

KfW/ZEW Start-up Panel 2013

Young high-tech companies go ahead

Executive summary

- **In many cases impressive turnover achieved:** nearly all young companies generated revenues in 2012. One in eight young companies succeeded in generating turnover of more than EUR 0.5 million; in manufacturing the figure was as high as one in five.
- **Higher turnover expected in 2013:** Around two thirds of young companies expect greater revenues in 2013 than in the previous year. One in four (23%) assume that they will maintain 2012 revenue levels. Young companies in high-tech manufacturing are especially optimistic.
- **Higher employment despite fewer start-ups:** Although there were fewer start-ups in 2012 than in 2011, their gross employment effect (GEE) was greater (+4%, 391,000 FTE): Start-ups recruited more frequently and on average appointed more employees than in 2011.
- **New high-tech companies start up with more employees:** High-tech start-ups in manufacturing are largest on average and show the highest percentage increase in GEE compared to the previous year. As they only represent a small proportion of start-ups, this positive effect is only of limited aggregated impact.
- **Employment growth in manufacturing industry is above average:** The employment built-up of start-ups in manufacturing is more stable and stronger in percentage terms than on average. Employment growth in high-tech sectors is usually higher than in non-high-tech sectors.
- **The consequences of the financial crisis have had a negative effect on employment growth:** The financial and economic crisis has had negative effects on employment growth of start-ups. Among start-ups cohorts established previous to the financial crisis, employment started to decline in the crisis year, even though companies at this age are usually in the growth phase.
- **Companies often engage in innovation activity shortly after establishment:** Of those young companies that engage in R&D, about half begin doing so in their very first year. Young high-tech companies produce innovations (product and process innovations, market novelties) more frequently. The share of product innovations in turnover is considerable.
- **Investment volume varies, investment frequency fairly uniform across industries:** Just under 70% of young companies invest. On average, the largest investments are made by young companies in manufacturing, especially in the high-tech segment. However, this group also includes the highest percentage of young companies whose investment plans failed.
- **Business activities generate substantial cash flow:** In virtually all young companies, business activities make a major contribution to financing operating costs and investments. Young companies are dependent on external investors for 8% of their financing volume; in the high-tech manufacturing sector this figure amounts to 12%. If the latter group turns to external funding, then on average they use three times the amount than young companies in general. Six per cent obtain more than half a million euros from third-party investors.
- **Financing difficulties also have structural causes:** In 2012, one in eight young companies had problems with financing from external investors. Due to their higher level of innovation activity, their greater financing requirements and their less favourable sales-cost ratios, young companies in manufacturing are especially vulnerable to financing difficulties.

Young companies stand their ground

Politicians, the public and academia are placing great hopes on the economic effects generated by newly established companies. These range from accelerating structural change to further developing the knowledge-based economy. It is anticipated that new companies will contribute significantly to employment growth as well as stimulating new technological developments and innovations. There are also hopes that investment by start-ups will serve to boost domestic demand.

It is especially young high-tech companies that are expected to generate these economic impulses. In contrast, the frequency of start-ups – both generally and in the high-tech sector – has been in decline since the mid-1990's. Moreover, high-tech start-ups only account for a small proportion (7%) of all new businesses. For this reason, the role played by non-high-tech start-ups also needs to be recognized. This is because most of

the effect on investment demand and employment from companies as a whole is derived from non-high-tech companies. In view of the above, this report contrasts young high-tech and non-high-tech companies.

The latest findings of the KfW/ZEW Start-up Panel 2013 show that start-ups do indeed generate the effects hoped for, as this was also demonstrated in 2012 (see Table 1). The findings are based on the Start-up Panel, which is representative for the total of around 560,000 new companies set up in the years 2009 to 2012. The structure and relations seen in these young companies are qualitatively the same as in the economy as a whole¹.

Young companies in high-tech manufacturing are distinguished by a significantly higher contribution to employment per company. On average, they generate higher turnover than young companies in the corresponding non-high-tech sectors. High-tech companies are also consid-

erably more innovative. This applies both on the input side (R&D activities) and on the output side – higher percentages of innovators and market novelties, and innovation success (contribution of sales from new products to turnover).

However, the above-average employment levels and above-average innovation activities which are evident in high-tech start-ups, and which give them their economic significance, are also the cause of their above-average costs – and these have to be financed. In addition, companies in high-tech manufacturing have additional financing requirements due to their higher levels of investment compared to young companies in other sectors.

Overall, young companies fund over 90% of their financing volume out of their business operations or with funds from their proprietors or founders. Only 8% of the financing volume is contributed by third-party investors. However, young companies in high-tech manufacturing fi-

Table 1: Selected indicators for young companies in 2012 by industry

	High-tech manufacturing	High-tech services & software	Non-high-tech manufacturing	Non-high-tech services	Construction	Total
Employment						
Percentage of companies with employees (cohort 2012)	45.0	31.8	36.2	42.7	33.8	40.7
FTE (cohort 2012)	5,900	24,700	18,300	308,200	33,300	390,500
Average company size (cohort 2012)	3.3	2.5	2.5	2.6	1.9	2.5
Sales						
Percentage of companies with sales	89.6	93.5	95.6	95.3	97.5	95.4
Median in EUR thousands	180,000	120,000	160,000	100,000	135,000	104,000
Innovation						
Percentage of companies with market novelties	28.1	17.5	16.3	10.8	4.3	11.0
Percentage of companies with product innovations ^{a)}	50.7	36.2	33.1	26.9	14.2	26.6
Percentage of companies with process innovations ^{a)}	28.7	22.9	16.3	12.6	9.9	13.4
Percentage of companies with R&D activities	57.1	37.0	26.0	10.4	7.2	13.2
Investments						
Average in EUR	59,000	23,000	44,000	28,000	26,000	29,000
Median in EUR	25,000	10,000	20,000	10,000	12,000	10,000
Percentage of companies investing	70.5	72.5	68.8	68.5	73.9	69.4
Financing						
Percentage financed internally	73.0	85.5	85.9	85.6	83.2	85.1
Percentage financed by third-party investors	11.5	7.2	6.1	7.0	11.4	7.6
Percentage of companies with financing difficulties	19.6	14.0	13.8	12.5	9.3	12.4

Note: a) Figures exclude companies in their first year, as in the year of establishment products and processes are, by definition, new for start-ups.

Source: The KfW/ZEW Start-up Panel.

nance around 12% of their financing volume externally, a fifth of them by venture capital. For a number of companies in these sectors, access to external finance, especially to venture capital, is thus of considerable significance. Financing requirements, even in high-tech manufacturing, are very unequally distributed. Many young companies have a low to moderate financing requirement, and only a few companies require very high volumes. These are the companies whose innovation projects have long development lead-times and which have a high growth potential.

In addition to high financing requirements, innovative companies are also confronted with uncertainty over the success of their R&D projects. First, it is uncertain whether these projects can be completed successfully and, second, it is unsure whether their product innovations will actually find customers in the marketplace. The level of uncertainty is especially high in the case of radical innovations representing genuine market novelties. This means that young high-tech companies are especially vulnerable to financing difficulties, as financing such companies are perceived as risky by potential investors.

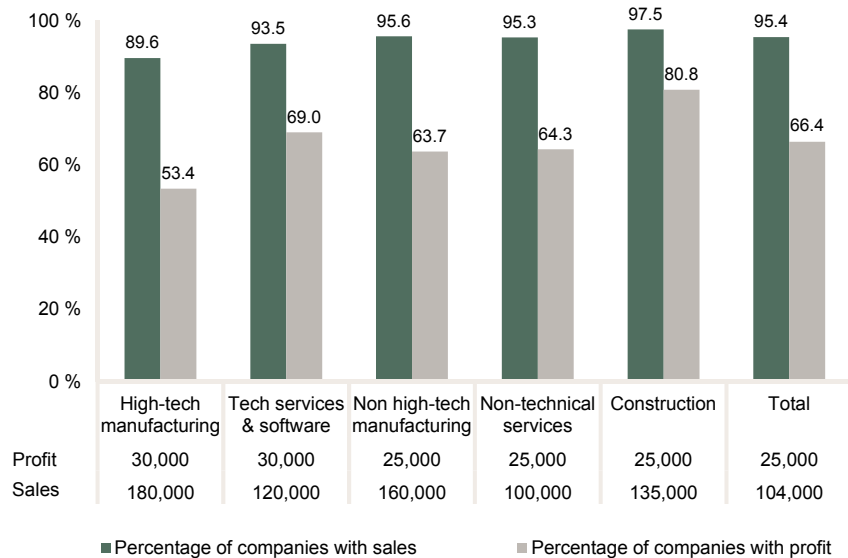
Turnover and profit situation slightly improved

The survival of business start-ups strongly depends on how quickly they manage to obtain orders and generate sales. As in the previous years, virtually all young companies generated sales in 2012 (see Figure 1). Only one in twenty did not have any turnover concerning principally start-ups in their first year of business. Median sales stand at EUR 104,000 and are thus slightly above median sales for the years 2009 to 2011.

Some companies generate very high turnover even in their first years in business. One in eight young companies succeeds in generating turnover of more than EUR 0.5 million; in manufacturing this figure is as high as one in five.

Young companies in high-tech manufacturing are confronted with a special situation. If these companies generate turnover, then it is often higher than in other companies: their median turnover in

Figure 1: Sales and profits of business start-ups in 2012



Note: Figure shows median profits and turnover for those companies achieving positive profits and turnover.

Source: KfW/ZEW Start-up Panel.

2012 amounted to EUR 180,000. This is the highest level across sectors. At the same time, 10% of young companies in these sectors did not report any turnover – again, the highest proportion in industry comparison. This may be associated with the above-average level of innovation activity in these sectors. In general, companies which are still in the product development process have to wait longer for sales revenues. In manufacturing, turnover is obviously normally higher than in other sectors: the median turnover for young companies in non-high-tech manufacturing is EUR 160,000. By way of comparison, young non-high-tech service providers achieve a median turnover of EUR 100,000.

The high median turnover volumes in high-tech manufacturing are associated with high costs. In contrast, the sales-to-costs ratio is especially favourable in the case of non-high-tech service providers. Young companies in high-tech manufacturing are above average in terms of innovativeness and job creation. This also contributes to their high costs. Young non-high-tech service providers demonstrate both a below-average job creation and a lower level of innovation activity. The costs to be financed are correspondingly lower.

What remains from turnover after deduction of costs determines – in simple terms – the level of profit and hence the

success of the business. Two thirds of young companies made a profit in 2012 (see Figure 1). As with turnover, the profit situation improves as companies mature.

The lowest percentage of young companies to achieve profits is found in the high-tech manufacturing sector; the highest is in the construction industry. Compared to turnover, the variation in profits between different sectors is lower. In the high-tech sector as a whole (manufacturing and services), the median profit amounts to EUR 30,000. In other sectors, the median profit is somewhat lower at EUR 25,000. Overall, 7% of young companies achieved a profit of more than EUR 100,000 in 2012. The proportion of these high-performers differs little between sectors: it amounts to 10% in high-tech manufacturing and about 7% in non-high-tech manufacturing and among non-high-tech service providers.

Young companies assess their future positively

Young companies demonstrate a healthy level of basic optimism. Around two-thirds expect turnover to increase in 2013. Another 23% expect that their turnover figures will remain roughly constant. The most pessimistic are young companies in the construction sector: 14% of them are assuming that their

sales will decrease in 2013 and only 56% anticipate increasing sales. In contrast, sentiment is at its most positive in manufacturing industry.

It is striking that companies with a poor starting position are more likely to expect sales to increase than companies which assess their current situation positively (see Figure 2). This seems to be a mixture of forced optimism and the pressure to succeed. Companies whose turnover is too low must improve their economic position if the company is to survive and thrive in the market. At the same time, it is easier to achieve an increase when coming from a low turnover level than it is for a company which is already in the higher sales categories. In manufacturing (high-tech and non-high-tech), only a small percentage of young companies (3–4%), which are dissatisfied with their 2012 sales situation, are expecting a further decline in sales. In contrast, this applies to up to 15% of the respective companies in other industries.

Contribution of start-ups to job creation

Right from setting up their new business, the founders of new companies make an important contribution to the number of new jobs created each year in Germany. In addition to providing jobs for themselves, a considerable proportion of founders also create jobs for employees. In order to better quantify the size of this contribution and its development, the direct job creation effectⁱ of newly established companies is analysed in more detail in this chapter.

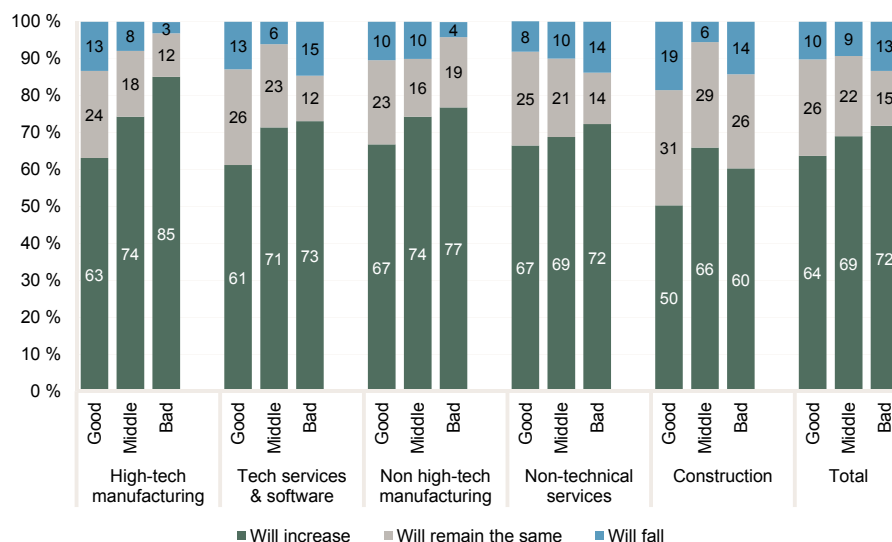
Fewer start-ups create more jobs

The direct job creation effect – which is the gross employment effect (GEE) – due to start-ups in 2012 was 391,000 full-time equivalents (FTEs)ⁱⁱ at the date of establishment. Compared to

ⁱ The direct job creation effect only considers jobs directly created by start-ups and does not take into account the jobs lost in those existing companies which are squeezed out of the market by the advent of new competitors.

ⁱⁱ The GEE calculation encompasses full- and part-time workers, “minijobbers”, family members providing assistance and trainees who are compulsorily insured under the social security scheme. Freelancers, temporary staff and interns are not taken into account.

Figure 2: Turnover expectations for 2013 based by initial situation



Note: Good – good to excellent turnover situation in 2012, average – average turnover situation in 2012, poor – poor to very poor turnover in 2012.

Source: KfW/ZEW Start-up Panel.

2011, the GEE has thus – in spite of a decline in start-up activity of 8% over the same period – increased by just under 16,000 jobs (4%).

The increase in GEE is comprised of two components (see Table 2 for a detailed breakdown). Firstly, more start-ups appointed employees in 2012 (up from 36 to 41%). Secondly, companies were on average significantly larger at the date of establishment (up from 2.2 to 2.5 FTEs). This is largely attributable to the fact that the average number of employees has increased by a third (from 0.9 to 1.2 FTEs) and – to a significantly lesser extent – to larger team sizes at the time of establishment (up from 1.3 to 1.4 FTEs).

The decrease in start-up activity can, at least partially, be attributed to further improvements seen in the job market in 2012. Many potential business founders – in giving up employee status in favour of self-employment – were confronted by comparatively high opportunity costs.

An increase in start-up activity is frequently observed in difficult economic environments.² This effect is mainly driven by so-called necessity start-ups, which are triggered by poor conditions in the job market. Such necessity start-ups are however often rather small, due, among other things, to the financial re-

strictions on the founders. In contrast, a good job market situation can on average result in larger start-ups. As the opportunity costs of a changeover to self-employment are relatively high under such conditions, more start-ups are being launched with a viable, promising business concept.³ In addition, as the financial restrictions are less severe, this facilitates larger start-ups. This was also evident in the percentage of companies with financial difficulties in 2012 which once again are less frequent compared to the previous year (see the section “Financing difficulties with external investors reduce further” for a detailed examination of this issue).

Job creation varies by sector

The analysis of GEE by sector makes it clear that the aggregate economic effect is very strongly driven by the largest industry group, which comprises non-high-tech service providers. Although average company size and the percentage increase in GEE are highest in high-tech manufacturing companies, they hardly register in aggregate terms when compared with the growth of non-high-tech service providers.

Examining the development of the employment effect from 2011 to 2012 more closely, it is noticeable that the GEE has not evenly increased across all sectors.

In the high-tech sectors – both service providers and manufacturers – an increase was evident in all the variables considered (GEE, average size, number of employees and the percentage of companies with employees).

The picture in non-high-tech sectors is less consistent: It was solely due to start-ups in the non-high-tech service industries that more jobs were created by start-ups in 2012 than in 2011. As was the case with the high-tech companies, in 2012 they were on average larger, had more staff and were more likely to have employees at the time of establishment. In contrast, both in non-high-tech manufacturing and in the construction industry fewer jobs were created overall. In the construction industry, although the start-ups created are on average larger and created more jobs than in the previous year, they could not compensate for the decrease in employment, due to the lower number of start-ups in this sector. Newly established companies in non-high-tech manufacturing were on average just as big in 2012 as in 2011. However, due to the decline in the number of start-ups, their contribution to the GEE was smaller.

Job creation in the first years after establishment

Job creation in the older cohorts of the KfW/ZEW Start-up Panel can be traced over several years. For example, employment in the companies of the 2005 cohort increased from 450,000 in the year of establishment to 510,000 at the end of 2007. From then on the numbers declined and, at 420,000 employees at the end of 2009, fell to a level below that at the time of establishment (see Figure 3).

Job creation in this cohort thus corresponds to the pattern typically seen in various empirical studies. The direct contribution to employment from by a given cohort rises in the years following immediately to establishment and then falls, and at some stage it drops below the initial level. Initially, the job gains achieved by growing companies are still greater than job losses due to market exits and the loss of jobs in less successful companies. However, if over the course of time more and more companies with-

Table 2: Contribution to job creation made by 2011 and 2012 start-up cohorts at time of establishment

	GEE	Average size	Of which employees	Of which founders	Companies with employees (percent)
2011 cohort					
High-tech manufacturing	4,800	3.0	1.3	1.7	43.9
High-tech services & software	23,700	2.1	0.6	1.5	27.0
Non-high-tech manufacturing	21,400	2.5	1.2	1.3	41.3
Construction	34,700	1.7	0.6	1.2	30.8
Non-high-tech services	290,100	2.3	0.9	1.3	37.3
Total	374,800	2.2	0.9	1.3	36.1
2012 cohort					
High-tech manufacturing	5,900	3.3	1.8	1.6	45.0
High-tech services & software	24,700	2.5	0.8	1.7	31.8
Non-high-tech manufacturing	18,300	2.5	1.2	1.4	36.2
Construction	33,300	1.9	0.8	1.2	33.8
Non-high-tech services	308,200	2.6	1.3	1.4	42.7
Total	390,500	2.5	1.2	1.4	40.7

Note: In calculating the GEE, the average size (incl. founders), the number of employees and the number of founders are all given as FTEs. The proportion of start-ups with employees at the time of establishment is calculated as a frequency value (in percent). Employees comprise full- and part-time workers compulsorily insured under the social security scheme, "mini-jobbers", family members providing assistance and trainees. Freelancers, temporary staff and interns are not taken into account. Summation discrepancies due to rounding.

Source: KfW/ZEW Start-up Panel.

draw from the market, the job losses can no longer be compensated for by the growth in employment generated by the surviving companies.⁴

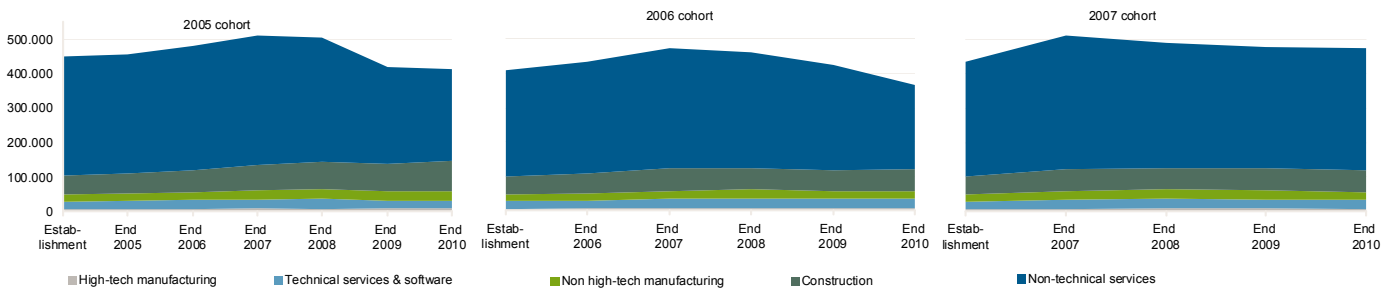
The exact progression of this pattern may vary greatly according to industry, region and year of establishment.⁵ A comparison of employment development in the 2005, 2006 and 2007 cohorts (see Figure 3) shows how strongly the year of establishment and hence the prevailing macroeconomic conditions can influence the employment trend of a cohort. In all three cohorts, employment was at its highest at the end of 2007 and declined thereafter. This means that the downward trend first took hold in the 2005 cohort from the fourth business year, while this decline occurred in the third and fourth years of existence of the 2006 and 2007 cohorts.

In all probability the cause of the decline in employment, which can be observed

from the end of 2008 regardless of the age of the cohort, lies in the financial crisis. This reached a climax in September 2008 and resulted in a distinct deterioration in the business climate and in business expectations during the second half of 2008.⁶ In this economic environment it is likely that many start-ups, which were actually in the expansion phase and, under other circumstances, would have recruited additional staff, refrained from appointing new employees. The percentage of expanding companies decreased as a consequence. Therefore, the point in the life cycle of a start-up cohort at which job losses due to market exits are no longer offset by the recruitment activities of the surviving companies was altered. The younger the cohort was at the start of the financial crisis, the earlier this point was reached.

Another reason for the earlier downturn in employment trends among the younger cohorts could also be that many start-

Figure 3: Development of the number of jobs created



Source: KfW/ZEW Start-up Panel.

ups withdrew from the market early due to the crisis. However, in 2008, when the downturn in employment took hold, it seems there was no increase in market exits. Thus, the percentage of companies from the 2007 cohort surviving at the end of 2008, i. e. at the end of the second business year, was hardly less than in the 2005 and 2006 cohorts at the end of 2006 and 2007 respectively, when these cohorts had reached the end of their second business year (see Figure 4). The probability of survival among young companies in 2008 was therefore hardly less than the probability of survival among companies from older cohorts at the same age, which were operating in a more benign macroeconomic climate.

That being said, there are certain signs that market exits increased in 2009. At

the end of this year, the survival rate for the 2007 cohort of 74 % at the end of the third business year was already significantly lower than the survival rates of the 2005 and 2006 cohorts (77 and 76 % respectively). Even if the differences in the survival rates are not pronounced, they indicate that the survival rate of young companies in 2009 was slightly lower because of the financial and economic crisis.

Summing up, young companies in the process of being established were hesitant about recruiting new employees in 2008 due to the effect of the financial crisis. As a result, total job creation across the cohorts switched over to the down escalator at an earlier stage than would have been the case if the overall economic picture had been brighter. Market exits by young companies did not in-

crease until 2009, when the crisis spread to the real economy, and then only to a moderate extent.

Sectoral differences also evident in employment trends

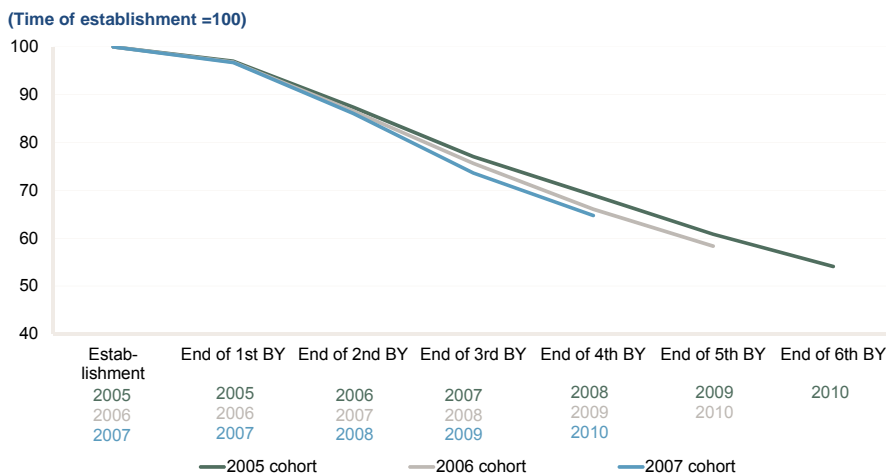
Non-high-tech service industries, the sector in which the majority of companies is set up, accounts for a high proportion of employment in a cohort. These sectors largely determine the employment trend of a start-up cohort (see Figure 5).

The highest rates of employment growth over a prolonged period are achieved in the manufacturing sector. Thus, in high-tech manufacturing the employment level in the 2006 cohort increased to 148 % compared to only 116 % in the economy as a whole. Over the period of four to six years in business considered in this report, employment in manufacturing is generally significantly higher than the level at the time of establishment. The employment trend in high-tech sectors is usually better than in non-high-tech manufacturing.

Even in the high-tech service and software sector as well as in the construction industry, the trend in employment for the start-up cohorts is better than in the economy as a whole, although it is usually worse than in manufacturing. In these sectors, too, employment in the period covered by the study almost never fell below the starting level.

Overall and in accordance with previous findings reported in the literature, the trend in employment among the start-up cohorts in manufacturing is better than in the service sectors. In high-tech manu-

Figure 4: Survival rates by start-up cohort and years in business

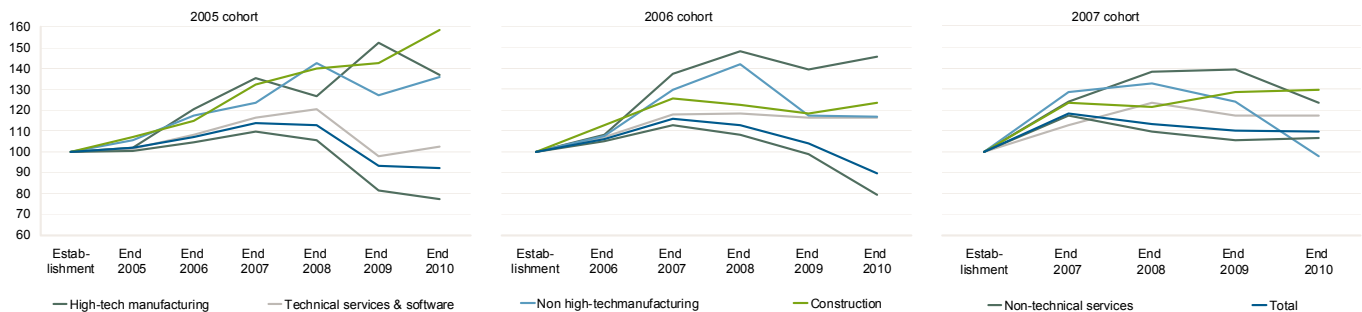


Note: Percentage of companies in the respective cohort which survived to the end of a given business year. The annual figures which are to be assigned to the business year vary according to the year of establishment and are represented by the corresponding colour for each cohort.

Source: KfW/ZEW Start-up Panel.

Figure 5: Employment trends

(Time of establishment =100)



Source: KfW/ZEW Start-up Panel.

facturing as well as high-tech service sectors, the employment trend is more positive than in non-high-tech industries.

A similar disparity between sectors is also evident in the two factors which determine the employment trends of the cohorts, i. e. the dynamics in employment in surviving companies and the number of surviving companies. At three employees (including the founder), the average number of employees at the time of establishment of a company set up in 2006 is distinctly higher for high-tech manufacturing than for the average of all sectors (two employees). After five years this figure doubles to six employees, while the average across all sectors is 3.1, i. e. in the latter case it increases by only around 50%. In non-high-tech manufacturing, it increases from 2.4 to 4.1 employees (+74%).

Young companies in manufacturing also show a better performance with regard to survival rates than service providers, and high-tech sectors perform better than non-high-tech sectors. 58% of the companies founded in 2006 are still in the market after five years. In all sectors apart from non-high-tech services (56% of surviving companies), the survival rate is higher than the average for all sectors, especially in the high-tech and non-high-tech manufacturing (72 and 67% respectively).

Innovation behaviour of young companies

Among the expectations pinned on young companies by politicians, the public and academics is the hope that they

will inspire and promote innovation, creating an impetus which will spread to existing companies.

Enterprise innovation activities include any projects which aim to launch new products or services onto the market or to introduce new production processes (production and process engineering, processes for creating a service). Besides research and development activities, the purchase of tangible as well as intangible assets, and the acquisition of external knowledge, these may also include product design, staff training and preparations for production, sales or marketing.

It is not only the innovation input of young companies in the form of R&D activities that is interesting, but also the innovations introduced by the companies as a result of these efforts. Innovations may comprise, on the one hand, product or service offerings (product innovations), which are new or have been significantly improved by the company. On the other hand, new or significantly improved production and process techniques (process innovations), which were not previously employed by the company, are counted as innovations. The term "innovation" is thus defined from the company perspective, i. e. it depends on whether it is something new to the company and not on whether another company has already implemented this innovation.

If young companies offer new products or services, which find acceptance on the market, then this directly improves

the competitive position of the German economy.

Moreover, innovations by young companies also have effects on the innovation performance of previously existing companies. If the latter are in competition with young companies, then if necessary they will also have to adopt innovations in order to hold their own with the competition. If they are the customers of innovative young companies, then it is possible that they can benefit from improved intermediate products. And they in turn would then have the chance to introduce improved products and services to the market. By the same token, these considerations also apply to process innovations made by young companies, which create scope for reducing prices by performing more economically for the companies themselves as well as other companies, too, as a result of competition.

These high expectations raise the question of how frequent innovation activities by young companies are in the first place.

Research and development (R&D)

Efforts in research and development (R&D) are among the important innovation activities. After all, they create the basis – provided that they are successful – for possible innovations and thus open up additional options to companies.

Even young companies carry out significant R&D operations. Out of the companies in the 2009–2012 start-up cohorts, 13% have already conducted R&D activities in at least one business year (see

Figure 6). In high-tech sectors, the proportion of companies actively involved in R&D is naturally higher than average. Over 57% of companies in high-tech manufacturing are actively involved in R&D. At 26%, the proportion in non-high-tech manufacturing is only half as large. The proportion of service providers actively involved in R&D is much smaller. Among high-tech service providers and software companies, the percentage of companies with R&D operations is 37%; in the non-high-tech service industries it stands at just over 10%. The percentage of young companies that undertake R&D operations in the construction industry is comparatively low. At 7%, it is only around half the average.

The decision to get involved in R&D is clearly made soon after the company is set up. About half of the young companies engaged in R&D begin doing so in their very first year of business. This applies both for both high-tech and non-high-tech manufacturing and for non-high-tech service providers. In high-tech services and software industries, almost two thirds of companies carrying out R&D activities did so in the very first year of business already. In the construction industry, on the other hand, only 27% of the companies that engaged in R&D activities were already active in this area in their first year of business.

In 2012, young businesses in the 2009–2012 cohorts spent an average of around EUR 40,000 on R&D activities (see Figure 7). The median value of this expenditure was EUR 20,000. R&D expenditure covers personnel costsⁱⁱⁱ and investment expenditure arising in connection with R&D projects together with expenditure on outsourced R&D^{iv}.

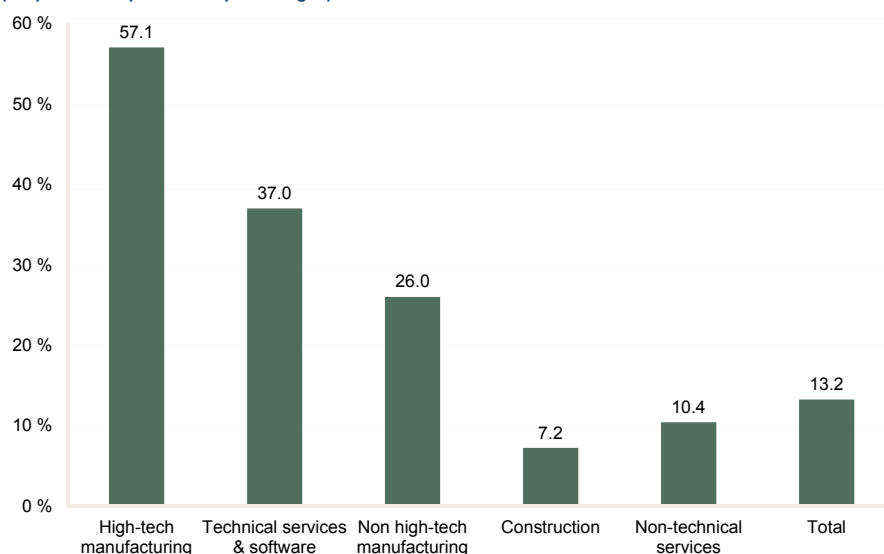
The majority of young companies involved in R&D (63%) do not spend more than EUR 26,000 on R&D. Some 14% of companies have R&D expenditure in excess of EUR 60,000. In the high-tech sectors, R&D expenditure is much higher

ⁱⁱⁱ In 2012, around 4% of employees in the 2009–2012 start-up cohorts spent at least half of their working hours on in-house R&D.

^{iv} In 2012, around 4% of young companies in the 2009–2012 cohorts engaged external agencies (e.g. other companies, research institutes) to carry out R&D projects.

Figure 6: Companies undertaking R&D activities

(Proportions expressed as percentages)



Note: Proportion of companies from the 2009–2012 start-up cohorts which are conducting, or have conducted, R&D activities since they were established. Values extrapolated.

Source: KfW/ZEW Start-up Panel.

than in non-high-tech sectors. Hence the highest amounts are spent on R&D by high-tech manufacturing (average EUR 97,000). The proportion of companies in these sectors, which spend more than EUR 60,000 on R&D is also above average at 36%.

Although young construction companies are characterized by low involvement in R&D, their expenditure in this area is high (EUR 44,000) if they actually engage R&D. The majority of young construction companies involved in R&D (63%) do not spend more than EUR 26,000 on it.

Product and process innovations

Out of the young companies in the 2009–2011 cohorts^v, just over 32% have introduced at least one product or process innovation in 2012 (see Figure 8).

As innovations are possible even without in-house R&D activities, the percentage of innovators is higher in each case than the percentage of companies undertaking R&D activities. The relationships shown in a comparison across different sectors are as expected. At almost 60%,

^v As the establishment of a new company in itself represents an innovation according to the above definition, only companies set up by 2011 will be considered here.

the percentage of innovators is highest in high-tech manufacturing, followed by high-tech services and software with just under 45%. All the non-high-tech sectors have a much lower percentage of innovators. It should be noted that manufacturing sectors have higher percentages of innovators than service sectors. The lowest proportion of young companies with innovations is in the construction industry.

German companies as a whole have a higher proportion of innovators than young companies. According to the Mannheim Innovation Panel (MIP)^{vi}, around 40% of companies as a whole are innovators; in high-tech manufacturing, well over 70% of companies innovate.⁷

Overall, there are more product than process innovators among young companies. A quarter of all young companies in the 2009–2011 cohorts could report at least one product innovation in 2012, and just over 13% had introduced at least one process innovation. In high-tech manufacturing, high-tech services and software, not only are the respective proportions of innovators well above av-

^{vi} The MIP's target group is actually established companies, as only companies with more than five employees are surveyed.

erage; in addition, process innovations have a much higher relative importance. The improvement of procedures and processes used to create services and goods is obviously of above average importance for young companies in these research- and knowledge-intensive industries.

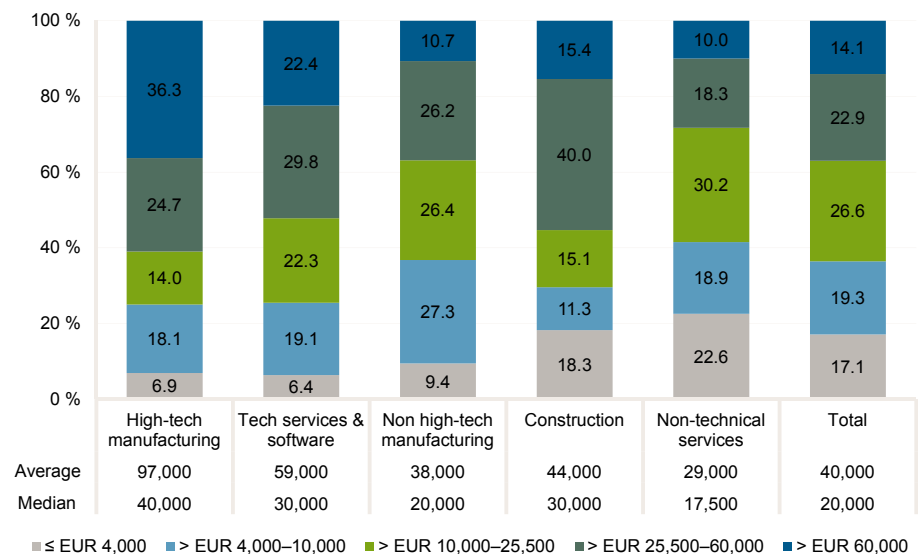
Success of product innovators

The introduction of innovations in itself is not necessarily beneficial for companies. It depends on how the innovations influence their commercial success. A measure for the success of product innovations that is established in the literature is the "Sales contribution of product innovations" to total revenues.

In 2012, some 11% of total turnover in companies in the 2009–2010 start-up cohorts was generated by innovative products that were launched in 2011 (see Figure 9). This value is just under the new products turnover contribution of around 13 to 15% achieved by German companies as a whole (MIP).⁸ With values between 10 and 16%, the levels of contribution to turnover which young companies achieve through product innovations in high-tech services and software, non-high-tech manufacturing, non-high-tech service sectors – and even in the construction industry – fall roughly within the average range. It is striking that young companies in the construction

Figure 7: R&D expenditure in 2012

(Proportions expressed as percentages)



Note: Figure shows distribution of young companies in the 2009–2012 cohorts according to R&D expenditure. Average and median are calculated without the 99% percentile of the distribution.

Source: KfW/ZEW Start-up Panel.

industry have achieved a slightly above average sales contribution from product innovations, even though the proportion of innovators in this sector is far below the average (14%).

Among young high-tech manufacturing companies, the percentage of turnover obtained from new products is more than twice as high as average (27%). However, according to the MIP, established companies in these sectors even man-

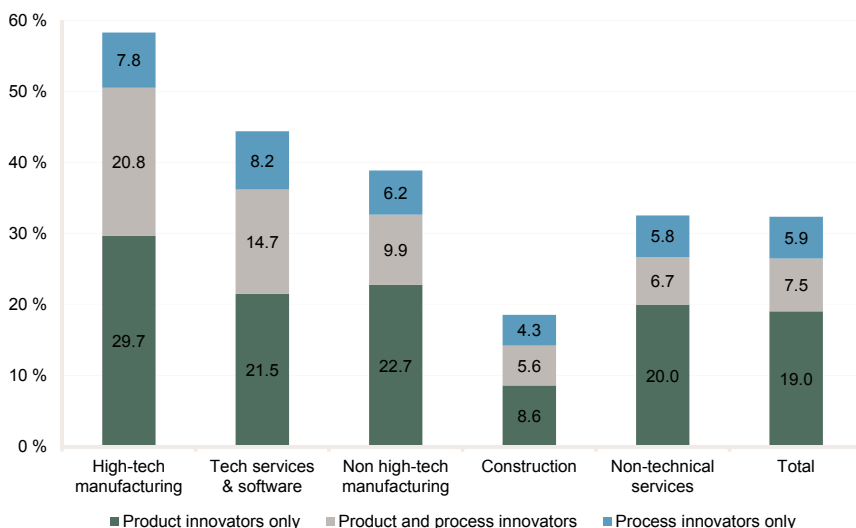
age to achieve a much higher turnover contribution by product innovations of just under 40%. The young companies considered had been in business for no more than three years when the innovations were introduced. With many developments, especially in high-tech manufacturing, there is a certain time lag until R&D efforts produce innovations. Sales revenues from innovations – even from developments initiated at an early stage – often do not accrue until years later. It is therefore not surprising that young companies in high-tech manufacturing on average generate smaller sales contributions from product innovations than established companies (in which it is not unusual to have a constant stream of innovations).

Market novelties

Product innovations, which did not previously exist on the respective company's market, are known as market novelties. These are ambitious product innovations which are also completely novel for consumers in these markets. These represent a special opportunity for companies. They can serve as yet unmet demand with their market novelties and open up market segments for which there are (at least initially) no direct competitors. However, the introduction of market novelties also poses risks. There is uncer-

Figure 8: Companies innovating in 2012

(Proportions expressed as percentages)



Note: Percentage of young companies in the 2009–2011 cohorts, which have introduced a product innovation, a process innovation or both in 2012. Values extrapolated.

Source: KfW/ZEW Start-up Panel.

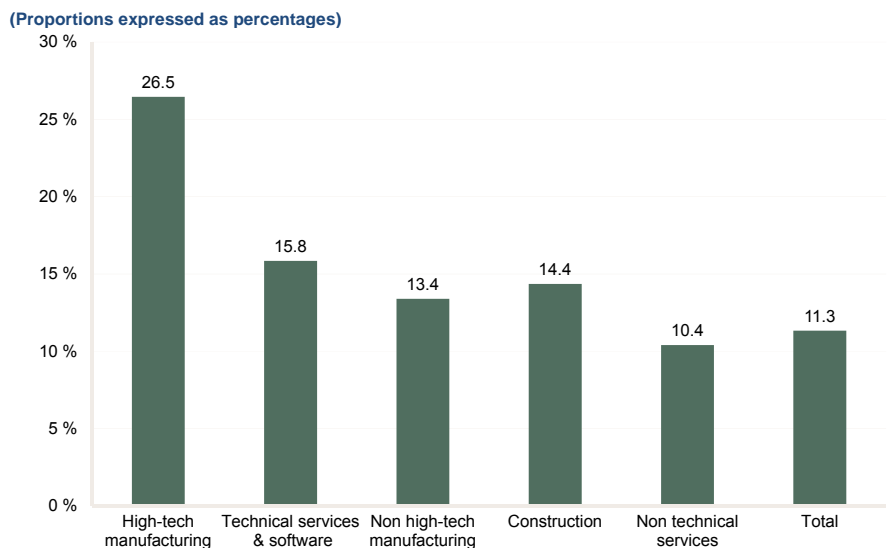
tainty about the actual demand for completely new goods or services. The new products are initially unfamiliar to the consumers. The market launch of such products therefore frequently requires resource-intensive marketing campaigns. There is a danger that market novelties will not be accepted by consumers and the innovation costs cannot be recovered. With incremental innovations (whereby existing products or services are improved), this risk is considerably reduced.

Just over 11% of young companies in the 2009–2012 cohorts launched a market novelty in 2012. Unlike the proportion of innovators, the percentage of companies with market novelties is somewhat higher than among German companies as a whole, which is under 10% (source: MIP, *ibidem*).

Depending on the areal market focus of the companies, distinctions can be made between worldwide, German-wide and regional market novelties. In total, some 3% of young companies introduced a world market novelty in 2012. Another 5% managed to introduce a completely new product to the German market. The remaining 3% of young companies developed new products or services for their regional market.

Young high-tech manufacturing compa-

Figure 9: Proportion of turnover from product innovations in 2012



Note: The proportion of turnover from product innovations is the proportion of aggregated turnover (in one industry) of the 2009–2010 start-up cohorts that was achieved by new or significantly improved products which were introduced to the market in 2011.

Source: KfW/ZEW Start-up Panel.

nies launch market novelties much more frequently than other young companies (28%). In well over half of the above cases (17%), these were even world market novelties. The proportion of companies with market novelties is lowest in the construction industry at 5%.

Young companies therefore not only display impressive levels of effort in terms of innovation, they also have considerable success with regard to innovations

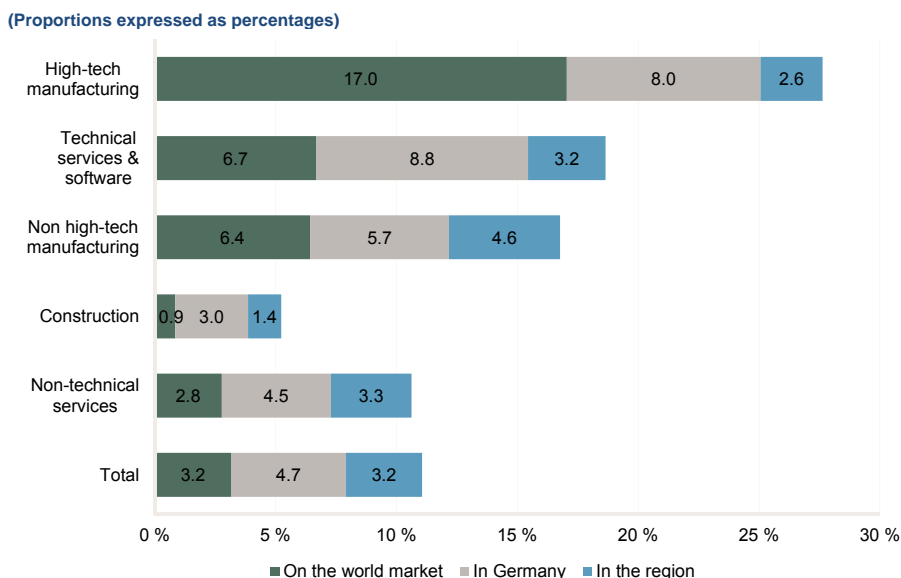
and market firsts. Even in the early years, these innovation outputs contribute appreciably to sales for these companies.

Heavy investment in the early years of company existence

Nearly 70% of young companies made investments in 2012 (see Figure 11). The proportion of companies making investments is thus almost twice as high as for small and medium-sized companies as a whole (41%).⁹ This is not surprising as young companies are still building up production capacity in their first years of business. The proportion of investors among young companies varies only slightly between sectors. Differences between sectors are mainly apparent in investment volumes.

The highest levels of investment were made by young companies in manufacturing, especially by those in the high-tech segment (see Figure 12). Around 2% of young high-tech manufacturing companies – by far the highest proportion of any sectors – invested at least EUR 0.5 million. For this reason, these sectors also have the highest average investment volume of all sectors at EUR 59,000. The median investment volume, however, is much lower even here: Half of young companies invest EUR 25,000 at most.

Figure 10: Companies introducing market novelties in 2012



Note: Figure shows the percentage of young companies in the 2009–2012 cohorts which introduced a market novelty in 2012 to the world market, to Germany or to the region. Extrapolated values.

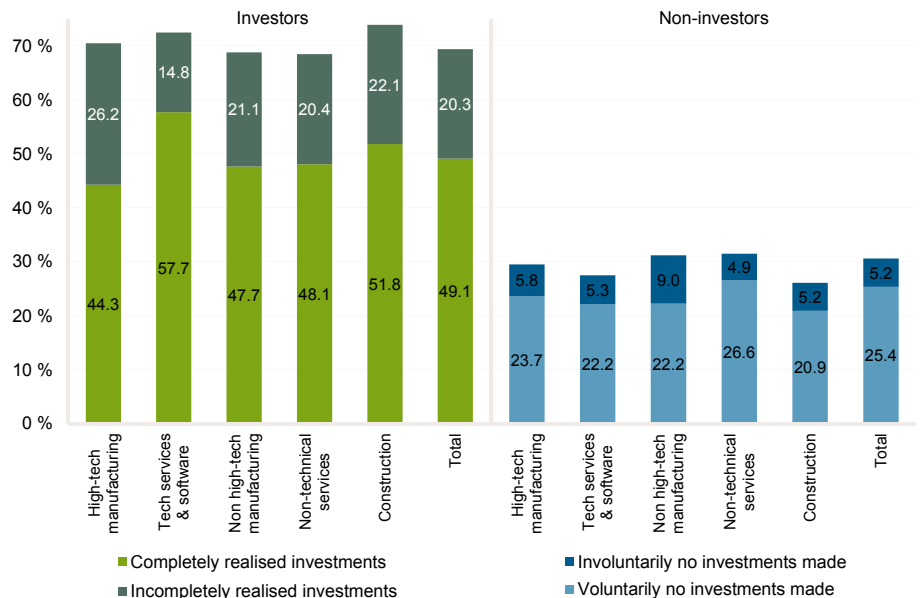
Source: The KfW/ZEW Start-up Panel.

High-tech service providers and software companies have the lowest average investment volume at EUR 23,000. Half of the new companies in these sectors even get by with less than EUR 10,000 for investments. The non-high-tech service providers also invested relatively low amounts in 2012 compared to non-high-tech manufacturing. Service providers – including, for example, hardware consultants, software companies or architect's bureaus – do not require extensive start-up investment usually, whereas production facilities in manufacturing (for example in metal working) demand extensive investment.

In 2012, young companies invested around EUR 2,000 more on average than in the previous year. At the same time, a certain spread can be observed in the volumes invested. A slightly larger proportion of small companies had especially high levels of investment. At the same time, however, there was also a slightly larger proportion which invested very little. The high investment volumes pulled the average up somewhat. Especially in high-tech manufacturing, young companies invested more in 2012 than in 2011.

Figure 11: Proportion of companies investing and implementation of investment plans, 2012

(Proportions expressed as percentages)



Note: Figure shows the proportions of new companies from the 2009–2012 cohorts which in 2012 a) invested and were able to implement all planned investments, b) have invested but have not been able to implement their investment plans in full, c) have not invested and do not have any investment plans that have not been implemented and d) have not invested and have not implemented their investment plans. Extrapolated values.

Source: KfW/ZEW Start-up Panel.

Majority of investment plans implemented

Half of young companies were able to implement their investment plans in full (see Figure 11). Around 20%, however,

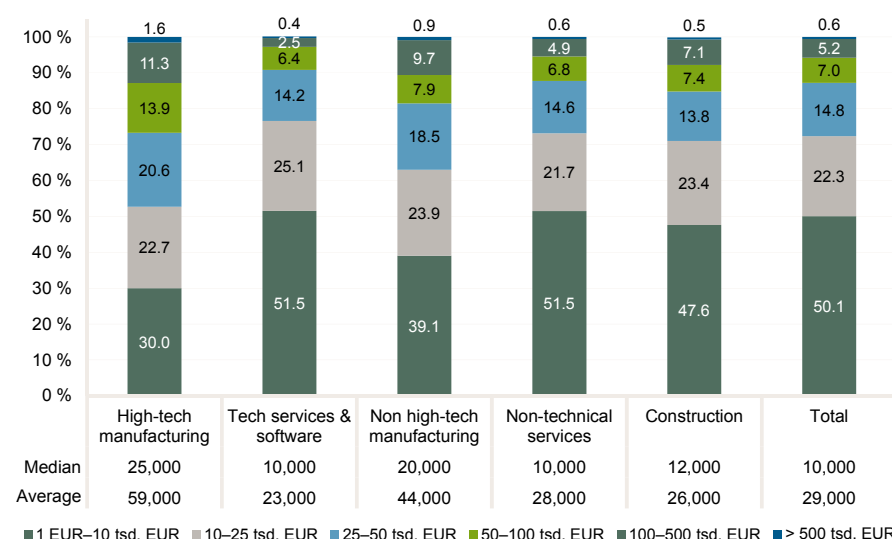
would have liked to invest even more. The high-tech service providers and software companies were the most successful in implementing their investment plans. At the same time, they also have the lowest average investment volumes. In contrast, new companies in high-tech manufacturing had the most frequent problems in fully implementing their investment plans.

A quarter of young companies have voluntarily forgone any investment in 2012. Only 5% were involuntarily unable to implement any investments. Looking at the different sectors, this particularly affects non-high-tech manufacturing. In this case, the investment plans made by 9% of new companies ultimately failed.

Compared with the previous year, it was somewhat more difficult for young companies to implement their investment plans in 2012. The proportion of young companies that were not able to invest as planned has risen slightly from 22 to 25%. Difficulties especially increased in the construction industry (+8 percentage points) and in high-tech manufacturing (+6 percentage points).

Figure 12: Amounts invested by start-ups, 2012

(Proportions expressed as percentages)



Note: Figure shows amounts invested by those company start-ups from the 2009–2012 cohorts which made investments in 2012, broken down by investment volume. Extrapolated values.

Source: KfW/ZEW Start-up Panel.

Half of companies with investments that did not go according to plan would have liked to have invested up to EUR 15,000 more. Broken down by sector, the average investment shortfall in 2012 amounted to:

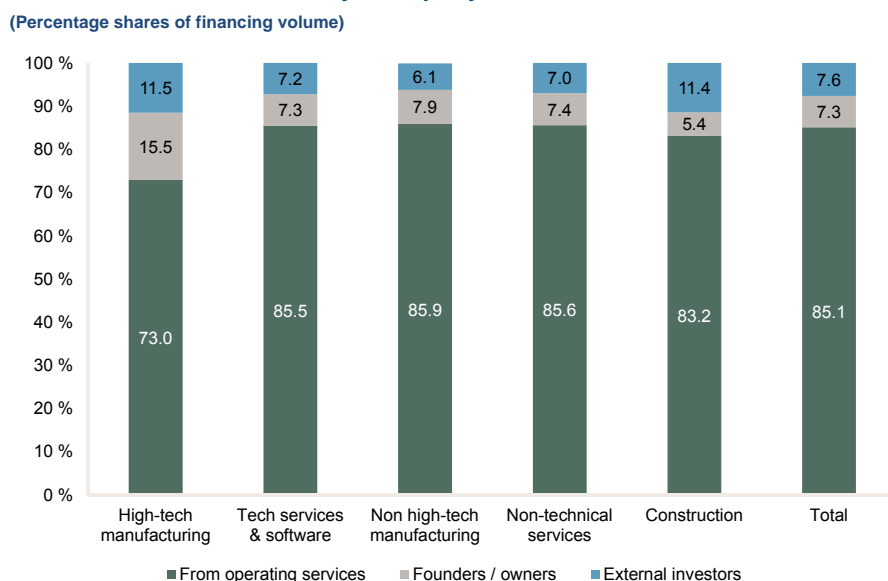
- High-tech manufacturing: EUR 35,000
- High-tech services & software: EUR 25,000
- Non-high-tech manufacturing: EUR 30,000
- Non-high-tech services: EUR 15,000
- Construction: EUR 15,000

The investment shortfall is thus highest in manufacturing and in particular in the high-tech segment. This follows the same pattern as that seen in the volumes of investments that were implemented. This points to large-scale investment projects in manufacturing. Such projects are often not easy to implement on a smaller scale; if problems arise, they have to be cancelled completely. This has a strong effect on volumes.

When young companies report that they have not implemented investment plans as expected, most of them have not even made a start on the investment projects in question (72%). Projects were much less often postponed (22%), interrupted (29%), scaled down (25%) or extended (34%).

Young companies must first build up their capacity, especially if they started (too) small. It is therefore rather unlikely that they will suffer from overcapacity. Accordingly, their investment behaviour differs from the trend in investments in the economy as a whole, which had been predominantly characterized by replacement investment rather than expansion investment.¹⁰ At the same time, the young companies are also influenced by conditions in the macroeconomic framework, especially financing conditions. Thus, it is likely that the economic downturn of 2012, which came as a surprise to the public – with the real growth rate dropped from 3.4% in 2011 to 0.9%¹¹ – did not leave young companies unmarked. Some of them will not have implemented their investment plans as they expanded more cautiously than ini-

Figure 13: Financing provided out of business activities, by owners and founders, and by third-party investors / lenders, 2012



Note: Volume percentages. Start-up companies from the 2009–2012 cohorts, which used financial resources (generated from the business activities or provided by owners / founders or by third-party investors / lenders) to cover investment costs and / or operating costs in 2012. Values extrapolated.

Source: KfW/ZEW Start-up Panel.

tially planned with a view to the weakness of the economy.

The expansion of production capacity in young companies is a prerequisite for successful business operations. Especially in high-tech manufacturing, these companies shoulder impressive investment volumes. However, investment activities are associated with problems in a quarter of start-up companies. Problems occur most frequently in high-tech manufacturing. The companies in this sector also make the largest investments. In earlier surveys, financing problems have proved to be the most common barrier to investment. The background to this is that the internal financing resources of young companies are insufficient to support the investment required. The access to adequate sources of external finance is correspondingly important to young companies in realizing their investment plans, especially in high-tech sectors.

External financing is essential

Expenditure on investments and on current business operations, especially for wages and salaries, determine the capital and financing requirements of young companies. They therefore seek out the most economical financing alternatives

available. At the same time, they must ensure they always remain solvent.

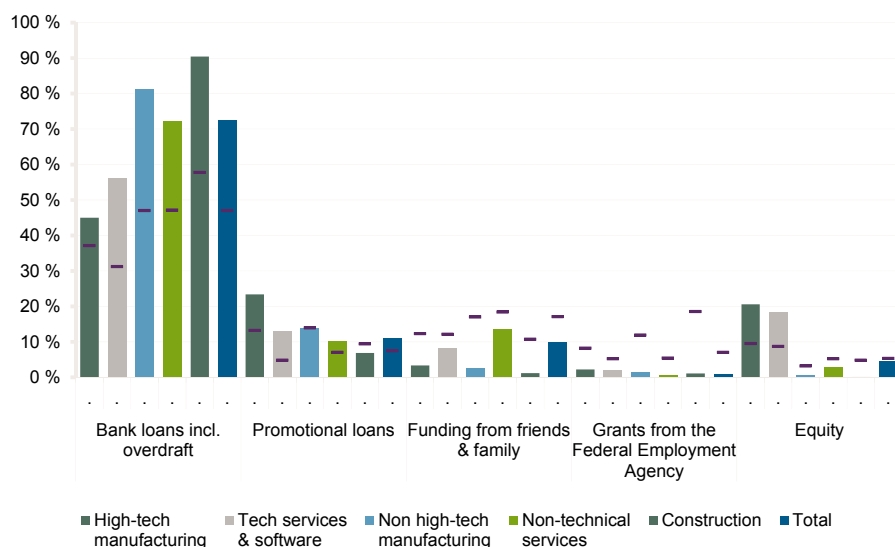
Earnings from business activities are a key source of company finance (internal financing). Virtually all young companies (97%) fall back on this. Young companies cover 85% of the financing volume that they need for investments and operating costs from internal financing (see Figure 13). To cover the remaining 15%, they have to obtain external financing. Founders provide around 7% of the external financing by themselves, approximately 8% is provided by third-party investors.

When sectors are compared, high-tech manufacturing stands out. Start-up companies in these sectors are relatively dependent on the supply of external funding (27% of total financing). It can be assumed that due to the relatively high level of innovation activities in these sectors, there are pronounced information asymmetries between investors and owners. It is therefore understandable that owners themselves contribute a higher proportion from their own funds and their share of the financing total is therefore relatively high (16%). However, young companies not only need external funding to finance their investments. On average, they also rely on funding from

founders or third-party investors to cover 21% of their running costs. Notwithstanding the above-average level of turnover in these sectors (see Figure 1), the internal funding resources of young high-tech manufacturing companies are insufficient to cover their operating costs in full. This may be because R&D activities have long lead-times before sales revenues can be obtained from new products and services, or before benefits from new processes are reflected in higher quality and / or lower costs. In addition, companies in these industries bear heavy investment budgets (see Figure 12). Due to that young companies in high-tech manufacturing are reliant to an above-average extent on funds from founders / owners and from external investors (62% of investment volume in high-tech manufacturing sectors vs. 50% overall).

When young companies take advantage of funding from external investors, the average volume is EUR 37,000. In high-tech manufacturing, the average external financing volume is three times greater. 6% of the companies in this sector with external financing requirements actually use more than EUR 0.5 million (see

Figure 14: Percentage financed by third-party investors / lenders, 2012
(Proportions expressed as percentages)



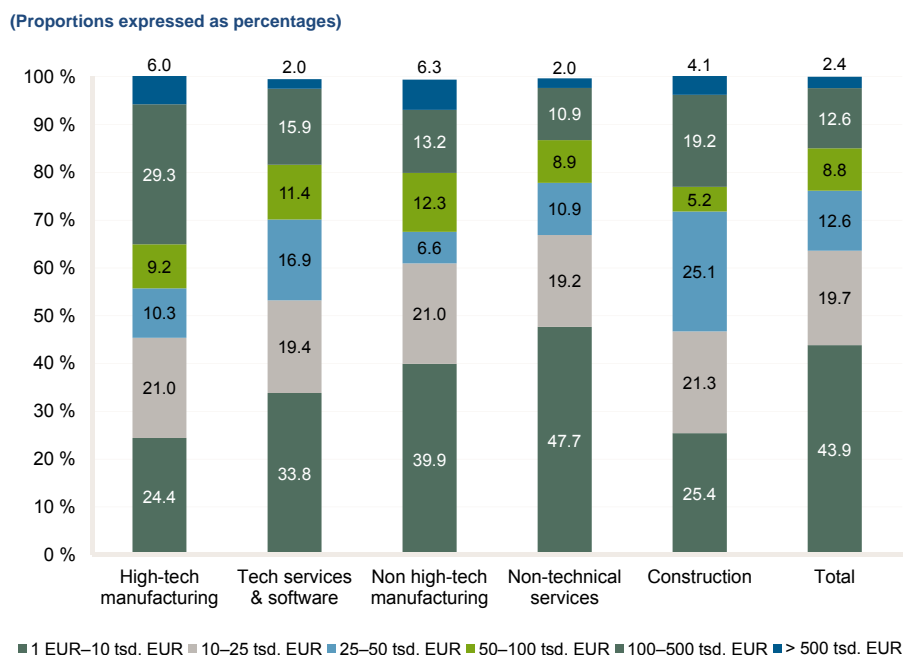
Note: Bars = volume shares, lines = frequencies. Due to the very low proportions which they constitute, mezzanine and other finance sources are ignored in this presentation of volume shares and frequencies. Figure covers start-up companies from the 2009–2012 cohorts which used finance provided by external lenders / investors in 2012. Extrapolated values.

Source: KfW/ZEW Start-up Panel.

Figure). In non-high-tech manufacturing about 6% of young companies use more than EUR 500,000 of external funding, too. But external financing requirements in high-tech young companies are fun-

damentally larger. This is clearly reflected in the high proportion of their use of external capital in the EUR 100,000–500,000 range, and the relatively low proportion of external funding in the EUR 1–10,000 range. The lowest financing volumes from external investors are found on average among non-high-tech service providers.

Figure 15: Breakdown of financing volumes provided by external investors / lenders, 2012
(Proportions expressed as percentages)



Note: Figure covers start-up companies from the 2009–2012 cohorts which used finance provided by external lenders / investors in 2012. Extrapolated values.

Source: KfW/ZEW Start-up Panel.

The level of running costs and investments codetermine whether third party finance is sought and, where applicable, its extent. The higher the financing requirement, the more likely it is that a commensurate amount of external financing will be needed. A favourable sales-cost ratio serves to counter the need for external funding.

Sources of finance

There is a range of options open to young companies in relation to external finance. The most frequently used option, and also the most significant in terms of volume, is bank loans (see Figure). As venture capital addresses the funding requirements of young, innovative and fast-growing companies, its share of the total financing volume is highest in high-tech sectors. One form of financing which is only to be found

among young companies is funding from friends and family. A substantial proportion of companies use this type of external financing. It accounts for a relatively large volume share, similar to that of promotional loans. Although grants from the Federal Employment Agency (BfA) are also used where possible, they only play a secondary role in volume terms.

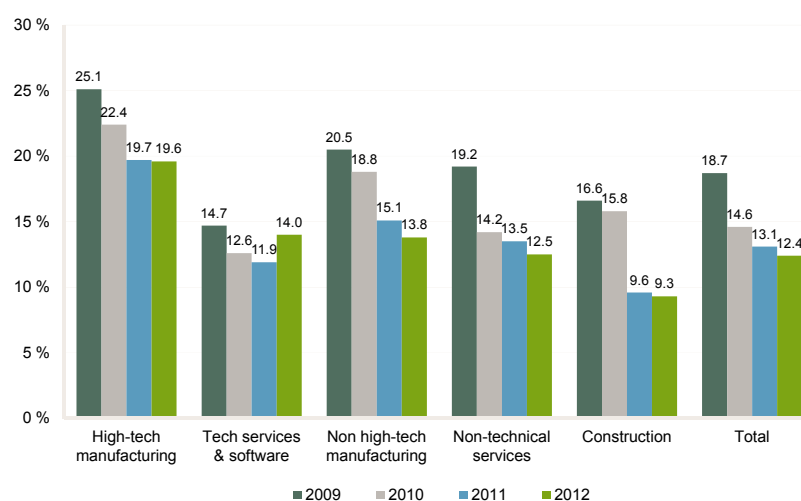
Financing difficulties with external investors decline further

Financing by external sources of capital usually takes the form of equity capital or borrowed funds. The investor has different rights to information and control, depending on the method of financing. Difficulties may arise with both methods of external financing, due to asymmetry of information between investors and young companies, differences in profit participation, and differences in the right to intervene in commercial decisions. Overall, the occurrence of financing difficulties with external investors has fallen back to the level of 2007, after peaking in 2009.^{vii} In 2012, 12% of start-ups had problems with financing from external investors. This relatively low value reflects the favourable general financing situation for companies in Germany.¹²

In addition to the macroeconomic financing environment, individual company characteristics influence whether financing by external investors is associated with problems. The asymmetry in information that is especially pronounced in innovative companies is likely to result in increased financing problems. It is obviously necessary to distinguish between R&D activities as the input to the innovation process and market novelties as the output. As it is uncertain whether R&D activities will actually lead to marketable products, financing difficulties are more likely among companies which undertake R&D. With market novelties in contrast, the uncertainty is relatively lower, even if

^{vii} Estimated results of a probit model (financing difficulties – yes / no) with interaction effects. Explanatory variables: Year, company age, sector, R&D, employees, market novelties, investment amount category, operating costs volume category, sales-to-costs ratio, KfW funding. Interactive effects taken into account: Sector and employees / R&D / market firms / investment volume category / operating costs volume category / sales-to-costs ratio and between investment volume category and operating cost volume category.

Figure 16: Financing difficulties over time and across industries
(Proportions expressed as percentages)



Note: Start-up companies in the cohorts 2009–2012 / 2008–2011 / 2007–2010 / 2006–2009, which had difficulties with external investors / lenders in 2012 / 2011 / 2010 / 2009. Values extrapolated.

Source: KfW/ZEW Start-up Panel.

market acceptance is not assured. This does not significantly hinder financing by external investors.

Due to the intensity of their R&D activities, companies in high-tech industries seem to be especially vulnerable.^{viii} For high-tech manufacturing, it is not, however, the industry in itself that sends out negative signals to external financiers and which leads to financing difficulties. Instead it is the R&D activities common in these industries, their high investment volumes and operating costs which are responsible for such difficulties. An additional problem for these companies is that, compared with other sectors, they have the least favourable sales-to-cost ratio. It is correspondingly more difficult for them to convince investors that their projects are good propositions for financing. The operating costs and investment volumes of high-tech service providers are lower and their sales-to-costs ratio is more favourable. This serves to counter financing difficulties.

The preceding analyses have shown that companies in high-tech manufacturing are the most likely to fulfil expectations in relation to job creation and innovation. It is, however, among this group of young companies that financing difficulties oc-

cur most frequently. This is also likely to impair investment activity. Young companies are, on the one hand, dependent on conventional financing sources such as bank loans and, on the other hand, they require special methods of financing such as venture capital.

Economic policy makers are therefore faced with two tasks. Firstly, broad-based credit financing should be facilitated for young companies. Not only does the high-tech sector, but all start-up companies benefit from this. In the process, it could be taken into account that it is likely to be especially difficult for young companies undertaking R&D activities to obtain external capital. Secondly, specialized offers such as venture capital should continue to be supported for the small but macro-economically significant group of “Gazelles” among the start-up companies. After all, financing difficulties among young companies are structural in nature due to asymmetries in information, even if the extent of those difficulties is subject to fluctuations driven by economic cycles. Hence funding for start-up financing is a long-term task for economic policy. ■

^{viii} Estimated results of a probit model (financing difficulties – yes / no) with interactive effects.

¹ For information on the German economy as whole see, for example, Schiersch, A. and B. Gehrke (2013): FuE-intensive Industrien und wissensintensive Dienstleistungen im internationalen Vergleich, Studien zum deutschen Innovationssystem No. 7 2013, Berlin.

² Fritsch, M., Kritikos, A. and K. Pijnenburg: Unternehmensgründungen nehmen zu, wenn die Konjunktur abflaut, DIW Weekly Report No. 12 2013.

³ See, for example Cabral, L. and J. Mata (2003), On the Evolution of the Firm Size Distribution: Facts and Theory, *The American Economic Review*, 93, 4, 1075–1090.

⁴ See, for example Engel, D. and G. Metzger (2006): Direct employment effects of new firms: Further empirical insights concerning the regional and technological dimension. In: Fritsch, M. and J. Schmude (Eds.), *Entrepreneurship in the region*, New York: Springer, 75–93.

⁵ Schindele, Y. and A. Weyh (2011): The direct employment effects of new businesses in Germany revisited: an empirical investigation for 1976-2004, *Small Business Economics* 36:353–363.

⁶ <http://www.cesifo-group.de/de/ifoHome/facts/Time-series-and-Diagrams/Zeitreihen/Reihen-Geschaeftsklima-Deutschland.html>.

⁷ Estimated results of a probit model (financing difficulties – yes / no) with interaction effects. Explanatory variables: Year, company age, sector, R&D, employees, market novelties, investment amount category, operating costs volume category, sales-to-costs ratio, KfW funding. Interactive effects taken into account: Sector and employees / R&D / market firsts / investment volume category / operating costs volume category / sales-to-costs ratio and between investment volume category and operating cost volume category.

⁸ Rammer, Ch., Aschhoff, B., Crass, D., Doherr, T., Hud, M., Köhler, C., Peters, B., Schubert, T. and F. Schwiebacher (2013), Innovationsverhalten der deutschen Wirtschaft, Indikatorenbericht zur Innovationserhebung 2012, Mannheimer Innovationspanel (MIP), ZEW, Mannheim.

⁹ Schwarz, M. (2013), Solider Gesamteindruck trotz Sand im Getriebe. Mittelstandspanel 2013, p. 7.

¹⁰ Projektgruppe Gemeinschaftsdiagnose (2013), Konjunktur zieht an – Haushaltsüberschüsse sinnvoll nutzen, Herbst 2013. Hornberg, C. (2012); Unternehmensinvestitionen: 2013 beginnt schwach, wird besser, KfW Investment Barometer Germany, KfW Group, Frankfurt M., 14 December 2012.

¹¹ Borger, Klaus (2013), End of recession in Europe benefits Germany, KfW Business Cycle Compass Germany, KfW Group, Frankfurt M., 23 August 2013.

¹² Zimmermann, V. (2013), Trotz schwacher Konjunktur Unternehmensfinanzierung stabil. 2013 survey of companies. KfW Group, Frankfurt M.