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**Innovative Small and Medium Sized Enterprises and the
Creation of Employment**

Executive Summary

*Submitted by: Austrian Institute for Small Business Research (IfGH) and
Instituto Vasco de Estudios e Investigación (IKEI)*

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Study supported by the Innovation Directorate (DG Enterprise, European Commission).
A copy of the main report can be obtained at innovation@cec.eu.int.

The responsibility for the content of this report lies with the

Austrian Institute for Small Business Research (IfGH)
A-1040 Vienna, Gußhausstrasse 8
Tel. ++43-1 505 97 61, Fax ++43-1 503 46 60
Internet: <http://www.ifgh.ac.at>, e-mail: ifgh@ifgh.ac.at



EUROPEAN COMMISSION

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Authors of the report:

Sonja Sheikh, IfGH
Thomas Oberholzner, IfGH

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Enterprise Directorate-General
(Innovation Directorate)

PREFACE

This report is an outcome of the study *“Innovative Small and Medium Sized Enterprises and the Creation of Employment”* commissioned by the Innovation Unit, Directorate-General Enterprise of the European Commission under the auspices of the Community Innovation and SMEs Programme. The study carried out by the Austrian Institute for Small Business Research (IfGH), Vienna and the Instituto Vasco de Estudios e Investigación (IKEI), San Sebastian, together with partner institutions from several member states of the European Union further elaborates on the complex relationship between innovative small and medium sized enterprises (SMEs) and the creation of employment. The results of the study shall together with other assignments strengthen the knowledge base of innovation performers and policies in Europe and shall serve to effectively support the analysis, updating and dissemination of priority topics of the new Innovation Policy of the Commission titled “Innovation in a knowledge-driven economy”⁽¹⁾.

The present publication summarises the main findings of the report “Innovative Small and Medium Sized Enterprises and the Creation of Employment” with the view to facilitating the diffusion of the outcomes among the target audience. This publication has been prepared by the Austrian Institute for Small Business Research (IfGH) and is published on its own responsibility. A copy of the main report can be obtained at innovation@cec.eu.int.

¹ European Commission (2000a)

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EXECUTIVE SUMMARY

1 INTRODUCTION

There is increasing evidence that new or small firms play an important role in the production of innovation, which is not only considered crucial to the growth of output, productivity, and employment in the economy, but also a fundamental driving force behind rising living standards and a better satisfaction of individual and collective needs (health, entertainment, working conditions, transport, etc.) (°). Much of this evidence has only recently been developed and has led to considering the advantages of smaller firms as a source of innovation, such as: a) a greater tolerance for higher risk initiatives, b) a collegial organisational context that values ideas and originality, c) a capacity to reap substantial rewards from market share in small niche markets, d) an improved capacity for integrating complex sets of information and technologies to create a useful outcome, and e) a sense of collective purpose where all may profit directly from a successful new innovation (³).

These considerations have led to an increased interest in the relationship between innovative small and medium sized enterprises and the creation of employment, which is furthermore enforced by two observations:

First, most of the European economies are facing serious difficulties to create a sufficient number of new jobs and show high unemployment rates. The governments of almost all European Union member states assume that an increase of innovation activities at firm level will help to overcome Europe's unemployment problem. This conviction is supported by the so-called "European Paradox" illustrated by the European Commission in the Green Paper on

Innovation. Compared to its principal competitors the scientific performance of the EU is excellent, but over the last fifteen years its technological and commercial performance in high technology sectors has deteriorated (⁴). Thus, one of Europe's major weaknesses is its lower ability to transform the results of technological research and skills into innovations and competitive advantages. Especially new and small firms whose key assets lie in their flexibility and capability to quickly respond to market challenges are considered to be an important source of innovation and employment creation.

Second, several studies have examined the impact of innovation on employment creation in recent years, from a theoretical as well as from an empirical perspective. However, despite enormous efforts made in national and international analyses, literature shows that the relationship between innovation and employment creation is not clear-cut. Especially with regard to employment effects of innovation in small and medium sized enterprises (SMEs), only little research has been done so far.

It is the purpose of this study to further explore the complex relationship between innovative small and medium sized enterprises and the creation of employment and to shed light on what can and what can not be expected from innovative SMEs in terms of employment creation. Although this research may not be able to provide a definitive answer to this question, it attempts to highlight the main aspects associated with the links between innovation and employment creation in small and medium sized enterprises.

² European Commission (1994)

³ OECD (1996a)

⁴ European Commission (1994)

2 MAIN FINDINGS

1. Despite enormous efforts made in theoretical and empirical research, literature shows that the linkages between innovative SMEs and the creation of employment are far from being clear-cut and due to a lack of harmonised data evidence is hardly comparable across countries.
2. Innovation in SMEs is often a very informal activity and quite difficult to capture with commonly used indicators, such as R&D expenditure, for example, which always tends to be biased in favour of large enterprises. Therefore, it might be necessary to elaborate different, SME-related indicators for measuring innovative activities in smaller enterprises and their effect on employment.
3. Despite existing limitations and insufficiencies with regard to the comparability of respective research findings, there seems to be evidence that innovation in general has a positive impact on employment. This positive effect is more pronounced in SMEs than in large scale enterprises.
4. Although innovative new and small firms are more likely to create employment than other firms, growth in small innovative firms seems to be very variable with some small innovative firms showing very high and others very low or even negative growth rates. Thus the absolute number of jobs created in these firms tends to be modest.
5. From the literature surveyed, it might be concluded that product innovation has a positive effect on employment, while the effect of process innovation on employment is not precisely detectable, particularly for large enterprises. Findings indicate that, especially in SMEs both, product and process innovations lead to employment increases.
6. Only little research has been undertaken in Europe so far on the impact of organisational innovation on employment. Studies conducted in the United States, however, show that organisational innovation may have a major impact on employment and economic growth in small and medium sized enterprises and therefore should be better addressed in future research on innovative SMEs and the creation of employment.
7. Despite the apparent positive relationship between innovation and employment, results also indicate that creativity, visionary leadership, entrepreneurial thinking, etc. in combination with innovative culture are the driving forces behind employment creation in SMEs, rather than the sole implementation of new technologies.
8. Results at aggregate level also show that innovative industries have a better development of employment over time than less innovative or non innovative sectors. Especially in modern service industries innovation seems to be particularly job intensive.
9. There seems to be evidence that the introduction of innovation improves the qualification level of employment, in the sense that it favours highly skilled labour and promotes the substitution of unskilled labour. This confirms the existence of a skill-bias in technological change.
10. The creation of employment seems to be only to a medium degree an aim of current support initiatives in the field of innovation: More than 30 % of representative bodies and private market operators state that innovation support measures consider job creation as an objective only to a rather low degree or not at all.

3 INNOVATION AND EMPLOYMENT CREATION AT INDUSTRY AND MACRO LEVEL

3.1 BASIC LINKS BETWEEN INNOVATION AND EMPLOYMENT

When analysing the impact of innovative SMEs on the creation of employment two different approaches can be distinguished in theoretical research according to the level of aggregation:

- a) the firm level approach and
- b) the aggregate level approach.

Analyses at *firm level* focus on the process of technological change at the level of the individual firm. They do not take into account inter-firm relationships. Analyses at *aggregate level* attempt to quantify the aggregate net employment effect in an entire economy or industry by considering, for example, displacement effects, where employment increases in one firm may be compensated by employment decreases in other firms and vice versa. In the following the theoretical linkages between innovation and employment are described from a rather macro-economic perspective. Some theoretical considerations, related to the perspective of an individual firm are illustrated in section 4.1.

Generally, product innovation which generates new demand is thought to increase employment, at least at the firm level. Process innovation is thought to decrease employment as it enables a company to achieve the same output with fewer resources, frequently with less labour⁽⁵⁾. However, the overall impact of innovation on employment is the outcome of a number of opposing forces and the mechanisms behind are not as

straightforward as they might look at first glance. With both, product and process innovation, indirect effects can counter the initial effects described above.

Process innovation, for example, can increase the efficiency of a firm, thus helping to lower costs. This might result in an increase in market share and a subsequent increase in demand, which may either keep employment at existing level or lead to an increase in employment within the respective firm or even within the entire sector⁽⁶⁾. A high elasticity between capital and labour, a high price elasticity of demand, and a high degree of market competition might thereby support a positive effect of (labour saving) technological progress on employment.

Product innovation is said to have an initial positive effect on the creation of employment. However, when new products only replace old ones no positive effect on employment at the *firm level* can be expected. Even a negative effect on employment is possible, if the new products are produced using more efficient production technologies⁽⁷⁾. Similar considerations hold true at aggregate level, where negative employment effects in firms offering “outmoded” products might compensate or even overcompensate for the initial employment increases in companies promoting new products and suppliers of intermediate inputs, due to sales declines⁽⁸⁾.

⁵ OECD (1996a)

⁶ Licht (1996)

⁷ Licht (1996)

⁸ Lehner (1998)

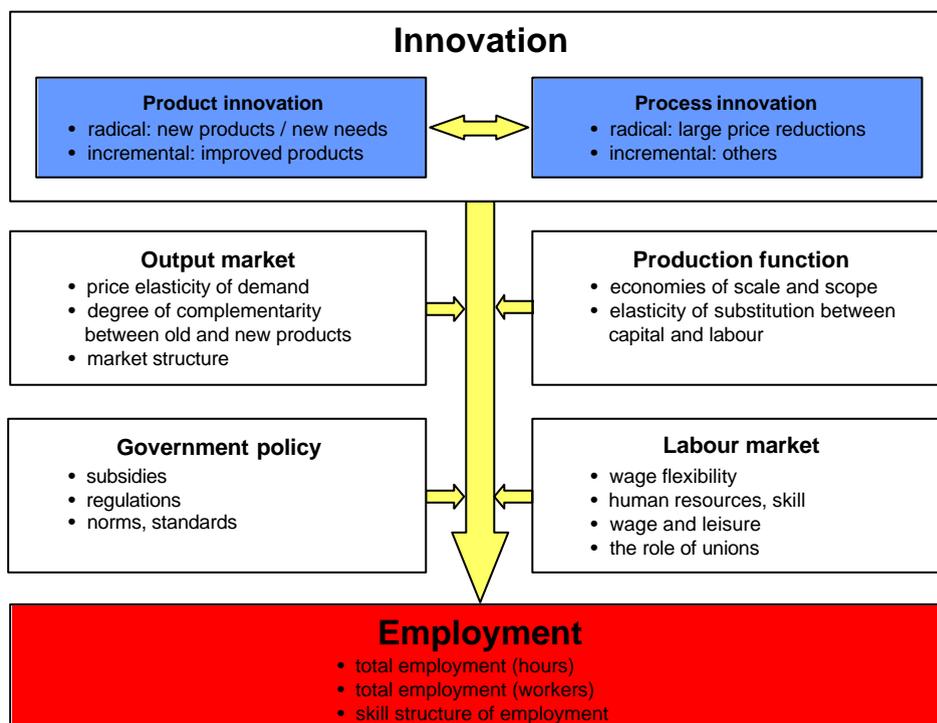
Given this background it is not surprising that most theoretical studies that have examined the coherence in recent years point to a rather complex relationship between innovation and employment. *Direct* effects may be offset by *indirect* ones and the balance of both of these effects depends on various factors such as:

- price elasticities,
- market structure,
- wage flexibility and union power,
- elasticity of substitution
- degree of economies of scale and scope,
- production technologies,
- government policies, etc.

Also, labour market regulations might influence the transmission from innovative activities to employment creation. Such regulations appear in a variety of features, e. g. employment protection legislation and determine the degree of flexibility or rigidity of the labour market. Obviously, a more flexible labour market is, in general, favourable and supportive to innovative activities (9). In the long run, it seems that the main effect of rigid work regulations is to slow down employment effects of innovations.

An outline of the most important economic forces at work on the path from innovation to employment is given in Graph 1.

Graph 1: **Factors influencing the impact of innovation on employment**



Source: Blechinger et al. (1997), modified

⁹ see also Saint-Paul (1996)

3.2 REVIEW OF EMPIRICAL RESULTS

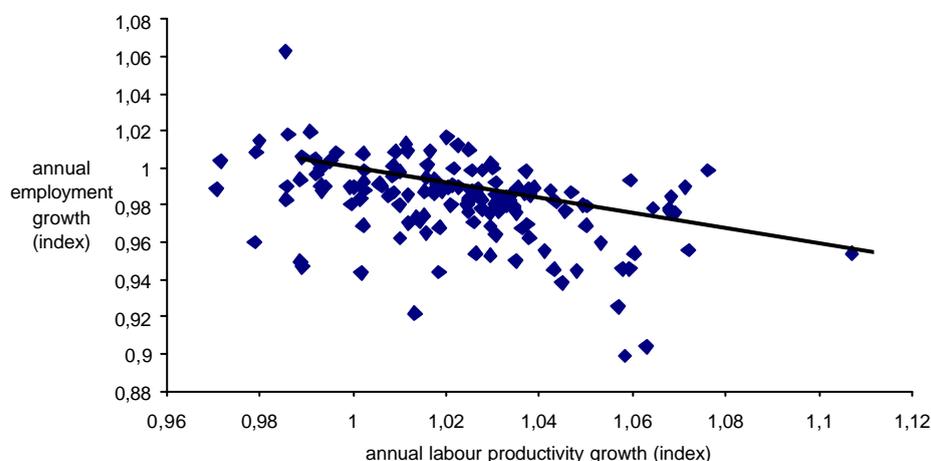
In contrast to analyses at firm level sector or macro studies, at least partially, account for effects of innovation on employment which are external to the firm (e.g. displacement effects). Put differently, these studies, in principle, exclude impacts on employment (gains or losses) which are merely caused by changes in the market share of an innovating firm. This might be considered an advantage against micro level analysis. But there are several disadvantages associated with sector and macro studies, too. These disadvantages mainly pertain to empirical and measurement problems. Since innovation regularly has the nature of a project and is actually introduced by individual enterprises it is difficult to decide whether an entire sector or even an entire economy is innovative or non innovative. Large enterprises still account for a high proportion of innovative activities (in particular R&D) in the economy and, therefore, are often decisive for the innovativity of an industry.

Another crucial problem is the definition of an “industry” or “market”. Sectors can be defined

rather broadly or narrowly. For example, if industries are defined too broadly the analysis might comprise a large number of firms which are not competing with each other and, thus, measured effects might not be valid. In the opposite case potential external effects might be cut off and neglected by the analysis.

Empirical sector and macro studies are rather scarce compared to firm level studies and they apply very different approaches in order to tackle the above mentioned problems. However, they seem to confirm that innovative industries show a better development of employment overtime than less innovative or non innovative sectors, in Europe as well as in the United States and Japan. It might also be concluded that although there exists an indirect negative effect of innovation on employment - i.e. innovation leads to higher productivity growth which in turn leads to decreasing labour demand - the direct positive effect, over-compensates this indirect effect and, in the end, employment growth may even be above average.

Graph 2: **Employment and productivity growth in manufacturing industries (2-digit ISIC) of selected OECD countries, 1990 - 1996**



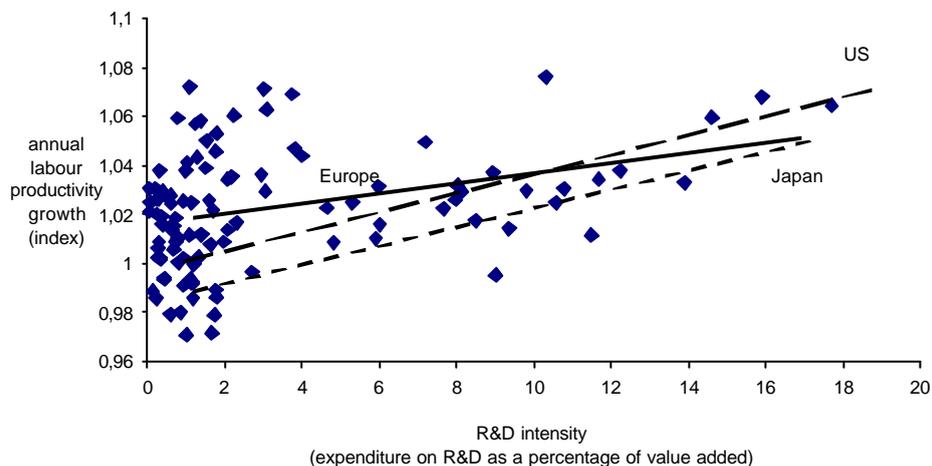
Source: Own calculations on basis of OECD STAN database

Graph 2 shows the position of 144 country/industry combinations⁽¹⁰⁾ with respect to their annual employment and productivity growth between 1990 and 1996. In addition, the regression line is presented⁽¹¹⁾. This figure suggests a negative and statistically highly significant correlation between job growth and labour productivity growth. Put differently, there is empirical evidence that an increase in (labour) productivity is accompanied by a decrease in employment.

This means that additional demand and production of goods due to productivity gains can not fully balance out “direct” losses from technological progress. This result is in line with the outcomes of analyses by Blechinger et al. (1997) obtained for earlier periods (mainly for the 70s and 80s).

Also the relevance of R&D intensity⁽¹²⁾ (as an indicator of an industries’ innovativity) in this context has been explored in more detail. At a first glance, from the data available there seems to exist no direct association between R&D intensity and employment change. However, from regression analysis it appears to be statistically evident that there is a positive relation between R&D intensity and productivity growth. Industries spending relatively more on R&D show a higher increase in productivity over the period 1990 to 1996 compared to those with less R&D spending (see Graph 3). Although differences between the three major regions are rarely significant the figure indicates that the influence of R&D intensity on productivity change is somewhat weaker in European countries as compared to the United States or Japan.

Graph 3: **R&D intensity and productivity growth in manufacturing industries (2-digit ISIC), by major regions, 1990 - 1996**



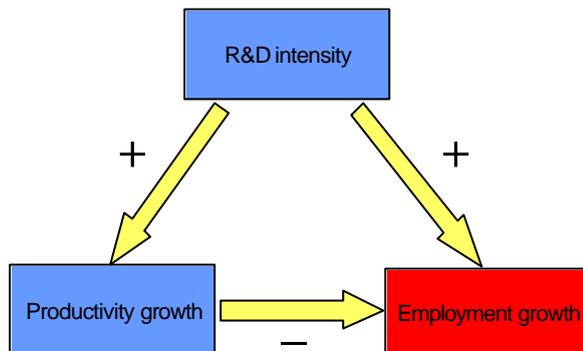
Source: Own calculations on basis of OECD STAN database and Main Industrial Indicators

¹⁰ For each of the 16 countries, 9 industries are included in the analysis, resulting in 16x9=144 "country/industry-combinations".

¹¹ For more technical information on the analysis performed see section 3.3 of the main report.

¹² R&D intensity is measured in terms of an industries' R&D expenditures in relation to its value added over the period 1990 to 1996.

Graph 4: **Interdependencies between R&D intensity, productivity growth, and employment growth**



Thus, excluding the *indirect* (negative) effect of R&D intensity via increasing productivity, it becomes evident that the *direct* effect of R&D intensity on employment growth is slightly but significantly positive (see Graph 4).

In the end, this analysis suggests that the *direct* positive impact of R&D intensity on the one hand and the *indirect* negative impact on the other seem to compensate each other. However, the influence of productivity growth on employment growth itself is still clearly negative, as is illus-

trated in Graph 2. Although labour productivity growth and R&D expenditures are able to partially explain differences in employment growth between Europe, the United States and Japan, these factors are not sufficient when determining, for example, why European countries perform distinctly weaker than the United States in terms of job creation.

Whereas the lag of Italy, for instance, can be attributed to differences in productivity growth and R&D intensity, these two determinants do not seem to be appropriate in explaining the relatively weak performance of, particularly, Finland (being a special case for several reasons), France, Germany and Sweden. Rather, labour market rigidities may still play a certain role in this respect.

Results from a few studies dealing with the service sector, like Blechinger et al. (1997), Tether et al. (1998), Lettmayr et al. (1997) or Blazcejczak (1991), for example, further suggest that innovation in modern industries, such as computer services, technical services and telecommunication is particularly employment intensive (¹³).

¹³ For more detailed information on the issue of innovation and employment creation at industry and macro level see section 3 of the main report.

4 EMPLOYMENT CREATION BY INNOVATIVE SMES AT FIRM LEVEL

4.1 THE RELATION BETWEEN INNOVATION AND EMPLOYMENT AT FIRM LEVEL

In section 3.1 the impact of innovation on employment has been illustrated from the perspective of an entire sector (market) or an entire economy. However, what is true for a sector or an economy in general must not necessarily hold for each individual firm in that sector or economy. An innovation is a kind of project and regularly introduced by individual enterprises, some of them being “pioneers” others being “imitators”. Individual firms introduce an innovation to gain a competitive advantage over other companies. According to Schumpeter’s work, enterprises innovate because they are seeking for rents⁽¹⁴⁾.

Thus, even if there is, for example, no or only a negative employment impact at the level of the sector innovation might lead to shifts in market shares and, as a consequence, to a reallocation of jobs in the sector or economy. Since firms generally aim to *increase their market share* by introducing an innovation it seems plausible that employment effects tend to be more favourable (i.e. more positive or less negative) at firm level than at aggregate level. In other words, innovation has a net effect at the level of the entire market and, independently from that, leads to a reallocation of jobs between firms within the market. As far as the reallocation effect is concerned, innovative enterprises, at least in principle, gain jobs and market shares at the cost of non or less innovative enterprises.

Thus, at the firm level there is an additional factor to those mentioned in section 3.1 determining the relationship between innovation and employment. This factor might be described as the potential of the innovation to create a *competitive advantage* for the respective firm⁽¹⁵⁾. However, under the circumstances of increasing globalisation it is not only firms that compete. Also regions and nations compete on world-wide markets for products and services. Hence, from the viewpoint of a nation or a region the question whether to innovate or not cannot be answered merely on the basis of the macro-economic interrelations outlined in section 3.1. The impact/opportunity of creating a competitive advantage and the risk of losing market shares, respectively has to be taken into account as well.

The reallocation effects described above suggest that determining employment impacts at firm level involves the risk of overestimation. It shall be noted that an examination at firm level might also lead to an underestimation of (positive) impacts on the number of jobs. This is because production of additional products and services in innovative enterprises in turn may create additional demand for inputs (raw material, services, innovation goods, etc.) offered by various suppliers. However, growth and employment effects occurring in supplying firms are difficult to capture and therefore are rarely taken into account in empirical analyses.

¹⁴ See for example Schumpeter (1949)

¹⁵ This in turn depends on the possibility to protect the innovation, etc.

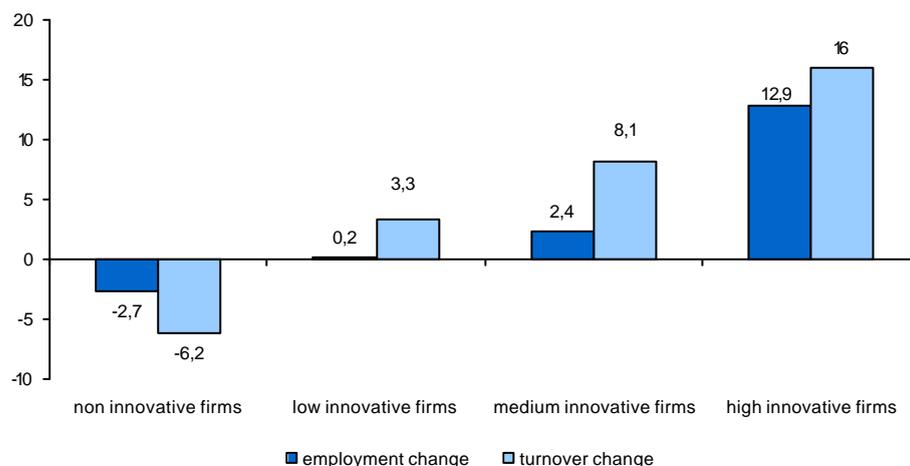
4.2 REVIEW OF EMPIRICAL RESULTS

Turning to the effect of innovative small and medium sized enterprises (SMEs) on the creation of employment at the individual firm level, it appears that quite some research has been undertaken in this field, but only few studies really consider size-class dimensions, either from a theoretical or from an empirical point of view. This might imply the hypothesis that the impact of innovation on employment does not differ by size-class. Considering the findings of the research study, however, this hypothesis ought to be rejected. While it is quite well established that innovation in general has a positive effect on employment creation, there exists some evidence that this effect is more pronounced in small and medium size than in large scale enterprises, in the manufacturing as well as in the service sector (see for example, Cesaratto et al. (1996), Kleinknecht et al. (1990) or Klomp and Pronk (1998)).

The statistical analysis presented in Graph 5, furthermore, shows that the innovativity of an enterprise correlates even closer with growth of turnover than with growth of employment. Lettmayr et al. (1997) find a highly significant increase of relative turnover growth (compared to sector average) with increasing degree of innovativity for the time period 1991 to 1996.

Despite these quite encouraging results, the authors show that the spectre between success and failure increases with the degree of innovativity, which underlines the higher *risk* small innovative enterprises face. The consistently higher standard deviations of turnover and employment growth of innovative enterprises found document that innovations do fail in many cases which is reflected in the phenomenon that individual innovative enterprises may even have a worse growth record than non innovative enter

Graph 5: **Employment and turnover change in Austrian craft firms, 1991 - 1996, by degree of innovativity, deviation of growth rates from sector average in percentage points**



Source: Lettmayr et al. (1997)

prises. This does not contradict the result that, on average, small innovative enterprises grow at a faster pace than non innovative enterprises, but growth in innovative small firms seems to be very variable and heterogeneous with some small innovative enterprises showing very high and others very low growth rates.

Generally, the analysis of employment creation by small innovative enterprises points to the following four key findings summarised in Tether (2000, p. 110):

1. "Innovative or technology based new and small firms are more likely to create employment than similar firms in the general population."
2. "The average rate of employment creation in an individual innovative or technology based new or small firm tends to be modest. In general the average rate of employment creation amongst such firms is much less than ten jobs per firm per year (Storey and Tether (1998)). This is not a recurrent finding for the UK, but also for continental Europe."
3. "Growth amongst innovative and technology based new and small firms tends to be concentrated in a few firms (Storey et al. (1987), North et al. (1994))."
4. "Even amongst the fastest growing innovative and technology based new and small firms the absolute number of jobs created over a decade tends to be modest."

There is strong evidence that innovation on aggregate as well as at firm level has a positive effect on employment. Furthermore there seems to be a consistently negative relationship between firm size and the rate of employment crea-

tion in innovative enterprises. However, although the average growth rate of employment appears to be higher in SMEs than in large scale enterprises, growth in innovative small firms is very variable with some small innovative enterprises showing very high and others very low growth rates. This underlines the higher risk small innovative enterprises face and may result in a comparatively low number of jobs created in these firms.

It should, however, be recognised that from the viewpoint of a firm, employment is seldom the main objective of innovative efforts. Employment increases in SMEs are usually the consequence of productivity growth and output increases, rather than of a desire to grow into a large firm.

Despite the apparent positive relationship between innovation in general and the creation of employment, results also point to the necessity of differentiating between kinds of innovation when analysing their effects on employment. Empirical studies have shown that a disaggregation of expenditure for product and process innovation might alter results obtained by using rather general indicators for innovation (see, for example, Blechinger et al. (1997)). This does not affect the meaningfulness of analyses based on rather global measures for innovation, but may stimulate implementation of a more differentiated approach in the assessment of innovative activities in small and medium sized enterprises and their effects on employment.

The most widespread differentiation of the concept of innovation found in theory as well as in empirical research relates to the distinction between product and process innovation. Unfortunately, only little research has been undertaken

on the impact of organisational innovation on employment so far - at least in Europe. From a theoretical point of view, organisational innovation is considered a type of process innovation dealing with the restructuring of internal or external working relations. Studies performed in the United States (see for example Coriat (1995)) show that organisational innovations, which especially in SMEs might be an important source for increased productivity and competitiveness, may well have a major impact on the creation of employment and economic growth. A correlation which currently seems to be more or less neglected in European research.

With regard to the different effects of product and process innovation on the creation of employment Lettmayr et. al (1997), for example, find that in Austria small and medium sized enterprises that do both product and process innovation yield the highest growth of *turnover* followed by enterprises with only product innovation, while enterprises with only process innovation perform worse than non innovative enterprises with regard to turnover growth. It is therefore concluded that the introduction of process innovation in small and medium sized enterprises might rather be a reaction on decreasing revenues. With regard to *employment* growth only those SMEs that do both, product as well as process innovation yield a perspicuous increase. Employment growth of the other groups does not differ from each other.

More recent research for all member states of the European Union and Norway based on data from the Second Community Innovation Survey (CIS II) confirms the findings of Lettmayr et al. (1997) for several other countries. Ludsteck and Steiner (2000) find in their analysis of the Euro-

pean *manufacturing* sector that innovation has a significant effect on employment only if product as well as process innovation is conducted jointly. This effect seems particularly pronounced in Germany, Norway, Spain, France, Finland and Italy. In Germany, for example, a firm which conducts both product and process innovation, *ceteris paribus*, increases its demand for labour by about 10 %.

It might be concluded from the studies surveyed that product innovation has a positive effect on employment, at least in the long run, in small and medium sized as well as in large scale enterprises. As far as process innovation is concerned, effects on employment seem to vary. However, findings seem to indicate that, especially in SMEs both, product and process innovations lead to employment increases, whereas in larger enterprises the effect of process innovation on employment is not precisely detectable (¹⁶).

However, despite the apparent positive relationship between innovation and the creation of employment there seems to be some evidence, particularly put forward by Clarysse and Uytterhaegen (1998) that the sole implementation of new technologies might not be sufficient for stimulating growth in small and medium sized enterprises. Creativity, visionary leadership, and entrepreneurial thinking in combination with innovative culture are the driving forces behind innovation and employment creation in SMEs. It, therefore, might hardly be sufficient to stimulate isolated and singular innovations but to promote an innovative mind-set, an openness to change and regular implementation of innovations by small and medium sized enterprises are important to foster the creation of employment.

¹⁶ For more studies dealing with this issue see section 4.2.2 of the main report.

5 THE IMPACT OF INNOVATION ON THE SKILL LEVEL OF JOBS

5.1 THE RELATION BETWEEN TECHNOLOGY AND SKILLS

Innovation might not only have an effect on the quantity of employment created, but also on the quality of employment. Technological change may, for example, alter the demand for workers skills. Many tasks once carried out manually are now performed by automated equipment. Additionally, as information-based technologies such as computers and sophisticated machine tools become more widespread the demand for certain skills may disappear, while the demand for workers able to maintain, use, and develop these technologies may rise. There is, therefore, concern that technological change increases the polarisation of society by widening the gap in income and employment opportunities between those whose skills have been displaced by new technologies and those who create and use these technologies.

When new technologies are introduced into production processes it is generally thought that they reduce the demand for low skilled workers and increase the demand for high skilled workers. A phenomenon commonly referred to as “*skill-biased technological change*” (see Box 1). A theoretical model dealing with the effects of innovation on the skill level of employment does not seem to be available. A positive relation between technological progress and the demand for high skilled workers (at firm level as well as at the level of the economy as a whole), how-

Box 1: What is “skill-bias”?

The notion of bias in technical change derives from the theory of economic growth and originally concerns the capital/labour relationship of production. Technical change is said to be biased (as opposed to neutral), if it entails, under certain conditions, changes among factors in the distribution of income. In the current debate the use of this concept has departed from its origin and is applied to the different skill levels of employment. Suppose, for example, that there are two factors, skilled and unskilled labour, each associated with a certain technology. If technological change improves one technology, let’s say the one used by skilled workers, more than the other then it is called “skill-biased”.

Source: OECD (1996c)

ever, can be explained by reference to at least three intuitive arguments (¹⁷):

1. High skilled workers adapt more easily to technological change than low skilled ones.
2. New technologies perform repetitive tasks traditionally carried out by low skilled labour or workers without extensive training.
3. Computer technologies increase the productivity of high skilled workers more than of low skilled workers, so that firms match high skilled workers with new technologies.

However, at the same time, and in addition to this “upskilling”, technology can also have a de-“skilling” effect, in the sense that it might lower the skills required to perform certain tasks.

¹⁷ OECD (1996b)

5.2 REVIEW OF EMPIRICAL RESULTS

Various empirical studies have shown that new technology favours highly skilled labour and substitutes low skilled labour⁽¹⁸⁾. However, while most of these studies refer to the aggregate level, only little is known about shifting labour demand due to innovation and technology in individual firms, especially in small and medium sized enterprises as only few empirical studies dealing with the impact of innovation on the qualification level of jobs consider any size-class dimension.

The empirical study conducted by Falk (1999) suggests that, in general, innovative firms have higher employment expectations than non innovative firms. In particular, job creation for *university graduates* is actually more common in innovative enterprises: between 49 % and 57 % of these firms expect employment to increase, depending on the type of innovation measure. For non innovative enterprises, only between 21 % and 33 % expect employment of *university graduates* to increase.

Similar to university graduates, employment expectations for *masters and technicians* differ between innovative and non innovative enterprises. For new market products, for example, which have proven to be more significant than any other measure of product innovation in determining expected employment probabilities, 39 % of the innovative enterprises plan to create new jobs for *masters and technicians* for the period 1997 to 1999, compared to only 26 % in the group of non innovative firms (see Graph 6).

Box 2: Skills and how to measure them

The term “*skill*” refers to the qualifications needed to perform certain tasks in the labour market. In the most general sense, it reflects the level of human capital, and *upskilling* can be seen as synonymous for human capital development. In empirical work, researchers often use proxies based on education and occupation. Education is usually defined by years of schooling or degree obtained and is not adjusted for quality. Occupations sometimes provide more information on the skills of workers, but measures vary considerably across countries and may be ambiguous. These measures do not necessarily take into account on-the-job-learning and skills associated with the use of new technologies. In practice, most empirical work which attempts to assess the evolution of skills uses crude proxies such as the ratio of production and non-production workers, that of blue and white collar workers, or the share of the workforce with a higher education.

Source: OECD (1996c)

Lettmayr et. al (1997) hardly find any difference between innovative and non innovative enterprises regarding the highest skill level of employees. Innovative SMEs, however, seem to employ more frequently *university graduates of technical studies*. As far as *high school graduates*⁽¹⁹⁾ are concerned, innovative enterprises (medium and high innovativity) show higher percentages compared to non innovative enterprises. The most striking differences, however, can be observed for the group of *skilled workers*⁽²⁰⁾. The higher the degree of innovativity the higher is the share of *skilled workers* in total employment. Less innovative firms, on the contrary, have a comparatively high share of *low skilled workers*⁽²¹⁾.

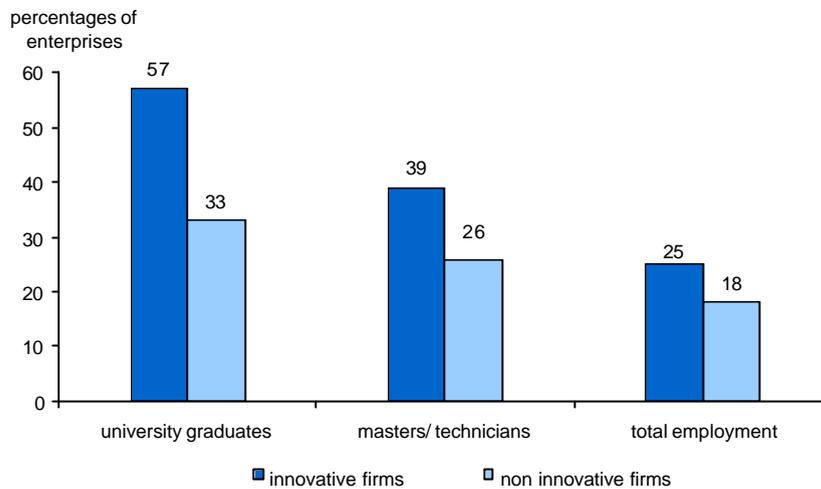
¹⁸ For a comprehensive overview of the most relevant studies see for example OECD (1996c).

¹⁹ secondary education

²⁰ workers with vocational education and/or professional training

²¹ workers with basic education (primary school)

Graph 6: **Demand for university graduates, masters and technicians, and total employment in West German enterprises, 1997 - 1999**



Source: Falk (1999), modified

In general, the introduction of innovation seems to improve the qualificational level of employment, in the sense that it favours highly skilled labour and promotes the substitution of unskilled or low skilled labour. This confirms the existence of a skill-bias in technological change. But in contrast to the quantitative impact of innovation on employment, which seems to *decrease* with firm size, there exists some evidence that the higher demand for highly skilled workers and the lower need for low skilled workers in innovative firms is more pronounced in larger enterprises than in smaller ones and *increases* with firm size ⁽²⁾.

The correlation between innovation and the qualification level of employment, however, needs to be further explored by future research. The definition or conceptualisation of “quality of work” by means of various indicators related to the skill level of employees as presently used in most empirical analyses is quite unsatisfactory. Although it is doubtless that innovation leads to a

change in required skills it is questionable whether this change is necessarily implying an upgrading. Today, new skills are often identified as higher skills, although they might “only” be *different* skills.

It should also be differentiated between the type of labour needed for conduction of R&D or for the implementation of innovation, which usually will increase the demand for high skilled personnel, and the effects of these innovations on the skill level of e.g. production personnel. Latter effects are much more difficult to capture and may be rather ambiguous.

In order to tackle the problem of changing skill requirements due to innovation public authorities should on a regular basis review the skills needed by the market and adjust their training and education schemes accordingly. An important role in this context might be attributed to the chambers of commerce, industrial associations, business representatives, etc.

²² The impact of innovation on the skill level of jobs is dealt with in more detail in section 5 of the main report

6 SELECTED VIEWS ON SUPPORT INITIATIVES IN THE FIELD OF INNOVATION

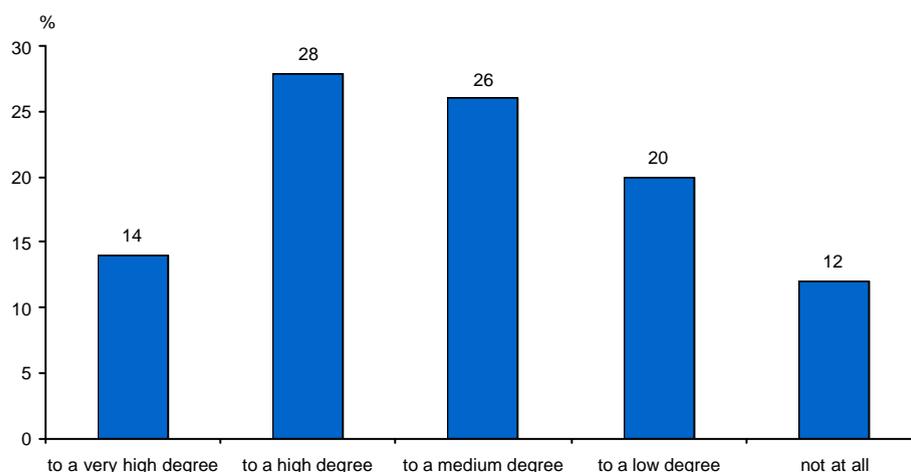
The findings on the relationship between innovation and employment in SMEs might give some valuable indications for the design of policy support for innovative small and medium sized enterprises. The degree to which they are already implemented might be reflected in the extent to which current innovation support initiatives are able to contribute to the objective of promoting the creation of employment in SMEs. Indeed, it seems - in the view of experts from representative and public bodies as well as private market operators - that current support initiatives basically acknowledge the fact that innovative enterprises are potential employment creators.

However, experts rate the degree to which employment related aims are achieved in the scope of current innovation support initiatives rather low: More than 30 % of representative bodies

and private market operators state that innovation support measures consider job creation as an objective only to a rather low degree or not at all (see Graph 7). This is not really surprising, considering that the comparatively low degree of achievement might be partly due to the fact that employment creation is mostly only an indirect aim of innovation support measures.

However, according to the opinion of experts interviewed in the scope of this study, the creation of employment is not pursued sufficiently enough in the frame of existing innovation support measures. At this point, some better coordination of innovation policy with other policy areas of the Commission, such as competition policy or employment policy might strengthen the link between innovative small and medium sized enterprises and the creation of employment.

Graph 7: **Expert opinion on the relevance of employment aims as pursued by current support initiatives in the field of innovation, in percent**



Source: Analyses of 53 expert interviews conducted in all European Union Member States and Norway by the IfGH

Also, regarding the target group-orientation of current innovation support initiatives there still seems to be room for significant improvement. While measures appear to be comparatively well targeted towards new technology sectors and modern services, the extent to which they focus on specific size-classes of enterprises is rather low, especially as far as micro firms, employing less than 9 employees, are concerned – although this group of innovative enterprises has the highest potential for employment creation.

If innovation support policy for SMEs is used as a tool to create employment, it, however, has to be considered that those SMEs that seem to contribute most to employment creation are very difficult to reach. They often do not have the time or resources to look for funding available in the frame of corresponding support programmes. This underlines the necessity of increasing their awareness of technology support measures. The lack of awareness is still one of the most significant barriers to the participation of more small and medium sized enterprises in existing support programmes ⁽²³⁾.

Also, innovation in small and medium sized enterprises and, particularly, in innovative fast growing small firms, seems to be more frequently based on technology transfer and diffusion, rather than on original R&D and radical technological novelty. It is usually product oriented and serving emerging niche markets, addressed at previously unmet customer needs - many start-ups in the so-called “new economy” can be attributed to this segment. As in other small firms the entrepreneur plays a key role in their innovative efforts. He secures access to technological know-how, personnel and close customer relations, which is important for the

recognition of latent needs, etc. This has important implications for the process of innovation in small and medium sized enterprises. Recognition of these differences should also support the design and adaptation of innovation policies targeted at the needs of small and medium sized enterprises.

There is also hardly any focus on organisational innovation discernible within the innovation policies of the member states of the European Union and Norway. This might be considered a weakness of current innovation support, as comparative analyses including the United States and Japan have shown that organisational innovation is essential for employment related issues, especially for SMEs. Therefore, public support organisations should be encouraged to make organisational innovation an objective in their support schemes offered to small firms.

In addition, it has been suggested by representative and public bodies as well as private market operators to further encourage and promote networking of SMEs - at national as well as at international level - in order to make existing knowledge available to other SMEs which may have similar innovation needs and problems. To put it into the words of a managing director of a small innovative enterprise in the United Kingdom: *“We need to have schemes in place where SME owners can meet with other SMEs in a peer atmosphere to exchange ideas, look at good practice and experiences. A system where owners do not feel under pressure in any way, where they can realise that they are not alone, and that their problems are not unique. There needs to be many hundred such places of focus allowing small and medium sized enterprises to take advantage of available experience.”*

²³ European Commission (2000b)

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