



International
Labour
Office

SKILLS FOR EMPLOYMENT

Policy Brief

MEASURING THE COSTS AND BENEFITS OF APPRENTICESHIP TRAINING

This policy brief provides an overview of the current debate and research efforts to measure cost and benefits of apprenticeship training. It introduces the methods and challenges associated with collecting data and attaching a monetary value to apprenticeships, for enterprises, learners and society. Despite the limited number of studies that exist, the policy brief shows that apprenticeships, if of a certain quality and regulated, are not only profitable for enterprises, but significantly increase employability and employment perspectives for apprentices, and in doing so, reduce the overall risks of unemployment and therefore potential social costs.

The policy brief also discusses how the findings of cost-benefit analysis can be used as an effective marketing tool by governments, trade unions and employers associations to boost the overall attractiveness of apprenticeships.¹

Why are we interested in the costs and benefits of apprenticeships?

To adequately respond to the pace of technical and organizational change in enterprises and to make education and vocational training more relevant to employers' requirements, governments are giving increasing importance to work based learning. This has also led to the re-discovery of apprenticeships as a cost-effective and relevant form of professional training (Rauner, Smith, 2010)

Growing pressure on national budgets worldwide has led countries to measure and assess the effectiveness and efficiency of technical and vocational education and training, and stakeholders involved are increasingly calling for more evidence based discussions on the cost and benefits of public investment in skills development, including apprenticeships. **A benefit-cost analysis attempts to accurately capture the variety of monetary and non-monetary costs and benefits associated with apprenticeship training in specific sectors and industries.**

The key stakeholders most concerned with training costs and benefits are enterprises, learners and governments. All of them

have different interests and look at costs and benefits from a different perspective; but each are interested to know whether the benefits of apprenticeship training will outweigh the costs:

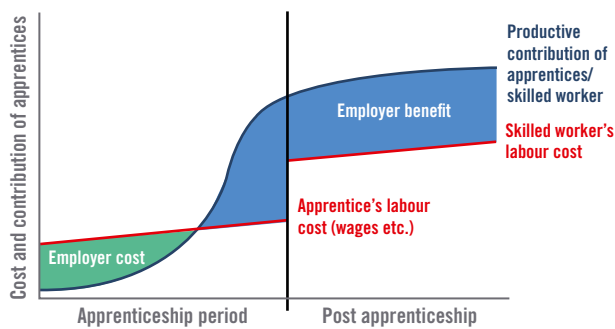
Governments seek to increase the relevance and quality of apprenticeship systems to promote investment in a skilled and adaptable workforce for the economy. The extent to which apprenticeships facilitate a smooth transition of young people from education to the world of work, thereby reducing the risk of unemployment is the guiding question. Quality apprenticeships are considered a cost-effective way of developing work relevant skills, since they ensure enterprise involvement and the sharing of costs. Hence, there are good policy reasons for governments to encourage and support employers to participate in apprenticeship systems. However, governments need information on the cost and benefits generated by apprentices during the training period in order to decide how apprenticeship training should be funded, including whether specific incentives or policy measures for enterprises or learners should be made, increased or reduced.

In many countries, parents and learners perceive apprenticeships as inferior to higher education. This low social status is associated with the view that for individuals, the costs and benefits of vocational training or apprenticeships deliver less income and career opportunities over a lifetime. In the case of apprenticeships, lower earnings during the apprenticeship period are seen as an investment that needs to be offset by future benefits (employment and careers) over time. Awareness of the benefits that result from increased employability and employment opportunities over a lifetime is still low and research needs to show and communicate more systematically that over a working life period, apprenticeships pay off for individuals and provide comparable and in some cases better outcomes than other forms of education and training.

Enterprises mention costs as one of the main barriers to providing apprenticeship places. Based on whether they believe apprentices positively contribute to their business and overall productivity, enterprises will take decisions about whether or not they want to train. The figure below visualizes the development of wage levels and learner productivity during the course of apprenticeship training. It shows that initially, wage levels are higher than productivity; but as the productivity of apprentices increases, the earlier investment in training by employers will be off-set by the relatively lower wages. Figure 1 indicates that not only can employers financially benefit during the period of an apprenticeship, they can as well after the apprenticeship is completed. The details of these costs and benefits are explained further later in this brief.

¹ This policy brief derives from various ILO sources and other comparative studies. The sources available are presented at the end. In this case we focus on formal apprenticeships; which are based on strong employer engagement, contractual arrangements and structured learning and assessment that leads to recognized certification.

Figure 1 Cost-benefit of apprenticeships in enterprise



Source: R. Lerman 2014, p.1

How can we measure costs and benefits?

Most cost-benefit analyses rely on enterprise based surveys to assess the costs and benefits enterprises accrue when participating in apprenticeship programs. However, social and individual costs and benefits are increasingly considered as important sources of empirical evidence for policy decisions as well. Whilst there are only slight differences in approaches to how costs and benefits are calculated between different countries with apprenticeship systems, the question still remains, how can we measure and valorize the different costs and benefits involved. The ILO has completed a review of methodologies used to measure the returns from apprenticeships (see Hausschildt, 2017) and has summarised the different costs and benefits that exist (see Table 1).

Measuring Costs and Benefits for Enterprises

Measuring Costs: At the enterprise level, the most important cost factors are: apprentice wages; social security contributions; wages of dedicated training staff and the costs associated with the use of machinery and materials used for training. Other costs could include examination fees, costs of administration and the cost of external and internal courses. All these factors are relatively easy to measure. Difficulties arise however when all aspects of apprentice training are considered (such as coaching and mentoring by different staff); or when service sectors are included (such as tourism and hospitality where equipment costs are difficult to measure); or when effort is made to determine the relative productivity of trained staff and apprentices (due to the lack of available data).

Measuring Benefits: The main determinant of financial benefit is the productivity of apprentices. Figure 1 shows that an apprentice's productivity is lower than the one of a skilled worker at the beginning of an apprenticeship, but may be higher than the actual wage level he/she is paid over the period of training. The actual level of an apprentice's productivity rises during the training process, so that the initial losses occurred are compensated for over the life of the program. This is the core argument for why it is attractive for enterprises to train apprentices. But

there are others. Cost benefit calculations at the enterprise level usually focus on the net short term (i.e. the value of an apprentice's productive work during the apprenticeship period) and less on the long term benefits that accrue when the company employs the apprentice after the training period. In this scenario, benefits include lower costs for future recruitment of skilled workers, less attrition, and higher productivity compared to a new recruit. Furthermore, there is evidence that non-monetary benefits also accrue to enterprises that take on apprentices. These include improved work climate including (job satisfaction, team spirit, training culture, commitment to work and attitude of the staff); improved employee retention (less absenteeism and staff turnover); improved innovation and work processes as a result of the new knowledge brought by apprentices; and improved public image and reputation for the firm from taking on apprentices. The use of subsidies or tax incentives can further motivate enterprises to hire apprentices and increase both the financial and non-financial benefits that accrue.

At the enterprise level, measuring both costs and benefits through surveys or interviews can be time consuming and involves a number of challenges including negotiating access and ensuring good response rates, confidentiality, and the general availability and accuracy of data (especially in SMEs). Recently, cost benefit simulators have been trialed in a number of countries that model costs and benefits using country specific calculations based on data from previous studies. Regardless, collecting firm level data can be difficult and costly, but as is argued here, of vital importance to stakeholders in the apprenticeship system.

Measuring Costs and Benefits for Individuals:

The benefits to individuals usually accrue from improved earnings, better employment outcomes, higher mobility and higher job satisfaction after an apprenticeship, compared with individuals who were not apprentices. Apprentices may need to accept lower incomes at the beginning or during the entire period of training as compared to unskilled workers. Lower earnings during the apprenticeship period thus need to be seen as an investment for future employment and career benefits that should pay off over time. An apprentice also benefits from a structured training process during this period, resulting in higher skills levels compared to an unskilled worker participating in informal learning on the job. This in turn, it is argued, not only makes an apprentice more employable and reduces the period to find employment after the training, but also results in higher wages and higher total income over a professional lifetime. Collecting data on some of these outcomes such as employment outcome and wage rates can be drawn from graduate tracer studies after program completion, but longer term impacts require longitudinal research to determine cumulative impact over time. However, as with analyses at the enterprise level, returns to individuals will be influenced by the different levels of apprentice wages that exist, the level of qualification level received and the industry sector and occupation in which the apprenticeship was completed.

Table 1 Cost Benefits generated according to stakeholders involved

| | | COSTS | BENEFITS |
|-------------|------------------------------------|--|--|
| ENTREPRISES | During the Quality Apprenticeship | <ul style="list-style-type: none"> • Wage/stipend • Social security contributions • Time for in-company mentors • Costs for training materials, space, equipment • Costs for recruitment and administration | <ul style="list-style-type: none"> • Contribution to the production of goods and services • Subsidies and incentives • Payments from training funds • <i>Improvements in reputations, through participation in reputation, through participation in apprenticeship training</i> |
| | After the Quality Apprenticeship** | | <ul style="list-style-type: none"> • Savings in recruitment and initial training costs • Higher productivity and quality • More loyal workforce • Savings from reduced labour turnover • Innovation • Wage stability |
| APPRENTICES | During the Quality Apprenticeship | <ul style="list-style-type: none"> • <i>Opportunity cost of working in an unskilled job</i> | <ul style="list-style-type: none"> • Wage / stipend • Social security coverage • No fees to be paid for learning to acquire a qualification • Higher quality and relevance of training compared to school-based training |
| | After the Quality Apprenticeship* | | <ul style="list-style-type: none"> • Enhanced employability • Higher wages • <i>Enhanced job satisfaction</i> |
| GOVERNMENT | During the Quality Apprenticeship | <ul style="list-style-type: none"> • Subsidies and incentives • Costs for providing off-the-job training in a public institute • Cost for regulatory body | <ul style="list-style-type: none"> • Governments are responsible** for education and pre-employment training of youth. They make a significant cost saving from apprenticeships compared to investing in school-based TVET • Tax revenue from apprentices • <i>Savings on employment programmes (e.g. active labour market programmes) and benefits for unemployed people</i> |
| | After the Quality Apprenticeship* | | <ul style="list-style-type: none"> • Higher tax revenue • <i>Savings on employment programmes (e.g. active labour market programmes) and benefits for unemployed people</i> |

Source: ILO. *When the employers recruit apprentices after completion of training as employees
 **The ILO Human Resources Development Recommendation, 2004 (No. 195).
 ILO Toolkit for Quality Apprenticeships Volume I, p.68

Note: Italicised items represent non-monetary or latent costs or benefits

Measuring Costs and Benefits for Governments and Society More Widely:

Measuring the benefits to government and society of apprenticeships and TVET more broadly is a complex task, and long-term benefits are difficult to quantify accurately. TVET systems, and apprenticeships as a program within them, are embedded in national economic structures and have their individual regulations and market realities. Other factors adding to the complexity of cost-benefit analysis include the nature

of different apprenticeship pathways, in vocational schools or work-based, the different levels of private sector engagement and the difference between specific occupations or industries.

For governments, costs for apprenticeships might include direct costs such as salaries for training and inspection personnel (in case of dual apprenticeships), teaching material, equipment and infrastructure and examination fees. Indirect costs such as subsidies or incentives to enterprises to hire apprentices may also exist.

As with all cost–benefit analyses, it is important to view the benefits and costs of apprenticeships over a long time period, not just for the duration of the apprenticeship itself or shortly after, because the positive impacts of training materialize not in the short but rather in the long run (see Figure 2). For governments, both social (non-market) and economic (market) benefits can accrue. An apprentice’s tax contribution increases over time, while at the same time there is a lower likelihood of being unemployed. The state hence yields net benefits both in terms of social rents (both individual and public costs plus positive externalities from increased productivity due to better education) and in fiscal terms: like saving of education expenses (co-sharing of training with private sector) versus increase in higher tax revenues (e.g. higher payroll, more VAT income) and savings on social security payments, savings on employment programmes (e.g. ALMPs) from better trained individuals.

Figure 2: Social costs and benefits



Source: National Audit Office, UK, 2012 in: ILO Toolkit for Quality Apprenticeships Volume I, p.19

What does the research say? Evidence from the field

Enterprise cost benefit surveys for apprenticeships can be traced to Germany in the 70’s. At that time, research focused on investment costs that influenced hiring decisions in firms and less on the short and long term benefits of apprenticeships. Whilst there has been a growth in the number of studies since then, cost benefit analyses of apprenticeships remains an under studied field. Most research takes place in Europe (such as Germany, Switzerland and Denmark), Australia and the United Kingdom, countries that have actively promoted apprenticeships over the years. Otherwise, the research is limited to a number of case studies conducted in recent years, for example in the United States in 2016 (13 companies and intermediaries); India in 2014 (five company cases); China in 2013 (a single enterprise case study); Vietnam (14 cases) and South Africa in 2016 (142 company cases). Studies measuring CB of apprenticeships beyond enterprise or firm level are still rare, perhaps a reflection of the difficulties of measuring social costs or benefits. However, interest in this area is growing. European studies for instance (CEDEFOP, 2017) have been stimulated by significant government investments into apprenticeship programmes and an interest to monitor whether those investments have been worthwhile.

Despite wide differences across these countries and the various methods of calculation applied, overall research suggests that benefits to enterprises learners and society overall in most cases exceed the costs (Comyn & Brewer 2018, p.8).

Benefits to Enterprises:

There is an overall consensus that apprenticeships bring value to enterprises across different trades, sectors and regions. In most cases, even if there is a higher cost at the beginning or during the apprenticeship, over time the benefits even out, in many instances even during the apprenticeship period, like in the case of Switzerland and Spain (Wolter, Mühlemann, 2015). How quickly net benefits are generated depends on the company size, sector, duration of training, the extent to which apprentices are engaged in real work/production processes and whether apprenticeships are subsidized. Studies in the UK found apprenticeships to be sound investments to businesses, with returns ranging from five per cent to 25 per cent across different sectors (Dockery et al., 1998). Data from Switzerland have been shown to receive a benefit of €2,739 per apprentice over a 3 year period (Wolter and Ryan, 2011).

Apart from these monetary benefits directly resulting from the productive contribution of a learner to a company’s business during the apprenticeship, there are a number of further non-monetary benefits, which are however more difficult to measure (see box). Surveys indicated that reduced turnover, improved recruitment, gaining a pipeline of skilled workers and lower injury rates often surpass the costs of paying higher wages after training and running an apprenticeship programme. Other benefits are associated with soft skills like improved employee engagement, greater problem solving abilities, flexibility to perform a variety of tasks and a reduced need of supervision (Hauschildt, 2017). In the case of Germany, the positive impact on the reputation of training companies is highlighted as an important non-monetary benefit that helps to improve the companies’ market performance.

Non-monetary benefits of Apprenticeships:

According to an EU wide survey conducted in 2011 among 21 European countries, companies offering apprenticeships, besides generating net benefits from apprenticeships, have also become more productive due to a higher satisfaction of their co-workers, and less attrition due to an improved organisational culture. Some studies in Australia highlight that apprenticeships contribute to a better knowledge sharing and learning culture within enterprises, when they invest into training, which leads to an improved diffusion of technological innovation and knowledge.

Source: Hauschildt, U., 2017.

Benefits to Individuals:

Registered apprenticeship programmes positively impact personal economic benefits and school-to-work transitions, as shown in studies undertaken in UK, Europe, Canada, Germany and Switzerland (Lodovici et al., 2013). Learners with a qualification gained from an apprenticeship show, shorter unemployment between training and getting a first job and overall a better labour market performance with higher wage premiums and very high returns on investments (Mühlemann, Wolter, 2015) as compared to learners without vocational education (see box). Australian research calculated that apprentices experience a 46.2 per cent return on investment (Dockery, Norris and Stromback, 1998), although it has been found that apprenticeships tend to yield greater advantages in the early stages of an apprentices working life (Ryan, 2000). Some of the main reasons for these positive returns stated are work experience gained, well developed non-cognitive skills as well as a positive work attitude which make apprenticeship graduates more attractive to hire.

Higher individual returns during entire working career:

US: over the whole career, apprentices who completed their apprenticeships would earn US\$ 240,037 (US\$ 301,533 including benefits) more than workers in similar positions who had not done an apprenticeship.

UK: young worker with an apprenticeship can expect a wage premium of up to 43.6 per cent relative to a comparable worker without an apprenticeship.

Source: Reed et al., 2012

Returns on investments in apprentices are however not equal when it comes to sex, race, pre-training competence or educational level, and the sector and firm size where the apprenticeship is organised. Women enjoy lower returns on investments for a shorter period of time. This might also have to do with the choice women make when enrolling in apprenticeships, which have remained primarily clustered in stereotypical women specific occupations, despite the current government efforts to attract women into more gender neutral or male occupations. These occupations result often in less returns with less pay and fewer career opportunities.

Similar observations can be made if a learner has lower education, numeracy and literacy skills. The deficits in languages and mathematics have been found highly disadvantageous for a future career. Consequently, the range of variables affecting potential costs and benefits to individuals from apprenticeships makes the task of calculating returns or benefits a complex one. Despite the progress made during the last two decades,

there is as yet no overall valid explanation for the full range of financial attributes seen in practice within, let alone between, countries.

Benefits to Government and Society:

As mentioned, social costs and benefits, particularly over the long-term, are difficult to quantify. Studies conducted in the UK (McIntosh, 2007) and the US (Reed et al. 2012) show that in these two countries the social benefits of apprenticeships exceed costs, although they were recognised as requiring initial investment by employers, individual apprentices and society/public budgets. The break even periods however, were not identified due to the variables involved.

As cross-country evidence shows in those European countries where apprenticeships are more developed, young people are less likely to be unemployed and have overall better labour market outcomes than in other countries (ILO, 2017a). In addition, compared to associate degree programmes in universities at the same level, apprenticeship programmes increase the probability of having and remaining in a job in France, Germany, Switzerland and the United Kingdom (Lodovici et al. 2013).

Social benefits:

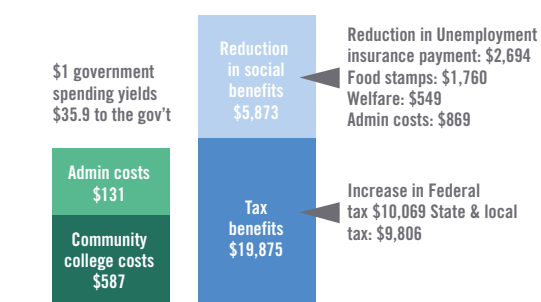
- Lower cost than other VET (shared with private sector)
- Less expenditure on unemployment
- Less other social costs caused in case of unemployment
- More tax revenues
- Returns on investment high:
US 1:35 USD
UK: 1:16/21£

Source: Lodovici et al. 2013,p.9)

Efforts have also been made to consider the wider benefits of apprenticeship schemes, besides resulting in lower unemployment, and higher earnings for learners. They are more cost-effective than other VET schemes, given that apprenticeship programmes are co-financed by the private sector; hence governments can save in expenditures on social security due to such contribution and expenditure for active labour market interventions (e.g. unemployment benefits). The public also benefits from better-quality work, increases in tax revenue and lower social insurance expenditure at little to no social cost.

While a saving effect depends on the cost of welfare schemes, some studies confirm a significant economic return on public investment in apprenticeships over the long term. A review of apprenticeship programs in five US states found a return of US\$27 for every dollar invested, and if potential benefits such as unemployment insurance, food stamps, welfare and administration costs were included, the total benefit rose to more than US\$ 35 for every US\$ 1 spent. In the case of UK, the net present value to the economy of £1 of government investment in apprenticeship training was estimated to be between £16 and £21 (Lodovici, 2013). While available data on the social returns to government from apprenticeship is still very limited, studies on apprenticeships do suggest high returns in terms of lower social security costs and higher tax earnings.

Figure 3: Government costs and benefits over a career (per apprentice)



Source: Mathematica Policy Research (2012) *An effectiveness assessment and cost-benefit analysis of registered apprenticeships*

Consequently, there is some persuasive evidence that on balance the financial and non-financial benefits of funding apprenticeships far outweigh the costs, for enterprises, governments and apprentices alike. Despite the generally positive picture presented in the literature, further quantitative and qualitative studies on the return to employers in specific country contexts are required to support policy efforts to expand the availability of WBL opportunities for learners in the TVET and higher education sectors.

Why should social partners be involved in cost benefit analysis?

Employers' organisations and their affiliated enterprises, trade unions and the Government can all play an important role in promoting apprenticeships by using such evidence on costs and benefits as a social marketing tool to engage more enterprises and learners in quality apprenticeship programs.

Enterprises will participate in apprenticeships programs if they see it makes business sense, and that decision making process is made easier if they have cost benefit information relative to their sector and national circumstances. The analysis of costs

and benefits can be used by governments to decide on policy directions, how to incentivise the uptake of more apprenticeships and steer the employability and wages of apprentices over the long term. Similarly, cost benefit analyses can inform well-functioning social dialogue between workers' organisations, employers' organisations and government which then strengthens career advice and counseling, and the promotion of apprenticeships through skills competitions, job fairs and awareness campaigns to all contribute to increase the status of apprenticeship and awareness about future perspectives amongst students.

Employers' Organizations: play a vital role in promoting skills development for and in enterprises. They should start a discussion with members, showing that apprenticeships have a positive impact on productivity and human resources over the medium to long-term. These discussions can highlight both the financial and non-financial benefits to employers and should be based where possible on real data – that's why more research on the returns from apprenticeships is needed in different countries and industry sectors. Once better data is available, employers' organisations can more easily promote apprenticeships as a means by which firms can take a more strategic approach to talent management.

Workers' Organizations: play a vital role in ensuring that learners looking for training and employment opportunities see apprenticeships as a useful and lucrative path to improved employability and labour market mobility. They can use the results of cost benefit analyses to promote apprenticeships and pursue a career in different occupations. They are also key actors in safeguarding apprentices' rights and entitlements, and ensuring quality training takes place in the workplace. The wages and stipends paid to apprentices should take into account the costs and benefits of delivering quality apprenticeship training in the workplace, and real data is needed for these calculations. Once the respective costs and benefits are known, workers' organisations can start negotiating with employers about increasing the engagement of apprentices while using cost benefit analyses as a social marketing tool.

Governments: can also use cost benefit analyses as part of social marketing campaigns to promote apprenticeships. Their role is also that of a facilitator and regulator, ensuring that social partners implement apprenticeship schemes in an effective and efficient manner. Partnerships are key and employers are key partners given their role in delivering quality training in the workplace. Governments need to understand the costs and benefits of apprenticeships so they can adjust policy settings, determine the right mix of financial and non-financial incentives and ensure that they reap the rewards from more productive enterprises and employable individuals.

International experience shows that, once legal safeguards are in place, employer engagement and constructive dialogue with worker representatives is the most fundamental condition for a successful apprenticeship system. Research indicates that when the social partners collectively manage apprenticeships within a negotiated regulatory framework, benefits to young people are considerable and most effective in addressing youth unemployment. In this way, employer representatives should,

jointly with worker organizations, drive the future of apprenticeships, while the Government should facilitate and oversee the process and ensure that quality and working conditions are maintained (Kuzcera, 2017).

Conclusion:

Information on the costs and benefits of apprenticeships enables evidence based discussion amongst stakeholders about how to strengthen apprenticeship systems. Having evidence at hand can go a long way to dispel the myths that investing in apprentices reaps little financial and other social benefits. Whilst cost-benefit analysis is important in its own right, it should be used with other monitoring and evaluation mechanisms to ensure that apprenticeships not only deliver monetary gain but that they also provide quality learning, adequate remuneration and increased employability.

There are challenges however to obtaining this data. Governments and social partners need to be supported in developing and strengthening institutions for data collection that funds need to be allocated to this type of research. Collecting data can be difficult because it is time consuming and interrogations regarding costs and benefits are not always popular. Data quality is also a factor. As a result, the training and support necessary for enterprises to ensure reliable data collection should not be underestimated.

There is a need for more refined methodologies and easy to use tools which make data collection more accurate and less onerous. When considering apprenticeship costs, more attention should be given to recruitment costs and the impact of subsidies and incentives, whereas with benefits, more focus should be given to assessing the long term economic and non-market benefits. As enterprise performance is significantly influenced by a positive work culture, understanding the qualitative contribution of apprenticeships should be given priority. Although there are challenges to quantifying them, qualitative interrogation for measuring job satisfaction and work morale, social cohesion and intergenerational collaboration would be possible instead. Empirical evidence can then support the argument that apprenticeships boost productivity and the overall work culture in enterprises and therefore ensure the sustainability of the enterprise. For individuals, additional surveys are recommended which assess not only monetary costs and benefits of apprentices but also non-monetary benefits of completion and career progression.

Greater effort should be made to document the costs and benefits of apprenticeship training so that social partners and the community more broadly can be better informed about this important pathway to enhanced employability, enterprise performance and social returns.

References

- CEDEFOP 2017. Investing in skills pays off: the economic and social cost of low-skilled adults in the EU. Luxembourg: Publications Office. Cedefop research paper; No 60.
- Comyn P.; Brewer L. 2018. Does work-based learning facilitate transitions to decent work? Employment Working Paper No. 24 (ILO Geneva).
- Dockery, A.M.; Norris, K.; Stromback, T. 1998. "The social return to apprenticeship training", in Australian Economic Review, Vol. 31, No. 1, pp. 37–46.
- Hauschildt, U. 2017. Methodologies to measure costs and benefits of in-company apprenticeship training Drafted recommendations towards a methodology for a field study in South Africa. Discussion Paper, ILO.
- International Labour Office. 2018. ILO Toolkit for Quality Apprenticeships Volume I: Guide for Policy Makers. Skills and Employability Branch (ILO Geneva).
- . 2017b. Defining work-based learning, unpublished discussion paper, Skills and Employability Branch (ILO Geneva).
- Kis, V. 2016. Work, train, win: work-based learning design and management for productivity gains. OECD, Education Working Paper No. 135
- Kuczera, M. 2017. Striking the right balance: Costs and benefits of apprenticeship. OECD Education Working Papers No. 153 (OECD, Paris).
- Lodovici, M.; Comi, S.; Origo, F.; Patrizzo, M.; Torchio, N. 2013. The effectiveness and cost benefits of apprenticeships: Results of the quantitative analysis. (Brussels, European Commission).
- Lerman, R. 2014: Do firms benefit from apprenticeship investment?" IZA World of Labour 2014:55
- McIntosh, S. 2007. A cost-benefit analysis of apprenticeships and other vocational qualifications. University of Sheffield, Research Report No. 834. London, Department for Education and Skills.
- Organisation for Economic Co- Operation and Development (OECD). 2016a. Education at a Glance 2016: OECD indicators. (Paris).
- Rauner, F.; Smith E. 2010: Rediscovering Apprenticeship: Research Findings of the International Network of Apprenticeship (INAP). Springer Netherlands.
- Reed, D., Yung-Hsu Liu, A., Kleinman, R., Matri, A., Reed, D., Sattar, S. and Ziegler, J. (2012), An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship in 10 States, Mathematica Policy Research, Washington.
- Rothboeck, S. 2014. Using benefit cost calculations to assess returns from apprenticeship investment in India: Selected SME case studies, ILO Asia Pacific Working Papers Series (Geneva).
- Ryan, P. 2000. "The institutional requirements of apprenticeship: Evidence from smaller EU countries", in International Journal of Training and Development, Vol. 4, No. 1, pp. 42–65.
- Wolter, S.; Ryan, P. 2011. "Apprenticeships", in Handbook of the Economics of Education, Vol. 3 (London, Elsevier), pp. 521–576.
- Wolter, S. Mühlemann S. 2015: Apprenticeship training in Spain – a cost-effective model for firms?. A cost-benefit simulation study commissioned by the Bertelsmann Stiftung and the Fundación Bertelsmann.

'This policy brief is an output of the Skills that Work Project, a development cooperation project implemented by the ILO and funded by the JP Morgan Chase Foundation'

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