5
Knowl.-int. s.	98	29	5	2	5	97	38	6	3	2
Other services	98	39	3	5	7	97	31	4	6	11
Size Class										
5-49	97	26	4	4	3	97	29	4	4	4
50-249	96	41	11	5	9	93	39	10	4	7
250-999	94	53	18	11	10	97	51	20	8	13
1,000+	99	80	54	44	39	99	74	40	33	24
Region										
Western G.	96	32	7	5	6	95	37	7	5	6
Eastern G.	99	25	6	3	4	99	21	4	4	3
Total	97	32	8	5	6	96	35	8	5	6

Share in enterprises with innovation cooperation (%).
A: Germany
B: Other Europe
C: United States
D: China, India
E: All other countries

Table 42. Developer of product innovations 2004-06, 2006-08, 2008-10

	Developer of product innovations									
	2004-2006[1)]			*2006-2008*[1)]			*2008-2010*[2)]			
	A	*B*	*C*	*A*	*B*	*C*	*A**	*B**	*C**	*D**
Sector										
10-12	52	36	12	71	28	0	68	33	3	13
13-15	69	24	7	84	11	5	55	56	3	8
16-17	41	48	11	60	16	24	43	54	2	13
20-21	76	23	1	83	14	3	77	44	6	13
22	50	42	8	51	39	10	53	56	9	6
23	70	30	0	92	8	0	66	39	5	8
24-25	50	41	9	56	33	11	62	36	4	8
26-27	74	20	6	80	16	4	70	45	4	9
28	71	25	3	70	21	10	63	44	4	9
29-30	84	14	2	70	19	11	71	45	2	6
31-33	53	25	21	61	17	22	50	40	18	10
5-9, 19, 35	65	33	2	63	25	13	67	31	9	6
36-39	54	25	20	73	22	4	43	39	12	24
46	29	39	32	47	17	36	31	35	28	15
49-53, 79	51	37	13	55	35	10	54	29	5	17
18, 58-60	45	40	15	49	33	18	39	40	18	16
61-63	72	18	10	80	12	8	73	37	6	20
64-66	52	36	12	53	31	15	41	48	17	10
71-72	51	38	11	56	39	6	46	48	1	24
69, 70.2, 73	55	25	19	57	39	4	37	59	7	11
74, 78, 80-82	31	32	36	48	42	9	59	47	3	14
R&D-int. mf.	73	24	3	76	18	6	70	44	4	7
Other mf.	54	35	12	63	26	11	56	40	8	12
Knowl.-int. s.	60	27	13	63	30	7	52	47	7	17
Other services	36	37	27	50	29	21	44	36	15	15
Size Class										
5-49	51	33	16	58	28	14	52	41	9	15
50-249	61	29	10	76	20	4	65	45	7	8
250-999	75	22	3	79	18	3	66	48	6	8
1,000+	85	13	2	80	17	3	72	55	7	12
Region										
Western G.	15	9	4	16	7	3	14	10	2	3
Eastern G.	11	8	4	14	7	3	13	11	2	3
Total	54	32	15	62	26	12	55	42	8	13

Share in product innovators (%).

1) only one answer allowed; 2) multiple answers possible.

A: Primarily own enterprise or enterprise group
B: Primarily own enterprise in collaboration with other enterprises/institutions
C: Primarily other enterprises/institutions

A*: Own enterprise
B*: Own enterprise together with third parties
C*: Other enterprises/institutions
D*: Own enterprise by adapting products developed by others

Table 43. Developer of process innovations 2004-06, 2006-08, 2008-10

	Developer of process innovations									
	2004-2006[1)]			*2006-2008[1)]*			*2008-2010[2)]*			
	A	*B*	*C*	*A*	*B*	*C*	*A**	*B**	*C**	*D**
Sector										
10-12	55	30	15	54	31	15	57	26	13	14
13-15	50	36	14	67	27	5	55	48	5	2
16-17	45	36	18	58	27	15	54	40	11	5
20-21	72	28	0	60	28	11	77	42	6	8
22	64	17	19	64	23	13	46	66	7	6
23	70	23	6	72	19	9	81	27	0	5
24-25	58	26	16	55	29	16	51	48	9	8
26-27	67	21	12	57	29	14	72	40	6	3
28	58	34	8	57	22	21	53	51	8	4
29-30	77	20	4	57	39	4	55	50	1	3
31-33	48	40	12	51	31	19	53	38	16	2
5-9, 19, 35	51	23	25	43	22	35	23	67	11	4
36-39	56	32	12	35	32	32	51	46	15	8
46	38	45	17	53	26	21	39	58	11	3
49-53, 79	49	38	13	59	27	14	46	48	5	8
18, 58-60	38	22	39	41	29	30	57	34	9	8
61-63	73	20	7	69	21	10	64	42	6	13
64-66	49	36	15	53	27	20	34	58	27	6
71-72	48	36	16	52	31	16	65	27	7	12
69, 70.2, 73	39	39	21	44	23	33	36	46	18	15
74, 78, 80-82	48	35	16	42	36	22	52	33	5	24
R&D-int. mf.	67	27	6	57	27	16	62	50	4	3
Other mf.	52	29	19	54	27	18	52	42	11	8
Knowl.-int. s.	51	34	15	53	25	21	53	41	12	12
Other services	45	40	16	52	29	19	45	47	8	11
Size Class										
5-49	50	32	17	54	25	21	50	40	11	11
50-249	56	34	10	52	35	13	54	53	6	6
250-999	59	35	6	55	37	8	58	59	9	7
1,000+	77	21	3	57	37	6	63	61	9	10
Region										
Western G.	9	6	2	11	5	3	8	6	1	1
Eastern G.	8	5	4	8	6	4	7	6	2	1
Total	52	33	15	54	27	19	52	44	10	9

Share in product innovators (%).

1) only one answer allowed; 2) multiple answers possible.

A: Primarily own enterprise or enterprise group
B: Primarily own enterprise in collaboration with other enterprises/institutions
C: Primarily other enterprises/institutions

A*: Own enterprise
B*: Own enterprise together with third parties
C*: Other enterprises/institutions
D*: Own enterprise by adapting processes developed by others

16.7 Barriers to Innovation

Table 44. Obstacles for innovation 2008-2010, all enterprises

	Obstacles															
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*
Sector																
10-12	31	33	29	25	15	18	20	14	17	16	19	19	17	8	14	17
13-15	30	34	26	22	11	16	22	14	14	21	14	15	11	10	14	14
16-17	40	48	38	33	24	34	33	26	26	27	24	24	25	19	21	15
20-21	54	55	47	38	22	25	34	22	20	27	37	28	18	15	26	19
22	33	38	29	18	8	20	20	9	11	26	6	8	8	4	12	15
23	44	39	35	22	19	23	21	15	10	25	12	15	20	3	16	19
24-25	36	36	32	24	6	18	18	9	11	14	12	12	8	6	8	10
26-27	49	48	36	25	17	25	34	19	19	23	13	15	17	12	23	15
28	46	46	34	27	14	19	30	11	9	18	13	14	10	10	12	17
29-30	42	44	39	33	9	18	24	17	10	27	18	16	13	8	19	12
31-33	35	41	33	31	8	14	16	12	9	24	17	11	12	11	13	11
5-9, 19, 35	27	27	18	13	12	7	8	5	7	14	17	13	7	2	8	10
36-39	23	27	21	14	10	10	13	7	8	16	26	20	15	6	11	14
46	33	31	23	16	10	10	13	9	10	17	18	13	9	7	14	9
49-53, 79	17	19	14	16	7	8	7	5	5	12	15	12	10	3	9	16
18, 58-60	38	35	31	23	10	21	14	8	10	25	11	10	6	2	16	11
61-63	44	47	34	27	13	26	35	10	9	25	11	7	9	5	16	10
64-66	16	16	15	8	10	15	18	5	8	12	19	7	5	3	7	8
71-72	36	41	32	30	10	14	20	12	13	24	15	15	11	8	17	17
69, 70.2, 73	11	12	14	11	9	14	10	4	7	12	7	3	4	1	6	7
74, 78, 80-82	21	21	24	19	7	10	13	6	5	14	11	7	7	2	7	26
R&D-int. mf.	51	51	39	30	16	22	33	17	15	22	17	17	14	12	18	17
Other mf.	34	36	30	24	12	18	19	11	12	19	16	15	13	7	13	14
Knowl.-int. s.	25	26	22	18	10	17	18	7	9	18	11	7	7	4	10	9
Other services	25	25	20	17	8	10	11	7	7	15	15	11	9	4	10	16
Size Class																
5-49	29	29	26	21	9	14	16	8	9	16	14	11	10	6	12	14
50-249	33	36	21	17	14	20	24	12	13	23	15	13	10	6	11	12
250-999	40	41	21	13	19	23	27	13	15	25	18	13	12	10	13	9
1,000+	56	57	28	12	31	30	39	18	16	35	25	16	14	11	15	14
Region																
Western G.	30	31	25	20	11	16	17	9	10	18	15	11	10	6	12	14
Eastern G.	27	28	26	24	8	11	16	8	7	15	12	13	9	4	11	12
Total	30	31	25	20	10	15	17	9	10	17	14	12	10	6	12	14

Share in all enterprises (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Standards and norms
N: Lack of access to IPRs
O: Market dominance by other enterprises
P: Others

Table 45. Obstacles for innovation 2008-2010, innovative enterprises

	Obstacles															
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*
Sector																
10-12	37	38	35	27	18	21	20	15	21	19	22	19	18	7	16	16
13-15	39	45	29	25	15	22	28	19	17	26	18	18	14	11	18	18
16-17	54	62	46	41	33	43	41	31	31	31	26	26	27	19	22	11
20-21	57	58	48	38	22	27	35	21	20	29	38	28	18	15	27	17
22	42	46	34	19	9	25	25	11	12	31	6	10	11	5	16	11
23	53	49	39	28	27	32	25	21	15	30	15	19	23	5	17	18
24-25	45	47	42	31	10	22	22	14	15	16	17	16	11	7	9	13
26-27	54	54	40	27	18	27	39	21	22	25	15	17	20	13	25	16
28	52	54	36	27	14	21	37	12	11	20	17	16	8	11	13	16
29-30	52	53	45	37	12	19	29	20	11	32	23	18	14	8	22	11
31-33	42	49	39	40	11	20	21	18	14	28	21	14	14	14	14	12
5-9, 19, 35	37	39	24	16	16	10	13	8	8	20	23	14	9	3	10	11
36-39	39	43	36	25	19	22	26	12	15	26	42	31	24	11	14	17
46	46	45	28	21	14	18	21	12	14	25	25	19	12	9	16	15
49-53, 79	22	31	17	19	11	12	11	6	6	17	23	18	14	4	11	19
18, 58-60	53	47	37	26	12	30	20	9	9	29	11	11	6	1	15	7
61-63	47	48	35	26	15	29	42	10	10	26	12	8	10	5	17	11
64-66	25	26	19	11	16	23	23	8	7	13	29	12	8	5	7	12
71-72	46	55	43	42	12	18	26	15	17	31	18	19	13	9	19	18
69, 70.2, 73	22	22	25	16	16	24	14	7	13	20	11	7	5	3	8	9
74, 78, 80-82	26	31	28	20	10	13	16	7	7	15	11	7	7	2	8	13
R&D-int. mf.	55	55	41	30	16	24	37	18	17	24	19	18	14	13	20	16
Other mf.	44	46	38	30	15	23	24	15	16	22	19	17	14	8	14	14
Knowl.-int. s.	36	38	32	25	14	24	25	10	12	24	15	11	9	5	13	12
Other services	34	38	24	20	12	15	17	9	10	20	21	16	11	6	13	16
Size Class																
5-49	39	41	34	27	13	20	22	11	13	21	18	15	12	7	14	14
50-249	42	46	26	20	18	26	30	15	16	27	19	15	13	8	14	12
250-999	48	49	26	15	23	29	33	16	18	30	21	15	14	12	15	9
1,000+	60	61	30	13	33	32	42	20	17	37	27	17	15	12	16	15
Region																
Western G.	41	43	32	25	15	22	24	12	14	23	19	15	12	7	14	14
Eastern G.	36	39	34	29	11	17	22	11	11	19	15	17	11	6	15	12
Total	40	43	33	25	14	21	24	12	13	22	18	15	12	7	14	14

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Standards and norms
N: Lack of access to IPRs
O: Market dominance by other enterprises
P: Others

Table 46. Obstacles for innovation 2008-2010 resulting in extending project duration, innovative enterprises

	Obstacles															
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*
Sector																
10-12	2	3	2	3	5	8	3	5	5	1	2	2	1	0	1	1
13-15	2	9	4	4	2	9	7	5	5	5	5	4	2	0	2	3
16-17	27	28	10	5	6	27	23	6	20	4	2	3	6	2	3	7
20-21	17	13	7	6	7	12	12	8	6	9	9	10	6	1	2	3
22	6	6	4	1	3	10	7	6	5	2	2	2	3	1	2	4
23	6	9	7	2	5	13	4	10	2	2	5	8	5	1	0	4
24-25	11	10	13	3	1	8	6	1	2	2	3	3	2	1	0	3
26-27	16	9	7	4	2	14	17	7	5	3	3	7	10	2	1	3
28	16	11	6	4	3	8	15	3	2	3	3	3	3	2	1	4
29-30	12	10	7	7	2	7	13	5	1	5	6	3	4	3	1	1
31-33	5	6	3	3	3	7	9	3	3	1	2	3	4	1	1	2
5-9, 19, 35	10	9	5	2	2	5	3	3	2	3	4	4	3	0	2	2
36-39	6	5	5	5	3	6	9	3	1	2	6	6	1	1	3	3
46	9	1	2	2	1	4	2	6	2	3	4	3	2	0	0	0
49-53, 79	3	5	1	0	1	4	3	1	1	2	3	4	3	1	0	1
18, 58-60	8	5	4	3	5	16	7	3	3	0	2	2	1	0	0	1
61-63	17	14	10	4	5	19	19	6	3	5	8	3	6	2	0	4
64-66	9	11	5	4	6	13	6	4	2	1	13	6	4	1	0	4
71-72	16	11	6	5	1	8	3	3	2	5	2	3	2	2	1	4
69, 70.2, 73	6	7	8	4	4	11	5	1	5	4	3	2	2	1	1	1
74, 78, 80-82	5	6	3	3	2	5	7	3	1	1	1	2	2	0	0	1
R&D-int. mf.	17	11	7	5	3	11	16	5	4	4	4	5	6	2	1	3
Other mf.	9	8	6	3	3	9	7	4	4	2	3	3	3	1	1	3
Knowl.-int. s.	12	10	7	4	4	13	8	3	3	4	5	3	3	1	1	3
Other services	6	3	2	2	1	4	4	4	1	2	3	3	2	0	0	1
Size Class																
5-49	10	7	5	3	2	8	6	3	3	2	3	3	3	1	1	2
50-249	10	9	5	3	5	13	12	6	4	4	5	4	4	1	1	3
250-999	13	12	7	3	8	16	16	7	7	4	7	9	6	4	2	3
1,000+	18	16	5	2	8	18	20	10	3	5	8	8	6	2	1	5
Region																
Western G.	10	8	5	3	3	9	8	4	3	3	4	3	3	1	1	2
Eastern G.	9	8	6	4	2	8	7	3	2	3	2	3	2	1	1	3
Total	10	8	6	3	3	9	7	4	3	3	3	3	3	1	1	2

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Standards and norms
N: Lack of access to IPRs
O: Market dominance by other enterprises
P: Others

Table 47. Obstacles for innovation 2008-2010 resulting in stopping of projects, innovative enterprises

	Obstacles															
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*
Sector																
10-12	8	13	9	7	6	6	8	4	5	10	4	4	8	3	5	4
13-15	10	8	4	3	3	4	3	2	4	7	7	5	6	4	5	1
16-17	12	7	17	19	4	3	5	17	2	4	1	3	18	0	0	0
20-21	15	19	17	11	7	7	5	3	3	12	12	4	2	3	3	4
22	6	4	8	0	0	2	4	0	1	11	1	3	0	0	3	1
23	21	8	2	3	3	9	8	8	8	7	4	1	7	2	3	3
24-25	9	7	6	4	3	4	3	2	2	5	2	4	2	3	2	3
26-27	15	15	10	6	3	4	2	4	2	9	4	2	2	3	3	3
28	8	11	9	7	5	3	3	4	2	4	4	3	1	1	2	1
29-30	10	8	5	4	1	3	3	1	1	13	3	2	1	0	3	1
31-33	8	5	5	7	4	2	4	3	0	7	1	2	1	6	2	1
5-9, 19, 35	7	4	1	0	3	1	1	1	2	2	4	3	1	0	1	1
36-39	12	8	2	2	3	5	5	6	9	9	5	3	9	2	1	6
46	10	9	6	3	1	2	5	1	2	7	7	5	4	4	2	2
49-53, 79	9	6	5	3	3	2	2	1	1	3	8	2	6	0	2	0
18, 58-60	12	9	5	5	2	4	3	1	2	17	3	1	1	1	1	0
61-63	7	10	4	3	4	2	5	2	1	8	1	1	0	0	3	0
64-66	4	3	2	2	5	5	2	1	1	5	4	2	1	2	2	2
71-72	6	8	3	2	3	3	3	1	2	5	4	4	4	1	1	2
69, 70.2, 73	8	3	2	2	6	2	2	2	2	8	2	2	0	0	0	1
74, 78, 80-82	4	6	5	7	4	4	3	2	0	3	1	2	0	0	1	0
R&D-int. mf.	12	14	12	7	4	4	3	4	2	8	5	3	2	2	3	2
Other mf.	9	8	6	5	4	4	4	3	3	7	3	3	4	2	3	2
Knowl.-int. s.	7	6	3	3	5	3	3	2	2	8	2	2	1	1	1	1
Other services	8	7	6	4	2	3	4	1	1	5	6	3	4	2	2	1
Size Class																
5-49	8	8	6	4	4	3	4	3	2	6	4	3	3	2	2	2
50-249	10	9	5	4	3	4	3	2	2	9	2	2	1	1	1	1
250-999	15	12	6	4	6	5	3	3	2	13	4	2	2	2	2	2
1,000+	17	12	5	2	8	6	5	4	3	15	6	1	1	3	3	3
Region																
Western G.	9	8	6	5	4	3	4	3	2	7	4	3	3	2	2	2
Eastern G.	7	5	4	3	2	2	3	2	2	5	3	3	2	1	3	2
Total	9	8	6	4	4	3	4	2	2	7	4	3	3	2	2	2

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Standards and norms
N: Lack of access to IPRs
O: Market dominance by other enterprises
P: Others

Table 48. Obstacles for innovation 2008-2010 resulting in resigning to start projects, innovative enterprises

	Obstacles															
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*
Sector																
10-12	24	22	25	18	7	7	10	6	11	8	16	14	9	3	10	12
13-15	30	30	21	19	9	10	18	12	10	15	11	10	5	7	12	15
16-17	17	28	20	17	23	13	13	9	10	25	23	20	4	18	19	4
20-21	28	29	26	24	8	9	20	10	11	10	20	15	11	11	23	11
22	30	37	22	17	5	15	16	5	6	20	3	5	8	3	12	6
23	26	33	32	24	19	10	14	3	5	22	6	10	12	3	14	11
24-25	26	31	24	24	6	10	13	11	11	9	12	9	6	3	7	7
26-27	32	35	26	20	14	11	22	10	15	15	9	9	8	8	21	10
28	29	34	21	16	7	10	19	5	8	12	10	10	4	7	11	11
29-30	31	36	33	26	8	9	13	15	9	15	14	12	9	5	18	10
31-33	30	40	32	34	4	12	8	11	10	20	19	9	10	8	11	9
5-9, 19, 35	21	26	18	13	11	4	8	3	5	15	15	7	5	2	7	8
36-39	21	30	29	17	12	11	12	3	5	14	31	22	13	9	10	7
46	27	35	19	17	11	12	13	5	10	15	15	11	6	6	14	13
49-53, 79	11	22	12	15	7	6	7	4	4	12	12	12	6	3	9	17
18, 58-60	37	34	29	19	6	11	10	5	4	14	7	8	4	1	13	6
61-63	27	31	26	20	7	9	23	3	6	15	4	3	4	3	14	8
64-66	15	15	14	6	6	6	16	4	5	8	11	5	3	2	5	8
71-72	28	38	35	36	8	7	21	11	14	22	12	11	7	8	18	14
69, 70.2, 73	9	12	15	9	6	11	6	4	5	8	7	3	3	2	7	7
74, 78, 80-82	18	20	19	10	4	5	6	2	6	11	8	3	5	2	7	12
R&D-int. mf.	30	34	24	19	10	10	19	9	11	13	11	10	7	9	16	11
Other mf.	27	31	25	22	9	10	12	8	9	14	14	11	8	5	11	9
Knowl.-int. s.	20	24	23	19	6	9	15	5	7	13	8	5	4	3	11	9
Other services	20	27	17	15	8	8	10	4	7	13	12	10	6	4	11	14
Size Class																
5-49	23	28	23	20	7	9	12	6	8	13	11	9	6	4	12	11
50-249	24	30	17	14	11	9	16	7	10	15	12	9	8	5	12	8
250-999	26	32	17	11	11	10	17	7	10	15	11	5	6	7	12	4
1,000+	29	35	20	9	18	9	17	7	11	18	13	7	7	7	13	8
Region																
Western G.	24	29	21	18	8	10	13	6	8	14	12	9	6	5	12	11
Eastern G.	22	27	26	22	7	7	14	6	7	12	10	11	7	4	11	8
Total	23	29	22	19	8	9	13	6	8	13	11	9	6	5	12	11

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Standards and norms
N: Lack of access to IPRs
O: Market dominance by other enterprises
P: Others

Table 49. Obstacles for innovation 2008-2010 resulting in resigning to start projects, non-innovative enterprises

	Obstacles															
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*
Sector																
10-12	24	26	22	23	11	14	19	14	12	13	15	18	16	10	13	17
13-15	12	10	19	15	4	4	8	3	7	10	6	7	6	6	4	6
16-17	14	25	23	21	8	19	20	17	18	20	21	21	20	18	20	21
20-21	30	32	42	37	26	12	26	25	23	15	36	26	16	13	15	35
22	9	13	17	16	6	6	7	6	6	10	6	3	1	2	1	27
23	27	19	26	11	4	7	14	3	1	15	7	5	12	0	15	20
24-25	21	18	14	13	0	10	13	2	3	11	5	6	4	5	6	6
26-27	14	13	13	14	8	12	2	4	0	7	2	2	0	6	8	11
28	29	24	26	26	13	11	11	9	3	13	3	8	16	8	7	18
29-30	10	17	23	21	2	13	10	6	6	10	2	8	9	8	10	13
31-33	23	28	23	12	4	4	7	1	1	17	9	5	7	4	12	10
5-9, 19, 35	15	14	11	9	7	5	3	3	6	7	9	11	5	2	5	8
36-39	12	15	9	7	4	0	4	4	2	8	15	12	8	1	8	13
46	18	15	17	11	5	2	5	5	5	7	11	6	5	5	11	3
49-53, 79	13	10	11	14	3	5	4	3	5	8	9	8	6	2	7	13
18, 58-60	13	16	20	16	8	7	4	6	11	19	10	8	6	4	17	18
61-63	31	39	29	33	5	9	2	8	4	21	4	4	4	4	12	4
64-66	4	3	11	5	0	4	10	1	10	11	6	1	1	1	8	1
71-72	20	18	13	9	7	7	8	6	8	13	9	8	8	7	13	15
69, 70.2, 73	1	3	3	6	2	6	7	1	2	4	3	0	3	0	3	4
74, 78, 80-82	18	15	21	18	6	8	11	6	4	14	11	8	8	1	7	35
R&D-int. mf.	27	27	29	28	11	12	10	12	5	9	6	8	14	9	7	20
Other mf.	20	20	19	16	6	10	12	7	7	14	10	11	10	7	11	14
Knowl.-int. s.	8	9	8	9	3	6	7	3	4	8	5	2	4	2	7	6
Other services	16	13	16	14	5	5	6	5	5	10	10	7	6	3	8	16
Size Class																
5-49	16	15	16	14	5	7	8	5	5	10	9	7	7	4	9	13
50-249	13	12	9	8	6	8	9	5	7	14	6	6	4	2	5	12
250-999	13	11	5	5	5	4	5	3	3	8	4	4	4	2	5	9
1,000+	4	6	3	4	0	0	1	0	0	2	2	1	0	1	1	2
Region																
Western G.	16	15	15	13	5	7	8	5	6	11	9	7	7	4	9	14
Eastern G.	15	14	16	17	5	4	8	4	3	10	9	9	6	2	7	11
Total	15	15	15	14	5	7	8	5	5	10	9	7	7	4	8	13

Share in firms without product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Standards and norms
N: Lack of access to IPRs
O: Market dominance by other enterprises
P: Others

Table 50. Obstacles for innovation 2004-2006, all enterprises

	Obstacles												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	24	18	17	9	9	11	7	9	3	8	18	12	11
13-15	19	21	9	10	7	10	9	7	4	13	6	5	8
16-17	15	14	9	6	3	9	4	4	5	8	6	5	7
20-21	23	23	16	11	11	19	18	8	16	23	18	13	16
22	21	24	19	13	5	16	15	10	7	11	8	10	12
23	12	14	7	6	3	7	5	4	2	4	8	11	3
24-25	19	15	15	12	7	9	13	7	8	7	4	4	5
26-27	33	39	29	21	10	24	22	11	12	15	14	10	16
28	23	29	19	14	9	21	20	8	11	18	15	10	8
29-30	30	26	19	13	11	28	23	10	3	14	13	14	15
31-33	21	23	16	11	9	15	11	3	4	5	6	4	8
5-9, 19, 35	11	9	5	4	2	7	4	6	2	4	8	6	8
36-39	10	9	7	6	2	6	5	3	1	2	12	12	3
46	12	13	12	7	9	8	4	1	4	9	6	6	10
49-53, 79	9	9	4	3	4	11	4	2	2	10	10	9	8
18, 58-60	18	18	12	12	5	14	7	8	9	7	9	12	4
61-63	27	30	32	24	8	27	23	10	9	18	10	7	16
64-66	14	10	6	3	7	21	16	4	2	10	12	6	4
71-72	24	27	20	17	6	8	11	3	7	10	15	12	14
69, 70.2, 73	8	7	8	6	4	12	11	9	5	13	5	1	5
74, 78, 80-82	11	13	8	8	4	9	5	4	4	12	10	8	10
R&D-int. mf.	30	32	22	18	11	23	21	10	11	20	17	12	13
Other mf.	18	17	14	10	6	11	10	6	5	7	9	8	7
Knowl.-int. s.	16	17	15	11	5	14	13	7	6	12	8	5	9
Other services	11	12	8	6	6	9	4	2	3	10	8	8	9
Size Class													
5-49	15	16	13	10	6	11	9	5	5	10	9	7	9
50-249	21	20	11	9	9	18	15	9	7	12	9	9	8
250-999	25	27	11	6	13	28	22	14	11	16	14	13	9
1,000+	39	31	16	9	20	29	28	11	13	29	22	17	14
Region													
Western G.	17	17	13	10	7	13	10	6	6	11	9	8	9
Eastern G.	13	13	13	9	3	7	7	3	4	6	9	8	6
Total	16	16	13	10	6	12	10	5	5	10	9	8	9

Share in all enterprises (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Market dominance by other enterprises

Table 51. Obstacles for innovation 2004-2006, innovative enterprises

	Obstacles												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	33	22	25	12	14	19	9	13	5	13	30	19	17
13-15	31	32	13	14	11	16	10	11	6	21	10	8	10
16-17	21	23	14	10	5	16	8	7	8	9	11	8	8
20-21	26	26	18	13	13	22	21	9	18	26	21	15	19
22	30	39	30	22	9	25	25	16	12	18	12	16	18
23	23	27	13	12	6	14	7	7	4	9	15	22	3
24-25	31	21	25	20	11	16	21	9	12	14	8	8	9
26-27	37	42	31	23	12	27	25	12	14	16	15	10	15
28	28	35	23	17	11	27	25	10	14	22	18	13	10
29-30	40	35	26	18	14	38	32	14	4	19	17	19	21
31-33	28	31	23	17	13	22	16	4	6	5	8	6	10
5-9, 19, 35	22	20	11	8	5	16	3	15	6	10	16	13	15
36-39	15	17	15	12	4	12	10	8	3	5	26	26	6
46	14	18	11	8	13	14	9	0	4	13	7	9	11
49-53, 79	12	14	9	7	10	30	9	4	5	27	28	27	21
18, 58-60	26	26	16	17	7	21	11	12	14	11	14	19	5
61-63	35	39	41	31	10	35	30	13	10	23	13	9	21
64-66	22	15	11	5	11	37	28	6	3	16	19	10	5
71-72	36	42	32	28	10	13	17	5	12	15	23	18	22
69, 70.2, 73	11	16	20	12	1	22	21	22	12	8	1	2	12
74, 78, 80-82	23	28	16	15	8	21	8	10	11	26	25	22	26
R&D-int. mf.	35	37	25	21	13	28	25	12	14	23	20	14	15
Other mf.	27	25	22	15	10	19	15	9	8	11	15	13	11
Knowl.-int. s.	25	29	27	20	7	24	22	13	12	15	12	9	16
Other services	16	19	12	10	11	20	9	4	6	20	17	17	17
Size Class													
5-49	23	25	22	17	9	20	15	8	9	15	15	13	15
50-249	30	29	16	13	12	26	21	13	10	17	13	13	11
250-999	31	34	13	8	16	35	28	17	14	20	18	16	12
1,000+	43	34	17	10	22	32	31	12	15	32	24	19	15
Region													
Western G.	25	27	21	16	11	23	17	10	9	17	16	13	15
Eastern G.	19	20	20	14	5	14	11	4	6	8	13	14	10
Total	25	26	21	16	10	22	17	9	9	16	15	13	14

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Market dominance by other enterprises

Table 52. Obstacles for innovation 2004-2006 resulting in extending project duration, innovative enterprises

	Obstacles												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	7	2	7	1	4	5	3	8	1	2	7	1	2
13-15	3	1	1	1	1	9	4	4	3	1	2	2	1
16-17	1	4	10	8	2	12	3	4	6	1	8	8	1
20-21	4	4	5	2	8	15	12	6	8	9	12	8	5
22	8	13	8	8	5	16	16	9	5	5	6	6	4
23	4	1	1	0	3	10	3	6	2	2	7	13	0
24-25	7	4	4	4	3	5	9	6	2	8	2	4	0
26-27	9	12	9	5	6	16	15	7	4	4	6	3	2
28	5	13	13	3	6	19	20	6	4	4	12	9	0
29-30	19	11	3	2	9	27	26	13	2	10	7	9	7
31-33	4	3	4	0	1	6	3	3	3	1	2	1	0
5-9, 19, 35	3	4	1	1	1	15	2	12	0	6	4	4	3
36-39	2	3	4	1	2	7	6	5	2	2	11	13	0
46	3	7	0	2	10	11	2	0	0	5	2	3	0
49-53, 79	2	2	1	1	7	10	5	2	4	1	1	4	1
18, 58-60	6	4	9	13	3	15	5	10	5	6	11	17	1
61-63	16	11	13	10	2	27	11	6	5	5	7	4	4
64-66	2	3	1	0	5	26	7	5	2	3	8	5	0
71-72	3	12	5	4	2	8	9	1	2	5	9	9	1
69, 70.2, 73	1	1	11	1	1	3	1	8	1	5	1	0	3
74, 78, 80-82	7	2	2	0	3	8	2	0	2	6	6	5	0
R&D-int. mf.	8	10	8	4	7	17	17	7	5	5	11	8	2
Other mf.	5	5	7	4	3	9	7	6	2	4	5	5	1
Knowl.-int. s.	6	7	9	4	2	14	7	6	3	5	6	4	2
Other services	4	4	1	1	7	10	3	1	2	4	3	4	0
Size Class													
5-49	4	6	6	4	4	10	6	4	2	4	5	4	1
50-249	11	6	4	2	5	17	13	7	4	5	7	7	1
250-999	7	9	6	2	9	27	17	11	7	4	11	10	2
1,000+	8	6	4	2	12	22	20	8	8	7	14	14	2
Region													
Western G.	5	6	6	3	5	12	7	5	3	4	6	5	1
Eastern G.	5	5	5	3	2	6	7	2	1	2	4	5	1
Total	5	6	6	3	4	12	7	5	3	4	5	5	1

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Market dominance by other enterprises

Table 53. Obstacles for innovation 2004-2006 resulting in stopping of projects, innovative enterprises

	Obstacles												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	9	1	1	1	2	5	0	2	2	3	7	4	1
13-15	9	5	0	0	10	7	0	1	0	7	2	2	3
16-17	4	5	1	0	0	0	0	1	1	6	0	0	1
20-21	9	8	4	3	3	4	2	1	2	11	4	1	1
22	8	3	4	9	2	5	0	4	3	10	1	4	1
23	5	9	4	4	1	2	3	0	1	5	3	5	0
24-25	14	4	3	1	6	4	0	0	2	3	1	2	1
26-27	10	7	4	3	2	7	2	3	1	7	4	2	1
28	6	4	2	2	1	4	2	2	3	11	6	6	2
29-30	3	3	14	8	2	6	2	0	2	7	5	4	0
31-33	7	1	2	0	0	4	0	1	0	1	0	1	3
5-9, 19, 35	7	3	0	0	2	0	0	0	5	4	6	1	5
36-39	3	2	0	0	2	3	0	1	1	1	10	9	4
46	4	1	3	4	2	2	3	0	3	5	3	3	5
49-53, 79	2	3	1	1	2	5	0	1	0	3	6	6	1
18, 58-60	7	9	1	2	0	1	1	1	5	3	1	1	1
61-63	8	9	9	5	5	4	1	1	1	13	0	0	9
64-66	5	2	0	0	0	1	1	0	0	3	1	0	0
71-72	16	6	5	4	2	2	1	1	1	7	1	1	1
69, 70.2, 73	2	3	3	4	0	8	1	0	0	1	0	0	1
74, 78, 80-82	1	1	0	0	1	5	0	2	3	4	0	0	5
R&D-int. mf.	8	6	4	3	2	6	2	2	3	10	6	5	2
Other mf.	8	3	2	1	2	4	0	1	2	3	3	3	1
Knowl.-int. s.	7	5	5	4	2	4	1	1	1	6	1	1	3
Other services	3	2	2	2	2	3	2	1	2	4	3	3	4
Size Class													
5-49	6	3	3	3	2	4	1	1	2	5	3	3	3
50-249	8	5	2	2	4	4	1	1	2	7	2	1	1
250-999	9	7	2	1	2	5	1	1	1	9	3	2	1
1,000+	13	9	3	1	5	5	3	1	1	15	5	1	2
Region													
Western G.	7	4	3	3	2	4	1	1	2	6	3	3	2
Eastern G.	4	4	3	3	1	3	1	0	2	3	2	2	3
Total	7	4	3	3	2	4	1	1	2	5	3	2	3

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Market dominance by other enterprises

Table 54. Obstacles for innovation 2004-2006 resulting in resigning to start projects, innovative enterprises

	Obstacles												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	21	19	18	10	11	9	6	3	2	8	18	14	14
13-15	19	25	12	13	1	0	6	5	3	13	5	4	8
16-17	16	14	5	2	3	5	5	2	1	2	2	0	6
20-21	14	14	12	8	2	6	10	5	10	9	8	6	13
22	17	23	20	12	2	5	12	3	5	5	5	7	13
23	14	19	8	8	3	5	1	1	1	2	5	4	3
24-25	12	14	18	15	3	8	12	3	7	3	5	2	8
26-27	23	27	20	15	4	9	11	2	10	6	7	5	12
28	20	18	8	12	4	4	4	2	7	8	10	4	7
29-30	19	23	10	8	4	5	7	1	1	3	7	8	14
31-33	17	27	18	16	12	12	14	0	3	3	6	4	7
5-9, 19, 35	12	13	9	7	2	1	1	3	0	0	6	9	8
36-39	11	15	11	12	1	3	5	2	0	1	8	5	2
46	7	10	8	1	2	1	4	0	1	3	2	3	6
49-53, 79	10	9	7	6	1	14	4	1	0	24	21	18	19
18, 58-60	14	14	5	3	3	5	5	1	6	2	3	1	4
61-63	14	20	19	16	4	4	18	6	5	5	5	4	8
64-66	15	11	10	5	7	11	20	3	1	10	12	5	5
71-72	18	28	26	22	5	4	7	2	9	4	13	10	20
69, 70.2, 73	9	13	8	7	0	12	18	14	11	3	0	2	12
74, 78, 80-82	15	24	15	15	4	8	6	8	6	16	19	17	21
R&D-int. mf.	23	24	14	14	4	7	8	3	7	8	10	5	11
Other mf.	15	17	14	11	6	7	8	2	4	4	8	6	8
Knowl.-int. s.	14	19	15	13	3	7	14	7	8	5	6	5	12
Other services	10	13	9	6	2	7	4	2	2	12	11	10	13
Size Class													
5-49	14	17	14	11	4	7	9	3	5	7	9	7	11
50-249	14	18	11	8	4	6	8	5	5	6	5	5	9
250-999	18	21	6	6	5	7	12	5	6	9	6	6	9
1,000+	27	21	11	7	7	7	9	4	7	12	6	5	11
Region													
Western G.	15	18	13	10	4	7	9	4	5	7	9	6	11
Eastern G.	12	12	13	9	3	5	5	2	3	4	8	8	7
Total	14	17	13	10	4	7	9	4	5	7	9	7	11

Share in firms with product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Market dominance by other enterprises

Table 55. Obstacles for innovation 2004-2006 resulting in resigning to start projects, non-innovative enterprises

	Obstacles												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Sector													
10-12	13	13	5	4	2	2	3	4	2	2	2	2	2
13-15	1	4	4	3	0	0	8	0	0	1	1	0	4
16-17	9	5	3	3	0	2	1	2	2	7	2	2	6
20-21	6	6	7	3	1	3	1	1	1	1	2	1	2
22	6	1	1	0	0	2	0	0	0	0	2	0	2
23	1	1	1	0	0	0	2	0	0	0	0	1	2
24-25	9	10	6	5	4	2	5	4	4	0	1	1	2
26-27	15	22	15	11	0	3	0	8	0	7	8	8	21
28	4	4	1	5	0	2	3	0	0	1	5	0	2
29-30	5	5	2	2	4	3	1	1	1	2	2	1	2
31-33	9	7	1	0	0	0	1	0	0	5	3	0	3
5-9, 19, 35	4	2	2	1	1	0	4	0	0	0	2	2	3
36-39	6	2	1	1	1	1	1	0	0	1	2	1	2
46	11	9	13	5	5	2	0	2	4	5	4	4	9
49-53, 79	7	7	2	1	1	1	1	1	0	1	1	0	1
18, 58-60	6	6	7	4	2	3	2	2	2	2	2	2	3
61-63	5	4	4	3	1	1	2	1	3	3	2	2	2
64-66	3	3	0	0	0	0	1	0	0	3	3	0	3
71-72	4	5	1	0	0	1	1	0	0	2	2	1	1
69, 70.2, 73	6	1	1	2	5	5	5	0	0	16	7	1	0
74, 78, 80-82	4	4	4	4	1	1	3	0	0	3	0	0	0
R&D-int. mf.	8	10	5	6	1	2	2	3	0	3	5	3	6
Other mf.	8	8	4	3	2	2	3	3	2	2	2	1	3
Knowl.-int. s.	5	2	1	2	3	3	3	0	0	10	5	1	1
Other services	8	7	6	3	2	1	1	1	1	3	2	2	4
Size Class													
5-49	8	6	5	3	2	2	2	1	1	5	3	1	3
50-249	3	3	2	2	2	3	2	1	1	2	1	1	1
250-999	4	3	1	1	2	2	2	2	0	2	1	0	1
1,000+	2	2	2	1	1	1	1	1	1	1	1	1	2
Region													
Western G.	7	6	4	3	3	2	2	1	1	4	2	1	3
Eastern G.	8	7	6	5	1	2	3	1	1	4	5	2	3
Total	7	6	4	3	2	2	2	1	1	4	3	1	3

Share in firms without product or process innovation activity (%).

A: Too high economic risk
B: Too high cost
C: Lack of internal funding sources
D: Lack of suitable external funding sources
E: Internal resistance against innovation projects
F: Organisational problems within the enterprise
G: Lack of qualified personnel
H: Lack of technological information
I: Lack of market information
J: Lack of demand for innovations
K: Legislation
L: Bureaucratic procedures
M: Market dominance by other enterprises

16.8 Internationalisiation of Innovation Activities

Table 56. Foreign business activities of innovative enterprises 2008-2010

	Foreign business activities			
	None	*Foreign locations only*	*Export only*	*Foreign locations & export*
Sector				
10-12	63	5	20	12
13-15	4	0	77	19
16-17	48	2	38	12
20-21	7	0	58	35
22	12	0	67	21
23	35	5	42	17
24-25	25	2	59	15
26-27	9	2	65	23
28	25	4	49	22
29-30	17	0	57	25
31-33	22	1	65	11
5-9, 19, 35	79	4	12	4
36-39	73	5	17	5
46	24	13	51	12
49-53, 79	54	8	23	15
18, 58-60	48	1	40	11
61-63	35	3	48	14
64-66	82	4	12	2
71-72	56	5	27	12
69, 70.2, 73	77	10	10	3
74, 78, 80-82	78	8	10	4
R&D-int. mf.	13	1	60	26
Other mf.	39	3	45	13
Knowl.-int. s.	60	6	25	9
Other services	46	10	33	11
Size Class				
5-49	47	6	37	9
50-249	27	3	47	23
250-999	24	4	28	45
1,000+	23	10	10	56
Region				
Western G.	42	5	39	13
Eastern G.	53	8	31	8
Total	44	6	38	13

Share in innovative enterprises (%).

Table 57. Foreign innovation activities, 2008-2010

	Foreign innovation activities		
	Foreign locations with innovation activities	*Foreign locations without innovation activities*	*No foreign locations*
Sector			
10-12	8	83	9
13-15	13	80	7
16-17	7	84	9
20-21	20	65	15
22	11	78	11
23	16	72	12
24-25	9	83	8
26-27	11	74	15
28	10	73	17
29-30	18	67	16
31-33	8	87	5
5-9, 19, 35	6	90	4
36-39	2	88	10
46	14	75	12
49-53, 79	14	74	12
18, 58-60	7	85	8
61-63	11	82	7
64-66	3	93	4
71-72	14	82	4
69, 70.2, 73	5	87	8
74, 78, 80-82	6	87	7
R&D-int. mf.	13	71	16
Other mf.	8	83	9
Knowl.-int. s.	9	85	6
Other services	12	77	11
Size Class			
5-49	9	83	7
50-249	11	72	17
250-999	22	51	27
1,000+	49	35	16
Region			
Western G.	10	81	9
Eastern G.	7	83	10
Total	10	80	10

Share in innovative enterprises (%).

Table 58. Type of foreign innovation activities, 2008-2010

	Type of foreign innovation activity							
	share in innovative firms (%)				*share in firms with foreign innovation activities (%)*			
	A	*B*	*C*	*D*	*A*	*B*	*C*	*D*
Sector								
10-12	3	3	4	5	38	40	53	62
13-15	5	8	6	4	40	58	45	28
16-17	5	5	5	4	74	66	62	53
20-21	12	7	9	7	62	33	47	33
22	7	7	9	5	64	68	86	45
23	7	9	9	8	46	53	55	49
24-25	3	3	3	4	39	34	39	45
26-27	7	7	5	4	65	59	44	33
28	4	4	7	2	37	43	68	16
29-30	12	11	9	8	65	61	48	45
31-33	2	4	5	4	29	45	63	47
5-9, 19, 35	2	2	3	2	40	30	46	29
36-39	1	1	1	1	37	41	46	38
46	4	4	6	5	26	26	44	33
49-53, 79	5	3	8	6	38	19	56	42
18, 58-60	0	3	6	3	6	41	88	38
61-63	4	6	5	4	32	55	46	37
64-66	1	1	1	1	15	31	28	24
71-72	6	7	7	7	45	48	51	47
69, 70.2, 73	2	2	1	1	31	34	28	22
74, 78, 80-82	0	0	2	1	0	0	41	18
R&D-int. mf.	7	6	7	4	55	50	58	28
Other mf.	3	4	4	4	40	44	53	47
Knowl.-int. s.	3	4	4	3	35	46	46	37
Other services	3	2	6	4	27	20	48	35
Size Class								
5-49	3	3	4	3	32	32	46	34
50-249	5	5	7	5	48	50	61	45
250-999	12	12	15	11	54	54	69	48
1,000+	28	26	27	24	57	53	55	48
Region								
Western G.	4	4	5	4	36	37	50	37
Eastern G.	3	2	3	3	36	36	49	38
Total	4	4	5	4	37	37	50	37

A: R&D
B: Design/preparation of innovations
C: Production of new products
D: Implementation of new processes

Table 59. Motives of foreign innovation activities 2008-2010

	Motives of foreign innovation activities						
	A	*B*	*C*	*D*	*E*	*F*	*G*
Sector							
10-12	39	62	79	72	72	81	51
13-15	37	77	97	89	83	72	45
16-17	65	87	87	87	78	87	78
20-21	71	78	89	89	83	88	85
22	43	79	90	66	90	90	71
23	61	74	89	88	92	84	87
24-25	60	44	96	92	90	37	36
26-27	66	84	93	92	91	78	65
28	79	90	83	82	78	76	84
29-30	85	84	77	87	69	61	87
31-33	61	67	88	72	84	57	79
5-9, 19, 35	57	80	90	86	72	80	77
36-39	80	92	95	94	82	82	81
46	41	46	92	90	84	63	52
49-53, 79	35	74	90	79	69	56	75
18, 58-60	42	67	94	80	89	59	59
61-63	39	39	95	98	75	69	89
64-66	69	90	95	95	91	85	83
71-72	73	81	89	77	78	97	87
69, 70.2, 73	24	26	54	93	45	43	80
74, 78, 80-82	37	39	73	73	62	41	81
R&D-int. mf.	76	86	86	87	82	77	78
Other mf.	54	64	89	81	84	66	60
Knowl.-int. s.	50	56	84	88	72	74	84
Other services	39	55	89	84	76	58	64
Size Class							
5-49	49	59	90	87	79	65	69
50-249	54	69	79	78	74	69	71
250-999	58	73	81	77	74	71	75
1,000+	67	76	85	88	78	74	74
Region							
Western G.	50	61	88	86	79	66	71
Eastern G.	54	70	90	79	71	67	59
Total	51	62	88	85	78	67	70

Share in firms with foreign innovation activities (%).
A Reduction of development costs
B: Reduction of production costs
C: Acquiring new customers
D: Adaptation of products and processes to customer needs
E: Contact to innovation leading customers/markets
F: Access to new knowledge/technologies
G: Recruitment of highly skilled personnel

Table 60. Highly important motives of foreign innovation activities 2008-2010

	Highly important motives of foreign innovation activities						
	A	*B*	*C*	*D*	*E*	*F*	*G*
Sector							
10-12	1	28	40	35	34	25	1
13-15	2	40	79	33	45	38	7
16-17	13	64	72	46	18	20	8
20-21	4	26	47	51	49	12	32
22	6	22	74	43	50	35	1
23	30	46	83	60	47	11	10
24-25	10	33	86	84	66	11	12
26-27	4	64	69	57	40	25	24
28	8	36	51	42	29	15	17
29-30	44	46	40	32	29	23	11
31-33	5	42	45	44	26	7	24
5-9, 19, 35	13	42	55	36	30	23	35
36-39	3	85	82	69	74	6	7
46	18	26	53	21	43	0	25
49-53, 79	6	40	68	55	31	4	30
18, 58-60	7	30	66	60	53	15	31
61-63	28	21	76	81	43	38	34
64-66	8	32	71	77	45	33	48
71-72	36	56	25	39	26	53	70
69, 70.2, 73	8	15	37	19	29	12	15
74, 78, 80-82	3	15	45	22	12	9	30
R&D-int. mf.	10	45	53	46	34	18	21
Other mf.	9	36	67	56	46	18	11
Knowl.-int. s.	25	34	48	52	35	37	45
Other services	12	30	58	34	35	3	27
Size Class							
5-49	15	33	58	45	38	17	26
50-249	13	37	57	44	36	18	27
250-999	12	43	51	49	33	16	27
1,000+	16	39	60	52	43	27	25
Region							
Western G.	14	33	58	46	38	16	26
Eastern G.	13	47	56	40	32	21	28
Total	14	35	57	46	38	17	26

Share in firms with foreign innovation activities (%).
A Reduction of development costs
B: Reduction of production costs
C: Acquiring new customers
D: Adaptation of products and processes to customer needs
E: Contact to innovation leading customers/markets
F: Access to new knowledge/technologies
G: Recruitment of highly skilled personnel

Table 61. Achievement of goals of foreign innovation activities 2008-2010

	Achievement of goals of foreign innovation activities						
	A	*B*	*C*	*D*	*E*	*F*	*G*
Sector							
10-12	51	80	87	81	76	69	75
13-15	73	91	92	61	88	87	84
16-17	64	95	76	96	56	61	67
20-21	90	92	92	99	91	85	78
22	51	100	87	83	69	71	73
23	52	96	95	100	100	93	100
24-25	19	71	79	91	57	57	72
26-27	69	81	84	91	73	79	90
28	87	81	90	87	84	80	77
29-30	77	84	92	78	81	100	75
31-33	60	77	90	90	80	53	68
5-9, 19, 35	50	81	89	92	85	66	64
36-39	20	35	96	97	95	26	26
46	41	59	90	85	90	82	78
49-53, 79	67	76	73	69	77	66	76
18, 58-60	55	64	87	91	83	74	75
61-63	92	94	88	99	92	81	99
64-66	69	81	85	87	84	55	66
71-72	70	75	71	74	74	52	75
69, 70.2, 73	49	78	89	92	87	82	89
74, 78, 80-82	71	80	94	73	92	87	45
R&D-int. mf.	82	85	89	89	81	83	82
Other mf.	45	81	85	87	73	68	73
Knowl.-int. s.	74	79	81	89	83	66	86
Other services	53	69	84	78	86	76	73
Size Class							
5-49	58	76	85	84	83	72	78
50-249	73	85	84	87	74	75	83
250-999	66	76	83	91	77	69	73
1,000+	76	80	81	85	77	83	78
Region							
Western G.	62	78	85	85	81	72	79
Eastern G.	59	79	81	84	82	77	74
Total	62	78	85	85	81	73	78

Share in firms with foreign innovation activities (%).
A Reduction of development costs
B: Reduction of production costs
C: Acquiring new customers
D: Adaptation of products and processes to customer needs
E: Contact to innovation leading customers/markets
F: Access to new knowledge/technologies
G: Recruitment of highly skilled personnel

Table 62. Completely achieved goals of foreign innovation activities 2008-2010

	Completely achieved goals of foreign innovation activities						
	A	*B*	*C*	*D*	*E*	*F*	*G*
Sector							
10-12	10	9	11	25	8	8	17
13-15	9	8	6	13	6	7	17
16-17	21	20	29	34	14	6	5
20-21	26	29	25	26	25	18	17
22	9	31	14	23	3	0	19
23	2	15	13	26	6	5	0
24-25	1	16	9	34	10	0	3
26-27	5	2	12	40	11	14	22
28	5	2	17	9	4	10	8
29-30	22	7	15	13	10	33	7
31-33	0	11	19	10	12	13	0
5-9, 19, 35	6	8	10	19	16	21	21
36-39	3	2	16	14	11	11	12
46	2	7	11	25	4	7	19
49-53, 79	3	10	9	18	18	7	7
18, 58-60	10	13	22	48	26	7	9
61-63	42	10	6	29	25	8	31
64-66	15	11	10	13	12	11	10
71-72	7	27	11	26	7	10	15
69, 70.2, 73	4	10	10	14	10	8	18
74, 78, 80-82	4	7	5	8	7	6	18
R&D-int. mf.	11	7	17	23	11	15	13
Other mf.	5	14	13	25	9	6	8
Knowl.-int. s.	16	19	10	26	15	9	20
Other services	3	8	9	21	9	7	14
Size Class							
5-49	7	11	10	25	10	8	14
50-249	9	12	18	17	6	9	13
250-999	14	12	14	21	19	15	16
1,000+	20	17	18	26	21	19	13
Region							
Western G.	8	12	11	24	10	8	14
Eastern G.	8	14	14	20	9	14	16
Total	8	12	12	24	10	9	14

Share in firms with foreign innovation activities (%).
A Reduction of development costs
B: Reduction of production costs
C: Acquiring new customers
D: Adaptation of products and processes to customer needs
E: Contact to innovation leading customers/markets
F: Access to new knowledge/technologies
G: Recruitment of highly skilled personnel

Table 63. Mechanisms used for knowledge transfer between foreign and domestic locations 2008-2010

	Mechanisms of knowledge transfer							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Sector								
10-12	61	26	32	0	51	22	31	15
13-15	55	84	40	8	38	25	43	15
16-17	86	100	83	28	42	20	75	28
20-21	83	81	62	29	52	16	45	21
22	88	80	54	19	48	24	49	7
23	62	57	74	27	49	25	52	12
24-25	97	26	41	4	19	4	12	3
26-27	94	87	84	22	61	15	42	11
28	88	88	52	15	46	13	32	9
29-30	96	79	76	12	60	35	53	19
31-33	86	65	68	27	41	28	40	21
5-9, 19, 35	82	72	71	16	43	16	32	9
36-39	86	72	66	11	50	10	36	4
46	87	71	43	0	54	0	26	0
49-53, 79	79	90	77	11	50	5	18	4
18, 58-60	63	81	75	6	33	23	31	20
61-63	73	76	99	34	30	15	22	7
64-66	88	91	45	13	45	33	81	19
71-72	61	56	86	16	63	35	61	25
69, 70.2, 73	63	70	56	6	36	18	22	4
74, 78, 80-82	73	77	51	6	35	21	29	18
R&D-int. mf.	91	88	68	17	52	17	41	13
Other mf.	80	51	51	14	40	18	34	13
Knowl.-int. s.	66	68	82	19	44	23	39	14
Other services	82	79	56	5	51	4	24	4
Size Class								
5-49	78	66	61	10	43	11	26	7
50-249	81	79	64	16	49	18	44	12
250-999	86	86	73	17	65	30	58	25
1,000+	86	84	83	28	74	47	64	31
Region								
Western G.	80	69	63	12	45	13	31	9
Eastern G.	72	72	56	12	43	15	32	9
Total	79	70	63	12	46	14	33	10

Share in firms with foreign innovation activities (%).
A: Personal meetings
B: Regular reporting
C: Telephone/video conferences
D: Licensing of foreign subsidiaries' patents
E: Short-term delegation of German employees to foreign subsidiaries
F: Long-term delegation of German employees to foreign subsidiaries
G: Short-term delegation of foreign employees to German locations
H: Long-term delegation of foreign employees to German locations

16.9 Protection Mechanisms for Intellectual Property

Table 64. Mechanisms used to protect intellectual property 2008-2010, all enterprises

	IP protection mechanisms							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Sector								
10-12	16	13	14	22	13	25	17	22
13-15	23	22	15	30	16	43	24	35
16-17	13	9	8	11	11	36	20	39
20-21	46	31	22	54	29	79	47	57
22	31	29	20	30	20	50	27	40
23	29	21	19	22	21	42	26	43
24-25	26	24	19	23	20	39	29	37
26-27	43	35	27	33	30	67	40	55
28	39	27	16	25	18	57	30	42
29-30	40	37	23	31	20	59	35	59
31-33	19	23	23	24	18	28	23	36
5-9, 19, 35	12	10	8	19	10	24	10	17
36-39	16	15	14	17	14	24	16	21
46	22	20	18	28	19	35	24	32
49-53, 79	6	5	5	6	5	14	7	11
18, 58-60	17	17	16	21	26	33	20	35
61-63	26	23	18	36	32	56	33	46
64-66	9	8	7	14	11	31	22	28
71-72	27	20	16	22	22	42	29	41
69, 70.2, 73	12	12	13	18	15	42	25	26
74, 78, 80-82	12	11	11	13	14	31	22	22
R&D-int. mf.	45	34	22	34	24	67	37	53
Other mf.	20	19	16	21	16	33	22	32
Knowl.-int. s.	18	16	14	22	21	44	26	34
Other services	14	13	12	17	13	27	18	23
Size Class								
5-49	17	16	14	19	16	34	22	29
50-249	29	23	18	27	20	47	29	41
250-999	48	35	28	45	28	60	32	52
1,000+	53	41	28	53	34	64	38	58
Region								
Western G.	20	18	15	22	18	37	23	31
Eastern G.	17	15	13	17	14	34	23	30
Total	19	17	15	21	17	37	23	31

Share in all enterprises (%).

A: Patent application
B: Utility model application
C: Registration of a design
D: Registration of a trademark
E: Copyright enforcement
F: Secrecy
G: Complex design
H: Lead-time advantage

Table 65. Mechanisms used to protect intellectual property 2008-2010, innovators

	IP protection mechanisms							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Sector								
10-12	24	23	25	37	22	44	29	39
13-15	36	32	19	38	23	65	35	54
16-17	18	13	9	14	10	48	27	59
20-21	48	35	25	59	32	86	54	63
22	39	36	25	39	24	61	34	51
23	43	31	26	32	32	59	38	59
24-25	48	45	34	42	38	61	45	58
26-27	49	40	30	37	34	73	44	65
28	49	30	17	28	19	68	34	54
29-30	47	44	26	36	22	70	36	68
31-33	30	37	34	38	28	44	34	54
5-9, 19, 35	24	19	14	38	16	35	16	28
36-39	26	26	24	30	25	45	27	44
46	31	31	25	43	25	50	36	46
49-53, 79	12	11	10	14	12	32	18	29
18, 58-60	22	20	20	27	30	37	33	45
61-63	31	28	22	44	39	62	38	53
64-66	11	10	11	22	12	38	25	36
71-72	41	29	23	32	27	56	42	61
69, 70.2, 73	20	21	21	30	28	52	42	45
74, 78, 80-82	11	15	14	13	12	47	31	32
R&D-int. mf.	51	37	24	37	26	74	40	61
Other mf.	34	32	27	35	27	51	35	51
Knowl.-int. s.	27	24	20	33	30	53	38	50
Other services	20	21	18	27	18	44	30	37
Size Class								
5-49	28	26	21	31	25	51	35	47
50-249	39	32	23	36	26	61	38	54
250-999	56	40	32	52	30	67	35	59
1,000+	58	44	30	57	36	68	41	62
Region								
Western G.	32	28	23	34	26	53	35	48
Eastern G.	28	25	19	28	22	55	36	50
Total	31	28	22	33	26	54	36	49

Share in firms with product or process innovations (%).

A: Patent application
B: Utility model application
C: Registration of a design
D: Registration of a trademark
E: Copyright enforcement
F: Secrecy
G: Complex design
H: Lead-time advantage

Table 66. Highly important mechanisms used to protect intellectual property 2008-2010, innovators

	IP protection mechanisms							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Sector								
10-12	8	7	8	14	7	25	3	14
13-15	18	16	6	20	9	40	11	37
16-17	10	6	2	8	3	14	13	48
20-21	23	11	1	35	7	63	21	42
22	12	12	5	7	3	43	13	37
23	19	15	8	15	15	38	17	49
24-25	13	13	5	14	9	32	11	35
26-27	22	8	5	13	11	48	22	43
28	24	11	2	7	5	44	12	35
29-30	25	24	7	20	6	45	15	46
31-33	16	18	10	16	6	25	18	35
5-9, 19, 35	7	2	0	12	2	20	7	20
36-39	1	1	0	5	0	24	10	29
46	4	7	1	16	1	24	12	31
49-53, 79	1	0	0	3	2	15	3	15
18, 58-60	2	0	0	7	15	20	13	20
61-63	6	3	1	15	14	41	12	41
64-66	1	0	0	9	1	15	6	15
71-72	15	2	0	13	9	38	19	39
69, 70.2, 73	1	0	0	5	6	31	20	26
74, 78, 80-82	2	2	1	3	2	28	12	14
R&D-int. mf.	26	12	4	14	7	50	17	40
Other mf.	11	10	5	12	6	28	11	30
Knowl.-int. s.	6	2	0	11	10	34	16	32
Other services	2	4	1	9	1	22	9	22
Size Class								
5-49	7	6	2	10	6	29	13	29
50-249	14	9	3	13	6	38	12	35
250-999	32	15	7	25	9	47	12	40
1,000+	35	14	7	31	11	47	17	45
Region								
Western G.	10	7	3	12	6	31	13	30
Eastern G.	9	6	2	9	6	33	13	32
Total	10	6	3	11	6	32	13	30

Share in firms with product or process innovations that rated the respective mechanism to be highly important for protecting their IP (%).

A: Patent application
B: Utility model application
C: Registration of a design
D: Registration of a trademark
E: Copyright enforcement
F: Secrecy
G: Complex design
H: Lead-time advantage

Table 67. Medium important mechanisms used to protect intellectual property 2008-2010, innovators

	IP protection mechanisms							
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Sector								
10-12	3	6	6	9	4	14	16	19
13-15	3	6	3	14	4	15	14	9
16-17	5	5	4	2	1	28	5	8
20-21	5	7	4	17	7	17	15	15
22	14	12	6	20	10	12	13	11
23	18	14	8	13	9	20	20	10
24-25	7	8	2	4	1	16	13	7
26-27	16	16	8	12	9	22	13	18
28	18	8	2	11	3	19	11	14
29-30	12	9	4	7	7	23	12	19
31-33	4	9	8	7	5	10	6	11
5-9, 19, 35	9	9	4	11	6	6	3	5
36-39	6	5	5	5	5	10	3	5
46	1	3	0	14	0	2	5	3
49-53, 79	3	2	0	5	1	9	8	4
18, 58-60	1	3	1	4	2	7	10	13
61-63	7	5	2	13	6	16	15	9
64-66	1	0	0	4	1	17	11	14
71-72	11	9	2	7	8	14	12	17
69, 70.2, 73	1	2	2	8	4	16	12	14
74, 78, 80-82	0	2	3	3	1	14	8	10
R&D-int. mf.	16	11	5	13	6	20	13	17
Other mf.	6	8	4	8	4	15	12	11
Knowl.-int. s.	5	4	2	8	5	15	12	13
Other services	1	2	1	8	0	7	6	5
Size Class								
5-49	5	5	2	8	3	13	10	10
50-249	11	8	4	11	5	17	14	14
250-999	15	11	9	18	6	15	11	13
1,000+	12	16	9	15	8	17	12	13
Region								
Western G.	6	6	3	9	4	13	10	11
Eastern G.	7	6	2	8	4	17	15	12
Total	6	6	3	9	4	14	11	11

Share in firms with product or process innovations that rated the respective mechanism to be medium important for protecting their IP (%).

A: Patent application
B: Utility model application
C: Registration of a design
D: Registration of a trademark
E: Copyright enforcement
F: Secrecy
G: Complex design
H: Lead-time advantage

16.10 Marketing and Organisational Innovations

Table 68. Marketing, organisational and technological innovations 2004-2010

	Marketing innovators			*Organisational innovators*			*Marketing and/or organisational innovators*			*Marketing/-organisational and/or -product/process innovators*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector												
10-12	55	53	44	43	33	30	68	63	50	75	74	65
13-15	44	67	60	53	39	38	66	73	66	80	82	79
16-17	44	41	47	39	36	45	57	53	55	65	69	70
20-21	56	60	55	64	60	60	79	76	74	91	94	90
22	47	41	49	56	41	45	64	58	61	79	78	76
23	43	56	47	40	35	35	58	63	58	72	75	67
24-25	27	39	39	44	34	41	53	55	60	59	68	72
26-27	59	61	54	63	51	57	79	76	73	93	86	89
28	54	46	41	48	42	45	71	63	58	84	81	74
29-30	57	46	49	68	49	58	79	67	71	88	81	85
31-33	54	44	44	57	40	38	79	60	59	84	75	73
5-9, 19, 35	33	38	38	41	31	42	49	51	55	61	63	66
36-39	25	27	24	44	29	30	54	43	37	62	58	46
46	46	42	43	43	35	37	60	57	55	67	64	61
49-53, 79	20	29	27	25	32	29	33	40	40	46	53	48
18, 58-60	51	56	66	45	43	44	68	66	73	75	76	82
61-63	60	65	52	61	58	50	74	74	66	87	89	85
64-66	51	52	57	60	52	53	67	71	74	71	83	78
71-72	43	40	36	59	49	42	65	63	55	78	75	70
69, 70.2, 73	26	42	40	36	43	37	44	61	53	56	65	61
74, 78, 80-82	42	44	45	50	35	46	65	56	58	72	66	66
R&D-int. mf.	56	55	50	58	50	54	75	72	69	89	88	84
Other mf.	43	44	43	46	35	37	63	58	56	71	71	69
Knowl.-int. s.	39	47	45	48	48	43	57	65	59	68	74	71
Other services	36	38	38	39	34	37	52	51	51	61	61	58
Size Class												
5-49	39	42	40	42	36	37	56	56	53	66	68	64
50-249	49	51	52	58	53	57	72	69	70	82	78	80
250-999	62	61	61	73	64	68	84	81	79	90	89	89
1,000+	69	70	68	81	76	76	87	86	87	97	97	97
Region												
Western G.	41	43	43	44	39	40	58	58	56	68	69	67
Eastern G.	42	46	42	50	39	40	65	58	56	72	70	66
Total	41	44	42	45	39	40	59	58	56	69	70	67

Share in all enterprises (%).

Table 69. Marketing innovations 2004-2010

	Significant changes to the aesthetic design or packaging			*New media or techniques for product promotion*			*New methods for product placement or sales channels*			*New methods of pricing*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector												
10-12	24	33	25	38	19	29	13	16	12	16	14	17
13-15	32	40	28	20	24	32	19	27	29	13	16	23
16-17	11	10	25	24	15	30	22	17	19	22	19	16
20-21	31	34	30	29	29	23	25	23	30	20	25	19
22	14	14	21	29	18	26	22	20	20	18	16	18
23	18	18	21	29	26	27	22	25	19	24	18	20
24-25	6	13	12	13	22	16	12	20	18	8	15	14
26-27	27	34	29	26	24	23	33	31	28	23	20	21
28	28	19	16	25	17	26	23	25	24	20	15	11
29-30	31	22	33	27	21	22	21	15	24	10	11	12
31-33	35	27	27	34	20	26	26	23	19	16	17	12
5-9, 19, 35	9	7	12	20	16	23	16	10	18	19	23	22
36-39	7	7	9	14	11	12	10	8	10	12	14	14
46	16	22	18	24	18	22	20	14	26	14	16	18
49-53, 79	3	9	12	12	13	15	6	14	12	12	13	12
18, 58-60	22	23	32	28	34	33	25	29	39	18	26	30
61-63	32	31	26	31	38	21	36	37	29	27	26	27
64-66	15	27	25	29	26	27	31	32	32	18	16	17
71-72	14	17	18	22	20	18	15	21	19	18	15	16
69, 70.2, 73	6	14	15	16	21	26	11	25	22	10	11	9
74, 78, 80-82	8	9	18	26	16	31	13	15	25	22	27	13
R&D-int. mf.	31	28	26	24	22	26	27	27	27	18	18	16
Other mf.	17	19	19	26	19	24	17	19	18	15	16	16
Knowl.-int. s.	14	20	20	22	26	24	19	28	25	16	16	16
Other services	10	14	16	20	16	22	14	14	21	15	18	15
Size Class												
5-49	13	17	18	22	19	22	16	19	20	15	16	15
50-249	23	25	25	27	24	29	24	24	30	19	20	19
250-999	31	31	34	32	27	36	33	28	34	23	22	26
1,000+	43	33	39	45	36	44	44	31	42	38	26	29
Region												
Western G.	15	19	19	22	21	23	18	20	22	15	17	15
Eastern G.	13	16	16	25	17	24	15	20	20	17	17	17
Total	15	18	19	23	20	23	17	20	22	16	17	15

Share in all enterprises (%).

Table 70. Organisational innovations 2004-2010

	New business practices for organising procedures			*New methods of organising work responsibilities and decision making*			*New methods of organising external relations with other firms or institutions*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector									
10-12	28	21	17	22	20	17	13	8	9
13-15	28	23	25	36	24	23	19	12	17
16-17	28	23	28	24	26	24	14	17	18
20-21	45	41	35	40	31	43	35	22	33
22	36	29	29	43	20	26	18	13	19
23	25	15	16	26	20	24	27	17	22
24-25	27	24	24	32	22	29	13	10	11
26-27	41	35	41	47	29	37	28	20	22
28	36	27	29	31	23	29	16	16	23
29-30	49	37	38	44	28	37	28	12	21
31-33	42	22	24	33	16	21	24	17	14
5-9, 19, 35	24	16	21	33	19	29	21	13	20
36-39	25	15	15	29	17	23	23	10	9
46	19	21	23	28	16	23	14	12	21
49-53, 79	15	18	19	17	20	17	13	13	12
18, 58-60	23	24	24	35	25	30	22	15	17
61-63	40	39	32	35	35	29	35	26	24
64-66	44	35	34	46	29	39	31	18	23
71-72	33	29	28	33	27	23	29	25	18
69, 70.2, 73	21	32	29	26	19	23	20	12	17
74, 78, 80-82	23	20	26	39	22	37	12	4	13
R&D-int. mf.	40	34	36	38	28	35	25	18	25
Other mf.	30	22	22	30	21	24	16	12	13
Knowl.-int. s.	29	33	30	31	25	26	26	18	19
Other services	19	20	22	27	19	24	13	10	16
Size Class									
5-49	24	23	22	27	20	23	17	12	15
50-249	39	38	42	44	31	37	25	18	25
250-999	54	44	50	57	41	51	41	25	31
1,000+	69	50	61	66	45	57	53	33	40
Region									
Western G.	26	26	26	29	22	26	18	14	17
Eastern G.	28	23	24	33	22	25	21	13	16
Total	27	25	25	30	22	26	18	13	17

Share in all enterprises (%).

Table 71. Marketing and technological innovations 2004-2010

	Product or process innovators that have introduced ...											
	significant changes to the aesthetic design or packaging			*new media or techniques for product promotion*			*new methods for product placement or sales channels*			*new methods of pricing*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector												
10-12	35	43	31	52	26	35	19	22	22	16	16	19
13-15	34	56	34	26	28	34	25	27	31	19	15	32
16-17	22	16	46	22	18	40	26	21	21	32	27	15
20-21	37	37	34	34	32	27	32	26	35	25	28	19
22	20	18	33	33	24	34	25	26	20	21	22	23
23	21	26	38	38	33	41	31	35	26	44	24	20
24-25	13	22	19	22	30	18	22	29	24	14	20	17
26-27	31	42	34	30	28	24	36	36	32	25	23	24
28	36	25	22	26	24	33	27	31	30	23	16	14
29-30	38	28	40	32	27	24	24	18	29	10	13	10
31-33	38	41	37	31	33	30	36	32	28	16	23	17
5-9, 19, 35	16	10	20	34	22	37	24	16	25	29	35	37
36-39	20	8	26	29	17	25	22	16	25	18	25	32
46	30	46	31	42	33	43	34	27	51	21	29	27
49-53, 79	7	17	16	20	22	24	12	30	24	16	20	27
18, 58-60	25	37	38	36	45	44	26	36	51	22	34	25
61-63	38	39	29	35	44	24	41	43	34	32	29	31
64-66	30	32	34	39	37	39	37	41	49	24	25	28
71-72	23	26	28	26	26	28	24	30	30	22	23	21
69, 70.2, 73	9	27	26	29	26	37	15	35	35	11	24	18
74, 78, 80-82	17	21	29	44	22	42	18	21	37	22	19	19
R&D-int. mf.	37	33	31	26	27	30	31	31	32	20	20	18
Other mf.	25	29	29	35	27	30	24	26	26	21	21	19
Knowl.-int. s.	24	31	29	31	34	31	27	38	36	21	26	24
Other services	20	31	27	36	27	38	24	26	40	20	24	25
Size Class												
5-49	23	29	27	32	29	31	24	30	32	19	22	21
50-249	31	36	33	34	29	36	30	30	38	24	26	24
250-999	36	36	39	35	30	40	37	30	39	26	23	30
1,000+	45	35	41	48	37	46	46	32	43	41	26	31
Region												
Western G.	26	32	29	32	30	32	26	31	34	20	23	22
Eastern G.	23	26	27	39	22	32	24	29	30	20	22	21
Total	25	31	29	33	29	32	26	30	33	20	23	22

Share in all firms with product and/or process innovations (%).

Table 72. Organisational and technological innovations 2004-2010

	Product or process innovators that have introduced ...								
	New business practices for organising procedures			*New methods of organising work responsibilities and decision making*			*New methods of organising external relations with other firms or institutions*		
	04-06	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*	*04-06*	*06-08*	*08-10*
Sector									
10-12	40	31	27	23	35	24	17	15	19
13-15	36	34	33	42	27	34	23	17	20
16-17	52	37	45	40	36	28	22	25	17
20-21	45	45	40	42	34	47	35	23	37
22	44	39	38	54	26	35	24	18	24
23	42	24	29	37	29	36	36	27	34
24-25	50	35	37	56	32	39	27	16	18
26-27	45	41	48	50	34	43	34	23	25
28	41	34	41	35	29	38	18	20	31
29-30	54	44	42	47	35	43	31	15	26
31-33	63	24	31	43	23	29	41	24	16
5-9, 19, 35	39	22	31	48	22	38	30	14	23
36-39	39	24	28	44	23	43	46	16	22
46	26	29	35	41	24	43	20	14	34
49-53, 79	28	34	34	32	35	38	23	21	18
18, 58-60	33	33	32	46	33	33	30	21	21
61-63	51	46	36	38	39	32	39	31	26
64-66	54	42	42	69	35	47	47	27	28
71-72	45	38	38	40	36	27	37	36	22
69, 70.2, 73	36	63	47	48	27	42	27	22	35
74, 78, 80-82	41	38	42	46	34	45	23	8	18
R&D-int. mf.	45	39	44	42	31	41	28	21	30
Other mf.	45	31	34	41	31	32	26	18	19
Knowl.-int. s.	43	49	40	45	33	36	35	28	28
Other services	30	33	37	40	30	42	22	15	25
Size Class									
5-49	38	35	33	38	29	34	26	19	23
50-249	48	49	52	54	41	45	31	25	31
250-999	62	50	57	65	47	56	47	30	35
1,000+	72	52	63	69	47	59	56	35	41
Region									
Western G.	41	39	38	42	32	38	27	21	25
Eastern G.	41	33	36	42	27	34	31	18	23
Total	41	38	38	42	31	37	28	21	25

Share in all firms with product and/or process innovations (%).

16.11 Environmental Innovations

Table 73. Environmental process innovations 2006-2008 by type of environmental impact

	Process-related innovations with positive environmental impact								
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Sector									
10-12	40	61	39	23	31	18	26	13	39
13-15	37	38	23	16	18	11	16	19	33
16-17	35	44	38	22	19	10	36	18	39
20-21	50	54	41	30	43	23	25	45	51
22	48	48	30	23	24	17	29	29	54
23	46	48	43	33	38	31	40	24	51
24-25	35	41	30	21	21	14	30	23	32
26-27	50	52	34	25	23	16	26	44	50
28	32	39	28	21	20	13	29	30	40
29-30	49	58	45	31	32	26	40	43	52
31-33	48	41	28	22	22	14	24	23	38
5-9, 19, 35	21	38	39	29	30	21	22	20	30
36-39	23	45	44	30	36	28	34	22	55
46	27	30	26	16	13	12	15	22	35
49-53, 79	20	38	50	32	23	14	37	14	28
18, 58-60	40	35	28	19	23	14	22	26	37
61-63	17	22	14	8	3	5	5	3	11
64-66	33	28	15	5	8	7	6	5	26
71-72	31	34	24	17	18	12	17	16	19
69, 70.2, 73	16	11	5	5	4	2	3	1	6
74, 78, 80-82	36	36	30	25	28	25	26	26	38
R&D-int. mf.	45	49	34	26	26	17	30	39	47
Other mf.	37	46	34	23	25	17	28	22	39
Knowl.-int. s.	22	20	13	8	8	5	7	6	12
Other services	27	34	35	23	20	16	25	20	33
Size Class									
5-49	29	33	27	18	18	13	21	17	29
50-249	39	46	36	27	26	18	28	26	40
250-999	48	54	40	32	29	18	30	31	43
1,000+	58	64	59	46	42	31	44	42	55
Region									
Western G.	31	35	29	20	19	14	22	19	31
Eastern G.	31	36	27	18	18	13	24	16	30
Total	31	35	29	20	19	14	22	19	31

Share in all enterprises (%).

A: reduced material use per unit of output
B: reduced energy use per unit of output
C: reduced CO2 footprint
D: reduced air pollution
E: reduced water pollution
F: reduced soil pollution
G: reduced noise pollution
H: replaced materials with less polluting substances
I: improved recycling of waste/water/materials

Table 74. Environmental process innovations 2006-2008 with high environmental impact

	Process-related innovations with high environmental impact								
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Sector									
10-12	4.6	13.1	6.7	4.8	4.6	0.9	2.3	3.1	11.8
13-15	4.0	7.2	3.8	1.4	2.8	1.0	1.0	0.8	4.6
16-17	5.1	11.3	7.0	3.6	6.4	0.1	4.4	2.5	5.8
20-21	7.7	8.3	6.2	3.0	12.1	5.0	0.6	9.3	8.9
22	5.0	5.9	3.2	2.3	1.4	1.2	3.0	5.2	8.1
23	2.9	7.1	7.7	8.6	0.4	0.4	3.8	4.5	6.5
24-25	8.2	8.5	6.0	3.8	3.8	5.1	4.7	5.4	6.9
26-27	4.6	10.2	5.4	3.4	3.1	0.8	1.7	9.7	7.0
28	3.4	5.3	3.8	2.9	2.7	1.3	2.5	6.4	4.8
29-30	6.3	8.6	7.2	4.4	4.7	4.4	6.3	9.8	12.6
31-33	9.2	8.2	7.5	6.0	4.0	2.8	4.9	4.8	7.7
5-9, 19, 35	5.6	10.7	12.5	9.1	7.1	4.7	5.1	4.2	8.8
36-39	3.7	8.3	11.9	6.8	9.2	5.7	5.4	2.0	17.9
46	0.4	3.1	0.6	1.3	0.6	3.2	2.5	3.2	6.8
49-53, 79	2.5	11.2	16.4	7.3	2.6	4.8	12.9	1.1	3.1
18, 58-60	2.4	1.5	1.5	0.6	0.7	1.2	1.8	2.3	3.8
61-63	0.8	4.4	1.9	0.1	0.1	0.0	0.0	1.2	2.3
64-66	1.8	4.8	1.4	0.0	3.0	2.9	0.0	0.0	6.0
71-72	5.1	6.3	3.4	3.7	4.7	1.4	2.7	2.1	3.6
69, 70.2, 73	0.8	0.1	0.5	0.5	0.3	0.3	0.2	0.0	0.3
74, 78, 80-82	6.1	2.2	5.0	3.3	1.4	1.2	2.3	2.0	6.9
R&D-int. mf.	4.2	7.6	5.3	3.4	4.5	2.1	2.8	8.6	6.9
Other mf.	6.0	8.8	6.3	4.4	3.9	2.6	3.6	3.9	8.4
Knowl.-int. s.	1.9	2.7	1.5	1.1	1.5	0.7	0.7	0.8	2.0
Other services	2.5	5.6	7.1	3.8	1.4	3.3	6.0	2.2	5.6
Size Class									
5-49	3.3	5.7	4.8	2.9	2.2	2.3	3.7	2.8	5.6
50-249	4.9	7.9	7.7	4.8	3.8	2.0	3.1	3.4	5.6
250-999	6.6	9.3	8.0	6.0	4.5	2.5	3.5	4.9	6.2
1,000+	10.7	15.1	16.7	10.9	5.9	2.4	5.8	5.9	9.4
Region									
Western G.	3.6	6.3	5.3	3.4	2.3	2.4	3.8	2.9	5.7
Eastern G.	3.4	4.7	4.8	2.6	3.6	1.7	2.4	3.1	5.3
Total	3.6	6.1	5.2	3.3	2.5	2.3	3.6	2.9	5.7

Share in all enterprises (%).
A: reduced material use per unit of output
B: reduced energy use per unit of output
C: reduced CO2 footprint
D: reduced air pollution
E: reduced water pollution
F: reduced soil pollution
G: reduced noise pollution
H: replaced materials with less polluting substances
I: improved recycling of waste/water/materials

Table 75. Environmental product innovations 2006-2008 by type of environmental impact

	Product innovations with positive environmental impact					
	any impact			*high impact*		
	A	*B*	*C*	*A*	*B*	*C*
Sector						
10-12	43	36	32	9.6	6.7	8.7
13-15	34	23	25	8.4	5.0	3.3
16-17	30	20	25	4.4	3.9	3.7
20-21	51	47	41	11.0	15.9	8.6
22	40	29	36	10.8	7.7	13.5
23	47	46	34	7.9	6.1	8.2
24-25	35	27	20	6.7	4.0	1.0
26-27	52	28	42	15.8	5.6	5.1
28	43	34	31	10.8	8.4	6.2
29-30	46	41	40	11.5	7.4	3.8
31-33	39	20	32	8.5	2.9	10.4
5-9, 19, 35	31	40	18	6.7	9.6	4.9
36-39	45	45	30	11.1	10.1	8.0
46	37	26	31	3.5	3.5	5.1
49-53, 79	40	44	21	7.9	13.6	1.4
18, 58-60	28	21	20	1.7	1.0	1.3
61-63	28	15	13	7.1	3.0	3.9
64-66	20	2	14	1.1	0.4	1.3
71-72	34	29	17	13.2	9.8	4.4
69, 70.2, 73	16	3	8	0.8	0.3	0.0
74, 78, 80-82	40	35	28	4.8	9.1	5.4
R&D-int. mf.	50	37	38	12.9	8.9	6.2
Other mf.	38	30	27	7.8	5.1	5.8
Knowl.-int. s.	23	11	12	4.7	3.0	1.9
Other services	39	34	27	5.3	8.3	3.9
Size Class						
5-49	34	26	23	6.0	5.6	4.1
50-249	42	35	27	9.5	7.8	4.6
250-999	48	37	33	12.8	8.9	5.0
1,000+	60	51	42	23.4	19.3	9.0
Region						
Western G.	35	27	24	6.9	6.2	4.2
Eastern G.	35	27	23	5.3	5.1	3.9
Total	35	27	24	6.6	6.0	4.2

Share in all enterprises (%).
A: reduced energy use
B: reduced air, water, soil or noise pollution
C: improved recycling of products after use

Table 76. Motives for introducing environmental innovations 2006-2008

	Motives for introducing environmental innovations				
	A	*B*	*C*	*D*	*E*
Sector					
10-12	29	29	11	11	28
13-15	19	8	7	29	24
16-17	27	33	13	29	28
20-21	38	36	8	32	29
22	24	21	5	28	23
23	29	22	11	22	30
24-25	26	27	6	22	27
26-27	42	29	4	29	18
28	27	27	9	32	27
29-30	31	27	5	34	41
31-33	23	15	3	22	22
5-9, 19, 35	37	35	8	26	36
36-39	37	37	7	19	30
46	29	24	3	28	29
49-53, 79	36	38	32	10	39
18, 58-60	9	9	3	14	14
61-63	17	9	5	21	16
64-66	18	15	3	12	14
71-72	35	22	18	46	36
69, 70.2, 73	3	3	2	3	20
74, 78, 80-82	25	21	4	27	34
R&D-int. mf.	33	29	8	32	27
Other mf.	27	25	7	20	25
Knowl.-int. s.	16	11	7	20	23
Other services	31	29	14	21	34
Size Class					
5-49	26	23	10	20	28
50-249	29	28	11	27	25
250-999	33	32	8	33	32
1,000+	47	53	16	51	44
Region					
Western G.	27	24	9	22	28
Eastern G.	29	24	12	20	28
Total	27	24	10	22	28

Share in enterprises with environmental innovations (%).
A: Existing environmental regulations or taxes on pollution
B: Environmental regulation or taxes on pollution expected to be introduced
C: Availability of government grants, subsidies or other forms of financial incentives
D: Current or expected demand of customers for environmental innova
E: Voluntary codes or agreements for environmental good practice within the firm's sector

Table 77. Implementation of environmental management and auditing systems

	introduced before 2006		*introduced 2006-2008*		*not in place by the end of 2008*	
	a	*b*	*a*	*b*	*a*	*b*
Sector						
10-12	7	5	2	1	91	93
13-15	8	6	1	1	91	93
16-17	9	7	9	6	83	86
20-21	26	24	8	7	66	68
22	12	9	4	5	84	86
23	13	10	8	6	79	84
24-25	12	8	7	4	82	88
26-27	10	8	7	6	83	86
28	8	6	4	3	88	90
29-30	24	20	6	5	70	75
31-33	11	9	3	2	86	89
5-9, 19, 35	18	13	8	6	75	81
36-39	27	25	4	3	70	72
46	4	2	3	2	94	96
49-53, 79	12	8	3	2	85	89
18, 58-60	4	3	3	2	93	95
61-63	4	2	4	2	92	96
64-66	2	1	2	1	96	98
71-72	5	3	2	1	93	96
69, 70.2, 73	1	0	1	0	98	99
74, 78, 80-82	5	4	6	4	89	92
R&D-int. mf.	13	11	6	5	81	84
Other mf.	11	8	5	3	85	88
Knowl.-int. s.	3	1	2	1	95	98
Other services	7	5	4	3	89	93
Size Class						
5-49	6	4	3	2	91	95
50-249	17	13	8	6	75	80
250-999	30	24	15	12	55	64
1,000+	51	44	13	12	37	44
Region						
Western G.	8	5	4	3	88	92
Eastern G.	8	6	4	3	88	92
Total	8	5	4	3	88	92

a: Share in enterprises with environmental innovations (%).
b: Share in all enterprises (%).

16.12 Innovation and Investment

Table 78. Total investment 2008 by component

	Component of total investment										
billion €	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*Total*
Sector											
10-12	0.55	0.07	1.05	0.06	0.24	0.03	0.54	5.32	3.20	0.12	11.2
13-15	0.17	0.02	0.24	0.03	0.09	0.00	0.23	0.33	0.79	0.02	1.9
16-17	0.19	0.02	0.57	0.03	0.04	0.01	0.09	1.81	0.66	0.05	3.5
20-21	6.59	1.53	2.35	0.14	1.17	0.12	0.74	6.87	6.66	0.27	26.4
22	0.55	0.06	0.76	0.04	0.11	0.03	0.38	2.25	0.77	0.09	5.0
23	0.32	0.07	0.38	0.13	0.03	0.01	0.32	2.32	0.42	0.06	4.1
24-25	1.23	0.22	3.59	0.11	0.09	0.10	0.77	8.35	0.87	0.26	15.6
26-27	6.98	1.35	3.43	0.36	0.94	0.19	1.10	4.48	2.25	0.23	21.3
28	6.10	0.93	4.07	0.17	0.51	0.28	1.62	6.59	1.53	0.28	22.1
29-30	14.37	4.83	9.97	0.73	2.82	0.56	0.75	5.01	4.50	0.20	43.7
31-33	0.87	0.13	1.00	0.07	0.18	0.07	0.33	1.97	0.84	0.15	5.6
5-9, 19, 35	0.36	0.17	1.86	0.07	0.08	0.08	0.33	15.61	1.48	0.20	20.2
36-39	0.03	0.02	0.31	0.01	0.01	0.01	0.17	5.83	0.14	0.05	6.6
46	0.21	0.05	1.03	0.21	0.31	0.05	0.43	11.05	4.57	0.43	18.3
49-53, 79	0.18	0.11	4.32	0.12	0.14	0.23	0.42	18.19	1.78	0.38	25.9
18, 58-60	0.21	0.08	0.63	0.28	0.24	0.04	1.09	7.54	1.32	0.09	11.5
61-63	4.16	0.43	3.10	0.49	0.96	0.20	1.09	11.31	3.47	0.38	25.6
64-66	1.35	0.15	1.15	0.47	0.52	0.32	1.14	11.48	5.75	0.55	22.9
71-72	1.93	0.31	0.83	0.12	0.02	0.08	0.61	1.30	0.43	0.22	5.8
69, 70.2, 73	0.24	0.04	0.26	0.09	0.04	0.05	0.27	1.75	0.50	0.38	3.6
74, 78, 80-82	0.05	0.02	0.29	0.05	0.02	0.02	0.20	2.03	0.62	0.17	3.5
R&D-int. mf.	34.03	8.63	19.81	1.39	5.43	1.14	4.21	22.95	14.95	0.99	113.5
Other mf.	4.33	0.78	10.09	0.60	0.88	0.36	3.45	44.83	9.32	1.03	75.7
Knowl.-int. s.	7.83	1.01	5.64	1.39	1.78	0.68	3.92	32.34	11.34	1.59	67.5
Other services	0.44	0.17	5.64	0.38	0.47	0.30	1.05	31.28	6.97	0.98	47.7
Total	46.63	10.58	41.19	3.76	8.57	2.48	12.63	131.4	42.57	4.58	304.4

A: In-house R&D (excluding capital expenditure for R&D)
B: External R&D
C: Capital expenditure for fixed assets and software for product/process innovation
D: Capital expenditure for IPRs for product/process innovation
E: Marketing expenditure for product/process innovation
F: Training expenditure for product/process innovation
G: Other expenditure for product/process innovation (design, preparatory work etc.)
H: Capital expenditure for fixed assets, software and (selected) IPRs not for product/process innovation
I: Marketing expenditure not for product/process innovation
J: Training expenditure not for product/process innovation

Table 79. Total investment 2008 by component as a share of sales

share in sales (%)	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*Total*
Sector											
10-12	0.30	0.04	0.57	0.03	0.13	0.02	0.29	2.89	1.74	0.06	6.07
13-15	0.63	0.09	0.90	0.09	0.33	0.01	0.86	1.22	2.93	0.07	7.13
16-17	0.33	0.03	0.96	0.05	0.07	0.01	0.16	3.06	1.12	0.08	5.87
20-21	3.39	0.79	1.21	0.07	0.60	0.06	0.38	3.53	3.42	0.14	13.58
22	0.79	0.08	1.10	0.06	0.15	0.05	0.56	3.27	1.12	0.13	7.30
23	0.77	0.17	0.93	0.32	0.07	0.03	0.78	5.62	1.03	0.15	9.85
24-25	0.51	0.09	1.50	0.05	0.04	0.04	0.32	3.48	0.36	0.11	6.51
26-27	3.70	0.71	1.81	0.19	0.50	0.10	0.58	2.37	1.19	0.12	11.28
28	2.69	0.41	1.80	0.08	0.22	0.12	0.71	2.91	0.68	0.12	9.75
29-30	3.64	1.22	2.53	0.18	0.71	0.14	0.19	1.27	1.14	0.05	11.08
31-33	1.11	0.17	1.27	0.09	0.23	0.09	0.42	2.51	1.07	0.19	7.14
5-9, 19, 35	0.08	0.04	0.43	0.02	0.02	0.02	0.08	3.61	0.34	0.05	4.68
36-39	0.07	0.05	0.63	0.02	0.02	0.03	0.34	11.93	0.28	0.11	13.48
46	0.02	0.01	0.12	0.02	0.04	0.01	0.05	1.27	0.53	0.05	2.11
49-53, 79	0.07	0.04	1.55	0.04	0.05	0.08	0.15	6.52	0.64	0.14	9.27
18, 58-60	0.26	0.10	0.77	0.34	0.30	0.05	1.33	9.19	1.61	0.11	14.04
61-63	2.75	0.28	2.05	0.32	0.64	0.13	0.72	7.49	2.30	0.25	16.94
64-66	0.13	0.01	0.11	0.04	0.05	0.03	0.11	1.08	0.54	0.05	2.15
71-72	4.46	0.71	1.92	0.27	0.06	0.18	1.42	3.01	1.00	0.52	13.55
69, 70.2, 73	0.36	0.06	0.39	0.13	0.06	0.07	0.40	2.57	0.74	0.55	5.33
74, 78, 80-82	0.07	0.02	0.38	0.06	0.03	0.03	0.26	2.68	0.82	0.23	4.58
R&D-int. mf.	3.39	0.86	1.97	0.14	0.54	0.11	0.42	2.29	1.49	0.10	11.30
Other mf.	0.36	0.06	0.84	0.05	0.07	0.03	0.29	3.72	0.77	0.09	6.28
Knowl.-int. s.	0.56	0.07	0.41	0.10	0.13	0.05	0.28	2.33	0.82	0.11	4.87
Other services	0.04	0.01	0.46	0.03	0.04	0.02	0.09	2.55	0.57	0.08	3.89
Total	0.97	0.22	0.85	0.08	0.18	0.05	0.26	2.73	0.88	0.10	6.31

A: In-house R&D (excluding capital expenditure for R&D)
B: External R&D
C: Capital expenditure for fixed assets and software for product/process innovation
D: Capital expenditure for IPRs for product/process innovation
E: Marketing expenditure for product/process innovation
F: Training expenditure for product/process innovation
G: Other expenditure for product/process innovation (design, preparatory work etc.)
H: Capital expenditure for fixed assets, software and (selected) IPRs not for product/process innovation
I: Marketing expenditure not for product/process innovation
J: Training expenditure not for product/process innovation

Table 80. Total investment 2006, 2008 and 2010

billion €	*2006* A	*2006* B	*2006* Total	*2008* A	*2008* B	*2008* Total	*2010* A	*2010* B	*2010* Total
Sector									
10-12	2.46	8.07	10.52	2.54	8.64	11.18	2.06	8.03	10.09
13-15	0.61	1.38	1.99	0.78	1.13	1.92	0.71	1.11	1.83
16-17	1.27	2.45	3.72	0.95	2.51	3.47	0.90	2.50	3.40
20-21	11.75	11.01	22.76	12.62	13.80	26.42	12.91	11.19	24.10
22	1.80	3.11	4.91	1.92	3.12	5.04	1.71	3.56	5.27
23	0.99	2.34	3.33	1.26	2.80	4.07	1.03	2.31	3.35
24-25	5.54	7.08	12.62	6.12	9.48	15.60	4.48	7.05	11.53
26-27	15.21	6.12	21.32	14.33	6.96	21.30	13.57	6.97	20.55
28	11.39	6.91	18.30	13.67	8.41	22.08	12.15	6.11	18.26
29-30	28.38	9.96	38.35	34.02	9.72	43.74	34.01	9.23	43.24
31-33	1.98	3.21	5.19	2.65	2.97	5.62	2.73	3.03	5.77
5-9, 19, 35	2.64	14.27	16.91	2.95	17.29	20.24	3.19	19.95	23.14
36-39	0.74	4.70	5.43	0.57	6.02	6.59	0.40	4.48	4.88
46	3.16	11.78	14.94	2.28	16.05	18.33	2.80	15.47	18.27
49-53, 79	4.97	19.88	24.85	5.53	20.35	25.88	6.11	19.91	26.02
18, 58-60	1.94	8.47	10.41	2.57	8.95	11.52	1.94	9.95	11.89
61-63	8.57	13.64	22.21	10.42	15.15	25.58	10.05	14.18	24.23
64-66	5.89	15.39	21.28	5.11	17.78	22.88	5.48	15.96	21.44
71-72	2.42	1.48	3.90	3.89	1.96	5.85	3.47	2.03	5.50
69, 70.2, 73	0.80	2.05	2.84	1.00	2.63	3.63	0.99	3.08	4.07
74, 78, 80-82	0.65	2.57	3.22	0.65	2.82	3.48	0.79	3.54	4.33
R&D-int. mf.	66.74	34.00	100.74	74.64	38.89	113.53	72.64	33.50	106.14
Other mf.	18.77	48.11	66.88	20.48	55.19	75.67	17.70	53.36	71.06
Knowl.-int. s.	18.87	39.50	58.37	22.25	45.26	67.51	21.45	43.89	65.33
Other services	8.77	34.23	43.01	8.46	39.22	47.68	9.70	38.92	48.62
Total	113.15	155.84	269.00	125.83	178.56	304.39	121.48	169.67	291.15

A: Investment for product/process innovation
B: Investment not for product/process innovation

17 Annex: Questionnaires

17.1 MIP Questionnaire 2007

mmunity Innovation Survey 2007

ture Perspectives of the German Economy“

r Institut
System- und
Innovationsforschung

Aim of the Survey

The Directive (EG) 1450/2004 of the European Commission of August 13, 2004 commits member states to report biannually indicators on innovation activities of enterprises. For this purpose, a harmonised survey across Europe– the **Community Innovation Survey** – is conducted under the co-ordination of the Statistical Office of the European Commission (Eurostat). This years survey is aiming to collect information on innovation activities in the years 2004 bis 2006. The information gathered serves as a main base for economic policy decisions on regional, national and European levels in order to improve the business environment.

Die Community Innovation Survey in 2007 continues the annual **German Innovation Survey** which is conducted by the ZEW on behalf of the BMBF since 1993, entitled „Future Perspectives of the German Economy".

To whom the survey is addressed

The *Community Innovation Survey* addresses all enterprises (both private and publicly owned) out of a large number of sectors. In order to keep the burden to enterprises as low as possible, the questionnaire is sent to a randomly selected sample of enterprises only. The answers of these enterprises are used to subsequently calculate representative indicators for the German enterprise sector in total as well as for individual sectors and regions. It is therefore of utmost importance that preferably **all contacted enterprises respond and return the completed questionnaire**. This also holds true for enterprises without any innovation activities.

Who is conducting the survey

In Germany, the **Federal Ministry of Education and Research** (BMBF) has commissioned the Centre for European Economic Research (ZEW) together with the Fraunhofer-Institute System and Innovation Research (ISI) and the Institute for Applied Social Scie to conduct the *Community Innovation Surve*

What is happening with the data prov

The three institutions conducting the survey legal obligation to observe confidentiality. A vided by enterprises will be treated strictl tially, based on the provisions of data priva means that all collected data will be proces nymised way, i.e. without name and add enterprise, and only pooled data will be Published results will not allow any conclu data of individual enterprises. In other w **protection is fully guaranteed.**

How to answer the questionnaire

Please tick the correct answer in the co box:

☒

Please enter figures or text asked for in the l

In case a figure is equal to zero, please Please skip a question only in case of a co instruction to do so (➔).

When will you receive survey results

All enterprises that participate in this survey a Sector Report containing the main res sector they are active in, including a bench innovation activities. Sector Reports are exp sent out in April 2008.

Results of previous innovation surveys ca here: *www.zew.de/innovation*.

für Europäische
sforschung GmbH

of any queries to this survey, please contact:

Birgit Jesske · infas · Telephone 0228 3822 324 · E-Mail b.jesske@infas.de

Dr. Christian Rammer · ZEW · Telephone 0621 1235 221 · E-Mail rammer@zew.de

Dr. Torben Schubert · ISI · Telephone 0721 6809 357 · E-Mail torben.schubert@isi.fraunhofer.de

eturn completed questionnaires in the attached envelope to:

Institut für angewandte Sozialwissenschaft · Friedrich-Wilhelm-Str. 18 · 53113 B

ur enterprise part of an enterprise group? (corporate group or a consortium of several companies)?

national enterprise group .... ☐ 1 → The head office is located ... in the old German Länder ....
multinational enterprise group .... ☐ 2 ↗ ... in the new German Länder (incl. Berlin) ..
.... ☐ 3 ... abroad ....

ur enterprise controlled by a family - or part of an enterprise group controlled by a family?

e of an enterprise controlled by a family, family members hold at least 50% of the company's shares.

.... ☐ 1 No ....

e state the entity that your following statements will refer to.

nterprise .... ☐ 1 The whole enterprise group (corporate group) ....

n answering the following question, please refer only to those units of the entity stated in 1.3 located in Ge

was your enterprise's total turnover (incl. exports) **and export value from 2004 to 2006?**

e of a ***bank****: turnover = gross interests- and commission earnings; In case of an* ***insurance****: turnover = revenues from contributio*

	2004		2005		2006
ver (without VAT)	.000	EUR	.000	EUR	.0
thereof: exports	.000	EUR	.000	EUR	.0

was your enterprise's number (annual averages) of employees from 2004 to 2006?

	2004	2005	2006
yees (annual averages; oprentices and interns)		....	....
thereof: part-time employees		....	....

e estimate the percentage of your enterprise's employees holding a university degree in 2005 and 2006.

	2005		2006
ntage of employees holding an university degree niversity of applied sciences and of cooperative education) ... approx.		% .... approx.	

e state your enterprise's top-selling line of products/ services in 2006 and their share of sales. For this line please also estimate the average duration of the product life cycle.

Share of sales 2006 *Durat proc life c*

ca. ☐ %

e estimate your enterprise's market share within this line of products / services in 2006.

t share: your enterprise's turnover as a percentage of total turnover the relevant sales market (total turnover = your company's plus ompetitors' turnover)

Your company's market share within the top-selling line of products ca.

06, did your enterprise sell products/services predominantly in regional, national or international markets?

e check the answer that best describes your rise's main am sales market:

predominantly regional (within a radius of approx. 50 km
predominantly national (entire German territory) ....
predominantly international ....

e assess the intensity of competition within your enterprise's main sales market, with respect to...

	very intense	*intense*	*average*	*low*
....	☐ 1	☐ 2	☐ 3	☐ 4
of products/services	☐ 1	☐ 2	☐ 3	☐ 4
ncy of launches of new products	☐ 1	☐ 2	☐ 3	☐ 4

ion (new or improved) **must be new to your enterprise,** but it **does not need to be new to your sector or market**. It does not
vas originally developed by your enterprise or by other enterprises.

thetic modifications of products (e.g. colouring, styling) are not included. Also the **sale of innovations** that have been dev
clusively by other enterprises, does not count as product innovation in this sense.

➔ ***For examples on product innovations, see the expandable part on the right hand side!***

**g the three years 2004 to 2006, did your enterprise introduce new or significantly improved products/servi
arket?**

.... ☐ 1 No .... ☐ 2 ➔ Please continue with ***part 3.***

eveloped the product innovation(s)?

Primarily your enterprise or your enterprise group ....

Your enterprise in cooperation with other enterprises/institutions.................................

Primarily other enterprises/institutions ....

e describe your enterprise's most important product innovation during 2004-2006.

does your enterprise's turnover (incl. exports) divide into the following types of products in 2006?

e of a bank: turnover = gross interests- and commission earnings; In case of an insurance: turnover = revenues from contribution

introduced or significantly improved products/services from 2004 to 2006 .... approx.

nged or insubstantially changed products/services since 2004
e also include products/services developed and produced exclusively by other enterprises) .... approx.

Turnover in 2006: **1 0**

**any of your goods and services during the three years 2004 to 2006 new to the market –meaning that your
was the first provider of this product/service on the market?**

.... ☐ What was the share of sales of this innovation in 2006? .... approx.

.... ☐ 2

**any of your innovations during the three years 2004 to 2006 new to your company –meaning that there wa
ous version in your product line?**

.... ☐ What was their share of sales in 2006? .... approx.

.... ☐ 2

ll product innovations, there were precursory versions.

cess Innovation

novation is the implementation of a new or significantly improved production process, distribution method, or support activity for
It should have a noticeable impact on the level of productivity, the quality of your product/service or the cost of production/distribu
procedures that enabled the introduction of product innovations, also count as process innovations.

ion (new or improved) must be **new to your enterprise, but it does not need to be new to your sector or market.** What co
perspective on the subject matter. Likewise, it is irrelevant if the innovation was developed exclusively by your enterprise or in
Exclude purely **organisational changes** such as management-practices.

➔ ***For examples on process innovations, see the expandable part on the right hand side!***

g the three years 2004 to 2006, did your enterprise introduce new or significantly improved in-house proce
procedures for the provision of services and/or the delivery of products)

.... ☐ 1 No ....☐ 2 ➔ Please continue with ***part 4.***

eveloped the product innovation(s)? Primarily your enterprise or your enterprise group ne process innovations introduced by your enterprise from 2004 to 2006 reduce the average cost (per unit/c

.... ☐ 1 ➔ What was the reduction in average unit cost due to process innovations in 2006? .... approx.

.... ☐ 2

ne process innovation introduced by your company from 2004 to 2006 lead to a noticeable improvement of ucts' / services' quality?

.... ☐ 1 ➔ What was the increase in sales due to these improvements of quality in 2006? .... approx.

.... ☐ 2

oing, Discontinued and Planned Innovation Activities

our enterprise have any innovation activities to develop product or process innovations that were abando 004 to 2006 or still ongoing by the end of 2006?

le answers possible)	*Product innovations*	*Process*
ngoing, not yet completed innovation activities from 2004-2006	☐ 1	...
iscontinued innovation activities from 2004-2006	☐ 1	...
...		☐ 1

your enterprise intend to realise activities to obtain product- or process innovations in 2007 or 2008?

le answers possible)	*2007*	*2*
roduct innovations planned	☐ 1	...
rocess innovations planned	☐ 1	...
t determined	☐ 1	...
ovation activities planned	☐ 1	...

➔ In case you answered "No" on all questions 2.1, 3.1, 4.1 and 4.2, please continue with part 8 on page 5 !

vation Activities and Expenditure

expenditures include all expenditures including labour cost and investments for activities (listed below) concerning the devel of product- and process innovations:

esearch and experimental development (internal R&D expenditures)

of R&D-contracts to third parties (external R&D expenditures)

of advanced machinery, facilities, software and external knowledge (e.g. patents, licenses, trademarks) to realise innovation pro

esign, construction, design of services and other preparations for the production/sale and distribution of innovations.

external training specifically for innovation projects

innovations onto the market (Marketing campaigns directly linked to product innovations)

e estimate the total amount of expenditure for all innovation activities in 2006 (including labour cost, cost of r of external services and investments) **as well as for all investments for innovation.**

xpenditures for tion projects in 2006 .... approx. [.000] EUR ⟶ ***thereof***: investments for innovation projects .. approx. [.]

will be the expected changes in expenditures for innovation projects in 2007 and 2008 within your enterpr

ared to last year, the total expenditures for innovation projects will...	*2007*	*2*
ease	☐ 1	...
approx. the same (+/- 1 %)	☐ 2	...
rease	☐ 3	...
yet determined	☐ 4	...

e estimate the expected total expenditure for innovation projects in 2007 and 2008.

	2007	*2008*
xpenditure for innovation projects	.000	.000

ıncl. the development of software).

our enterprise realise in-house R&D activities during the years 2004 to 2006?

ontinually .... ☐ 1 Yes, occasionally .... ☐ 2 No ....

ıe estimate the total expenditure for R&D projects in 2005 and 2006.

	2005		2006
₹&D-expenditures (internal expenditures plus diture for R&D contracts to third parties) .... approx.	.000	EUR . approx.	.
ːD-expenditures	☐ 1	....	☐ 1

many employees have been assigned to R&D activities in 2005 and 2006 within your company?

	2005		2006
ı averages of number of employees assigned to R&D .... approx.		.... approx.	

lic Financial Support for Innovation

ncial support for R&D / innovation includes the financial sponsorship of R&D and Innovation projects through public authorit s, subsidies, shareholdings or credit guarantees. The **normal payment of orders** from public authorities **does not count as p t**. Please bear in mind indirect public support via authorised Institutions (e.g. project executing organisations or agencies like AiF ıanks).

our enterprise receive public financial support for R&D/innovation projects in the years 2004 to 2006?

	Yes	
ːederal states (federal government departments)	☐ 1	....
ıational government departments	☐ 1	....
→ *thereof*: ... Ministry of Economics (BMWi) Yes......... ☐ 1 No.......... ☐ 2		
... Ministry of Science (BMBF) Yes......... ☐ 1 No.......... ☐ 2		
ːuropean Union agencies	☐ 1	....
ɔthers, namely: .... [ ]	☐ 1	

straints to Innovation Activities

ıation activities can be hampered by several factors. Has your enterprise during the period from 2004 to 2(

	Yes	
ıificantly expanded the project duration of at least one innovation activity?	☐ 1	....
rted at least one innovation project?	☐ 1	....
rted at least one innovation project already during conception stage?	☐ 1	....

➔ *In case you answered "No" on all points of question 8.1, please continue with part 9!*

impacts on your enterprise's innovation activities had the following hampering factors during the time peı to 2006?

ɔle answers possible)	the duration of projects was extended	Projects were aborted	projects were not initiated
ı an excessive economic risk	☐ 1	☐ 1	☐ 1
ı substantial cost of innovation projects	☐ 1	☐ 1	☐ 1
ı the lack of internal sources of funding	☐ 1	☐ 1	☐ 1
ı the lack of suitable external sources of funding	☐ 1	☐ 1	☐ 1
ı internal resistance against innovation projects	☐ 1	☐ 1	☐ 1
ı organisational problems within the enterprise	☐ 1	☐ 1	☐ 1
ı the lack of suitable specialised staff	☐ 1	☐ 1	☐ 1
ı the lack of technological information	☐ 1	☐ 1	☐ 1
ı the lack of information about the market	☐ 1	☐ 1	☐ 1
ı a lack of consumer acceptance concerning innovations	☐ 1	☐ 1	☐ 1
ı legislature, legal regulations, norms	☐ 1	☐ 1	☐ 1

ıtangible assets) **and <u>innovation projects</u>** (according to questions 2.1, 3.1 and 4.1) **from 2004 to 2006.**

Used to finance ...

ıle answers possible) *investment* *innovat*

ch activities 2004-2006 .... ☐ 1 ....
ng business operation (profit/surplus, reserves) .... ☐ 1 ....
quity, admission of new shareholders, participation of other enterprises .... ☐ 1 ....
ıolders' loans, dormant equities, participation certificates .... ☐ 1 ....
of bonds and debt obligations .... ☐ 1 ....
ıt account advances, credit line .... ☐ 1 ....
ırked bank credits .... ☐ 1 ....
loans /supportive loans (e.g. from KfW, federal state banks) .... ☐ 1 ....
allowance/bonus .... ☐ 1 ....
.... ☐ 1 ....

ming your company had at its disposal an unexpected <u>additional profit</u> or <u>additional equity capital</u> of <u>10 %</u> <u>s turnover</u>. Which possibilities of resource-allocation would your enterprise choose most probably?

Yes

ılementation of (additional) <u>investments</u> .... ☐ 1 ....
ılementation of (additional) <u>innovation projects</u> .... ☐ 1 ....
ention / accumulation of reserves .... ☐ 1 ....
ıout of proprietors (incl. repayment of shareholders' loans) .... ☐ 1 ....
ıment of liabilities (e.g. payment of bank credits, supplier credit) .... ☐ 1 ....
estimation possible .... ☐ 1 ....

case you answered „Yes" on <u>question 9.2</u> <u>A.</u> or <u>B.</u>, please proceed to <u>question</u> <u>9.3</u> - otherwise to <u>questior</u>

ming, instead of the unexpected additional profit / additional equity capital mentioned above, your compar ss to a credit of the same amount and with a comparatively attractive interest rate. Would your enterprise iı implement the considered investments / innovation projects as well?

ıle answers possible)

nplementation of <u>investments</u> is very probable .... ☐ 1
nplementation of <u>innovation projects</u> is very probable .... ☐ 1
ther improbable .... ☐ 1
ıtion impossible .... ☐ 1

o what <u>reasons</u> would your enterprise <u>abstain from</u> the implementation of additional investments or innova cts in case of pure credit financing?

ıle answers possible) *Investment* *Innovat*

sive <u>dependency</u> on lender .... ☐ 1 ....
sive <u>interest rate</u> payments .... ☐ 1 ....
ırns about the possible <u>divulgement of project-relevant company data</u> .... ☐ 1 ....
ırns about the <u>securities</u> to be provided .... ☐ 1 ....
.... ☐ 1 ....

was your company's equity-to-assets ratio in <u>2006</u>, and <u>how did it change respective 2004</u>?

-to-assets ratio: capital stock + reserves + returns [- loss] in % of balance sheet total = (fixed- + circulating assets)

-to-assets ratio in 2006: .... approx. ☐ % → Change respective to 2004: increased ....
approx. equal ....
decreased ....

kind of outside-capital financing was most important for your enterprise in 2006?

e only one answer)

m- and longterm bank credits (credits with a duration of more than 1 year) ....
erm bank credits (credits with a duration of up to 1 year) ....
ıolder's loan ....
finanacial liabilities (e.g. leasing duties, bonds, obligations, mezzanine capital). ....

esign of packaging, product placement, product promotion or pricing and must be part of a **new marketing concept or strategy**
ificant departure from the firm's existing marketing methods.

that seasonal, regular and other routine changes in marketing instruments are not marketing innovations.

e indicate whether your enterprise has introduced marketing innovations in any of the following four areas
g during the three years 2004-2006.

		Yes
ct design	Introduction of significant changes in product design (incl. packaging) as a result of new marketing concepts ...... (e.g. introduction of new design or packaging concepts to target new customer groups)	☐ 1
t./Brands	Introduction of new media or techniques for product promotion ...... (e.g. first time use of a new media for advertising products, first time use of brand names, introduction of a new branding system, introduction of loyalty cards)	☐ 1
channel	Introduction of new methods for product placement (incl. new sales channels)...... (e.g. franchising, direct selling, exclusive retailing, new concepts for product presentation)	☐ 1
g policy	Introduction of new methods for pricing of products ...... (e.g. pricing by demand, first time use of discount systems)	☐ 1

e estimate your company's total marketing expenditures in 2006. Please also estimate the percentage of e
assigned to marketing innovations (according to question 10.1).

ting expenditures include all internal and external expenditures for advertisement (incl. trade marketing), for the conceptual de strategies, market and costumer research, and the installation of new distribution channels. **Pure selling costs do no count a** ditures.

narketing expenditures
6 (internal + external) .... approx. [.000] EUR → ***Thereof***: Share of expenditures for marketing innovations .... approx. [ ]

ırketing expenditures in 2006 .... ☐ 1 No expenditures for marketing innovations in 2006 ......

➔ *In case you answered „No“ on all four points of question 10.1, please continue with part 11!*

e state the relationship between your companies' marketing innovations from 2004 to 2006 and possible p
rocess innovations. (according to questions 2.1 and. 3.1)

ase your company did not introduce any product or process innovations. (according to questions 2.1 and. 3.1), ase skip this question!

	Yes, completely	*In part*	
ting innovations were linked to the introduction of new products (*acc. to quest.* 2.1)	☐ 1	☐ 2	......
ting innovations were linked to the introduction of new processes (*acc. to quest.* 3.1)	☐ 1	☐ 2	......
‹penditures for marketing innovations are included in al expenditures for innovations (= as stated in quest. 5.1)	☐ 1	☐ 2	......

anisational Innovation

tional innovation is the implementation of a **new organisational method** in the firm's business practices, workplace organisation **t has not been used before in the firm** and is the result of **strategic decisions** taken by management.

that mergers with, and the acquisition of other firms are **not** considered organisational innovations, even if a firm merges with or the first time.

e indicate whether your enterprise introduced organisational innovations in any of the following three are
ree years 2004-2006.

		Yes
ess organisation	Introduction of new methods for organising business practices ...... (e.g. supply chain management systems, business reengineering, lean production, quality-management sy knowledge management systems or education and training systems)	☐ 1
ledge management	Introduction of new systems of knowledge management ...... (e.g. methods to use or share information within the enterprise and to use external information)	☐ 1
ır organisation	Introduction of new methods for workplace organisation ...... (e.g. decentralisation of decision making, job rotation, team work, integration or de-integration of departme	☐ 1
ıal Relations	Introduction of new methods for organising external relations with other firms or public institutions ...... (e.g. alliances, partnerships, outsourcing, supplier integration)	☐ 1

ntage of employees directly affected by organisational innovations .... approx. [ ]

No estimation possible.......................

e state the relationship between your companies' organisational innovations from 2004 to 2006 and possil nd process innovations. (according to questions 2.1 and. 3.1)

case your company did not introduce any product or process innovations. (according to questions 2.1 and. 3.1), please skip this q

	Yes, completely	*In part*
isational innovations were linked to the introduction of new products	☐ 1	☐ 2
isational innovations were linked to the introduction of new processes	☐ 1	☐ 2 ....
penditures for organisational innovations are included in al expenditures for innovations (= as stated in quest. 5.1)	☐ 1	☐ 2 ....

ic Financial Information

were your enterprises' estimated total payroll costs and expenditures for materials, intermediate inputs, e port in 2005 and 2006?

	2005		*2006*
l costs (incl. employee benefits, social security utions, pension costs and other social costs) .... approx.	.000	EUR .... approx.	.
ditures for materials, intermediate inputs, , transport, incl. services obtained .... approx.	.000	EUR .... approx.	.

were your enterprises' estimated expenditures for professional training in 2005 and 2006?

	2005		*2006*
ditures for professional training al plus external) .... approx.	.000	EUR .... approx.	.

was your enterprises' estimated gross investment in fixed assets (= gross addition of fixed assets) **and what l stock of tangible assets in 2005 and 2006?**

	2005		*2006*
investment in fixed assets .... approx.	.000	EUR .... approx.	.
of fixed assets at the beginning of the year .... approx.	.000	EUR .... approx.	.

was your enterprises' estimated operating margin (= Profit before taxes on income as a percentage of turr and 2006? *In case of a bank: Please use return on assets instead of the operating margin.*

	2005	*2006*
0 %	☐ 1	☐ 1
to < 2 %	☐ 2	☐ 2
to < 4 %	☐ 3	☐ 3
to < 7 %	☐ 4	☐ 4
to < 10 %	☐ 5	☐ 5
to < 15 %	☐ 6	☐ 6
and more	☐ 7	☐ 7
imation possible..	☐ 8	☐ 8

Thank you very much for your valuable help!

urther enquiries, please state your name and your contact details:

sponder:	Company's address (-stamp):
in the enterprise:	

17.2 MIP Questionnaire 2009

Perspectives of the German Economy – Services for the Future

Institut System- und Innovationsforschung

n für Europäische aftsforschung GmbH

Aim of the survey

Regulation (EC) 1450/2004 of the European Commission of 13 August 2004 commits member stat biannually indicators on innovation activities of enterprises. For this purpose, a harmonized su Europe – the **Community Innovation Survey** – is conducted coordinated by the Statistical Office pean Commission (Eurostat). The aim of this year's survey is to collect information on innovation act years 2006 to 2008. The information gathered serves as an important basis for economic policy c regional, national and European levels in order to improve the business environment.

Who is conducting the survey?

In Germany, the Federal Ministry of Education and Research (BMBF) has commissioned the Cent pean Economic Research (ZEW) together with the Fraunhofer-Institute for System and Innovatio (ISI) and the Institute for Applied Social Sciences (infas) to conduct the Community Innovation Survey

What happens to the data you provide?

The three institutions conducting the survey bear full legal responsibility for data protection. All data enterprises will be treated strictly confidentially, based on the provisions of data privacy law. This collected data will be processed anonymously, i.e. without names and addresses, and only pooled analyzed. It will not be possible to identify the data from individual enterprises from the published resu words: data protection is fully guaranteed.

Further information on the German Innovation Survey you can find on www.zew.de/innovation.

How to answer the questionnaire

Please tick the correct answer in the corresponding box: ☒

If a number is equal to zero, please enter a "0".

Please enter the numbers or text requested in the large boxes: 87

Please skip a question only if instructed to do so.

e of any queries about this survey, please contact:

it Jesske · infas · Telephone 0228 3822 501 · E-Mail b.jesske@infas.de

Christian Rammer · ZEW · Telephone 0621 1235 221 · E-Mail rammer@zew.de

Torben Schubert · ISI · Telephone 0721 6809 357 · E-Mail schubert@isi.fraunhofer.de

Please return completed question the **enclosed envelope** to:

infas
Postfach 24 01 01
53154 Bonn

eral Information on your Enterprise

ur enterprise part of an enterprise group (corporate group or a consortium of several enterprises)**?**

national enterprise group .... ☐ 1 → The head is located: ... in the old German *Länder* [states] ....

multinational enterprise group .... ☐ 2 ↗ ... in the new German Länder (incl. Berlin) ..

.... ☐ 3 ... abroad ....

Country:

se state the entity that your following statements in the questionnaire will refer to.

nterprise .... ☐ 1 The entire enterprise group (corporate group) ....

When answering the following questions, refer only to the entity given in 1.2 and only to activities in Germa

: was your enterprise's average number of employees from 2006 to 2008?

	2006	*2007*	*2008*
yees (annual averages; incl. ntices and interns)			
This includes: part-time employees			

se estimate the percentage of your enterprise's employees holding a university degree in 2007 and 2008

ver (without VAT) .... .000 EUR ..... .000 EUR 0

This includes: Exports .... .000 EUR ..... .000 EUR 0

se state your enterprise's top-selling line of products/services in 2008 and its share of sales.

Share

e estimate your enterprise's market share within this line of products / services in 2008 and how the marke hanged since 2006.

***t share:** your enterprise's turnover as a percentage of total turnover within the applicable sales market (total turnover = your ente our competitors' turnover)*

nterprise's market share within -selling line of products.........ca. % below 0.1% ☐ 1

➔ Change of the market share between 2006 und 2008: increased .... unchanged .... decreased ....

ich geographic markets did your enterprise sell goods and/or services in 2008?

le responses possible)

al / regional within Germany .... ☐ 1
ional (other regions of Germany) .... ☐ 1
er European Union (EU), EFTA, or EU candidate countries * .... ☐ 1
other countries .... ☐ 1

Which of these geographic areas was your largest market in terms o turnover between 2007 and 2009? *(Give corresponding letter)* ....

se indicate to what extent the following characteristics describe the competitive situation in your main mar

e mark an X for each line.)

	Applies fully	*Applies somewhat*	*Applies very little*
threat to market position because of entry of new competitors	☐ 1	☐ 2	☐ 3
cts/services are quickly outdated	☐ 1	☐ 2	☐ 3
cts from competitors are easily substituted for those of your enterprise	☐ 1	☐ 2	☐ 3
etitor's actions are difficult to predict	☐ 1	☐ 2	☐ 3
demand is difficult to predict	☐ 1	☐ 2	☐ 3
competition from abroad	☐ 1	☐ 2	☐ 3

duct Innovations

novation describes a product (incl. services) whose components or basic characteristics (technical features, components, inte ations, user friendliness, availability) are either new or significantly improved.

ion must be **new to your enterprise**, but it does **not need** to be **new to your sector or market**. The sole significant factor is uation of it. It does not matter if the innovation was developed by your enterprise alone or in collaboration with other enterpri **nodifications** of products (e.g. colouring, styling) are **not** regarded as product innovations. **Selling alone of innovations** tha nd produced entirely by other enterprises, also does **not** count as product innovation in this sense.

➔ For examples of product innovations, see the foldout section

ng the years 2006 to 2008, did your enterprise introduce new or significantly improved products/services?

.... ☐ 1 No .... ☐ 2 *➔ Please continue with **section 3***

se product innovations relate to *le responses possible)*

goods (= physical products, incl. software) ....
services ....

eveloped the product innovation(s)?

Primarily your enterprise or enterprise group ....
Primarily your enterprise in cooperation with other enterprises/institutions ....
Primarily other enterprises/institutions ....

does your enterprise's turnover (incl. exports) **break down among the following types of products in 2008?**

introduced or significantly improved products/services during 2006-2008 ....ca.

.... ☐1 ➔ What was the share of sales of these innovations in 2008? ....ca.
.... ☐2

any of the product innovations introduced during the three years 2006 to 2008 new to your enterprise's pr
, i.e. there was no previous version in your enterprise's product line?

.... ☐1 ➔ What was their share of sales in 2008? ....ca.
.... ☐2

ny of the product innovations introduced during the three years 2006 to 2008 demand new development o
ficant improvement of process technology (machinery, devices, equipment, IT-systems, logistic systems etc.)?

r all .... ☐1
r most .... ☐2
r some .... ☐3
none .... ☐4

cess Innovations

ss innovation is the implementation of a new or significantly improved manufacturing/production process, distribution method or goods or services. It should have a noticeable impact on the level of productivity, the quality of your product/service or the cos ribution. Newly introduced procedures that enabled the introduction of product innovations, also count as process innovations.

ovation must be **new to your enterprise**, but your enterprise does **not need** to be the **first to introduce** it. The significant facto s evaluation of it. It does not matter if the innovation was developed by your enterprise alone or in collaboration with other **rganizational changes** such as the introduction of **new management practices** are **not** process innovations.

➔ For examples of product innovations, see the fold-out section at left.

g the years 2006-2008, did your enterprise introduce new or significantly improved internal processes (inc
for service performance and product delivery)?

.... ☐1 ➔ No .... ☐2 *➔ Please continue with section 4*

se process innovations relate to
le responses possible)

... a manufacturing process and/or procedure for service delivery ....
...logistics procedures, delivery/distribution methods ....
... supporting activities for your processes (e.g. maintenance, accounting, EDP) ....

eveloped the product innovation(s)?

Primarily your enterprise or enterprise group ....
Primarily your enterprise in cooperation with other enterprises/institutions ....
Primarily other enterprises/institutions ....

he process innovations introduced by your enterprise during 2006-2008 reduce the average cost (per unit/o

.... ☐1 ➔ What was the reduction in average unit cost due to process innovations in 2008? ....ca.
.... ☐2

he process innovations introduced by your enterprise during 2006-2008 lead improvement in the quality?

.... ☐1 ➔ What was the increase in turnover due to these quality improvements in 2008? .... ca.
.... ☐2

any of your process innovations introduced between 2006 and 2008 new to your market, i.e. no other ente
market has applied these process innovations yet (that is your enterprise is the first innovator)?

.... ☐1
.... ☐2
own .... ☐3

rogress, Discontinued and Planned Innovation Activities

our enterprise have any on-going activities in 2006 to 2008 to develop or introduce product or process inn
ere discontinued or were still in progress at the end of that period? Also include ongoing and abandoned
s, including contract R&D for third parties!

le responses possible)

	Product innovations	*Process innovations*	*ass*
novation activities in progress in 2006-2008	☐1	☐1	
iscontinued innovation activities in 2006-2008	☐1	☐1	

roduct innovation activities planned .... ☐1 ..
rocess innovation activities planned .... ☐1 ..
ınovation/ R&D activities planned, assignment to product or process innovations not possible .... ☐1 ..
t determined .... ☐1 ..
ı R&D or innovation activities planned .... ☐1 ..

➔ ***If you answered NO to questions 3.1, 4.1, 5.1 and 5.2 then continue with section 11 on page 7!***

›vation Activities and Innovation Expenditures

h of the following innovation activities did your enterprise carry out during 2006-2008?

Yes

-house research and experimental development (**internal R&D**) .... ☐1 ..
ystematic creative work for the expansion of available knowledge and utilization of the knowledge gained in that way on evelopment of new applications, e.g. newer or noticeably improved products or processes (including software development)

yes: Was R&D conducted **continuously** or **occasionally** .... continuously .... ☐1
occasionally .... ☐2

warding of R&D contracts to third parties (**external R&D**) .... ☐1 ..
ame activities as above, but carried out by other enterprises or research institutes

cquisition of **machinery, facilities** and **software** to realize innovation projects .... ☐1 ..
achinery, facilities, computer hardware and software procured for the introduction of product or process innovations

cquisition of other **external knowledge** .... ☐1 ..
cquisition of patents, unpatented inventions, licenses, and trademarks associated with innovation projects

rofessional development measures for innovation projects .... ☐1 ..
ternal or external employee training and continued education directly related to innovation projects

arket launch of innovations .... ☐1 ..
ternal or external marketing activities, including market research, directly related to innovation projects

roduct design, service philosophy, preparation of production/distribution for innovations .... ☐1 ..
reparations for the introduction of product or process innovations, such as design, prototype manufacture, design work

se estimate the total amount of expenditures for all innovation activities (sum of items A to G, as per questior **as well as all the amount of capital expenditure for innovation.**

Innovation expenditures *include all expenditures for personnel and consumables, including services provided by third parties capital expenditure. Total innovation expenditures include all types of* ***R&D expenditures****.*

Capital expenditures *(capex) for innovation include the purchase of fixed investment and intangibles used to realize innovatic*

ɜxpenditures
8 .... ca. [.000] EUR ⟶ ***This includes:*** *Capital expenditures* for innovation projects .... ca. [.]

ɔenditures for innovation projects in 2008 ... ☐1 | No capex for innovation projects in 2008 .... ☐1

se estimate the amount of your enterprise's expenditures in 2008 for innovation activities A. to D. (as stated .1). **Please fill in "0" if no expenditures have been made in the respective field of activity in 2008.**

ıouse R&D (incl. capex cally for R&D) .... ca. [.000] EUR | C. Acquisition of machinery/software for innov. (less R&D capex) .... ca. [.]

ernal R&D (R&D contracted third parties) .... ca.. [.000] EUR | D. Acquisition of other external knowledge .... ca. [.]

: will be the anticipated changes in total innovation expenditures (as stated in question 5.1) **by your enterpris 2010?**

tal innovation expenditures compared with the **previous year** will ... *2009* *2*

ease .... ☐1 ....
' approx. the same (+/- 1 %) .... ☐2 ....
rease .... ☐3 ....
yet determined .... ☐4 ....

se estimate the expected total innovation expenditures in 2009 and 2010.

2009 *2010*

Total number of innovation projects executed in the years 2006 to 2008 (newly started, ended, still ongoing projects)	thereof: '06-'08 newly started	'06-'08 successfully completed	still ongoing at the end of 2008	al
ca. ...	...	...	...	...

your enterprise allocate the majority of funds for innovation projects at the start of a project or step by ste milestones)?

ty at the start .... ☐ 1

Step by step .... ☐ 2 ➔ How many steps does such an allocation process typically involve? .....

) / Innovation Support

upport includes the financial encouragement of R&D and Innovation projects by public authorities, e.g. by grants, loans, subsidie credit guarantees. The **normal payment for contracts** by public authorities **does not count as public financial support**. Pleas ration public support through authorized agencies.

our enterprise receive public financial support for innovation projects during 2006-2008?

		Yes
states (state government departments)		☐ 1 ....
national government (federal departments)		☐ 1 ....
→ *Including:* ... Ministry of Economics and Technology (BMWi)	Yes .... ☐ 1 No .... ☐ 2	
... Ministry of Education and Research (BMBF)	Yes .... ☐ 1 No .... ☐ 2	
the European Union		☐ 1 ....
→ *Including:* ... 6./7. Community RTD Framework Programme	Yes .... ☐ 1 No .... ☐ 2	
others, namely: ...		☐ 1

ovation Objectives

important were each of the following objectives for your activities to develop product (good or service) or ations between 2006 and 2008?

e mark at last one X for each line!)

	Relevance of the objective: *high*	*medium*	*low*
se range of goods or services	☐ 1	☐ 2	☐ 3
ce outdated products or processes	☐ 1	☐ 2	☐ 3
new markets	☐ 1	☐ 2	☐ 3
se market share	☐ 1	☐ 2	☐ 3
ve quality of goods and services	☐ 1	☐ 2	☐ 3
ve flexibility for producing goods or services	☐ 1	☐ 2	☐ 3
se capacity for producing goods and services	☐ 1	☐ 2	☐ 3
ase labour costs per unit output	☐ 1	☐ 2	☐ 3
ase material or energy cost per unit/operation	☐ 1	☐ 2	☐ 3
tion in environmental load	☐ 1	☐ 2	☐ 3
vement of health and safety	☐ 1	☐ 2	☐ 3
iance with laws and regulations	☐ 1	☐ 2	☐ 3
iance with norms and standards	☐ 1	☐ 2	☐ 3

rces of Information

ng the three years 2006 to 2008, how important to your enterprise's innovation activities were each of the fo nation sources?

e mark an X on each line!)

	Relevance of the source of information: *high*	*medium*	*low*
es within your enterprise or enterprise group	☐ 1	☐ 2	☐ 3
s or costumers	☐ 1	☐ 2	☐ 3
ers of equipment, materials, components, or software	☐ 1	☐ 2	☐ 3
etitors or other enterprises in your sector	☐ 1	☐ 2	☐ 3
ltants, commercial labs, or private R&D institutes	☐ 1	☐ 2	☐ 3
sities or other higher education institutions	☐ 1	☐ 2	☐ 3
nment research institutes	☐ 1	☐ 2	☐ 3
rences, trade fairs, exhibitions	☐ 1	☐ 2	☐ 3

and/or with non-commercial organizations such as universities or research institutes. This should not mean that both partners g
enefit out of the collaboration. **Straightforward contract awards**, which do not involve any active collaboration, are **not regarde**

ng the three years 2006 to 2008, did your enterprise co-operate on any of your innovation activities with oth
s or institutions?

.... ☐ 1 No .... ☐ 2 ➔ *Please continue with section 1*

se indicate the type of innovation co-operation partner by location

ll that apply)	*Germany*	*elsewhere in Europe*[1]	*United States*	*China, India*	
er enterprises within your enterprise group	☐ 1	☐ 1	☐ 1	☐ 1	....
nts or costumers	☐ 1	☐ 1	☐ 1	☐ 1	....
pliers of equipment, materials, components, or software	☐ 1	☐ 1	☐ 1	☐ 1	....
npetitors or other enterprises in your sector	☐ 1	☐ 1	☐ 1	☐ 1	....
nsultants, commercial labs, or private R&D institutes	☐ 1	☐ 1	☐ 1	☐ 1	....
versities or other higher education institutions	☐ 1	☐ 1	☐ 1	☐ 1	....
vernment research institutes	☐ 1	☐ 1	☐ 1	☐ 1	....

ean Union (EU) countries, EFTA (Suisse, Norway, Iceland), or EU candodate countries (Croatia, Turkey, Macedonia)

h type of co-operation partner did you find the most valuable for your enterprise's innovation activities?
corresponding letter to question 10.2)

eration partner with the greatest contribution: .... ☐ No estimation possible .... ☐ 1

vation Perspectives

h changes do you expect in the following factors relevant to innovation during the year 2009, and which in
changes, if so, most likely have on innovation activities of your enterprise in 2009?

e evaluate for each factor listed below to what extent this factor affects the ability and readiness of your enterprise to engage in in
ts and to fund innovation activities.

terprises without any ongoing innovation activities: Please evaluate the effect of each factor on a likely start of innovation activitie

	*expected **change** in **2009***					→ *most likely **impac** **innovation activitie***	
	strong decrease	*moderate decrease*	*no change*	*moderate increase*	*strong increase*	*negative*	*neutral*
bility of internal funds , cash-flow)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 1	☐ 2 ..
bility of external funds , external equity etc.)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 2	☐ 2 ..
bility of suitable lized staff	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 1	☐ 2 ..
nd for tive products	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 1	☐ 2 ..
e of public financial support) and innovation activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 1	☐ 2 ..
ity of competition sales market	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 1	☐ 2 ..

keting Innovation

arketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterprise's e
keting methods and which has not been used before.· It requires significant changes in product design or packaging, product pla
duct promotion or pricing. Exclude seasonal, regular and other routine changes in marketing methods.

se indicate whether your enterprise has introduced marketing innovations in any of the following four area
g during the three years 2006-2008:

	Yes
cant changes to the aesthetic design or packaging of a good or service ... *de changes that alter the product's functional or user characteristics- these are product innovations)*	☐ 1 ..
nedia or techniques for product promotion, introduction of brands ... *e first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc)*	☐ 1 ..
nethods for product placement or sales channels (incl. new ways to present products and services) ... *st time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)*	☐ 1 ..

ıce products to new costumer groups	☐ 1	☐ 2	☐ 3
ıce products to new geographic markets	☐ 1	☐ 2	☐ 3

anizational Innovation

ıtional innovation is a **new organizational method** in your enterprise's business practices (including knowledge management or external relations that **has not been previously used** by your enterprise. It must be the result of strategic decisions taken de mergers or acquisitions, even if for the first time.

se indicate whether your enterprise introduced organizational innovations in any of the following three are 2008.

	Yes
usiness practices for organizing procedures *ıpply chain management, business re-engineering, knowledge management, lean production, quality management, etc)*	☐ 1
ıethods of organizing work responsibilities and decision making *am work, decentralization, integration or de-integration of departments, job rotation, etc)*	☐ 1
ıethods of organizing external relations with other firms or public institutions *st use of alliances, partnerships, outsourcing or sub-contracting, etc)*	☐ 1

➔ If NO to all options, please continue with section 14!

important were each of the following effects for your enterprise's organizational innovations introduced 2

	high	*medium*	*low*
ːe time to respond to customer or supplier needs	☐ 1	☐ 2	☐ 3
ve ability to develop new products or processes	☐ 1	☐ 2	☐ 3
ve quality of your goods or services	☐ 1	☐ 2	☐ 3
ːe costs per unit output	☐ 1	☐ 2	☐ 3
ve communication or information sharing (both internal and external)	☐ 1	☐ 2	☐ 3

ovations with Environmental Benefits

mental innovation is a new or significantly improved product (good or service), process, organizational method or marketing ironmental benefits compared to alternatives. The environmental benefits can be the primary objective of the innovation or the re bjectives. The environmental benefits of an innovation can occur **during the production** of a good or service, or during the aft service by the **end user**.

ng the three years 2006 to 2008, did your enterprise introduce innovations that had any of the following en al benefits, and if yes, was their contribution to environmental protection high, medium or low?

mark an X in each line!	*Yes, high*	*Yes, medium*	*Yes, low*
ːed material use per unit of output	☐ 1	☐ 2	☐ 3
ːed energy use per unit of output	☐ 1	☐ 2	☐ 3
ːed CO_2 ‚footprint' (total CO_2 production) by your enterprise	☐ 1	☐ 2	☐ 3
ːed air pollution (i.e. SO_x, NO_x)	☐ 1	☐ 2	☐ 3
ːed water pollution	☐ 1	☐ 2	☐ 3
ːed soil pollution	☐ 1	☐ 2	☐ 3
ːed noise pollution	☐ 1	☐ 2	☐ 3
ːed dangerous materials	☐ 1	☐ 2	☐ 3
led waste, water, or materials	☐ 1	☐ 2	☐ 3

ıg 2006 to 2008, did your enterprise introduce new products or services with the following environmental b gh the use of these products/services, and if yes, what was their contribution to environmental protection

mark an X in each line!	*Yes, high*	*Yes, medium*	*Yes, low*
ıuced energy use	☐ 1	☐ 2	☐ 3
ıuced air, water, soil or noise pollution	☐ 1	☐ 2	☐ 3
ıroved recycling of product after use	☐ 1	☐ 2	☐ 3

If you answered „Yes" in A., B., or C.: How high was the share of sales with new products that had a positive environmental impact on your enterprise's total sales in 2008? .... ca.

ıg 2006 to 2008, did your enterprise introduce an environmental innovation in response to:

	Yes
sting environmental regulations (incl. taxes on pollution)	☐ 1
vironmental regulations that you **expected** to be introduced in the future (incl. taxes on pollution)	☐ 1

; your enterprise have procedures in place to regularly identify and reduce your enterprise's environmenta
;? (For example preparing environmental audits, setting environmental performance goals, ISO 14001 certification,

nplemented before 2006 .... ☐ 1 Yes, during 2006 to 2008................ ☐ 1 No ....

ic Financial Information

: **were your enterprise's estimated payroll costs** (including benefits and social security contributions) **and exper**
aterials, intermediate inputs, energy in 2007 and 2008?

		2007			2008
l costs (incl. employee benefits ocial security contributions)	ca.	.000	EUR	ca.	.
ditures for materials, intermediate inputs, /, incl. ordered services..	ca.	.000	EUR	ca.	.

: **were your enterprise's estimated expenditures for professional development training in 2007 and 2008?**

		2007			2008
ditures for professional development training al and external)..	ca.	.000	EUR		.

: **were your enterprise's estimated total marketing costs in 2007 and 2008?**

eting expenditures include all internal and external expenditures for advertisement (incl. commercial marketing), for the concept
rketing strategies, market and costumer research, and the installation of new distribution channels. ***Pure selling costs*** *do* ***not*** *co*
eting expenditures.

narketing expenditures (internal + external)	ca.	.000	EUR	ca.	.

: **was your enterprise's estimated gross investment in fixed assets** (i.e. gross addition of fixed assets, includin
ed internally and buildings) **and what were its holdings of tangible property in 2007 and 2008?**

		2007			2008
investment in fixed assets	ca.	.000	EUR	ca.	.
amount of tangible property at the beginning of the year	ca.	.000	EUR	ca.	.

: **was your enterprise's estimated operating margin** (i.e. profit before taxes on income as a percentage of turno
and 2008?

	2007	2008
0%	☐ 1	☐ 1
to < 2%	☐ 2	☐ 2
to < 4%	☐ 3	☐ 3
to < 7%	☐ 4	☐ 4
to < 10%	☐ 5	☐ 5
to < 15%	☐ 6	☐ 6
and above	☐ 7	☐ 7
imation possible	☐ 8	☐ 8

Thank you very much for your valuable assistance!

ther enquiries, please complete your contact information below:

oonder:	Enterprise address or stamp:
nterprise:	

17.3 MIP Questionnaire 2011

Perspectives of the German Economy – Services for the Future

aunhofer
ISI

nfas

EW
n für Europäische
aftsforschung GmbH

Aim of the survey

Regulation (EC) 1450/2004 of the European Commission of 13 August 2004 commits member stat biannually indicators on innovation activities of enterprises. For this purpose, a harmonized su Europe – the **Community Innovation Survey** – is conducted coordinated by the Statistical Office pean Commission (Eurostat). The aim of this year's survey is to collect information on innovation act years 2008 to 2010. The information gathered serves as an important basis for economic policy c regional, national and European levels in order to improve the business environment.

Who is conducting the survey?

In Germany, the Federal Ministry of Education and Research (BMBF) has commissioned the Cent pean Economic Research (ZEW) together with the Fraunhofer-Institute for System and Innovatio (ISI) and the Institute for Applied Social Sciences (infas) to conduct the Community Innovation Survey

What happens to the data you provide?

The three institutions conducting the survey bear full legal responsibility for data protection. All data enterprises will be treated strictly confidentially, based on the provisions of data privacy law. This collected data will be processed anonymously, i.e. without names and addresses, and only pooled analyzed. It will not be possible to identify the data from individual enterprises from the published resu words: data protection is fully guaranteed.

Further information on the German Innovation Survey you can find on www.zew.de/innovation.

How to answer the questionnaire

Please tick the correct answer in the corresponding box: ☒

If a number is equal to zero, please enter a "0".

Please enter the numbers or text requested in the large boxes: 87

Please skip a question only if instructed to do so.

e of any queries about this survey, please contact:
it Jesske · infas · Telephone 0228 3822 501 · E-Mail b.jesske@infas.de
Christian Rammer · ZEW · Telephone 0621 1235 221 · E-Mail rammer@zew.de
Torben Schubert · ISI · Telephone 0721 6809 357 · E-Mail schubert@isi.fraunhofer.de

Please return completed questionnair **enclosed envelope** to:
infas
Postfach 24 01 01
53154 Bonn

eral Information on Your Enterprise

ur enterprise part of an enterprise group (corporate group or a consortium of several enterprises)?

ı national enterprise group .... ☐ 1 → The head is located:
multinational enterprise group .... ☐ 2 ↗
.... ☐ 3

... in the old Federal Lands (states) ....
... in the new Federal Lands (incl. Berlin) ....
... abroad ....
Country:

se state the entity that your following statements in the questionnaire will refer to.

nterprise .... ☐ 1 The entire enterprise group (corporate group) ....

When answering the following questions, refer only to the entity given in 1.2 and only to activities in Germa

was your enterprise's average number of employees from 2008 to 2011?

	2008	2009	2010
yees (annual averages; . Apprentices and interns)			
This includes: part-time employees			

se estimate the percentage of your enterprise's employees who are holding a university degree in the years 2010.

2009 2010

	2008		2009		2010
ver (without VAT)	.000	EUR	.000	EUR	.(
This includes: Exports	.000	EUR	.000	EUR	.(
No exports	☐ 1		☐ 1		☐ 1

se state your enterprise's top-selling line of products / services in 2010 and its share in turnover.

Share i

se estimate your enterprise's market share for your top-selling line of products / services in 2008 to 2010.

t share: *Your enterprise's turnover as a percentage of total turnover within the applicable sales market (total turnover = your ente our competitor's turnover)*

	2008			2010	
nterprise's market share within -selling line of products / services .... ca.		%	below 0,1 % ☐ 1 ....ca.		% .

ket Environment

ich geographic markets did your enterprise sell goods or services in 2008 to 2010?

ple responses possible)

al / regional within Germany (within a radius of ca. 50 km) .... ☐ 1
ional (other regions of Germany) .... ☐ 1
er European Union (EU), EFTA, or EU candidate countries .... ☐ 1
other countries .... ☐ 1

Which of these geographic areas was your largest market in terms of turnover in 2010?
(Give corresponding letter) ....

se estimate your enterprise's share of sales with the three most important clients and the three most impor s in 2010?

of sales with the 3 most ant clients in 2010 .... ca. ☐ % .... below 1 % ☐ 1

Share of the 3 most important suppliers in total materials and inputs in 2010......... ca. ☐ %

often does your enterprise conclude a purchase contract with your most important suppliers?

	daily	weekly	monthly	annual	less than annual
e mark a cell)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5 ....

se indicate to what extent the following characteristics describe the competitive situation of your enterprise

se mark an X for each line)

	applies fully	*applies somewhat*	*applies very little*
cts / services become outdated quickly	☐ 1	☐ 2	☐ 3
chnological development is difficult to predict	☐ 1	☐ 2	☐ 3
cts / services from competitors are easily substitued for those of your enterprise	☐ 1	☐ 2	☐ 3
threat to market position because of entry of new competitors	☐ 1	☐ 2	☐ 3
etitor's actions are difficult to predict	☐ 1	☐ 2	☐ 3
competition from abroad	☐ 1	☐ 2	☐ 3
ing out among the main competitors in the market	☐ 1	☐ 2	☐ 3
ncreases lead to immediate loss of clients	☐ 1	☐ 2	☐ 3
s have difficulties to assess the quality of your products before purchasing them	☐ 1	☐ 2	☐ 3
ing to other suppliers is easy	☐ 1	☐ 2	☐ 3
oducts / services of your suppliers are of high quality	☐ 1	☐ 2	☐ 3

many main competitors does your enterprise face on your main market (according to 1.6)?

.... ☐ 1 ➔ *Please continue with* ***Section 3***
.... ☐ 2
.... ☐ 3
.... ☐ 4
.... ☐ 5
han 50 .... ☐ 6

Your main competitors are ...

mostly larger .... ☐ 1
mostly smaller .... ☐ 2
mostly of equal size .... ☐ 3
both smaller and larger .... ☐ 4

How did the number of your main competitors change over the past three years? ...

increased .....
remained con
decreased ....

do your main competitors typically react to a change in your product policy? (e.g., changing prices, increa crease production)?

ations, user friendliness, availability) are either **new or significantly improved**.

ion must be new to your enterprise, but it does not need to be new to your sector or market. **The sole significant factor is luation of it.** It does not matter if the innovation was developed by your enterprise alone or in collaboration with other enterpr odifications of products (e.g. colouring, styling) are not regarded as product innovations. Selling alone of innovations that have oduced entirely by other enterprises, also does not count as product innovation in this sense.

➔ For examples of product innovations, see the foldout section

g the years 2008 to 2010, did your enterprise introduce new or significantly improved products / services?

.... ☐ 1 ➔ Who developed these product innovations? *(Multiple responses possible)*
.... ☐ 2
↓
*e continue with **Section 4***

- Your enterprise alone ....
- Your enterprise together with third parties ....
- Your enterprise by adjusting product of others ....
- Other enterprises / institutions ....

does your turnover (incl. exports) break down among the following types of products in 2010?

introduced or significantly improved products / services during 2008 to 2010 .... ca.

nged or slightly changed products / services since 2008
roducts / services developed and produced entirely by other enterprises) .... ca.

Total turnover in 2010: 1

any of the product innovations introduced during 2008 to 2010 new to the market, i.e. your enterprise was o market these products / services?

.... ☐ 1 ➔ What was the share of sales of these innovations in 2010? .... ca.
.... ☐ 2
↓
These market innovations were ... *(Multiple responses possible)*

- new to the German market ....
- new to the European market ....
- New to the World market ....

any of the product innovations introduced during the three years 2008 to 2010 new to your enterprise's pr e, i.e. there was no previous version of this product in your enterprise's product line?

.... ☐ 1 ➔ What was the share of sales in 2010? .... ca.
.... ☐ 2

some of the product innovations during 2008 to 2010 registered as a trademark?

ınder an existing trademark .... ☐ 1
ınder a new trademark .... ☐ 1
No, not any product innovations have been trademarked.......

cess Innovation

innovation is the implementation of a new or significantly improved manufacturing / production process, distribution method oods or services. It should have a noticeable impact on the level of productivity, the quality of your product / service or the cost o . Newly introduced procedures that enabled the introduction of product innovations, also count as process innovations.

ion must be **new to your enterprise**, but your enterprise does **not need** to be the **first to introduce** it. The significant factor is uation of it. It does not matter if the innovation was developed by your enterprise alone or in collaboration with other enterpri **nal changes** such as the introduction of **new management practices** are **not** process innovations.

➔ For examples of process innovations see the fold-out section at left

g 2008 to 2010, did your enterprise introduce new or significantly improved internal processes (incl. proce ce performance and product delivery?

.... ☐ 1 ➔ Who developed these process innovations? *(Multiple responses possible)*
.... ☐ 2
↓
*e continue with **Section 5***

- Your enterprise alone ....
- Your enterprise together with third parties ....
- Your enterprise by adjusting product of others ....
- Other enterprises / institutions ....

ne process innovations introduced by your enterprise during 2008 to 2010 reduce the average costs (per u on?

.... ☐ 1 ➔
.... ☐ 2 What was the reduction in average unit costs due to process innovations in 2010 .... ca.

ne process innovations introduced by your enterprise during 2008 to 2010 lead to improvements in quality

were discontinued or were still in progress at the end of that period?

nclude ongoing and abandoned R&D activities, including contract R&D for third parties.

le responses possible)

	product innovations	process innovations	ass
nnovation activities in progress in 2008 to 2010	☐ 1	☐ 1	
iscontinued innovation activities in 2008 to 2010	☐ 1	☐ 1	
	☐ 1	☐ 1	

your enterprise intend to conduct activities in 2011 or 2012 leading to product or process innovations? Al ongoing and abandoned R&D activities, including contract R&D for third parties.

le responses possible)

	2011
roduct innovation activities planned	☐ 1
rocess innovation activities planned	☐ 1
nnovation / R&D activities planned, assignment to product or process innovations not possible	☐ 1
t determined	☐ 1
R&D or innovations activities planned	☐ 1

➔ If you answered No to questions 3.1, 4.1, 5.1 and 5.2 continue with Section 11 on page 7

vation Expenditure and Innovation Projects

expenditure includes expenditure on the following activities:
n the enterprise (in-house R&D)
ucted by third parties (external R&D)
of equipment, machinery or software for innovation purposes
of external knowledge for innovation activities (e.g., patents, licenses, trademarks)
sign, service philosophy preparation of production / distribution for innovation activities
al development for innovation activities (e.g., employee training or continued education)
of innovations (marketing activities directly related to innovation projects, incl. market research)

se estimate the total amount of expenditure for innovation activities in 2010, as well as the amount of capit for innovation.

***ation expenditures**: expenditures on personnel, consumables, services of third parties and capital expenditures,incl. all R&D ex*
***l expenditures** (capex) for innovation include the purchase of fixed investment and intangibles used to realize innovation projec*

xpenditure
0 ca. [ ].000 EUR

***Thereof**: Capital expenditure for innovation projects* .... ca. [ ]

expenditures for innovations in 2010 .... ☐ 1

No capital expenditure for innovations in 201☐

are the anticipated changes in total innovation expenditure for your enterprise in 2011 and 2012?

		increase	stay approx. the same (+/- 1 %)	decrease	not yet
tal innovation expenditures in the year …	2011	☐ 1	☐ 2	☐ 3	
mpared with the previous year) …	2012	☐ 1	☐ 2	☐ 3	

	2011	2012
ated total innovation expenditure apital expenditures for innovation projects) .... ca.	[ ].000 EUR .... ca.	[ ]
pected innovation expenditures	☐ 1	☐ 1

was the total number of innovation projects (incl. R&D projects) **executed in your enterprise during 2008 to**

otal number of innovation projects xecuted in the years 2008 to 2010 (finished or still ongoing projects)	thereof: '08-'10 successfuly finished projects	'08-'10 discon-tinued / abandoned projects	ongoing projects at the end of 2010	ther '08-'10 star proj
ca. [ ]	[ ]	[ ]	[ ]	[ ]

your enterprise allocate the majority of funds for innovation projects at the start of a project or step by ste milestones)?

ty at the start ☐ 1 Step by step ☐ 2 ➔ How many steps does the allocation typically involve? ....

earch and Experimental Development (R&D)

ned as the systematic creative work to increase the stock of knowledge and its use to devise new products or services and ne re development).

our enterprise conduct in-house R&D in the years 2008 to 2010?

ɜe estimate the amount of R&D expenditure (internal and external, incl. capital expenditures) of your enterprise
R&D expenditure is part of total innovation expenditure according to question 6.1)

ɜxpenditure in 2010 (internal + external, incl. capital expenditures) .... ca. [.000] EUR ☐ 1 ...... No R& diture i

ɔperation for Innovation Activities

ınnovation cooperation as active participation in joint innovation projects or research projects with other enterprises and / (organizations such as universities or research institutes. This should not mean that both partners gain a direct economic bene ı. **Straightforward contract awards**, which do not involve any active collaboration, are **not regarded as cooperation.**

our enterprise co-operate on any of your innovation activities during 2008 to 2010?

.... ☐ 1 No .... ☐ 2 ➔ *Please continue with Section 9*

ɜe indicate the type of co-operation partner and their location?

ɪll that apply)	*Germany*	*Other Europe*	*United States*	*China, India*
er enterprises within your enterprise group	☐ 1	☐ 1	☐ 1	☐ 1
ɪnts or costumers	☐ 1	☐ 1	☐ 1	☐ 1
ɔpliers of equipment, materials, components, or software	☐ 1	☐ 1	☐ 1	☐ 1
ɪnpetitors or other enterprises in your sector	☐ 1	☐ 1	☐ 1	☐ 1
ɪsultants, commercial labs or private R&D institutes	☐ 1	☐ 1	☐ 1	☐ 1
versities, or other higher education institutions	☐ 1	☐ 1	☐ 1	☐ 1
vernmental research institutes	☐ 1	☐ 1	☐ 1	☐ 1

h type of co-operation partner did you find the most valuable for your enterprise's innovation activities?
ɪte the letter according to the categories in question 8.2)

eration partner with the greatest contribution: .... [ ] No assessment possible .... ☐ 1

lic Financial Support to R&D / Innovation

ıcial support to innovation includes the financial promotion of R&D or innovation projects by public authorities by grants, subsi ın guarantees. The **payment for contracted R&D or innovation activities** by public authorities **is not considered as public fi** ɜase also take into consideration public support through authorized agencies such as 'Projektträger' or public banks.

our enterprise receive public financial support for innovation projects during 2008 to 2010?

Yes

he states (state government departments) .... ☐ 1 ....
he national government (federal departments) .... ☐ 1 ....
→ *Thereof*: ... Ministry of Economics and Technology (BMWi) Yes .... ☐ 1 No .... ☐ 2
... Ministry of Education and Research (BMBF) Yes .... ☐ 1 No .... ☐ 2
he European U nion .... ☐ 1 ....
→ *Thereof*: ... 7. Community RTD Framework Programme Yes .... ☐ 1 No .... ☐ 2

ɔthers, namely: .... [ ] .. ☐ 1

rnationalisation of R&D / Innovation Activities

our enterprise conduct any innovation activities (incl. R&D) at foreign facilities of your company during 200
?

.... ☐ 1
ıterprise does not have any foreign facilities .... ☐ 2
ɾeign facilities were not used for innovation activities .... ☐ 3
Please continue with Section 11.

type of innovation activities did your enterprise conduct abroad during 2008 to 2010?

Yes

internal R&D) at foreign facilities .... ☐ 1 ..
ı, industrial engineering or feasibility studies for new products or processes at foreign facilities .... ☐ 1 ..
acture of new products or launch of new services at foreign facilities .... ☐ 1 ..
ıction of process innovations at foreign locations .... ☐ 1 ..

ich countries other than Germany did your enterprise conduct innovation activities during 2008 to 2010?

n locations (country code)

... make at least one tick in every line)	high	medium	low	not relevant	comp letely	part ially	no
...ase of development costs	☐1	☐2	☐3	☐4	☐1	☐2	☐3
...ase of production costs	☐1	☐2	☐3	☐4	☐1	☐2	☐3
... new clients	☐1	☐2	☐3	☐4	☐1	☐2	☐3
...nd to clients' needs	☐1	☐2	☐3	☐4	☐1	☐2	☐3
...ct to clients / markets at the forefront of innovative trends	☐1	☐2	☐3	☐4	☐1	☐2	☐3
...s to knowledge / technology	☐1	☐2	☐3	☐4	☐1	☐2	☐3
...s to skilled labour	☐1	☐2	☐3	☐4	☐1	☐2	☐3

...h channels did your enterprise use to exchange knowledge between domestic and foreign locations durin...
...?

	Yes
...nal meetings on a regular basis between employees at different facilities	☐1
...ting on a regular basis	☐1
...unication via information and communication technology (e.g., telephone / video conferences.)	☐1
...sition of patents or licences that were developed at foreign locations	☐1
...ation of employees from Germany to foreign facilities on a short-term basis (less than 3 months)	☐1
...ation of employees from Germany to foreign facilities on a long-term basis (more than 3 months)	☐1
...ation of foreign employees to German facilities on a short-term basis (less than 3 months)	☐1
...ation of foreign employees to German facilities on a long-term basis (more than 3 months)	☐1

...self-governed are your foreign facilities in deciding about innovation activities?

	very high	high	medium	low
...omy in decisions about innovation activities	☐1	☐2	☐3	☐4

...npetences within your Enterprise

...distinct are the following competences in your enterprise?

...e make at least one tick in every line)	strongly distinct	distinct	medium	weakly distinct
...ing new client's needs	☐1	☐2	☐3	☐4
...opment of new technical solutions	☐1	☐2	☐3	☐4
... for development via 'trial and error'	☐1	☐2	☐3	☐4
... individual responsibility of employees	☐1	☐2	☐3	☐4
...vity of employees	☐1	☐2	☐3	☐4
...ive schemes for employees to innovate	☐1	☐2	☐3	☐4
...ation of internal competition between projects	☐1	☐2	☐3	☐4
...al co-operation between departments / firm units	☐1	☐2	☐3	☐4
...on of external partners	☐1	☐2	☐3	☐4
... implementation of new ideas to the point of market launch	☐1	☐2	☐3	☐4
... imitation of competitor's innovations	☐1	☐2	☐3	☐4

...tacles to Innovation Activities

...effect did the following obstacles possibly have to your innovation activities during 2008 to 2010?

...le responses possible)	Duration of innovation projects extended	Innovation projects have been ended or discontinued	Innovation projects have been not started in the first place
...nancial risk	☐1	☐1	☐1
...novation costs	☐1	☐1	☐1
...f internal sources of financing	☐1	☐1	☐1
...f external sources of financing	☐1	☐1	☐1
...al opposition against innovation projects	☐1	☐1	☐1
...isational problems within the company	☐1	☐1	☐1
...f skilled labour	☐1	☐1	☐1
...f technological information	☐1	☐1	☐1
...f appropriate market information	☐1	☐1	☐1
...f demand from clients / for innovation	☐1	☐1	☐1
...restrictions	☐1	☐1	☐1
...administrative procedures	☐1	☐1	☐1
...ry standards and norms	☐1	☐1	☐1
...f access to intellectual property rights (e.g. patents)	☐	☐	☐

rketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterpris
ting methods and which has not been used before. It requires significant changes in product design or packaging, product place
omotion or pricing. Exclude seasonal, regular and other routine changes in marketing methods.

	Yes
cant changes to the aesthetic design or packaging of a good or service ... *de changes that alter the product's functional or user characteristics - these are product innovations)*	☐ 1 ..
iedia or techniques for product promotion, introduction of brands ... *ie first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc)*	☐ 1 ..
iethods for product placement or sales channels (incl. new ways to present products and services) ... *rst time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)*	☐ 1 ..
iethods of pricing goods and services ... *rst time use of variable pricing by demand, discount systems, etc)*	☐ 1 ..

our enterprise introduce the following organisational innovations during 2008 to 2010?

ganisational innovation is a **new organisational method** in your enterprise's business practices (including knowledge ma
lace organisation or external relations that **has not been previously used** by your enterprise. It must be the result of strateg
by management. Exclude mergers or acquisitions, even if for the first time.

	Yes
usiness practices for organising procedures ... *upply chain management, business re-engineering, knowledge management, lean production, quality management, etc)*	☐ 1 ..
iethods of organising work responsibilities and decision making ... *eam work, decentralization, integration or de-integration of departments, job rotation, etc)*	☐ 1 ..
iethods of organising external relations with other firms or public institutions ... *rst use of alliances, partnerships, outsourcing or sub-contracting, etc)*	☐ 1 ..

llectual property, patents and trademarks

**h of the following measures did your enterprise use to protect its intellectual property during 2008 to 2010,
rtant have they been?**

	Yes	No	Importance: high	medium
ıl measures				
ng for patents	☐ 1	☐ 2	☐ 1	☐ 2
ng for utility patents	☐ 1	☐ 2	☐ 1	☐ 2
ering of industrial designs	☐ 1	☐ 2	☐ 1	☐ 2
ering of trademarks	☐ 1	☐ 2	☐ 1	☐ 2
ght	☐ 1	☐ 2	☐ 1	☐ 2
gic measures				
cy	☐ 1	☐ 2	☐ 1	☐ 2
ex design of goods or services	☐ 1	☐ 2	☐ 1	☐ 2
ime advantage over competitors	☐ 1	☐ 2	☐ 1	☐ 2

our enterprise have any active out-licensing agreements at the end of 2010 (= sold own patent licenses to thi

.... ☐ 1 → Number of active out-licensing agreements at the end of 2010 .... ☐ → Income from royalty rates in 2010 .... ca. ☐

.... ☐ 2 no royalties in 2010 .... ☐ 1

many registered trademarks did your enterprise have at the end of 2010?

er of registered
iarks at the end of 2010.................. ca. ☐ ☐ 1...... No registered trademarks 2010 → *Please continue with Section 15*

**e name the three most important (umbrella) brands for goods / services to your enterprise and their share
their share of the marketing budget, and the amount of goods / services that operate under the brand.**

of the three most important brands	Brand's share of turnover	Brand's share of marketing budget	Amount of products / s that operate under the
☐	...... ca. ☐ %	.... ca. ☐ %	.... ☐
☐	...... ca. ☐ %	.... ca. ☐ %	.... ☐
☐	☐	☐	

s are well-known to potential consumers	☐1	☐2	☐3
s stand for constant high quality	☐1	☐2	☐3
s stand for low prices	☐1	☐2	☐3
s are considered as a status symbol	☐1	☐2	☐3
nterprise uses different brands for different price segments	☐1	☐2	☐3
nain competitors own stronger brands than you do	☐1	☐2	☐3
s are important to distinguish between competitor's products	☐1	☐2	☐3

ic Financial Information

t were your enterprise's estimated payroll costs (including benefits and social security contributions) and
for materials, intermediate inputs, energy in 2009 and 2010?

	2009		2010
l costs (incl. employee benefits ocial security contributions) ca.	.000	EUR ca.	
ditures for materials, intermediate inputs, , incl. ordered services ca.	.000	EUR ca.	

t were your enterprise's estimated expenditures for professional development training in 2009 und 2010?

	2009		2010
ditures for professional development training al and external) ca.	.000	EUR ca.	
No expenditures on professional development	☐1		☐1

t were your enterprise's estimated total marketing costs in 2009 and 2010?

ting expenditures include all internal and external expenditures for advertisement (incl. commercial marketing), for the conce keting strategies, market and costumer research, and the installation of new distribution channels. ***Pure selling costs*** *do* ***not*** *cc expenditures.*

	2009		2010
narketing expenditures (internal plus external) ca.	.000	EUR ca.	
No marketing expenditures	☐1		☐1

t was your enterprise's estimated gross investment in fixed assets (i.e. gross addition of fixed assets, inclu ts created internally and buildings) and what were its holdings of tangible property in 2009 and 2010?

	2009		2010
investment in fixed assets ca.	.000	EUR ca.	
No investment in fixed asstes	☐1		☐1
amount of tangible property at the beginning of the year ca.	.000	EUR ca.	

t was your enterprise's estimated operating margin (i.e. profit before taxes on income as a percentage of tu 09 and 2010?

	below -5 %	*-5 % to -2 %*	*-2 % to 0 %*	*0 % to 2 %*	*2 % to 4 %*	*4 % to 7 %*	*7 % to 10 %*	*10 % to 15 %*	*15 % and more*
	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9
	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9

Thank you very much for your valuable assistance!

ther enquiries, please complete your contact information below

ponder:	Enterprise address or stamp
nterprise:	

ZEV

Zentrum für Europäi
Wirtschaftsforschung G

; Zentrum für Europäische Wirtschaftsforschung bH (ZEW) ist ein Wirtschaftsforschungsinstitut mit : in Mannheim, das 1990 auf Initiative der Landes- ierung Baden-Württemberg, der Landeskreditbank len-Württemberg und der Universität Mannheim ge- ndet wurde und im April 1991 seine Arbeit aufnahm. Arbeit des ZEW liegen verschiedene Aufgabenstel- gen zugrunde:

interdisziplinäre Forschung in praxisrelevanten Bereichen,
Informationsvermittlung,
Wissenstransfer und Weiterbildung.

Rahmen der Projektforschung werden weltwirtschaft- ie Entwicklungen und insbesondere die mit der eu- äischen Integration einhergehenden Veränderungs- zesse erfaßt und in ihren Wirkungen auf die deutsche tschaft analysiert. Priorität besitzen Forschungsvor- en, die für Wirtschaft und Wirtschaftspolitik prak- he Relevanz aufweisen. Die Forschungsergebnisse den sowohl im Wissenschaftsbereich vermitteltals h über Publikationsreihen, moderne Medien und iterbildungsveranstaltungen an Unternehmen, Ver- ide und die Wirtschaftspolitik weitergegeben. herchen, Expertisen und Untersuchungen können ZEW in Auftrag gegeben werden. Der Wissenstrans- an die Praxis wird in Form spezieller Seminare für h- und Führungskräfte aus der Wirtschaft gefördert. lem können sich Führungskräfte auch durch zeitwei- Mitarbeit an Forschungsprojekten und Fallstudien den neuen Entwicklungen in der empirischen Wis- ischaftsforschung und spezifischen Feldern der Wirt- aftswissenschaften vertraut machen. Aufgabenstellung des ZEW in der Forschung und praktischen Umsetzung der Ergebnisse setzt In- lisziplinariät voraus. Die Internationalisierung der tschaft, vor allem aber der europäische Integrati- ;prozeß werfen zahlreiche Probleme auf, in denen betriebs- und volkswirtschaftliche Aspekte zusamn treffen. Im ZEW arbeiten daher Volkswirte und Betri wirte von vornherein zusammen. Je nach Fragestel werden auch Juristen, Sozial- und Politikwissenscha hinzugezogen.

Forschungsprojekte des ZEW sollen Probleme handeln, die für Wirtschaft und Wirtschaftspolitik pr sche Relevanz aufweisen. Deshalb erhalten Forschu projekte, die von der Praxis als besonders wic eingestuft werden und für die gleichzeitig Forschu defizite aufgezeigt werden können, eine hohe Prior Die Begutachtung von Projektanträgen erfolgt d den wissenschaftlichen Beirat des ZEW. Forschungs jekte des ZEW behandeln vorrangig Problemstellur aus den folgenden Forschungsbereichen:

- Internationale Finanzmärkte und Finanzmanagement,
- Arbeitsmärkte, Personalmanagement und Soziale Sicherung,
- Industrieökonomik und Internationale Unternehmensführung,
- Unternehmensbesteuerung und Öffentliche Finanzwirtschaft,
- Umwelt- und Ressourcenökonomik, Umweltmanagement

sowie den Forschungsgruppen

- Informations- und Kommunikationstechnologien
- Wettbewerb und Regulierung

und der Querschnittsgruppe

- Wachstums- und Konjunkturanalysen.

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