

Chapter 5

Industria 4.0: Tackling weak skill demand and poor skill use in Italy

This chapter discusses the recent set of measures that goes under the name of Industria 4.0 and how this has the potential to boost the demand for skills in Italy by helping the country to transit to the use of new digital technologies and innovative production strategies. The chapter discusses how technical and soft skills will become increasingly important in the adoption of these new technologies. The chapter also discusses the importance of lifelong learning to ensure that workers of all ages are part of the digital revolution and contribute meaningfully to Italy's growth.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

The increase in data availability (e.g. big data) that has been triggered by the dramatic expansion in the use of new digital interfaces and by the increase in computational power poses challenges to countries and workers as to how to adopt and adapt to these technological changes. These mega-trends, however, represent an enormous chance to reshape and upgrade economies' productive systems and to rethink the associated skills of a country so as to become more competitive, productive and enjoy higher living standards.

Italy, more than other countries across the OECD, is likely to struggle to adjust to these technological changes as the skills of its workforce will need to go through a substantial transformation. Albeit difficult, this transition can also lead to great rewards.

The Italian Government has recently introduced a set of ambitious industrial measures with the objective of igniting a radical shift of the Italian productive system towards the use of new and high value-added technologies. The set of reforms goes under the name of *Industria 4.0* (I4.0), recalling the terms used to identify the digital revolution that is taking place across many developed economies (Box 5.1) and that is radically changing their manufacturing sectors.

Box 5.1. A revolution 4.0

The terms “Industry 4.0” are used to define the recent phase in the digitisation of the manufacturing sector, driven by four disruptions: the rise in data volumes, the increase in computational power and connectivity, especially new low-power wide-area networks; the emergence of analytics and business-intelligence capabilities; new forms of human-machine interaction such as touch interfaces and augmented-reality systems; and improvements in transferring digital instructions to the physical world, such as advanced robotics and 3-D printing. The four trends are not the reason for the “4.0,” however. Rather, this is the fourth major upheaval in modern manufacturing, following the lean revolution of the 1970s, the outsourcing phenomenon of the 1990s, and the automation that took off in the 2000s.

Source: McKinsey, <http://www.mckinsey.com/business-functions/operations/our-insights/manufacturings-next-act>
[Manufacturing's next act.](#)

Big Data Analytics, Cloud Computing, Industrial Internet, Additive and Advanced Manufacturing (i.e. 3D printing and interconnected robots) are among some of new technologies that the I4.0 measures aim to stimulate through a mix of public and private investments in new infrastructures, R&D initiatives and programmes to upskill the Italian workforce. The skill component of the I4.0 measures is, therefore, pivotal for its implementation and success. Several challenges lie ahead, however, and these are discussed below.

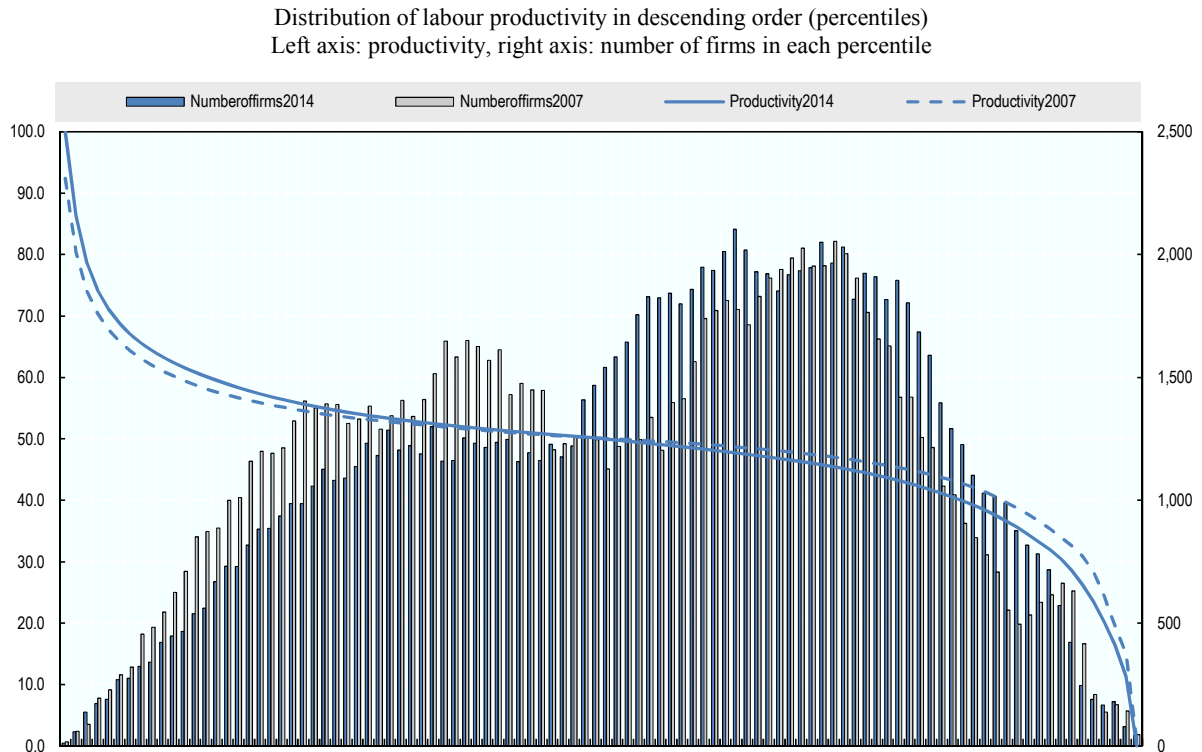
Distance from technology frontier, firm size and lack of product diversification help explain the Italian sluggish skill demand...

The complexity of the challenges facing the implementation of the I4.0 measures revolves around (at least) two intertwined aspects; the distance of the Italian productive system from the so-called “*technology frontier*” (e.g. the extent of the Italian technology gap) and the weaknesses of its workforce's skills (e.g. how “skill-ready” Italian workers and managers are to switch to I4.0 technologies).

While the analysis of the multiple reasons behind the long-standing Italian *productivity puzzle* is beyond the scope of this review, the relationship between firms' size and productivity assumes particular relevance to explain the skills challenges that Italy will have to face when implementing the I4.0 measures.

Recent evidence from *Confindustria* (2016) shows that the low level of Italian aggregate productivity is the reflection of the high variability in the performance of large and small firms. A polarised picture emerges when analysing Italian productivity: some (few and relatively large) firms are highly productive while others (many and relatively small firms) show extremely low productivity levels.¹ Empirical evidence (Figure 5.1) suggests that the productivity gap between large and small Italian firms has increased in between 2007 and 2014 and that fewer larger firms are now converging towards the world “technology frontier” (e.g. the highest productivity levels experienced in other countries). An increasing number of smaller Italian firms, instead, is unable to absorb innovations developed elsewhere and, as a consequence of it, they show extremely low productivity levels.

Figure 5.1. Productivity in manufacturing sector by centiles, 2014 and 2007



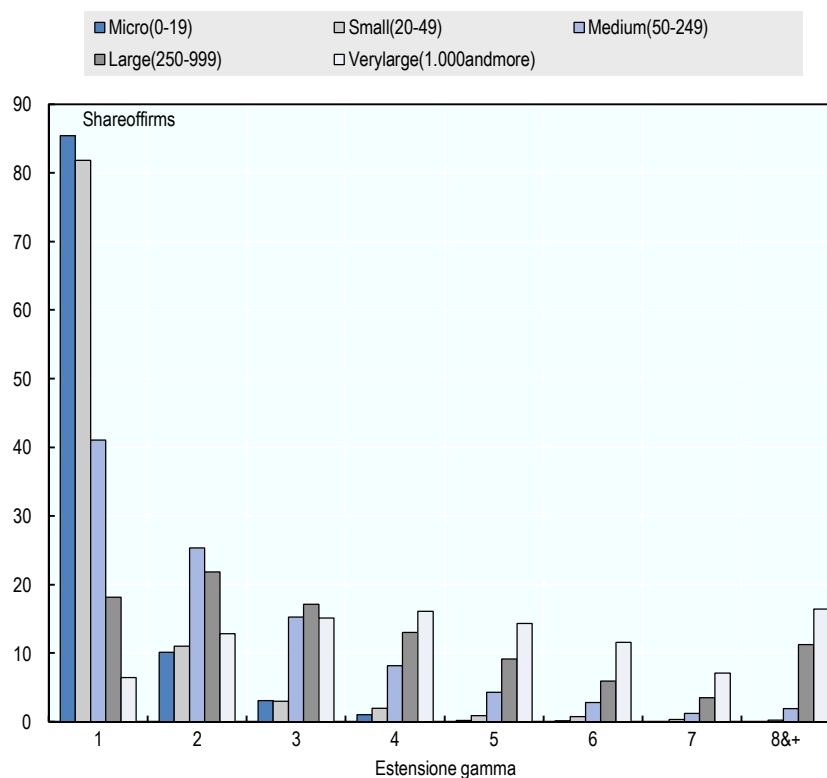
Source: Centro Studi Confindustria on data of Bureau Van Dijk.

Evidence from *Confindustria* (2016) also suggests the existence of a threefold relationship between i) product diversification (e.g. the number of different products produced by each firm), ii) firm size and iii) the extent and quality of skills demand in Italy.

In 2013, 65.4% of Italian firms was specialised in the production of one single good, 15.4% in that of two and only 7.6% in three different products. The number of

firms showing a more diversified production pattern (e.g. producing ten or more different goods) was only 0.8%. Figure 5.2 shows that product diversification is strongly correlated to firm size (and so to productivity levels). Some 85% of small Italian firms (e.g. those with less than 20 employees) produced only one good in 2013, no firms of that size produced more than five different products. Conversely, only 6% of large firms produced only one good and around 16% produced more than eight different products.²

Figure 5.2. Firms size and product diversification in Italy



Source: Centro Studi Confindustria.

Being small is, therefore, associated to a less diversified and innovative production. This, in turn, leads to a weaker demand for skills. Data from Excelsior (2016) show that, on average across all sectors in Italy, around 30% of firms that are developing new products or services will also recruit new workers in the coming year. The share of firms recruiting new workers decreases substantially (14.4%), instead, among those that are not developing new products³ and that remain anchored to their traditional productive patterns.

The reasons for recruiting new workers (and to attract human capital and skills) are, therefore, very different between large and small firms. Table 5.1 shows that large and more productive/innovative firms tend to recruit new human capital mostly due to the expansion of the enterprise and, crucially, to develop new products and services which will require a highly skilled workforce for the firm to compete in larger international markets.

Some 36.3% of small firms (less than ten employees) that plan to recruit in the coming year will do so, instead, due to an increase in the demand for their goods. Expansion, internationalisation and development of new goods and services are only seldom the reason to hire new workers for the many small Italian firms.

It is evident that both i) the skill needs of large and small firms i) and the reasons to recruit are, therefore, radically different. A set of few/large/innovative Italian firms seeks workers with high/technical skills to reinforce their position in global and international markets. Smaller firms, instead, react to upward (or downward) swings in the demand for their goods. In good times, this means hiring workers, but in bad times the recruitment and skill needs may cease.

The fact that the skill needs of small firms depend on short-term cyclical demands may also lead them to invest less in the development of the skills of their workforce, as this tends to be recruited to fill immediate labour gaps rather than to pursue a strategic vision for the future. The different reasons to recruit across large and small firms can also help explain the different “quality” of skills that firms seek in the labour market. Larger firms are usually after technical and high skills to develop new and more technologically advanced products while the needs of small firms are driven by production in traditional sectors and, therefore, less skill demanding.

Table 5.1. Recruiting and its reasons across firms in Italy by firm size

Firm size	Foresee hiring	Growing demand	Firm expansion	Internalisation of jobs	Development of new products	Replacement of workers in retirement	Seasonal activities	Other
1-9	11.0	36.3	3.9	1.9	3.4	22.6	20.2	15.7
10-49	29.9	34.1	4.5	3	3.4	31.7	15.3	16
50-249	65.1	26.8	8.7	6.4	5.6	44.5	14.5	24.2
250-499	91.2	15.4	18.8	12.3	9.6	61.8	23.8	21.5
500+	97	9.5	19.1	10.4	11.1	70.3	27.7	22.9

Source: Excelsior: La domanda di professioni e di formazione delle imprese italiane (2015).

It is interesting to notice that a similar pattern can be observed when analysing the propensity to recruit across geographical areas in Italy and the associated reasons (Table 5.2). Firms in the more productive and technologically advanced Northern regions foresee to recruit more workers than do firms operating in other areas of the country. The development of new goods and services are, again, among the most important reasons for firms in the North to hire new workers. Swings in the demand for goods are, instead, driving recruiting needs of the more traditional firms in the Centre and South/Islands regions.

Table 5.2. Recruiting and its reasons across firms in Italy by geographical area

Firm size	Foresee hiring	Growing demand	Firm expansion	Internalisation of jobs	Development of new products	Replacement of workers in retirement	Seasonal activities	Others
Nord Ovest	16.3	28.9	6.3	4.4	4.9	37.9	16.1	18.6
Nord Est	18.5	29.7	6.2	3.8	4.6	36	19.7	16.4
Centro	15.7	31.6	6.4	3.4	4.4	31.9	19.6	17.5
Sud e Isole	15.6	37.5	5.9	3	3.9	22.7	21.6	17.2

Source: Excelsior: La domanda di professioni e di formazione delle imprese italiane (2015).

The polarisation observed between, on the one hand, few/large/innovative and skill-intensive firms (operating mostly in the north of the country) and the many/small/traditional and skill non-intensive firms in the south of Italy can help make sense of the evidence for which a large supply of low-skilled workers can coexist with large shares of over-skilled workers and, at the same time, with large shares of under-skilled workers and shortages in certain sectors.

On the one hand, the large share of under-skilled workers⁴ and the emergence of skill shortages are the reflection of the skill needs and demands of big and productive firms that the Italian workforce (being generally low-skilled) is not able to fill. On the other hand, the large shares of over-qualified workers emerge as the result of the weak demand for skills coming from the many small and traditional firms for which even the low-skills of the Italian workforce results to be eventually in excess.

All in all, it appears that the skills of the Italian workforce are *trapped* at a level which is too low to satisfy the demands of large firms, but too high relative to the weak demand of small ones.

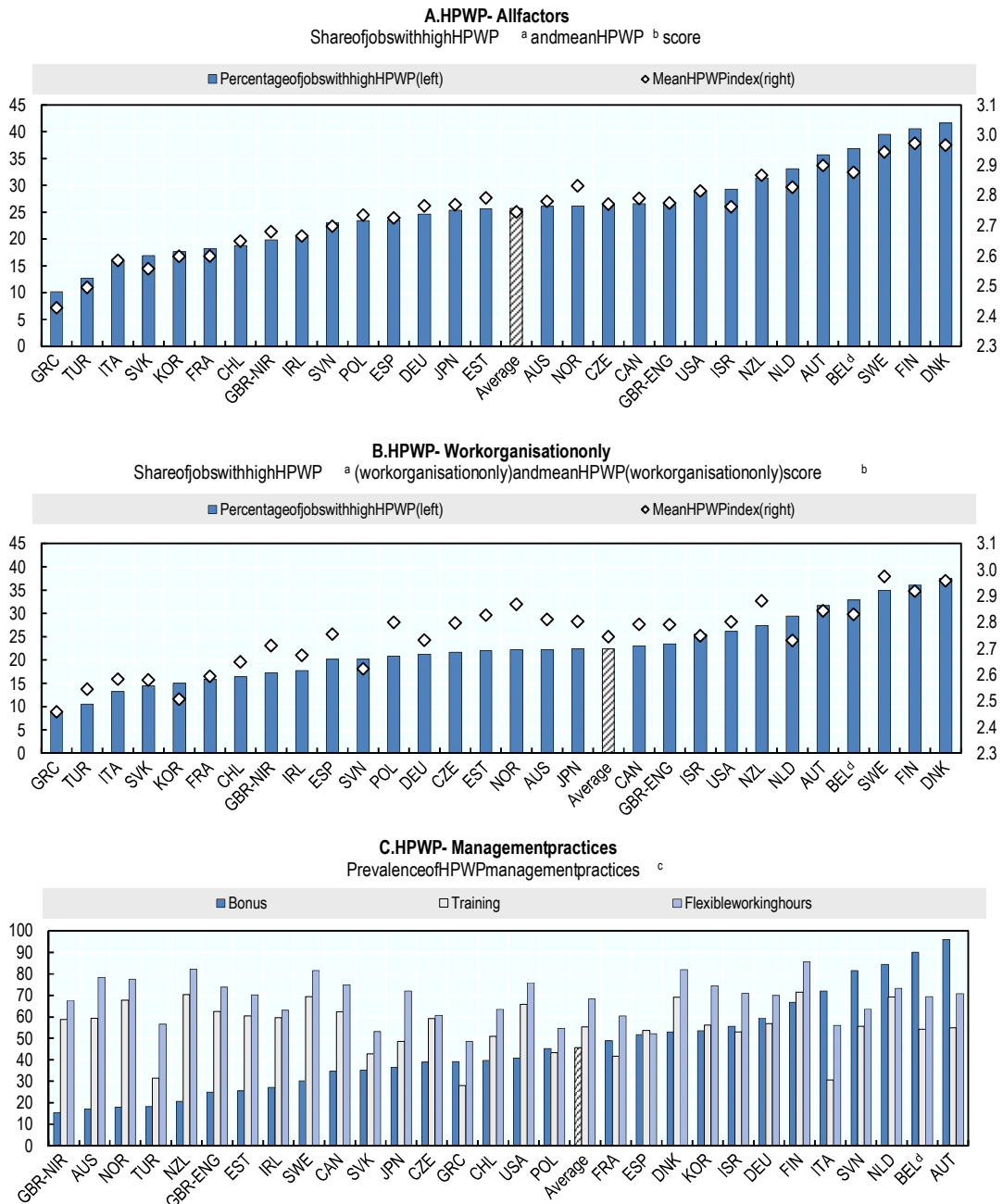
...but I4.0 can ignite a virtuous circle if managerial skills are boosted at all levels

The small size, low productivity and limited product diversification of many Italian firms represent a major challenge to the Italian skill system as this situation is leading to a weak demand for skills in most sectors while creating shortages in few others.

Industria 4.0 can play a pivotal role in boosting the Italian sluggish skill demand by helping smaller firms to become more innovative, connected to the world technology frontier and open to international markets. Achieving this result, however, requires strengthening the entrepreneurial and managerial skills of Italian employers to make them pro-active actors of the digital revolution.

Bandiera, Prat and Sadun (2013) provide empirical evidence for the hypothesis that firms' management structure affects the performance of the firms and that family CEOs seem to weaken it. Weak management practices are a long-standing issue in Italy as the share of family owned and managed firms is very high. Figure 5.3 shows that Italy ranks very low in the share of jobs with high performance workplace practices (HPWP).⁵ The use of flexible hours or of training is especially low by international standards and too many workers in Italy end up in jobs where their skills are not used and/or developed effectively. While larger firms show better results in terms of HPWP than smaller ones, work organisation practices in Italy are still extremely low across firms of all sizes (Figure 5.4).

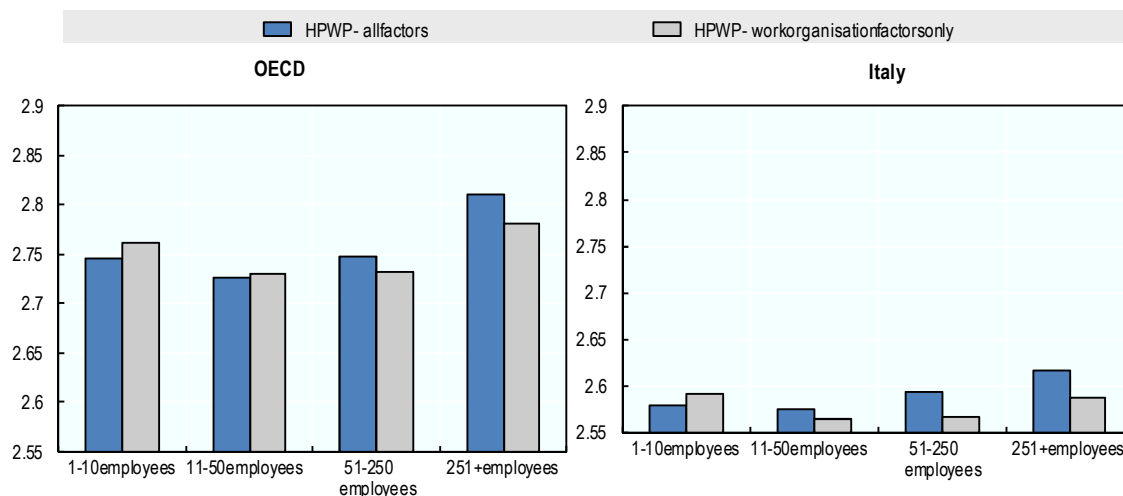
Figure 5.3. High-performance work practices across countries



- a) Share of workers in jobs where the summary HPWP is above the top 25th percentile of the pooled distribution.
- b) Average value, across jobs, of the HPWP index. The HPWP index is a sum scale of all subcomponents shown in Figure 2.9 (Panel A) or summing the scales of the work organisation subcomponents only (Panel B).
- c) Share of workers receiving bonuses (bonus), having participated in training over the previous year (training) or enjoying flexibility in working hours (flexible working hours).
- d) Data for Belgium corresponds to Flanders.

Source: OECD Survey of Adult Skills (PIAAC), 2012, 2015.

Figure 5.4. High-performance work practices in Italy and OECD by firm size



Source: OECD Survey of Adult Skills (PIAAC), 2012, 2015.

Several commentators, many of them also among employers, acknowledged the fact that Italian “family” managers lack, in many cases, the key skills needed to face the challenges prompted by globalisation and internationalisation (see also OECD, 2017c). This weakness, peculiar to the Italian tradition, contributes to the vicious circle for which Italian firms remain small and concentrated in traditional sectors, making use of low skills and producing (with some notable exceptions) low value-added goods.

Identifying the skill needs of a firm as well as planning the adequate training programmes to meet those needs is one of the main challenges for Italian managers. Managers, especially those in small firms, struggle to identify their own firm-specific skill needs and, while some tools exist to retrain and upskill managers (e.g. *Formazienda*), their use is still limited.

Against this backdrop, *Assolombarda* (the employers’ organisation in the Lombardia region) in collaboration with *ECOLE (Enti Confindustriali per l’Education)* recently implemented the pilot programme *T.I.M.E (Training Innovation Management Experience)*. This programme, targeted to SMEs, provided personalised counselling services to SMEs’ managers to guide them through the steps that are needed to effectively identify their skill needs and to plan adequate “skill development programmes”. The approach is based on the construction of a “*skill needs grid*” where different types of skills and qualifications are inputted based on the observation of the average skill needs of similar firms, sectors and industries. SMEs participating to *T.I.M.E* then use this generic grid/list to identify their specific needs (and discard others that do not apply to their specific case). Once skill needs are identified, tailored training and upskilling programmes for their workforce are developed.

Advocates of this simple, but effective, approach argue that this could be scaled up at the national level⁶ to design a more comprehensive skills-needs grid that will help firms that struggle to express their skill needs, to do so more effectively. Similarly, others argued that this tool (or similar ones) could be used by policy makers to monitor skill demands to implement more coherent policy interventions⁷ at the local level.

14.0 has developed tools to help firms absorb the change and react to low-skills challenges

As mentioned above, many Italian firms lag far behind the technology frontier and the skills of both managers and employees should be boosted if Italy wants to transit towards the use of new I4.0 technologies. Raising awareness (and not only skill proficiency) among employers and employees about the potential economic returns that stem from the use of new technologies is, however, equally important as many Italians are not familiar with the use of new technologies (Box 5.2).

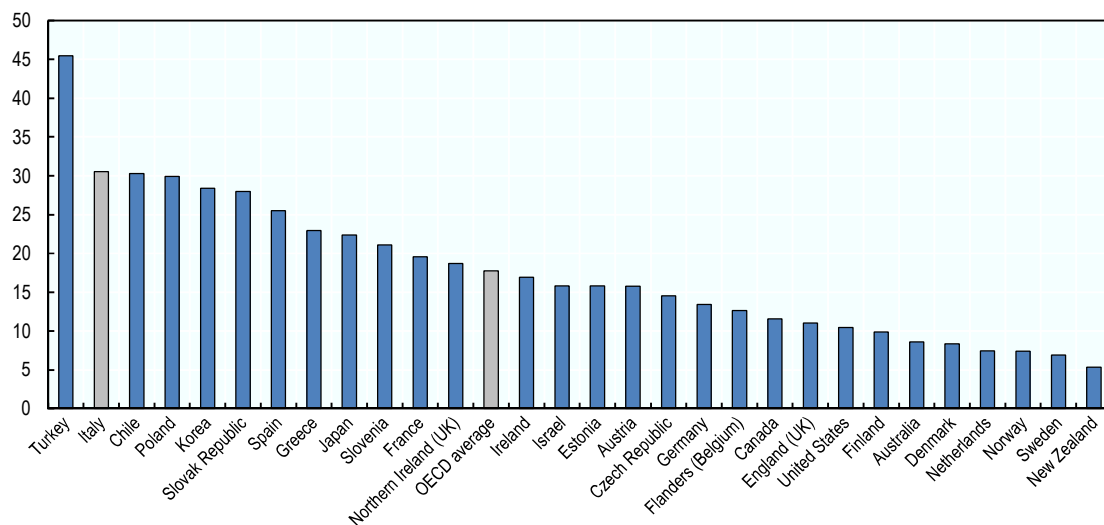
Box 5.2. Information and communication technology (ICT) is not used enough in schools

In 2013, some 31% of lower secondary teachers in Italy reported that they use ICT “frequently”, or “in all or nearly all lessons”, for project or class work with students – compared to an average of 40% across OECD countries. In 2012, a majority of 15-year-old students (57%) reported that they do not use the Internet at school during a typical school day (the OECD average was 36%). A lack of preparation among Italian teachers may contribute to below-average levels of the use of ICT. Indeed, even if 53% of lower secondary teachers reported in 2013 that they had participated in professional development activities, over the previous year, to improve their ICT skills for teaching, some 36% of teachers – the second-highest proportion among countries participating in the OECD Teaching and Learning International Survey (TALIS) – still reported a high level of need for developing their ICT skills.

Source: OECD (2016), *Education at a Glance: OECD Indicators*.

Much more than in other OECD countries, firms, employers and employees in Italy are, in fact, not familiar with the use of ICT technologies (Figure 5.5). This represents a major impediment to the take-up of the I4.0 measures in the first place.

Figure 5.5. Italian adults lack ICT skills

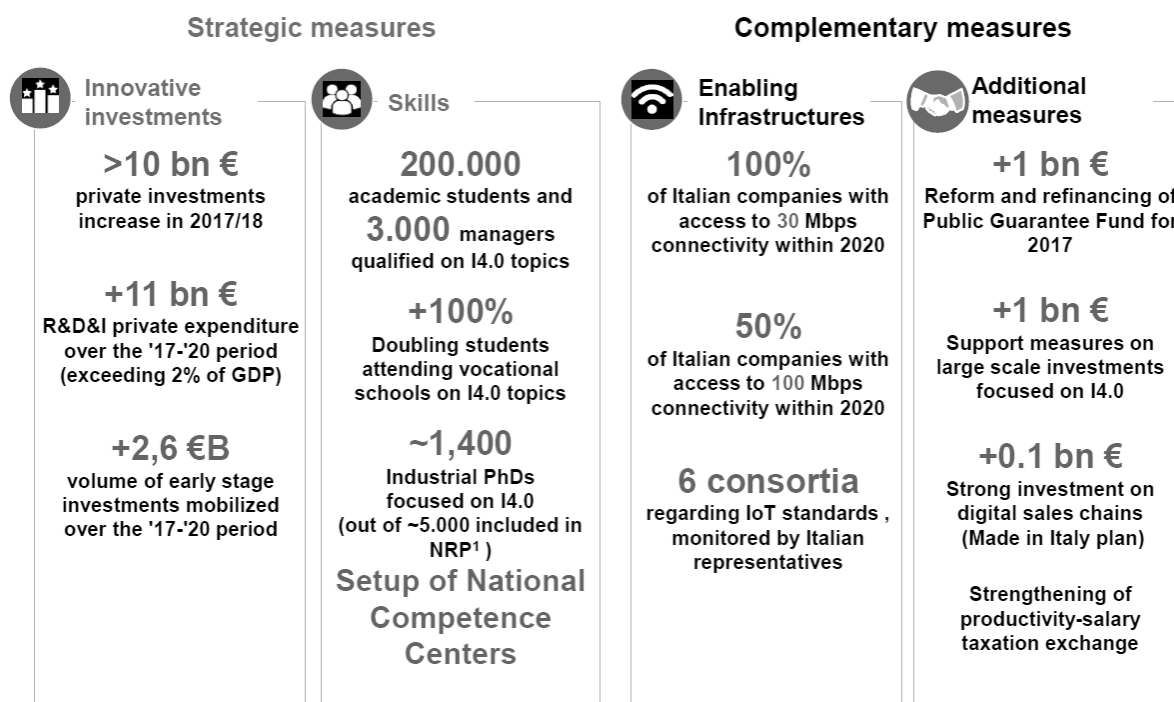


Source: OECD Skills Outlook 2013.

The incentive structure behind the I4.0 measures is largely based on the assumption that the combination of i) better information on the potential of new technologies, ii) public investments in developing technology infrastructures (i.e. Digital Innovation

Hubs – DIH, and Competence Centres) and iii) education programmes boosting the ICT skills of the workforce will eventually trigger private investments which will, then, lead to the adoption of the new I4.0 technologies (Figure 5.6).

Figure 5.6. *Industria 4.0* National Plan: 2017-20 targets



Source: Steering committee *Industria 4.0*.

A “hyper and super-depreciation” tax benefit scheme has been designed for firms investing in new tangible assets, devices and technologies enabling companies’ transformation to “*Industria 4.0*” standards. Similarly, a tax credit of up to 50% on R&D investments has been designed to encourage private investment in Research and Development for product and process innovation so as to boost the competitiveness of Italian enterprises in the future. In the plans of the government, the tax credit is going to be comprehensive as it applies to all expenditure on basic research, industrial research and experimental development: hiring of highly qualified and technically specialised employees, research agreements with universities, research institutes, enterprises, innovative start-ups and SMEs, depreciation on laboratory equipment and instrumentation, technical know-how and industrial property rights. This financial measure is meant to support innovative enterprises at all stages of their life cycle and to spur the creation of Italy’s start-up ecosystem by enhancing firms’ business culture, innovation and openness towards international markets.

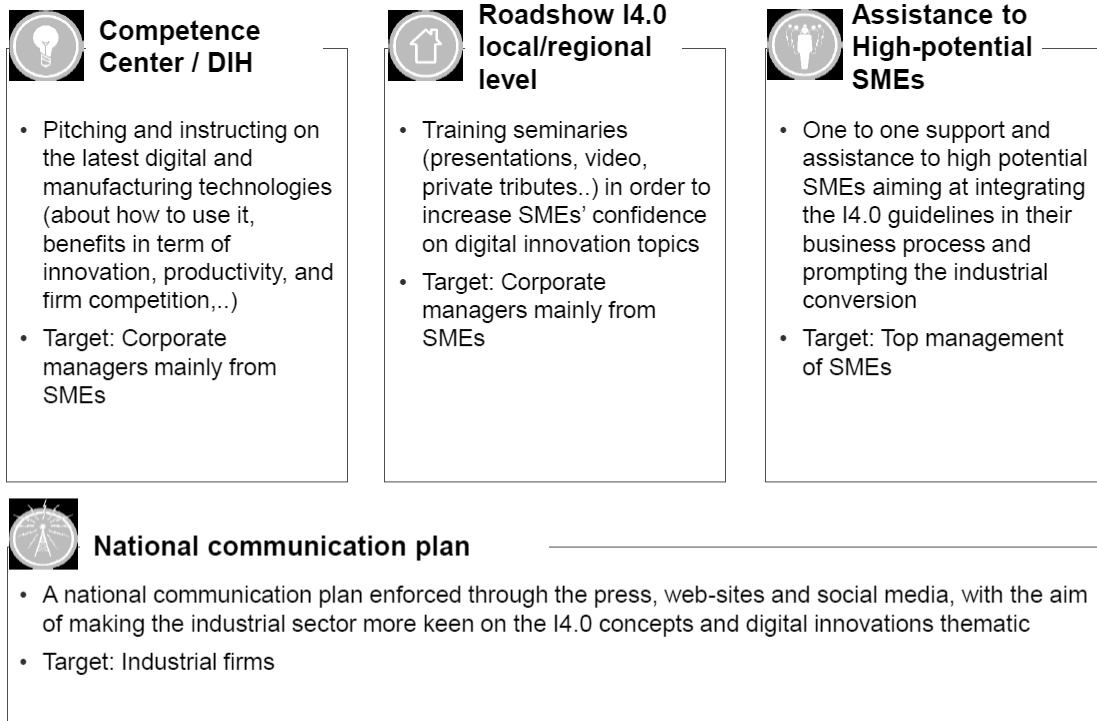
A recent analysis carried out by the Observatory MECSPE and SENAF⁸ suggests that around half of Italian firms foresee to increase investments in technologies I4.0 by around 10% in the coming year. The increase in investments is linked to the new I4.0 incentives planned by the government as well as to the recent improvements of the manufacturing sector more generally. That being said, only half of the firms interviewed by SENAF declare to have a clear vision on how to integrate the

I4.0 technologies in their production streams. Around 30.6% of SMEs contacted by SENAF reported to have invested in technologies related to cybersecurity, 20.7% in robotics, 20.1% mechatronics, 16.5% in cloud-computing technologies and 16.2% in simulation-related technologies. The integration of many of these technologies is perceived to be important by SMEs and 79% of the interviewed believes it can positively affect the optimisation and quality control of production processes. Similarly, half of firms believe that I4.0 technologies will play a key role in the management of real-time supply chain as well as in the remote control of production and in the optimisation of energy consumption.

To spur the buy-in of the set of new measures, the Ministry for Industry and Economic Development (MISE) designed an “Awareness” plan aiming at informing employers (especially those of SMEs) about the use and potential productive returns of new ICT technologies applied to manufacturing. Tailored demonstrations, informative sessions and discussions on the productive-enhancing potential of new technologies are at the core of the plan (see Figure 5.7).

Figure 5.7. The “Awareness” plan to disseminate *Industria 4.0*

Awareness Blazoning the acquaintance of “*Industria 4.0*”



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Source: Ministry of Economic Development (MISE).

The Awareness Plan provides tailored support not only to small firms but also to top managers of larger enterprises.⁹ Other training and awareness activities have been recently launched by several other stakeholders (Box 5.3).

Box 5.3. Check-up Industry 4.0 and Vanguard: Leading by example initiative

The *Associazione per le Piccole e Medie Imprese* (Association for SMEs – API) and SIAM 1838, a well-established TVET provider, recently launched the “check-up Industry 4.0” initiative. This involves building up a team of technology experts and engineers with the aim of contacting firms all over the Italian territory to show the potential uses and the returns of new technologies applied to their local context. The one-day training is targeted to firms that are potentially interested in digitalising part of their production. The training ends with a survey of the firm’s skill needs that will help them identify the best way to tackle future skill imbalances and challenges.

In Emilia Romagna, the ASTER consortium for technology transfer and innovation launched the Vanguard Initiative to promote the I4.0 measures through the creation of demonstration plants where employers can easily gauge on the real effectiveness of new technologies applied to production. It has been argued, in fact, that part of the technological gap experienced by small firms is due to the hesitations of small firms to invest in technologies whose economic returns and usability is not clear to the manager.

While demonstration plants can be fundamental in increasing awareness of the returns of different technologies, these plants are relatively expensive, especially when these are designed to satisfy the needs of different types of firms. More funds should be made available to experience similar to Vanguard as they prove to be useful information channels for SMEs to familiarise with I4.0 technologies.

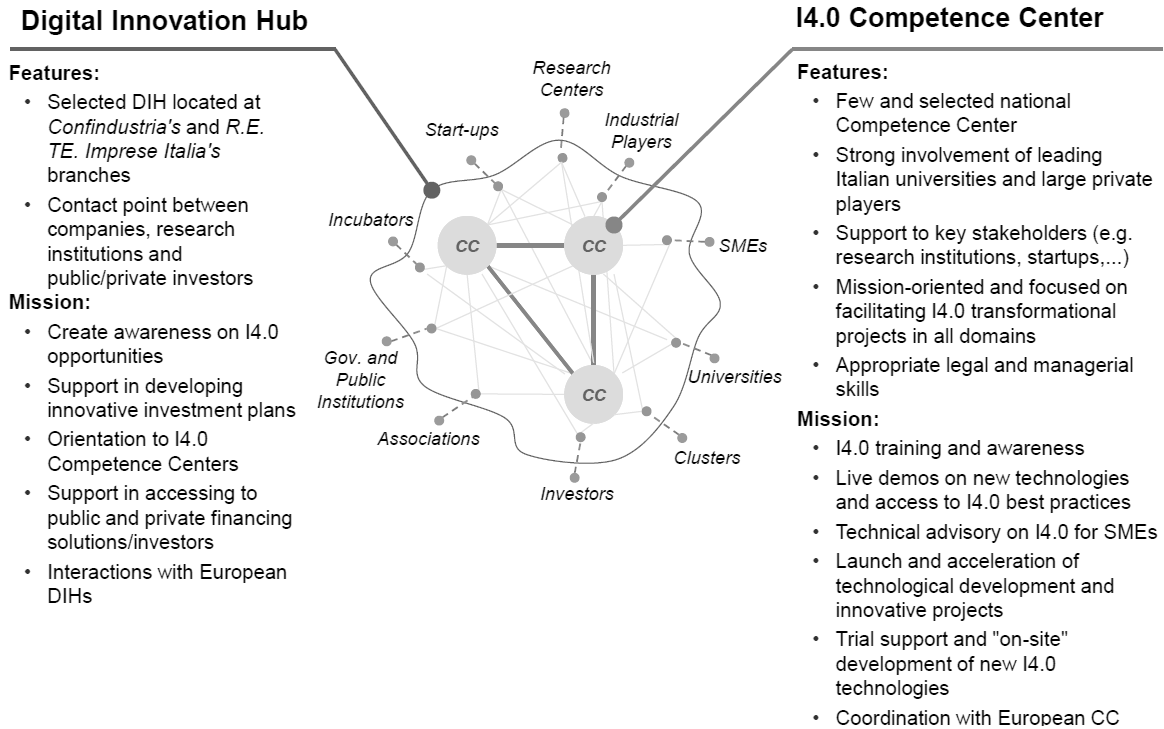
Source: Associazione per le Piccole e Medie Imprese (API), <http://www.apmi.it/>.

The I4.0 measures foresee the allocation of substantial public investments in technology infrastructures and in the creation of Digital Innovation Hubs and Competence Centres (Figure 5.8). These infrastructures and technology platforms are expected to create a bridge between Italian firms demanding I4.0 skills and the stakeholders (universities, research centres but also schools) that are in charge of creating the supply of workers with technology-intensive skills.

Interestingly, many of the skills that will be key for the successful adoption of the I4.0 measures are expected to materialise as the result of the *Buona Scuola* through the implementation of the *Alternanza Scuola Lavoro* and the *Digital School* reform or the establishment of ITS foundations in key technological areas.

As an example, around EUR 355 million (see Table 5.3) will be invested¹⁰ in the implementation of a National Plan for the Digital School to promote Italian youth’s digital skills through work-based learning activities. Many of these activities will be financed through funds allocated to the ASL¹¹ and are eventually expected to create the supply of skills needed to absorb the I4.0 revolution. Technology laboratories and tailored education programmes will also be financed through funds channelled from the *Buona Scuola* reform. Around EUR 70 million will be, for instance, invested in potentiating ITS foundations that offer programmes aligned to the skills required by the I4.0 measures.¹²

Figure 5.8. Skills: Digital Innovation Hub and I4.0 Competence Center



Source: MISE, MIUR website.

While this shows a very much welcome high degree of policy coherence between the different sets of interventions pursued by the Italian Government, it also poses the fundamental question of whether the implementation challenges to the *Buona Scuola* reform (see above) – if not addressed successfully – will translate into additional hurdles potentially hindering the implementation of the I4.0 measures too. Constant monitoring of the two sets of reforms and support to their simultaneous implementation will be key to extract full returns from the efforts that the Italian Government is putting forward.

Table 5.3. Guidelines for *Industria 4.0* to develop relevant skills

Key directives: Skills

Cumulated investments 2017-2020

Initiatives	Private investment	Public investment
Implementation of the National Plan for the Digital School- Directives <i>Skills for manufacturing 4.0: creative ateliers, technology courses and laboratories I4.0</i> <i>Territorial labs: linkages education-firms, development of digital skills for the Made in Italy</i> <i>Digital CVs: development of 25 CV with a digital focus on I4.0 areas</i> <i>Computational thinking: development of computational and quantitative skills in the primary</i> Focus on the Alternanza Scuola-Lavoro on tracks relevant for the I.40	0	355
Specialised university courses, masters and master executive in areas of the I4.0. Development of partnerships with technology and industrial players Increase in the number of students in ITS in areas connected to I4.0	30	70
Boost to technological clusters "Smart Enterprise" and "Agrifood" <i>Linkages with other technological clusters and industrial stakeholders</i> Boost to PhDs in technologies related to I4.0	70 approx.	170
Creation of selected Competence Centres at the national level in areas of the I4.0	100	100
Lifelong learning through the Fondi Interprofessionali	<i>Budget under approval</i>	
Total	200 approx	700 approx

Source: Adapted from the Ministry of Economic Development (MISE).

Adapting to a “hard” revolution requires “soft” skills

Technical skills are certainly crucial to adopt and use new technologies. Boosting their supply will be key for the implementation of the I4.0 measures in Italy. That being said, several commentators argue that the labour market challenges stemming from rapid technological change can be effectively addressed only through a combination of hard and soft/transversal skills. While a commonly agreed definition of soft skills does not exist, they generally encompass skills or character qualities such as leadership, initiative, adaptability and persistence. The growing importance of social skills in the labour market has already been documented in the literature (OECD 2017a). Deming (2015), for instance, shows that in the United States employment growth in jobs with high social skill requirements has been substantial in the last decades. Growth has been particularly strong in jobs that combine high levels of both cognitive and social skills. It is argued by many that technological progress could be a potential explanation for the growing importance of social skills, as social skills cannot (easily) be automated.

Skills that allow to easily switching from one occupation to others (or between tasks within the same occupation) will be increasingly important in the future. *Learning to learn* will be one the crucial characteristics of future workers' skill set as this will help them adopt and adapt to new technologies and face rapid changes in labour market demands.

A recent survey¹³ run across four European countries shows that, on average, employers' perception towards the adequacy of young individuals' soft skills is rather negative. Some 48% of the employers indicate that youth lack written communication skills as well as “self-critical” and “conflict management” interpersonal skills. Flexibility, the ability to make a professional introduction or being punctual are among the skills that employers struggle to find in young graduates and, in many cases (46%), the lack of one of these skills results in employers discarding an otherwise suitable candidate for the advertised vacancy.

Italy is not an exception. In the opinion of Italian employers and heads of human resources interviewed by the *Fondazione Agnelli*,¹⁴ most Italian graduates lack adequate soft and transversal skills. As highlighted by Mangano (2014), the heads of human resources of large firms such as Edison, EPTA or Bosch acknowledge that education titles and qualifications are nowadays outdated recruitment criteria and that excellent work performance can only be obtained by a combination of technical and transversal skills.

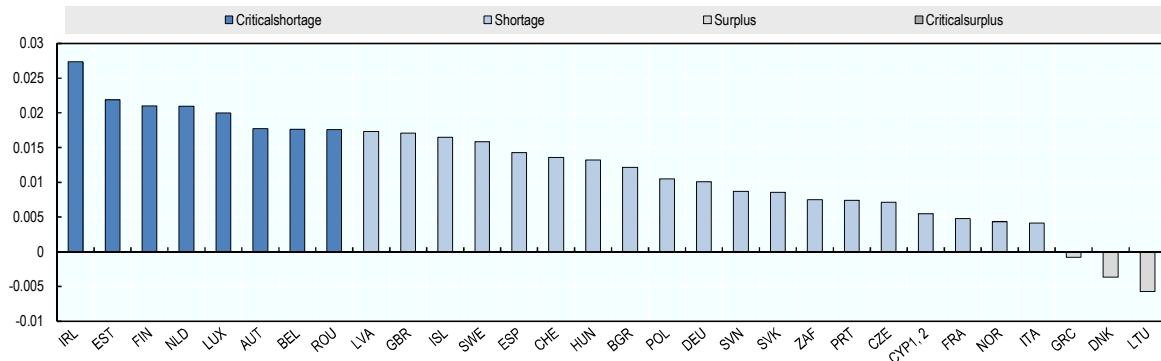
Internationally comparable measures of soft skills are difficult to find. The new *OECD Skills for Jobs Database* provides cross-country evidence on imbalances across several different types of soft skills (Figure 5.9). When compared to other countries, Italy shows small shortages in skills such as adaptability and leadership. More substantial shortages are, instead, found in areas such as that of “persistence” in the face of obstacles and, especially, in the one related to the “attention to details” (e.g. being careful about detail and thorough in completing work tasks).

If soft skills will be increasingly important in the future, one key skill challenge for most countries lies in finding suitable ways to help students develop these skills throughout the period they spend in education. This is, indeed, an extremely complex task as soft skills are, in most cases, developed through interpersonal interaction, social context and personal and work-related experiences.

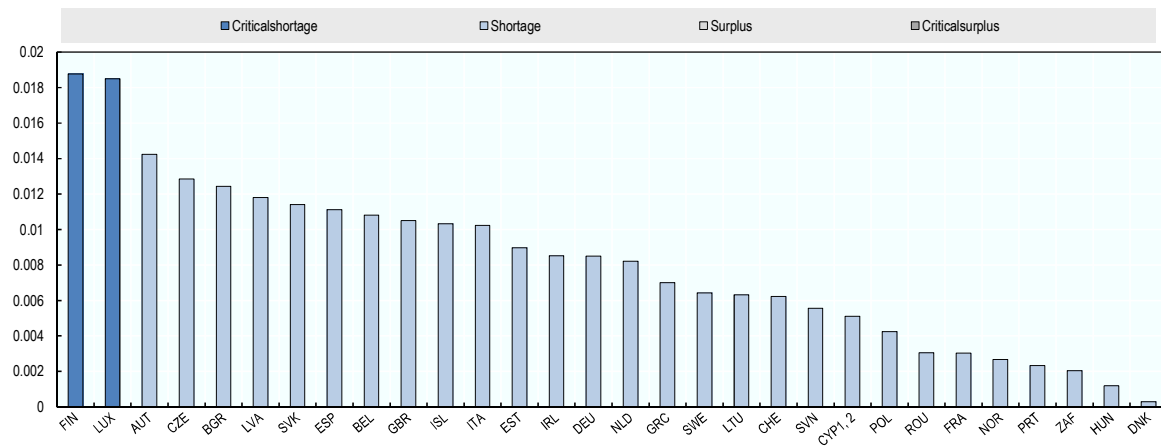
Schools and teachers can play an important role as educators and provide support to students in developing soft skills through innovative teaching methods. The Italian education system seems, however, to be unprepared for this challenge. As an example, Italian school and universities have historically favoured traditional teaching over innovation (Figure 5.10). Several commentators also argue that Italian schools and universities focus too much on delivering strictly disciplinary contents and that soft and transversal skills are, instead, learnt only later at work.

Figure 5.9. Selected imbalances in soft skills

Panel A. Adaptability/Flexibility



Panel B. Attention to details



Panel C. Leadership

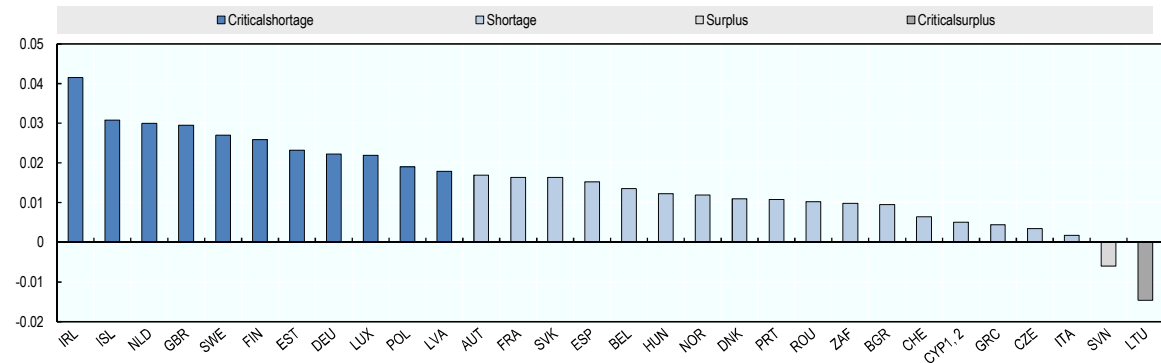
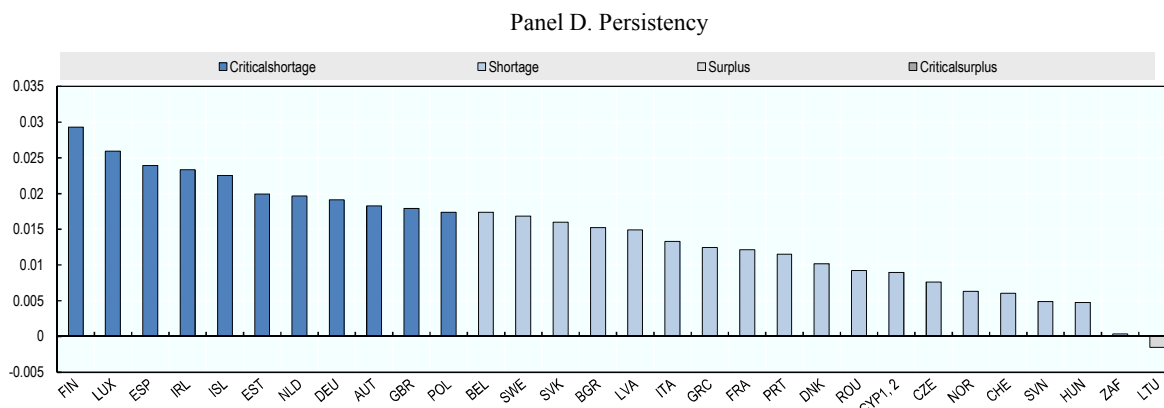


Figure 5.9. Selected imbalances in soft skills (cont.)

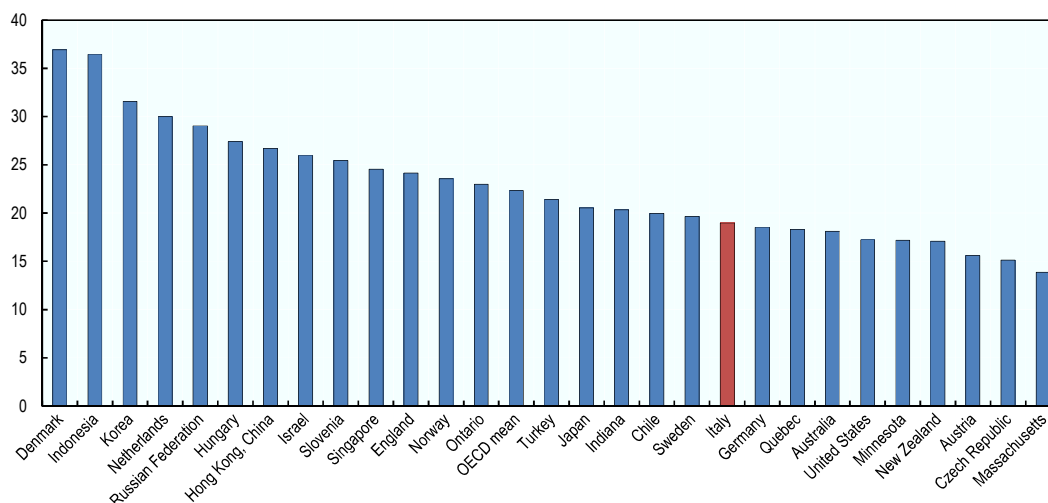
Note: Latest available year.

Critical shortage (darker blue) is defined as the observations in the top quartile of the positive skill imbalance values across countries and skills. Critical surplus (darker grey) is defined as the observations in the bottom quartile of the negative values. Values for the Work Styles dimension vary between -0.019 and 0.053 across countries.

1. Note by Turkey: The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

2. Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Source: OECD Skills for Jobs Database.

Figure 5.10. Overall composite education innovation index, 2000-11

Note: The composite innovation index is based on average absolute effect sizes of changes reported across a set of indicators in Measuring Innovation in Education: A New Perspective (2014). A large value on the index shows that changes have occurred across different aspects of that education system, whether reductions or increases in a particular practice. Each set of indices, including the overall indices is calculated separately; it is not possible to sum two or more sets of indices to replicate this overall measure.

Source: Measuring Innovation in Education: A New Perspective (2014).

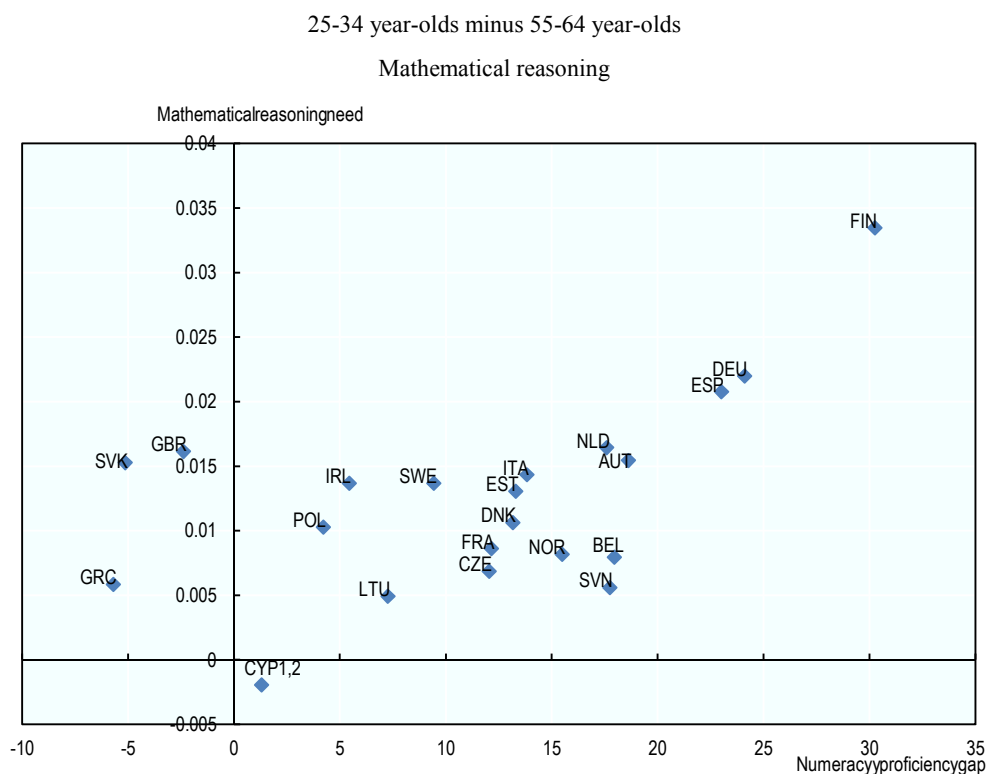
Building bridges between education and the world of work is a good strategy to “teach” students work-relevant soft skills such as team-working, punctuality and flexibility. The *Alternanza Scuola-Lavoro* (ASL) reform (see above) is certainly a step in the right direction as this provides support to young students in developing technical skills while also familiarising with soft skills such as punctuality or team work. If anything, more effort should be put into strengthening these experiences to reinforce and broaden the skill set of young Italians.

Lifelong learning should be strengthened to support adult workers in adapting to changes in skill needs induced by technological progress

Across countries, the Adult Skills Survey (PIAAC) shows that older individuals (55-64) have significantly lower proficiency in literacy and numeracy than their younger counterparts (25-32). This can be explained both by differences in quantity and quality of education across generations (i.e. cohort effect) and the deterioration of skills with age (i.e. age effect). Better skill use and on-the-job training could reduce skill gaps between younger and older workers (Paccagnella, 2016).

Results from the *OECD Skills for Jobs Database* (2017a) also show that in countries where the cognitive skill gap between older and younger workers is bigger, shortages in key information processing skills could be expected to be bigger. Figure 5.11 confirms this relationship for mathematical reasoning (but similar results are found for reading comprehension and written expression). Results show that, in countries where the gap in numeracy proficiency between young and old cohorts is larger, the shortages in mathematical reasoning are also substantially large and that the comparatively lower skills of older cohorts drive such shortages. Italy shows moderate differences between the skill of young and older cohorts (both similarly low) and slightly above-average shortages of mathematical reasoning.

Rather than being comforting, this evidence points to the need for Italy to raise the skills proficiency of all workers and that such improvement needs to take place across all age groups equally. Evidence in Figure 5.11 shows that neglecting the importance of developing and maintaining the skills of adults and older workers can lead countries to suffer significant shortages in key-processing skills. All this is especially important in the context of the I4.0 measures that have been recently implemented in Italy and that have the potential to reshape its skill demand towards the use of technology-intensive skills of workers of all ages. Italy is in the position to anticipate these future changes and to reap full benefits from it by boosting its lifelong learning system.

Figure 5.11. Link between age-related skill gaps and information processing skill shortages

Note: For literacy and numeracy proficiency United Kingdom only includes England, Belgium only includes Flanders.

Skill proficiency gaps are corrected for gender, education, immigrant and language background and parents' educational attainment.

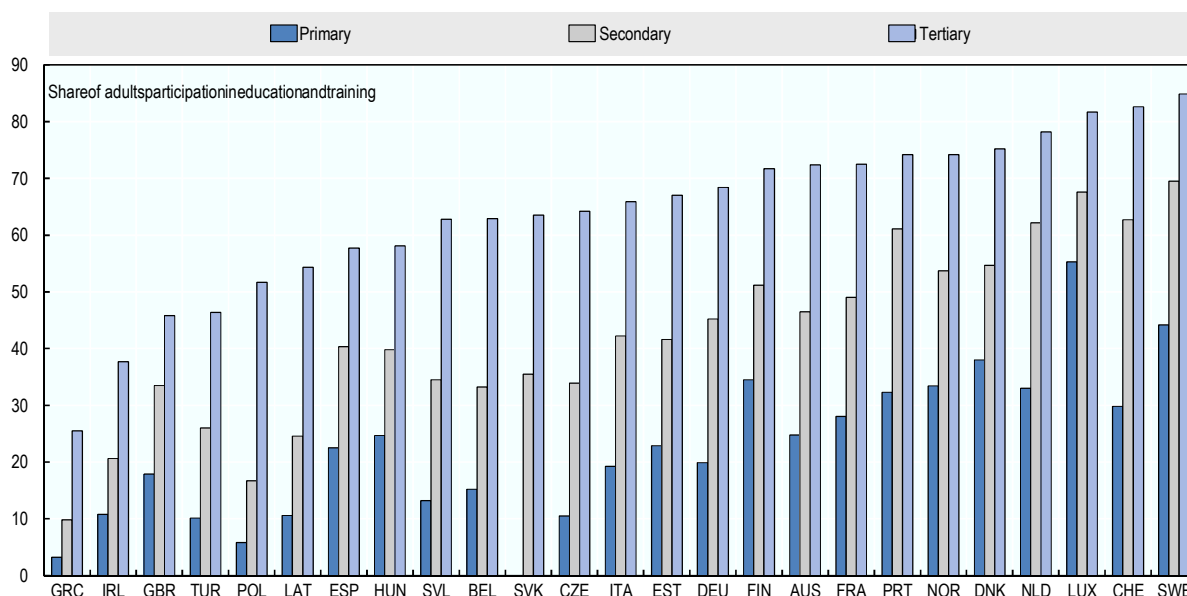
1. Note by Turkey: The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

2. Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Source: OECD Skills for Jobs Database, PIAAC.

While young workers are in a relative better position to fill the skill gaps that are likely to emerge from the adoption of new technologies, older workers can (should) also play an important role in the implementation of the I4.0 measures. The risk is, in fact, that older workers – less familiar with new technologies – may be displaced and mismatched when I4.0 technologies are adopted in the production workflows of firms.

Retraining and upskilling programmes can help workers of all ages to become familiar with new technologies and to reduce the depreciation of their skills induced by rapid technological change. Italy, however, lags behind other countries when it comes to the participation of adult workers in education and training (Figure 5.12).

Figure 5.12. Adult education in Italy

Note: Share of adults (aged 25-64) participating in education and training refers to year 2011.

Source: OECD (2017b) *The Next Production Revolution: Implications for Governments and Business*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264271036-en>, using Eurostat, Adult Education Survey and Secretariat calculations using PIAAC.

The reasons behind this poor result can be several. Commentators argued, for instance, that public funds for training are not easily accessible to firms, especially to small ones. Burdensome administrative procedures limit the use of available funds for retraining and LLL.¹⁵

The recent economic crisis has also had a considerable impact on training and LLL activities in Italy. A survey conducted by API (2014) on a sample of firms that requested financial assistance to local regional governments through different channels (FCI, FSE and *Fondi Interprofessionali*) shows a reduction in training activities carried out by firms (34.8% on average). The reduction has been especially sharp in firms operating in the North-East and Centre regions of Italy (Table 5.4).

Table 5.4. Consequences of the crisis on training providers by geographical area, 2012

	Total	North-west	North-east	Centre	South and Islands
Sample	100	35.8	8.8	25.6	29.8
Reduction in training activities	34.8	39.4	57	40.1	18
Reduction in teaching personnel	27.5	23.1	6.3	21	44.6
Recruitment through atypical contracts	12.8	7.1	14.8	10.1	21.4
Delays in paying staff	10.7	10.1	7.6	15.6	8.1
Introduction of flexible work arrangements	6.8	12	1	5.8	3
No information	7.5	8.4	13.3	7.4	4.9

Against this backdrop training providers have tried to diversify their offer (47.5%) and retrained their own workforce (12.9%) to provide training programmes that are

more aligned to labour market needs, responding more effectively to the requests of employers. Much needs, however, to be done to ease the access to funds for training to small firms and to reduce administrative burden to promote innovative retraining and LLL programmes. Data from Excelsior (2016) highlights that the training provided to workers to perform new tasks – and so to face the upcoming challenges of the labour market – has been steadily decreasing in between 2009 (18.8%) and 2015 (11.4%). Regional difference emerge also (Table 5.5) in the quantity and quality of training provided by firms as the north of the country provides substantially more training to its workforce than the south and centre of the country. This result is also likely to be the reflection of the different size of firms across the territory as medium and larger firms provided training in 64 and 82% of the cases respectively while micro (1-9 employees) and small (10-49 employees) firms have provided training in merely 16 and 30% of the cases.

Table 5.5. Firms that provided training in 2015

Percentage

Size	Total	Training to new hires	Upskilling or re-training of current employees	Training of current employees to perform new tasks
1-49	16.5	3.4	85.2	11.3
10-49	30.6	3.5	84.4	12.1
50-499	63.9	6	83.9	10.1
500	81.7	19.7	67.9	12.4
North-west	23.4	4.6	84	11.4
North-east	24.1	5.6	81.9	12.5
Centre	19.5	4.8	83.8	11.4
South and Islands	16.9	3.4	86.4	10.2

Source: Sistema Informativo Excelsior 2016 – La domanda di professioni e di formazione delle imprese italiane.

Adult and lifelong learning passes through the activities of local networks

Over time Italy has developed robust local networks with the objective of providing adult and lifelong learning opportunities to both employed and unemployed individuals. These local networks consist of several different actors and stakeholders whose activities span from the provision of formal to informal training. Apart from traditional education and training providers, the *Poli Tecnico-professionali* (Technical-professional Poles) play a fundamental role in aligning the provision of training to the needs of local labour markets.

As highlighted by ISFOL (2017) universities, businesses, chambers of commerce and the Internal Migration Observatory (*Osservatorio sulla migrazione interna*) are also integrated in the local networks for lifelong learning with the idea of spurring the development of a wide and varied supply of training alternatives for Italian workers and unemployed.

Within the broad range of actors involved in lifelong learning in Italy, a special mention goes to the *Centri Provinciali d'istruzione per gli adulti* (CPIA – Provincial Centres for adult education). The CPIA are involved in two key activities. On the one hand, they are responsible for the provision of formal education and training to adults

at the secondary level. On the other hand, they are also involved in the validation of competences and skills of adult workers as well as in their guidance and in counselling activities. While the activities of the CPIA are mainly targeted to meet skill and training needs at the local level, with the view of favouring a tailored approach to skill development in the territory, CPIA have also formed a national network, the “*Rete Italiana Istruzione degli Adulti*” (Italian National Network for Adult Education – RIDAP) which aims to further strengthen the existing tools to monitor prior learning and skills acquisition (both formal and informal) across the whole national territory.

At the tertiary level, the *Poli Tecnico-professionali*, the Universities and the AFAM (*Alta Formazione Artistica e Musicale*) supply a similar service which spans from the validation of skills and competencies to the provision of flexible programmes with the view of satisfying the training needs of a varied audience of adults. Similar to the CPIA, 33 Italian universities have also developed a national network to promote lifelong learning at the tertiary level, the *Rete Universitaria Italiana per l'Apprendimento Permanente* – RUIAP. This national network is integrated in the European experience of the EUCEN (<http://www.eucen.eu/>) whose objective is to encourage high standards in all areas of lifelong learning and to harmonise levels and quality of lifelong learning among its international members.

The wide range of stakeholders operating at the local level can help tailoring the provision of training opportunities to the needs of the territory but, at the same time, the articulated structure and linkages across stakeholders can potentially end up in the delivery of heterogeneous services across regions. While the creation of the national networks (RIDAP and RUIAP) already mitigates the co-ordination challenges, the recent legislative decree 150/2015 has also promoted the creation of a specific network, the “*Rete dei servizi e delle misure di politica attiva del lavoro*” (network for the provision of active labour market policies) that puts the new National Agency for Active Labour Market Policies (ANPAL) at the centre of such network, bridging and linking the activities of other existing stakeholders such as the *Istituto nazionale Assicurazione Infortuni sul Lavoro* (INAIL), the Public Employment Service centres, the Inter-professional funds (see later), INAPP, the chambers of commerce and universities as well as secondary schools. Careful monitoring of the effective co-ordination across these stakeholders is imperative, especially in the aftermath of the constitutional referendum that has modified the prerogatives and role that the Jobs Act foresaw for the ANPAL (see Chapter 6).

Fondi Interprofessionali can be powerful tools to develop skills...

While financial constraints may be an important barrier for small firms to provide training and LLL to their employees, several tools do exist in Italy to support companies in keeping their workforce’s skills up to date. Among the most important ones are the *Fondi Interprofessionali* (Inter-professional Funds). The *Fondi Interprofessionali* finance training plans at the sectoral and regional level that firms, either alone or in association, may decide to create for their employees. The inter-professional funds can also finance individual training plans, as well as additional educational activities.¹⁶ Training plans may also involve employees with apprenticeship contracts and project.

A recent report (ISFOL, 2017) highlights the strengths and weaknesses of the functioning of the system. Despite an increase, in 2014, in the number of workers involved in training supplied through the inter-professional funds, this upward trend

has reversed in 2015. The most updated figure (ISFOL, 2017) reports 1.3 million firms participating to the *Fondi Interprofessionali* in 2016, with 1.255 million adhering to the funds providing training to workers and approximately 29 000 to the funds to train managers.

The important resources available and the number of firms adhering to the training plans are challenged by the fragmented allocation of funds to activities other than training. ISFOL (2017), highlights how, over time, part of the funds have been diverted from training to pursue other strategic objectives of the firms and have been used, for instance, as welfare measures and for the *Cassa Integrazione Guadagni* (CIG). Strikingly, in 2016, out of the EUR 781 million available, only 62% have been devoted to training initiatives. Similarly, in between 2009 and 2016, 20% of resources have been devoted to activities other than training.

In a context where Italian workers are low-skilled and shortages are pervasive in specific key knowledge areas, it is imperative for Italy to take a closer look at the way inter-professional funds are used and to limit the extent by which these are employed for purposes other than the upskilling and retraining of firms' workforce and managers.

While the share of funds allocated to training activities has to increase vis a vis other uses, the content of the training courses has also to improve as funds are employed, in too many instances (26% of the times), to provide training in areas that are already compulsory *ex lege*, as for instance, in the area of safety at the workplace.

A closer look at *Fondimpresa*

The largest¹⁷ inter-professional fund in Italy is *Fondimpresa*. Firms adhering to it devote 0.3% of the social security contributions paid to the National Social Insurance Agency (INPS) to the fund and, in return, they can access 70% of these contributions to develop training plans and LLL activities for their workers.

The funds allocated to training plans need to be approved by the board of directors of *Fondimpresa* which is composed by representative of social partners (CGIL, CISL, UIL and Confindustria). It is interesting to notice that the 74 614 training programmes approved by *Fondimpresa*¹⁸ until 2014 sum up to almost EUR 2 billion of investments in training activities. These have involved around 4 million workers and 56 000 firms.¹⁹

The considerable financial resources available through *Fondimpresa* make the fund a remarkable tool to address skills imbalances through LLL and tailored courses to adapt to the rapid changes in labour market needs. It is, therefore, fundamental that the training programmes funded through this channel really meet the skill needs of firms and that resources are not diverted, instead, to activities other than developing the necessary skills to address future labour market challenges.

...training programmes should better target the true skill needs of firms

Since its inception, *Fondimpresa* has grown considerably. It still remains, however, a tool that is used primarily by SMEs in the manufacturing sector (51.3% of adhering firms) and in the Lombardia region (23.1% of employees involved in the activities). When analysing the information on the recipients of training programmes (*Fondimpresa*, 2016) data show that the training activities mostly involved older workers. Up to 55% of participants were age 45 or above and 21% were age 55 or

above. Only 14% of workers was age 33 or below. Most workers participating to the training activities were low-skilled (38%) while workers with a tertiary degree were involved considerably less (16% of participants). Training Programmes involved a relatively low share of women (around 30%).²⁰

While many Italian workers are lacking basic ICT skills, have only basic knowledge of foreign languages and lack a wide range of soft and hard skills, too much of the Fondimpresa's training funds has been used to provide courses in areas that are only marginally related to the development of those skills that would be needed to tackle the challenges arising from rapid technological change and globalisation.

Information from Fondimpresa (2016) shows (Table 5.6) that around 39.4% of activities (49.4% of total workers involved in training) were devoted to courses on "safety in the workplace" (*sicurezza sul lavoro*).²¹ Though important, the training on safety regulations in the workplace is already compulsory by law and it should be provided by employers by default.

The allocation of funds to provide training on safety regulations frustrates the spirit and objectives of the Fund to act as a tool to provide workers with a flexible tool to adapt their skills to the challenges arising from rapid technological change and globalisation. It is imperative, therefore, to boost the provision of courses to develop language or ICT skills by diverting resources to these programmes from others that are, instead, financing less relevant training programmes.

Table 5.6. Training areas of the *Conto Formazione of Fondimpresa*

	Areas of the Conto Formazione Plan 2016			
	Actions (% total)	Hours of training (% total)	Participants (% total)	Cumulated hours (% total)
Personal abilities	16.9%	14.6%	16.8%	18.2%
Other	2.0%	2.3%	2.5%	3.0%
Accounting - finance	1.2%	1.7%	0.9%	1.3%
Business and management	5.9%	7.8%	4.2%	6.5%
Environmental impact	1.0%	1.3%	0.9%	1.1%
ICT	7.4%	10.8%	5.2%	9.3%
Clerical skills	0.4%	0.3%	0.3%	0.3%
Languages	9.3%	19.2%	4.2%	9.4%
Marketing and selling	4.9%	3.9%	5.4%	4.2%
Quality	4.2%	4.6%	3.7%	4.6%
Safety at the workplace	39.4%	21.3%	49.4%	30.7%
Production techniques	7.5%	12.1%	6.4%	11.2%
Total	100.00%	100.00%	100.00%	100.00%

Source: Fondimpresa (2016).

Notes

1. While similar results can be found in other countries too, the large share of small firms in Italy makes the problem more prominent than in other countries and so, also, the productive gap more evident.
2. Estimates from Confindustria point to a potential increase in GDP per capita of 7.3% if Italian firms were able to increase the variety of their production by 10 percentage points.
3. A similar pattern, where innovative firms recruit new workers twice as much as firms that stick to their traditional products, is observed when analysing each productive sector separately.
4. The percentage of under-skilled workers in Italy is the highest across OECD countries participating to the OECD Survey of Adults Skills.
5. HPWP include both aspects of work organisation – such as team work, autonomy, task discretion, mentoring, job rotation, applying new learning – and management practices – such as employee participation, incentive pay, training practices and flexibility in working hours. The Survey of Adult Skills collects information on a number of job aspects that are often associated with HPWP, including: whether workers have any flexibility in deciding on the sequence of tasks they perform, how they do the work, the speed of the work, and working time; how often they organise their own time and plan their own activities; how often they co-operate or share information with others; how often they instruct, teach or train other people; whether they participated in education/training in the previous 12 months; and whether they received a bonus payment.
6. The TIME pilot project was carried out in the Lombardia region only.
7. Commentators also argued that the scaling up of such programmes needs a clear separation between training providers and bodies assessing skill needs in order to avoid potential conflicts of interest.
8. <http://www.mecspe.com/>, <http://www.senaf.it/senaf/chi-siamo/>.
9. The immediate returns from the use of I4.0 technologies may be larger in larger firms, at least in the early phases of the implementation of the I4.0 measures. This, in turn, may stimulate the interest of other, smaller, firms and contribute to the buy-in of the reform.
10. Investments are for the period 2017-20.
11. Commentators argued that, while boosting youth's digital skills is fundamental in the long-run, the appeal of these measures to overcome the *current* skill deficiencies of the Italian workforce is very limited and, as such, the impact of these tools to tackle the skill needs urged by the implementation of the I4.0 measures.
12. A similar boost to investments in research doctorates in I4.0 areas is foreseen as well as investments to strengthen technological clusters.

13. App-titude project: <http://www.vfu-ffi.be/fr/outils/app-titude/>. The countries covered are the Netherlands, France, Luxembourg and Belgium.
14. Fondazione Agnelli funded a study carried out in collaboration with the GRISU (*Gruppo di Ricerca Interdisciplinare sui Sistemi Universitari*), AlmaLaurea and Unioncamere/Excelsior to analyse graduates and employers' perception towards the importance of soft and transversal skills in the labour market: http://www.dafist.unige.it/?page_id=1898/09062011IRAPPORTODILAVOROCARED.pdf.
15. As an example, public funds for training can only be accessed by firms with a minimum number of employees and training funds for self-employed are rare and barely used.
16. As detailed in the Law 148 of 14/09/2011.
17. In terms of employees and firms involved across the national territory.
18. For the sole financing channel of the “Conto Formazione”.
19. See “Le Attività di Fondimpresa” (2016).
20. Training programmes are concentrated in male-dominated areas such as the construction, metal mechanic and chemical sectors.
21. Similar shares (44.5%) are found when looking at all interprofessional funds, see ISFOL (2017). As for Conto Formazione, this marks an increase in both hours and workers involved in courses focusing on safety at the workplace since 2014 were the figures were (38.4 and 48.6% respectively).

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