ASSOLOMBARDA
Confindustria Milano Monza e Brianza

With the support of
J.P.Morgan

Costs and benefits of company involvement in ITS projects

RESEARCH N°05/2017

By the
Education System and Human Capital Unit

Costs and benefits of company involvement in ITS projects

The present research project was promoted by Assolombarda's Education Systems and Human Capital Unit and was conducted by the Fondazione IRSO.
The research was supported by the JPMorgan Chase Foundation. The contents and opinions in this paper are those of Assolombarda alone and do not reflect the views of the JPMorgan Chase Foundation, JPMorgan Chase & Co, or any of its affiliates.

The findings and data from the survey on member companies, carried out in November 2016 and February 2017 by Centro Studi Assolombarda, are indicated in italics.

Contents

Introduction

The present research was conducted within the framework of the "Focus on youth: develop ITS employability" project, promoted by Assolombarda Confindustria Milano Monza e Brianza and sponsored by the JP Morgan Chase Foundation. Its objective was to further develop the model of Higher Technical Education (Istruzione Tecnica Superiore - ITS), both in Lombardy and at a national level, as a training opportunity able to facilitate the transition of young people towards the labour market.

Higher Technical Institutes (ITS) constitute a tertiary training channel which was launched in 2011 in order to respond to companies' demand for high quality, innovative, skills. ITS are schools that offer highly specialised technological courses, in line with the most advanced European vocational training models, alternating schooling and work. The strong link between the corporate system and ITS training courses ensures high placement rates for the young people who attend them. The employment rate of ITS students a year after graduation is around 80%, but the number of students enrolled in these institutes is still low (little more than 8.000 students in the whole of Italy).

The limited number of students – combined with the limited awareness young people and families have of such programmes – is also due to the limited public resources available for financing them (13 million euros from State funds, plus roughly 50 million euro from Regional funds), as opposed to University funding. Aside from intense lobbying efforts on a national scale in favour of increasing funding for this type of training, Assolombarda also deems it necessary to enhance the operational and financial capacity of ITS by encouraging greater corporate involvement and a more structured partnership with companies, including higher apprenticeships. Consequently, the "Focus on youth: develop ITS employability" project provides for three experimental programmes under which 80% of the students enrolled in the first year will join companies through higher apprenticeships during their second year of training.

In this context, the research carried out by Fondazione IRSO aims at analysing corporate costs and benefits deriving from participating in Higher Technical Education programmes and from the subsequent hiring of young workers who have completed such programmes. With this study, therefore, Assolombarda wishes to provide companies with a model for assessing the potential returns (both in financial and human resources terms) of investing in ITS programmes, and to offer a more structured insight to companies which are already partners of ITS Foundations, or which are interested in becoming involved in the tertiary professional education system.

Executive summary

1. Research contents

The research consisted in:

1. An in-depth examination of scientific literature regarding the costs and benefits of vocational training.
2. A survey conducted initially upon a sample of 228 Assolombarda member companies (of which 25% with over 100 employees and 75% with under 100 employees, operating in the services (38%) and industrial (62%) sectors. At a later stage, on a sample of 40 ITS partner companies (operating in the manufacturing (52%) and services (15%) sectors, of which 40% with up to 100 employees and 47% with over100 employees): contained in the present report.
3. Three case studies regarding three ITS Foundations operating outside the Region of Lombardy in sectors equivalent or similar to those identified in the project "Focus on Youth: develop ITS employability".

2. Problems and opportunities

In Italy, where youth unemployment is at 35%, there exists a skills gap affecting at least 100,000 jobs which are not filled because of a lack of skilled staff. This gap is bound to grow as we move towards Industry 4.0, given that 50% of the jobs and professions that will appear in the next five or ten years, currently do not exist. There is, therefore, a great need for schools able to combine labour market and innovation, based on practical knowledge, open to change and developing hard and soft skills.

It is estimated that in 2025, corporate demand will be increasingly focused on medium-skilled workers: 46.7%, compared to 37.4% for low skilled and 15.9% for highly skilled workers.

The answer to this challenge is on-the-job training at the workplace and, particularly, joining **Higher Technical Institute (ITS) programmes** which offer numerous advantages for both young workers and employers, even though there is limited awareness of the added value of this type of training. The active involvement and collaboration of companies, schools and Foundations is necessary in order to direct and finance these activities. The role of companies is particularly important. According to a Cedefop survey (2013) employers, especially, should carefully examine the benefits linked to such investments through a cost/benefit analysis and become aware of the advantages these programmes offer so as to encourage and finance them, particularly if they are working in emerging sectors or if their company is experiencing a skills gap.

The tertiary level of education and training in Italy is lagging behind that of other European countries but several very concrete ways have been suggested for increasing collaboration between companies and the education system. The 93 Foundations that in recent years developed the post-secondary education Higher Technical Institutes in Italy have obtained some significant but not impressive results: despite the fact that they target the profiles and skills required by companies, they are based on the colaboration between the public education system and the companies, their graduates have an employment rate of roughly 80%, the number of students is still unfortunately only around 8,500. In Germany, the corresponding Fachhochschule have 880,000 students, a number that impacts greatly on youth employment and company productivity rates.

Many of the 93 ITS Foundations have been accumulating best practices, experiences and important data on the 'Italian way to ITS': school/company organizational and collaboration methods, real professional profiles, selection methods, training programmes, training of instructors and many others. For example, the Regions of Lombardy and Emilia Romagna have launched research projects regarding the most successful cases. Assolombarda Confindustria Milano Monza e Brianza is promoting pilot-projects regarding ITS and Bachelor's degrees which are highly job-oriented.

The structure and number of Italian Universities are in line with other European countries: there are 95 State and private universities, offering tuition to 1.6 million students. However, with the exception of Medicine and Engineering, universities educate and provide degrees but, for the most part, do not train students to carry out the jobs required by the labour market, obliging employers to train them after they have been hired.

The relationship between Universities and and higher, non-university institutes in Italy has never been easy. A first attempt to create in Italy something similar to the German Fachhochschule was made by Federico Butera in 1998 at the request of Prime Minister Romano Prodi and Minister of Education Enrico Berlinguer: the project, carried out in collaboration with the Ministry of Education, Conferenza dei Rettori delle Università Italiane (CRUI) and Confindustria was approved by the Conferenza Stato Regioni on July 9th, 1998 and by Law 144/99, but was immediately downgraded to a more limited version of IFTS courses which fall under the sole competence of the Regions and the Education Department of the Ministry. A Legislative Decree passed on 7 February 2013 relaunched ITS courses lasting 4 to 6 semesters, with 30% of the time spent in companies and with at least 50% of the teaching staff coming from the labour market.

3. The keys to success: corporate commitment and motivation by young workers and their families

The legislative and educational framework of ITS is now in place. What now needs to be done is to 'change the numbers', by increasing the number of students enrolled in ITS. Two key factors, among others, emerge in this effort to strengthen ITS:

a. Corporate commitment
b. Motivation of students and their families to take up this training option

Let us briefly examine them:

COMPANIES

The first question we asked when starting our research was: why should companies use their own financial resources, their own management staff, their own instructors, their own equipment to participate in Higher Technical Education programmes?

The right cost/benefit balance

Let us assume that a company's decision to invest in training activities, regardless of the sector it operates in, is always based on **a cost/benefit analysis**. The present empirical study has shown that no single model can be applied or is applied by all employers in all sectors; moreover, a trainee's contribution to productivity as well as the costs incurred by an employer vary according to the sector and the particular characteristics of the employer. A cost/benefit analysis, therefore, should be able to highlight these differences.

The cost/benefit simulation models which are indicated below, used in EU and non-EU countries and backed by a vast scientific literature, as well as the survey conducted on a sample of ITS partner companies, have identified the main **cost items** that could be reduced as a result of hiring students coming from ITS paths or other training programmes: costs due to errors made by trainees, cost of internal staff used for training and supervising

activities, cost of hiring external staff, costs linked to the infrastructure and supplies used during the training period.

Subsequently, the hiring of ITS or other training programme graduates has, in the short-term, resulted in **benefits** for the company such as the possibility to reduce the cost of recruiting highly-skilled workers and the availability of a group of people with practical skills and specific knowledge and competencies.

Theoretical and practical training

The research has confirmed the **great importance of traineeships** not only because of the acquisition of skills suited to the company's requirements but also because they facilitate the passage towards work and the labour market. The survey has shown that in 85% of cases, collaboration between companies and the Institutes began as a result of direct contact by the Institute and by taking on trainees.

A really different programme

The research has confirmed that some of the benefits resulting from corporate involvement in ITS training programmes include the fact that **training courses correspond to the profiles required by the labour market** (30%), the ability to count upon human resources with a high-quality and personalized training (25%) combining scientific-technical training with the development of soft skills such as: teamwork, problem solving etc.

YOUNG PEOPLE AND FAMILIES

The distinctive character of the programme

The importance and the added value of the programme, as well as its advantages, are obvious to both students and companies. The main advantages for ITS students reside in the acquisition of updated and certified technical skills which allow them to work in multidisciplinary environments, organize their work efficiently, make decisions and propose solutions to any problems that may occur, limit errors and have the necessary tools for understanding and dealing with problems that are not strictly of a technical nature but are linked to their job. ITS students have **an advantage compared to other newly-hired workers** particularly in terms of their ability to propose improvements to carrying out their tasks and meeting deadlines. New recruits are given the opportunity to show what they are capable of, to carry out tasks and solve problems within a specific working environment. This type of training improves the quality of work as well as the confidence of the workers in themselves, their behaviour and self-esteem.

4. Aspects that need 'fine tuning'

Improving companies' awareness of the technical education system imprese

Only 36% of the contacted companies is aware of the existence of Higher Technical Institutes (ITS), but 65% would be interested in collaborating with them and becoming involved in training programmes. The reasons given by companies were lack of contact by schools, lack of time, the belief that these programmes would not benefit the company in any way: this is also true for companies with over 100 employees. Moreover, 6% of companies with up to 100 employees stated that they had never collaborated with technical institutes because of a lack of financial resources.

Enhancing recruitment through the public education system

The main recruitment channel indicated by companies (58%) is that of accredited/authorized employment agencies. **Only 25% claimed to recruit young people from lists of graduates/final-year students from technical education and training courses** or following an indication from the training institutes' placement services. This means that only 25% of companies noted a shortening of the selection process of less than 1 month and 27% a shortening by 2-4 months. On the contrary, 30% of the companies, despite having the possibility to call upon ITS graduates when hiring a new employee, did not note any change in the time necessary for the hiring process.

Greater use of traineeships

Companies with over 100 employees show **a greater propensity to use and experiment with different hiring methods** such as: curricular and extracurricular traineeships, temporary agency work contracts and professional apprenticeships.
On the contrary, companies with up to 100 employees, rely on more traditional forms of hiring and only 30% claim to have used professional apprenticeships as an employment method in the last five years.

Main contact opportunities with institutes

64% of companies stated that in the last five years they had not collaborated with seconadry technical institutes or institutes offering post-secondary education courses. The main reason for the lack of contacts was lack of time, the belief that this would not have benefited the company and lack of resources.

Improvement of training activities

Among ITS partner companies, 20% experienced a shortening of the training period by less than one month, 20% by 2 to 4 months and 10% by over 4 months. In order to significantly reduce the time needed for training and supervision through the hiring of ITS graduates **it is necessary to redesign and fine-tune the relationship between theoretical and practical training**. The research has, in fact, shown that in 42% of cases newly-hired graduates had undergone training inside the company aimed mainly at developing new skills, improving already existing skills and filling gaps in their education.

5. Benefits from company involvement in ITS programmes

When a company decides to invest in an ITS project a favourable cost/benefit ratio is necessary but not sufficient in itself. The cost of the project should not be excessive but the decision drivers are broader.

Investing in an ITS project produces benefits for the company on various organisational levels that cannot be evaluated only in economic terms.

a) Tangible benefits

Reduction of

- direct costs linked to the **recruitment and selection** of people suitable for the required positions;
- direct **training** costs aimed at developing the skills required from newly-hired employees (particularly in terms of time and human resources);
- indirect costs as a result of **missed business opportunities** due to the lack of skills linked to innovation, market presence, use of technologies, efficiency etc.;

- indirect costs due to the **failure to quickly embrace company culture** and to make the transition from the world of training to that of production.

More efficient recruitment of talented and skilled workers

- Recruitment of **suitable young workers** who are motivated, intelligent, able to take initiatives, flexible, cooperative, resilient, creative and bent on continuous improvement and innovation;
- Acquisition of **new, specific skills** linked to new roles and emerging professions, focusing on a company's innovative products and processes as well as on new markets, especially at a metacognitive and relational level (complex thinking, problem-finding and problem-solving, proactiveness, pro-socializing).

Acquisition of new know-how

- Access to the **scientific, technical and educational know-how provided by ITS**, which goes beyond a single product group/market;
- Possibility to **commission custom-made projects** for individual companies (project work) developed jointly by students and experts from the ITS Foundation, impacting positively on the company;
- Transfer of **models and tools aimed at technological, organisational and social innovation**, previously tested in the ITS Foundation's 'laboratories' in collaboration with national and international research centres and Universities.

b) Reputational benefits

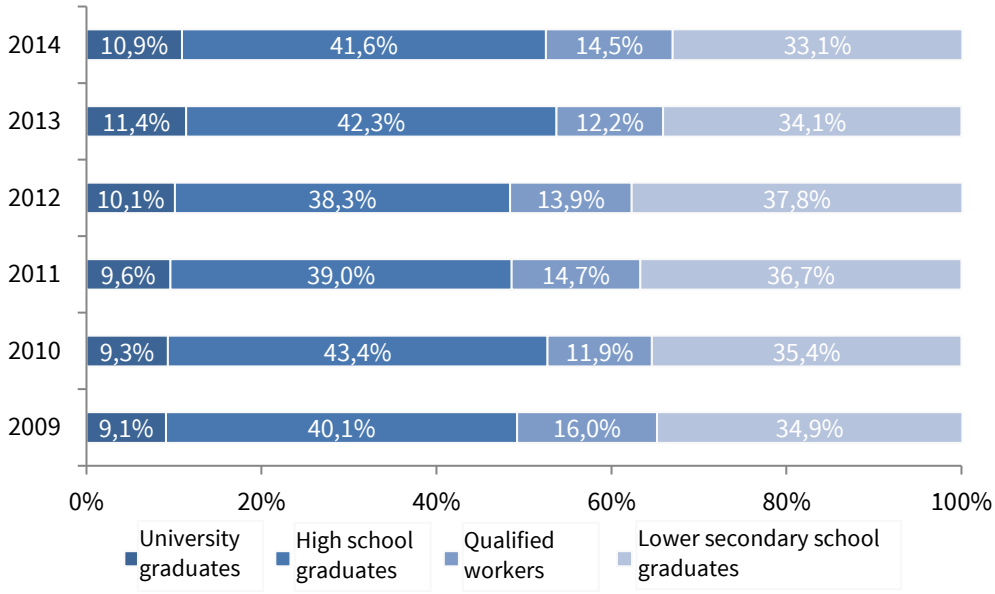
- Public recognition and media visibility of a company's **social responsibility** through its involvement in national strategic projects which could not have been carried out by institutions and single companies;
- Access to the **social relations network** generated by the project.

1. Corporate demand and technical diploma holders

The Excelsior survey, conducted annually by the Unione delle Camere di Commercio on a sample of 90,000 companies, highlights certain positive elements which will become more important once the employment rate starts rising again, and more specifically:

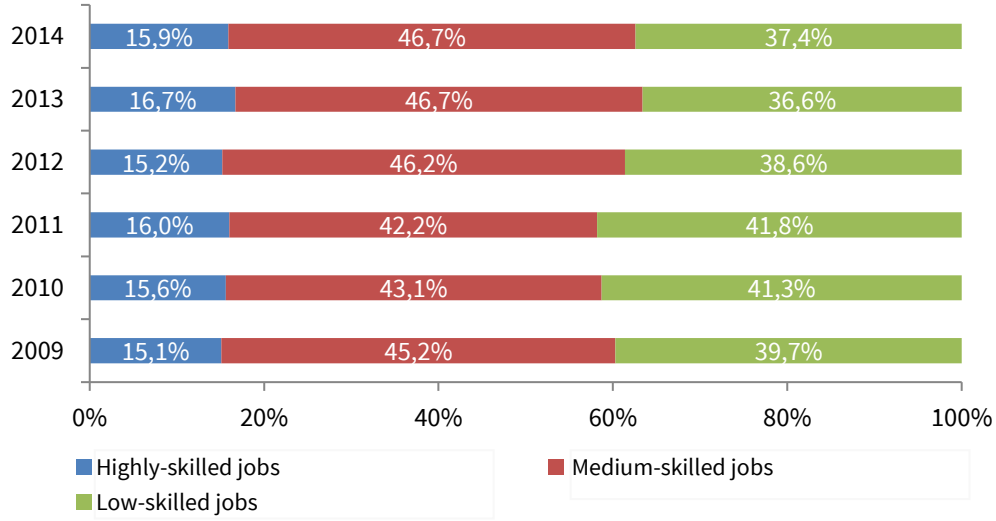
- companies' tendency **to seek increasingly more qualified staff**: 52% of new staff hired in 2014 consisted of college or high-school graduates compared to 50% in 2009; in particular, high school graduates were the largest group (41.6%) of workers requested by companies;
- increased demand for **high-school graduates with a post-graduate specialization,** representing 6.2% of total planned recruitments, and driven by a greater demand by companies for medium-skilled staff (46.7%, compared to 37.4% for low-skilled and 15.9% for highly-skilled staff).

Figure 1 - Planned recruitment by companies, by level of education



Source: Unioncamere - Ministero del Lavoro, Sistema Informativo Excelsior, Gli sbocchi professionali dei diplomati nelle imprese italiane per il 2014, p. 16

Figure 2 - Planned recruitment by companies, by professional level



Source: Unioncamere – Ministero del Lavoro, Sistema Informativo Excelsior: Il lavoro dopo gli studi. La domanda e l'offerta di laureati e diplomati nel 2014, p. 11

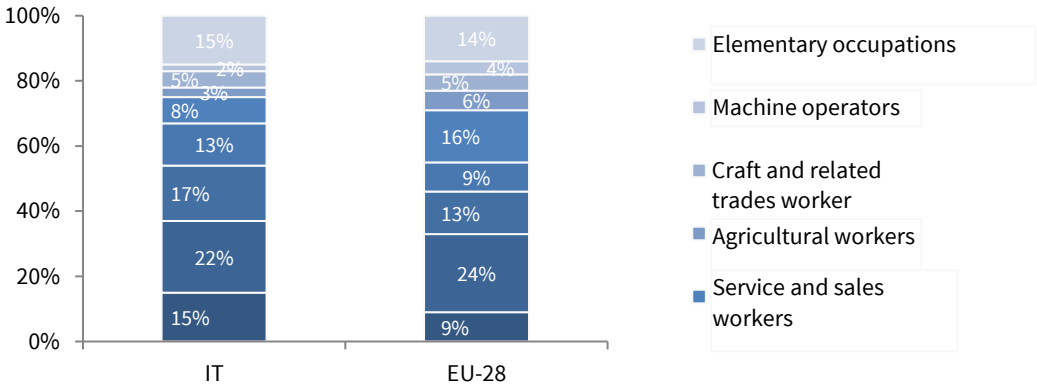
Medium-term forecasts also confirm the demand for intermediate technical workers: according to Cedefop, the European Centre for the Development of Vocational Training, job opportunities in Italy from now to 2025 will mainly regard:

- around 22% of professionals (highly-skilled workers in the science, health, economics and education sectors);
- around 17% of technical and similar professions (implementation of models, methods and operating rules in the scientific, arts, engineering, health and industrial sectors and in the public sector).

There are various motives behind the increase in the demand for such workers both in Italy and in all the industrialized countries:

- technological progress, requiring enhanced technical and scientific knowledge;
- competition, requiring the ability to innovate and promote value-added production;
- organizational transformation processes, requiring a greater integration of roles.

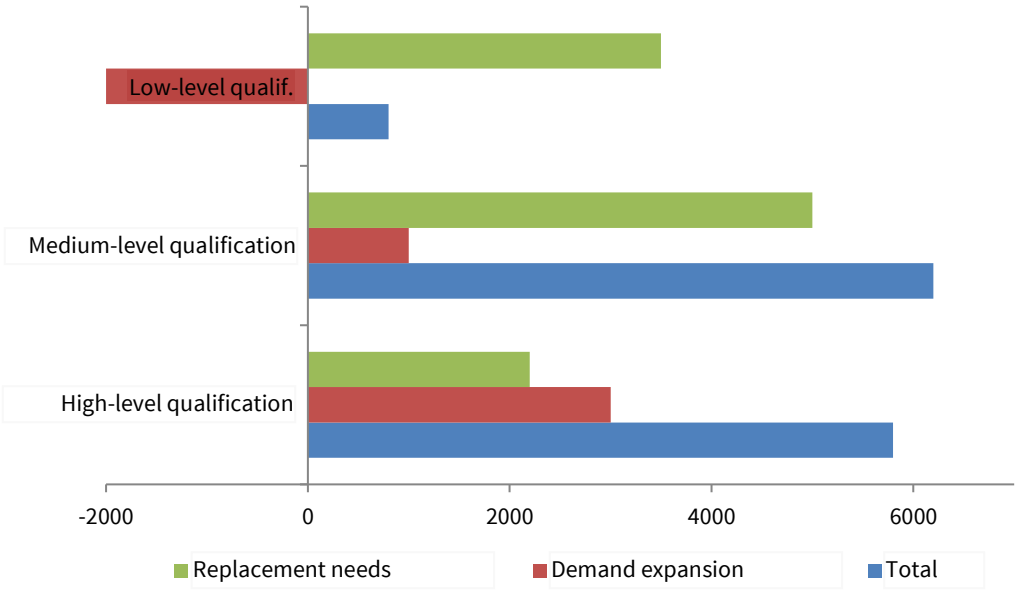
Figure 3 – Types of job opportunities available by 2025



Source: Cedefop, Skills supply and demand up to 2025, Country forecast, Italy, 2015 edition

These job opportunities will, in most cases, require medium-level qualifications (secondary education diplomas or post-secondary non tertiary education diplomas) and will often involve filling jobs of workers who have retired.

Figure 4 - Qualifications required by the labour market until 2025



Source: Cedefop, Skills supply and demand up to 2025, Country forecast, Italy, 2015 edition

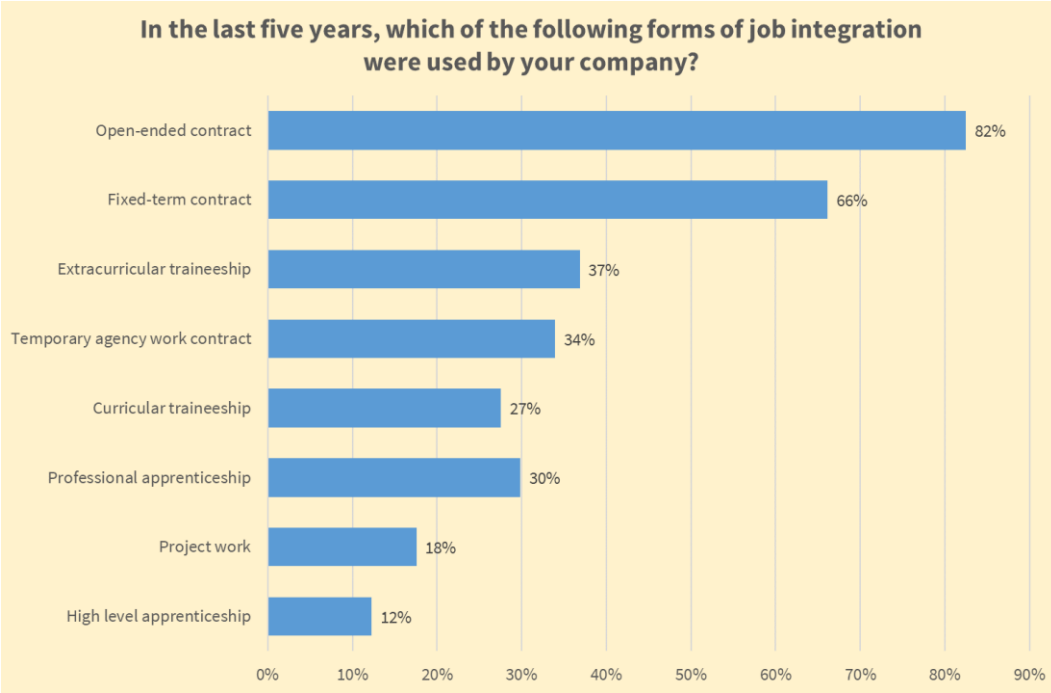
In order to respond to the need for skilled technicians, many countries have launched various post-seconadry school job-oriented training programmes, with a duration of 2 or 3 years. Following their secondary education, many young people obtain a diploma or certificate after attending 2 or 3-year courses aimed at acquiring practical, technical and professional skills. They are, for the most part, programmes based on applied research closely linked to the corporate world and able to facilitate the immediate entry into the labour market in view of undertaking a job or profession.

In the last decade in Italy, the higher, non-university education sector has witnessed the birth and **implementation of the ITS system**, whose aim is to fill the gap that is traditionally larger in Italy than in most industrialized - and in particular – OECD countries, and to train young people who possess the necessary skills for entering the labour market also by collaborating with companies involved in training programmes.

The research was conducted in two stages: first on a sample of 228 companies (Assolombarda members), of which 25% with over 100 employees and 75% with up to 100 employees, operating in the services (38%) and industrial (62%) sectors; at a later stage on a sample of 40 ITS partner companies operating in the manufacturing (52%) and services (15%) sectors, of which 40% with up to 100 employees and 47% with over 100 employees. It demonstrates that in the last five years, hiring by companies in Italy has been mainly carried out through fixed-term and open-ended contracts.

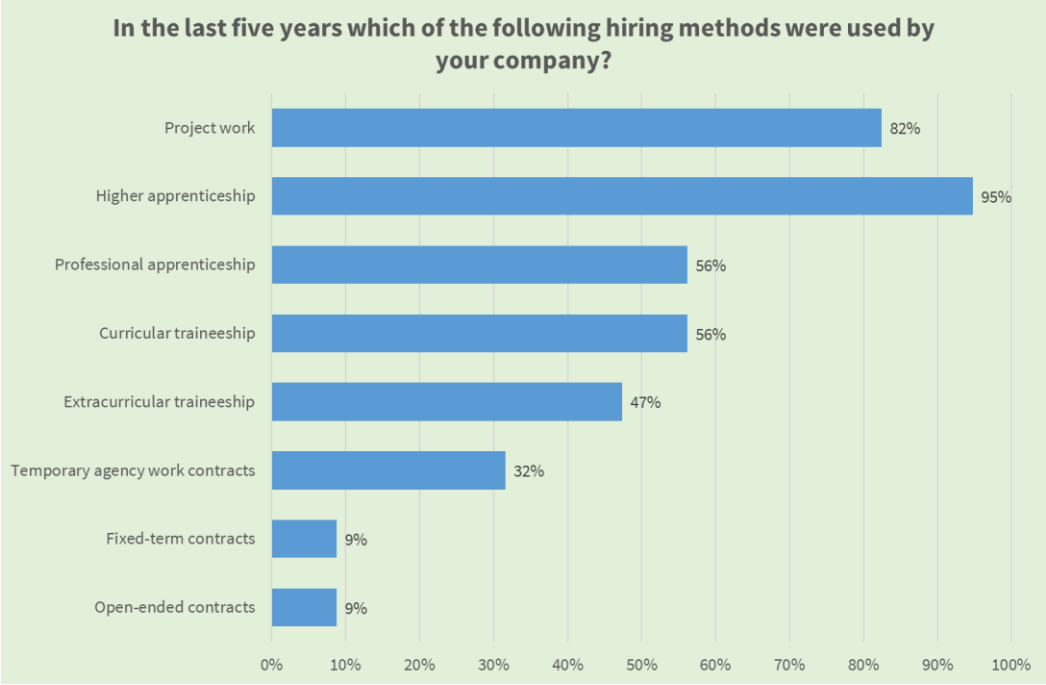
The two charts below regarding companies with up to 100 employees (Figure 5) and over 100 employees (Figure 6), demonstrate that companies with over 100 employees have a greater propensity to use and experiment with different employment options other than hiring such as: curricular and extracurricular traineeships, temporary agency work contracts and professional apprenticeships. On the contrary, companies with up to 100 employees rely on more traditional hiring methods and only 30% claim to have used professional apprenticeships as an employment method in the last five years.

Figure 5 - Hiring methods by companies with up to 100 employees



Source: Centro Studi Assolombarda

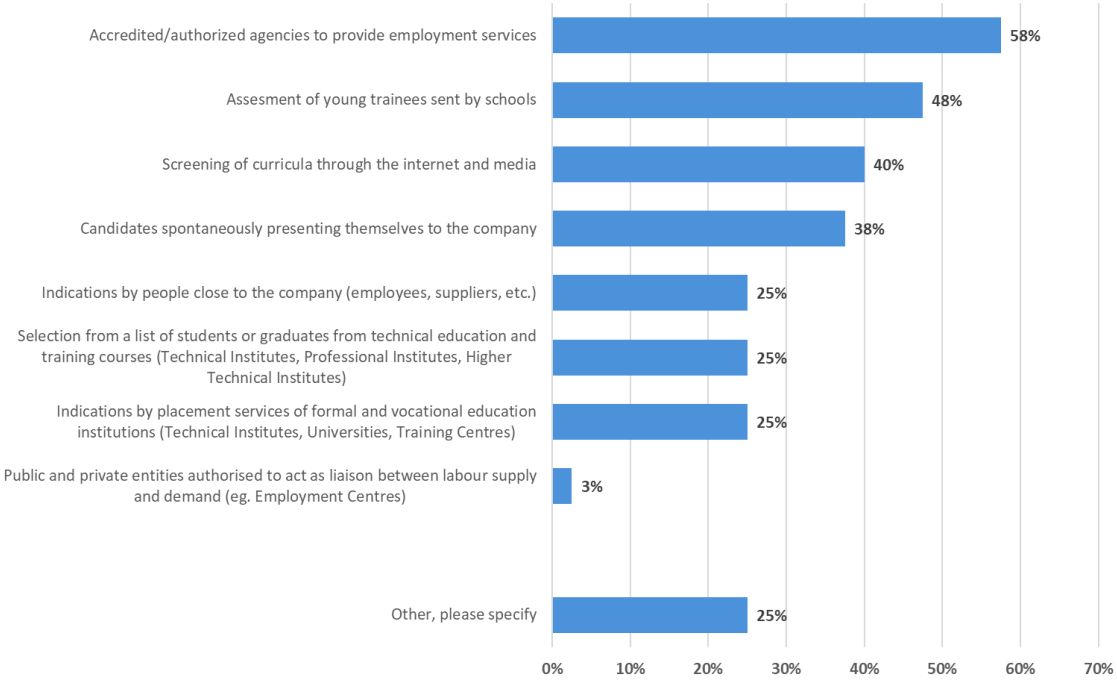
Figure 6 - Hiring methods by companies with over 100 employees



Source: Centro Studi Assolombarda

According to the data emerging from the analysis of ITS partner companies, the main recruitment channel (58%) is through agencies accredited/authorized to provide employment services. The second most-used method (48%) is the assessment of young trainees sent to companies by schools. Other channels include the screening of curricula through the internet or social media and spontaneous candidatures of people presenting themselves to a company. Only 25% of companies claim to recruit young people by selecting them from a list of graduates from technical education and training courses or following indications by educational or training institutes provided through placement services.

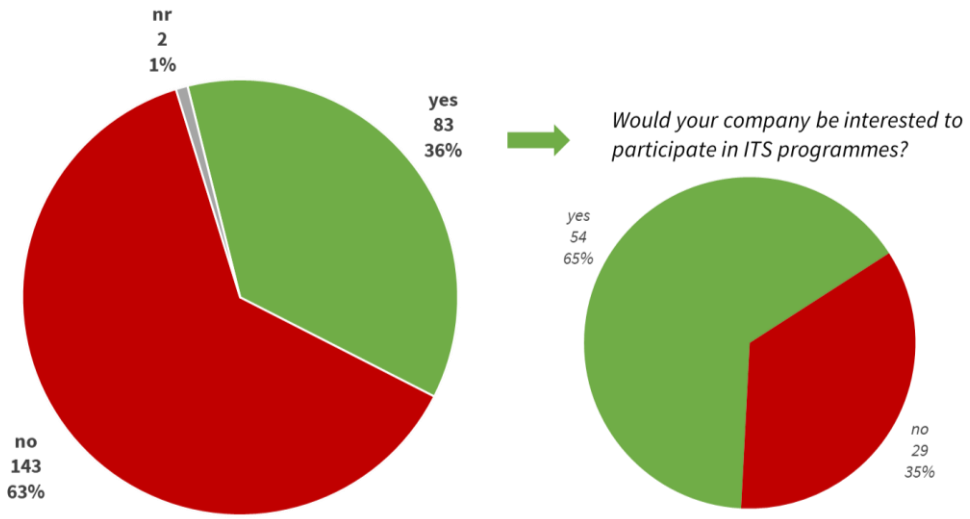
Figure 7 - Recruitment channels used by ITS partner companies



Source: Centro Studi Assolombarda

From the data regarding Higher Technical Institutes (ITS) and, more generally, secondary technical institutes and/or institutes offering post-secondary education courses, it is possible to understand the level of awareness and cooperation on the part of companies: it emerges that only 36% knew about Higher Technical Institutes (ITS), but 65% would be interested in collaborating and being involved in training programmes.

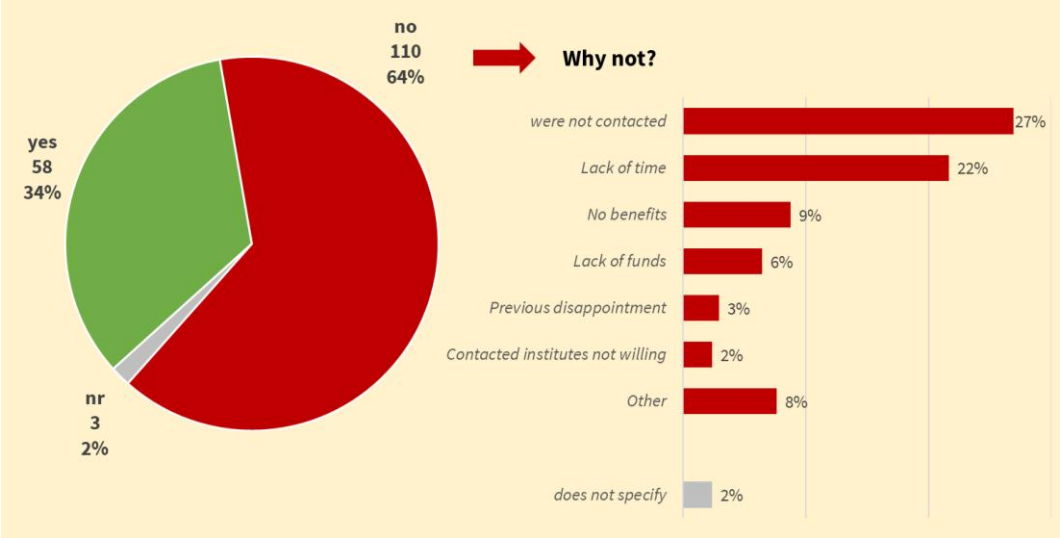
Figure 8 - Level of awareness of Higher Technical Institute programmes



Source: Centro Studi Assolombarda

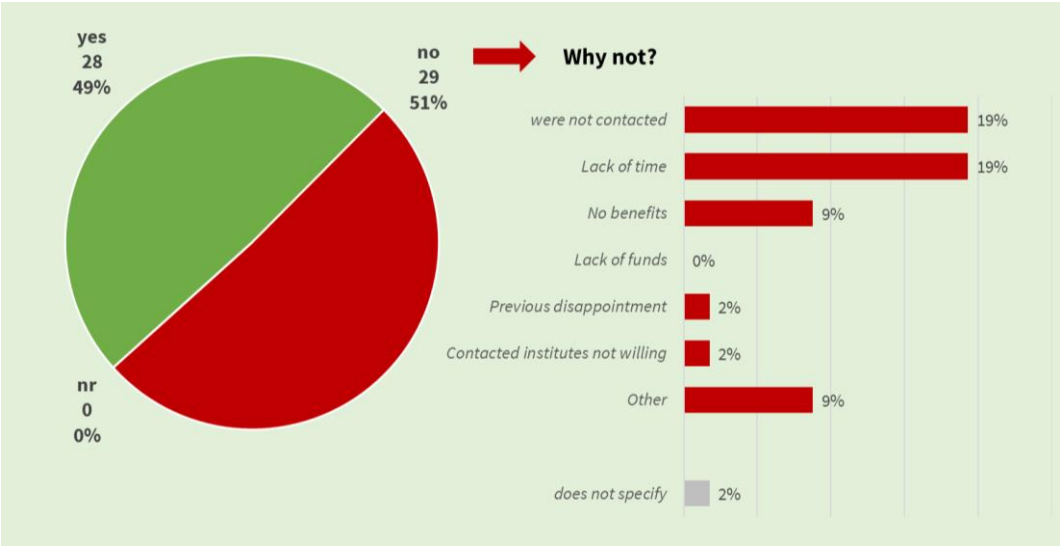
Greater differences can be observed with regard to the level of collaboration with secondary technical institutes and/or institutes offering post-secondary education courses as well as with regard to the motives behind companies' decision to collaborate with such institutes or not.

Figure 9 - Collaboration with secondary technical institutes and/or institutes offering post-secondary education courses – companies with up to 100 employees



Source: Centro Studi Assolombarda

Figure 10 - Collaboration with secondary technical institutes and/or institutes offering post-secondary education courses – companies with over 100 employees

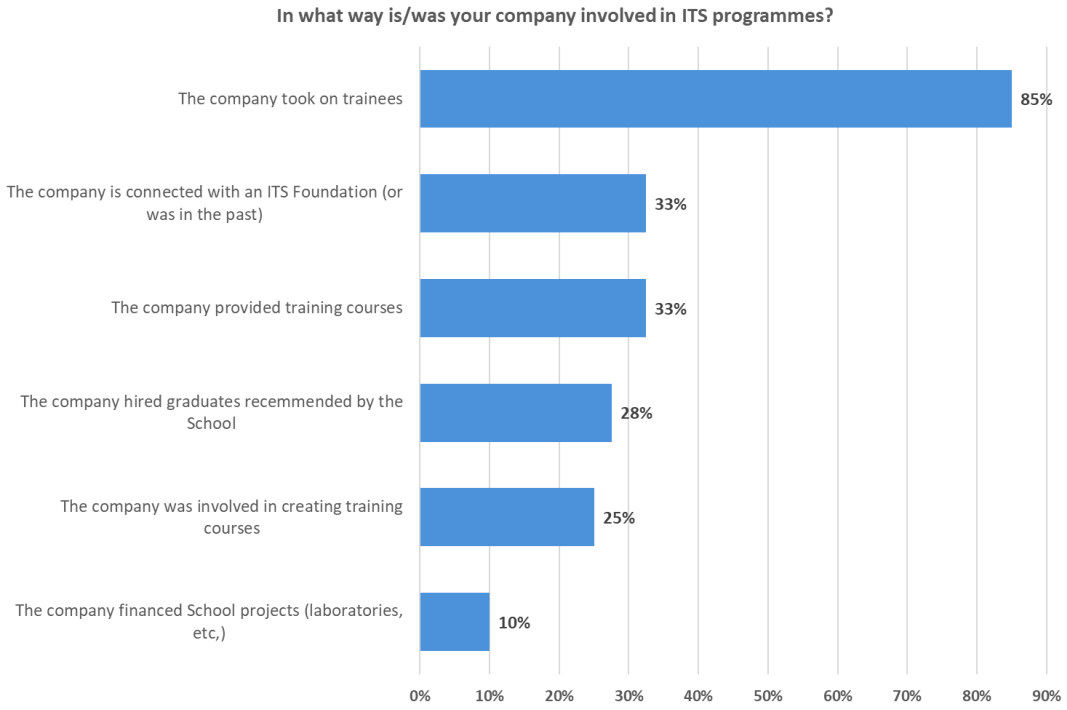


Source: Centro Studi Assolombarda

64% of companies with up to 100 employees report that in the last five years they have not collaborated with secondary technical institutes and/or institutes offering post-secondary education courses. The reasons given by companies are lack of contact by schools, lack of time, as well as the belief that the programme would not benefit the company in any way: this is also true for companies with over 100 employees. Moreover, 6% of companies with up to 100 employees state that they have never collaborated with technical institutes due to a lack of resources.

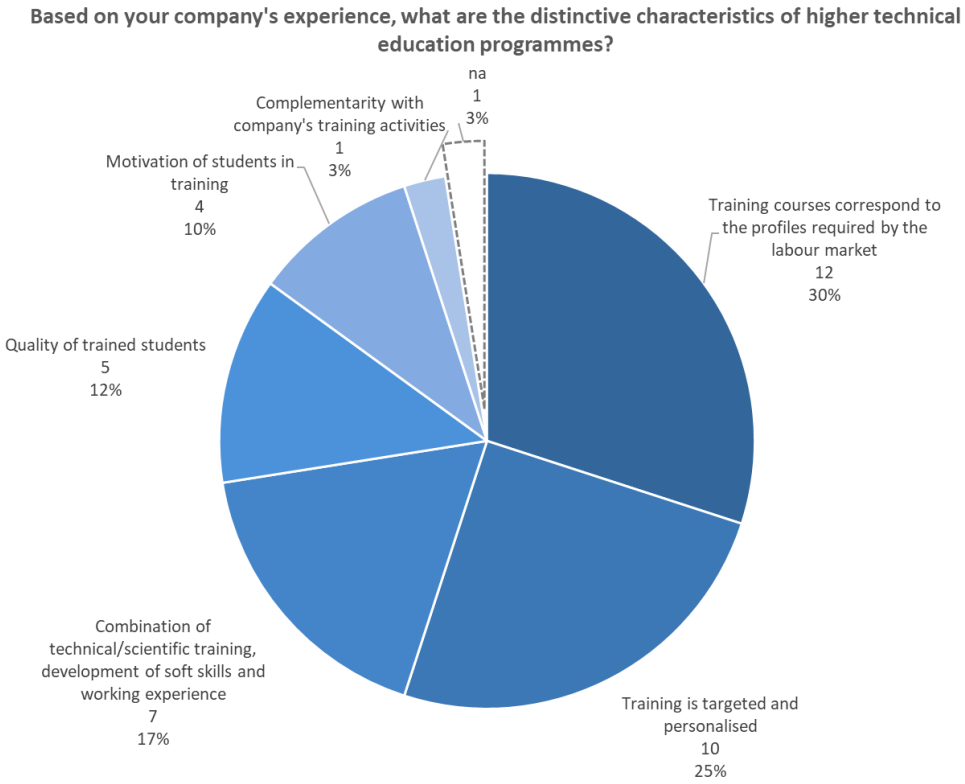
On the contrary, from the sample of ITS partner companies it emerges that collaboration with the Institutes started after direct contact by the school, followed by traineeships (in 85% of cases) which revealed: a compliance between training programmes and work profiles requested by the labour market (30%); the availability of resources with a targeted and personalized training (25%) able to acquire technical and scientific skills, develop soft skills and working experience as well as greater transversal skills such as working in a group, problem-solving etc.

Figure 11 - Involvement of partner companies in ITS programmes



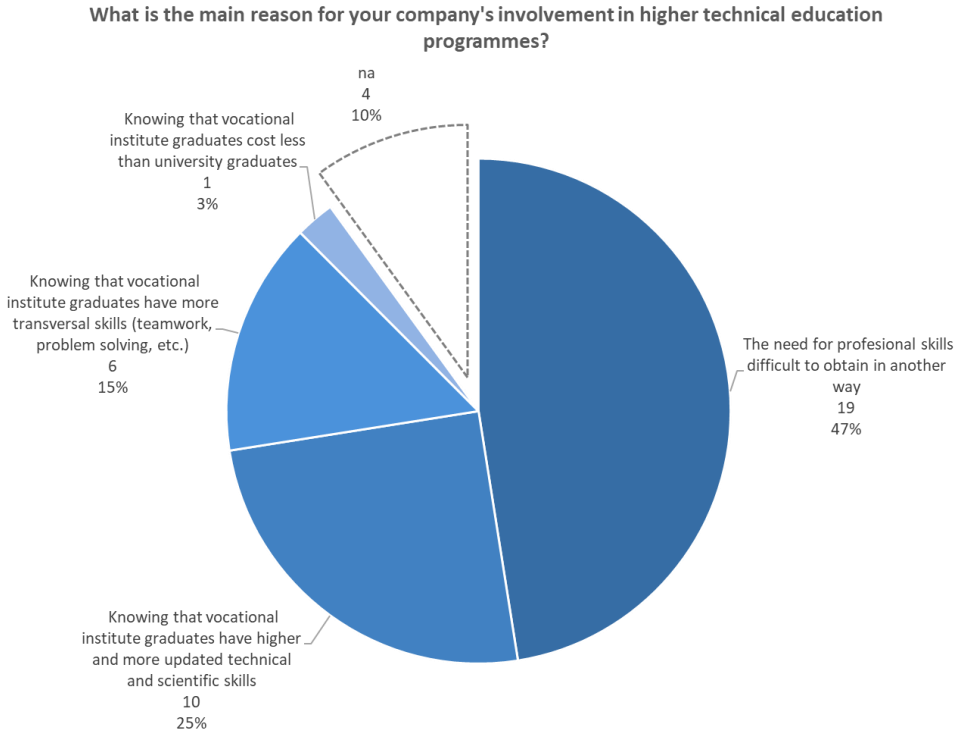
Source: Centro Studi Assolombarda

Figure 12 - Distinctive characteristics of higher technical education programmes



Source: Centro Studi Assolombarda

Figure 13 - Main reasons for a company's involvement in higher technical education programmes



Source: Centro Studi Assolombarda

Some companies consider that by dedicating resources to the training of newly-hired staff they are sacrificing the earnings they would have had if they had used the same resources differently. This is manifestly not the case.

By analysing the literature and empirical evidence, the present survey will therefore strive to provide answers to the following questions:

- ***What are the costs incurred by companies willing to train a young worker and what are the costs for young students participating in ITS programmes?***
- ***What are the benefits from participating in an ITS programme for both companies and young workers?***
- ***Why should a company participate in an ITS programme?***

2. Vocational integration and training costs

2.1 Economic approach: the “ingredients method”

What is the cost of selecting, training and integrating a new employee in a company? How does this compare to the possibility of selecting an already trained employee? It is not easy to answer these questions not only because it is difficult to exactly quantify the cost but mainly because it is difficult to quantify the benefits gained by this type of process. The cost-effectiveness of training programmes can be analyzed with the help of the “ingredients method” developed by Henry Levin (Levin, 1975; Levin, 2001; Levin, 2013; Fletcher, Sottilare, 2014): the method is based on the concept that every intervention uses ingredients with a certain value or cost. By identifying the specific ingredients and their exact cost it is possible to estimate the total cost of an intervention as well as its usefulness and advantages.
In theory, the “ingredients method” provides a simple, and apparently objective, way of estimating the total cost of a training programme. In practice, however, it is difficult to obtain a precise estimate given that it is not easy to categorize ingredients and not all the ingredients and their cost are known: it is only possible to estimate the value of a single ingredient (Mishan, 1982; McEwan, 2011).

2.2 Classification of costs

There is no standard classification of the costs linked to training programmes and processes although various classificatons can be found in literature. However, some distinctions between costs are generally accepted. For instance, we can distinguish between: direct and indirect costs, variable and fixed costs, public and private costs, personnel and non personnel costs, educational and non educational costs, etc. Listed below are the main cost items related to the training of a newly-hired worker, distinguishing between costs incurred by the company in order to launch training programmes and costs incurred by workers participating in such programmes. For each cost item we will present the relevant empirical studies and references in literature.

2.2.1 Costs incurred by the company

According to Pfeiffer et al. (2009), Hogarth (2012), Muehlemann, Wolter (2014) the costs incurred by a company for the selection, integration and training of young workers are the ones indicated below.

Cost of newly-hired staff

The cost of newly-hired workers is usually expressed as the ratio between their salaries and those of already integrated workers performing the same tasks. In some countries, this ratio is established by collective contracts which determine salary costs according to the

employment sector, particularly with regard to apprenticeships. As regards Germany where apprenticeships are closely linked to the transition from school to the workplace, Euwals and Winkelmann (2001) indicate that the average salary during the last year of apprenticeship corresponds to only one third of the first year's salary after the end of the training period. This means that the ratio between the salary of a trainee and that of a worker performing the same task is low. Gitter (1994) stresses that the trainee/worker salary ratio in Germany is significantly lower than the one in the United States or the United Kingdom. Smits and Stromback (2001) summarize six studies on the ratio between trainee/skilled workers salaries as shown in the Table below:

Table 1 – Trainee and skilled worker salary ratio

	Salary ratio trainee vs skilled worker
Australia (survey)	65%
Australia (case studies)	57%
Germany	33%
The Netherlands (manufacturing sector)	46%
The Netherlands (distribution sector)	18%
UK (manufacturing sector)	57%

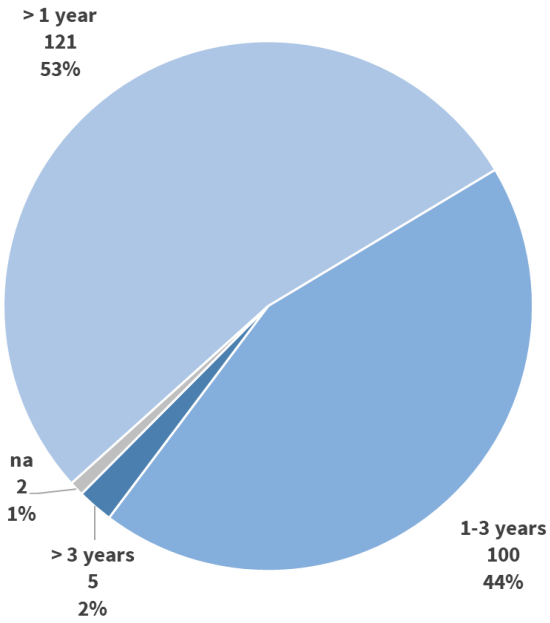
Source: Smits, Stromback (2001), The Economics of the Apprenticeship System, Edward Elgar Publishing

Based on these studies, it is possible to distinguish between two different areas: in the first one, which includes countries such as Australia, Great Britain and the United States, the salaries of newly-hired workers are relatively high compared to those of skilled workers. In the second area, which includes Germany and the Netherlands, salaries are relatively low.

Supervision time and cost

In most workplaces, newly-hired workers are trained by staff already working in the company and therefore more experienced. This training process is very time-consuming. According to the Assolombarda research, 53% of companies state that the training of newly-hired workers lasts for over a year while 44% state that it takes 1 to 3 years.

Figure 14 - Time it takes a newly-hired worker to complete training



Source: Centro Studi Assolombarda

The real cost for the employer emerges by estimating to what extent time dedicated by supervisors and staff being trained to become training instructors reduces productivity.
However, it is also important to distinguish between the nominal unit labour cost of an already trained worker and the cost an employer would have incurred by hiring instead a highly-skilled worker.
Soskice (1993) stresses that the productive time 'lost' by a trained worker engaged in the training of newly-hired staff is an "opportunity cost" rather than an absolute cost. If the training takes place during less busy periods (the so-called downtime), the "opportunity cost" will be lower than when training takes place during periods of intense working activity. In his study of the German system of apprenticeships, Soskice reaches the conclusion that most small companies provide training to newly-hired workers when trained staff is not working at full capacity. Therefore, the real opportunity cost is much lower than it would have been if a trained worker had taken time to train newly-hired staff during a period of intense productivity. Franz and Soskice (1995) point out, however, that small employers often do not have alternative opportunities (i.e. the possibility to postpone the training activity to a less busy period) and consequently training costs risk being largely overestimated. In the case of large employers, this does not happen because there usually is a specific employee responsible for training and not staff involved in the production process. Consequently, the alternative opportunity factor is not as important as for small companies.
As regards the use of specific employees assigned to training activities by large German companies, Harhoff and Kane (1993) indicate the staff training cost incurred by employers in different sectors: according to the table below, training costs amount to 40-45% of gross costs, with the exception of the agricultural sector.

Table 2 – Percentage of staff training costs compared to total gross costs, Germany (1980)

Industry and Trade	40%
Arts and crafts	41%
Consulting services	45%
Public service	40%
Agricultural sector	26%
All sectors	41%

Source: Harhoff, Kane (1993), Financing Apprenticeship Training: Evidence From Germany, NBER Working Paper Series, No. 4557 Appendix A.1

Hogarth and Hasluck (2003) estimate the cost of vocational training in various sectors in the United Kingdom (engineering and construction) and illustrate the main cost items: cost of supervisors, training managers and cost of production-line workers. These costs amount to 45% of net costs in the engineering sector and 77% of net costs for employers operating in the construction sector.

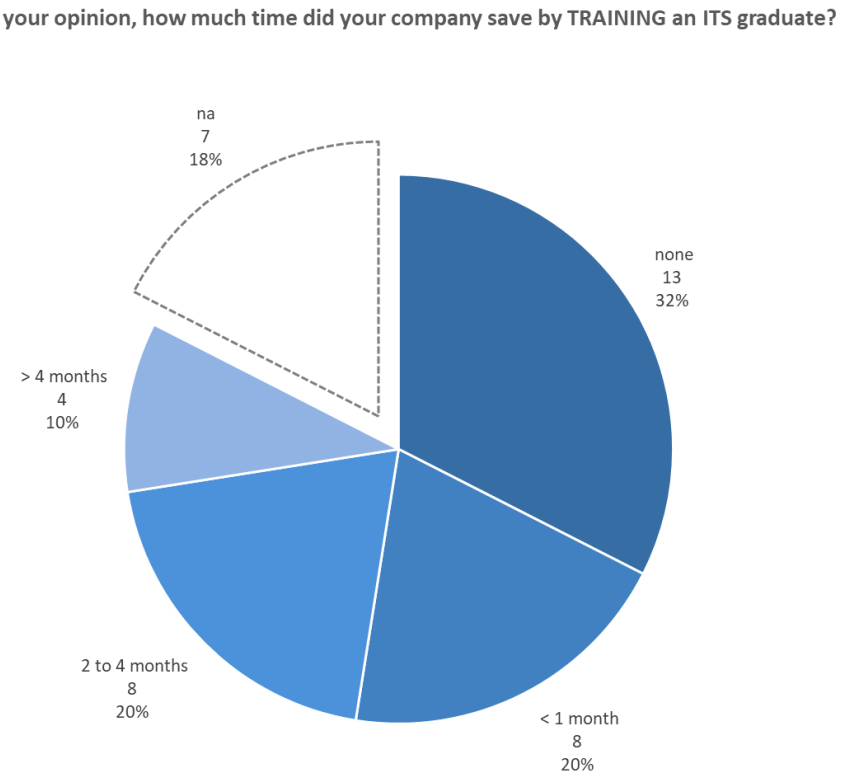
Existing surveys do not provide systematic quantitative evidence of the time and cost spent by companies on supervising newly-hired staff. Hogarth et al. (2012) provides, based on qualitative case studies regarding a limited number of employers, some estimates of supervision costs in the United Kingdom in sectors such as construction, engineering, retail sales etc.

These estimates were obtained by registering the minimum regulatory hours that trainees spent training 'on the job' multiplied by a specific multiplier for each sector (between 1 and 2.5 hours of supervision per hour of on-the-job training). The multiplier is high (2.5) for the technology and industrial sectors with a high level of human resources (engineering / science / energy / construction) and the services sector (IT / police / armed forces / fire-fighting and emergency services); medium (1.5) for other sectors: production / arts and crafts and business services / training; and low (1) for personal services (health, social work and entertainment activities / hospitality). The result was then multiplied by the average salary cost of workers carrying out supervison activities. In this way it was possible to

estimate the total time used and the necessary cost for the supervision of every training programme.

The hiring of ITS graduates could shorten the training and supervision time given that they have already acquired specific skills. However, according to the survey conducted on companies involved in the ITS system, only 20% of the companies reported that the time saved was less than 1 month or between 2 to 4 months, 10% saved over 4 months, while 32% of companies reported that, despite integrating workers from ITS programmes, the training process took the same amount of time.

Figure 15 - Time saved by ITS partner companies as regards training



Source: Centro Studi Assolombarda

Early exit from a company that has invested in training before it has recouped its investment

The net costs related to the hiring a new worker are only recouped if the worker stays with the company. It is evident that if the the worker leaves the company early, the employer will not be able to recoup the initial loss. In the past, employers were protected from this type of occurrence by clauses obliging young workers to respect the induction period. This is not the case today and, consequently, the risk is high. Furthermore, there is a high risk of 'poaching', i.e. hiring a worker trained by another company which invested in the training process instead of hiring directly from the external labour market.
'Poachers' are companies which save on training and induction costs by hiring workers already trained by another company, often by offering higher salaries. 'Poaching' by a competitor leads to a competitive disadvantage because, despite paying for the training activity the employer is not able to reap the benefits of this investment. The risk of poaching in some sectors is sometimes the main reason for the reluctance to invest in training programmes (John O'Grady Consulting Ltd , 1997; Prism Economics and Analysis, 2000).
However, it would be wrong to presume that if a working relationship is terminated before the end of the induction period there are only disadvantages for the employer: the reverse can also be true when the early termination of the relationship with a newly-hired worker is to the employer's advantage. This is the case, for instance, when an employer gains net

benefits during the first part of the training period but has to face increased costs in the later stages because of the worker's higher salary. In this scenario, the employer is 'perversely' motivated to hire and then fire, or induce the worker to quit, before the completion of the induction process (*ibidem*).
The rate of interrupting or quitting the induction period contrasts with the post-training 'conservation' rate of a company's ressources by using the employee as a skilled worker. Winkelmannn (1996) reported that over 75% of trainees remain with the company that invested in their training after completing the apprenticeship period. This is also confirmed by Euwals and Winkelmann (2001) who show that the propensity of German trainees to remain with their first employer grows in proportion to the size of the company. Dockery et al. (1997), with reference to a study conducted Australia on a sample of 59 companies, reached a contrasting result based on a different evaluation: according to their findings, 10 out of 59 employers do not retain workers after the apprenticeship period because they consider those resources too costly, while another 6 employers try to retain them so as to recoup their investment.

The cost of 'poaching'

It is useful to distinguish between two types of 'poaching': the most serious damage for an employer occurs when a trainee who has just completed the apprenticeship period is hired by a competitor. The second type regards cases where newly-hired workers quit to join a big company. In both cases, however, the employers who have invested in the training activity suffer an obvious loss which is even greater in sectors where the only return on the investment lies in employing the worker after the completion of the apprenticeship period. In order to reduce the risk of 'poaching', an employer can raise the newly-hired worker's salary after training is completed, but this of course reduces the expected benefits (Mohrenweiser, Zwick, Backes-Gellner, 2013).

Mangement costs

The management costs linked to integration and training are relatively stable since they do not increase as a result of the decision to hire (or not) a new worker, regardless of whether the person in question must be trained, is already skilled or is an assistant. However, when managers dedicate time to newly-hired staff they are not available perform other productive tasks. Three types of management costs can be observed:

1. Time leading up to hiring;
2. Time for administrative tasks;
3. Time for supervision.

In their study on apprenticeships in the United Kingdom, Hogarth and Hasluck (2003) have specifically identified supervision/training costs in an engineering company which amounted to 9% of net costs, while in construction companies the same costs amounted to 39%: this difference is due to the fact that many employers in the construction sector are small-sized companies and therefore it is likely that a large part of supervision costs are in fact training costs.

Acquisition of tools/equipment

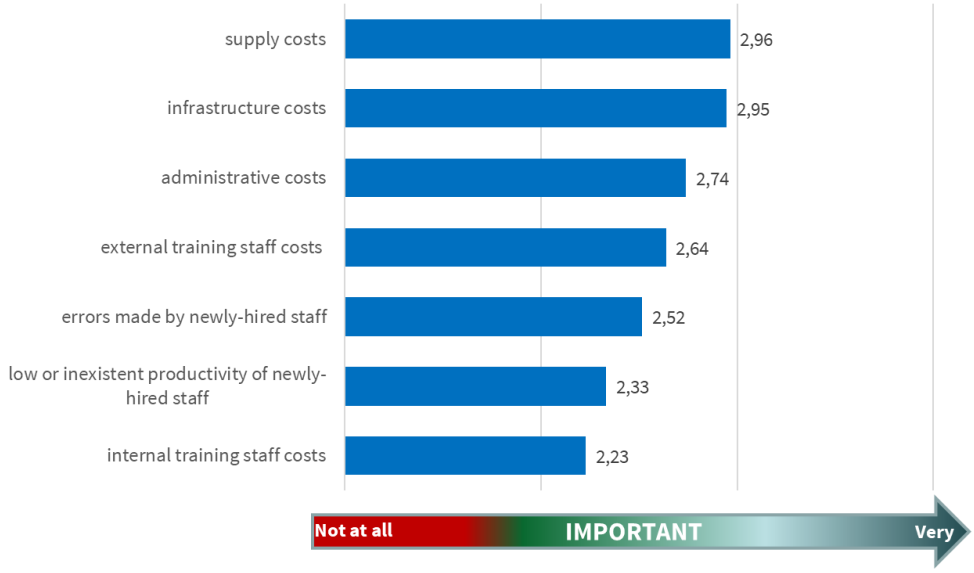
The necessary tools for performing a given job are usually provided by the employer and are calculated as part of the company's normal operational costs. These should also include costs for the equipment and tools used by newly-hired staff during the training period which could be damaged or ruined and subsequently replaced. In the case of manual labour that implies the use of many tools (for example, building work requiring the use of cranes) this cost could potentially be significant.

General contributions to the integration system

Apart from the costs described above, many employers also pay general contributions to the integration system. These contributions may include scholarships for technological colleges or institutes, machinery and equipment lent for training purposes to laboratories of schools and technical institutes etc.. In the latter case, there could also be fiscal advantages if the machinery and equipment are lent during periods when they would have otherwise been inactive.
Although these contributions to the integration system in theory go beyond the scope of a cost/benefit model they should be taken into consideration if an analysis is to be considered complete.

In short, the research demonstrates that the most important costs for companies involved in a selection/integration and training process consist mainly in supply and infrastructure costs, followed by administrative costs and costs for external training staff.

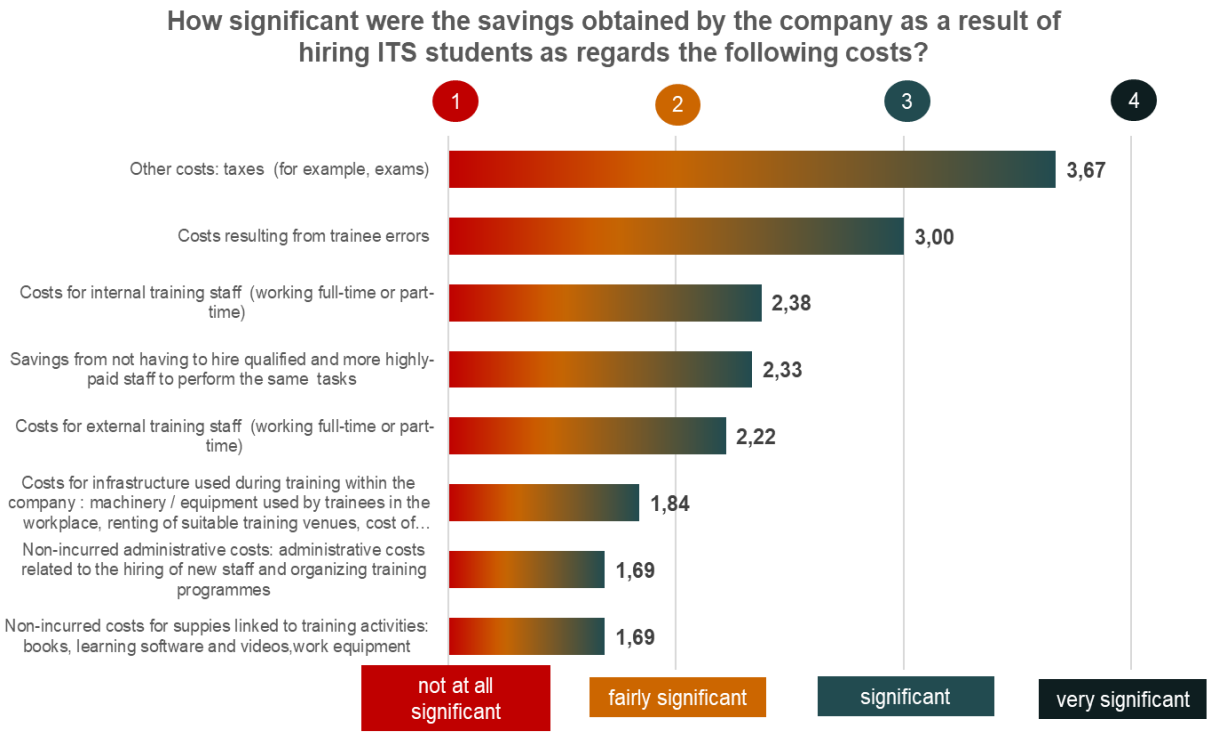
Figure 16 - Most important costs related to selecting-integrating-training a new employee



Source: Centro Studi Assolombarda

What emerges from the survey on the sample of ITS partner companies is that the hiring of students participating in ITS programmes has allowed companies to lower certain cost items such as: costs linked to the payment of taxes and incurred as a result of errors committed by trainees, cost of internal staff involved in training activities, cost of salaries compared to that for staff hired from the external labour market.
A reduction of costs was also observed with regard to infrastructure and supplies used within a company during the apprenticeship period, and also with regard to administrative tasks.

Figure 17 - Savings for the company attributed to the hiring of ITS students



Source: Centro Studi Assolombarda

2.2.2. Costs for the newly-hired worker

As far as workers are concerned, integration in a company implies certain costs that can be broken down as follows (McIntosh, 2007):

a) **Costs with a distinct monetary value**: the "opportuniy cost" for newly-hired workers consists in the lower wages they receive compared to the wages they could have earned had they found a regular job on the labour market, instead of participating in training programmes or enrolling in technical schools.
b) However, as training improves skills and hence productivity, it is probable that **after completing the training programme the worker will earn a higher wage than an unskilled worker**. This wage difference is the benefit gained from training. The net benefit is calculated by subtracting the total cost of training (direct and indirect costs, as well as opportunity costs) from the wage difference (Jäger, 2003).
c) **Direct costs incurred by a worker participating in training programmes, apprenticeships and job integration**, for instance travel or living expenses, purchase of required material for the course, such as textbooks and equipment necessary for performing tasks.
d) **Costs without a distinct monetary value**, and consequently more difficult to quantify but which must be taken into account in order to build a plausible cost/benefit model. This means that besides taking into consideration all the above-mentioned monetary costs, it is also necessary to identify and evaluate all other costs such as, for example, the loss of free time because of involvement in a structured apprenticeship (which could be longer than the normal weekly working hours), the effort to learn and obtain specific results so as to be able to continue with the training programme as well as further costs linked to increased stress and anxiety, performance expectations by employers and by trainees themselves who work together with skilled staff, etc.: the latter are not perceived as costs by workers motivated to learn and grow but if such motivation is lacking they could be taken account by the worker and influence his/her decisions.

3. Benefits of vocational training

3.1 Classification of benefits

The aim of vocational training is usually to teach new skills or update existing competencies so as to increase the productive capacity of newly-hired staff. One of the primary objectives of vocational training is also to satisfy the labour market's demand for manpower. The output of these programmes is, on one hand, the effects this training has on the trainee and, on the other, the benefits obtained by the employer and society. As regards the trainee, these effects consist in the enhancement of cognitive and non-cognitive skills required in the workplace as well as financial benefits (such as, for example, higher income, a higher possibility to get a first job and more stable employment) and non-financial benefits (for instance, greater job satisfaction and more options). The benefits for the company providing the training include a lower worker turnover rate, a decrease in downtime, lower production costs and more productive workers.

The benefits gained from training activities can usually be identified and evaluated in monetary terms and consequently be directly subtracted from gross costs to determine the cost of training. In calculating the cost/benefit ratio, however, one must take account of the fact that some benefits are only perceived in the long term: for instance, the potential benefit from a trained worker can become apparent years after the company has invested in training and provided that the worker does not leave the company for another competitor. Moreover, it should be noted that some benefits are easy to quantify (savings on integration costs) while others are not (for example, a lower turnover risk). In any case, to obtain a correct eveluation, all benefits should be taken into consideration, including those that cannot be quantified in the short term (Walden, 2006).
As mentioned above, the main benefit a company derives from investing in training activities is the trainee's contribution to that company in terms of productivity. However, this benefit is not apparent in the short term, i.e. at the same time the company is investing in training programmes and therefore it is necessary to take a long-term view and consider future output.

3.1.1 Benefits for the company

According to Bellmann (2006), Lotz (2007) and Walden (2006) the main benefits from training for a company can be classified according to the following dimensions.

Trainees' productive contribution

This dimension refers to the benefit to the company during the training which comes about in the form of returns and the increased productivity of trainees integrated into the operational work. There are three approaches in literature that can be used to estimate the contribution to productivity:

- the first consists in evaluating the contribution to productivity in terms of billable time. This method can be applied only if the employer is in the services sector or is a large company where it is possible to use an internal productivity rate as a reference;

- the second procedure is to use studies that compare a trainee's productivity to that of a skilled worker. These studies are extremely costly and the results are heavily influenced by the tasks that are chosen and the guidelines according to which they are carried out;
- the third method is to ask employers to estimate, based on their experience, the average contribution of trainees to the company's productivity.

The on-the-spot survey method is the less expensive and allows the collection of a large number of data even though it also has certain shortcomings. To begin with, it is essential that the survey identifies opportunity costs as well as nominal costs. Secondly, survey methods are often abstract and do not take account of the potentially significant differences between employers regarding the quality and quantity of training programmes (Stoll, Paul, Baignée, 1997).

In a study on apprenticeships in the United Kingdom, Hogarth and Hasluck (2003) indicate that notable variations exist in terms of apprentice productivity in various sectors. In the engineering sector, in particular, the gap between the apprentices' wages and their contribution to productivity is estimated at 31% of the net costs borne by the employer, while in the construction sector this gap is reduced to 20%.

Fayek et al. (2002) conducted a series of studies aimed at determining apprentices' productivity in the engineering sector, with particular reference to the productivity of steel workers in Canada. The study demonstrated that, for certain 'standard' tasks, there were considerable benefits linked to using apprentices instead of already trained and skilled workers. For example, to perform the first task of welding an 18 cm diameter pipe, a work group composed of 2 apprentices and 1 skilled worker cost 44% less than a group composed of 3 skilled workers. It is obvious that different results may emerge in other sectors such as services or repairs where most tasks are not standardized.

Table 3 – Apprentice productivity level in the steel industry in Canada (in $)

Task	Welding of an 18 cm diameter pipe	
Group type	**Cost**	**Number of cases**
1 apprentice/2 skilled workers	$ 48,24	2
2 apprentices/1 skilled worker	$ 31,13	3
3 skilled workers	$ 55,31	2
Task	Welding of an 6 cm diameter pipe	
Group type	**Cost**	**Number of cases**
2 skilled workers	$ 120,67	1
1 apprentice/1 skilled worker	$ 77,37	1
Task	Welding of an 12 cm diameter pipe	
Group type	**Cost**	**Number of cases**
2 skilled workers	$ 24,13	1
1 apprentice/1 skilled worker	$ 26,37	1
Task	Welding of an 12 cm diameter pipe	
Group type	**Cost**	**Number of cases**
2 skilled workers	$ 24,13	3
1 apprentice/2 skilled workers	$ 25,53	1
2 apprentices/2 skilled workers	$ 27,14	1

Source: Fayek (2000)

Ryerie (2012) considers that, in some surveys, employers underestimate the value of apprentices' contribution to productivity and, consequently, overestimate training costs. In a study involving 31 engineering companies, Ryerie observed that, while the usefulness of apprentices was acknowledged by everybody, three companies, for example, admitted that their work could not be done without apprentices and another six that they used apprentices as general assistants or unskilled labour.

Muehlemann and Wolter (2014) underline that the benefits for a company during the apprenticeship period derive from the value of productive work which is generally divided into skilled and unskilled tasks:

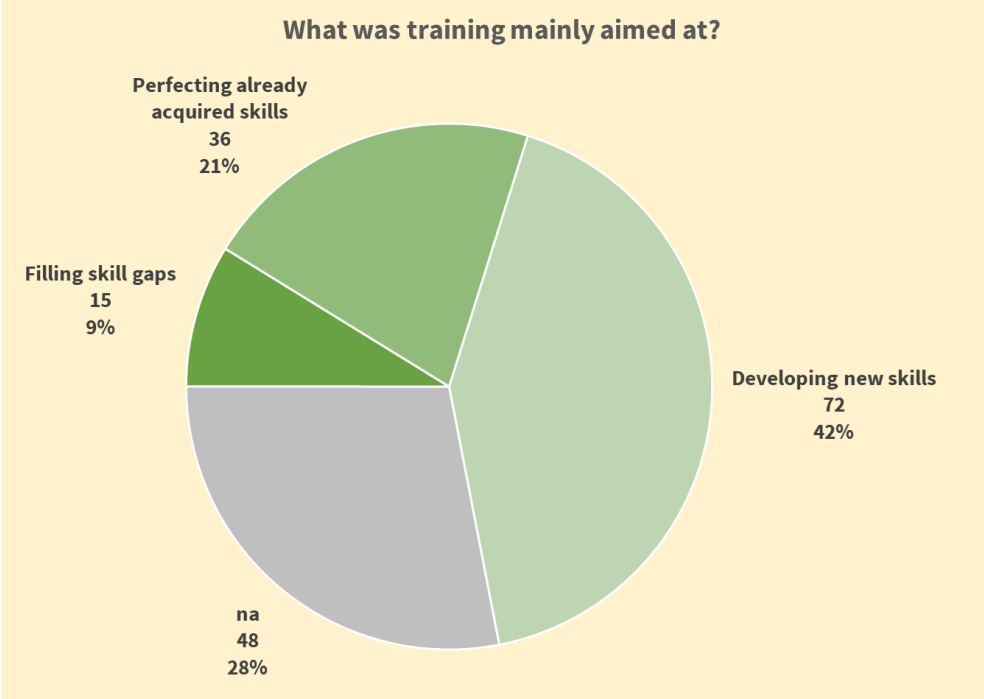
- the value of employing apprentices to perform skilled tasks is calculated as the time it takes an apprentice to perform such tasks, multiplied by the wage the company would have paid a hired, non-apprenticed, skilled worker. This value, however, is also multiplied by an apprentice's productivity compared to that of a skilled worker;
- as regards unskilled tasks, the value of having an apprentice perform the work corresponds simply to the wage the company would have paid an unskilled worker.

Increase in benefits and decrease of the turnover rate

Empirical literature on the benefits of employing an apprentice instead of hiring a worker from the labour market focuses on the importance of skills specifically linked to the company and its organizational structure which are acquired during the apprenticeship.
Franz and Soskice point out that the willingness of German employers to invest in training programmes is based on the specific skills apprentices can acquire during their apprenticeship. Large companies, in particuar, offer specific corporate training as well as general training with the result that apprentices become more productive than a worker hired from the external labour market.

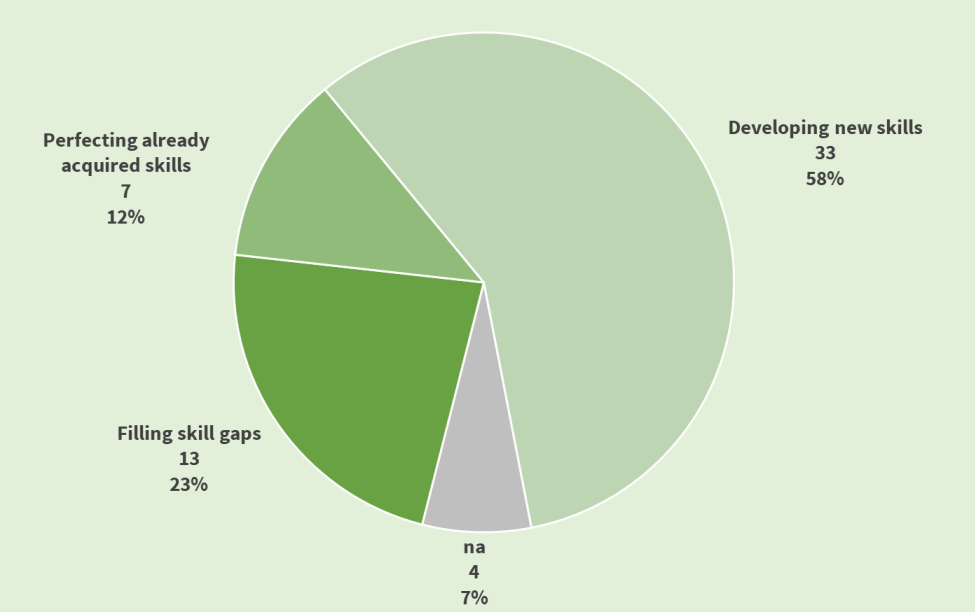
The survey demonstrates that in companies with up to 100 employees, training is mainly aimed at developping new skills (42%) and enhancing already existing skills (21%), while in companies with over 100 employees training focuses mostly on developping new skills and also filling skills gaps.

Figure 18 - Motivations for initiating training programmes – companies with up to 100 employees



Source: Centro Studi Assolombarda

Figure 19 - Motivations for initiating training programmes – companies with over 100 employees



Source: Centro Studi Assolombarda

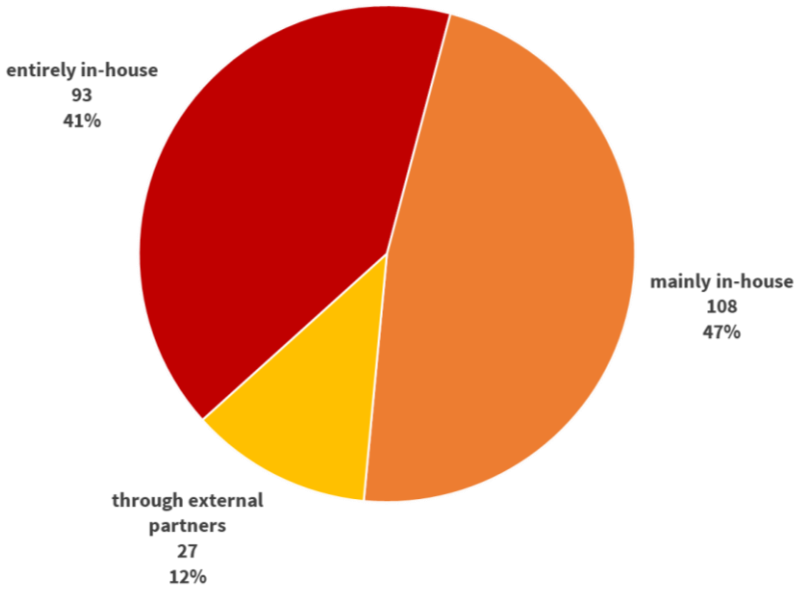
A company that hires an external worker who has to be trained in order to acquire specific skills bears a high cost in terms of loss of productivity as well as of the cost of the newly-hired worker's salary. On the contrary, the cost of an apprentice who acquired specific skills during his/her training period is much lower for the company.
This distinction is more apparent in companies where the specific skills acquired in-house are significant and, subsequently, it is essential for companies that have invested in training to be able to keep their trained apprentices after the completion of their apprenticeship.
Companies are aware that providing training opportunities is also a way of maintaining their staff in place. In some companies, groups including apprentices register higher job satisfaction rates among company staff. In 2005, for instance, the apprentice satisfaction rate in the British telecommunications company BT was around 85%, higher than any other team (Hogarth et al., 2005).
Moreover, we can assume that the productivity of trained workers is higher than that of external recruits. In this context, a further benefit for the company is the effect that a trained worker can have on the productivity of his colleagues, in other words he/she can set an example for less qualified workers thus increasing their productivity (Dohmen, 2007).

Avoiding replacement costs

When vacant posts within a company cannot be covered in a satisfactory manner, the company is obliged to incur high costs in order to identify and select suitable candidates. This risk can be lessened if a company employs apprentices who have participated in an in-house training course and who, most probably, are able to better satisfy the company's requirements and possess the necessary skills for filling a given position (Dohmen, 2007).

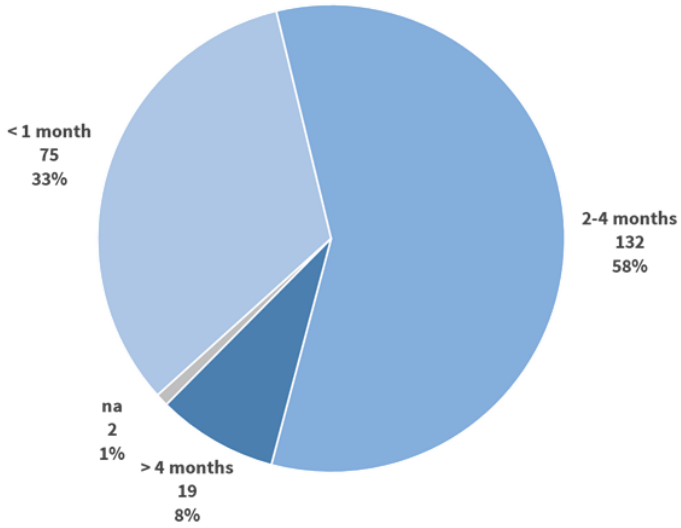
According to the findings, the selection process for hiring a new worker takes place within the company (47% mainly within the company, 41% entirely within the company), it requires time and resources, and lasts roughly between 2 and 4 months (58% of companies) and less than one month in 33% of companies as it involves a detailed examination of curricula in order to identify the candidates posessing the skills and knowledge required for a given position.

Figure 20 - Management of the selection process for hiring a new worker



Source: Centro Studi Assolombarda

Figure 21 - Average length of the selection process for hiring a new worker



Source: elaborazione Centro Studi Assolombarda

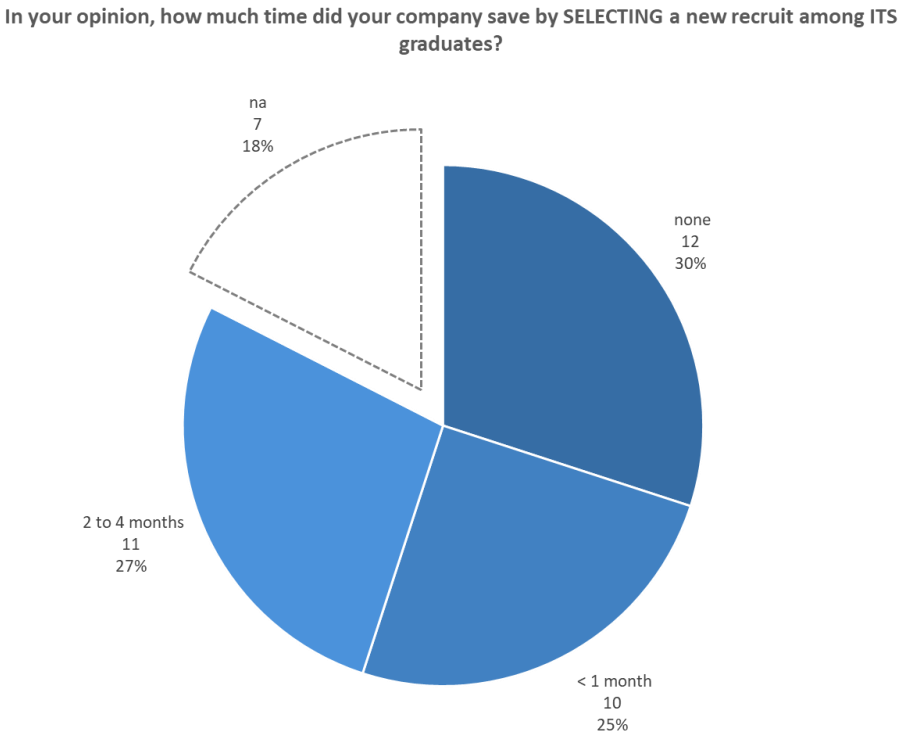
Impact on the selection process

If we equate an apprenticeship with the induction process in a company, it is interesting to note the findings of a survey on employers, carried out in Germany, in 2003, by the Federal Ministry for Education and Technical Research, according to which three quarters of the companies stated that apprenticeship programmes had allowed them to choose the best apprentices and avoid errors in terms of hiring. Furthermore, the time and resources that a former apprentice requires in order to settle down in the new job are usually minimal since the employee is already integrated and familiar with the specific requirements of the company and job. The risk of hiring the 'wrong person' and the subsequent costs (of firing, etc.) is much lower given that the company is already well-aware of the behaviour, working methods and productivity of apprentices trained in-house.

The analysis of the sample of ITS partner companies has shown that, by using ITS graduates, 25% of companies noted that the selection period had been shortened by less than a month

while 27% noted that the period had been shortened by 2 to 4 months. It should also be noted, however, that only 30% of the companies that were interviewed claimed that, despite being able to use ITS graduates, the time required for integrating newly-hired staff did not change.

Figure 22 - Time saved by ITS partner companies as a result of hiring ITS graduates



Source: Centro Studi Assolombarda

Improvement of the company's image

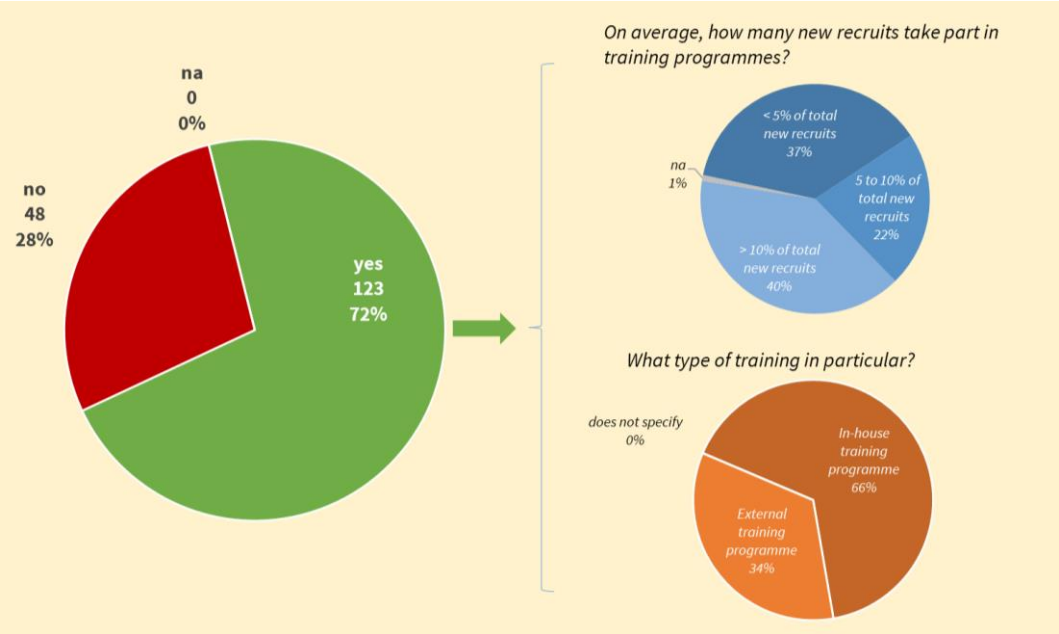
Employers claim that participating in apprenticeships/technical training programmes aimed at integrating new workers, improves a company's image. This is particularly the case for large companies which claim that these programmes improve their image in the eyes of both clients and suppliers and render the company more appealing to potential high-level staff (Ebbinghaus and Ulmer, 2009). We can assume that the organization and management of training programmes enhances a company's reputation of being socially responsible and this can impact positively on the company's image and its appeal as a workplace.

Possibility to remedy the lack of skills

The lack of skills and gaps in education have a series of negative consequences for companies. In Germany, a study conducted on 15,000 companies showed that for six out of ten companies, technical training programmes aimed at integrating new workers constitute a very important means of satisfying future demand for staff (Ebbinghaus, Ulmer, 2009). This is due to the fact that these courses help newly-hired staff to develop skills which allow them to face unforeseeen problems and real working life situations (Rauner, 2005), in other words to acquire key competencies.

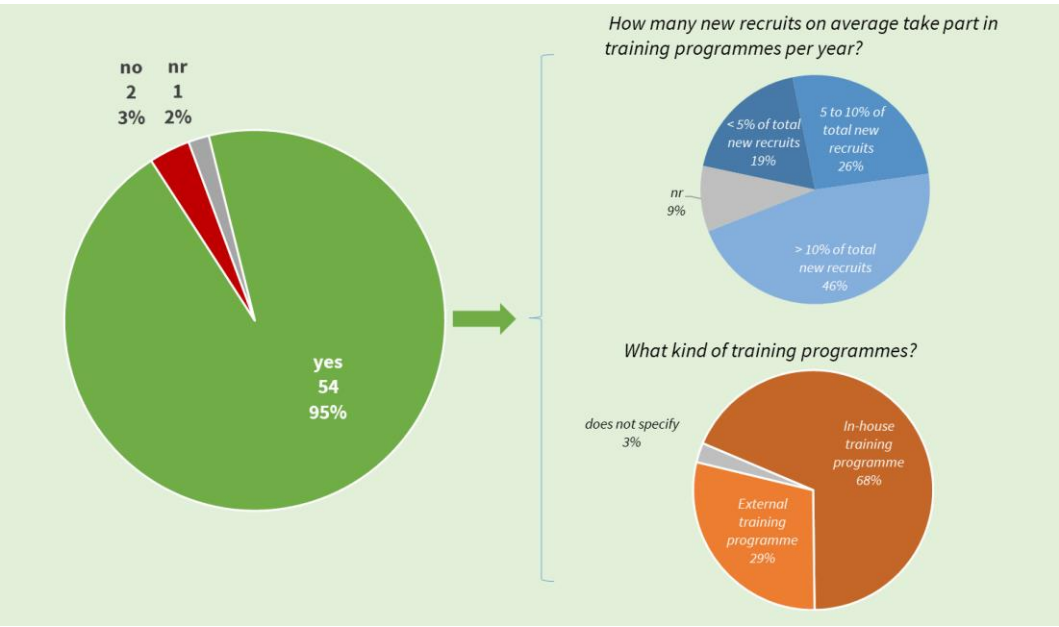
The research also demonstrates that 72% of companies with up to 100 employees provide training courses for newly-hired staff and that in 40% of companies, over 10% of new workers is engaged in training courses which are most often organized within the company. In the case of companies with over 100 employees, only 3% claim that they do not organize training courses for new workers, while 95% organize courses, once again mostly within the company and involving over 10% of total newly-hired staff.

Figure 23 - Organization of training courses/programmes for newly-hired workers – companies with up to 100 employees



Source: Centro Studi Assolombarda

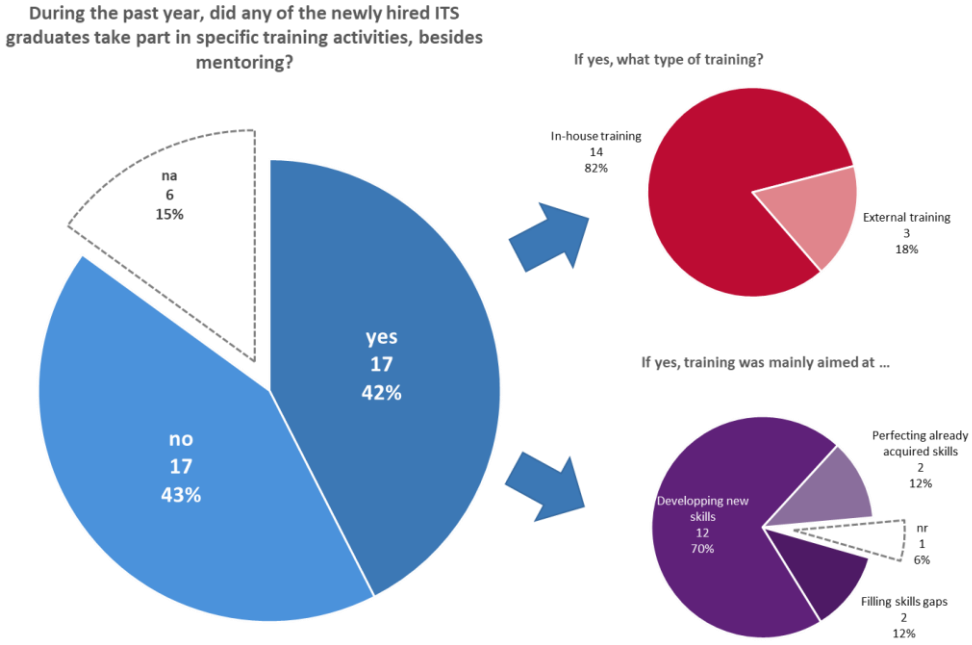
Figure 24 - Organization of training courses/programmes for newly-hired workers – companies with over 100 employees



Source: Centro Studi Assolombarda

The research conducted on ITS partner companies has also shown that in 42% of cases ITS graduates have been involved, in the last year, in training activities organized within the company and aimed mainly at developing new skills, improving existing competencies or filling gaps in training, while 43% was not involved in specific training activities, other than mentoring, in the workplace.

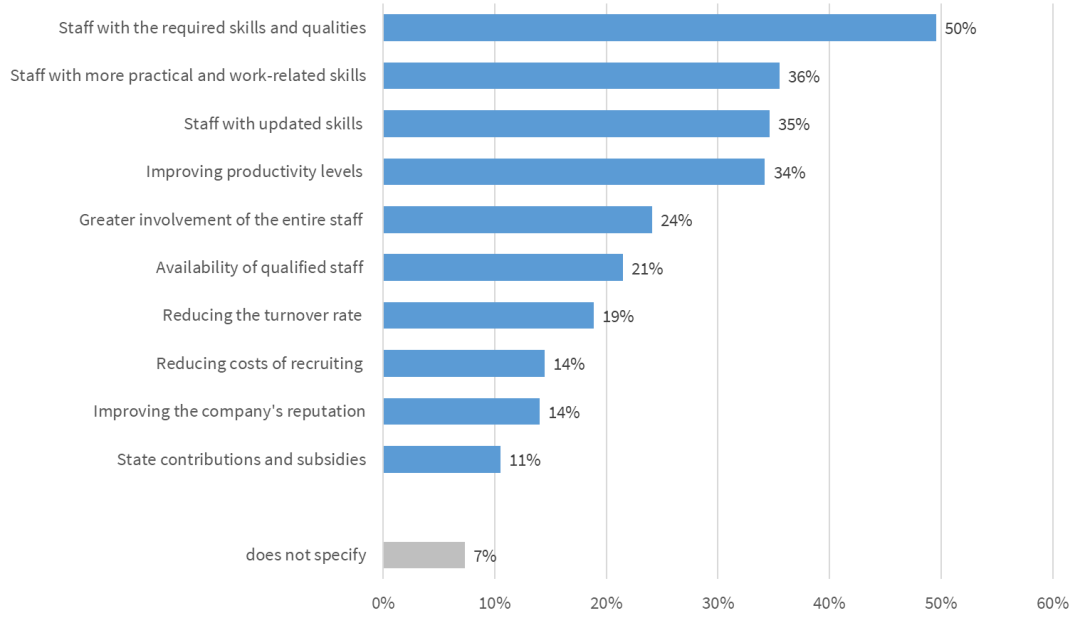
Figure 25 - Organization of training courses/programmes for graduates from ITS partner companies



Source: Centro Studi Assolombarda

In short, according to the survey, the main benefits for companies that invest in apprenticeships and training programmes include the ability to hire workers with the specific skills required by the company and having practical and updated competencies, as well as young workers who are more productive and more involved in corporate matters. At the same time, the company is able to lower the turnover rate and recruitment costs and to improve its image by investing in training programmes aimed at enhancing young workers' professional growth.

Figure 26 - Main benefits gained by a company investing in training programmes

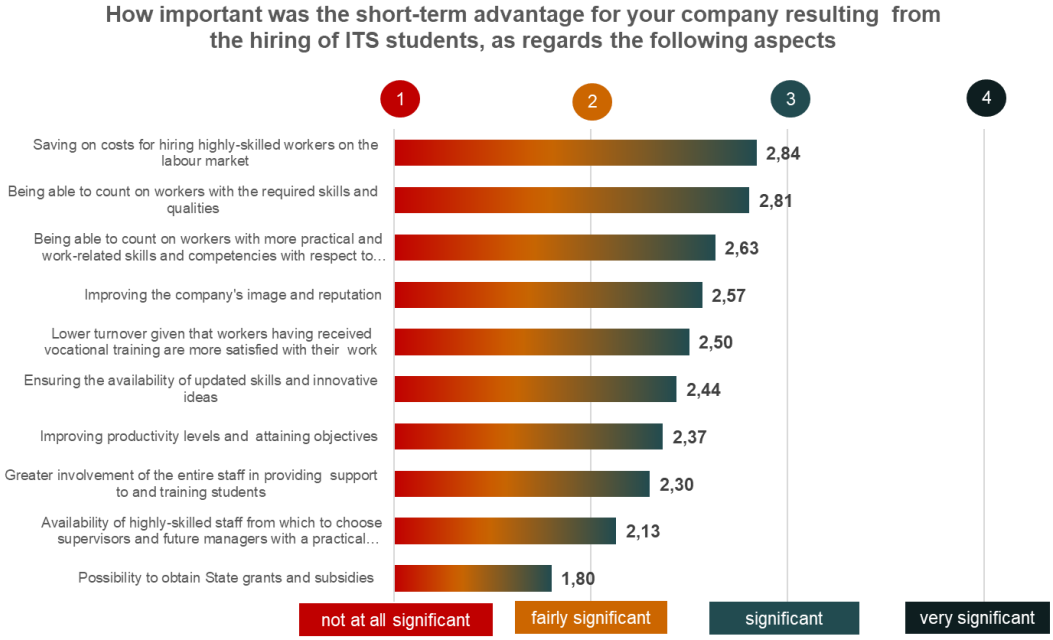


Source: Centro Studi Assolombarda

What emerges from observing the sample of ITS partner companies is that the hiring of students participating in ITS programmes has allowed companies to reap, in the short term, benefits such as the reduction of highly-skilled worker recruitment costs, to avail themselves of a group of people with practical skills, as well as knowledge and competencies which are

specifically targeted to the company's needs and constantly updated, as well as to lower the turnover rate as trained workers tend to be more satisfied with their jobs.

Figure 27 - Benefits for the company resulting from the integration of ITS students

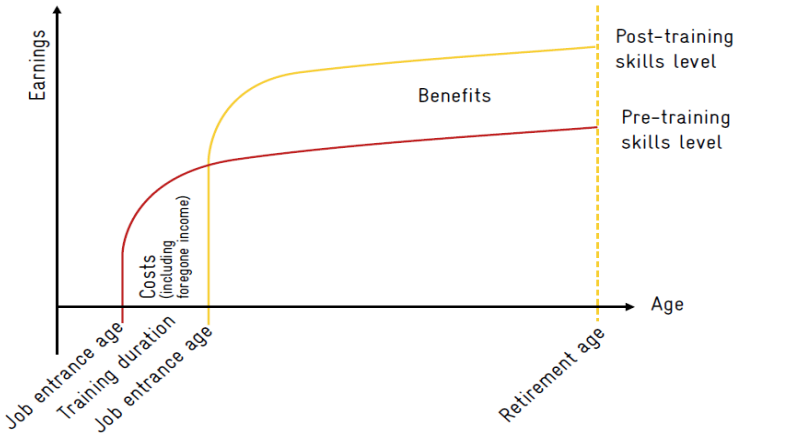


Source: Centro Studi Assolombarda

3.1.2 Benefits for the worker

The decision to engage in a training programme depends on a cost/benefit evaluation not only for the company but also for the worker. A worker must quantify both the cost of participating in a training programme and also the benefits derived from it, such as the probability of unemployment for trained workers and the probability of being promoted within the company (Descy, Tessaring, 2005).

Figure 28 – Individual benefits linked to apprenticeships



Source: Key Aspects of the Economics of Technical and Vocational Education and Training (TVET), Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, 2009

The advantages for young people taking part in these programmes are linked to the fact that they develop their professional profile not only through the acquisition of technical competencies and personal and social skills but also through socializing in the workplace. The extent to which these competencies are acquired varies from company to company and depends on the situations workers find themselves in and the support they receive.

Specialized skills, technical competencies and tacit knowledge

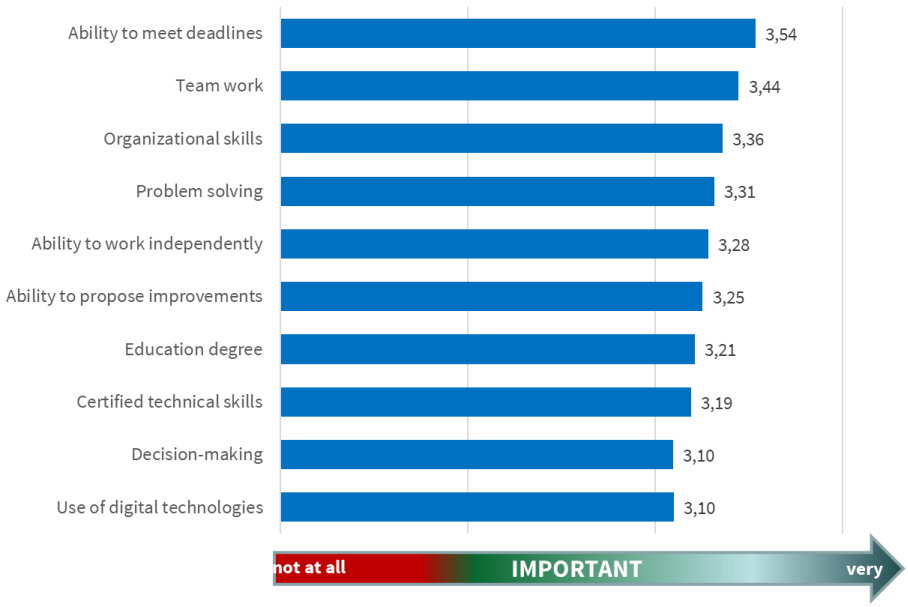
Because of the strict correlation between learning, real professional activities and the mechanisms underlying technical training programmes (learning through observation and practice), the development of job-related knowledge goes hand in hand with the acquisition of tacit knowledge (know-how and knowledge of procedures) regarding a specific job. The resulting skills are strengthened through direct involvement in the productive process contrary to what happens when knowledge is acquired in a classroom. In the former case, students can become familiar with the production methods and working conditions characterizing a real – and usually economically viable – workplace (Ryan, 2011).

Transversal skills, competencies and attitudes

Technical skills alone are no longer considered sufficient in today's labour market. Social and personal competencies (communication, teamwork and social skills), general competencies (planning and problem solving) and personal characteristics (such as being resourceful, highly motivated and ready to take risks) are today more important than ever (Brennan, 2009).

This aspect is also confirmed by the research which indicates that the competencies carrying the most weight during the selection process are related to the ability to meet deadlines, work in a team, organize one's own work and solve problems.

Figure 29 - Importance attributed to candidates' skills



Source: Centro Studi Assolombarda

Many of these skills are difficult to develop outside the real working world like, for instance, the attitude towards work, including the ability to take on responsibility, meet deadlines and act according to the situation. The key competencies known as soft skills (communication, teamwork and social skills) are becoming increasingly important in today's labour market. People engaged in technical training programmes are able to develop such skills by directly participating in the productive process, interacting formally or informally with colleagues and resolving the real problems that occur daily at work.
Technical training programmes are able to develop self-esteem and self-efficacy once newly-hired workers are given the opportunity to demonstrate what they are capable of, complete tasks and solve problems in a specific work context (Darche et al., 2009; European Commission, 2010; Fuller and Unwin, 2008; Luecking and Gramlich, 2003; Consiglio

Nazionale delle Ricerche, 2004; Oberth et al., 2006). According to several in-house assessments of training programmes, for instance, this method of learning improves students' quality of work and increases self-confidence, self-esteem and general approach to work.

Working experience can also help young people develop their self-assessment capacity and acquire the necessary confidence for learning from and reflecting upon their experiences. People usually become aware of the need to develop transversal skills when they have to put them to practice and these skills are difficult to develop if one is not faced with the concrete demands of a real working environment (Darche et al., 2004; Darche et al, 2009; Fuller and Unwin, 2008; Oberth et al, 2006; Field. et al, 2009). The same skills can benefit workers also outside their working environment, even though this may not be perceived as clearly and immediately as the return obtained from developing professional skills or specific competencies linked to a given job. Moreover, transversal skills are particularly important in the context of permanent training as people do not stay in the same job all their lives and tend to often change jobs and employers in the course of their career (Smits, 2008).

From the survey on ITS partner companies it emerges that ITS graduates present greater advantages than other new workers particularly in terms of their ability to propose better ways of performing their assigned tasks and to respect agreed deadlines. Further advantages regard their updated and certified technical skills which allow them to work in multidisciplinary environments, to organize their work efficiently, to make decisions and propose solutions to potential problems, to minimize errors and to have adequate tools for understanding and dealing with problems which are not strictly technical but part of the professional profile.

Socialization and motivation

A growing number of studies show that technical training aimed at job insertion not only facilitates the acquisition of technical and professional skills but also favours socialization within the working environment through interaction (interactive dimension) and motivation (emotional dimension linked to learning).
Students learn in a more efficient manner when teaching is put into context and there is an opportunity to perform practical tasks instead of studying abstract and theoretical procedures (Cedefop, 2011).

Being able to single-out career opportunities

Participation in technical training programmes can also strongly contribute to boosting students' career paths (Brennan, 2009; Cedefop, 2010; Darche at al., 2009; European Commission, 2010; Field et al., 2009) given that it helps people to better understand corporate culture and expectations (Darche et al., 2009) and to develop a positive approach towards work (Luecking and Gramlich, 2003) as it gives them the opportunity to perform real productive tasks and to interact with colleagues and clients.
For example, most of the apprentices interviewed in the course of a study conducted in Germany stated that the apprenticeship had helped them to mature and decide upon their chosen career (Pilz, 2008). This is also true in the case of training courses based on virtual companies: according to an American study regarding a direct initiative to support training in virtual companies, 79% of interviewees stated that the experience had helped them develop realistic expectations regarding both the work and the working environment (Hughes and Golann, 2007).

Ability to manage one's own career

Managing one's own career implies the ability to imagine a broader scope for the development of one's skills: this can be done through "*the acquisition of 'meta-skills' not*

specifically linked to a type of job but transferable, and therefore able to help …. to manage more efficiently their training and their work" (Cedefop, 2011f p. 31).

Every individual is unique as regards career aspirations, skills, competences, strengths and weaknesses. The ability to manage one's own career can help people navigate the tortuous path of educational options and a labour market which is increasingly complex and changeable, and characterized by a diminishing number of life-long jobs.

4. Cost/benefit simulation models: empirical evidence

4.1 How the economic cost/benefit model affects decisions to invest in training: the productivity-driven model and the investment-driven model

From an economic viewpoint, the decision to invest in training activities is based on the assessment of the costs and benefits of the investment. Given that, as indicated above, not all benefits are quantifiable (like, for example, the non-incurred costs during the hiring process), this assessment must also take into account the benefits which are difficult to quantify (for example, the lower turnover rate) as well as qualitative elements, so as not to underestimate the benefits deriving from such investments (Walden, 2006).

Two different models can be used in assessing a company's decision to invest in training: the **productivity-driven model** and the **investment-driven model**. Acording to the former, a company's incentive for investing in training is the apprentice's productivity during the apprenticeship. The cost of apprentices corresponds to that of low-skilled workers and they are able replace skilled workers but to a lesser degree than they can replace low-skilled workers. The investiment-driven model takes account of the future benefits derived as a result of employing the apprentice after the end of the apprenticeship. According to the human capital theory, the higher a worker's qualifications, the higher his/her productivity. Therefore, once the training period has been completed, the employer can expect a depreciation of the investment. The period which is considered significant in terms of deciding to invest in training activities should consequently not be limited only to the apprenticeship phase. A company favouring long-term planning should be ready to provide training even if the net return will be positive only after the worker has completed his/her training and provided he/she stays with the company. This means that a company must not only pay for the training in advance but also run the risk of losing the apprentice once his/her training has been completed

At this point, however, it is important **to distinguish between general human capital and human capital specific to the company**. In the former we find competences that can be also used in other companies while the latter refers to specific knowledge aimed at increasing productivity only in the company providing the training, thus making it less probable that an apprentice leaves the company when the training period is over. If a company decides to invest only in general human capital the incurred costs would have to be recouped during the training period. If not, the company would have incurred training costs but would not enjoy the benefits of the investment as the apprentice would leave the company after the apprenticeship (Wolter, 2008).

In the last 20 years many studies were conducted in order to assess the social and economic benefits linked to vocational training. In many countries, the increase of fiscal expenditure on education led to a more attentive assessment and evaluation of the efficacy of technical and vocational training. Moreover, many studies (CFA, 2009; Wolter et al., 2006, Dionisius et al., 2008) demonstrate that, even today, employers perceive costs as one of the major obstacles to providing vocational training.

The cost/benefit analysis model regarding vocational training programmes has a long history in Germany and dates back to the 1970s when the 'Experts Commission on the costs and financing of educational and vocational training', also known as the "Edding Commission", investigated this issue through various studies (Dionisius A.et al, 2008). Previous studies carried out in other countries had focused mostly on corporate investment and hiring costs without devoting particular attention neither to short-term benefits (i.e. to the value of a newly-hired worker's productivity) nor to long-term benefits (lower recruitment cost of skilled workers) derived from apprentices both during and after their training period (Muehlemann, S. et al., 2013). Nonetheless, over the years most countries opted for a more standardized model and began to conduct surveys among companies regarding the *return of investment* (ROI), underlining the benefits derived from vocational training programmes. This approach was used as empirical evidence by employers and companies for hiring new workers and became a widely-used method internationally for assessing the impact of newly-hired workers. It is based on a standard cost/benefit analysis of a single company that hires apprentices and attempts to exactly assess the different monetary costs and benefits linked to vocational training programmes in specific industrial sectors.

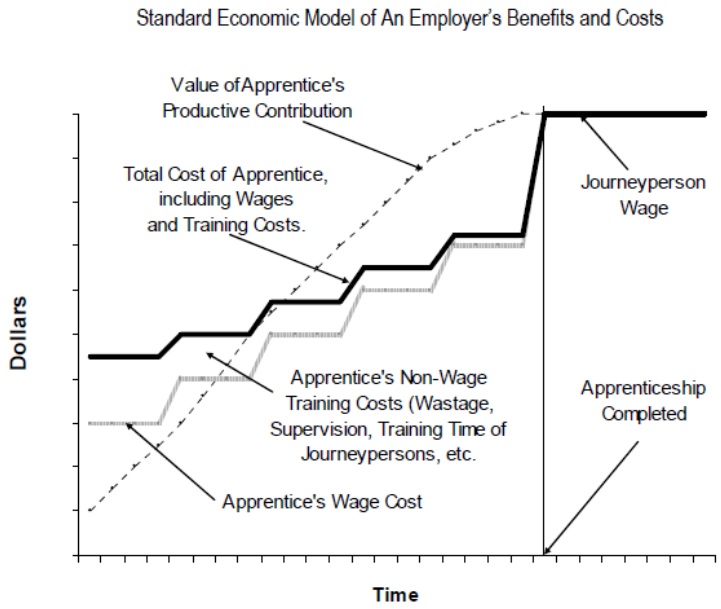
The aim of studies on the *return of investment* is to **highlight benefits and costs for a company during the training process of newly-hired staff** and to also demonstrate that the training of new staff does not represent only a monetary cost for the company but also a great value in terms of filling skills gaps within the company, provided that new workers are well trained.
This analysis therefore helps to:

1. understand how training can be considered an investment;
2. understand how to maximize output from training;
3. understand how to measure the effectiveness of training;
4. provide companies with guidelines for optmizing the type and duration of training in order to obtain the best results.

The ROI analysis seeks to provide an answer to the following question: "For every euro/dollar spent on training, how many euros/dollars are returned to the investitor/employer, to the apprentice, to the government programme or to anyone who has invested in training?" Calculated in percentage terms, the ROI analysis makes it possible to identify the return of investments in training and provide concrete answers to the question, "why should we hire new workers that have to be trained"?
It is difficult to assess the ROI because the company must take into account monetary costs and benefits, which are usually calculated per new worker on a yearly basis and can be quantified, but also costs and benefits of a qualitative nature. If total benefits are higher than total costs the investment in vocational training is economically viable for companies. Consequently, a company's decision to invest must be based on costs and benefits than can be measured and quantified.
Figure 30 illustrates the basic economic model used for deciding whether to invest in the training of a new worker. The model's key variables are the following:

- wage costs of new worker/apprentice;
- training costs of new worker/apprentice;
- productive output of new worker/apprentice;
- duration of the apprenticeship period.

Figure 30 - Basic economic model on costs and benefits of apprenticeships



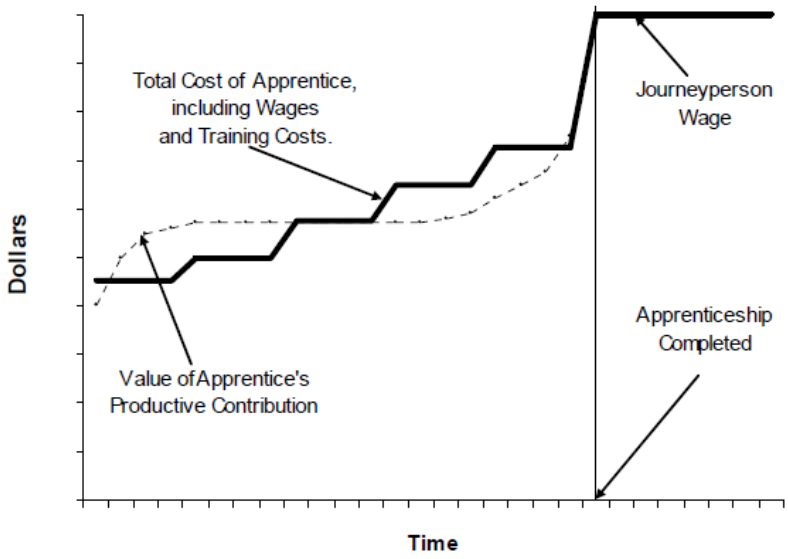
Source: Canadian Apprenticeship Forum – Estimating the Return on Investing in Apprenticeship. Analytical Report, 2005

According to the above graph, wage costs increase during apprenticeship until they reach, upon completion of the training period, the level of a qualified worker's wages. Training costs are significant in the first year but decrease as training continues and are close to zero at the end of the period. Total costs (black line) include wage costs and training costs. They are gross costs and do not take account of the apprentice's productive contribution. The benefit for the employer, traced by the dotted line, is linked to the apprentice's productive contribution which is initially limited but increases constantly during the apprenticeship until it reaches that of a qualified worker at the end of the period.

In this economic model, when the costs line is above the productive contribution line, there is a net cost for the employer. On the contrary, when the costs line is below the productive contribution line, there is a net benefit for the employer. At the start of the training period, the employer bears a net cost. In the subsequent period, the employer gains a net benefit. In this graph, the net benefits obtained during the second period are higher than the net costs incurred during the initial training period and consequently the company recoups the costs of investing in training.
It should be stressed, however, that the graph in Figure 30 could take a different shape and lead to a much different result. For example, the new worker's productivity line could remain constantly above or below the wage and training costs line.

Figure 31 illustrates another potential situation where a new worker's productive contribution is higher than his/her wage and training costs during the first part of the appreticeship, but lower than the wage and training costs during the last part. In this case, an employer could have an incentive to hire apprentices during the initial phase but also has an incentive to end the apprenticeship before its completion (behaviour of low-skilled staff users).

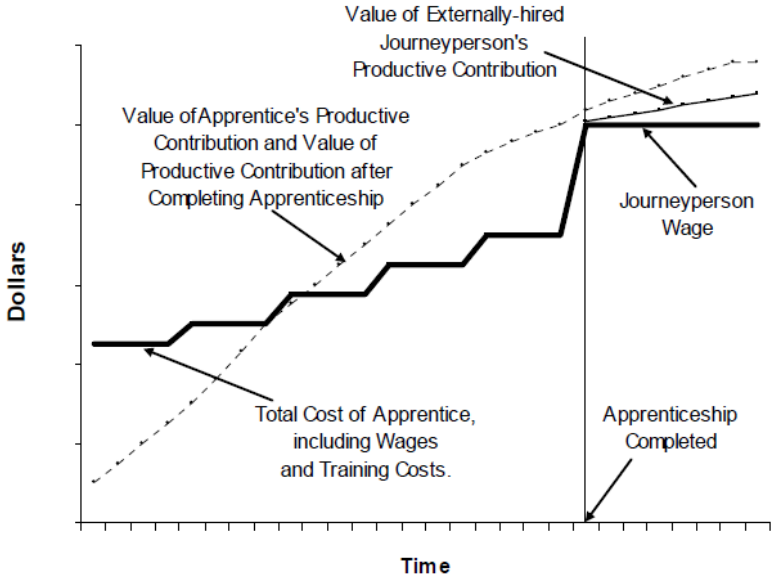
Figure 31 - Basic economic model on costs and benefits of apprenticeships – apprentice's productive contribution higher than training costs



Source: Canadian Apprenticeship Forum – Estimating the Return on Investing in Apprenticeship. Analytical Report, 2005

A further factor that the costs-benefits model should take into consideration is the potential value to an employer of a worker trained directly by the company rather than recruited from the external labour market. There are circumstances where company-specific skills or attitudes that are acquired during apprenticeship yield a benefit to the employer following completion of the apprenticeship and which cannot be easily replicated simply by hiring a person from the external labour market. This is particularly the case where company-specific skills are of strategic importance. Figure 32 illustrates such a situation.

Figure 32 - Benefits deriving from a new worker trained in-house vs an externally hired worker



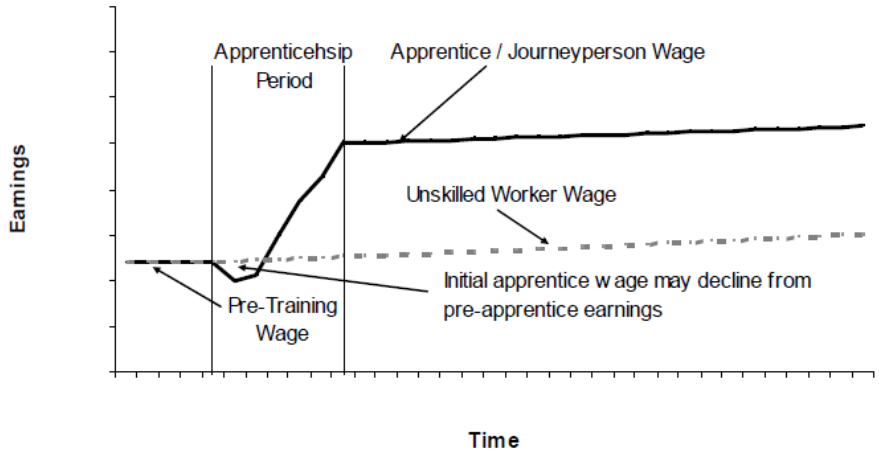
Source: Canadian Apprenticeship Forum – Estimating the Return on Investing in Apprenticeship. Analytical Report, 2005

A number of important inferences can be drawn from the models outlined above:

1. **wage costs, training costs and an apprentice's productive contribution** are the major determinants of an employer's costs and benefits;
2. **there is no reason to believe that there should be a single cost/benefit model** which is applicable to all sectors, all employers and all types of work. On the contrary, the line tracing an apprentice's productive contribution, as well as the line tracing employers' costs may vary according to the sector and the employer's characteristics. A cost/benefit analysis should be able to capture this diversity;
3. for some employers, **the advantages of hiring a new worker trained in-house are a crucial element** of the decision to invest in a training programme;
4. for some employers **the alternative to in-house training could be the risk of employing workers lacking in skills** and thus lose opportunities in terms of higher productivity.

Literature on in-house training focuses mainly on employers' costs. However, something which is sometimes overshadowed by empirical studies, is the important distinction between gross costs borne by employers and net costs. Gross costs include all he costs items attributable to training: wage costs, loss of productivity due to apprentices' supervision by already qualified workers, additional monitoring costs, waste of raw material, non-productive use of equipment, etc. On the other hand, net costs are calcuated by subtracting a new worker's productive contribution from gross costs.
From an apprentice's viewpoint, it is important to underline that he/she too has to bear two types of costs: on one hand, the lower wages earned as an apprentice and, on the other, training-related costs.
Figure 33 illustrates the costs and economic advantages of an apprentice in training compared to a worker working as a helper. In this graph, the wages of an apprentice following a training course are lower than those of a helper during the first two years of training. At a certain point during the apprenticeship, the earnings of the apprentice are higher than those of an unskilled worker. In Figure 33, the economic benefits of apprenticeship training are illustrated by the area between the apprentice earnings line (dark line) and the unskilled worker earnings line (dashed line).

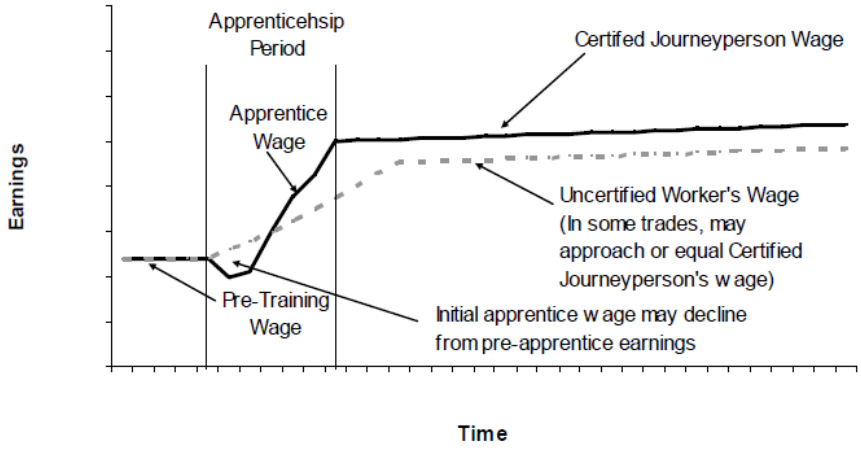
Figure 33 - Costs and benefits of a trained apprentice vs an unskilled worker/helper



Source: Canadian Apprenticeship Forum – Estimating the Return on Investing in Apprenticeship. Analytical Report, 2005

In Figure 34, apprentice earnings are traced by the black line which, initially, can fall below the wages of an unskilled worker. The apprentice's wages come close to those of an unskilled worker during the apprenticeship and equal them upon its completion. From then on earnings increase moderately.

Figure 34 - Benefits of a trained apprentice vs an unskilled worker



Source: Canadian Apprenticeship Forum – Estimating the Return on Investing in Apprenticeship. Analytical Report, 2005

Presented below are different costs and benefits simulation models adopted in EU and non-EU countries, as well as the empirical evidence emerging from studies regarding various sectors.

4.2 The German model

Many studies have been conducted in Germany on the importance of company-specific training and the results of these training programmes. A common element that emerges from all the studies regards those who leave a company upon completing the training period in order to perform a different type of job requiring skills that are different from those they have acquired. This implies a loss in earnings given that former apprentices are not able to use the complete set of skills obtained at the company that provided the training. Furthermore, companies may be obliged to accept a lower degree of productivity from apprentices during training without being able to adapt wages accordingly.
The **BIBB model - The Federal Institute for Vocational Education and Training** (Noll et al., 1983) is based on a cost/benefit analysis conducted by an "Experts' Commission on the costs and financing of education and vocational training" (1974). Although the original cost/benefit model has been largely modified over the years, the basic concepts used for measuring the costs and benefits of training have remained almost intact. The model assesses apprentice training costs borne by employers and divides them into three categories:

- apprentice costs;
- wages of training staff;
- other costs.

The model was further perfected by BIBB and the item "other costs" was divided in:

- cost of materials (cost of working equipment, training workshops and in-house training);
- miscellaneous (cost of learning and educational material, external courses, clothing, training management costs and apprentice recruitment costs).

As regards the advantages derived from training programmes, the model indicates the following:

- **apprentices attending a training course constitute a fairly reliable source of potential employees able to staisfy employers' skill requirements**. Morever, these workers cost less than skilled workers available on the labour market;

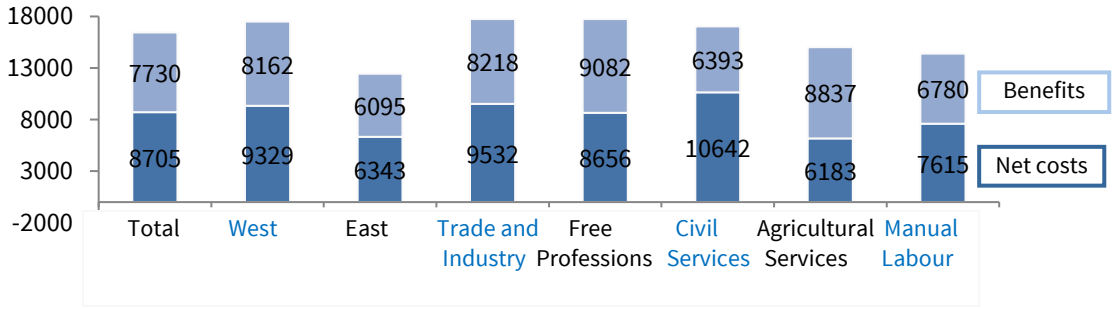
- **training produces a pool of skilled workers** who can be promoted more easily and hence fill higher positions on the corporate ladder;
- **turnover rates are often lower** following the start of a training programme because apprentices are more likely to keep their job upon completion of the apprenticeship;
- **in-house training makes it possible to 'instill' corporate values and ethics**, an aspect considered very important by employers, particularly when newly-trained apprentices remain with the company after training;
- **apprentices attending an in-house training programme have a better understanding of the skills and competencies necessary** for carrying out their tasks.

A company's decision to become involved in training activities is influenced not only by the above-mentioned costs and benefits but also by other factors, such as:

- **the sector in which the company operates**. In general, by training apprentices employers bear a net cost in the short-term but obtain a net benefit in the long-term;
- **the size of the company**;
- **the characteristics of the labour market**. During periods of economic growth, there is a relatively low availability of workers with the right skills and competencies. Hence it is more interesting to invest in training. When hiring is relatively easy (for instance, in the case of large, well-known companies) an apprenticeship programme gives the opportunity to recruit a more diversified pool of workers. Sometimes employers view apprentices as the main path to recruitment, when hiring from the labour market is difficult (for example, in sectors which are not considered particularly attractive or in the case of employers who have to bear very high recruitment costs).

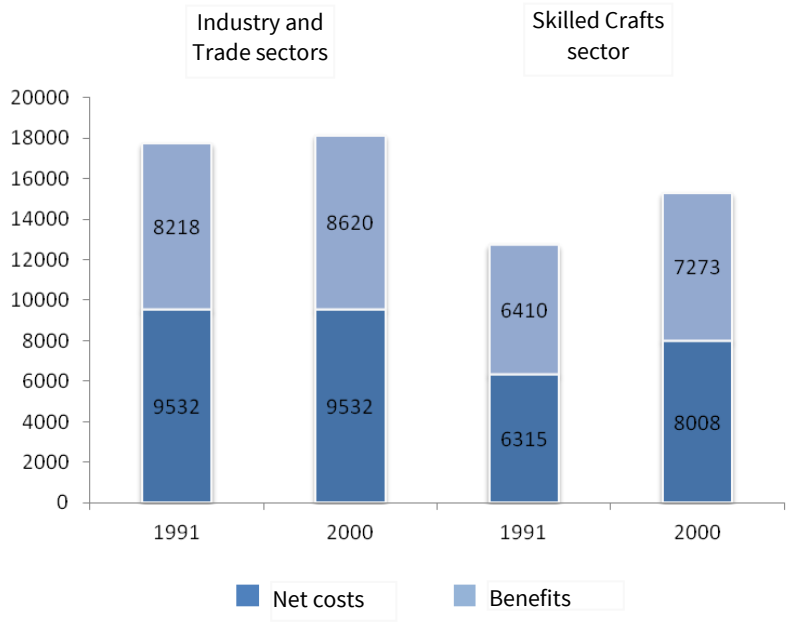
The survey conducted in 2005 by the Federal Institute for Vocational Education and Training (BIBB), on a sample of 2,500 companies involved in training activities in 2001, analyses the costs and benefits of training and highlights, in particular, the differences regarding the level of costs incurred in the Eastern and Western parts of Germany (Figure 35): total costs are lower by 29% in the Eastern part while net costs are lower by 25%. The main reason for this is the different level of apprentices and of wages. There are significant differences among the various sectors: high gross costs can be observed in the trade and industry sectors, followed by free professions and civil service. On the contrary, the lowest gross costs are registered in the agricultural and manual labour sectors. Moreover, the study shows how costs incurred for training activities in the last ten years vary in the different sectors, particularly as regards the industry and trade sectors and manual labour. Between 1991 and 2000, gross costs (total costs) increased by 17% in the trade and industry sectors and by 20% in the manual labour sector (Figure 36).

Figure 35 - Net costs and benefits of apprenticeship training – Germany, year 2000 (yearly figures per apprentice in €)



Source: Federal Institute for Vocational Education and Training (BIBB) 2005

Figure 36 - Net costs and benefits of apprenticeship training in the Industry and Trade sectors and the Skilled Crafts sector – Germany, year 2000 (yearly figures per apprentice in €)

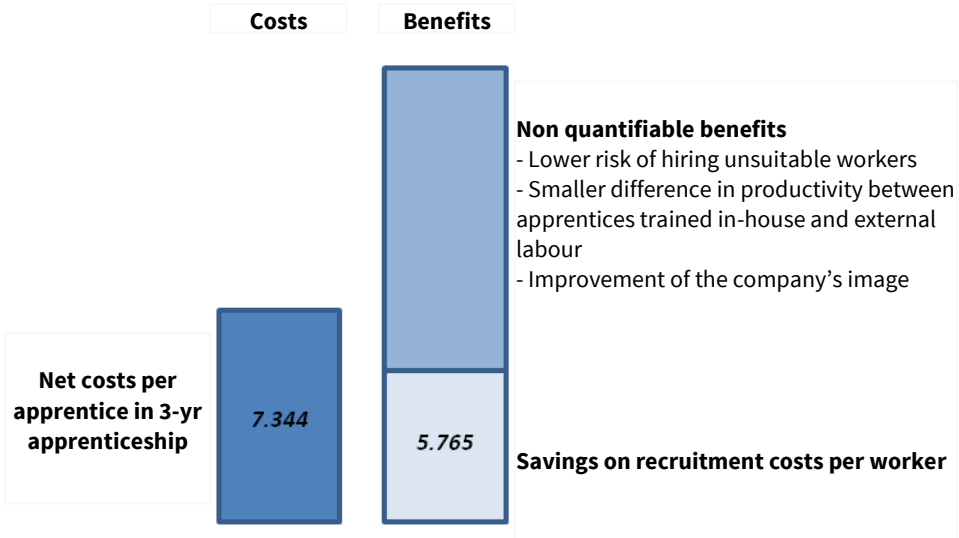


Source: Federal Institute for Vocational Education and Training (BIBB) 2005

Furthermore, the study highlights the advantages companies gain from providing apprenticeship training. A major advantage lies in the significant cost savings resulting from not having to select and recruit qualified external workers (see Figure 37). This advantage can be estimated and expressed in monetary terms given that recruitment cost savings can be broken down as follows:

- **cost savings linked to staff recruitment** (advertising costs, cost of staff that selects candidates). The average cost in all the companies was estimated at € 1,429 per new qualified worker;
- **cost savings linked to the hiring of staff from the labour market**, whose average cost was estimated at € 3,927, and cost savings amounting to € 722 for continuous apprenticeship training programmes.

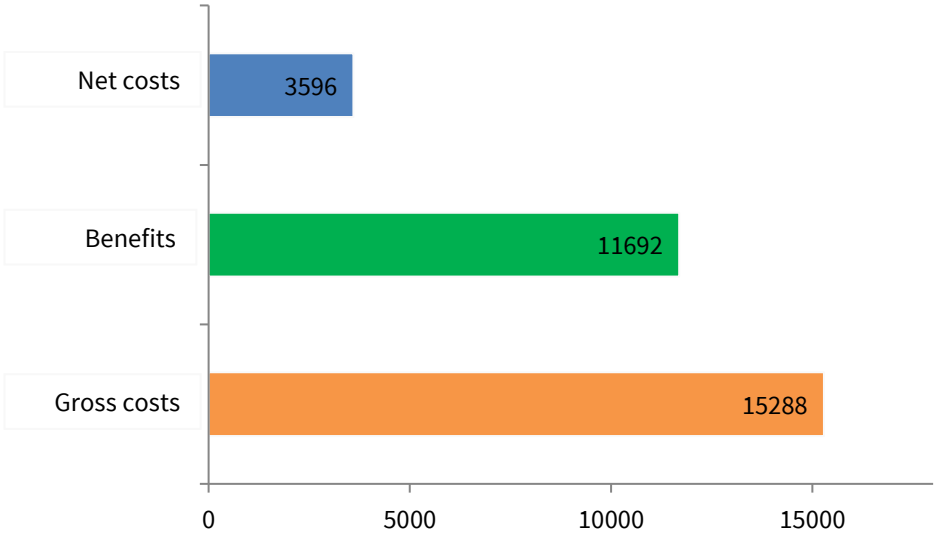
Figure 37 - Net costs and benefits of apprenticeship training in Germany nel 2000 (average cost in €)



Source: Federal Institute for Vocational Education and Training (BIBB) 2005

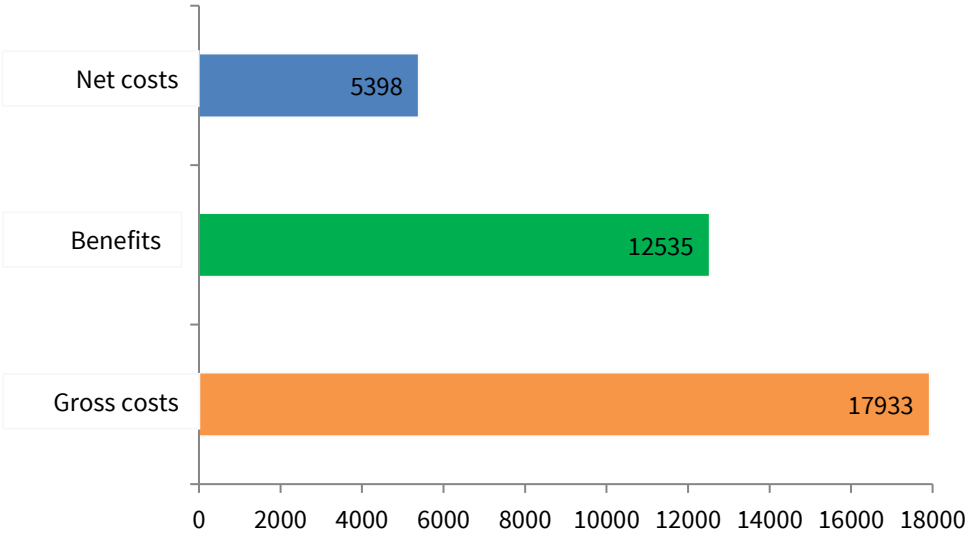
From studies conducted by BIBB in 2007 and 2012 it emerges that the gross cost of in-house training decreased from € 16,435 to € 15,288 in 2007 and rose again in 2012 (€ 17,993).

Figure 38 - Total costs, net costs and benefits of apprenticeship training in Germany in 2007 – average cost per apprentice in €)



Source: BIBB Cost Benefit Study 2007

Figure 39 - Total costs, net costs and benefits of apprenticeship training in Germany in 2012 – average cost per apprentice in €)

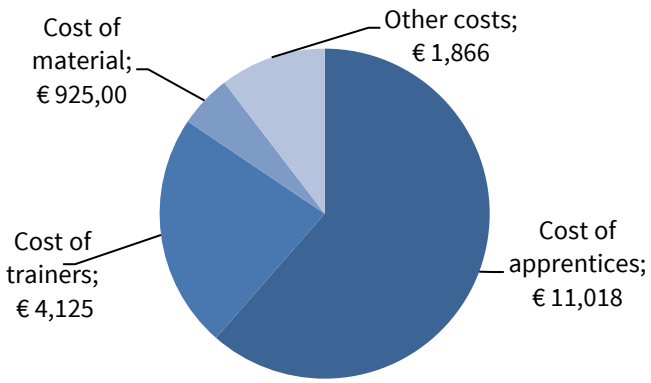


Source: BIBB – CBS 2012/13

In particular, 62% of gross costs corresponds to the cost of apprentices, 23% to the cost of training staff whose wages are taken into account only to the degree that they represent training costs. A distinction is made between full-time and part-time occupation and between external trainers and internal trainers who carry out training activities alongside their usual tasks in the company. Their work as trainers becomes important in terms of estimating training costs when their productivity within the company decreases. Consequently, the cost was calculated taking account of both the duration of training and the decrease in productivity.

Non-personnel costs amount on average to € 925 (5%) and include the supply costs of tools and equipment for apprentices, training laboratory costs, and the cost of material necessary for training activities.

Figure 40 - Total costs of apprentices by category



Source: BIBB – CBS 2012/13

With regard to the various sectors, gross costs are higher, on average, in the trade and industry sectors and lower in the agriculture and free professions sectors. High returns are obtained in the trade and industry sectors, as well as in the agriculture and free professions sectors, amounting roughly to € 13,400 and € 12,750 respectively. As regards net costs, the situation is as follows: public service has the highest net costs (€ 8,032), followed by Home Economics (€ 6,385) and Industry and Trade (€ 6,146). Lower net costs, on average, are reported in relation to Free Professions (€ 3,705) and Agriculture (€ 1,293).

Table 4 – Total costs, net costs and benefits per sector (in €)

	Total costs	Benefits	Net costs
Industry and Trade	19,535	13,189	6,346
White-collar work	15,188	10,798	4,390
Agriculture	14,043	12,750	1,293
Free professions	16,474	12,769	3,705
Public service	19,800	11,768	8,032
Home economics	15,330	8,945	6,385

Source: BIBB – CBS 2012/13

Another factor influencing both costs and returns is the duration of training in a given job.

Table 5 – Total costs, net costs and benefits by duration of training (in €)

	Total costs	Benefits	Net costs
Two years	16,970	11,652	5,318
Three years	17,666	13,854	3,814
Over three years	18,636	9,543	9,093

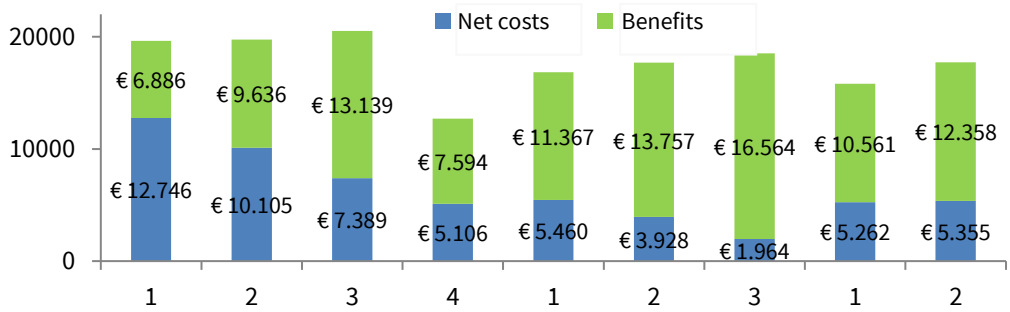
Source: BIBB – CBS 2012/13

Yearly gross costs are higher in the case of occupations that require an apprenticeship of more than three years (€ 18,636) and lower when the apprenticeship lasts two years (€ 16,970). Figure 41 shows the average gross costs, returns and net costs for each year of apprenticeship training. Workers engaged in three-year apprenticeships are more productive and generate returns amounting on average to almost € 14,000 per year. It is obvious that occupations requiring training apprenticeships lasting over three years have the highest net costs during the entire period.

The total net costs of a training programme exceed € 35,000. Occupations that require more than three years of training include technical jobs for which a great amount of material is needed and where it is difficult to impart all the necessary information during

the apprenticeship period (for instance, when part of the training takes place in a laboratory).
As regards occupations that require less than two years of training, it is surprising that there is no decrease of net costs from the first to the second year. In other occupations a decrease can be observed during the training period, provided that there is an increase of returns.

Figure 41 – Benefits and net costs per apprentice and per duration of training (in €)



Source: BIBB – CBS 2012/13

A recent comparative study conducted by Dionisus et al. (2008) focused on the net cost of in-house training in Germany and Switzerland and demonstrated that average training costs amount to € 15,537 in Germany and € 18,131 in Switzerland. Consequently, the costs difference between Germany and Switzerland amounts to € 2,595 per year, which corresponds to a total of € 7,785 for a three-year training programme.

This difference, while significant, is low compared to the difference in the benefits deriving from training. **The value of an apprentice's productive contribution is much higher in Switzerland, where the average benefit is estimated at € 19,044, while in Germany it amounts to € 8,008 per apprentice, per year. Therefore, apprentice training in Germany generates net costs of € 7,529 per person, while in Switzerland companies are able to gain an advantage estimated at € 913.**

As regards total costs, they mainly consist in wages of training personnel and wages of apprentices. The average wage for a management position in Switzerland is higher by 46% compared to Germany. The wages of Swiss qualified workers (administrators, technicians, craftsmen) are higher than those of their German counterparts by 60%, 53% and 71% respectively. Lastly, the monthly wage of a worker without a professional degree is higher in Switzerland by 59% compared to Germany. On the contrary, apprentice salary costs are on average higher in Germany than in Switzerland. During the first and second year German apprentices' wages are higher, but they decrease during the third year.
Further differences can be attributed to the number of days an apprentice has to spend in a vocational school. The difference between Germany and Switzerland is on average 15 days during the first year of training, 10 in the second and 8 days in the third. This is the main reason why Swiss apprentices spend more days per year in the workplace within the company providing the training. Moreover, German apprentices spend more days attending internal and external courses and traineeships in other companies. Consequently, Swiss apprentices spend more time in the workplace compared to German apprentices (+23 days in the first year, +18 days in the second year, +13 days in the third year).

Beyond the time spent within a company, significant differences emerge also in terms of net training costs linked to the type of work and training within the company. Companies have a great degree of freedom as regards the type of tasks assigned to apprentices during their training. They can perform productive tasks (both tasks usually only performed by skilled workers or tasks usually only performed by unskilled workers, i.e. workers without a professional degree), or tasks that do not have a direct value for the company (for example, time spent on practice or learning in the workplace) (*Ibidem*).

There are substantial differences between Germany and Switzerland with respect to these parametres. The time dedicated to non productive tasks by German apprentices is higher than that of their Swiss counterparts by 36% in the first year, 28% in the second year and 18% in the third year. During the entire apprenticeship period, Swiss apprentices spend 468 days in the workplace and dedicate 83% of this time to productive tasks while German apprentices spend a total of 415 days in the workplace and dedicate 57% of their time to non productive tasks (*Ibidem*).

However, the respective rates of skilled and unskilled productive tasks are not very different in both countries. Apprentices' relative productivity when performing skilled tasks increases in a similar way: from 37% in the first year to 75% in the last year of training in Switzerand and from 30% to 68%, respectively, in Germany. This also confirms that the two training systems produce comparable results, given that apprentices' performance compared to that of skilled workers during the last year of training is almost the same in both countries.

The difference between training net costs in the two countries can be explained to a large extent by the different ways of using time in the workplace. Swiss apprentices are more engaged in productive tasks than their German counterparts, something that could be due to the different labour market regulations applied in the two countries. Because of the great flexibility of the Swiss labour market, most Swiss companies appear obliged to adopt a training strategy aimed at productivity, while German labour market regulations allow most companies to adopt investment-oriented strategies (Lindley, 1975, for a first analysis of these two strategies).

Trained apprentices' post-degree mobility is in line with this hypothesis. On average, only 36% of apprentices trained in Switzerland remain with the company that provided the training a year after its completion (Wolter and Schweri, 2002). In Germany, this percentage is above 50% (64% in West Germany and 46% in East Germany, see Bundesministerium für Bildung undForschung, 2002). This could explain why German companies are not as keen to have apprentices perform productive tasks during their training period.

4.3 The British model

Research on the economic returns to apprenticeship training in the United Kingdom has shown **very positive results in terms of earnings and the probability of trained apprentices to be hired after completing the apprenticeship.**
While there is a vast literature regarding the economic returns to education, research on apprenticeship training returns are rather limited. As regards the United Kingdom, Dearden et al. (2002) have examined and provided a few estimates on apprenticeship returns within the framework of a broader study on the returns to Education, while McIntosh (2004), using data from the labour force survey for the years 1996-2002, focused explicitly on the returns to apprenticeship training in the United Kingdom and also examined the various combinations between training/apprenticeship and other qualifications held, and estimated a gain in wages of around 5-7% for men having successfully completed their apprenticeship while, for women, completion of the apprenticeship did not result in any gain. Salary returns, among men, differ according to workers' qualifications; for example, holders of Level 3 professional qualifications (specialized skills in a wide range of jobs, including complex and non-routine jobs) having also completed an apprenticeship, receive wages that are twice as high as those of workers without these qualifications.
The research was further updated by McIntosh in 2007 based on data from the labour force survey for 2004 and 2005. The author highlighted the fact that completing an intermediate training programme is linked to a 16% rise in wages, compared to workers who have not completed such training, while completing an advanced apprenticeship results in an 18% rise in wages, compared to workers who have not completed the apprenticeship. As regards employment possibilities, the completion of an advanced apprenticeship has been

associated to a 15.7% higher probability of being employed compared to those who haven't completed the apprenticeship. The completion of an intermediate training programme is, on the other hand, associated with a 7.4% increase in the probability of being employed.

More recently, other studies commissioned by the "Department for Business, Innovation and Skills" have provided updated estimates of the returns to apprenticeship training in a broader context, using a methodology similar to that of McIntosh ("London Economics", 2011a) and using data from various sources (e.g. "London Economics", 2011b). It emerges that in recent years the returns to intermediate and advanced apprenticeship training have followed a different trend: the estimated wage increase for Level 2 training obtained by "London Economics" (2011a) is 12%, compared to 16% indicated in the McIntosh survey on the basis of 2004-05 data, while the estimate for Level 3 is 22%, compared to 18% in the 2007 McIntosh survey. However, these surveys are not perfectly comparable due to slight differences in methodology together with the fact that the "London Economics" survey refers to hourly wages whereas McIntosh uses weekly earnings.

The surveys indicated above throw light on the benefits derived from training programmes in the labour market and allow us to compare them with training-related costs in order to obtain a cost/benefit analysis (CBA analysis). Based on available estimates, a CBA takes account of the costs and benefits for (i) employers (wage costs, supervision and management costs, apprentice productive contribution, etc.); (ii) apprentices (opportunity costs of engaging in an apprenticeship, remuneration); and (iii) public budgets (training apprenticeship costs, tax revenues and social security expenses), as well as for society in general. The results of the CBA differ significantly for the various stakeholders and also depend on whether the analysis refers to a short-term or long-term perspective. For example, by hiring new apprentices, employers bear a cost in the short-term but gain a net benefit in the longer-term. A similar result emerged as regards new recruits. The hiring of an apprentice may appear costly but in the long-term it seems to produce benefits for all parties involved.

Table 6 summarizes the costs and benefits of Level 2 and Level 3 apprenticeships. These estimates were obtained from the labour force survey for the years 2011-2012 and the higher costs are determined by new recruits' remuneration costs which amount to roughly £ 13,000 for a Level 2 apprenticeship lasting on average 13.4 months and £ 19,000 for a Level 3 apprenticeship which usually takes longer to complete (19.7 months).

In addition, there are average supervision costs amounting to £ 7,131 (Level 2) and £ 10,600 (Level 3). The value of an apprentice's productivity is slightly lower than the wage and supervision costs borne by the employer and therefore they constitute net costs.

These costs amount to £ 8,244 and £ 10,777 for Level 2 and Level 3 apprenticeships. There are several benefits for the employer following the start of a training programme such as savings in recruitment costs of qualified staff and other positive outomes for the company that cannot be quantified. However, to be economically rational, the return for the employer should at least cover the initial investment for the decision. In other words, the return should be at least equal to the net cost incurred at the start of the training programme.

Table 6 – Costs and benefits for the employer (in £)

	L2	L3
Apprenticeship costs		
Apprentice wages	£ 12,982	£ 19,072
Supervision/administrative costs	£ 7,131	£ 10,600
Benefits during apprenticeship		
Apprentice productivity	£ 11,869	£ 18,894
Public image	-	-
Social status	-	-
Net benefits	- £ 8,244	- £ 10,777

Source: Framework data, LSF data, apprentice starts in England, 2011/12

The cost/benefit analysis of apprenticeships at an individual/trained apprentice level shows high positive returns for both Level 2 and Level 3 apprenticeships. Individuals would have earned between £ 7,400 (Level 2) and £ 10,900 (Level 3) more if they had held a regular job and not engaged in an apprenticeship. However, if lifelong earnings are considered, there is a difference between the earnings of individuals having succesfully completed an apprenticeship and those with low skill levels: £ 131,000 for individuals having completed a Level 2 apprenticeship and £ 200,883 for individuals having completed a Level 3 apprenticeship.
However, as there is a substantial risk of not completing the apprenticeship, the expected value of this return has to be adjusted for the fact that not everybody starting an apprenticeship receives the related benefits. At the start of the apprenticeship, only about 75% of all Level 2 apprentices and 79% of all Level 3 apprentices are achieving a return. The resulting increase in post-apprenticeship earnings is about £ 99,000 for a Level 2 and £ 158,000 for a Level 3 apprenticeship. Subtracting the initial investment by individuals, the net benefit value to individuals is £ 92,000 in the case of a Level 2 apprenticeship and £ 147,000 in the case of a Level 3 apprenticeship.

Table 7 – Costs and benefits for apprentices (in £)

	L2	L3
Benefits during apprenticeship		
Apprentice wages	£ 12,982	£ 19,072
Non-financial benefits	-	-
Social status	-	-
Costs during apprenticeship		
Wages of qualified staff	£ 20,376	£ 29,934
Net benefits during apprenticeship	- £ 7,394	- £ 10,862
Post-apprenticeship benefits		
Increase in earnings over time	£ 131,571	£ 200,883
% apprentices with immediate return	75%	79%
Increase in earnings at apprenticeship completion	£ 99,073	£ 157,894
Net benefits	£ 91,679	£ 147,032

Source: Framework data, LSF data, apprentice starts in England, 2011/12

In order to assess the level of efficiency and the benefits from apprenticeship training, Hogarth et al. conducted a study in 2012 based on 79 case-studies of employers operating in eight different sectors: engineering, construction, retailing, hospitality, transport and logistics, financial services, business administration, social assistance.

The study, whose main aim was to estimate the level of investment in apprenticeship training by employers, was based on the following steps:

1. identification of training costs:
   - apprentices' labour costs;
   - cost of supervision from training managers, first line managers, and supervisors (obtained by multiplying time spent training by wage costs);
   - other training costs (e.g., training material, recruitment costs, etc.);
2. identification of benefits for the apprentice:
   - apprentice productive contribution over the entire training period. This is measured as the proportion of the work the trainee can complete in each year of the apprenticeship compared to an experienced worker. It is then multiplied by the wage costs of the experienced worker. The calculation takes account of the fact that the apprentice may spend time away from the workplace thus making no productive contribution.

The benefits of training are then subtracted from the cost to give an indication of the total cost of training for the employer.

Using as a reference the hospitality sector, which includes restaurants, hospitality services, pubs, bars, nightclubs, holiday centres, housing, catering services, it is possible to understand how training costs have been calculated.
The hospitality sector in Great Britain has grown significantly over recent years and employs over 1.6 million people. The composition of jobs in the sector has been changing: the number of restaurants and hospitality establishments has increased while the number of pubs, bars, nightclubs and hotels is decreasing. The sector is dominated by small businesses (99% of companies employ less than 250 people), even though big chains and international companies are present in sectors such as hotels and restaurants.
The hospitality sector has the highest turnover rate in the British economy and this reflects the relatively low wages and working conditions that exist in many hospitality establishments. The result is a constant need to replace workers who leave the company, as well as significant skills gaps. One recent response to this high labour turnover has been to recruit workers from overseas, especially from Eastern Europe, who are prepared to accept the working conditions offered and have the necessary skills. An alternative response has been to offer training as a means to increase loyalty to the business and reduce labour turnover. Therefore, training is something that is offered to employees (new or existing) in order to promote or reward loyalty and reduce turnover. Some managers are convinced that training can reduce turnover and therefore is a good investment. On the contrary, other employers are reluctant to invest in training because, as a result of their high employee turnover, they did not have enough time to recoup their investment.

The 10 case studies analysed by Hogarth et al. (2012) are summarised in Table 8. In all the cases, employees were offered training in the form of apprenticeship or workplace learning.

Table 8 – Case studies analysed

Case study	Apprenticeship or Workplace Learning (WBP)	Level	Description
Case Study No 1	Workplace Learning	2[1]	Café in a tourist location
Case Study No 2	Workplace Learning	2	Hotel belonging to a large chain
Case Study No 3	Workplace Learning	2	Luxury hotel belonging to a small group
Case Study No 4	Workplace Learning	2	Large restaurant belonging to a chain
Case Study No 5	Workplace Learning	2	Family-run café
Case Study No 6	Apprenticeship	2	Large hotel belonging to family-run group
Case Study No 7	Apprenticeship	2	Large hotel belonging to an international group
Case Study No 8	Apprenticeship	2	Fast food restaurant, part of a chain
Case Study No 9	Apprenticeship	2	Large hotel with a spa and golf course
Case Study No 10	Workplace Learning	3	Privately-owned hospitality establishment

Source: The employer net benefit of training study 2011

The difference that emerged from the case studies mainly regards the motive which drove companies to launch training programmes: small companies tend to train young people so that they will acquire *ad hoc* skills required at a specific moment in time; companies that are part of a group tend to comply with the strategic decisions taken by the group which

[1] Intermediate Level Apprenticeships, aimed at obtaining a Level 2 Qualification. Advanced Level Apprenticeships, aimed at obtaining a Level 3 Qualification.

often encourage training in the interest of maintaining service quality and promoting the business 'brand'. Employers, in particular, claimed to have provided training in order to:

- meet an existing skills shortage (especially in regard to chefs);
- encourage and motivate existing staff;
- prepare staff for progression to supervisory roles within the establishment;
- accredit existing skills (acquire specific qualifications);
- reduce staff turnover.

Table 12 shows the costs and benefits of a Level 2 training apprenticeship in the hospitalty sector. The general picture that emerges is that training costs in this sector are relatively low for the apprentice compared with costs in other sectors (as shown in the following Table). If one compares the training costs through an apprenticeship or a workplace learning pogramme, the net cost of the latter is under £ 2,000; this is due to the fact that trainees are already employed by the company and have a high productive contribution (in proportionate terms), given that they are experienced at the job and require little supervision. On the contrary, apprenticeship training (particularly as regards the skills and training of chefs) has a higher cost because apprentices normally are new recruits and hence less productive during the training period and in need of greater supervision. However, employers offset some of these costs by paying apprentices low wages.
Tables 9 and 10 show the net costs of training and compare employers who provided high and low cost training. As regards workplace learning, net costs vary from a little under £ 4,000 to a negligeable £ 37. The difference is due to two related factors. In the high cost case, trainees were not fully productive during the training period because they were out of the workplace one day a week (making their productive contribution 80%). In the low cost case, the trainee was 100% productive during the training period and required little supervision.
As regards apprenticeship training, the net cost of a high cost apprenticeship amounts to roughly £ 8,000, while that of a low cost apprenticeship is roughly £ 3,500. A key factor contributing to this difference is apprentice salaries.

Table 9 - Costs and benefits of an apprenticeship in the hospitality sector

	Apprenticeship	**Workplace Learning**
Dropout rate (%)	20	0
Apprentice salary	£ 8,685	£ 9,928
Experienced worker's salary + national insurance contribution	£ 15,540	£ 11,110
Apprentice productivity	58%	92%
% time spent training	3%	2%
% Line Manager's time spent training	2%	0%
% Supervisor's time spent training	13%	5%
Manager's salary	£ 27,000	£ 32,800
Line Manager's salary	£ 30,000	£ 18,000
Supervisor's salary	£ 23,366	£ 18,688
Total costs of supervision	£ 4,672	£ 1,631
Apprentice selection costs	£38	£ 0
Training course management costs	£5	£ 195
Supervision costs	£ 4,672	£ 1,631
Administrative costs/ Other costs	£10	£0
Apprentice's salary including national insurance contribution	£8,907	£ 10,323
Total costs	£ **13,632**	£ **12,149**
Apprentice productivity	£ 9,033	£ 10,193
Other benefits	£ 396	£ 0
Total benefits per apprentice	£ 9,428	£ 10,193
Net costs per apprentice	£ **4,204**	£ **1,956**

Source: The employer net benefit of training study 2011

Table 10 - Costs and benefits of low and high cost apprenticeships

	High cost		Low cost	
	First year	**Total**	**First year**	**Total**
Dropout rate (%)	0%		0%	
Apprentice salary	£ 11,101		£ 5,365	
Experienced worker's salary + national insurance contribution	£ 15,593		£ 20,327	
Apprentice productivity*	48%		45%	
% time spent training	3%		5%	
% Line Manager's time spent training	n.a.		n.a.	
% Supervisor's time spent training	10%		30%	
Manager's salary	£ 33,000		£ 28,000	
Line Manager's salary	n.a.		n.a.	
Supervisor's salary	£ 22,464		£ 22,000	
Total costs of supervision	£ 3,373	£3,373	£ 8,762	£ 12,766
Apprentice selection costs	£ 0		£ 150	£ 150
Training course management costs	£ 20		£ 0	£ 0
Supervision costs	£ 3,373		£ 8,762	£ 12,766
Administrative costs/ Other costs	n.a.		n.a.	n.a.
Apprentice's salary including national insurance contribution	£ 11,657		£ 5,365	£ 8,225
Total costs	**£ 15,050**	**£ 15,050**	**£ 14,277**	**£ 21,141**
Apprentice productivity	£ 6,916	£ 6,916	£ 9,147	£ 17,662
Other benefits	£ 6,916	£ 6,916	£ 9,147	£ 17,662
Total benefits per apprentice	£ 8,134	£ 8,134	£ 5,130	£ 3,479
Net costs per apprentice	**£ 8,134**	**£ 8,134**	**£ 5,130**	**£ 3,479**

Source: The employer net benefit of training study 2011

Table 11 - Costs and benefits of low and high cost workplace learning programmes

	High cost	**Low cost**
Dropout rate (%)	0%	0%
Apprentice salary	£ 10,816	£ 12,480
Experienced worker's salary + national insurance contribution	£ 11,333	£ 13,226
Apprentice productivity*	80%	100%
% time spent training	n.a.	0,08%
% Line Manager's time spent training	0,01%	n.a.
% Supervisor's time spent training	5%	n.a.
Manager's salary	n.a.	£ 41,600
Line Manager's salary	£ 18,000	n.a.
Supervisor's salary	£ 30,000	n.a.
Total costs of supervision	£ 1,660	£ 37
Apprentice selection costs	£ 0	£ 0
Training course management costs	£ 0	£ 0
Supervision costs	£ 1,660	£ 37
Administrative costs/ Other costs	n.a.	n.a.
Apprentice's salary including national insurance contribution	£ 11,333	£ 13,226
Total costs	**£ 12,993**	**£ 13,263**
Apprentice productivity	£ 9,066	£ 13,226
Other benefits	£ 9,066	£ 13,226
Total benefits per apprentice	£ 3,927	£ 37
Net costs per apprentice	**£ 3,927**	**£ 37**

Source: The employer net benefit of training study 2011

As mentioned above, the study focuses on case studies in 8 different sectors. The following table compares the results that emerged from the analysis, taking account in all sectors of only the first year of training in view of acquiring Level 2 skills (Intermediate Level Apprenticeships).

Table 12 – Analysis results

	Engineering	Construction	Retailing	Hospitality	Transport and logistics	Finance	Business Admin.	Care services
Drop out rate (%)	11	12	5	20	0	9	11	0
Apprentice salary	£ 11,423	£ 10,306	£ 11,056	£ 8,685	£ 10,960	£ 15,167	£ 8,336	£ 12,135
Experienced worker's salary + national insurance contribution	£ 24,831	£ 25,687	£ 11,795	£ 15,540	£ 25,763	£ 17,442	£ 15,444	£ 14,175
Apprentice productivity*	28%	28%	100%	58%	50%	79%	56%	86%
Time spent on supervision								
% time spent training	7%	2%	1%	3%	5%	Na	1%	Na
% Line Manager's time spent training	9%	2%	5%	2%	Na	8%	2%	Na
% Supervisor's time spent training	15%	16%	13%	13%	5%	10%	12%	Na
Manager's salary	£ 41,750	£ 44,500	£ 19,000	£ 27,000	£ 30,000	Na	£ 32,350	Na
Line Manager's salary	£ 29,600	£ 31,418	£ 19,667	£ 30,000	Na	£ 24,000	£ 33,167	Na
Supervisor's salary	£ 25,800	£ 27,218	£ 12,400	£ 23,366	£ 30,000	£ 17,500	£ 19,150	Na
Total costs of supervision	£ 9,515	£ 6,584	£ 3,028	£ 4,672	£ 3,316	£ 3,869	£ 3,555	£ 2,727
Total training cost per apprentice								
Apprentice selection costs	£ 750	£ 490	0	£ 38	£ 1,600	0	£ 273	£ 362
Training course management costs	£ 558	0	0	£ 5	£ 1,325	£ 120	£ 193	0
Supervision costs	£ 9,515	£ 6,584	£ 3,208	£ 4,672	£ 3,316	£ 3,869	£ 3,555	£ 2,737
Administrative costs/ Other costs	£ 500	£ 200	0	£ 10	0	£ 200	£ 259	£ 75
Apprentice's salary including national insurance contribution	Na	£ 10,752	£ 11,605	£ 8,907	£ 11,497	£ 16,284	£ 8,510	£ 12,834
Total costs	**£ 22,747**	**£ 18,026**	**£ 14,633**	**£ 13,632**	**£ 17,738**	**£ 20,473**	**£ 12,790**	**£ 16,007**
Benefits for the apprentice								
Apprentice productivity	£ 6,299	£ 7,064	£ 11,795	£ 9,033	£ 12,881	£ 13,821	£ 8,715	£ 12,191
Other benefits	Na	0	0	£ 396	0	0	0	0
Total benefits per apprentice	£ 6,299	£ 7,064	£ 11,795	£ 9,428	£ 12,881	£ 13,821	£ 8,715	£ 12,291
Net costs per apprentice	**£ 16,448**	**£ 10,962**	**£ 2,838**	**£ 4,204**	**£ 4,857**	**£ 6,652**	**£ 4,075**	**£ 3,861**

*percentage of qualified work undertaken
Source: The employer net benefit of training study 2011

It is obvious that there exist marked differences particularly with regard to apprentice salaries which range from £ 8,000 in the business administration sector to £ 15,000 in the finance sector, a gap that is maintained also with regard to experienced workers' salaries. On the contrary, if we compare an apprentice's salary with that of an experienced worker we can see that in some sectors the difference is above 50% while in others, such as the finance and retailing sectors, the difference is 13% and 6% respectively.

Enormous differences can also be observed with regard to apprentices' productivity, calculated as a percentage of qualified work undertaken by apprentices: the sector with the highest productivity percentage is retailing (100%), while the sector with the lowest productivity is construction (28%).

A further distinctive factor between sectors is the percentage of time spent on training by supervisors. Indeed, there are sectors where supervisors dedicate over 10% of their time to training young apprentices and others where, on the contrary, supervisors spend only 5% of their time in supervising and training apprentices.
By analysing the total cost of training per apprentice – obtained by summing up the costs of apprentice selection, training management, supervision, administration and apprentices' salaries – it emerges that the sectors reporting the highest costs are engineering followed by finance, while the sectors with the lowest training costs are hospitality and business administration. If, on the other hand, we take account of the net cost per apprentice – obtained by subtracting the productivity value from the total cost - the sectors reporting the highest costs are, once again, engineering followed by construction.
The research based on case studies shows that employers' benefits from training cannot be reduced to a purely monetary cost/benefit calculation. Employers who participated in the study acknowledge a wide range of benefits from training, such as:

- employees trained in-house have a better understanding of corporate values;
- trained former apprentices are often recruited as supervisors and managers;
- trained former apprentices tend to stay longer with the company (low turnover);
- trained former apprentices are often a source of new ideas and innovation.

4.4 The Spanish model

Wolter and Mühlemann (2015) indicate various cost/benefit models that have been used in the past two decades in order to gather data on the costs and benefits of apprenticeships for hundreds of occupations, to calculate costs and benefits for companies which for decades have been involved in training programmes (particularly German and Swiss companies) and to highlight, by means of a study focusing on the situation in Spain, the costs and benefits for companies if a training model similar to that used in Switzerland were introduced in Spain.

Three simulation models were created in order to contribute to the development of the **Spanish vocational training system**:

- **Model 1** is the most similar to the Swiss training model, where apprentices enter training at the end of compulsory schooling as an alternative to general full-time schooling. In this model, training lasts three years, which corresponds to the minimum duration of Swiss training programmes and constitutes an alternative for those who opt for a vocational training course once compulsory schooling is completed. According to this model, apprentices spend 1,600 hours in class and 600 hours training in-house (5 hours of training once a week), in addition to the time spent working (total training time: 2,200 hours);
- the decision to delegate training to companies is based on the following factors: the quality of in-house training is superior to that obtained in vocational schools, as companies are usually at the forefront of technological developments; greater savings on the purchase of expensive equipment and machinery used for teaching specific skills; the possibility to train smaller groups of trainees whereas vocational schools teach the same skills in classes with over 20 students; the acquisition of special skills often requires practical exercises and the presence of a trainer instructing one apprentice (or a small group of apprentices) makes it easier to meet the required objectives;
- **Model 2** is closer to the situation that exists in Spain, where students enter a two-year qualification programme after completing higher secondary education as an alternative to attending University. In this model, apprentices spend 1,000 hours in

class and 600 hours in in-house training, in addition to the time spent working (total training time: 1,600 hours).
Companies that train apprentices in-house have to bear costs but also have the opportunity to train them in their technology and business processes thus saving on the adaptation costs that would have been incurred had the company hired people directly from schools or from the labour market;

- **Model 3** is an extension of Model 2 and is, once again, based on the assumption that apprentices enter the programme after completing higher secondary education. In this three-year model apprentices spend the third year of training in the company and therefore, compared to Model 2, spend 200 hours more in in-house training (total training time: 1,800 hours). While in Model 2 apprentices accumulate the necessary human capital in the first two years and relatively little time is left for productive work within the company (which is a disadvantage for many occupations as it makes training incomplete), Model 3 allows apprentices to acquire substantial theoretical knowledge but also gives companies the opportunity to provide further general and specific training so that apprentices can successfully perform their assigned tasks.
  This model offers more flexibility compared to Model 2 which could seem too rigid for two reasons: a two-year programme is not sufficient for providing apprentices with the necessary skills, not because of the time spent on training, but because of the limited time dedicated to putting recently acquired skills into practice at the workplace. Secondly, companies that provide (and pay for) a significant number of training activities in-house may not be able to obtain the desired benefits during the two-year training period as apprentices may not stay with the company long enough.

Table 13 – Three simulation models

Model 1	Model 2	Model 3
Three years of training	Two years of training	Three years of training
1,600 hours of training in vocational schools	1,000 hours of training in vocational schools	Same as Model 2 for the first 2 years
5 hours per week of training for each apprentice (600 hours in total) + workplace experience	600 hours of training + workplace experience	The third year is dedicated exclusievely to in-house training (about 200 hours)
Total training time: 2,200 hours	Total training time: 1,600 hours	Total training time: 1,800 hours

Source: Wolter and Muehlemann, 2015

To better understand the differences between the three models, Wolter and Mühlemann (2015) base their analysis on three sources:

1. **the first source is a cost/benefit analysis from Switzerland** (Strupler & Wolter 2012), which gathered data on the costs and benefits of apprenticeship training from a representative sample of approximately 2,500 Swiss vocational training companies. The survey was used to collect data on apprentice participation and productive contribution: number of training hours per week invested by the company for each apprentice, hours spent by staff (for example, HR) involved in hiring and training apprentices, amount of non-productive time spent by apprentices in the company (mainly spent in performing practical/manual tasks), number of hours during which apprentices replace unskilled workers, number of hours during which apprentices replace qualified workers, apprentice productivity levels during a given year compared to those of qualified workers, tools and machinery and other training-related expenses;
2. **the second source is data regarding wages in the different economic sectors and for different occupations**. To calculate the productive contribution of apprentices, we used the wages of average skilled workers as well as the wages of unskilled workers in the same occupational sector. In some cases, the data showed that the average unskilled worker earns the same or slightly less than the average

skilled worker in the same economic sector. The most likely explanation is a difference in the number of years on the job.

As regards apprentice wages, the models are based on the assumption that companies pay wages on a monthly basis. Two cases are used as a reference: in the first, the apprentice's monthly cost is € 300 and in the second it amounts to € 530.

For training and personnel expenses, the data used regarded the wages of skilled workers as well as of other categories of workers (such as HR personnel) involved in the training or management of apprentices;

3. **the third source of data consists in the hiring costs for new workers** obtained by interviewing a representative sample of companies in the various sectors under study so as to calculate the average cost of hiring a new worker, the costs linked to their salaries before they are fully productive, the costs (where applicable) for external or internal training and costs linked to time 'lost' by already trained staff in supervising apprentices.

In order to illustrate the simulations of the various cost/benefit analysis models, we present case studies regarding technical professions in the following sectors: chemical industry, automobile industry, retail sales, banking, food and hospitality/tourism. Each study focuses on the following aspects:

- assessment of net training costs for the three models;
- assessments of costs incurred by companies when recruiting skilled workers from the external labour market;
- analysis of the relative productivity of aprentices and qualified workers at the start of the apprenticeship;
- break-even analysis of apprentice wages, indicating the monthly remuneration level at which companies can offer apprenticeships with close to zero net costs;
- cost variation according to the size of the company.

Taking the profession of retail sales expert as a reference we can analyse the costs linked to training.

Apprentice training costs and qualified worker recruitment costs

If we examine the results emerging from the models on the basis of two different remuneration scenarios for apprentices (low wage and high wage), it becomes clear that net training costs incurred by the company differ substantially.

Table 14 - Net costs – Retail sales expert

Wage	Model 1	Model 2	Model 3
300	- 3,258	-332	-8.388
530	5.022	5.188	-108

Source: Wolter and Muehlemann, 2015

While net training costs exceed € 5,000 if a company opts for the high-wage scenario in Model 2, it can expect to generate a net benefit of more than € 3,000 by training an apprentice according to the low-wage scenario of Model 1, and almost € 8,400 according to the low-wage scenario of Model 3. The main reason for this large difference is the duration of training. In Model 1, an apprentice spends around 400 days at the workplace during the apprenticeship period, but only around 270 days in Model 2. Thus, even though the company pays the apprentice for an extra year, the simulation shows that this extra expenditure is clearly offset by the additional benefit of having apprentices involved in the company's production processes for longer.

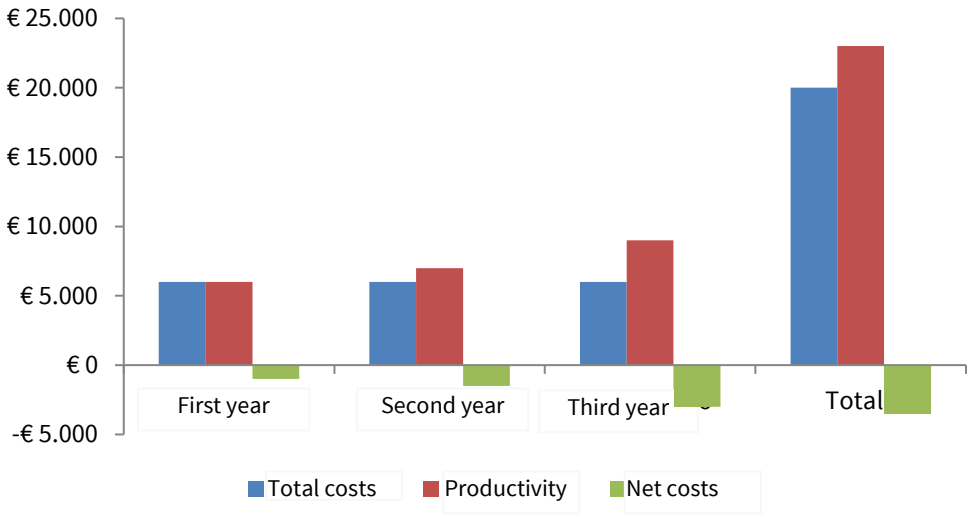
From the comparison between Model 1 and Model 3 (in the high-wage scenario) it emerges that there is a relatively small difference in net training costs and that net training benefits are higher in Model 3 than in Model 1. While, in Model 1, apprentices spend less time at the

workplace, in Model 3 they receive additional on-the-job training (200 more hours) and spend the entire final year at the workplace. The high productivity rate in the third year means greater benefits for the company.

The results of a (non-representative) survey among companies in the retail industry revealed that hiring a skilled worker from the external labour market costs the equivalent of around 5 months of apprentice wages. That includes costs for finding and selecting suitable candidates (36%), adaptation and training costs before the worker becomes fully productive (40%) and costs associated with disruption to other workers involved in mentoring (10%).

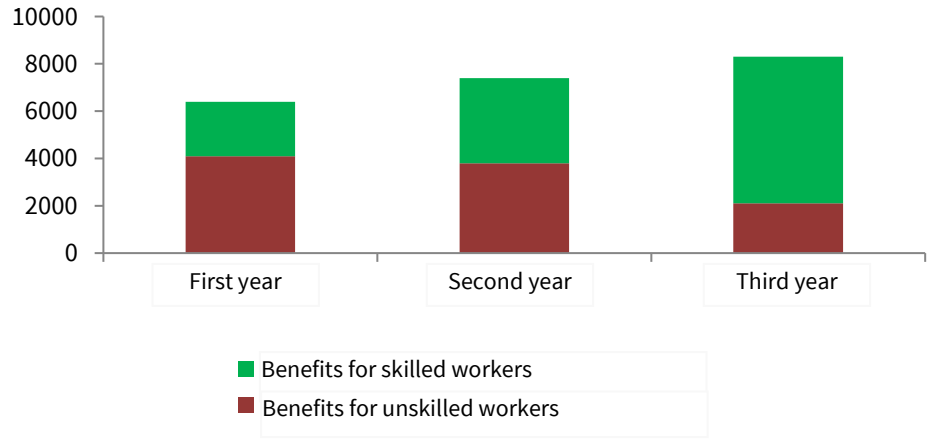
Another aspect which was analysed is how training costs evolve over time. Figure 42 regarding the first year of training shows that the cost is almost equal to the benefit, resulting in a net cost of around zero, while in the second and third years net training costs decrease. While training expenditure remains stable over time, the relative productivity level of apprentices rises faster than that of a skilled worker, and thus the gross benefit increases over time. In the case of the store clerk, relative productivity is assumed to be 50% in the first year of training, and 82% in the last year of training. As apprentices become more experienced in difficult tasks usually performed by skilled workers, companies increasingly move them from unskilled to skilled tasks. The graph below shows the breakdown of training benefits, by year, associated with performing skilled and unskilled tasks. While low-skilled tasks correspond to more than half of the work in the first year of training, high-skilled tasks correspond to around 75% in the third year of training.

Figure 42 – Gross costs, productivity and net costs of a retail sales expert



Source: Wolter and Muehlemann, 2015

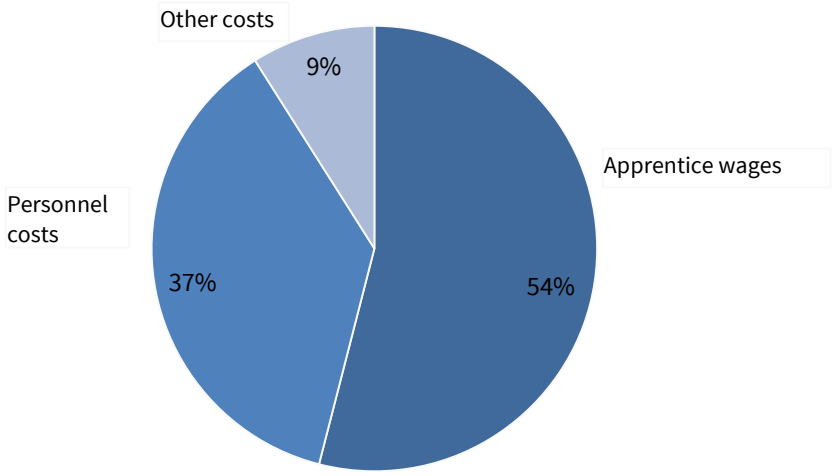
Figure 43 – Breakdown of training benefits, by year and by skilled and unskilled tasks (in %)



Source: Wolter and Muehlemann, 2015

In the model described above, an apprentice's monthly wage remains constant at € 300 for every year of training even though, in general terms, apprentice wages increase over time (Strupler and Wolter 2012). Another constant is learning time at the workplace. This assumption is based on the fact that time spent in learning activities in Swiss companies varies very little over the entire training period.
Figure 44 shows that the largest part of training costs is made up of the wages of apprentices and of instructors engaged in training. In Model 1, considering a basic monthly wage of € 300 per hired worker, trainee wage costs correspond to 54% of total training costs. Moreover, trainer wage costs correspond to 37% of total training costs leaving only 10% to cover other expenditure such as, for instance, infrastructure or equipment used for training purposes.

Figure 44 - Breakdown of training costs per year – retail sales expert

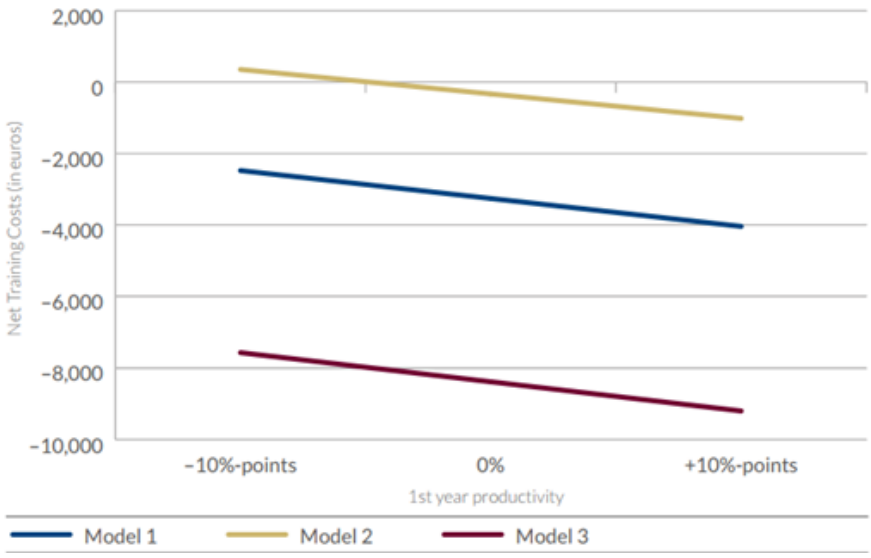


Source: Wolter and Muehlemann, 2015

Apprentice productivity

The main motivation, for apprentices, for engaging in an in-house training course is the possibility to be hired as a skilled worker, at the end of apprenticeship, by the company that provided the training or by another company. The acquired skills include not only theoretical knowledge but also the practical ability to perform skilled tasks. The advantage for the company of having apprentices replace qualified workers largely depends on the apprentices' relative performance (Productivity). Estimates are based on the assumption that the relative productivity of Spanish apprentices and skilled workers is the same as that of Swiss workers. It emerges from the analysis that net training costs could change by around € 800 with a change in productivity during the first year of more or less 10 percentage points. The effects are less pronounced for Model 2, under which apprentices spend less time at the workplace.

Figure 45 - Productivity analysis – Retail sales expert

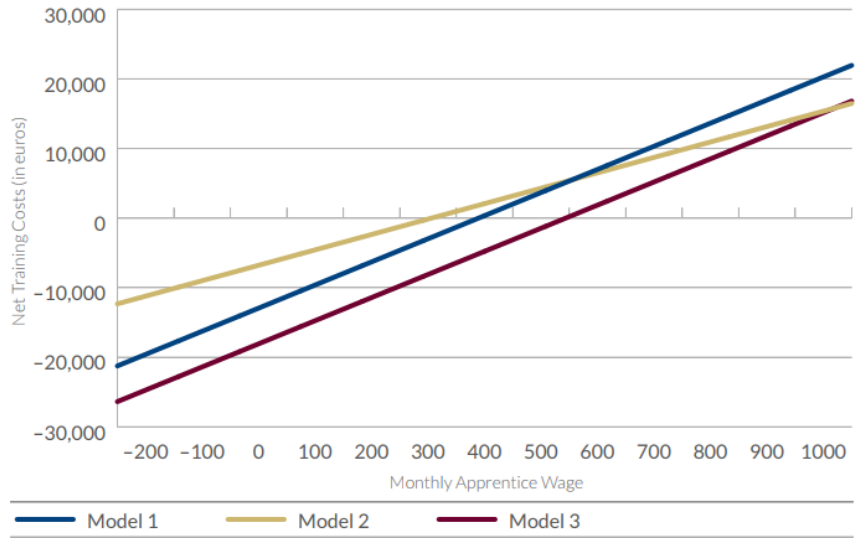


Source: Wolter and Muehlemann, 2015

Net training costs

The break-even analysis illustrates the linear relationship between the apprentice's monthly wage and the company's net training costs, all other factors being constant. It also helps to determine the rate by which average apprentice wage would have to be changed to obtain additional benefits without increasing costs. Technically, a € 1 increase in the monthly apprentice wage leads to a € 36 increase in net costs for Model 1 and Model 3 (36 months of training), while resulting in an extra € 24 net costs for Model 2 (24 months of training). As indicated above, an apprentice's wage constitutes 54% of total training costs in Model 1 based on the € 300 wage scenario. This shows that an apprentice's wage is a key factor in the company's cost/benefit ratio and that net training costs are relatively sensitive to salary changes.

Figure 46 - Break even analysis – Retail sales expert

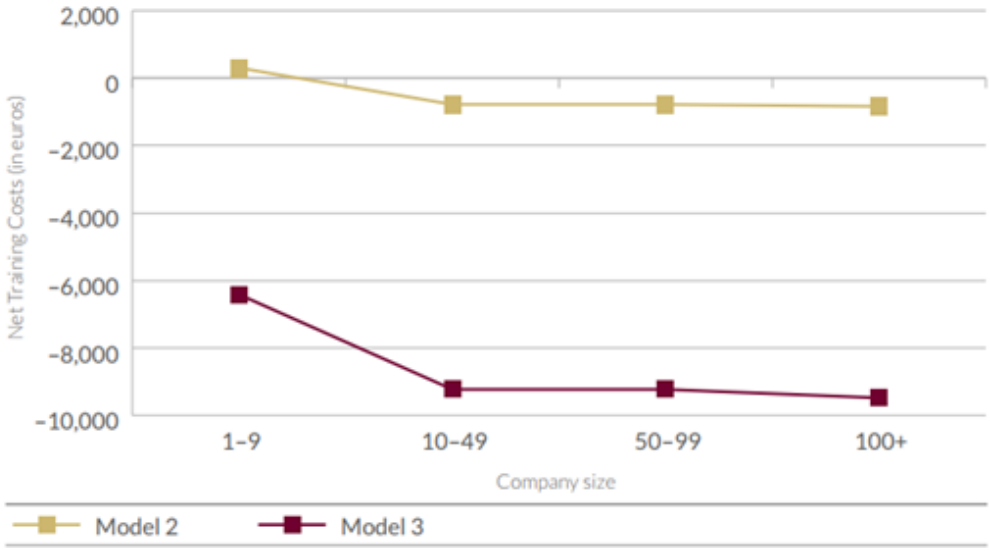


Source: Wolter and Muehlemann, 2015

Costs and company size

While apprentice wages are a major component of cost, the wage structure for low and highly skilled workers is another key factor for determining an apprentice's productive contribution. The value of an apprentice per hour of work on a skilled or unskilled task is calculated on the basis of a qualified worker's salary. Hence, the higher the salaries for skilled and unskilled workers, the greater the benefit for the company of employing apprentices to perform productive tasks. Given that companies do not differ only as regards wage levels (which reflect differences in total productivity) but also with respect to the relative wages of skilled and unskilled workers, this latter aspect helps determine the optimal allocation of tasks to apprentices working in the company.
To illustrate this aspect in detail we consider a hypothetical case where wages for skilled and unskilled work are equal. In this scenario, companies wanting to reduce net training costs to a minimum have an incentive to allocate less skilled tasks to apprentices because their productive contribution is lower than that of a qualified worker, while apprentices are – by definition – equally productive in unskilled labour as unskilled workers. However, if apprentices are paid lower wages than qualified workers, companies have an incentive to allocate more productive tasks to apprentices as soon as possible, so that their productivity in skilled work increases faster. Let us consider an extreme case where the productivity of an apprentice in the last year of training is equal to that of a skilled worker. In this case, the company's benefit from having apprentices carry out skilled tasks is simply the difference in hourly pay between the skilled worker and the apprentice.
According to wage data for Spain, wages are generally lower in small than in large companies, while differences in remuneration for skilled and unskilled work are usually greater in large companies. In small companies with less than 10 employees, the wage ratio for skilled and unskilled workers is 0.81; in companies with over 100 employees the ratio is 0.75. This means that the salary of an unskilled worker corresponds to roughly 81% of a skilled worker's salary in a small company and to 75% of a skilled worker's salary in a large company.

Figure 47 – Net training costs by company size – Retail sales expert



Source: Wolter and Muehlemann, 2015

The table below summarizes the costs for all the occupations and scenarios we have considered. Net costs corresponding to the monthly wage of a skilled worker are indicated in red. Net costs or benefits in a +/- € 3.000 range are indicated in light green. On the contrary, when benefits exceed € 3.000 they are marked in dark green, with a clear indication that that training model would be advantageous to the company.

Table 15 – Results of the analysis

	300 €			530 €		
Occupation	***M1***	***M2***	***M3***	***M1***	***M2***	***M3***
Laboratory technician	5,672	6,619	-285	13,952	12,139	7,995
Chemical plant technician	-6,742	-2,483	-12,319	1,538	3,037	-4,039
Automobile sector expert	32	1,492	-5,380	8,312	7,012	2,900
Electromechanical technician	3,735	5,064	779	12,015	10,584	9,059
Bank clerk	-370	4,112	-4,165	7,910	9,632	4,115
Store clerk	-3,258	-332	-8,388	5,022	5,188	-108
Retail sales expert	-2,501	-132	-7,597	5,779	5,388	683
Food industry technician	-5,752	-502	-9,842	2,528	5,018	-1,562
Hotel management expert	-7,956	-2,689	-13,047	324	2,831	-4,767
Cook in hotels and restaurants	-2,392	871	-6,173	5,888	6,391	2,107

Source: Wolter and Muehlemann, 2015

These findings give rise to three main considerations:

- at least one of the models leads to the desired net benefits from training in every occupation;
- in the chemical and automobile industries, in which companies have reported the highest recruitment costs, there are more scenarios where net costs are higher than net benefits but this could be due to factors such as the need for a longer period in practical training (non-productive). On the other hand, sectors such as the food industry and hospitality reported low recruitment costs and this implies higher net benefits. In other words, the cost of trainining in these sectors and occupations must be equal to zero by the end of the training period;
- Model 1 usually only results in net benefits due to the low wages paid to apprentices, while Model 2 appears to be the least advantageous even considering the low wage scenario.

If we look at differences in net costs or benefits by company size, we see marked differences between small firms (under 10 employees) and large firms. In some sectors and occupations, we even see an almost linear relationship between net costs and company size, with larger companies generating the highest net benefits of up to € 10,000. This pattern is hardly surprising and leads to a situation in which medium-sized and larger companies are more likely to offer training than very small companies. However, a situation in which large firms dominate training opportunities might be problematic, especially in sectors with predominantly small businesses and in rural regions with few large employers. As regards costs, large companies with numerous apprentices can benefit from economies of scale and reduced training costs where older apprentices are assigned to tutor younger apprentices. Finally, every company must make an initial investment and in large companies, these costs can be distributed over several apprentices, making the cost per apprentice lower than in small firms, where these investments sometimes have to be made in order to train a single apprentice.

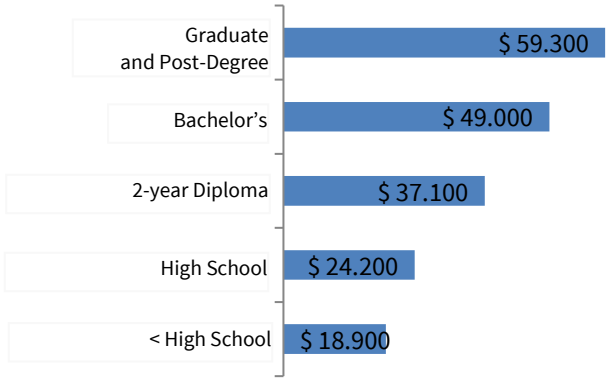
4.5 The Canadian Model

Training activities are very widespread in Canada and the number of trained individuals has doubled in the last 25 years, between 1977 and 2002, and has more than doubled since 2002, to reach roughly 426,000 individuals engaged in training activities in 2011.
Almost half of these trainees are engaged in four specific occupations: auto mechanic, carpenter, electrician, plumber. Despite the fact that all these occupations are related to construction, the number and diversity of potential occupations rises rapidly and alongside

the rise in training programmes which doubled in the 1997-2012 period. Many of the new job opportunities are linked to high-tech sectors (Miller, 2013[2]).
Contrary to the approach used in Austria, Germany and Switzerland, training in Canada is mostly addressed to adults. Canadian trainees under 20 years of age make up only 7% of the total; 28 % are between 20 and 24 years of age while more than 40% are over 30.
According to two Canadian surveys (Boothby and Drewes 2010; Gunderson and Krashinsky 2012) male workers who have completed apprenticeship training earn more than those who have only completed secondary education, and almost as much as those who have completed a post-secondary education, non-university training programme. Boothby and Drewes report that male workers having completed apprenticeship training earn 17-20% more. Even 20 years after having finished apprenticeship training, workers earn 12-14% more than their peers who did not engage in a training programme. Gunderson and Krashinsky (2012), on the other hand, estimate that the earnings of workers having completed apprenticeship training are higher by 10%, but not as regards women.
By promoting training programmes, Canada's Colleges and Institutes contribute to the country's economic growth in several ways: they constitute a primary source of training for domestic and foreign students and provide trained workers with new skills to Canadian companies. The analysis regarding the 2014-2015 period indicates that domestic and international students in Canada generated added income amounting to $ 189.5 billion. The global impact of Canadian institutes on the national economy amounts to $ 191.2 billion.

During the years 2014-15, Canadian institutes trained a total of 1.2 million students who invested around 15.1 billion dollars. In return for their investment, these students developed the necessary skills for entering an increasingly globalized market and for ensuring increased earnings over the course of their working lives.
As shown in Figure 48 below, average earning levels increase in proportion to higher training levels. For instance, the completion of a two-year training course results in increased earnings of $ 12,900 compared to the earnings of a worker with a secondary education or equivalent diploma. If we take account of a worker's entire working life, the value of these increased earnings can be estimated at around $ 482,506.
The future benefits that students at Canada's colleges and institutes will receive over their working lives is $ 57.9 billion. Dividing this value by costs incurred by students yields a benefit-cost ratio of 3.8. In other words, for every $ 1 students invest in colleges and institutes in the form of expenses, time and wages they would have received if they had been working, they receive $ 3.80. The return on investment to students (i.e., the benefit-cost ratio less the cost of the original investment) thus amounts to $ 2.80.[3]

Figure 48 – Average training-related earnings and benefits in Canada



Benefits (thousands $)
$ 57,888,778
Costs (thousands)
$ 15,117,177
Net present value
$ 42,771,602
Cost/benefit ratio
3.8
Rate of return
16.1%

Source: Economic Impact of Education and Return on Investment. EMSI, 2016

[2] Miller, Linda. 'Canada' and 'England' in 'Possible futures for the Indian Apprenticeships system project. Interim Report to the World Bank. 2013. Edited by Erika Smith and Ros Brennan Kemmis. University of Ballarat, Australia.
[3] Economic Impact of Education and Return on Investment Demonstrating the Value of Canada's Colleges and Institutes, EMSI, 2016

In 2006 and 2009, a survey sponsored by the "Canadian Apprenticeship Forum" was conducted in Canada which calculates training-related costs and benefits for employers in 16 sectors. The findings are based on an average sample composed of all the employers (in some sectors fewer than 20 employers were interviewed and therefore the sample cannot be considered significant and the results cannot be generalised) with the aim of identifying and quantifying training-related costs and benefits, even though the latter are harder to calculate.

The cost/benefit model that was adopted is based on a standard cost/benefit analysis for every company hiring apprentices while net costs and benefits, calculated annually for each new recruit, take account of the following components:

- ***cost components***
  - wages and benefits: basic pay and benefits;
  - costs related to the resources used by apprentices during training. Opportunity costs also include time and wastage. Wastage is defined as the cost of material damaged as a result of mistakes made by apprentices, while time is that spent for correcting any such mistakes. Costs were estimated for every apprentice on an annual basis;
  - disbursements: costs incurred by employers and linked to the on-going training and development of apprentices, such as fees and wages during in-school training;
  - administration: these costs include the office work necessary for launching a training programme.
- ***benefit components***
  - revenue generated by the apprentice: average revenue associated with each apprentice, calculated by each employer.

The findings of the cost/benefit survey for every one of the 16 sectors are as follows:

- **the net benefit of an apprentice increases every year during the training period;**
- **the revenue generated by an apprentice increases during the entire training period;**
- **wages and benefits paid to apprentices increase in proportion to training and experience;**
- **the cost of the time dedicated to training by experienced workers decreases during the training period.**

The overall results of the cost/benefit analysis indicate that benefits largely exceed costs in most sectors. All but two sectors showed a positive net return. Net benefits ranged from $ 39,524 (restaurants) to $ 245,264 (heavy industry). Furthermore**, results indicate that for every $ 1 spent on training, an employer receives a benefit, on average, of $ 1.47 or a return of $ 0.47**. The two sectors showing a negative return were the electronics and personal care sectors. In the former, returns are negative because apprentices are paid high wages and and considerable time is needed to supervise them. In the case of apprentice hairdressers, on the contrary, as training lasts only two years, employers have only those two years to recoup their investment.

Table 16 – Total costs and benefits by apprentice and by sector

Occupation	Apprenticeship duration[1]	Costs [2] $	Benefits [3] $	Net benefits [4] $	cost/benefit ratio[5]
Automotive service technician	*4*	*250,016*	*423,138*	*173,122*	*1.69*
Boiler technician	*4*	*246,889*	*473,696*	*226,807*	*1.92*
Bricklayer	*4*	*237,687*	*316,853*	*79,166*	*1.33*
Carpenter	*4*	*180,369*	*247,298*	*96,237*	*1.49*
Electrician	*4*	*196,811*	*293,048*	*96,237*	*1.49*
Industrial	*4*	*254,287*	*403,272*	*148,985*	*1.59*

mechanic					
Cook	*4*	*125,344*	*164,868*	*39,524*	*1.32*
Cable worker	*4*	*336,770*	*319,759*	*(17,011)*	*0.95*
Hairdresser	*2*	*77,096*	*42,620*	*(34,476)*	*0.55*
Heavy industry mechanic	*4*	*252,371*	*497,636*	*245,264*	*1.97*
Machinist	*4*	*204,921*	*382,877*	*178,955*	*1.87*
Automobile mechanic	*4*	*210,088*	*362,237*	*152,149*	*1.72*
Plumber	*4*	*237,681*	*329,728*	*92,047*	*1.39*
Air conditioning mechanic	*4*	*240,060*	*344,601*	*104,541*	*1.44*
Metal worker	*4*	*258,160*	*322,022*	*63,862*	*1.25*
Average	*4*	*220,242*	*330,371*	*110,128*	*1.47*

Source: The Return on Training Investment for Skilled Trades Employers in Canada, 2009

[1] Source: Apprenticeship survey (Q28)

[2] Total cost per apprentice during the apprenticeship

[3] Estimate of benefits generated by each apprentice

[4] Benefits – costs

[5] Benefit/cost

Beyond illustrating the differences between the various sectors, the survey shows how net returns from training differ from region to region (the regions considered were: Atlantic, Quebec, Ontario, West) as well as according to company size in terms of number of employees (companies with fewer than 10 employees, companies with 10 to 19 employees, companies with over 20 employees). The regional/employer size analysis was conducted for the sectors where the collected data was sufficient and representative: the automobile sector with 159 companies; the construction sector with 166 companies; the engineering sector with 118 companies.

On average, employers in all regions obtained a positive return on their investment. On the whole, results suggest that employers in Western Canada are more able to obtain greater benefits from their apprentices, but to also incur higher costs in terms of wages and supervision time. Employers in Quebec experienced net benefits that were, on average, higher by 12% to 16% than the national average. This return occured because, generallly, employers reported a lower cost in terms of average wages and benefits paid to apprentices, and low cost levels also in terms of time spent in supervision activities.

Table 17 – Benefits by region and by company size

	Automobile sector	**Mechanics**	**Construction**	**Average**
Region				
Atlantic	*n/a*	*-2,8%*	*+3,4%*	*-0,3%*
Quebec	*+12,4%*	*+16,0%*	*+12,1%*	*+13,5%*
Ontario	*-4,7%*	*-11,8%*	*-2,0%*	*-6,2%*
West	*-7,1%*	*+9,7%*	*-0,6%*	*+0,7%*
Company size				
< 10 employees	*-7,9%*	*-13,9%*	*+1.0%*	*-10,4%*
10-19 employees	*+3,69%*	*+10,0%*	*+22,5%*	*+12,0%*
> 20 employees	*+14,1%*	*+19,6%*	*-9,0%*	*+8,2%*

Source: The Return on Training Investment for Skilled Trades Employers in Canada, 2009

If we compare these findings with those of the pilot study, “Apprenticeship Building a Skilled Workforce for a Strong Bottom Line, Return on Apprenticeship Training Investment for Employers, A Study of 15 Trades, June 2006”, it emerges that although the cost of hiring,

training and supervising a worker has increased over the last two years, employers' ability to generate revenues from training new workers has increased at a higher rate than costs. This analysis was not only identified by comparing the total costs-benefits in the 10 occuational sectors studied in 2006 and 2008, but was also confirmed through the detailed examination of employer costs/benefits provided by 106 companies both in 2006 and in 2008. From the examination of the costs/benefits of employers who participated in both surveys it emerged that, while there was an increase in training-related wage costs, on average revenues generated by the hiring of trained apprentices increased at a greater rate. The table below summarizes the variations of key cost and revenue components regarding the 10 sectors under study both in 2006 and in 2008 for all employers. We can therefore observe that:

- revenues increased by 23% between 2006 and 2008 in the ten comparable occupational sectors;
- with the exception of 'other costs', most cost elements increased between 5% and 7%;
- the net cost/benefit ratio for the ten sectors increased from 1.37 nel 2006 to 1.57 in 2008, an increase of 15%.

Table 18 – Comparison of survey results 2006 and 2008

Category	2006	2008	% increase
Revenue	*285,710*	*351,155*	*+23%*
Wages/Benefits for the apprentice	*144,918*	*154,399*	*+7%*
Time used for apprentice	*51,088*	*53,385*	*+5%*
Other costs	*12,940*	*15,190*	*+17%*
Total costs	*208,946*	*222,975*	*+7%*
Cost/benefit ratio	*1.37*	*1.57*	*+15%*

Source: The Return on Training Investment for Skilled Trades Employers in Canada, 2009

5. A model for analysing and designing roles and professions: jobs and skills in ITS projects in Vicenza, Como and Parma

5.1 Foreword: the demand for skilled workers

As indicated in the first part of the study, according to Cedefop, most job opportunities in Italy from now to 2025 will regard:

- professionals (highly-skilled workers in the science, health, economics and education sectors), for about 22% of total jobs;
- technical and similar professions (implementation of models, methods and operating rules in the scientific, artistic, engineering, health and industrial sectors and in the public sector), for about 17% of total jobs).

Skilled jobs and the demand for a highly qualified and flexible workforce will increase. Most tasks in skilled, non-manual professions will require highly-skilled workers, skilled jobs will be carried out by medium-skilled workers while only half of elementary occupations will be filled by low-skilled workers.

One of the reasons for the increased demand for training is the **change in the nature and requirements of all occupations, even at the lowest levels**: employers (particularly in the services sector) will increasingly demand transversal skills, and in particular the ability to 'learn how to learn', in other words the ability to acknowledge one's training needs and find a way to satisfy them. This is of crucial importance in a changing economy where some occupations disappear and new ones are created. Other non-routine/soft skills include language and technical skills, problem solving, analytical and communication skills, self-management, skills that go beyond the potential of advanced technologies, that make it possible to perform routine and repetitive tasks that were traditionally allocated to medium-skilled workers, a category that today seems to be shrinking.

Modern employers appear to place a higher value on so-called soft skills than in the past (such as, for example, teamwork, interpersonal communication, initiative, creativity, entrepreneurship, leadership, presentation skills, learning ability). This is the case both in large and in medium-small companies, which are gradually becoming aware that their success and competitiveness depend on the right mixture of hard and soft skills: technical skills and professional qualifications are undoubtedly important, but the conversion of skills and knowledge into economic returns requires horizontal skills such as problem solving, motivation, flexibility and teamwork.

Higher technical education programmes can help individuals to develop specific technical skills as well as the ability to interact with the natural and social environment, manage

information and analyse data, so as to be able to meet the requirements of companies that are always on the lookout for human resources who not only perform tasks, but do so better than others.

Higher technical education courses, therefore, teach students specific skills (within a specific field/task or sector/company, closely related to their formal education, easy to notice and to measure which makes them easier to acquire) and general skills (not linked to a specific job, closely related to personal, intangible, behaviour: this makes it more difficult to quantify, measure and develop them. Soft skills cannot be learnt from a textbook but can only be acquired through a high quality, vocational training programme as well as over the course of an individual's personal and professional life.

Technical training, the dual training system, particularly in the form of apprenticeships, developed jointly by companies and training institutes with the aim of providing practical training, favours the development of transversal and specific skills linked to a given profession; these skills are constantly updated and in line with the various sectoral, regional and local requirements and the development of new jobs and professional profiles, based not only on knowledge, expertise and know-how but also on the ability to cooperate, share and develop knowledge, lead, and develop technologies.

However, the basic need that is felt by everybody is that of a 'central pivot', i.e. of a professional identity. In the industrial society, the main, pivotal figures were those of workman, technician, employee, middle manager which, in legal terms, formed two large categories, workmen and employees, and thus regulated the workforce. Today labour appears to be fluid and once again in pieces. The great dispersion of skills that do not seem to be suited to any clearcut role or profession makes it difficult to foresee how things will evolve.

So which are the jobs and professions of the future? They will certainly not be defined on the basis of tasks and occupations, nor on skills that are not linked to any specific profession. It is impossible to foresee the type and number of future jobs without drawing up categories that will propose and cover new labour activities.

Competition with countries with low labour costs can be beaten by adding value to manufacturing, integrating products and services, providing high quality services and by aiming at the international market.
This mission is entrusted to knowledge workers, i.e. professionals, technicians, middle managers, specialised workers and employees, craftsmen, who use and develop all kinds of abstract and concrete knowledge in order to produce excellent products and services, working closely with the final or the internal customer. These workers, who fall under regulations and fiscal incentives that encourage companies to employ them, should be integrated in organizations that enhance their productive and creative skills, and in professional systems that acknowledge and develop their emerging paradigm. Moreover, they should receive training both at the start and throughout their professional careers.
As regards international competition, these new jobs can help Italian companies to secure the placement of their products and services, for which they are appreciated throughout the world.

Therefore, the quality of the work and of the workers is the key to the success of the Italian production system and to the cultural and economic growth of young people.

5.2 Crucial role of higher technical staff in Industry 4.0

People who create products, services, production and sales systems (the so-called knowledge owners) as well as people in managerial positions must usually possess a three-year university degree, a Master's degree or a PhD, corresponding to levels 6 and 7 of the European Qualification Framework (EQF). Specialized workers, craftsmen, technicians are usually situated at EQF levels 3 and 4. **The intermediate area, made up of higher technical staff situated at level 5, is crucial for Italian medium-tech industries because it contains professional profiles (roles, jobs, professions) which can bridge the gap between theory and practice** by being able to take on both the role of higher technical worker and the role of middle manager: the people in these roles, jobs and professions are responsible for the crucial processes of producing high-end products and providing high-quality services to the final or intermediate customer, who help to integrate processes, technologies, highly complex and interdependent activities, who animate or are proactive in the workplace. These jobs and professions are at the centre of the production process and are crucial to international competition.

Competencies and attitudes, hard and soft skills must start to be cultivated in technical schools offering training at EQF levels 3 and 4, or even earlier. What must be developed, in particular, 'are the human qualities of creativity, desire to innovate, cooperation, communication, sense of community' and all other factors that help to form 'integral individuals'. It is necessary to train people to appreciate both human and technical aspects: '*Ἦν γάρ παρῇ φιλανθρωπίη, πάρεστι καί φιλοτεχνίη'*, i.e. where there is love for human beings there is always love for technicity, wrote Plato in *Precepts, part VI.* And there is no time to be lost.

5.3 The context: developing new skills and new jobs in ITS programmes

We must, therefore, consider the development of new professional systems which are not only based on knowledge, ability and know-how but also on how to work together, share and expand knowledge, master and develop new technologies. Creating new jobs and training people to perform them is the key to combining unmet labour demands by companies with an unappreciated supply by a generation of young workers.

In this context, the role of schools and universities in training students to perform these new jobs is crucial. In the words of Attilio Oliva and Gian Felice Rocca[4] 'technical education, which has traditionally been a high point of the Italian education system, has been submitted in the last twenty years to conflicting modifications and reforms which have weakened its educational curriculum and made it less appealing to families and corporations. One of the reasons for this decline is that, in Italy, humanistic culture is still perceived as being of a higher level than technical-scientific studies: consequently, technical institutes have been progressively downgraded to high-school status. Another reason is inadequate professional orientation. Thus, many students and their families face the risk of choosing the wrong field of study (moreover, also for reasons of status, many young people choose to attend high school and then university even though their aspirations, needs and type of intelligence would be more suited to other careers).

There are many reasons for improving and promoting technical education. There are **economic reasons**, such as enhancing the quality of human capital, training medium-skilled and highly-skilled workers, promoting technical and scientific culture. **Political**

[4] Attilio Oliva and Gian Felice Rocca *Innovare l'istruzione tecnica secondaria e terziaria*. Fondazione Tre Elle and Fondazione Rocca, 2015

reasons also exist: the famous Cresson White Paper (EU Commissioner, 1996) recommended that not only there should be no discrimination between general culture and vocational training but, instead, a strengthening of the links between schools, society and companies, the latter being considered places of training. Lastly, there are also **purely educational reasons**: a 'normal' school is not able to take account of multiple types of intelligence, different backgrounds and needs, different talents and aspirations. It is therefore necessary to provide diversified training paths and environments so as to reduce the dropout rate and facilitate access to the labour market. To do this, it is necessary to develop a cultural-technical-scientific area in order to respond to the challenges of globalization, an area which is largely neglected in Italy.

The aim of technical education is to design and launch not only innovative education courses but also 'new jobs'. [5]

5.4 New jobs, new crafts and new professions

What will labour in Italy be like in the future? The most recently updated study in Italy is Delphi, coordinated by Domenico De Masi[6], which presents the various optimistic and pessimistic viewpoints that exist on a number of aspects: quantity and quality of occupations, social structure, income, regulatory systems, industrial relations. However, everybody agrees on one point: a new perception of labour will be necessary, new roles and new professions and people trained in a different way. This is all the more true if we consider the new jobs created within the Industry 4.0 framework which are listed below.

The 'architects of new techno-organizational systems' cannot only be trained in technology-related disciplines. Like experts in many other fields, they will have to be multidisciplinary architects of socio-technical systems, able to conceive and engineer business models, markets, objectives, technologies, processes, organization, jobs, culture. It is obvious that nobody can do all that alone. Therefore their task will mainly be to work together with people who will contribute different skills and different points of view. These 'systems architects' will have to have a multidisciplinary training and to apply design thinking. It is very probable that the subject able to carry out this task will not be an individual but a team of individuals. It is also certain that the tasks and teams in question will change very rapidly.

Another category which is crucial to the development of Industry 4.0 are technical workers and professionals. The development of complex interdependencies between technological and organizational systems and labour on the path towards Industry 4.0 will require a great many new activities linked to executive planning, systems integration, maintenance, working group leadership, continuous improvement, research and analysis, sales, customer care and many other tasks. We are talking about roles such as domain experts, maintenance workers, retail sales persons, team leaders, etc.: these jobs contribute to the growth of highly complex, socio-technical systems that are subject to variations, unexpected events, breakdowns, monitoring requirements and, particularly, requirements related to personal involvement and leadership. They increasingly rely on development potential, communications technologies and artificial intelligence which they see not as a menace to their work but as a means of empowerment.

The 'architects of socio-technical systems' and professionals are key variables in the development of Industry 4.0. They are the so-called knowledge workers, used in statistics to classify existing jobs of researchers, teachers, middle managers, professionals, technicians who currently already correspond to over 42% in Italy - and 51% in the UK - of the working population. In the next five years these numbers are expected to rise by at least 10%. Moreover, the educational qualifications (university degrees, tertiary education diplomas) of those who will have to fill both old and new roles and positions are extremely inadequate

[5] Butera F. "L'evoluzione del mondo del lavoro e il ruolo della istruzione e formazione tecnica superiore: le potenzialità dell'ITS e il suo modello culturale e formativo", presentation at the Conference organised by Ufficio Scolastico della Lombardia ; in *Professionalità Studi*, Adapt Bergamo University Press, under preparation.

[6] De Masi D., *Lavoro 2025*, Marsilio, 2017

in Italy and very far removed from the situation existing in the rest of Europe. In Italy, in fact, university graduates are 25.3% of the population, holding the last place in Europe, where the average is 38.7%, and (slightly) below the EU target fixed for 2020 (26%). Students enrolled in Istituti Tecnici Superiori (ITS) in Italy are about 6-7,000 compared to the 880,000 German students enrolled in the equivalent Fachhochschule. If these roles and professions are well-designed and if the people meant to fill them are well-trained, Industry 4.0 will be able to expand in Italy and at least 50/60 % of these knowledge workers will be able to successfully hold their place in the race against machines.

The very diverse activities that make up the old and new jobs of Industry 4.0 have certain things in common: they produce knowledge through knowledge, they provide economic output and they are very tangible from a social viewpoint, i.e. they represent high-quality services for the final customer (persons, families, companies) or production services for the internal structures of organizations (internal tertiary sector). They transform cognitive input (data, information, images, concepts, signals, symbols) into more valuable knowledge output (problem solving, situation management, enhanced data and information, innovation) particularly in services to internal or external customers. Even when the output of such work is a material object (a crafted artefact or piece of art, a painting or a sculpture, a musical work, a culinary dish) its distinctive value is linked to the knowledge and the ability that went into its making. When output is related to a service, it consists in the necessary contextual and personalised knowledge to provide a service to a specific category of users (e.g. medical examination, legal advice, lesson, press article, etc.).

The above service jobs and professions include, in different proportions and forms, on one hand all types of tasks involving practical and theoretical knowledge (knowledge of what, why, how, for whom, knowing how to perform routine tasks, use one's hands, etc.), and, on the other hand, the task of forging relationships with external and internal customers as well as, particularly, the responsibility for producing results. These jobs and professions will be performed in close collaboration with other people and with technologies.

A new concept of labour built upon an old basis could be the starting point of the 4.0 revolution. Knowledge work based on responsibility for the results, requiring technical and social skills. Work that requires commitment and passion. Work relying on a good relationship between men and machines. Work that also includes the so-called workplace within, i.e. the workplace, the professional attitude of the workers, their personal and professional life-stories, their training, their aspirations: potential that is achieved only at a certain point in their personal and professional lives.

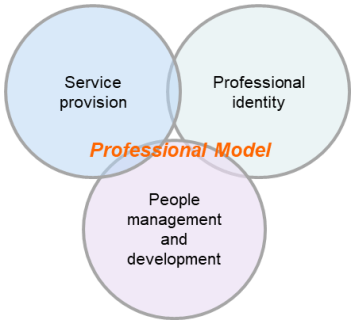
5.5 The new work paradigm and professionalisation

How will people be able to maintain and develop a work identity, how will policy makers be able to programme labour market and schooling, in a context where regulated tasks, profiles, jobs, professions will rapidly become obsolete and be replaced by others which do not even have a name yet? There are those who suggest that we should have recourse to skills, but skills are only the components of roles and professions. It would be like using molecules when we are not able to present and name objects and living beings.

Within the framework of Industry 4.0 labour will include a great many, changing roles, jobs and professions, some new and some profoundly modified, resulting not from some inevitable 'technological effect' but from the meticulous planning of roles, jobs and professions that make sense.

We are already aware of a system that brings together very different types of labour, with highly differentiated levels of responsibility, remuneration and seniority: jobs (alas largely destroyed by the Taylor-Ford revolution) and professions (alas confined within the borders of professional orders: doctors, journalists, engineers, surveyors etc.). In the last decades semi-professions have appeared that involve the same work as regulated jobs and professions but are not recognized by professional orders: ICT experts, materials experts, techno-commercial experts, mechatronics experts, planning and monitoring professionals, human resources experts, logistic experts, and many others.

Now that it is necessary to design jobs on the basis of a 'central pivot' able to direct training and occupational policies and to give people an identity and flexicurity in the midst of the rapidly changing sectors, roles, responsibility levels and skills they will have to face their entire lives, it is time to examine and reinvent the concept of job and profession upon a new basis. **This 'central pivot' could be based on the professional model which includes a large variety of concrete situations**: it defines, at the same time, the system for providing a service, a person's source of identity despite job changes, a system for managing and developing human resources and which identifies training and development paths that people can follow, a concept that envelops many diverging functions.



According to our research the dominant paradigm for labour in the Industry 4.0 framework could be that of *service professions* and *broadband professions*. Service professions, i.e. services provided to the final customer or to an organization's internal structure; broadband professions, i.e. jobs and professions that include activities that differ greatly as regards content, level and training background. They allow workers to pass from one role to the other without losing their identity and can help institutions and organizations to plan education and mobility. This is the best way to obtain professionalisation, employability, flexibility, real participation, probably satisfaction and certainly identity. Flexibility is not intended as a subordinate system which is indifferent to people's needs but as a way to promote sociability and subjectivity, as indicated by R. Sennett [7].

The most qualified jobs and professions could/should be contained in a limited number of broadband professions which will be the subject of training and development. It is not a case of inventing names and profiles but of enhancing concrete job design processes and consolidating a limited number of jobs and professions in which to invest in terms of development and training. The development of ITS (Istituti Tecnici Superiori) and of vocational diplomas are one of the ways to develop new jobs and new skills.

We have already talked about 'architects of socio-tech systems' and the specialised skills they involve: knowledge owners of company functions, managers, entrepreneurs, consultants, university professors, etc. able to work with people specialized in various fields and also to change specialisation. As regards professionals, some will be sector-specific. For example, in the clothing sector, jobs like model-maker, stylist, tailor, cutter, mender. Others will be transversal as in service salespersons; experts in customization, techno-commercial activities, IT, social media; middle managers and coaches able to teach and learn; project leaders and coordinators able to teach by example; professionals able to purchase raw materials on a global scale; integrated logistics experts; economic management and corporate wellbeing experts; corporate employees with enhanced language skills that allow them to operate worldwide.

The above jobs and professions will obviously not cover all labour activities but will represent the core of the labour world, just like craftsmen during the Rennaissance period, liberal professionals in the 19th century and factory workers during the Industrial Revolution. *Service professions* will become the locomotive that will move the rest of the labour world.

[7] Sennet, R *L'uomo artigiano*, 2008, Feltrinelli

This paradigm could in the future unite dependent employment and self-employment, knowledge workers and craftsmen, highly-skilled and 'humble' jobs.
Industry 4.0, not only needs these roles, jobs and professions but is also generating them. All this makes the prospect of a 'professionalisation for everyone' plausible[8]: not only managers and professionals but also young people entering the labour market, NEETs, temporarily unemployed workers, people seeking to acquire new skills so as to get new jobs. It can be done by helping them to learn and train, to enhance their professional and human identity. Professionalisation is more than a simple increase of competencies and skills for all, what used to be called professionalism. In 1964, the famous sociologist Wilensky wrote a memorable article entitled "The professionalisation of everyone?"[9] in which he set two requirements for professionalism: distinctive knowledge (when not exclusive) and the ideal of (the propensity for) service. These requirements were not present in the Taylor-Ford model or Weber's bureaucratic system, even for qualified jobs. Knowledge was the prerogative of the organization and people answered to their superiors and not to customers. Those who lost or could not find a job in an organization, even when highly skilled, were 'out'.
We now know that the structural changes that we have mentioned require that knowledge also belong to the person who has to share it and that dedication to service is more important than respecting the hierarchy. What we see is a 'professional future' and in order to achieve it we need to create innovative job design and training processes that policy makers will be obliged to adopt, also benefitting from the experience of Italian and international companies and of the top training institutes.

5.6 A method: how to design roles, jobs, professions and personal development[10]

Basic training and the continuous development of knowledge (content, know-how, culture, in other words knowing, doing, being) are the keys for undertaking any kind of work. For this reason, and contrary to the Taylor-Ford theory according to which people were spare parts within organizational machines, tasks, positions in which traditional management placed 'the right person in the right job', today, a role – a job – is largely shaped and developed by the person who performs it. Training is crucial for this purpose.

As we have seen, new jobs require knowledge spanning various sectors (technology, economics, management, etc.) and different skills (leadership, teamwork, the ability to innovate, create, take risks, etc.). They are usually carried out together with other activities, thanks to self-regulated ways of cooperation, knowledge-sharing, enhanced communication, professional and social communities. Such communities are often new and can take the form of professional communities, practice communities, social networks based on ICT and web 2.0 applications such as blogs and wiki.

These new jobs are like an iceberg whose visible tip represents the assigned and effective role, the more or less formally accepted job or profession, the required education and competencies, the intelligence distributed among persons and technological systems. The invisible part – which is much larger – is the *workplace within*, i.e. the sum of a person's potential, knowledge, skills, energy, professional e non-professional motivation. The new workers are not just persons who fill a certain job or position but real people (whose personal stories and career paths impact the organization and management systems) and members of human communities.

---

[8] Butera F. "Industry 4.0 come progettazione partecipata di sistemi socio-tecnici in rete " in *Il lavoro 4.0 Le trasformazioni delle attività lavorative nella IV Rivoluzione Industriale*, Edited by Alberto Cipriani, Alessio Gramolati, Giovanni Mari, Firenze University Press, under preparation

[9] Wilensky H., The professionalization of everyone?, *in American Journal of Sociology*, 2, September 1964

[10] Butera, F., Bagnara S., Cesaria R., Di Guardo S. (eds.) *Knowledge Working. Lavoro, lavoratori, società della conoscenza,* Mondadori Università, Milano, 2008. Butera F. e Di Guardo, S. Il metodo di analisi del lavoro, in *Studi Organizzativi*, n. 2, 2009.

The organization of the work and the management of these communities brings together organizations, corporate professions 'relying upon' people and the workplace within.
In order to identify these new professions we must start by defining the real content of every job. In one of the most important studies in this field, Abbott mentions 'a system of professions'[11]. He indicates the issue of a job's content as the main problem affecting professional people's identity and development. 'The system of professions is a structure that links professions with tasks'. 'There is a map of tasks to be done and an isomorphic map of people doing them'. And this is the crux of the matter: in our opinion to find this isomorphic map of people we have to discover the map of tasks these people perform.

To ensure that people have a socially recognizable identity in which they also recognize themselves it is necessary to develop a system of professions that will be recognized by institutions, companies and families. It is also necessary to develop broadband jobs and professions which remain relatively stable despite the constantly changing tasks, roles and skills and that allow public institutions to design training programmes, companies to manage the changes occurring in organizations and roles and people to have a 'central pivot' that safeguards their identity, guides and supports them when faced with changes regarding roles, specific jobs, companies or even sectors.

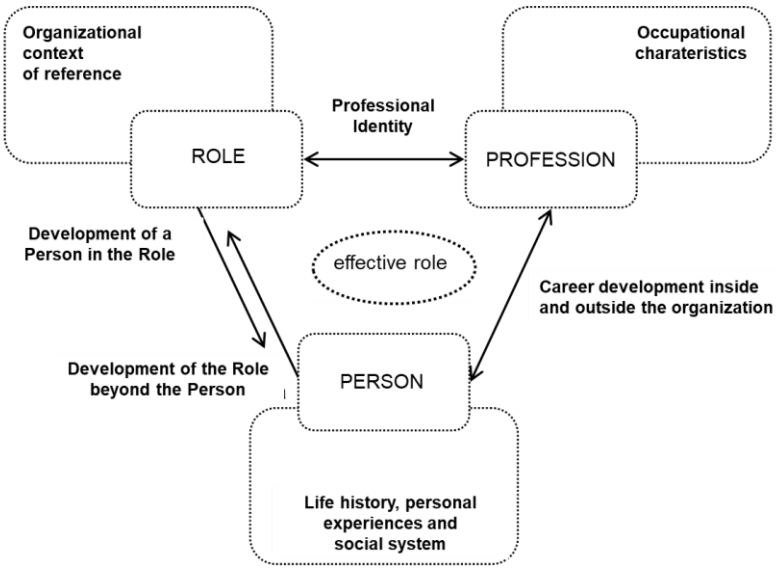
The model that for years has been proposed by the Fondazione Irso for developing both the aforementioned jobs and professions is based on three key dimensions, all of which are constantly changing, strongly interact with each other and are closely linked to external dimensions: *Role, Profession, Person*.

- **The *Role* is composed of the entire Work Process (activities and tasks), Knowledge (competencies and skills), Relationships (with roles, organizations, persons and technology), Objectives and Results**. The ascribed or assigned role is what an organization requires from a person, while the effective role is the way a person effectively carries out activities, forges relationships, pursues and obtains results. As already mentioned, new workers do not usually deal with prescribed tasks but have a much larger scope of activities which change according to production requirements and evolve in line with the development of personal skills. For this reason, also, they are more differentiated than was the case for occupations such as agricultural worker, factory worker, employee. The effective role was already present in traditional organizations: each person performed his/her job in a different way but these variations were limited and mainly had to do with speed and precision.
- **The *Profession* is at the same time a system of services, a system that manages human capital and the source of a person's identity**. It can be defined as 'the responsible and socially recognizable way in which a person undertakes a role (or a series of similar roles), in view of managing and innovating service-providing processes (profession as a component of the service-providing process). It requires a large amount of theoretical and technical knowledge regarding a specific field of skills and competencies, acquired through a study programme and a series of more or less related work experiences (profession as a social institution). Lastly, a profession has a name, social recognizability, a positioning on the labour market (profession as a source of identity)' (Butera 1987[12]).
- **The third variable, *Person*, has to do with the unique story of each individual including characteristics, aspirations as well as physical, psychological, cognitive, professional and social identity** resulting from life experiences and actions.

[11] Abbot, A. *The System of Professions. An essay on the Division of Expert Labor*, University of Chicago Press, 1988
[12] Butera, F. "Professionisti nelle organizzazioni", in *Studi Organizzativi*, 1991.

Role	*Profession*	*Person*
Nature • Work processes (phases, activities, tasks) - Transformation - Coordination and control - Innovation - Government • Professional domain - Knowledge - Ability (know-how) - Behaviour • Relationship - With other roles - With organizations - With people - With technology • Objectives and results - Economic, technical, social - Importance (extent, consequences etc.) - Tangible and intangible ***Assessment*** • Complexity • Importance • Conditions and quality of working life - Physical - Cognitive - Psychological - Professional - Social • Autonomy and discretion - Impact of others' decision - Integration in a relational network - Integration with other roles - Autonomy	• Name of profession • Processes • Jurisdiction • Theories and techniques of reference • Knowledge, skills and their evolution • Training • Experience • Deontology • Autonomy and discretion • Reputation and notoriety • Economic positioning on the labour market • Horizontal and vertical mobility • Professional standards • Local and international professional communities	• Cultural heritage • Aspirations • Motivations • Assets and social bonds • Skills - Cognitive - Psychomotor - Relational - Decision - Creative - Emotional • Style of work • Ability to cope

Analysis and planning model for knowledge work



These dimensions can be analysed, developed and planned. However, the analysis and monitoring of these dimensions does not suffice for understanding and planning labour activities. It is also necessary to analyse and optimise the positive and/or negative relationship between them.

The relationship between Role and Profession defines professional identity, in other words people's ability to establish a relationship between the tasks they are currently undertaking, *hic et nunc*, within an organization and how these tasks could be positioned in an existing or future profession. The pin maker described by Adam Smith could not aspire to a profession and had the 'consciousness of the pin'.

In the relationship between Persons and their Role there are two processes: Growth of the Person in the Role and Development of the Role. The first interaction becomes positive when, in the presence of a consolidated and secure Professional Identity, the Person grows in terms of human qualities thanks to what he/she is doing.
On the contrary, the second interaction happens when a Person causes his/her formal Role to evolve and reaffirms it. Sometimes, a person's ingenuity can redefine the rules for the entire model. Lastly, the relationship between Profession and Person gives rise to the possibility of career development both inside and outside the organization as well as within and without a specific profession.
The model's three dimensions are not generated inside a specific professional framework but also originate from non specific contexts and extended organizational and societal environments. The basic size of the model, the mutual relations and their specific traits are in fact a unique system that draws upon a vast array of contexts from which the professional system, by osmosis, imports and exports positive and negative elements. Moreover, the Role is part of the Organizational Context of reference which evolves rapidly, destroying and creating roles; Profession is a part of the labour market with particular *Occupational Characteristics*, which attributes value and remuneration based on socio-economic dynamics that go beyond profession. The Person at work is the tip of the iceberg, i.e. a very small part of a person's personality, life history, career and social system.

5.7 Roles and scripts for ITS students

The role for which ITS should prepare students includes

- specific cognitive and operational activities (tasks) within the context of processes;
- expected results and performance;
- relationship with others, with the organization, with technology;
- required and effective competencies and skills.

Contrary to tasks, positions and profiles, a role is not a requirement but a continuously evolving "part of the organizational and professional system", a "script" that depends heavily on training. Training helps to transform required roles, in other words the script to be followed, into fulfilling effective roles.

A programmed or developed set of roles constitutes a broad profession, in other words, a job or profession involving a variety of specialized skills which are linked by similar types of service, development and social identity and able to adapt to changes.
Therefore new jobs and broad professions are the boundaryless careers for which new skills are developed, i.e., the profiles suited to ITS training. They do not include highly specialised tasks destined to quickly become obsolete as a result of technological or organizational progress. Instead, they include craft work, occupations based on formal knowledge and supervisory work, in other words 'knowledge work' in all its forms and skill levels. Each school should therefore identify, with the help of companies and institutions, the roles, tasks and professions that enhance personal identity and increase manageability by companies and the educational system, as was the case with the formal professions of

doctor, architect, journalist, and the non-formal professions of carpenter, goldsmith, software developer etc.

For ITS students, skills are attributes of the roles and professions they will have to undertake through their professional careers. These professions will not consist of a disordered mix of competencies but, as already mentioned, will be composed of organizational micro-units, management systems and sources of personal identity.
In this context, the skills that will have to be developed by ITS can be divided into three categories:

- **specialized skills,** related to activities/tasks linked to sector, product, technology;
- **transversal, hard and soft skills** (OECD[13]);
- personal abilities and potential, the "workplace within" (Larry Hirshorn[14]) and the ability to follow one's professional and personal 'path' (Martin Buber[15]) towards the 'chosen broad profession' or in order to change the broad profession one is in.

As regards high-level technical workers:

1. specialized skills require an in-depth theoretical and technical knowledge of the professional field, excellent specific operational skills, a good grasp of digital technology applications etc.
2. transversal skills include
   - hard skills, related to basic knowledge (mathematics, technology, logic, history of Art, languages, etc.);
   - soft skills, related to basic abilities (client focusing, results focusing, creativity, design thinking, problem solving, project work, teamwork etc.);
   - skills suited to Industry 4.0. (cooperation skills, knowledge sharing, strong communication and community-building skills);
   - personal attitude (willingness to perform also humble tasks, ability for manual labour, propensity to improve, participation in organized work, desire to work well and particularly to serve the customer);
3. personal skills and abilities, the workplace within: resilience, personality, maintaining one's identity even under changing conditions, being an 'integral person'.

Therefore, these are key skills common to various sectors:

Hard skills	*Soft skills*
• programming • social media management • mathematics • cad/cam production systems • craftsmanship • project management • planning	**Basic** • customer service/customer experience skills • product/aesthetic awareness • relational skills • creativity • problem solving/structured approach to problems • consistency • mindfulness • fluent English **Enabling** • flexibility • curiosity • not taking things for granted • cultural understanding • learning agility • ability to learn • resilience • empathy • emotional engagement

[13] OECD, Assessing and Anticipating Changing Skill Needs, 2015
[14] Hirshorn, L., *The Workplace Within: Psychodynamics of Organizational Life,* MIT Press, 2000
[15] Buber, M *Il cammino dell'uomo*, Edizioni Qiqajon Comunità di Bose, 1990

5.8 Applicability of the model to roles, professions and skills developed by ITS in Vicenza, Cernobbio, Parma

5.8.1 Mechatronics ITS

Mechatronics ITS profiles

The **Highly-skilled Technician in the innovation of mechanical processes and products** works in the planning and industrialization sector and also deals with the use of materials. He/she is able to combine different technologies like engineering and electronics. He/she uses his/her competence and practical skills in activities such as the building, testing and documenting automatic processes and installations, has good knowledge of work cycles, command systems, the monitoring and regulation of testing and functioning methods, as well as of the basic concepts of industrialization and breakdown prevention. He/she also plans and manages maintenance activities and takes part in the post-sales actions. He/she interacts and collaborates with the technological units in which he/she is involved.
He/she therefore has to be able to:

- develop and interpret planning, prototype development and industrialization techniques;
- identify materials, manufacturing processes and methods;
- choose manufacturing technologies and machinery;
- manage post-sales and maintenance requirements.

The **Highly-skilled Technician in automation and mechatronic systems** works in a sector dealing with building, integrating, monitoring automatic machines and systems meant for many different types of production. He/she uses tools to interface between machines and the programmable systems that control them in order to programme, test and make them function while documenting the various stages. He/she manages command, monitoring and regulation systems.
He/she collaborates with the technological units dealing with the design, production and maintenance of the equipment he/she is called to work upon. He/she also has to deal with economic, regulatory and safety issues.
He/she therefore has to be able to:

- design mechatronic systems;
- create and install mechatronic systems;
- manage mechatronic systems in machinery;
- programme and manage the maintenance of mechatronic systems.

The role: going beyond the Ministerial Decree

a) Specific cognitive and operational activities (tasks) within the processes

- Knows how to design cycles that include the entire system
- Is able to determine the required parameters and obtain results

b) Expected results and performances

- Is able to solve problems
- Processes are constantly optimized

c) Relationship with others, with the organization, with technology

- Knows how to find the resources to reach the objective
- Is aware of his/her limits but is able to work with other people to attain his/her goal

d) Required and effective hard competences and skills
- Project management
- Problem solving / structured approach to problems

e) Required and effective soft competences and skills
- Ability to do concrete things *'even as simple as turning a screw*'
- Teamwork
- Attaining goals
- Ability to learn

5.8.2 ITS International Academy of Tourism and Hospitality

ITS International Academy of Tourism and Hospitality profiles

- International hotel and restaurant manager
- International hospitality and tourism management
- Digital marketing and communication for tourism and hospitality

The role: going beyond the Ministerial Decree

a) Specific cognitive and operational activities (tasks) within the processes
- Versatility as regards all basic tasks

b) Expected results and performances
- Ensure maximum customer experience
- Enhance customer journey

c) Relationship with others, with the organization, with technology
- part from one's own team and entire unit, with the informatics system and social media

d) Required and effective hard competences and skills
- Business planning
- Management control

e) Required and effective soft competences and skills
- Welcoming and smiling approach towards the customer
- Readiness to perform even menial tasks at any time

5.8.3 ITS TECH&FOOD

ITS TECH&FOOD profiles

The **Highly-skilled technician in food design and production technologies:**
- Identifies and applies production technologies according to processing procedures
- Manages food production programmes
- Deals with issues regarding the quality and safety of food products as well as with the sanitization of production plants
- Carries out projects and feasibility studies aimed at innovating both products and processes
- Abides by the existing food regulations

Potential work areas:
- Production Programming and Management
- Quality Control or Quality Guarantee

The **Highly-skilled technician in food product marketing and promotion technologies:**

- Manages the marketing of food products
- Promotes Made in Italy agri-food specialties
- Manages relations with large-scale distribution and retail outlets
- Uses digital marketing and e-commerce technologies
- Manages supplies and checks the quality of raw and semi-processed materials

Potential work areas:

- Product marketing
- Supplies, logistics and distribution

5.8.4 The role: going beyond the Ministerial Decree

a) Specific cognitive and operational activities (tasks) within the processes

- Understanding the quality, safety, traceability cycle of the production process
- Integrating production in order to optimize delivery (e.g. cold chain)

b) Expected results and performances

- Overall quality of the process
- Innovation of daily operational tasks

c) Relationship with others, with the organization, with technology

- Is knowledgeable about all types of production methods, including the more traditional ones

d) Required and effective hard competences and skills

- Knowing how to promote the Made in Italy brand on a global scale

e) Required and effective soft competences and skills

- Teamwork
- Capable of fast-paced production work and meeting objectives

5.9 Broad Professions of Higher Technical workers

In all the above cases, the existence of Broad Professions would make it easier to develop retraining policies because this would simply involve completing/updating certain specific skills of a series of professions that could find their place in the new system.
Broad professions are characterised by a name under which we find a large scope of theoretical and technical fields, vast work processes, vocational training and development programmes and, occasionally, certification systems and deontological approaches. They include, at the same time, production systems, social institutions, identity systems. They allow organizations to have a flexible management style and contribute to the recognition of a person's professional identity.

In order to offset the lack of professional identity, precariousness and instability, broad professions tend to boost professional identities that allow people and organisations to avoid 'erosion of characters' and promote contents and paths leading to 'jobs and professions' with 'boundaryless high employability'.

Broad professions are:

- **long-lasting,** i.e. able to resist the passing of time and be easily upgraded
- **solid,** therefore competitive in the labour market

- **useful to socio-economic systems,** therefore integrated in the production system and the labour market
- **clear-cut,** therefore easy to manage, train for and develop
- **transversal,** therefore flexible and not linked to specific contexts
- **recognisable,** therefore able to constitute a well-defined professional option for potential candidates.

Three synergistic actions are necessary in order to develop a high-level technical training programme:

- **Creation of effective roles**, by devising, as already mentioned, Effective Roles for Highly-skilled Technicians which favour the existence and development of technical skills but particularly of decision-making, communication, relational and managerial skills which broaden the professional scope;
- **Organizational planning (regarding work teams and technologies)**, by enhancing working and organizational methods which, through the use of network and systems technologies, increased cooperation based on innovation and integration, exchange of information, limitless communication and communities in which working and social lives are optimized;
- **Development of management systems and new types of labour**, through training and the validation of broad and diverse skills able to ensure the ability to evolve and adapt, as well as pursue flexible, cross-functional and horizontal solutions.

From the three cases analysed above, two types of Broad Professions emerge involving different profiles and roles.

Specific broad professions per sector

TOURISM AND HOSPITALITY
- International Hotel and Restaurant Manager
- International Hospitality and Tourism Management
- Digital Marketing and Communication For Tourism and Hospitality

FOOD
- Highly-skilled technician in food product marketing and promotion technologies

MECHATRONICS
- Highly-skilled technician in the innovation of mechanical processes and products

Transversal broad professions

When adequately developed, specific broad professions can grow and embrace other sectors.

For example:
- project leaders and coordinators able to work and teach
- service salespersons: events, products/services, maintenance etc.
- intermediate leaders such as coaches able to facilitate learning

References

Akyeampong, E. B. (1991), "Apprentices: Graduate and Drop Out Labour Market Performances", *Statistics Canada*, *Perspectives on Labour and Income*, Vol. 3, No 1, Spring, p. 7-15.

Backes-Gellner, U., Geel, R., Mure, J. (2010), Specificity of Occupational Training and Occupational Mobility: An Empirical Study Based on Lazear's Skill-Weights Approach, *Education Economics*, 18, 1–17.

Beicht, U., Walden, G., Herget, H. (2004), *Costs and Benefits of In-Company Vocational Education and Training in Germany*, Federal Institute for Vocational Training (BIBB), Bielefeld.

Bellmann, L., Hartung, S., Janik, F. (2006), *Lohntsich die betriebliche Berufsausbildung? Der Nutzen für die Ausbildungsbetriebe*. Eschborn: Vortrag auf dem Thementag Berufliche Bildung des Kompetenzfeldes Berufliche Bildung der GTZ.

BIBB Cost Benefit Study, 2007.

Boothby, D., Drewes, T. (2010), "Returns to Apprenticeship in Canada", *Canadian Labour Market and Skills Researcher Network*, Working Paper no. 70.

Bougheas, S., Georgellis, Y. (2004), Early Career Mobility and Earnings Profiles of German Apprentices, *Theory and Empirical Evidence Labour*, 18 (2), 233–63.

Brennan, L. (2009), *Integrating work-based learning into higher education: A guide to good practice*. Bolton: University Vocational Awards Council.

Callan, Victor J., (2000), *Apprenticeship and Traineeship Non-Completions*, University of Queensland, Australia.

Canadian Apprenticeship Forum – Estimating the Return on Investing in Apprenticeship. Analytical Report, 2005.

Casey, B. (1986), "The Dual Apprenticeship System and the Recruitment and Retention of Young Persons in West Germany", *British Journal of Industrial Relations*, 24:1.

Cedefop (2010), *Working and ageing: Emerging theories and empirical perspectives*. Luxembourg: Publications Office of the European Union.

Cedefop (2011), *Development of national qualifications frameworks in Europe.* Luxembourg. Publications Office of the European Union.

Cedefop, *Skills supply and demand up to 2025,* Country forecast, Italy, 2015.

Centre for the Study of Living Standards (2000), *Apprenticeship in Canada: A Training System Under Siege?,* Report prepared for the National Apprenticeship Committee of the Canadian Labour Force Development Board.

Darche, S., Arnold, M., Newhouse, C. (2004), *The benefits of work-based learning and occupational coursework in the California community colleges*. Berkeley: California Community College.

Darche, S., Nayar, N. Bracco, K. (2009), *Work-based learning in California: Opportunities and models for expansion*. Los Angeles: James Irvine Foundation.

Darche, S., Nayar, N. Bracco, K. (2009), *Work-based learning in California: Opportunities and models for expansion*. Los Angeles: James Irvine Foundation.

Dearden, L., Reed, J., Van Reenen, J. (2005), "The Impact of Training on Productivity and Wages: Evidence from British Panel Data", *CEP Discussion Papers dp0674*, Centre for Economic Performance, LSE.

Dionisius, R., Mühlemann, S., Pfeifer, H., Walden, G., Wenzelmann, F., Wolter, S.C., (2008) "Costs and benefits of apprenticeship training. A comparison of Germany and Switzerland", *Applied Economics Quarterly,* 55 (1), 5–38.

Dockery, A.M., Koshy, P., Stromback, T., Ying, W. (1997), *The Cost of Training Apprentices in Australian Firms*, Centre for Labour Market Research (Australia).

Ebbingaus, M., Ulmer, P. (2009), "Sclussfolgerungen aus einer Befragung von 15.000 Betrieben: Grunde betrieblicher Ausbildungsbeteiligung und ihr Einfluss auf die Ausbildungsqualität, Wirtschaft und Berufserziehung, Vol. 61, No 1, pp. 20-27, *Education*, Vol. 22, No 3, pp. 325-334.

Economic Impact of Education and Return on Investment, Demonstrating the value of Canada's colleges and institute, EMSI, 2016.

Employer Investment in Apprenticeships and Workplace Learning: The Fifth Net Benefits of Training to Employers Study, BIS RESEARCH PAPER NUMBER 67, 2012.

Euwals, R., Winkelmann, R. (2001), *Why Do Firms Train? Empirical Evidence on the First Labour Market Outcomes of Graduated Apprentice,* Discussion Paper 319, Institute for the Study of Labor.

Field, S., Hoeckel, K., Kis, V., Kuczera, M. (2009), *Learning for jobs: OECD reviews of vocational education and training*, Initial Report, Organisation for Economic Cooperation and Development, Paris.

Fletcher, J.D., Sottilare, R.A. (2014), "Cost Analysis for Training and Education Systems", *Science & Technology Division – Institute for Defense Analyses.*

Franz, W., Soskice, D. (1995), "The German Apprenticeship System," in Butler, F., et al., *Institutional Frameworks and Labor Market Performance*, Routledge, pp 208-34.

Fuller, A., Unwin, L. (2008), *Towards expansive apprenticeships: A commentary by the Teaching and Learning Research Programme*. London: Teaching and Learning Research Programme.

Gitter, R. J. (1994), "Apprenticeship-Trained Workers: United States and Great Britain", *Monthly Labor Review*, April, pp. 38-43.

Gunderson, M. Krashinsky, H. (2012), "Returns to Apprenticeship: Analysis based on the 2006 Census." CLSRN Working Paper 99. Vancouver: Canadian Labour Market and Skills Researcher Network. April.

Harhoff, D., Kane, T.J. (1993), *Financing Apprenticeship Training: Evidence from Germany*, NBER Working Paper Series, No. 4557 Appendix A.1.

Hasluck, C., Hogarth, T. (2011), *The Net Benefits to Employers' Investments in Apprenticeships: Case study evidence from the UK.*

Hogarth, T. & Hasluck, C. (2003). *The Net Costs of Training to Employers: Apprenticeships*. Nottingham: Department for Education and Skills Publications.

Hogarth, T., Gambin, L., Winterbotham, M., Baldauf, B., Briscoe, G., Gunstone, B., Hasluck, C., Koerbitz, C., Taylor, C. (2012), *Employer Investment in Apprenticeships and Workplace Learning: The Fifth Net Benefits of Training to Employers Study*, Research paper 67, Department for Business, Innovation and Skills.

Hogarth, T., Gambin, L., Winterbotham, M., Koerbitz, C., Hasluck, C., Baldauf, B. (2012) *Employer Investment in Apprenticeships and Workplace Learning: The Fifth Net Benefits to Employers Study*, London Department for Business Innovation and Skills, Research Report 67.

Hogarth, T., Hasluck, C. (2003), *Net Costs of Modern Apprenticeship Training to Employers*, Institute for Employment Research, UK, Research Report 418.

Hogarth, T., Hasluck, C., Daniel, W.W. (2005), *Employing apprentices: The business case*, Coventry: Institute of Employment Research.

Hughes, K. Golann, J. (2007), *When the virtual becomes real: Student learning in the Virtual Enterprises Programme.* New York: Institute on Education and the Economy, Teachers College, Columbia University.

IT PAYS TO HIRE AN APPRENTICE: Calculating the Return on Training Investment for Skilled Trades Employers in Canada, Canadian Apprenticeship Forum, 2009.

Jäger, M. (2003), *Costing and Pricing of Training and Skills Development*, Zürich: KODIS Consult GmbH for: SDC – Swiss Agency for Development and Cooperation.

John O'Grady Consulting Ltd. (1997), Training and Apprenticeship Needs in the Drywall Installation and Finishing Sector, and Prism Economics and Analysis, (2000) *Human Resources Analysis* – Plastering and Taping Trade.

Kenyon, R. (2005), The business benefits of apprenticeships: The English employers' perspective, *Education + Training*, Vol. 47 No 4/5, pp. 366-373.

Korpi, T., Mertens, A. (2003), "Training Systems and Labor Mobility: A Comparison between Germany and Sweden", *Scandinavian Journal of Economics*, 105 (4), 597–617.

Levin, H. M. (1975), "Cost-effectiveness analysis in evaluation research", in Guttentag, M., Struening, E. L. (Eds.), *Handbook of evaluation research* (Volume 2), Beverly Hills, CA: Sage.

Levin, H. M. (1995), "Cost-effectiveness Analysis", *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Oxford Pergamon: 381- 386.

Levin, H. M., McEwan, P.J. (2000), *Cost-effectiveness analysis as an evaluation tool*, International Handbook of Educational Evaluation.

Levin,H.M. (2013)**,** *Education and Innovation Theme Cost-Effectiveness in School Education*, City University of New York, Columbia University.

Lindley, R. M. (1975), "The Demand for Apprentice Recruits by the Engineering Industry: 1951-1971", *Scottish Journal of Political Economy,* 22: 1-24.

London Economics (2011a), "Returns to Intermediate and Low Level Vocational Qualifications", *BIS Research Paper* 53.

London Economics (2011b), "The Long-Term Effect of Vocational Qualifications on Labour Market Outcomes", *BIS Research Paper* 47.

Lotz, G. (2006), *Engagement von Unternehmen in der beruflichen Qualifizierung von Mitarbeitern*: Anregungen für die Berufsbildungszusammenarbeit. Hannover: commissioned by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

Luecking, R., Gramlich, M. (2003), *Quality work-based learning and post-school employment success*, National Center on Secondary Education and Transition Issue Brief, Vol. 2, Issue 2, Minneapolis: University of Minnesota. Luxembourg: Office for Official Publications of the European Communities.

McEwan P.J. (2012), "Cost-effectiveness analysis of education and health interventions in developing countries", *Journal of Development Effectiveness*, Vol. 4, 2: 189-213.

McIntosh, S., (2007), "A Cost/benefit Analysis of Apprenticeships and Other Vocational Qualifications", Department of Economics, University of Sheffield- Sheffield University Management School, Research Report 834.

Miller, L. (2013) "Canada" and "England" in 'Possible futures for the Indian Apprenticeships system project. Interim Report to the World Bank. 2013. Edited by Erika Smith and Ros Brennan Kemmis. University of Ballarat, Australia.

Mishan, E.J. (1982), *Cost/benefit Analysis*, London, George Allen & Unwin (Publishers) Ltd 3 Edition.

Mohrenweiser, J., Zwick, T., Backes-Gellner, U. (2013), *Poaching and firm sponsored training: first clean evidence*, Leading House Working Paper No. 51, Universität Zürich.

Muehlemann, S., Braendli, R., Wolter, S.C. (2013), Invest in the Best or compensate the Weak? An Empirical Analysis of the Heterogeneity of Firm's Provision of Human Capital, *Evid base Hum Resource Manag* 1(1):80–95.

National Audit Office (2012), *Adult Apprenticeships. Estimating economic benefits from apprenticeships – Technical Paper.* Department for Innovation, Business and Skills, Skills Funding Agency and National Apprenticeship Service.

National Research Council (2004), *Engaging schools: Fostering high school students' motivation to learn*. Washington: The National Academies Press

Noll, I., Beicht, U., Boll, G., Malcher, W., Wiederhold-Fritz, S. (1983), *Nettokosten der betrieblichen Berufsausbildung. Schriften zur Berufsbildungsforschung*. Berlin: Bundesinstitut für Berufsbildung.

Oberth, C., Zeller, B. Krings, U. (2006), Lernort Betrieb-Berufliche Qualifizierung von benachteiligten Jugendlichen: Methodische Anstze fur Ausbilder und Ausbilderinnen. Bonn: Bundesinstitut fur Berufsbildung (Eigendruck).

Pfeiffer, H., Dionisius, R., Schoenfeld, G., Walden, G., Wenzelmann, F. (2009), *Kosten und Nutzen der betrieblichen Berufsausbildung*, Forschungsbericht BiBB 2.1.203, Bonn: Bundesinstitut fuer Berufsforschung.

Pilz, M. (2008), *Bildungswa lmotive von Abiturienten mit und ohne studierabsicht im dualen Ausbildungssystem: Begru ndungszusammenh.nge, empirische Befunde im Kontext von Finanzdienstleistungsberufen sowie bildungspolitische Konsequenzen, Bildung und Erziehung*, Vol. 61, pp. 221-246.

Rauner, F. (2005), *Work process knowledge and development of vocational competence,* Bremen: Institute of Technology and Education, Universitat Bremen.

RKA Inc. (2002), *Assessment of Training Costs for Machinists, Auto Mechanics and Plumbers engaged in Apprenticeship Training*, study prepared for HRDC.

Ryan, P. (2011), *The apprentice: Employee, student, both, neither? Evidence from four countries,* Paper presented at the ETF International Panel on Work-based Learning, 14-15 November 2011, Turin: European Training Foundation.

Ryrie, A. C. (2012), "Research Note: Employers and Apprenticeship", *British Journal of Industrial Relations*, Vol. XIV, No. 1, p. 89.

Smits, W. (2008), *The private benefits from vocational training: A new framework*, in Cedefop, Modernising vocational education and training – Fourth report on vocational training research in Europe: background report Vol. 1.

Smits, W., Stromback, T. (2001), *The Economics of the Apprenticeship System*, Edward Elgar Publishing.

Soskice, D. (1993) "Reconciling Markets and Institutions: The German Apprenticeship System," in Lisa Lynch, ed., *Training and the Private Sector*: International Comparisons, University of Chicago Press.

Stoll, P., Baignee, A. (1997), *The National Apprenticed Trades Survey: An Overview of the Apprenticeship Experience*, HRDC.

Strupler, M., Wolter, S.C., (2012), *Die duale Lehre eine Erfolgsgeschichte - auch für Betriebe. Ergebnisse der dritten Kosten-Nutzen-Erhebung der Lehrlingsausbildung aus der Sicht der Betriebe*, Glarus/Chur: Rüegger Verlag.

T*he effectiveness and costs-benefits of apprenticeships: Results of the quantitative analysis,*European Commission, 2013.

Unioncamere - Ministero del Lavoro, Sistema Informativo Excelsior, *Gli sbocchi professionali dei diplomati nelle imprese italiane per il 2014.*

Wainer, R. (2006), *Making apprenticeships work: The business benefits*, The Confederation of British Industry.

Walden, G. (2006), *Kosten und Nutzen betrieblicher Ausbildung. Eschborn*: *Vortrag auf dem Thementag Berufliche Bildung des Kompetenzfeldes Berufliche Bildung der GTZ.*

Walden, G. (2006). "Short-term and long-term benefits as determinants of the training behaviour of companies", *Journal for Labour Market Research*, 40(2+3), 169–191.

Werwatz, A. (1996), *How firm-specific is German apprenticeship training?* Working Papers. Humboldt University, Sonderforschungsbereich 373.

Winkelmannn, R. (1996), "Employment Prospects and Skill Acquisition of Apprenticeship-Trained Workers in Germany", *Industrial and Labor Relations Review*. Vol. 49, No. 4, July.

Wolter, S. C. (2008), *Ausbildungskosten und -nutzen und die betriebliche Nachfrage nach Lehrlingen*. Perspektiven der Wirtschaftspolitik (Special Issue 2008 9), pp. 90–108.

Wolter, S., Mühlemann, S., Schweri, J. (2006), "Why Some Firms Train Apprentices and Many Others Do Not", *German Economic Review*, 7: 249- 264.

Wolter, S.C., Mühlemann, S. (2015), *Apprenticeship training in Spain – a cost-effective model for firms?*, Fundacion Bertelsmann.

Wolter, S.C., Ryan, P. (2011), *Apprenticeship*. In: E. A. Hanushek, S. Machin & L. Woessmann (Eds.), Handbook of the Economics of Education, Vol. 3, pp. 521–576. North-Holland: Elsevier Science.

List of published research papers:

– “Alternanza scuola-lavoro: le condizioni per il successo” N° 01/2016
– “L’accessibilità dei Comuni della Città Metropolitana di Milano e della Provincia di Monza e Brianza. Focus sull’accessibilità agli ambiti produttivi di cinque Comuni” N° 02/2016
– “Modelli di partenariato didattico università-impresa” N° 03/2016
– “Le performance delle imprese europee: un'analisi benchmark” N° 04/2016
– “Analisi e strumenti per l’attrazione di investimenti esteri” N° 05/2016
– “Strategie di internazionalizzazione: export strategy ed export performance” N° 06/2016
– “The Chemical and Pharmaceutical Industry in Lombardy” N° 07/2016
– “Approfondimento sulle tecnologie abilitanti Industria 4.0” N° 08/2016
– “La filiera Scienze della Vita e l’innovazione” N° 09/2016
– “Crescita digitale e opportunità per l’area metropolitana di Milano” N° 10/2016
– “Le performance delle imprese europee: un’analisi benchmark - Executive summary” N° 01/2017
– “Progetto pilota Zona Sud-Est: contributo preliminare al PUMS di Zona omogenea” N° 02/2017
– “Ricognizione, analisi e valutazione della modalità di gestione dell’Alternanza Scuola-Lavoro nelle scuole” N° 03/2017
– “Donne STEAM: evoluzione e scenari in Lombardia” N° 04/2017

www.assolombarda.it
www.assolombardanews.it