

R1

Research Report on training best practices on sustainability and circular economy





This work is licensed under CC BY-NC 4.0. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/4.0/>

ABSTRACT

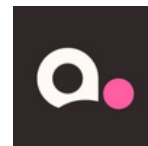
The project aims at establishing a European VET Academy on Circular Economy, based on a transnational cooperation of a very experienced and complementary partnership, (including associated partners), joining Research centers, Vet centers, University, SMEs, clusters, Umbrella organizations and international networks, public administrations, that will work together as an ecosystem to increase capacity building and responsiveness of the VET systems, according to an “European Education Area”.



Università
degli Studi
di Ferrara



Wuppertal
Institut



Co-funded by
the European Union

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

2021-1-IT01-KA220-VET-000033123

LEARN MORE ABOUT PROJECT



The Circular Education



The state-of-art of the Educational Path for the sustainability and circular economy

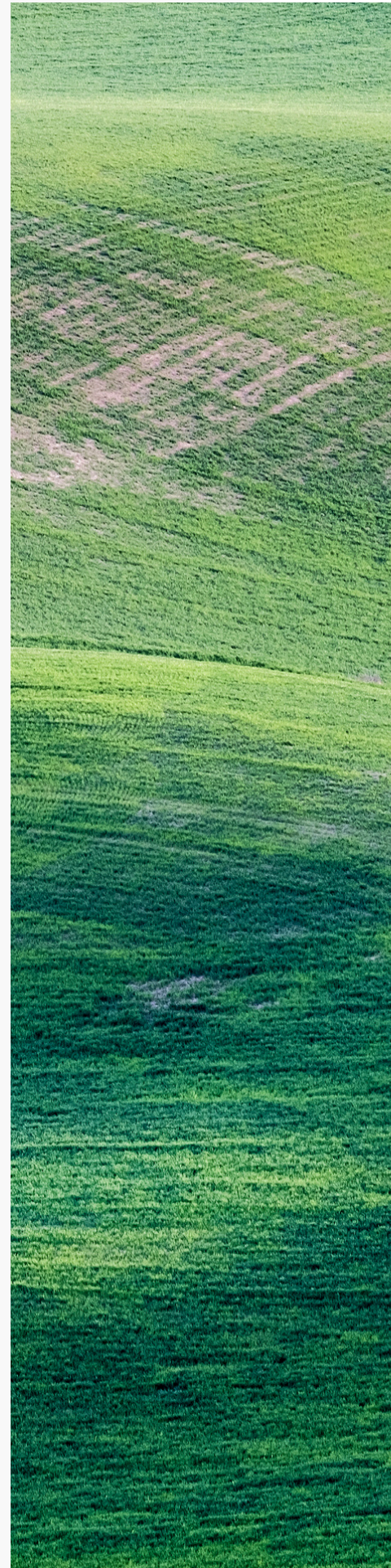
Executive summary

Starting from the European green deal that puts the debate on the Circular Economy and the need to change the economic paradigm in favor of a circular vision at the center of the analysis, the report aims to analyze the presence of study paths dedicated to circularity, and in a broader whole to sustainability.

The development of a circular economy has drawn attention to the radical change affecting the labor market. The presence of a new economy that completely changes the rules of the old linear economy implies the need to rethink new professional figures related to new production and consumption models. The need for new professionals requires courses of study that are dedicated to the new requirements. Traditional courses of study, in fact, are only partly modeled on the new needs of the circular economy and are in many cases they are surpassed or non-specific.

Therefore, there is a demand for new study courses that are tailored to the new positions of the labor market and that are able to cover all the required skills, both high and low. The circular economy, constituting a radical change in the economy, does not occupy just a few sectors, but stands as a revolution in all sectors of the economy, affecting them at all levels.

The report will try to highlight the strengths and weaknesses of the analysed systems.



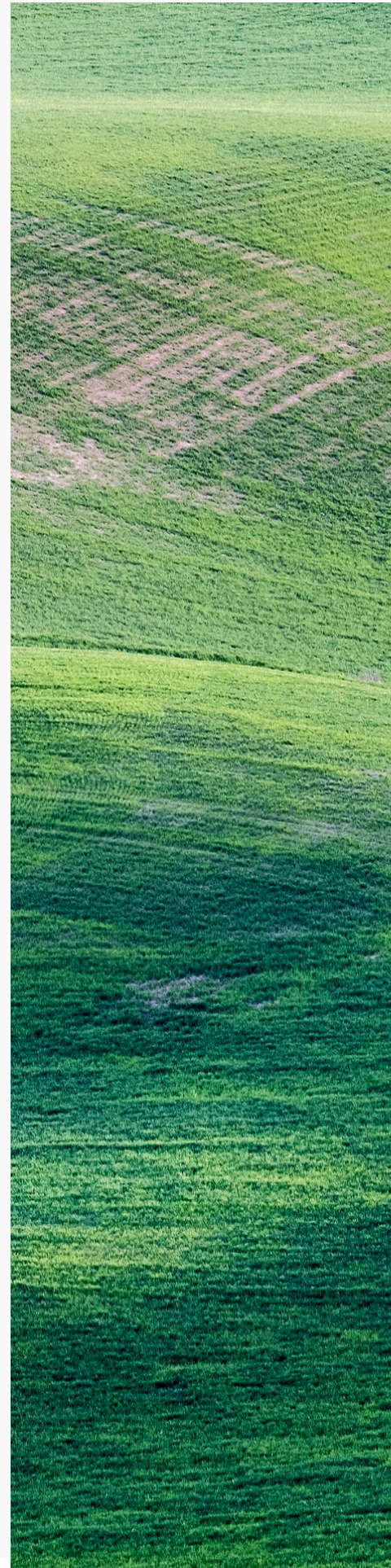
Executive summary



However, the transition process requires that educational pathways can meet the changes in consumption patterns, which implies that citizens and consumers are able, on the one hand to understand the operating mechanisms of the new economy, and on the other hand to implement the strategies necessary to implement the new models.

This implies a twofold role for education systems: they must meet the new demands of green jobs in the labor market by training workers capable of implementing the new circular economy, and on the other side, they must train conscious consumers who are able to bring the principles of the new economy into their life and consumption choices.

The combination of these two domains generates educational paths designed for circular transformation. The report aims to investigate the needs of the new economy by analyzing five different countries to understand the reactions of different educational systems. In addition, the report will try to highlight strengths and weaknesses of the analysed systems



Kiertotalouskoulutus



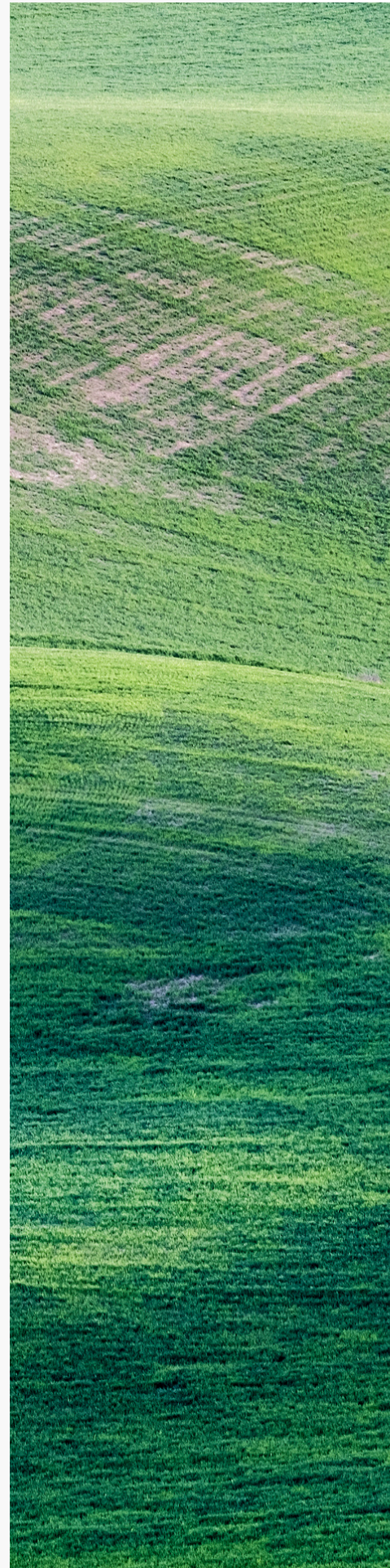
Kestävän kehityksen ja kiertotalouden koulutuksen nykytilanne

Tiivistelmä

Raportin lähtökohtina ovat Euroopan vihreän kehityksen ohjelma (European Green Deal), joka nostaa kiertotalouden keskiöön, sekä yleinen tarve muuttaa talouden paradigmaa kiertotalouden eduksi. Raportissa analysoidaan kiertotalouteen ja laajemmin kestäväyteen painottuvien koulutuspolkujen olemassaoloa.

Kiertotalouden kehittymisen myötä on tapahtunut radikaali muutos, joka vaikuttaa myös työmarkkinoihin. Vanhan lineaarisen talousjärjestelmän periaatteet täysin muuttava uudenlainen talousajattelu merkitsee tarvetta arvioida uudelleen ammattikuvia, jotka liittyvät uusiin tuotanto- ja kulutustapoihin. Tarve uusista ammattilaisista edellyttää koulutusta, joka keskittyy uusiin vaatimuksiin. Itse asiassa olemassa oleva koulutus on usein suunniteltu vain osittain kiertotalouden tarpeiden pohjalta ja monissa tapauksissa koulutus ei ole kohdennettua.

Tämän vuoksi on tarve uudelle koulutukselle, joka on räätälöity työmarkkinoiden uusia tehtäviä varten ja joka pystyy kattamaan kaikki tarvittavat taidot niin ylemmällä kuin alemmalla tasolla. Talouden radikaaliin muutokseen johtava kiertotalous ei kosketa vain muutamia sektoreita, vaan se merkitsee mullistusta kaikilla talouden sektoreilla vaikuttaen niihin jokaisella tasoilla.



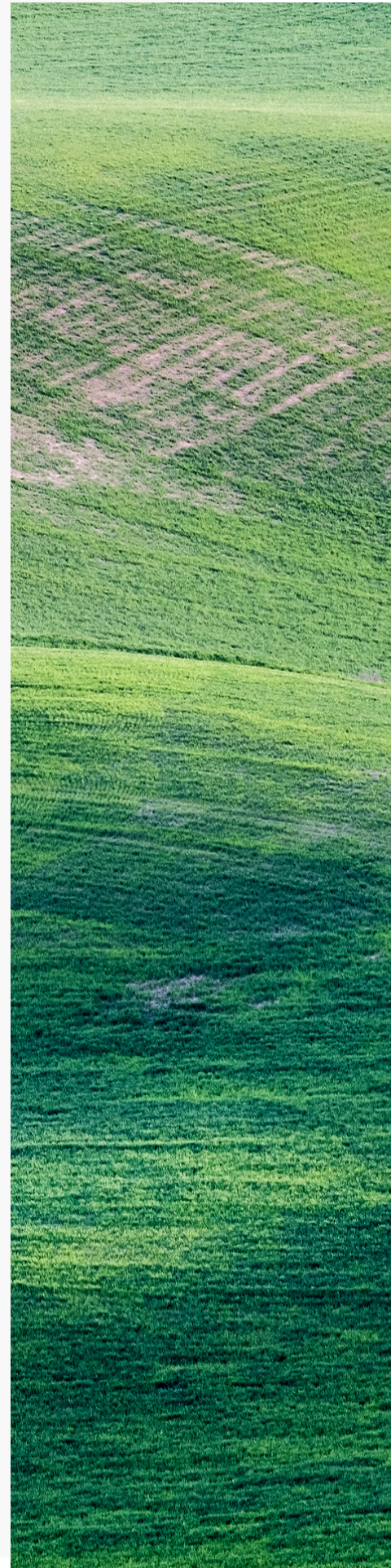
Tiivistelmä



Edellytyksenä onnistuneelle siirtymäprosessille kohti kiertotaloutta on se, että tarjolla olevat koulutuspolut kykenevät vastaamaan kulutustapojen muutoksiin, eli ihmisten tulee kyetä ymmärtämään uudenlaisen talousmallin periaatteet ja toisaalta heillä tulee olla taidot toteuttaa kiertotalouden mukaisia toimintatapoja.

Tämä merkitsee myös kaksitahoista roolia koulutusjärjestelmille. Niiden tulee täyttää vihreiden työpaikkojen asettamat uudet vaatimukset kouluttamalla työntekijöitä, joilla on taidot kiertotalouden toteuttamiseen. Toisaalta tavoitteena on kouluttaa tiedostavia kuluttajia, jotka pystyvät yleisesti omaksumaan kiertotalousajatteluun pohjautuvia periaatteita elämäänsä ja kulutusvalintoihinsa.

Näiden kahden tavoitteen yhdistäminen luo uusia koulutuspolkua, jotka on suunniteltu kiertotaloussiirtymää ajatellen. Raportissa pyritään selvittämään, mitä vaatimuksia kiertotalous asettaa koulutukselle analysoimalla koulutusta viidessä eri maassa. Lisäksi raportin tavoitteena on löytää tarkasteltujen koulutusjärjestelmien vahvuuksia ja heikkouksia.



Die zirkuläre Bildung

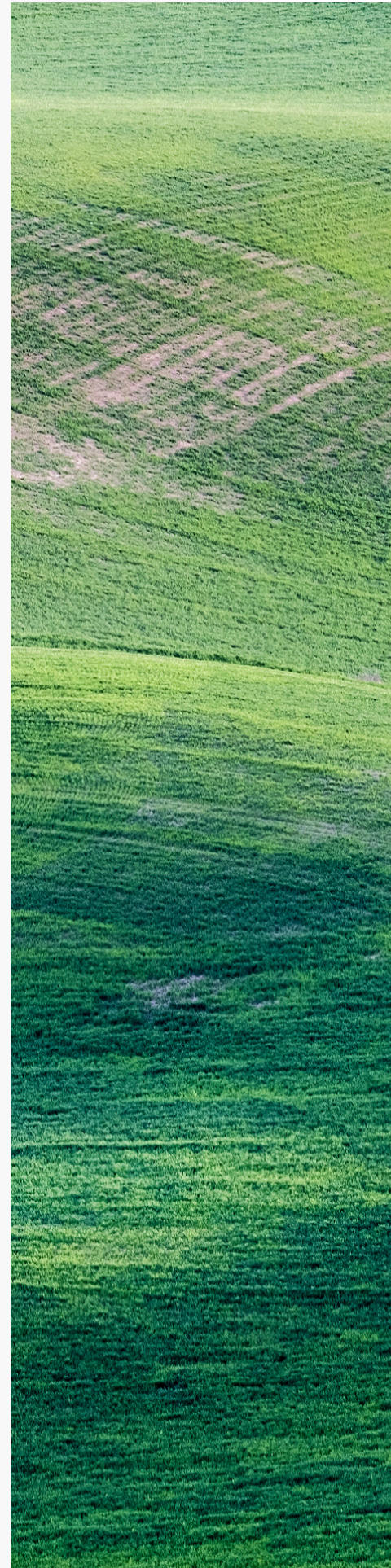
Der Stand des Bildungsweges für Nachhaltigkeit und Kreislaufwirtschaft

Zusammenfassung

Ausgehend vom europäischen Green Deal, der die Debatte über Kreislaufwirtschaft und die Notwendigkeit, das wirtschaftliche Paradigma zugunsten einer zukunftsweisenden Kreislaufwirtschaft zu verändern, in den Mittelpunkt der Analyse stellt, zielt der Bericht darauf ab, eine Bestandsaufnahme des Bildungsweges in Bezug auf Kreislaufwirtschaft und im weiteren Sinne Nachhaltigkeit vorzunehmen.

Die Entwicklung einer Kreislaufwirtschaft hat die Aufmerksamkeit auf den radikalen Wandel des Arbeitsmarkts gelenkt. Die Entwicklung einer neuen Wirtschaft, die die Regeln der alten, linearen Wirtschaft völlig verändert, macht es notwendig, Berufsbilder im Zusammenhang mit neuen Produktions- und Verbrauchsmodellen umzudenken. Der Bedarf an neuen Fachkräften erfordert Ausbildungen, die auf die neuen Anforderungen ausgerichtet sind. Traditionelle Bildungswege sind nur teilweise auf die neuen Anforderungen der Kreislaufwirtschaft ausgerichtet und in vielen Fällen überholt oder unspezifisch.

Daher besteht ein Bedarf an neuen Lehrmaterialien, die auf die neuen Berufe des Arbeitsmarktes zugeschnitten sind und die alle erforderlichen Qualifikationen abdecken können, sowohl die hohen als auch die niedrigen. Die Kreislaufwirtschaft, welche einen radikalen Wandel der Wirtschaft bedeutet, betrifft nicht nur einige wenige Sektoren, sondern stellt eine grundlegende Transformation in allen Sektoren dar, die sich auf allen Ebenen auswirkt.





Zusammenfassung

Der Bericht versucht, die Stärken und Schwächen der untersuchten Systeme aufzuzeigen.

Der Übergangsprozess setzt jedoch voraus, dass die Bildungswege den veränderten Konsummustern gerecht werden können, was bedeutet, dass Bürger*innen und Verbraucher*innen in der Lage sind, einerseits die Funktionen der neuen Wirtschaft zu verstehen und andererseits die für die Realisierung der neuen Modelle erforderlichen Strategien umzusetzen.

Daraus ergibt sich eine doppelte Aufgabe für die Bildungssysteme: einerseits müssen sie den neuen Anforderungen an grüne Arbeitsplätze auf dem Arbeitsmarkt gerecht werden, indem sie Arbeitnehmer*innen befähigen, die neue Kreislaufwirtschaft umsetzen zu können, andererseits müssen sie bewusste Verbraucher*innen ausbilden, die in der Lage sind, die Grundsätze der neuen Wirtschaft in ihre Lebens- und Konsumententscheidungen zu verstehen.

Die Kombination dieser beiden Bereiche führt zu Bildungswegen, die auf die zirkuläre Transformation ausgerichtet sind. Der Bericht zielt darauf ab, die Ansprüche der neuen Wirtschaft zu untersuchen, indem fünf verschiedene Länder analysiert werden, um die Reaktionen der verschiedenen Bildungssysteme zu verstehen. Darüber hinaus wird der Bericht versuchen, Stärken und Schwächen der untersuchten Systeme aufzuzeigen.



L'educazione circolare



Lo stato dell'arte del percorso educativo per la sostenibilità e l'economia circolare

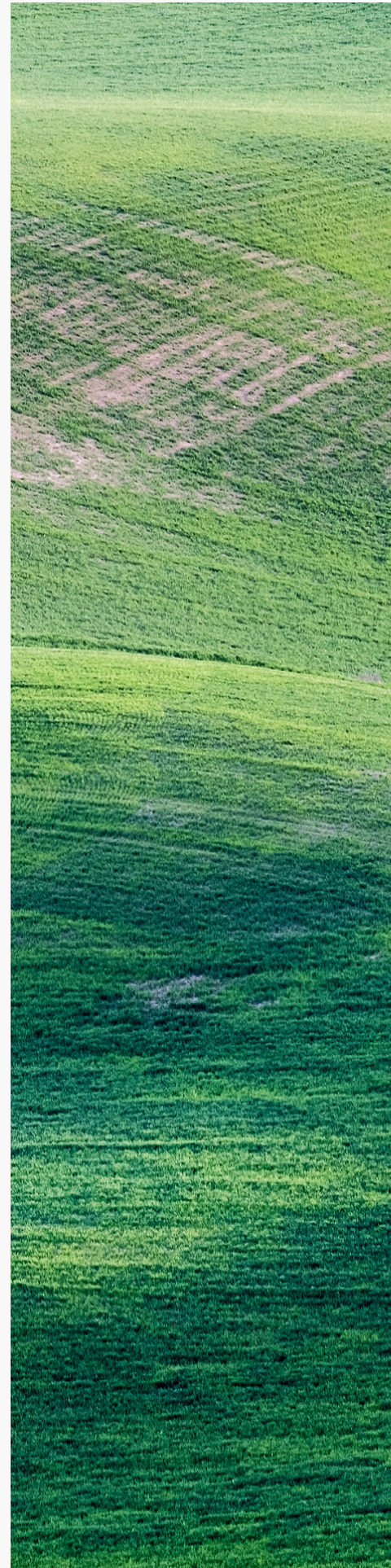
Sintesi

Partendo dal green deal europeo che pone al centro dell'analisi il dibattito sull'Economia Circolare e la necessità di cambiare il paradigma economico a favore di una visione circolare, il report si propone di analizzare la presenza di percorsi di studio dedicati alla circolarità, e nel complesso alla sostenibilità.

Lo sviluppo di un'economia circolare ha richiamato l'attenzione sul cambiamento radicale che interessa il mercato del lavoro. La presenza di una nuova economia che cambia completamente le regole della vecchia economia lineare implica la necessità di ripensare nuove figure professionali legate a nuovi modelli di produzione e consumo. La necessità di nuove figure professionali richiede corsi di studio dedicati alle nuove esigenze. I corsi di studio tradizionali, infatti, sono solo in parte modellati sulle nuove esigenze dell'economia circolare e in molti casi sono superati o non specifici.

Esiste quindi una domanda di nuovi corsi di studio che siano adeguati alle nuove posizioni del mercato del lavoro e che siano in grado di coprire tutte le competenze richieste, sia alte che basse. L'economia circolare, che costituisce un cambiamento radicale nell'economia, non riguarda solo alcuni settori, ma si pone come una rivoluzione in tutti i settori dell'economia, influenzandoli a tutti i livelli.

Il rapporto cercherà di evidenziare i punti di forza e di debolezza dei sistemi analizzati.





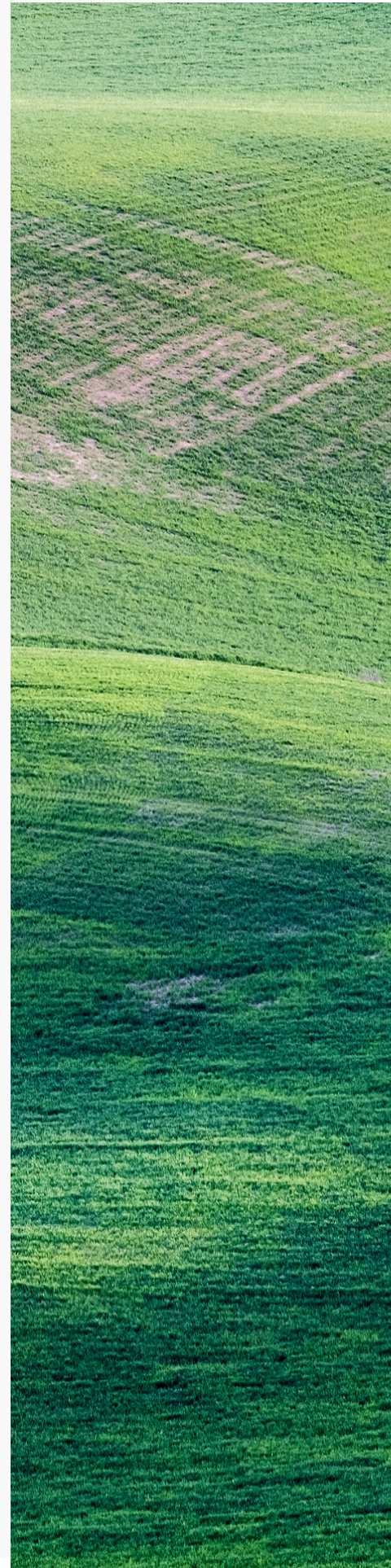
Sintesi

Tuttavia, il processo di transizione richiede che i percorsi educativi siano in grado di rispondere ai cambiamenti dei modelli di consumo, che implica che i cittadini e i consumatori siano in grado, da un lato, di comprendere i meccanismi di funzionamento della nuova economia e, dall'altro, di attuare le strategie necessarie per implementare i nuovi modelli.

Ciò implica un duplice ruolo per i sistemi educativi: da un lato, devono rispondere alle nuove richieste di lavori verdi nel mercato del lavoro formando lavoratori in grado di implementare la nuova economia circolare; dall'altro, devono formare consumatori consapevoli che siano in grado di portare i principi della nuova economia nelle loro scelte di vita e di consumo.

La combinazione di questi due ambiti genera percorsi educativi pensati per la trasformazione circolare. Il rapporto si propone di indagare le esigenze della nuova economia analizzando cinque diversi Paesi per comprendere le reazioni dei diversi sistemi educativi.

Inoltre, il rapporto cercherà di evidenziare i punti di forza e di debolezza dei sistemi analizzati.



Εκπαίδευση Πάνω στην Κυκλική Οικονομία

Η τελευταία λέξη της εκπαίδευσης για τη Βιωσιμότητα και την Κυκλική Οικονομία

Περίληψη

Ξεκινώντας από την Ευρωπαϊκή Πράσινη Συμφωνία, η οποία φέρνει ως θέμα συζήτησης την κυκλική οικονομία και την ανάγκη μετάβασης από το υπάρχον οικονομικό υπόδειγμα προς ένα κυκλικό όραμα, αυτή η έκθεση στοχεύει να αναλύσει την παρουσία μονοπατιών μελέτης αφιερωμένων στην κυκλικότητα, και ευρύτερα στη βιωσιμότητα. Η ανάπτυξη της κυκλικής οικονομίας έχει επιστήσει την προσοχή στη ριζοσπαστική αλλαγή που επηρεάζει την αγορά εργασίας. Η παρουσία μιας νέας οικονομίας που αλλάζει εντελώς τους κανόνες της παλιάς γραμμικής οικονομίας συνεπάγεται την ανάγκη επανεξέτασης του νέων επαγγελματικών προοπτικών που σχετίζονται με τα νέα παραγωγικά και καταναλωτικά μοντέλα. Η ανάγκη για νέους επαγγελματίες προϋποθέτει την ύπαρξη μαθημάτων τα οποία θα είναι αφιερωμένα στις νέες απαιτήσεις. Τα «παραδοσιακά» μαθήματα, στην πραγματικότητα, καλύπτουν εν μέρει τις νέες απαιτήσεις της κυκλικής οικονομίας και σε αρκετές περιπτώσεις είναι ξεπερασμένα και πολύ γενικά.

Επομένως, υπάρχει ζήτηση για νέα μαθήματα τα οποία θα είναι προσαρμοσμένα στις νέες θέσεις εργασίας και θα μπορούν να καλύψουν τις θέσεις που απαιτούν τόσο ειδικές όσο και γενικές γνώσεις και ικανότητες. Η κυκλική οικονομία, που συνιστά μια ριζική αλλαγή στην οικονομία, δεν αφορά μόνο συγκεκριμένους τομείς, αλλά αποτελεί επανάσταση σε όλους τους τομείς της οικονομίας, επηρεάζοντας τους σε όλα τα επίπεδα.



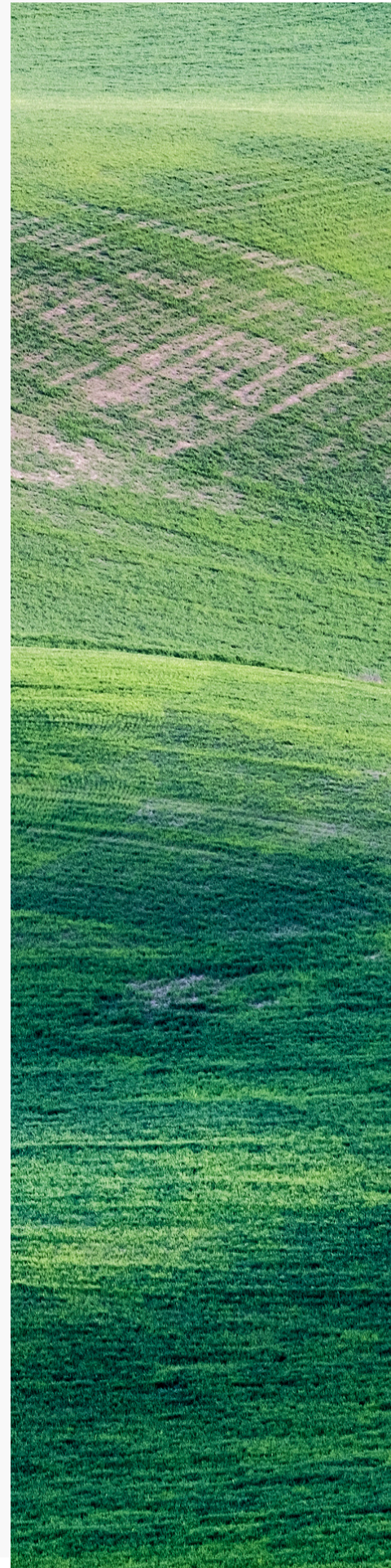


Περίληψη

Αυτή η αναφορά θα προσπαθήσει να υπογραμμίσει τα δυνατά και αδύναμα σημεία αυτών των συστημάτων. Ωστόσο, η διαδικασία της μετάβασης απαιτεί τα εκπαιδευτικά μονοπάτια (educational pathways) να μπορούν να ενσωματώσουν τις αλλαγές στα καταναλωτικά πρότυπα, πράγμα που σημαίνει ότι οι πολίτες και οι καταναλωτές να είναι σε θέση αφενός να κατανοήσουν τους μηχανισμούς λειτουργίας της νέας οικονομίας και αφετέρου να εφαρμόσουν τις απαραίτητες στρατηγικές για την εφαρμογή των νέων μοντέλων.

Αυτό συνεπάγεται διττό ρόλο για τα εκπαιδευτικά συστήματα: Από τη μία, πρέπει να ανταποκριθούν στις νέες απαιτήσεις των πράσινων θέσεων εργασίας στην αγορά εργασίας εκπαιδεύοντας εργαζομένους ικανούς να εφαρμόσουν την κυκλική οικονομία και, από την άλλη πλευρά, πρέπει να εκπαιδεύσουν συνειδητούς καταναλωτές που να είναι σε θέση να εφαρμόσουν τις αρχές της νέας οικονομίας στην καθημερινότητά τους.

Ο συνδυασμός αυτών των δύο διαστάσεων δημιουργεί εκπαιδευτικά μονοπάτια σχεδιασμένα για τη μετάβαση στην κυκλικότητα. Η έκθεση στοχεύει να διερευνήσει τις ανάγκες της νέας οικονομίας αναλύοντας πέντε διαφορετικές χώρες προκειμένου να γίνουν κατανοητές οι αντιδράσεις των διαφορετικών εκπαιδευτικών συστημάτων. Επιπλέον, η έκθεση θα προσπαθήσει να επισημάνει τα δυνατά και αδύνατα σημεία των συστημάτων που αναλύθηκαν.



L'éducation circulaire

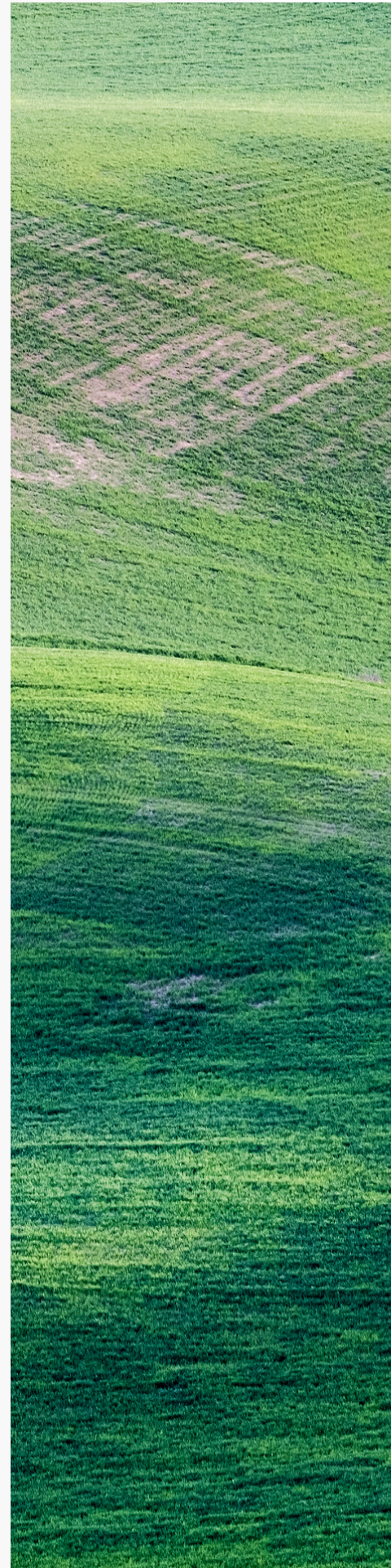
L'état de l'art du système éducatif pour la durabilité et l'économie circulaire

Résumé exécutif

Prenant appui sur l'accord vert européen qui engage à changer de paradigme économique en faveur d'une vision circulaire, le rapport analyse l'existence de parcours d'études dédiés à la circularité et, plus largement, à la durabilité. Le développement d'une économie circulaire révèle les changements majeurs affectant le marché du travail.

L'existence d'une nouvelle économie qui modifie complètement les règles de l'ancienne économie linéaire implique de repenser les pratiques professionnelles en lien avec les nouveaux modèles de production et de consommation. Le besoin de nouvelles compétences nécessite des programmes de formation dédiés.

Les cursus traditionnels ne s'inspirent que partiellement des nouveaux besoins de l'économie circulaire et, dans de nombreux cas, ils sont dépassés ou non spécifiques. Il existe donc une demande pour de nouvelles formations adaptées aux nouvelles attentes du marché du travail et qui apportent toutes les compétences requises. L'économie circulaire, qui constitue un changement radical, ne concerne pas seulement quelques secteurs mais tous les secteurs de l'économie. Le rapport mettra en évidence les forces et les faiblesses des systèmes analysés.



Résumé exécutif

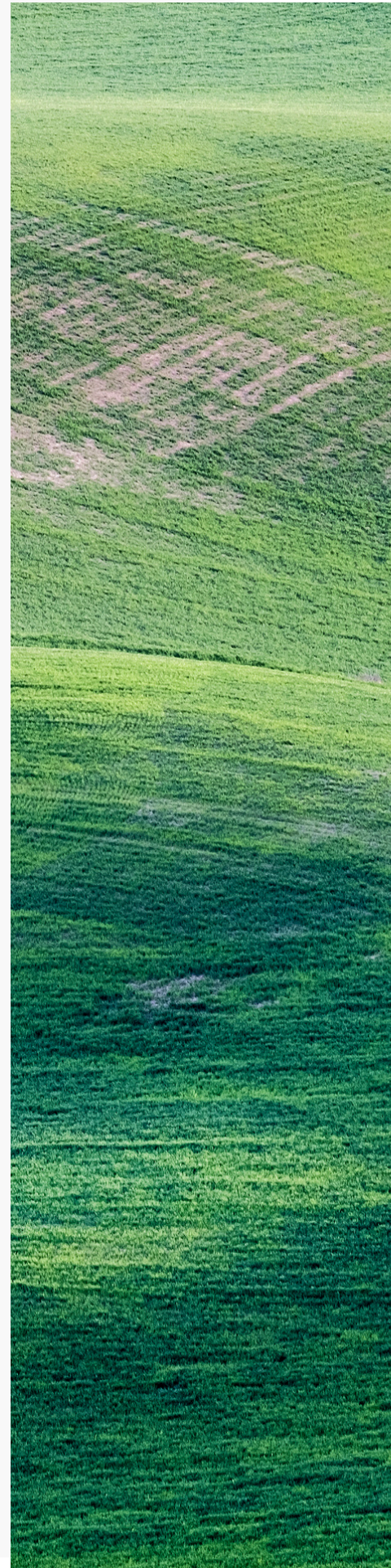


Le processus de transition exige que les parcours éducatifs accompagnent l'évolution des modes de consommation.

Cela implique, d'une part, de comprendre les mécanismes de fonctionnement de la nouvelle économie et, d'autre part, de mettre en œuvre les stratégies nécessaires à l'application des nouveaux modèles. Les systèmes éducatifs ont donc un double rôle à jouer.

Ils doivent répondre aux nouvelles demandes d'emplois verts sur le marché du travail en formant des travailleurs capables de mettre en œuvre l'économie circulaire. Ils doivent aussi former des consommateurs conscients, capables d'intégrer les principes de la nouvelle économie dans leurs choix de vie et de consommation.

La combinaison de ces deux enjeux permet de faire émerger des parcours éducatifs conçus pour la transformation circulaire. Le rapport vise à déterminer quels sont les besoins de la nouvelle économie en analysant les différents systèmes éducatifs de cinq pays différents. Le rapport mettra en évidence les forces et les faiblesses des systèmes analysés.



Introduction



The transition to a circular economy implies radical changes. The dissemination and adoption of different strategies to reduce environmental pressure is a necessary condition to achieve a sustainable growth path, which will lead to growth in the world economy and at the same time reduce impacts on the environment.

This is the context of the European Green Deal, issued at the end of 2019, which places the Circular Strategy at the centre of the European sustainable debate. In this context, the focus of European policies is on companies and the change of their business models. However, if we look at this transition from a broader perspective, the most profound changes are those that will have to affect the behaviour of citizens, understood simultaneously in their role as consumers and workers. For these reasons, one of the key aspects of the sustainability transition is to enable a pathway to new production and consumption systems, while activating multiple processes of change that also involve demographic, technological, fiscal and labour forces (EEA, 2019). It is therefore important to consider how to involve every aspect of social life, seeking to ensure the implementation of the 'Just GE transition' to promote development, prosperity and well-being. Creating opportunities to enable learning about environmental sustainability has therefore become crucial for the present and future of our planet.

In this context, the application of a circular system implies the existence of an appropriate education system. Therefore, in the near future it will be necessary on the one hand to promote new educational systems and on the other hand to adapt the current pathways.



It is clear that, although this is a need shared in all European countries, new school systems and their adaptation to new educational needs will vary according to the specificities and criticalities of the school systems in each country. Education based on new and improved intellectual and manual skills in the area of sustainability will help to create a cultural background capable of stimulating responsible collective action towards achieving a sustainable transition ¹.

From this it follows that monitoring analyses aimed at understanding the state of the art of change in educational systems is of fundamental importance in order to understand what interventions have been adopted and what other interventions are needed to ensure greater benefits. More specifically, it is necessary to understand: the purpose for which the new educational pathway is introduced and the impact it has in creating new skills. In these terms, it will be possible to understand which pathways are concerned with the creation of new skills directly linked to the needs of the sustainable paradigm (re-skilling), and which ones focus on the adaptation of current practices (up-skilling).

The aim of this report is to study the transition path towards greener jobs and to collect data on circular-oriented (and sustainable) courses in five EU countries. Specifically, the study will highlight best practices and weaknesses in accordance with the above-mentioned classification. The report is structured in two different sections. The first one tries to investigate the role of education in the circular economy, while the second one explain how different are educational programmes in the five countries analysed, and the impact of these differences on the development of new green jobs and positions.

¹ Green Comp The European sustainability competence framework

1. The role of Education in the «Circular Revolution»

The role of education in the transition process concerns both the need to form aware citizens and to provide them with the necessary skills to occupy strategic job roles and positions in accordance with circular logic and, more generally, sustainable logic.

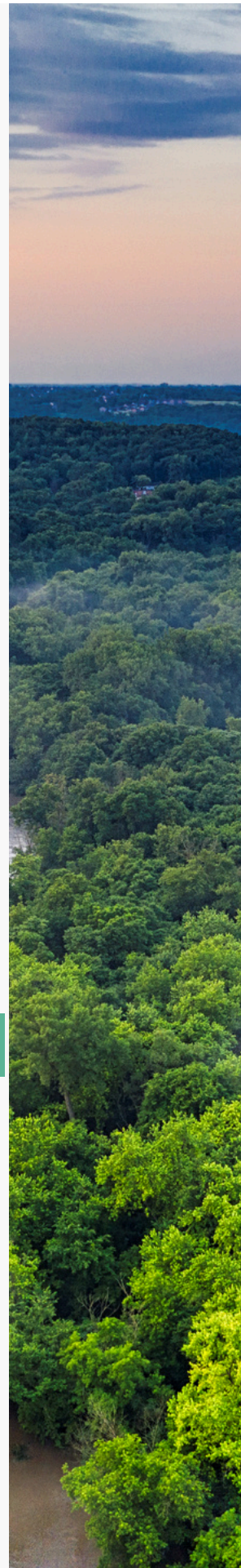
Based on this idea, the objective of education is, on the one hand, to train citizens to make conscious consumption choices and, on the other, to create skills that meet the new demands of the labour market. Education therefore has two different objectives, which together contribute to the adoption of greener behaviour. As we shall see in the course of the discussion, there is a very close link between the design of new courses of study and the updating of current courses. Although they belong to different areas of education, they contribute together to the achievement of sustainability goals.

In order to conduct the analysis on these two different levels, it is necessary to focus on two fundamental aspects that can influence educational change: on the one hand, the different labour market conditions and, on the other hand, the consideration of the peculiarities of each country's educational system.

1.1 Drivers demand of green jobs

There are several definitions of green jobs. Based on the UNEP definition, green jobs are defined as "jobs in agriculture, manufacturing and research and development, administrative and service activities that contribute substantially to preserving and restoring the quality of the environment"; while the ILO defines "green jobs" as "decent jobs that contribute to, preserve or restore the environment, whether in traditional sectors such as manufacturing and construction, or in newer, faster-growing green sectors such as renewable energy and energy efficiency".

The OECD stated in 2012 that support for green skills is an integral part of the transition to a sustainable economy. The OECD also recognises that the skills involved in (new) green activities are likely to be different from those currently required in contract sectors. It therefore follows that:





The development of green skills is part of a broader challenge of increasing strategic management skills;

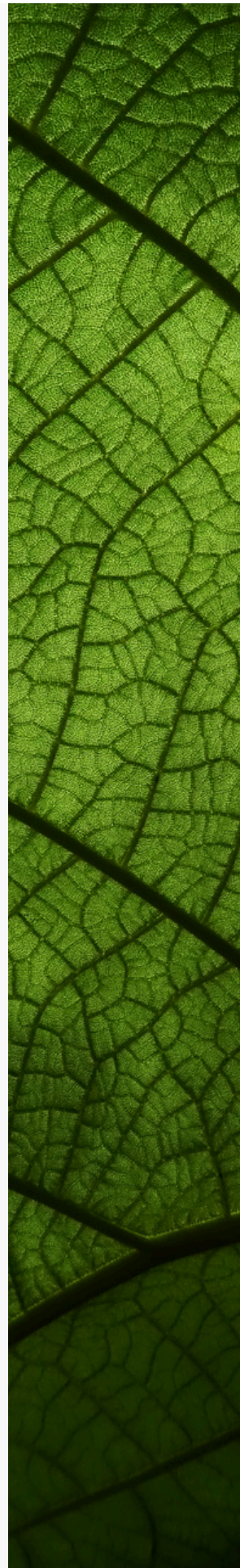


Investing in R&D is essential to anticipate the knowledge gaps that the green economy challenge reveals.

As Cecere and Mazzanti (2017) argue, innovation in green products and services is especially important to support green job creation. What emerges is that the offer of green jobs is not only the result of a change in the mindset of companies deciding to change their business models to a circular perspective but also responds to consumers' need for cleaner goods and production processes that respect environmental standards. Increased consumer awareness leads them to investigate what is behind the finished product they find on the market. With this in mind, eco-labeling is of great importance as it enables consumers to make comparisons between products/services when making purchasing decisions. Eco-labelling is in fact a form of positive declaration that identifies a certain product or service as less harmful to the environment than other similar products or services. Eco-labels can cover a range of environmental attributes, and include health issues, atmospheric or other environmental impacts, packaging and other industrial issues, to name a few. Certainly, consumer demands stem from increased knowledge of environmental consequences. The role of sustainability education courses is therefore not only aimed at the acquisition of skills to work in a circular (or basically sustainable) economy, but are also necessary for the creation of aware consumers (citizens) who, through their demand for green goods and processes, can stimulate the demand for green jobs. The supply of green jobs is thus driven by the demand for green goods and services; the role of educational programs is therefore twofold:

- Train informed consumers who demand green goods.
- Train workers specialized in green production.

The role of educational programmes is not only to train those who will be involved in the production of green goods and services but also to stimulate green behaviors. Knowledge is one of the key factors in stimulating environmental awareness. The training of environmentally aware citizens is one of the objectives of education programmes, even if not totally aimed at training green workers. As anticipated, the role of citizens/consumers is fundamental to the creation of green jobs: by increasing the demand for goods and services with a certain environmental quality, they act as a driving force for the entire green sector.



1.2 Labour market conditions



As visible from the graph 1 below, the unemployment rate started to rise in 2019 in all countries analysed in this report., and the pandemic Covid-19 certainly exacerbated a situation that already required a change of path, and the transition to a green economy could represent a strategy creating new jobs globally. The transition to a circular economy, in fact, entails the creation of new jobs on the one hand and the reallocation of employment on the other. The role of policy is to ensure that this transition takes place in a fair manner, eliminating the opposition between losers and winners in accordance with the just transition paradigm. With regard to the creation of new jobs, according to the ILO (2018), changes in energy production and use (e.g. shift to renewable energy sources and greater efficiency, the planned adoption of electric vehicles and construction work to achieve greater energy efficiency in buildings) to meet the 2°C target can create around 18 million jobs across the global economy. This net growth comes from the creation of about 24 million new jobs and the loss of about 6 million jobs by 2030. It follows that in the Circular Economy -and in the sustainable transition in general- job creation more than compensates for job losses.

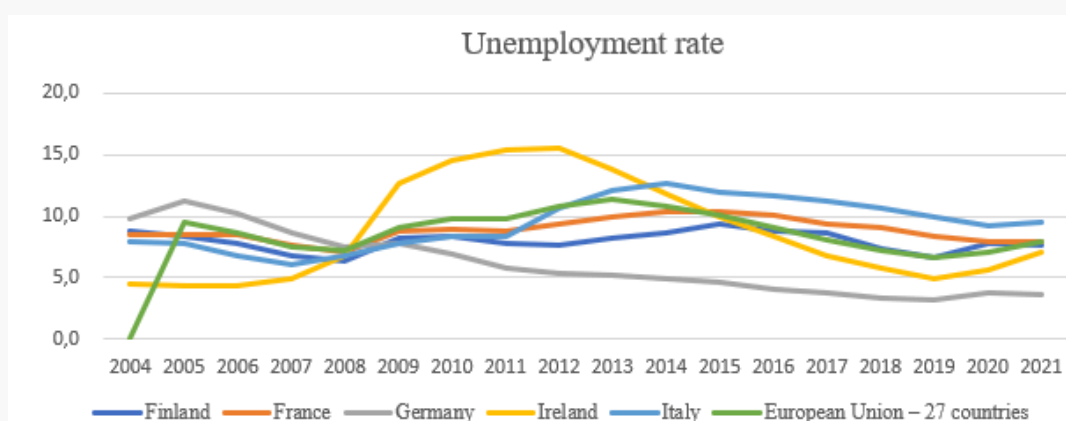


Figure 1 Unemployment rate comparison 2004-2021 OECD database, own elaboration




Regarding the redistribution process of occupation, Tab 1 shows a sectoral redistribution of employment towards green sectors, moving workers from one sector to another. The shift of workers from dirty to cleaner sectors will profoundly change labour market conditions, because new skills will be required. Specifically, the increase in unemployment, as visible in the graph below, will lead to a reallocation of the labour force, which will increase the demand for new training courses in order to find a new job. Although there have been sectors more affected by the employment crisis in the last two years, unemployment has affected both low- and high-skilled positions relatively evenly. As a result, there is a need not only for vocational courses, but also for new university courses and master's degrees in environmental subjects.

Table 1. Green Jobs and sectors

Industries set to experience the highest job demand growth (absolute)		Industries set to experience the strongest job demand decline (absolute)	
Sector	Jobs (millions)	Sector	Jobs (millions)
Construction	6.5	Petroleum refinery	-1.6
Manufacture of electrical machinery and apparatus	2.5	Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	-1.4
Mining of copper ores and concentrates	1.2	Production of electricity by coal	-0.8
Production of electricity by hydropower	0.8	Mining of coal and lignite, peat extraction	-0.7
Cultivation of vegetables, fruit, nuts	0.8	Private households with employed persons	-0.5
Production of electricity by solar photovoltaics	0.8	Manufacture of gas, distribution of gaseous fuels through mains	-0.3
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	0.7	Extraction of natural gas and services related to natural gas extraction, excluding surveying	-0.2
Industries set to experience the highest job demand growth (percentage)		Industries set to experience the strongest job demand decline (percentage)	
Sector	Jobs (percentage)	Sector	Jobs (percentage)
Production of electricity by solar thermal energy	3.0	Production of electricity by coal	-0.19
Production of electricity by geothermal energy	0.4	Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	-0.11
Production of electricity by wind	0.4	Extraction, liquefaction, and regasification of other petroleum and gaseous materials	-0.11
Production of electricity by nuclear energy	0.3	Petroleum refinery	-0.08
Production of electricity by biomass and waste	0.3	Manufacture of gas, distribution of gaseous fuels through mains	-0.05
Production of electricity by solar photovoltaics	0.3	Mining of coal and lignite, peat extraction	-0.03
Production of electricity by hydropower	0.2	Extraction of natural gas and services related to natural gas extraction, excluding surveying	-0.03

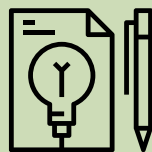
ILO, World Employment and Social Outlook 2018 - Greening with Jobs, 2018

1.3 Who acquires the skills?

 The introduction of environmental subjects within the educational pathways concerns any school order. o this end, it is necessary to emphasise how the first step is precisely the training of teachers and tutors who are able to introduce and develop these subjects. Therefore, it is necessary to support skills and competencies development for educators and trainers, in order to enhanced professional development, equip educators, trainers and other staff with the ability to teach students the competencies and skills required for green jobs (Cedefop, 2021).

In nutshell, it seems clear that the need for green education not only has the dual purpose of training conscientious consumers and workers to meet their demand, but also addresses teachers who have the task of spreading green knowledge

Therefore, teacher education and professional development is key to promoting environmental sustainability in education and training at all levels. To this aim the report wants to highlight the presence of two courses in Germany and Finland for the training of teachers and tutors.



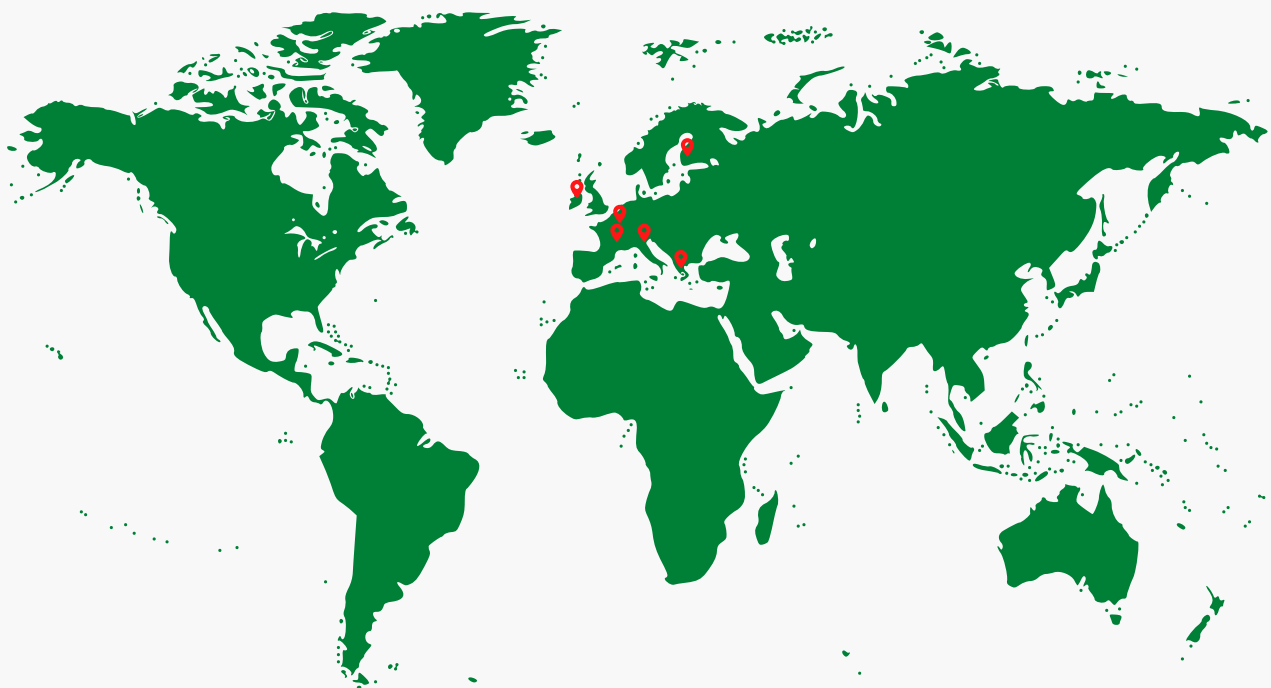
Local in Global project (Key Action 1 – Youth: mixed schemes), 2017–2019 (GERMANY) plementation



ECORoad project (Key Action 2 – School education), 2016–2018 FINLAND

2. The link between Educational Programs and High-low Skill jobs: five countries compared

Teachers and trainers have a potentially powerful role in helping society to achieve environmental High-skilled occupations involved in developing green technologies, such as scientists and researchers requiring high and intensive programs (University, Masters, PhD), while low-skilled occupations requiring lower level of education. This is affected by differences in education systems[2].



[2] The information on this section was mainly retrieved from <https://eurydice.eacea.ec.europa.eu/> and other sources in the refs.

Germany

Compulsory education starts for all children which have reached the age of six until the age of 16. However German education generally lasts until the age of 18. Compulsory schooling involves primary school or the so called Forderschule, both delivered by Landers, for this reason the schooling experience may vary across different German states. Forserschulen is a type of education addressed to children with special educational needs (SEN). SEN students will receive support and specific education depending on their level of disability. The secondary schools are free and vary across different typologies. Each student can therefore independently choose the typology to attend based on different needs and abilities. The gymnasium is similar to grammar school and generally students follow this path until the age of 18. The course ends with a final exam that will allow pupils to get into German Universities. Realschule is dedicated to intermediary students and offer education until the age of 15/16.

. Obtaining a final diploma enables the continuation of studies with vocational studies or the transfer to a gymnasium. The Hauptschule has a less academic imprint. It lasts until the age of 15/16 and enables students to pursue a vocational pathway. The gymnasium offers a direct outlet to university studies, which in turn are divided into obtaining a Bachelor's and a Master's degree. On the other hand, Realschule and Hauptschule pupils study to obtain a diploma and pursue vocational studies. Finally, after the attainment of a Master's degree, students may choose to conclude their educational path with a Ph.D program.

Germany

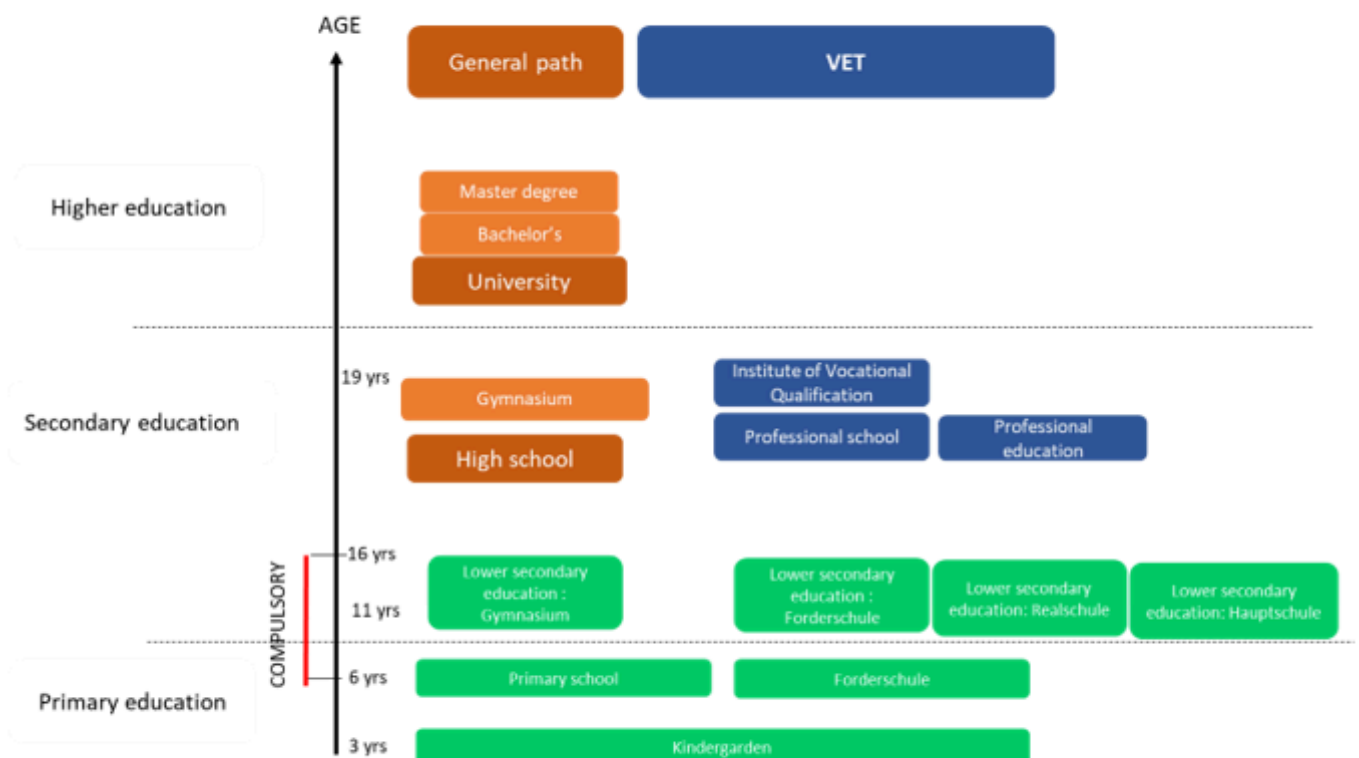


Figure 2: German Education System, own elaboration

Finland

Finnish school education starts at the 6 year of age, and it is followed by eight years of basic education. This last is free of charge and is organized by municipalities. Compulsory education ends when children reach the age of 18 or when they complete the upper secondary qualification/vocational qualification. After basic education, students can choose between general or vocational education. Students end the general secondary school after passing the matriculation examination, and they are therefore eligible to apply for universities, universities of applied science and vocational institutions. On the other hand, vocational qualifications mark the end of the vocational pathway of studies, and pave the way for further specialist or vocational qualifications to allow students to develop skills for their job career. Finnish higher education system comprises universities to conduct academic research and universities of applied science to acquire more practical education, hence to prepare students to the labour market. Universities offer Bachelor's and Master's degrees as well as doctorate degrees. While, Universities of applied science allow students to award UAS Bachelor's degrees and UAS Master's degrees.

Finland

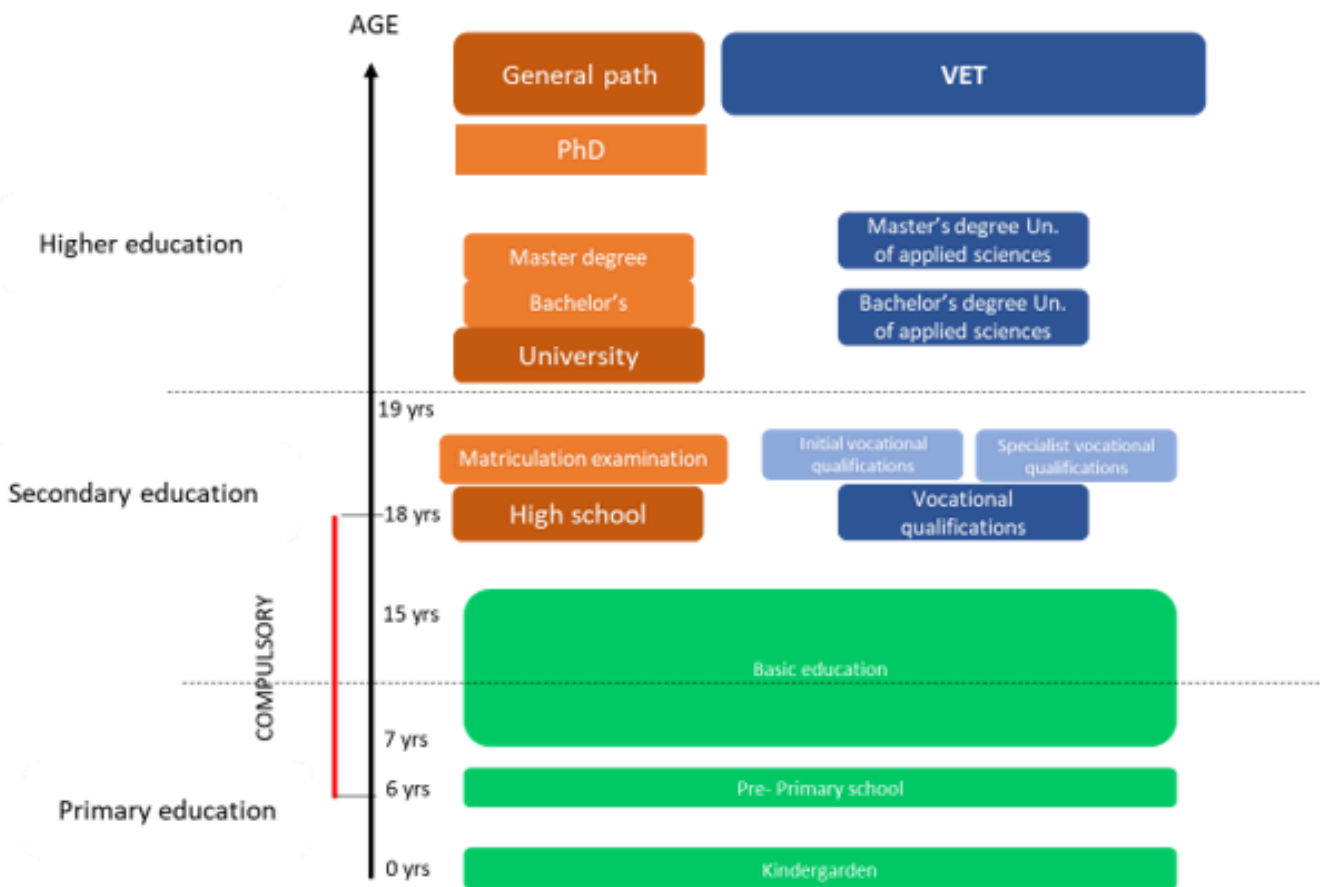


Figure 3 Finnish Education System, own elaboration

France

French children must be enrolled into primary school at the age of six. This last consists in five years of study, hence approximately until the age 11. Students subsequently move toward the secondary level of education which is divided in two stages. The collège develops for four years until the age 15, which ends after the completion of the brevet des collèges. After this, students may decide to attend the lycée and take the examination to obtain the baccalauréat qualification, or opt for professional high schools or training centers, which allow to receive respectively the professional high school diploma and the professional certificate. Afterwards, the French schooling system gives the possibility to student to pursue either vocational diploma/qualifications or academic degrees. Vocation diplomas includes a two year technology-oriented diploma, namely the technology diploma. This latter may be followed by one further year of study leading to the achievement of the professional licence. As for academic diplomas, universities offer three different degrees levels in many field, Bachelor's, Master's and Ph.D

France



Figure 4 French Education System, own elaboration

Ireland

In Ireland education is compulsory from the age of 6 until the age of 18. Primary education starts when children are at the 6 years of age. At the end, children at the age of 12 will start the Junior cycle which ends after three years with the obtainment of a certificate. This level of education is followed by the senior cycle, which will normally last three years, except for those who chose the transition year, for which the senior cycle lasts only two years. During the final year of the senior cycle, students must choose between three different programs, each leading to a different final examination. First, the Established leaving certificate prepare students willing to continue toward universities, institutes of technology and colleges of education. Second, the Leaving Certificate Vocational Programme, focused on technical subjects. Third, the Leaving Certificate Applied Programme aimed to prepare students for the job market through working experiences. It also allows students to continue with practical or vocational programmes. Higher education is made up of three different sectors: University, Technological, and colleges of education. University offers students bachelor, masters, and doctorate degree levels. The college of education, on the other hand, allow students to sepecialise in training activities for primary school teachers. Finally, the technological sectors is guaranteed by institutes of technology which provide programs of education in different training areas such as business, engineering, linguistic, music, among the others.

Ireland

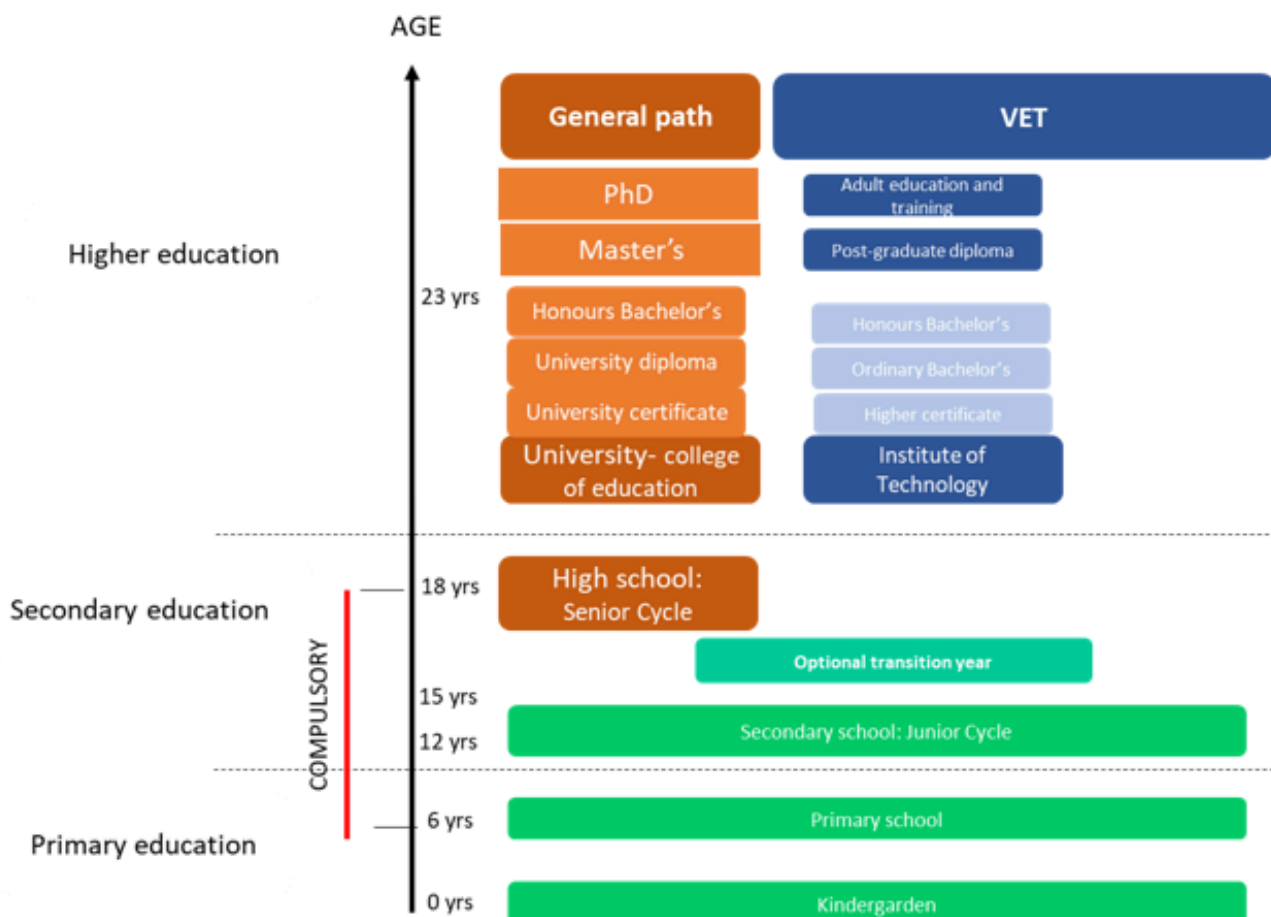


Figure 5 Irish Education System, own elaboration

Italy

Education in Italy is compulsory for students from 6 to 16 years of age, and it is divided into four stages: primary school (scuola elementare), middle school (scuola media), high school (scuola superiore). The primary school curriculum is the same in all schools. From middle school onwards, on the other hand, students can choose courses of study more in line with their interests. The differentiation in education is especially evident with the start of the upper secondary school. The latter are divided into the formula of Liceo (classical and scientific) and technical, professional and art institutes for the most addressed toward vocational pathways. In fact, it is usually high school students who, after obtaining their diploma, decide to pursue university studies. At the University level, some training courses (such as medicine) are defined as single-cycle, as they consist of five years of study. Most studies, on the other hand, allow to opt for the three-plus-two formula, i.e. obtaining a three years bachelor's degree followed by two years of Master's degree. After Bachelor's degree students may decide to achieve a specialising Master of 1st level, which directs them towards the job market. Similarly, after obtaining a Master's degree, students can choose between obtaining a second-level Master's degree or continuing the academic studies with a Ph.D.

Italy

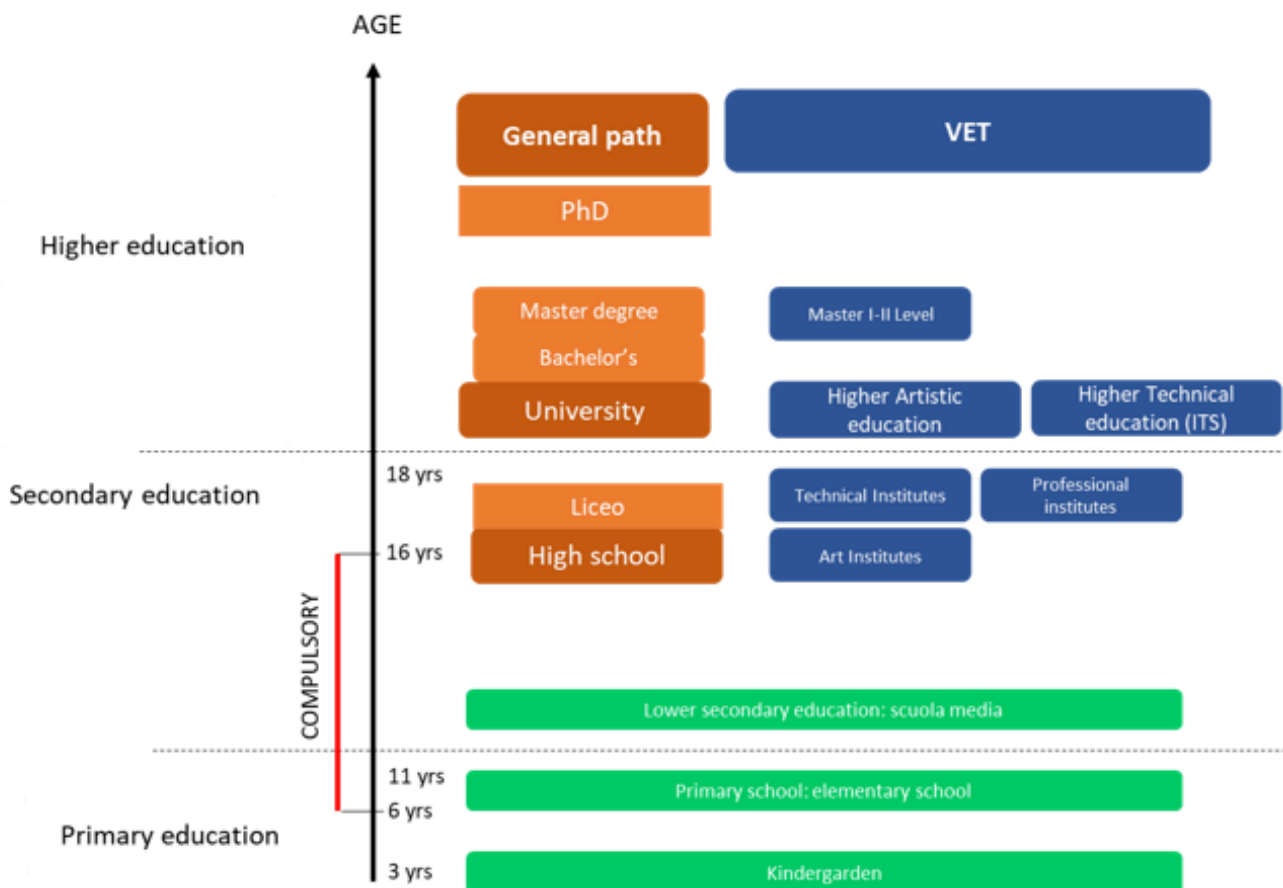


Figure 6 Italian Education System, own elaboration

Greece

The educational system in Greece is ancient and brings some futures from the organization of the ancient Greece. The education is compulsory for 11 years and extends from the ages of 4 to 15. The stages of the formal Greek education are mainly 6. The primary school includes pre-schools and primary schools. The Nipiagogeio is the pre-school in Greece has become compulsory for all 4-year-old children, since school year 2018/19. Infant centres (vrefikoi stathmoi), infant/child centres (vrefonipiakoi stathmoi) and child centres (paidikoi stathmoi) represent early childhood care. They are run under the remit of the municipal authorities for children between the ages of 2 months and up to the age of the beginning of compulsory education. Then the primary school (dimotiko scholeio) is the next stage and spans 6 years concerning children in the age range of 6–12 years. After the primary school starts the second level of education including two cycle of study: Gymnasio and Lykeio. The first one provide general education for at least three years, while the second enrolls guys from 15– years old and provides different education Geniko (general) lykeio and Epangelmatiko (vocational) lykeio. For those who have not concluded the nine-years compulsory education there is the Second chance schools (SDE) which are public and target persons aged 18 years or older, the attendance lasts 2 years. After the Greek system consists in Post-secondary vocational training with two different levels: Vocational training institutes (IEK) and Post-secondary cycle of studies - apprenticeship class. IEK provide initial vocational training to graduates from upper secondary schools, i.e. general upper secondary schools, as well as holders of equivalent certificates/degrees. Vocational training lasts 4–5 semesters. While post-secondary cycle of studies consists in apprenticeship class providing initial vocational training to graduates from upper secondary vocational schools, or holders of equivalent certificates or degrees, who have a basic level of knowledge, skills and competences. The post-secondary – apprenticeship programme lasts 11 months. The last level is the Higher education, most undergraduate degree programmes take 4 academic years of full-time study, while postgraduate courses last from one to two years, while doctorates at least 3 years

Greece

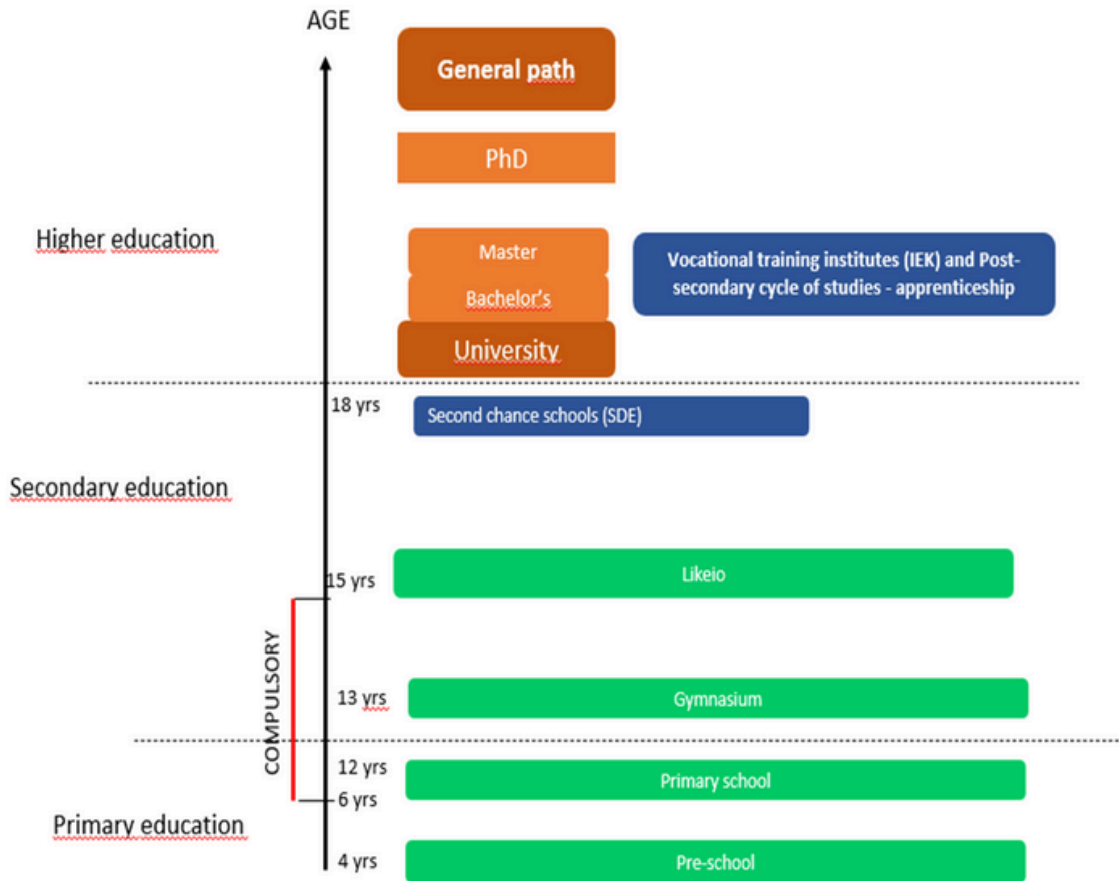
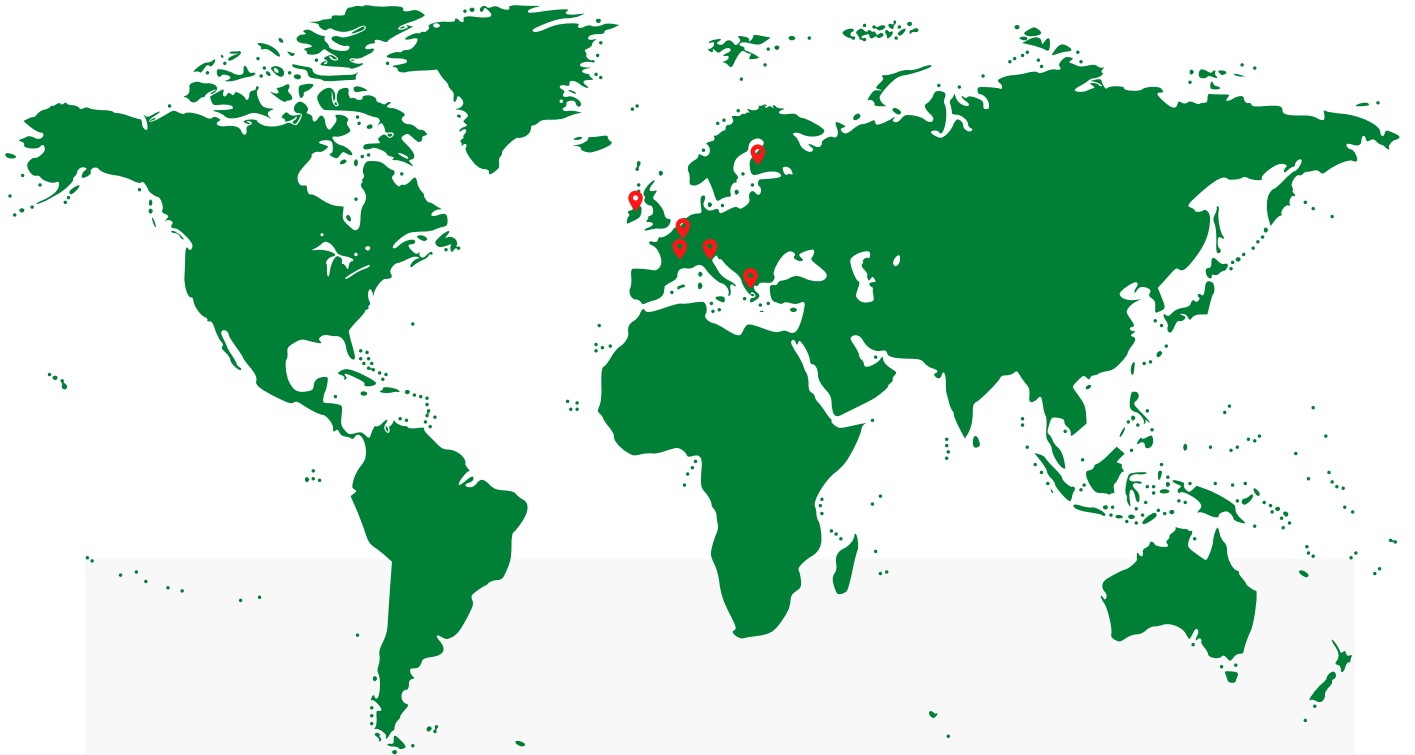


Figure 7 Greek Educational System, own elaboration



2.2 Circular programs in each country

This section presents an overview of the study paths in the analysed countries. It attempts to highlight strengths and weaknesses of different the educational offers.

Really Great site

2.650K

Total Users

Really Great Site

1.9

Total



Really Great Site

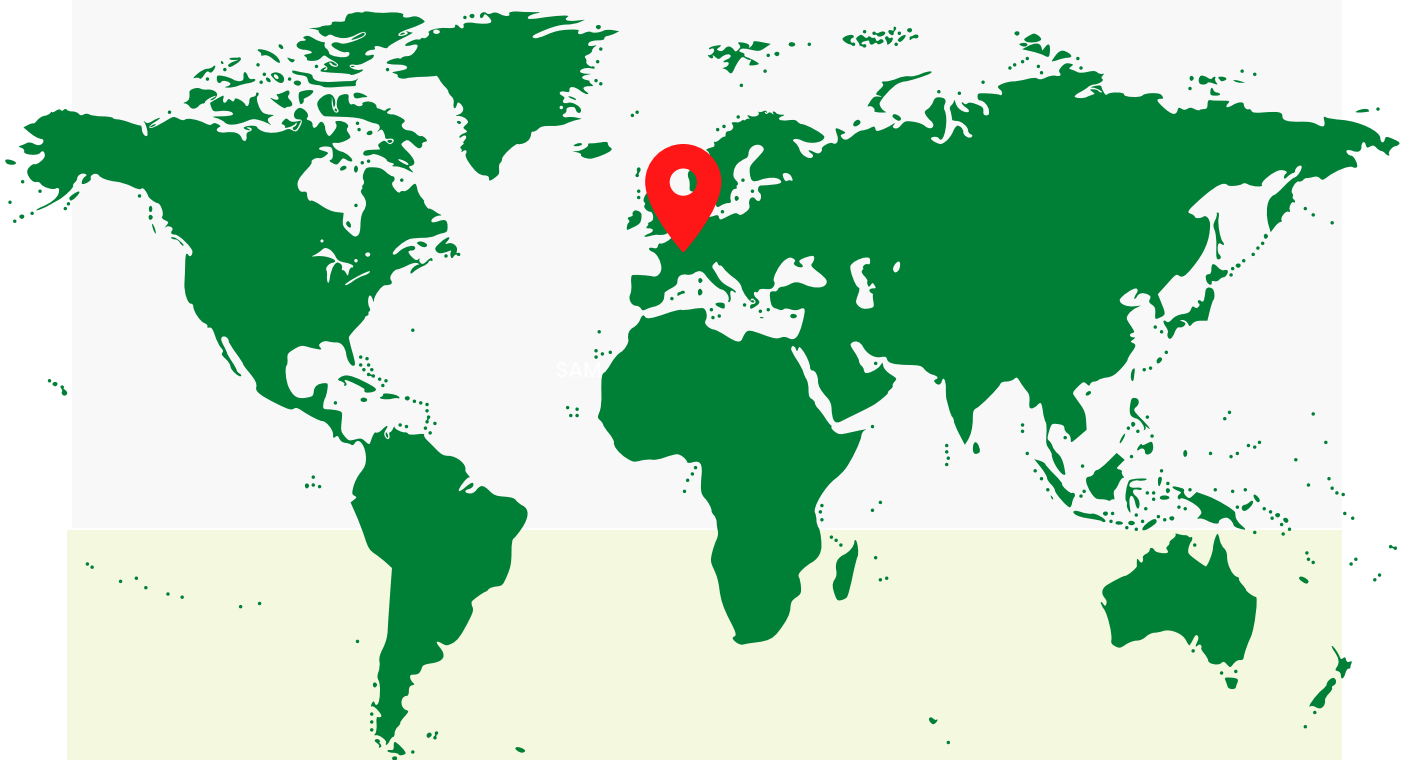
1.850K

Total Users

Germany

Type	Course name	University	Description	Duration	Field
Bachelor degree	Global Environmental and Sustainability	Leuphana University of Lüneburg		3 years	Policy
Bachelor degree	Sustainable Agriculture	Rhine-Waal University of Applied Sciences		3 years	Agriculture
Master degree	Master in Resources Engineering (Innovative Education in Geometallurgy and Circular Economy)	TU Bergakademie Freiberg	The program trains a new generation of engineers with an entrepreneurial mindset and a global vision of the value chain, putting the extraction of mineral and metal resources on a circle that continues by collecting end-of-life products and recovering valuable materials out of urban mines (circular economy).	2 Years	Engineering
Master degree	Engineering and Sustainable Technology Management - Focus on Industry 4.0 - Automation, Robotics and 3D Manufacturing	Berlin School of Technology	This master help designing, implementing and launching in the market innovative systems and technologies. Students will gain a deeper insight into the top technologies of the digital industry, such as digital twins, automation or 3D printing, and learn how these technologies can be introduced, promoted and optimized in companies.	2 years	Business and Management
Master degree	Engineering and Sustainable Technology Management Smart Building Technologies	Berlin School of Technology	During this program students will learn how the infrastructure of buildings can be made more sustainable and smarter and expand their knowledge of building data modelling, automation and decentralized energy supply.	2 years	Urban planning
Msc	Raw Materials Exploration and Sustainability	EIT RawMaterials Academy	This Master combines raw materials expertise and circular economy principles with the objective of educating a new generation of entrepreneurial geologists and engineers.	2 years	Geology and engineering
Msc	Circular Economy	University of Applied Sciences Rosenheim	The course qualifies in the areas of strategy & management, sustainable technologies & sustainable materials, economics & ethics, sustainable finance, leadership & customer experience, sustainable innovation & sustainable entrepreneurship.	5 semesters	Business and Management
MBA	Sustainable Innovation and Entrepreneurship	Berlin University of Applied Sciences	The curriculum includes both classic management modules and courses on innovation management, entrepreneurship and sustainability. It will help broadening students' horizons and exchange ideas on current topics such as the circular economy, organizational behavior or management ethics.	3 semesters	Business and Management
Phd	Study of Energy Transition and its Integration in Copper Production for a Sustainable Circular Economy	Helmholtz-Zentrum Dresden-Rossendorf - Freiberg, Sachsen, Germany		3 years	Chemistry
Phd	Built environment in a circular economy	Leibniz Institute of Ecological Urban and Regional Development	Material Flow Analysis (MFA) based investigations of the built environment in a spatial planning context. The research topic should be oriented at the analysis and modelling of recycling paths towards a circular economy.	3 years	Industrial engineering, environmental science
Upskilling course	Specialization course Circular Economy	Bern University of Applied Sciences	This is aimed at professionals and managers who want to apply the concept of Circular Economy in their strategies, business models and operations.	5 days	Business and Management
Upskilling course	Teaching methods for circular economy skills (CIRCLE VET)	Circular Berlin	CIRCLE VET aims to evaluate and exchange teaching methods on circular economy skills for vocational education and training, focusing on three case study sectors: fashion, coworking and recycling. It provides adults with skills relevant to the circular economy.		Fashion
Upskilling course	Disseminating knowledge on circular economy throughout the construction sector	DGNB Academy	The DGNB Academy provides professionals from the construction and real estate sectors with up-to-date knowledge on sustainable construction, including circular economy principles which have been made assessable in the DGNB Certification System.		Construction

The majority of the courses offered by the German education system concern higher education. Specifically, there are two bachelor's degree programmes, three master's degree programmes, two master of science programmes, one MBA and two PhDs. Courses focus on circular economy strategies mainly in the fields of business and management, and engineering. Higher educational programs are also recognised, albeit to a lesser extent, in the areas of: policy, agriculture, urban planning, and chemistry. On the other hand, vocational programs aim to enhance competences already acquired in specific sectors i.e. business and management, fashion industry and construction by orienting them towards circular economy objectives.



Finland

Bachelor degree	Sustainable Solutions	LAB University of Applied Sciences	It provides tools to manage challenges such as climate change and sustainability. Students will learn how to manage technologies in a sustainable way by adopting a circular economy perspective	4 years	Engineering
Bachelor degree	Culture and Arts in Smart and Sustainable Design	Häme University of Applied Sciences	It provides the ability to work as a designer in companies in different fields and in public organizations or act as an independent entrepreneur.	4 years	Product design
Msc	Program In Circular Economy	LUT University	It prepares to work as a professional in the circular economy in a wide range of jobs focusing primarily on sustainable business and production. It opens job opportunities in industry, consultancy, regulatory agencies, and governmental and non-governmental organisations, where increasing interest is being devote to sustainability issues.	2 years	Business and Management
Msc	Zero Defect Manufacture for a Circular Economy	Aalto University	It is a combination of studying manufacturing science including physics of equipment and processes, data analysis, including the methodology to use gained process data in the context of process quality, and process management including the flexibility enabled for smaller lot production	2 years	Technology and Engineering
Msc	Advanced Materials for Innovation and Sustainability	Aalto University	The programme tackles with substituting and exploiting materials and technologies for products in order to improve their performance while focusing on material and value chain optimisation in the spirit of circular economy. The students will acquire an understanding of the full materials value chain with a mind-set for innovation & entrepreneurship focusing on sustainability.	2 years	Chemistry, physics or materials science
MBA	Risk Management and Circular Economy	Tampere University of Applied Sciences	The program offers competence to apply the ideas of circular economy and risk management at job level. Designing new products and services needs understanding about the whole life cycle.	2 years	Engineering, business and natural resources
Summer school	Circular Economy and Co-design	Aalto University	The course focuses on how to prevent waste and pollution, how to keep products and materials in use longer and how to regenerate the whole system towards a better balance.	2 weeks	Design Architecture
Phd	Doctoral Researcher in Bio and Circular Economy	Faculty of Engineering and Natural Sciences of Tampere University	The research project is focused on understanding the occurrence of microplastics in municipal sewage sludge and the faith of microplastics in different sewage sludge treatment technologies	2 years	Engineering
Phd	Sustainable use of renewable natural resources	University of Helsinki		2 years	Biology - Agriculture - Forestry
Upskilling course	The Circular Economy Now Module	Collaboration between LUT University/ University of Helsinki/ Aalto University/ University of Eastern Finland/ The Finnish Innovation Fund Sitra.	It is suitable for teachers in all fields, as it does not require any special knowledge about the circular economy. It will allow incorporating perspectives and topics of attendants' own field in the course through contact teaching and project assignments.	-	Multidisciplinary
Upskilling course	Circular Economy for Sustainable Growth	Sitra	The learning lane is designed to equip the student with a well-rounded understanding of how to plan, implement, execute and measure the success of circular economy initiatives within a modern, internationally oriented company.	15 days	Business and Management
Course, upper secondary education	Circular Economy Business course	Sitra			Business and Management
Upskilling course	Circular economy as a societal change	University of Eastern Finland	The course studies circular economy as a societal change, that touches many aspects of life. Both social, political and judicial preconditions of the circular economy are examined. The course is multidisciplinary and provides perspectives to circular economy through environmental policy, environmental law and geography.		Policy
Project for vocational education	Circular economy training pilot projects	Sitra	The aim of the project is to embed circular education into secondary professional education based on needs identified by industries.		
Educational Platform	Walki Circular Classroom: co-created learning material stimulates circular thinking at school	Walki Group	The Circular Classroom is a new educational platform for learning about the circular economy. This open platform provides secondary schools and upper secondary schools with new tools for discussing the circular economy within a curriculum that promotes phenomenon-based learning and integrated subjects.		

The Finnish education system provides a balanced educational offer between higher education and vocational programs. Higher education comprises: two bachelor's degree programmes, three master's or science programmes, one MBA, one summer school, and two PhDs. However, there is a lack of master's degrees on the subject. The training offering is mainly geared towards the in-depth study of circular economy strategies in engineering. Other high educational programs' areas are: product design, business and management, chemistry, design architecture, biology. On the other hand, the vocational programs are mainly aimed at upskilling of professional figures, specifically in business and management. One course is also dedicated to upper secondary education. Clearly, the Finnish education system intends to strengthen vocational training in the circular economy as evidenced by the presence of the Circular economy training pilot project and an Educational Platform.



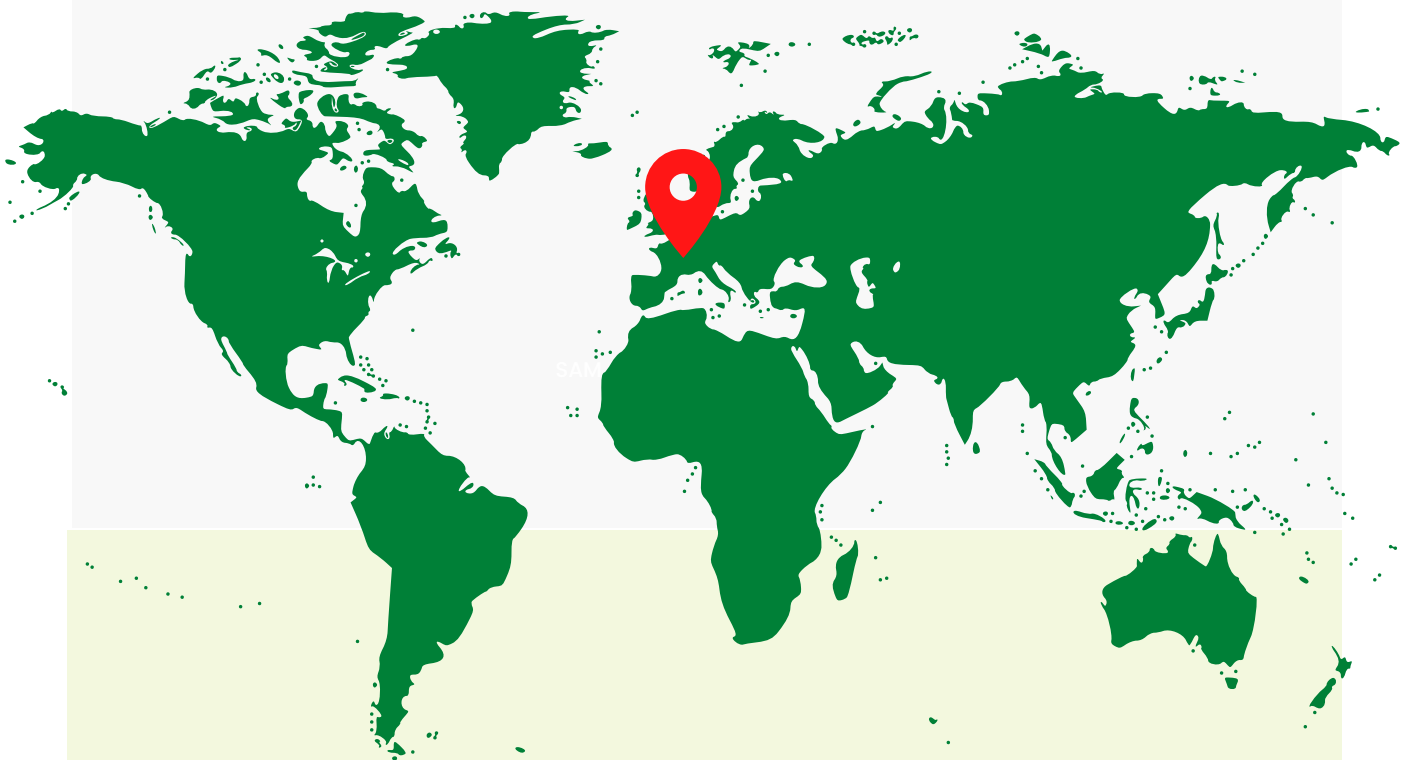
France

Bachelor degree	Assistant Designer in Sustainable Innovation	BESIGN The Sustainable Design School, Nice	The program provides foundation skills to be a professional designer, embracing the requirements of a sustainable future	3 years	Product design
Master degree	Alternance transition énergétique, écologie industrielle, économie circulaire	Management School ISEAM	The master will form environmental managers, auditors or consultants in energy transition and/or industrial ecology, experts in innovation strategies and/or circular economy	2 years	Business and Management
Master degree	Management du développement stratégique et environnemental	IET - Institut de l'environnement et des Technologies	Students will acquire skills on: environmental (project) manager - CSR; assistant business manager in environment; sales assistant: green products or services; environmental management system project manager; consultant " Audit and Advice " in sustainable development	1/2 years	Business and Management
Master degree	Sustainable Development and Environment	ESI Business School-Boulogne-Billancourt, France		2 years	Business and Management
MSc	Master sciences, technologies, santé mention sciences pour l'ingénieur spécialité éco-conception de produits	Université de Franche-Comté - Besançon	The program will teach technical manager for studies, research and development in the mechanical industry; manager of a design office/development of eco-designed products; consultant/expertise in eco-design; project manager; product developer		Engineering
MSc	Circular Economy and Sustainable Innovation	Lyon Business School	It trains professionals in the circular economy capable of defining a strategy for transforming the business model of a company or an organization by proposing innovative and sustainable solutions, in accordance with the concepts and challenges of the circular economy.	1 year	Business and Management
Msc	Management de la transition écologique et de l'économie circulaire	Université de Montpellier - Montpellier Management	The master will form: environmental project managers, green finance" Specialist Research officer", environmental management controller, green tech start-up creators, green buyers, public service executives, consultant in sustainable development	360 hours	Business and Management
Msc	Circular Economy	UniLaSalle	It trains specialists capable of responding to the environmental challenges of companies and industries on a territorial scale, thanks to their knowledge and know-how in the field of eco-innovation.	1 year	Business and Management
Msc	International and Sustainable Management	ESSCA School of Management	It develops essential leadership skills and a deep understanding of how sustainable approaches to business can offer new opportunities for organisations	12-16 months	Business and Management
Msc	Sustainable Management & Eco-Innovation	Rennes School of Business	The program will allow applying sustainability-related knowledge in the formulation of responsible business practices and ethical management of people in organizations.	15 months	Business and Management
Phd	Environmental Economics: Innovation and Circular Economy of Mineral Resources	Aix-Marseille Université		3 years	Economics

France

Upskilling course	Design Circular Business models	Online-Circulab Academy	In this course students will learn how to evaluate a socio-economic system and its situation. Students will additionally grasp the fundamentals of system design within a business ecosystem, and they will be able to articulate and translate business choices into positive and negative impacts.	15 hours	Business and Management
Upskilling course	MOOC économie circulaire et innovation	UVED – Université Virtuelle Environnement et Développement Durable	The objectives of this course are: increasing ability to be both critical and proactive in relation to circular economy projects, identifying the knowledge and skills that are useful to invest in the field of the circular economy	8 hours	Business and Management
Complementary trainings	7 trainings in Eco-conception & circular economy	AFNOR	Life Cycle Assessment; CSR; Value analysis; Standards and regulations	1 to more days	Law
Upskilling course	Circular Design	Online-Circulab Academy	This training course has been designed to give students the keys to start a circular journey, adapt participants' organizations and create their future products and services	35 hours-8 weeks	Product design
Specialization course	Diplôme d'Université d'Économie Circulaire & d'Intelligence Collective	IUT de Sceaux, Université Paris-Saclay	Support private or public organizations engaged in a circular economy approach. Master the regulatory and conceptual aspects of the circular economy. Transmit values and behaviors adapted to a circular economy approach	5 months	Business and Management
Specialization course	Circular Economy Engineering	IMT University of Lille	Expert in environmental engineering and the circular economy, able to respond to new ecological challenges, in the fields of sustainable development, eco-innovation and eco-design	12 months	Engineering
Specialization course	Circular Economy and Sustainable organizations	Polytech Marseille			Industrial engineering
Professional license	Licence Professionnelle Spécialité Valorisation et REcyclage des Matériaux pour une Économie Circulaire	Faculté des Sciences et Technologies	Students will learn to: understand the impact of end-of-life products on the environment; understand environmental regulations, standards and safety, implement and monitor recycling operations including collection and transportation; build a global analytical approach to characterize materials before and after recycling, to know the economic models of the recycling industry, to know the major actors of the sector	1 year	Industry and Technology
Research Centre	Circular Economy Research Center	Paris based École des Ponts Business School	The aim is to enable students as well as the alumni of the School to learn more about the upcoming transformation so that they can understand it, embrace it and prepare for it in their domains of professional interest.		

In the French education system, circular economy strategies and concepts are integrated into higher education programmes by a bachelor's degree course, three master degree courses, six master of science courses and a PhD. However, the offer appears to be almost exclusively aimed at addressing the circular economy concept to the industrial level. Business and management courses indeed predominate, followed by an engineering course, a product design course and an economics course. In line with this, upskilling vocational courses are also mainly aimed at creating new figures able to translate and re-design current business models in a circular perspective. The specialisation courses, on the other hand, also involve the field of engineering and aim to train professionals capable of integrating and enriching their skills with circular economy practices. Finally, a Research Centre on Circular Economy complete the French educational offer.



Ireland

Bachelor	Sustainable Energy Engineering	Technological University Dublin	The programme investigates renewable energy sources, such as wind energy, solar energy and other heat sources. Students will learn about the design and operation of wind turbines, solar energy panels and other equipment associated with alternative energy.	4 years	Energy sector
MSc	Manufacturing Engineering with Zero Defect Manufacture for a Circular Economy	University of Dublin		2 years	Engineering
Msc	Sustainable Environment	National University of Ireland, Galway	It integrates ecological, health and sustainability issues and considers their interaction within the natural and built environments. It combines modules from Environmental Science, Engineering and Economics to provide students with experience of research-led learning opportunities that will develop skills in identifying and evaluating sustainable solutions for real world environmental problems	1 year	Environmental science; Engineering; Economics
Post-graduate course	Circular Economy and Recycling Technologies	Trinity College Dublin, the University of Dublin.	This course will provide students with core knowledge of the Circular Economy concept as well as the relevant technologies used in the recycling area	1 year	Business and Management
Certification	Cartificate in Circular Economy	Munster Technological University		4 months	Business and Management
Course-training programme	Circular Economy Skills Initiative	FIT with the support of Louth Meath Education and Training Board	FIT, WEEE Ireland, and the White Goods Association have come together to create a curriculum and formal career pathway for field service technicians to attract new entrants and create a steady supply into the sector to address a growing requirement with regard to maintenance, repair and recycling of white goods.	36 weeks	Electrical Repair
Upskilling course	Pathways to the Circular Economy: Designing for Circularity to Unlock Opportunity		It offers the possibility to learn more about circular economy strategies and apply it to the engineering field.	1 day	Engineering
Certification	Certificate in Sustainability and the Circular Economy	Griffith College			Business and Management

The Irish educational offer is more limited in terms of highly qualified training programmes. It is possible to recognise one bachelor's degree, two master's degrees and one postgraduate course. Master's and PhDs in the field of the circular economy are therefore lacking. The offer, however, spans several disciplines, indeed, differently from other countries, there is no specific polarisation in certain areas. There are courses in the energy sector, engineering environmental science, and business and management. Among vocational programs, it is possible to distinguish two courses aimed at providing certifications in circular economy and sustainability, one upskilling course and one training course. Concerning the latter, Ireland positively distinguishes among other countries. Indeed, at the best of our knowledge, only the Irish educational system offers a course aimed at training technician involved in activities of repair, maintenance and recycling. These figures are fundamental if we aim to reorganize current end-of-life product management systems in a circular perspective.



Italy

	Type	Course name	University	Description	Duration	Field
HIGHSKILL EDUCATIONAL PROGRAMS	Master degree	Sustainable Chemistry and Technologies for Circular Economy	University of Padua	It is a training programme for professionals to be employed in companies or public bodies applying a circular economy model to production and services. Students will be trained on the whole value chain underlying a circular economy model, though a strong focus will be given chiefly to techno-scientific skills and competences.	2 years	Industrial chemistry
	Master degree	Food Animal Metabolism and Management in the Circular Economy	University of Bologna	It aims to obtain a professional figure specialized in the management of animal production systems within circular economic approach. This goal is achieved by combining specific skills in the field of animal metabolism, its multiple connections with the issues of animal efficiency and health and advanced notions on the circular management of intensive production.	2 years	Food-animal production
	Master degree	Green Economy and Sustainability	University of Ferrara	The course provides students with interdisciplinary abilities in order to enable them to address issues related to green economy and sustainable development. The main topics of Green economy and sustainability are eco-innovation, green economy and sustainable development. Challenging eco-policy issues - from both national and international perspectives - are studied as well	2 years	Economics and Management
	Master degree	Master In Resource Economics and Sustainable Development	University of Bologna	It offers a solid preparation in environmental economics, a critical understanding of the economics of sustainable development, and of the complex interactions between economic decisions, market forces, governmental policies, and the environment	2 years	Economic Policy
	Master degree	Environmental and Sustainable Building Engineering	Sapienza University of Rome	It train professionals who, thanks to a relevant in-depth and interdisciplinary technical preparation, are able to work as designers, production and site managers, and inspectors in the civil construction sector, focusing on the sustainability of the underlying processes, both from a technological and an energy efficiency point of view and from a seismic, hydraulics, hydrogeological and environmental safety point of view.	2 years	Engineering
	Master degree	Circular Economy	University of Tuscia	The course aims to provide students with the necessary skills to operate consciously in different areas, often heterogeneous among them and offers the possibility of integrating technological innovation and new skills in activities of productive reconversion and sustainable development. The course is designed with a common path, oriented to the learning of themes, methods, and tools often used in a circular approach to the economy.	3 years	Economic Policy
	Master I level	Management of ecological transition	Università di Modena		9 months	Business and Management
	Master I level	Master In Sustainability Management	Polytechnic Milano	It is divided in 4 full time programs to choose: Environmental Sustainability & Circular Economy, Sustainable Industrial Management, Sustainability Management & Corporate Social Responsibility, Sustainable Finance	12 months	Business and Management
	Master I level	Green economy and sustainable management	Unicusano	The objective is training professionals prepared to respond to the economic challenges posed by the deterioration of the environment and the need to optimise resources.	1 year	Business and Management
	Master II level	BioCirce- Master in Bioeconomy in the Circular economy	University of Turin, University of Milan Bicocca, University of Bologna and University of Naples Federico II	It is an extensive training program for professionals interested in working within the bio-based goods and services industry using biological resources and biotechnological processes.	4 weeks	Product design
	Master II level	Executive Master In Circular Economy Energy and Waste Management	Luiss Business School			Business and Management
	MBA	Green Energy and Sustainable Businesses	Bologna Business School	It is aimed at young managers who see the challenges of climate change as the principle on which to build the future of business. These professionals are required to have general management skills and the ability to apply them in the field of sustainability and efficient use of natural resources.	1 year	Business and Management
	MBA	Master In Sustainability and Circular Bio Economy	Rome Business School		2 years	Business and Management
	VOCATIONAL PROGRAMS	Upskilling course	Executive Programme in Circular Economy Management	Luiss Business School	The main goal of this programme is to provide participants with managerial and professional skills to lead companies and organisations' transition to the circular economy, reaching economic success together with environmental and social value	6 months
Upskilling course		Business Sustainability and Circular Economy	Bologna Business School	Those attending the course will also increase their skills through discussions with academics, managers and management consultants from this sector. Together with them, the most significant experiences for different types of business will be discussed.	4 days	Business and Management
Research Centre		CERCIS Centre for Research on Circular economy, Innovation and SMEs	University of Ferrara	CERCIS is aimed to improve research education at a doctoral and master level, to develop synergies with companies and public institutions, to create networks, and to compete for additional funding opportunities, which can help conduct and expand an articulated set of activities focused on circularity, innovation, and SMEs.		
OTHER ACTIVITIES						

Italy

Master degree	Sustainable Chemistry and Technologies for Circular Economy	University of Padua	It is a training programme for professionals to be employed in companies or public bodies applying a circular economy model to production and services. Students will be trained on the whole value chain underlying a circular economy model, though a strong focus will be given chiefly to techno-scientific skills and competences.	2 years	Industrial chemistry
Master degree	Food Animal Metabolism and Management in the Circular Economy	University of Bologna	It aims to obtain a professional figure specialized in the management of animal production systems within circular economic approach. This goal is achieved by combining specific skills in the field of animal metabolism, its multiple connections with the issues of animal efficiency and health and advanced notions on the circular management of intensive production.	2 years	Food-animal production
Master degree	Green Economy and Sustainability	University of Ferrara	The course provides students with interdisciplinary abilities in order to enable them to address issues related to green economy and sustainable development. The main topics of Green economy and sustainability are eco-innovation, green economy and sustainable development. Challenging eco-policy issues - from both national and international perspectives - are studied as well	2 years	Economics and Management
Master degree	Master In Resource Economics and Sustainable Development	University of Bologna	It offers a solid preparation in environmental economics, a critical understanding of the economics of sustainable development, and of the complex interactions between economic decisions, market forces, governmental policies, and the environment	2 years	Economic Policy
Master degree	Environmental and Sustainable Building Engineering	Sapienza University of Rome	It train professionals who, thanks to a relevant in-depth and interdisciplinary technical preparation, are able to work as designers, production and site managers, and inspectors in the civil construction sector, focusing on the sustainability of the underlying processes, both from a technological and an energy efficiency point of view and from a seismic, hydraulics, hydrogeological and environmental safety point of view.	2 years	Engineering
Master degree	Circular Economy	University of Tuscia	The course aims to provide students with the necessary skills to operate consciously in different areas, often heterogeneous among them and offers the possibility of integrating technological innovation and new skills in activities of productive reconversion and sustainable development. The course is designed with a common path, oriented to the learning of themes, methods, and tools often used in a circular approach to the economy.	3 years	Economic Policy
Master I level	Management of ecological transition	Università di Modena		9 months	Business and Management
Master I level	Master In Sustainability Management	Polytechnic Milano	It is divided in 4 full time programs to choose: Environmental Sustainability & Circular Economy, Sustainable Industrial Management, Sustainability Management & Corporate Social Responsibility, Sustainable Finance	12 months	Business and Management
Master I level	Green economy and sustainable management	Unicusano	The objective is training professionals prepared to respond to the economic challenges posed by the deterioration of the environment and the need to optimise resources.	1 year	Business and Management
Master II level	BioCirce- Master In Bioeconomy in the Circular economy	University of Turin, University of Milan Bicocca, University of Bologna and University of Naples Federico II	It is an extensive training program for professionals interested in working within the bio-based goods and services industry using biological resources and biotechnological processes.	4 weeks	Product design

Italy

Master II level	BioCirce- Master In Bioeconomy In the Circular economy	University of Turin, University of Milan Bicocca, University of Bologna and University of Naples Federico II	It is an extensive training program for professionals interested in working within the bio-based goods and services industry using biological resources and biotechnological processes.	4 weeks	Product design
Master II level	Executive Master In Circular Economy Energy and Waste Management	Luiss Business School			Business and Management
MBA	Green Energy and Sustainable Businesses	Bologna Business School	It is aimed at young managers who see the challenges of climate change as the principle on which to build the future of business. These professionals are required to have general management skills and the ability to apply them in the field of sustainability and efficient use of natural resources.	1 year	Business and Management
MBA	Master In Sustainability and Circular Bio Economy	Rome Business School		2 years	Business and Management
Phd	Economics and Management of Innovation and Sustainability	University of Ferrara		3 years	Economics and Management
Phd	Innovation for the Circular Economy	University of Turin,		3 years	Economics and Management
Phd	Circular Economy CE.TS	University of Trieste		3 years	Economic Policy
Upskilling course	Executive Programme In Circular Economy Management	Luiss Business School	The main goal of this programme is to provide participants with managerial and professional skills to lead companies and organisations' transition to the circular economy, reaching economic success together with environmental and social value	6 months	Business and Management
Upskilling course	Business Sustainability and Circular Economy	Bologna Business School	Those attending the course will also increase their skills through discussions with academics, managers and management consultants from this sector. Together with them, the most significant experiences for different types of business will be discussed.	4 days	Business and Management
Research Centre	CERCIS Centre for Research on Circular economy, Innovation and SMEs	University of Ferrara	CERCIS is aimed to improve research education at a doctoral and master level, to develop synergies with companies and public institutions, to create networks, and to compete for additional funding opportunities, which can help conduct and expand an articulated set of activities focused on circularity, innovation, and SMEs.		

Italy's higher education offer is the richest compared to the other countries surveyed. Although there are no bachelor's degree courses, there are six master's degree courses, three first-level master's degrees, two second-level master's degrees, two MBAs and three PhDs. Higher education is also complemented by the presence of a research centre specializing in the circular economy. The courses mainly focus on economics (political economy and economics and management) and business and management disciplines. However, there are also courses in industrial chemistry, food animal production, engineering and product design. Less attention is paid to the provision of vocational programmes. In fact, the Italian education system only offers two upskilling courses in business and management. There are a number of regional study courses in Italy that offer to train new professional figures. This creates a non-homogeneity across the territory with respect not only to the training offer, but also to the presence of specialised figures.



Greece

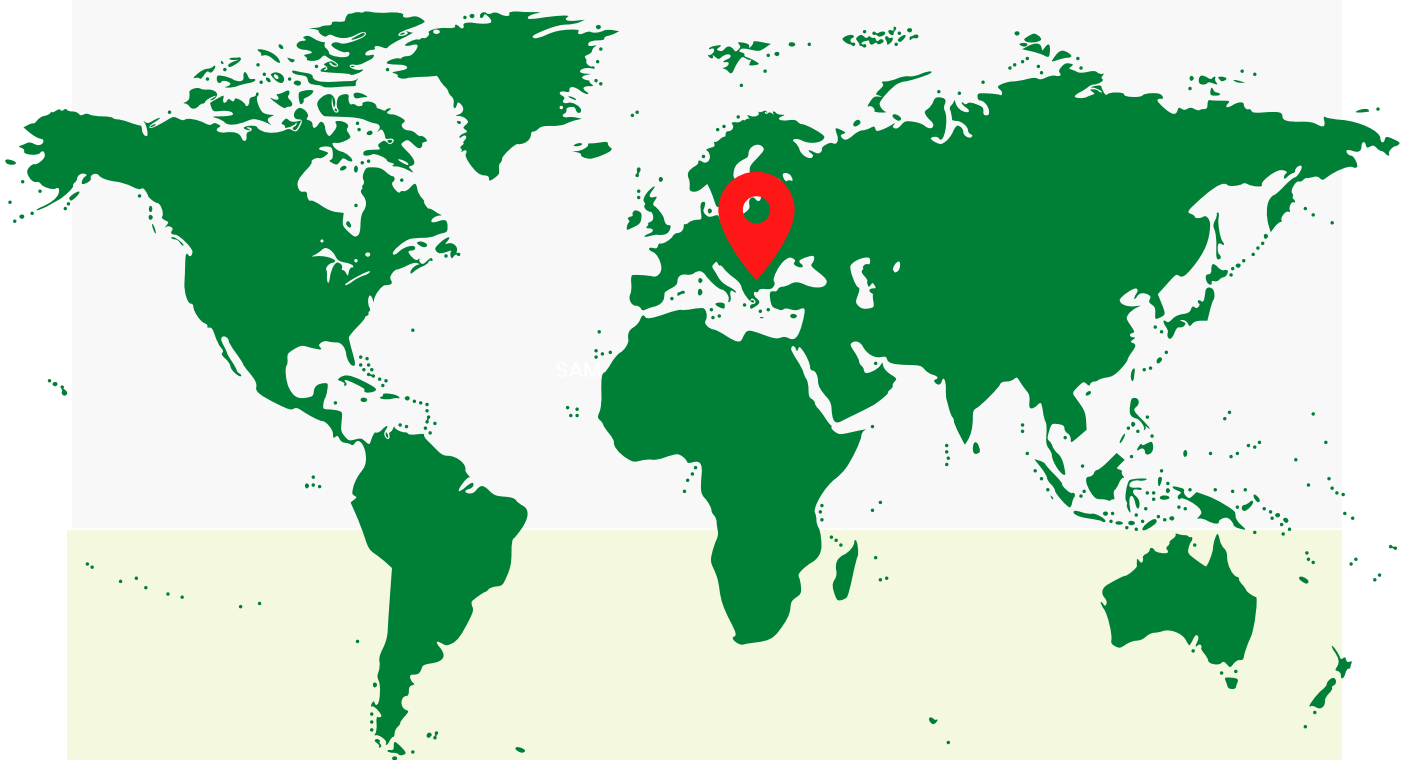
HIGH SKILL EDUCATIONAL PROGRAMS

Type	Course name	University	Description	Duration	Field
Bachelor degree	Environmental Engineering	University of Patras		5 years	Engineering
Bachelor degree	Environmental Studies	University of Aegean		4 years	Agriculture
Master degree	Conservation and Management of the Natural Environment in Protected Areas	University of Ioannina	Sustainable Management of Protected Areas: Inter-University Programme (in conjunction with the Biology Departments of the University of Patras and the Aristotle University of Thessaloniki.	2 years	Engineering
Master degree	Environmental Economics and Policy	Agricultural University of Athens	Master in Environmental Economics & Policyholder is a student who has studied economics in context within economy and Earth's systems. Postgraduates must hold abilities such as self-reliance, motivation, written and spoken communication, and organizational and time management skills.	2 years	Environmental Economics
Msc	MSc in Sustainable Agriculture and Business	International Hellenic University (IHU)	The MSc in Sustainable Agriculture and Business Programme is being offered by the School of Humanities, Social Sciences, and Economics of the University Center of International Programmes of Studies of the International Hellenic University. The courses are taught exclusively in English and conducted through flexible learning methods combining traditional face-to-face education with distant learning	3-4 semesters	Sustainable Agriculture
Msc	MSc in Environmental Management and Sustainability	International Hellenic University (IHU)	The programme has as its objective the provision of postgraduate level studies in Environmental Management and Sustainability and is designed for graduates including professionals or executives of businesses and 2 organizations who wish to broaden their specialization in the field and in Sustainable Development in general.	18-month programme	Management

Greece

	Phd	Department of Environment	University of Aegean	The Ph.D. courses in the Department of Environment last a minimum of three calendar years. They have no fees yet you may be required to successfully conclude a number of post-graduate level courses during the first year of your Ph.D. studies.	3 years	Different Sectors of Environmental Science
VOCATIONAL PROGRAM	Upskilling course	EPAL	Scientific Unit of Technical and Vocational Education. Greek Ministry of Education and Religious Affairs	The Scientific Unit of Technical and Vocational Education focuses on and advises on all issues concerning Vocational High Schools (known in Greek as EPAL) and the 4th optional year of apprenticeship. Nine sectors including environment and sustainability.	3 years	Sector of Agriculture, Food and Environment

The Greek offer of programmes dedicated to the environment and sustainability in general is very diverse and covers all levels of education. The table above shows just a few of them, ranging from engineering to economics to agriculture. Particularly noteworthy is the EPAL training programme, which provides lengthy training in nine different fields. Courses last a maximum of three years, with a possible additional year dedicated to apprenticeships. Exploring the Greek training offer, we could therefore see that the Vocational Training system is particularly supported by the Greek ministry, which regulates it centrally. Comparing the Greek offer with that of the other countries examined in this work, it is possible to note profound differences, such as the Italian system, which decentralises this level of training to third regional level bodies.



Conclusion

The new economic paradigm designed by the circular economy implies the shift of workers from dirty to cleaner sectors that profoundly change labour market conditions, because new skills will be required.

Moreover, the presence of new patterns of living and consumption requires the formation of conscious citizens and consumers who are able through their choices to promote and support change. To meet all these factors, human and professional growth paths must be adequate to support this growth. Without a suitable framework, the transition process towards a circular economy, and in a broader sense a sustainable one, will not be able to take place because the engine that fuels the transition would be missing.

In the middle of the transition process, it is therefore useful to try to analyse the conditions of the current education system in order to identify strengths to nurture, and weaknesses to modify, so that the transition can be founded on solid fo To this end, the report aims firstly to analyse the need for green workers in the labour market, and secondly to analyse how different education systems are able to respond to the training of new workers and new consumers. What emerges is a highly heterogeneous situation among the countries examined.

In some cases, the education system lacks precise and targeted pathways for transitions. In other cases, such as Italy, the training of new green workers is often entrusted to regional courses that therefore do not guarantee uniform training throughout the territory. In addition, we highlight in many contexts the presence of study courses (especially PhD/McS) that aim to train high-skilled workers (e.g. Germany), resulting in a lack of low-skilled green labour in the labour market. this leads to segments in which the supply of green labour is lacking. The presence of different educational pathways also responds to a logic of organizing education systems very differently across countries as seen in section 2. The report also shows a strong non-homogeneity if we look at the sectionalization, with a greater presence of pathways related to industrial and chemical sectors, and less devoted to business and management areas.

References

- Cecere, G., Mazzanti, M., (2017) "Green jobs and eco-innovations in European SMEs" Resource and Energy Economics 49 (2017) 86–98
- Cedefop (2021). The green employment and skills transformation: insights from a European Green Deal skills forecast scenario. Luxembourg: Publications Office.
<http://data.europa.eu/doi/10.2801/112540>
- European Commission (2022) "GreenComp: The European sustainability competence framework"
- German education system, <https://www.studying-in-germany.org/german-education-system/>
- ILO (2018) World Employment Social Outlook "Greening Jobs"
- ILO (2019). Skills for a Greener Future: A Global View
- Kirchherr, J., Piscicelli, L., (2019) "Towards an Education for the Circular Economy (ECE): Five Teaching Principles and a Case Study" Resources, Conservation & Recycling 150 (2019) 104406
- OECD/Martinez-Fernandez. C, Hinojosa C, Miranda G., "Green jobs and skills: the local labour market implications of addressing climate change", 8 February 2010, working document, CFE/LEED, OECD,
www.oecd.org/dataoecd/54/43/44683169.pdf?contentId=44683170
- Overview of the Irish education system,
https://www.citizensinformation.ie/en/education/the_irish_education_system/overview_of_the_irish_education_system.html#:~:text=The%20Irish%20education%20system%20is,years%20of%20post%2Dprimary%20education.
- Study in France, <https://fulbright-france.org/en/study-france/understanding-french-education-system#:~:text=The%20French%20education%20system%20consists,that%20have%20highly%20centralized%20administrations.>
- The Finnish education system, <https://www.infofinland.fi/en/education/the-finnish-education-system>
- The Italian School System,
<https://www.fermimn.edu.it/formazione/KRISNEL/THE%20ITALIAN%20SCHOOL%20SYSTEM%20KN.pdf>
- The organization of school in Europe, <https://eurydice.eacea.ec.europa.eu/Study-Environmental-Studies-in-Germany>,
<https://www.mygermanuniversity.com/subjects/environmental-studies>
- UNEP (2012). Green economy in action: Articles and Excerpts that Illustrate Green Economy and Sustainable Development Efforts. Disponibile
http://www.un.org/waterforlifedecade/pdf/green_economy_in_action_eng.pdf
- UNEP (2021) "Global Guidance for Education on Green Jobs Connecting Higher Education and Green Opportunities for Planetary Health"