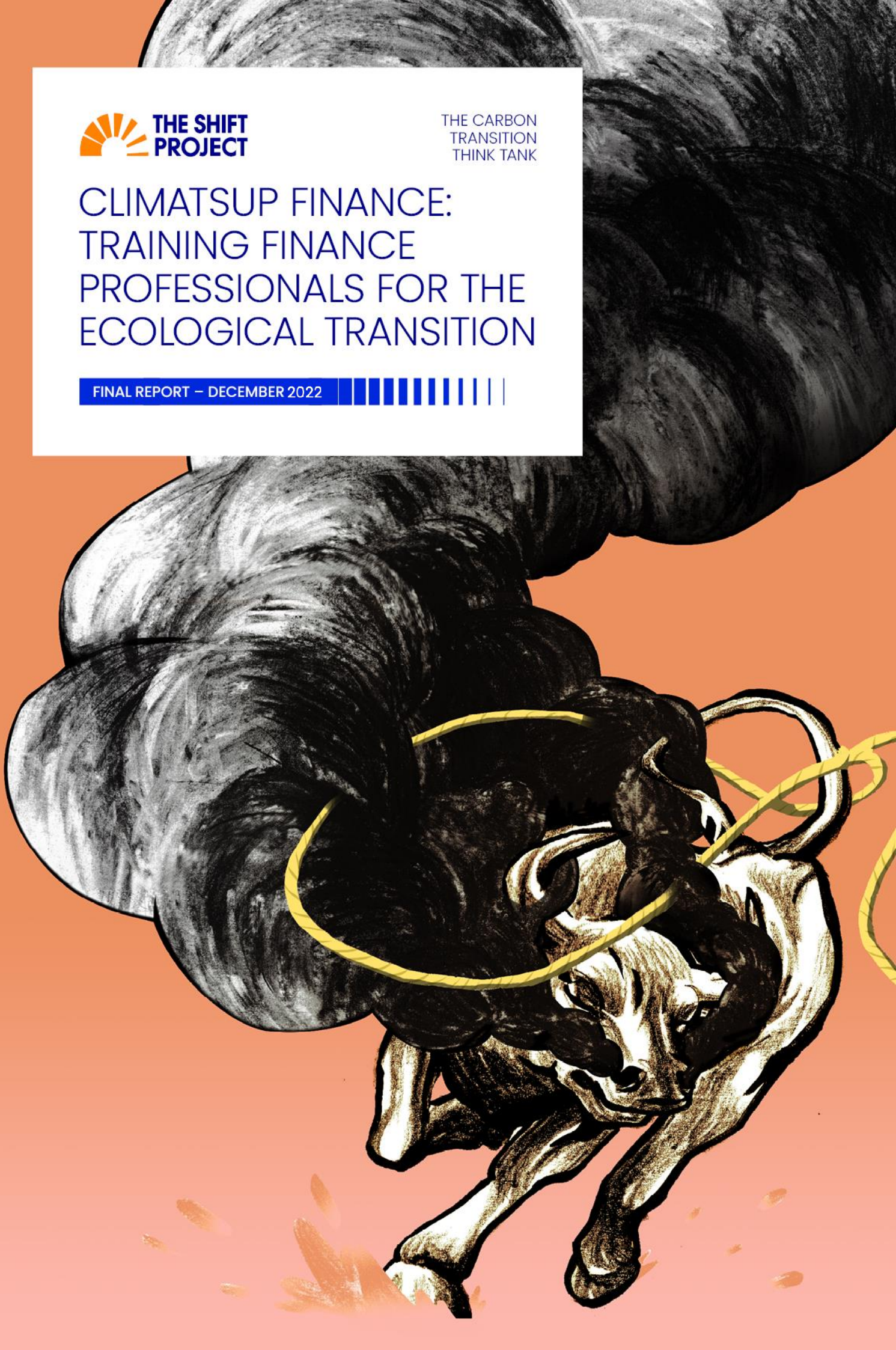
THE SHIFT PROJECT

THE CARBON TRANSITION THINK TANK

CLIMATSUP FINANCE: TRAINING FINANCE PROFESSIONALS FOR THE ECOLOGICAL TRANSITION

FINAL REPORT – DECEMBER 2022



Illustrations: Virgile Bellaiche

Preamble

This report is intended for the finance higher education ecosystem, and more specifically for the heads and presidents of institutions and teaching staff.

The financial industry has been at the heart of climate negotiations since the Paris Climate Agreement. The stakes are twofold: on the one hand, finance has an impact on the Earth system, and the ecological transition requires a major redirection of financial flows towards an economy that respects planetary boundaries. On the other hand, climate change and the overstepping of planetary boundaries represent a threat to the stability of the financial system. Financial sector players are mobilizing to contribute to the low-carbon transition. However, the majority of finance professionals are not trained in ecological issues. Yet the French financial sector benefits from a large number of recognised educational programmes in finance. It is therefore essential that these programmes prepare students and professionals to adapt their practices to ecological challenges such as global warming, the erosion of biodiversity and the depletion of resources, both energy and non-energy.

The aim of the ClimatSup Finance project is to **help transform higher education in finance so that 100% of students and professionals are trained in ecological issues** (climate, biodiversity, depletion of energy and non-energy resources). It is intended to inspire all higher education institutions, whatever their nature (public or private) and whatever the programme taught.

The project concerns only the teaching provided. Research activities, the implementation of environmental practices in campus management and other aspects of an institution's ecological transition are dealt with only incidentally. It deals with **ecological issues in the broadest sense** (see "Why discuss ecological issues?", p.23) and covers **initial and continuing education**.

The ClimatSup Finance report is structured around five questions:

- **Why integrate environmental issues into finance courses?**

The first part (p.18) provides an overview of the current ecological crises, examining their relationship with our economic and social systems, and discussing the consequent implications for finance educational programmes. It presents a detailed assessment of the extent to which ecological issues are integrated into initial and ongoing finance educational programmes that are considered benchmarks in France.

- **How is finance evolving, particularly in relation to ecological issues?**

The second part (p.55) examines the role of finance in its modern context, reviews current initiatives addressing ecological issues, and presents the outcomes of a forward-looking study intended to stimulate discussion on the necessary knowledge and skills to be imparted in finance education.

- **What should new graduates in finance know on ecological issues?**

The third part of the report (p.91) sets out the knowledge and skills required to understand and implement the ecological transition. It consists of a "management" framework, common to all management students, a "finance" framework, specific to students intending to work in finance, and job descriptions, specifying required knowledge and skills for jobs in finance: risk analysis, regulation and compliance, and asset management.

- **How can this content be integrated into existing training courses?**

At the end of part 3 (p.173), we provide some food for thought for programme managers and professors. They concern the teaching of ecological issues and the integration of the knowledge and skills framework into a curriculum.

- **What should financial education stakeholders do to ensure that environmental issues are integrated into training courses?**

Recommendations for all stakeholders in higher education in finance (management and presidents of institutions, teachers, students, staff of institutions, the State and players in the institutional framework, companies and financial institutions, alumni, certification bodies, accreditation and ranking bodies, and academic associations in finance) are presented in part 4 (p.192).

This report extends the reflection on higher education in management initiated in the "ClimatSup Business - Educating the actors of tomorrow's economy" report[1]. Readers may wish to refer to this first report to consult the **guide to transforming training courses for school directors and presidents**, which has not been included in ClimatSup Finance. The ClimatSup Business project has also produced a **collection of feedback from business schools on the transformation of management courses**. It is available on the project's web page[2].

This work was guided by the principle of scientific rigour (see project guiding principles in appendix). It was carried out in consultation with stakeholders, including partner higher education institutions and companies, finance professors from other institutions, finance professionals, alumni, students, etc. (see acknowledgements at the end of the report p.217).

[1] The Shift Project, « ClimatSup Business - Educating the Actors of tomorrow's Economy », 8 novembre 2022, https://theshiftproject.org/wp-content/uploads/2023/04/230330-ClimatSup-Business-Final-Report-The-Shift-Project_ENGLISH.pdf.

[2] https://theshiftproject.org/former-acteurs-economie-de-demain/

Foreword

« Regardless of the nature of their activities, whether salaried or self-employed, in a large or very small structure, people in charge of financial aspects cannot afford not to take ecological issues into account - and the training they receive, whether initial or more advanced, must provide them with the main elements of understanding and intelligence.

Developments in the sector over the last few years have multiplied the number of subjects to which these issues can be applied, and they now concern the wide range of activities covered by the term "Finance": from the cash management of a very small company to the taxation of international groups, not forgetting a good knowledge and, if possible, informed practice of the ever-increasing number of regulations, in France, Europe and beyond; from the simple keeping of accounts to the drafting of complex reports and participation in the follow-up of "missions" that the company sets itself and must continually refine and specify. And in keeping up with the continuous changes that these issues are now undergoing.

Finance is a tool, or rather a toolkit, many of which are complex.

All those destined for these professions, whatever their chosen speciality, should receive initial and ongoing training in understanding and incorporating ecological issues into their work. Such training cannot be reduced to a few hours of furtive introduction. This is also true for those who, although not initially destined for these subjects, are led to take an interest in them at a later stage in their lives.

The responsibility of teachers and trainers is eminent. Individually and collectively, it's up to them to sow the seeds of an appetite that life and career will gradually enrich. This requires each and every one of them to pay constant attention to their own understanding of the scientific, human and ethical issues encompassed by ecological challenges.

As we can see from what sometimes seems to be an acceleration of history, the urgency here is obvious. »

Sylvain De Forges, Administrator, **The Shift Project**

« Faced with the ecological crisis, CNP Assurances is convinced that the financial sector is part of the solution, not part of the problem. As a major player in life insurance in France, we collect our customers' savings and invest them in all sectors of the economy. Our responsibility is therefore to direct our investment flows towards economic activities that have a positive impact on the environment, adopting a holistic vision that takes into account issues linked to climate change, biodiversity loss, pollution, water resources and the circular economy.

To transform the financial sector from within, we need specialised skills: understanding the causes and consequences of the ecological crisis, mastering the major environmental issues specific to each sector, integrating the new regulatory framework for sustainable finance, actuarially estimating future claims by integrating climate drift, defining investment policies that take planetary boundaries into account, applying an environmental stress-test to the balance sheet of a financial establishment, etc.

Until now, these skills have been acquired mainly through continuing education and in-house project experience. It is now imperative that higher education courses in finance integrate these ecological issues, so that banks, insurance companies and asset managers can recruit young graduates who are able to reconcile social, environmental and financial issues in a sustainable way.

As a business leader with a long-term development vision, I am certain that mastering these skills is now an essential factor in the development of our sector, and a differentiating criterion for selecting the best graduates. It is my wish that this report will mobilise and guide school leaders, teachers and students who wish to integrate ecological issues into their training courses to meet the recruitment needs of the financial sector. »

Stéphane Dedeyan, General Manager of **CNP Assurances**

« "When we at BNP Paribas decide to become a driver of the energy transition, this requires us to take far-reaching action: recruiting engineers capable of understanding the true environmental impacts, training teams from sales to risk specialists to human resources, learning to identify new business models, creating financing methods that encourage individual and professional customers to engage in their own transition, inventing new measurement tools, and finally, perhaps most importantly, leading the great work of cultural transformation within our company."

This is what we wrote to the presidents of universities and grandes écoles back in 2019. This is what motivated our support for the Shift Project's work in 2022. The need for knowledge and skills in climate and biodiversity is enormous. And we're well placed to know it. As Europe's leading corporate bank, we are witnessing the real economy in action. As the largest employer in the Paris financial centre, we are the first to be affected by these HR changes.

Since 2019, we've come a long way. We have developed our expertise internally: through specific training for all business lines, through a 250-strong group dedicated to supporting our corporate customers that we are in the process of duplicating for SMEs, through a 500-strong network of experts in sustainable transitions... To align our portfolios with the trajectory of the Paris agreements, we are looking for ESG Data Scientists, ESG risk analysts, banking advisors capable of understanding new business models, etc.

This report provides an overview of the issues at stake and some initial insights into the business. Nevertheless, in our view it is still incomplete. The operational challenges posed by the ecological transition for banks and businesses are considerable. We believe that the resulting training and recruitment needs are still underestimated. »

Antoine Sire, Head of Corporate Commitment,
Member of the Group Executive Committee **BNP Paribas**

A word from our partners

« The financial sector must transform itself to comply with an ever-changing regulatory framework and respond to today's socio-ecological emergencies. This transformative challenge can only be met by enabling industry professionals to acquire new expertise and skills. In an environment where training opportunities are still not easily accessible, Finance for Tomorrow aims to strengthen relations between the academic world and financial players, and to give credibility to their training offerings in order to support the skills development of industry professionals and meet the market's need for talent in the field of sustainable finance. The initiative therefore supports the work of Shift and its ClimatSup Finance project. »

Pauline Becquey, General Manager, **Finance4Tomorrow**

« The emergence of a financial model that better integrates sustainability issues has become a necessity, and all players in the financial ecosystem are now mobilized, in particular through a strong regulatory impetus. The AMF and its 500-strong staff are actively involved on a daily basis in building the regulatory framework for sustainable finance, supporting the players involved and giving credibility to the ecosystem. The challenge for our institution is unprecedented: to ensure a rapid, technical and educational rise in expertise. This is essential if today's students are to become tomorrow's supervisors. »

Benoît de Juvigny, General Secretary, **Autorité des marchés financiers**

« The financial sector is a facilitator of the ecological transition thanks to three levers: by stopping financing the expansion of harmful activities, by financing the transition of activities at stake, and finally by financing the climate solutions needed to mitigate and adapt to climate change. The training of future professionals must therefore integrate climate issues in a systemic way, so that they can clearly identify them, become aware of the impacts of financial institutions and navigate through the growing number of regulatory changes. »

Noam Leandri, General Secretary, **ADEME**

« IFCAM wanted to take part in the ClimatSup Finance project to integrate ecological issues into its training courses. This need stems from the evolution of a sociological, regulatory and legal environment, which has been rapidly structuring over the past decade, both at a European level (the taxonomy more recently), and at a national level (the Pacte law, for example). Ecological issues are now an essential part of corporate life. This work will be a particularly useful viatic for training those involved in adapting companies to tomorrow's world, at the cost of a major and inescapable cultural change that will affect all our practices and those of companies. »

Guillaume Lefebvre, General Director, **IFCAM, University of Groupe Crédit Agricole**

« The French General Commission for Sustainable Development ('Commissariat général au développement durable') agrees with the Shift Project on the challenge of changing financial sector practices in favour of sustainable development. Higher education and continuing training must fully integrate environmental issues so that teaching provides the methods, tools and the renewed conceptual framework essential to the transformation of the financial sector. »

Thomas Lesueur, **Commissaire général au développement durable**

EDUCATING *ALL* FINANCIAL ACTORS ON ECOLOGICAL ISSUES

AN ESSENTIAL CONDITION FOR FINANCE TO SERVE THE ECOLOGICAL TRANSITION

The Shift Project offers concrete solutions to integrate ecological issues to financial education, in partnership with professors and sector experts.

The ecological transition requires massive financing. Regarding mitigation of climate change only, investments required in France amount to 100 billion euros per year by 2030.

Financial needs are diverse : industrial processes decarbonization, building insulation, species protection, etc.

Only 5 % of France's financial trainings include ecological issues : financial actors have a major role to play, but they are not being trained for it.

Financial professionals must understand the physical constraints and their implications for their job. To get there, they need to follow **at least 320 hours of trainings for a 5 year post-graduate program.**

Ecological issues must be integrated in a transverse manner to all courses. Events to raise awareness or a single course on those issues are not enough. **All actors, initial and continuous education alike, must be involved in this evolution.**

THIS REPORT OFFERS

A "finance" knowledge and skills framework	▸ Elements which should be taught to all finance students for an understanding of what's at stake in ecology and how to act in their line of activity ▸ Sources for going deeper and to fully integrate the basic elements : lessons, studies, scientific papers, ...
A "management / economics" knowledge and skills framework	▸ Elements to be taught to all management students for an understanding of the stakes in ecology and link them to management and economics ▸ Examples and sources (lessons, studies, scientific papers, ...) to dive deeper into the basic elements ▸ A focus on the ecologic stakes of digital technology
4 occupational profiles	▸ Projects and businesses financing Regulation and compliance Risk analysis Asset management
12 potential evolutions in finance	▸ 12 developments to stimulate the thoughts on the knowledge and skills to be taught
Recommendations for every actor	▸ Top management of universities and schools, State, companies, certificating bodies, teachers, students, ...
Operationalizing the framework in a 3-year program	▸ In order to help the programs managers and teachers to implement in a practical way the finance framework into a program specialised in finance

More than 150 professionals in finance, management and higher education are involved

This report is a sequel on the report «ClimateSup Business - educating the actors of tomorrow's economy» (november 2022) which offers recommendations for management trainings.

[1] ADEME - CGDD. February 2022
[2] 1 400 training curriculum in France analysed by The Shift Project for this report

WHAT DO FINANCE GRADUATES NEED TO KNOW
TO BECOME ACTORS OF THE TRANSITION ?

The skills and knowledge framework is a tool for professors and education manager. I**t outlines the knowledge and skills to include in core** management and finance **courses.**

It is supplemented with a **"finance" skills and knowledge framework**, which lays out the skills and knowledge to teach finance students in addition to (and not instead of) the core courses.

Knowledge from the management framework amount to about **165 hours of teaching, including 48 hours (6 ECTS credits) dedicated to the planetary boundaries and their socio-economic implications.** In addition, knoweldge form the "finance" framework consist in 156 hours of teaching for a 5 year post-graduate program. Beyond these classes, the whole students' academic pathway must contribute to the teaching of these skills and knowledge.

Economic actors must :

- **Understand the physical constraints and their implications** for society, economic systems and organisations.
- **Mobilise natural sciences, engineering sciences, humanities and social sciences.**
- **Know the limits of the models** taught in management and economics to take into account the ecological issues
- **Understand scenarios to get to global carbon neutrality, the impacts and dependencies on biodiversity, the critical nature of resources** and their implications for each sector of the economy.
- **Plan the transformation of economic activities to be consistent with a minimum 6% decrease in greenhouse gas emission per annum.**
- **Know how to train their management and their teams** in a transformation project towards planetary boundaries respect
- **Dare to be creative** to reinvent current practices

Financial actors must also develop their job-specific skills and knowledge, such as :

- **Know the limits of the mechanisms used in finance to take ecological issues into account** (green finance, ESG etc.).
- **Understand finance's necessary contribution to the ecological transition :** financing the mitigation of organisations' impacts on the environment, improve the real economy's resilience in the face of crises to come, not worsening the ecosystemic disequilibrium.
- **Understand the ways in which ecological issues are taken into account by regulatory authorities and monetary institutions :** monetary policies for climate objectives, consideration of ecological issues by regulatory authorities, etc.
- **Know the regulatory framework guiding finance in the context of the transition,** their limitations and the tendencies in place.
- **Aim for impact in the ecological transition :** ask and redefine the relevance of financial metrics, know where to find and how to use extra-financial data, judge their quality and their limitations.

This finance knowledge and skills framework is completed with a focus on 4 different types of jobs:

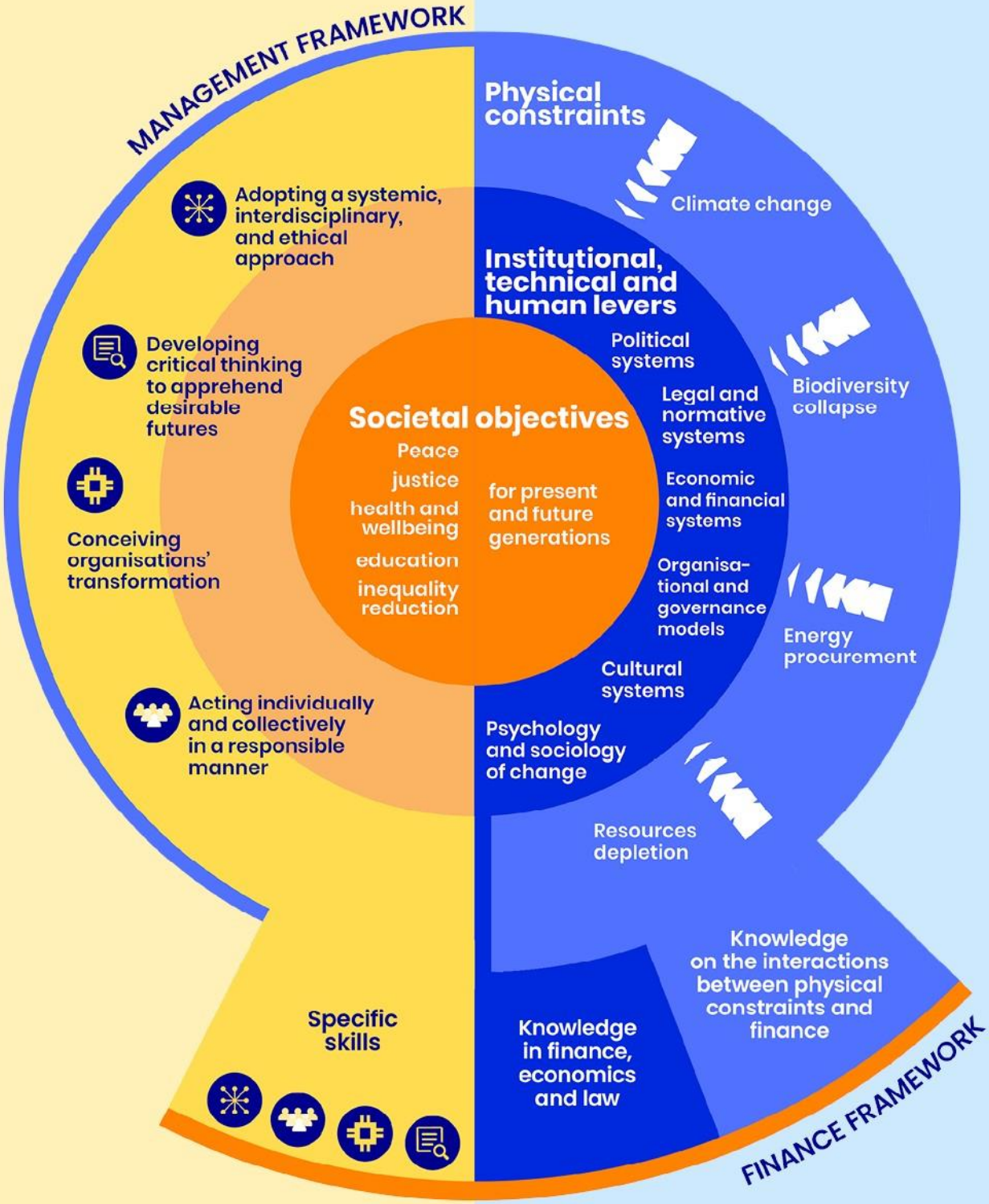
- **Project and businesses financing**
- **Regulation and compliance**
- **Risk analysis**
- **Asset management**

These focus describe the role of these types of jobs in the ecological transition and explain further the knowledge and skills to be taught to finance students

"MANAGEMENT" KNOWLEDGE AND SKILLS FRAMEWORK...

SKILLS FOR THE TRANSITION

KNOWLEDGE RELATED TO ECOLOGICAL ISSUES



COMPLETED WITH SPECIFIC KNOWLEDGE AND SKILLS FOR FINANCE STUDENTS

FINANCIAL PROFESSIONALS MUST BE PREPARED TO AN UNCERTAIN FUTURE

Anticipating the many potential changes in finance under the effect of the crises caused by the ecological emergency is an essential step in preparing for them.

In a prospective manner, this report reviews 12 potential evolutions of finance under the effect of the ecological emergency.

Inspired by literature and contributions from sector experts, these 12 evolutions describe **chosen or incurred events that could happen and lead to significant changes in the way finance works.**

This prospective reflection aims to **help program directors and professors to identify the skills and knowledge professionals** need to develop for them to be able to tackle the challenges they may be facing in the future.

A change in some economico-financial practices ?

1. **The use of public investment and public guarantee** to finance the ecological transition either by coordinating central banks' and public investment banks' actions, or by monetizing public debt, or by canceling a part of public debt.

2. **An evolution of central banks' mission** in favour of financing the ecological transition, for example, by integrating dual materiality to their doctrine (revising the collateral policy, reorienting quantitative easing, changing macro and micro-prudential policies...).

3. **Injection of free currency in the economy,** via buy-back of bank bonds by the central bank without asking for reimbursement.

4. **Stop focusing on GDP growth objectives** and the changes in practices due to repeated recession risks.

5. **An evolution of exchange and inflation regimes** due to an ever more volatile world with physical flows slowing-down and deglobalizing

12 evolutions to consider

A reinforced regulation

6. **Development of a "brown" taxonomy,** with European norms forbidding investments in sectors considered detrimental to the environment.

7. **Evolution of the prudential Bâle III regulation** to introduce quantitative and qualitative constraints on portfolios and banks' capital to limit climate or biodiversity risks.

8. **Set up a management policy for carbon stranded assets** to redirect financial flows toward sustainable activities.

9. **Generalization of methods accounting for socio-ecological impacts,** such as triple capital accounting (financial, human, environmental).

10. **Accounting for ecological issues in fiduciary duty,** conditioning executives' salaries and dividends to the ecological impact of the company

11. **Integrating ecological risk at the heart of banks' and insurances' practices** to best hedge against physical risks and overcome non-insurable pockets.

12. **Orienting individuals' savings** towards financing the transition.

RECOMMANDATIONS BY ACTOR

For each recommendation, you will find precisions in the report, as well as examples and resources.

MANAGEMENT AND PRESIDENTS

Driving the institution's approach

- Train all staff members:
  - **20h for management and administrative staff**
  - **At least 48h for professors,** in order for them to understand the planetary boundaries and their implications on management teaching
- **Redefine the university's strategy** to include the ecological issues with ambition and coherence in teaching, research, campus, practices, and governance
- **Mobilise human and financial resources** to lead the transformation: **3 % of the operating budget for at least 3 years**
- Make sure that professors do not face **conflicts of interest between their courses and their professional activity.** If there are some, those conflicts of interest should be publicly disclosed.
- **Define the starting point** of the university and identify the assets it can rely on (professors, partners, etc.)
- **Organise a consultation** with all stakeholders of the institution to define a **common base of knowledge and skills**
- **Drive the integration of this common base in all programs** in a coherent manner
- **Collaborate** with other universities to move forward at a faster pace

PROFESSORS

Se former pour former

- **To train oneself** : 48h on planetary boundariesand their consequences on the course taught
- **Change course** content on the basis of skills and knowledge framework
- **Publicly share the courses** and teaching materials to accelerate the teachings' evolution
- **Report the expectations** from students and professors to the university administration
- **Switch from a posture of knowledge to a posture of facilitator,** making students actors of their learnings
- **Integrate those issues into their research program**
- **Expose potential conflicts of interest** in research and teaching

STUDENTS & ALUMNI

Engage and testify

- **Learn about ecological issues**
- **Mobilise and raise awareness** among peers and students and alumni associations, for example, by organising events
- **Alert, and relay expectations** to professors or university administration, for example by talking with them or writing open letters
- **Testify and manifest the need for skills** in the professional world (for alumni)

THE STATE

Set up a suitable framework

- **Provide clear and consistent orientations** on ecological issues such that corporates are on board for the ecological transition
- **Inject momentum by defining a national secondary teaching and research strategy for climate** with the objective of training 100% of students on ecological issues
- **Create a framework that incentivises the transition,** for example, by valuing interdisciplinarity work and teaching in the career of professor-researchers
- **Offer a financial support to universities** - especially public ones - to aid them in their transition

ACCREDITATIONS & RANKINGS

Encourage and value

- **Grant more importance to ecological issues than to any other criteria** in the evaluation
- **Precisely define how ecological issues** will be assessed, placing planetary boundaries at the center
- **Value the integration** of ecological issues in **all academic curriculum**
- **Quantitatively and qualitatively assess the impact** of actions undertaken
- **Ensure transparency** in the approach, methodology, and data, and **use cross-referencing**

CORPORATES & FINANCIAL INSTITUTIONS

Train, recruit, finance

- **Thoroughly train the Board of directors and Executive Committee on ecological issues**
- **Engage their organisation in a coherent and ambitious strategy respectful of planetary boundaries,** and make their practices evolve accordingly
- **Organise continuous training of all staff** on ecological issues to be able to lead this transition
- Systematically **recruit** staff trained on ecological issues, and communicate around it
- **Finance research** on ecological issues in finance, respecting research independence
- **Integrate, in a systemic manner, the ecological issues to their strategy** and across operations

PROFESSIONAL CERTIFICATION BODIES

Redefine the norm

- **Embed ecological issues to all certifications**
- **Devote 25% of certification content** to ecological issues
- **Go beyond ESG index, aim for impact :**
  - Ensure proper understanding of physical constraints, their implications on economic and financial activities, and of the systemic nature of the ecological transition
  - Encourage critical thinking with regards to the integration of ecological issues in finance, and promote practices that allow for real redirection of capital flows towards activities that underpin the ecological transition

Table of contents

PART 1

EDUCATION IN FINANCE IS CRUCIAL FOR ECOLOGICAL TRANSITION

I. Carrying out ecological transition involves rethinking our activities and societal models

This report addresses ecological issues that go beyond energy and climate topics, i.e. the usual scope of The Shift Project. It reflects the vision of the teaching teams with whom the think tank worked in the framework of this project and upstream. In addition to climate change and energy issues, it addresses other planetary boundaries, first and foremost the loss of biodiversity[3,4], and other physical constraints linked to the finitude of resources. Above all, it takes into account the social issues linked to physical constraints, in a systemic approach. This broader scope was essential for offering the teaching of an alternative vision of our economy and its financial system.

A. Indisputable scientific consensus: human activities are at the origin of the major imbalances affecting the planet Earth

The situation is worrisome at the beginning of the 21st century.

Human societies are facing what The Shift Project defines as a "double carbon constraint": downstream, it is characterized by climate change, as a result of greenhouse gas (GHG) emissions, and upstream, by the progressive scarcity of fossil energy resources.

Downstream, climate change, which is the result of greenhouse gas emissions of human origin, creates different risks of unprecedented magnitude for both humans and all other living organisms, as the IPCC (Intergovernmental Panel on Climate Change) has been pointing out for three decades. Since 1850, human activities have added about 2,400 billion tons of CO_2 to the atmosphere. The most recent estimates indicate that the remaining carbon budget to meet the Paris Agreement[5] goal of keeping global warming well below 2°C by 2100 is less than 1,000 billion tons of CO_2, or between 20 and 25 years of global emissions at current rates. The challenge is immense: to date, all the commitments of the signatory countries of the Paris Agreement lead to a global warming of more than +3°C.[6]

Upstream, fossil energy resources[7], which account for more than 80% of the primary energy used in the world, are becoming increasingly scarce. In the case of oil in particular, the rate of extraction appears to be increasingly constrained by geological limits. Conventional oil production (which provides 4/5ths of the world's liquid fuel production) reached an all-time high in 2008 and is expected to decline inexorably.[8]. The total oil production of the European Union's main current suppliers is likely to be 10 to 20% lower in the course of the 2030s than in 2019, due

[3] Will Steffen, Katherine Richardson, Johan Rockström, Sarah E. Cornell, Ingo Fetzer, Elena M. Bennett, Reinette Biggs, Stephen R. Carpenter, Wim de Vries, et al., « Planetary Boundaries: Guiding Human Development on a Changing Planet », *Science* 347, nº 6223 (13 février 2015): 1259855, https://doi.org/10.1126/science.1259855.

[4] Biodiversity can be divided into three levels: ecological diversity (diversity of ecosystems), specific diversity (species) and genetic diversity (genes). Biodiversity loss does not only refer to the disappearance of species, but also to the loss of genetic diversity: population decline (decrease in the number of individuals) or disappearance of varieties and races within a species.

[5] The Paris Agreement is an international treaty on climate change mitigation and adaptation adopted in 2015.

[6] IPCC, "Climate Change 2021: The Physical Science Basis - Summary for Policymakers", August 2021, https://www.ipcc.ch/report/ar6/wg1/.

[7] Oil, coal and natural gas.

[8] In 2010, the International Energy Agency identified a crude oil peak in 2006. It corrected this in 2012, setting the date for the peak of conventional crude oil at 2008. International Energy Agency (IEA), "World Energy Outlook 2010", November 2010, 48; International Energy Agency (IEA), "World Energy Outlook 2012", November 2012, 81; International Energy Agency (IEA), "World Energy Outlook 2018", November 2018, 142.

to the lack of sufficient new reserves to compensate for the decline in existing production[9]. In addition to the obligation to reduce the consumption of fossil resources to limit greenhouse gas emissions, this scarcity obliges us to foresee the reduction of their extraction and use, since it will be done by choice or by force.

The global nature of climate change and the omnipresence of fossil fuels in every aspect of our economies make this double carbon constraint inexorable, both on the global scale and in France.

Recent human activities are also the source of other physical upheavals of a magnitude never before seen in human history, which some researchers have grouped together under the notion of the "Anthropocene". This is the name given to "new era in the history of the Earth where humanity as a whole has become a geological force capable of approaching and, in some cases, reaching the limits of the Earth system. [10,11]

Several origins are proposed to qualify the beginning of this era. In 2004, the International Geosphere-Biosphere Programme (IGBP) laid the foundations for thinking about the phenomenon of "great acceleration". **The Great Acceleration refers to the period from the middle of the 20th century onwards during which human development accelerated sharply** (population growth, primary energy consumption, freshwater use, tourism, etc.), **with unprecedented consequences for the Earth's functions**: ocean acidification, loss of atmospheric ozone, biodiversity loss, etc. Indicators of this great acceleration show links between socio-economic development and the evolution of the Earth's systemic organisation (Figure 1).

[9] The Shift Project, "Oil: what risks for Europe's supplies?", May 2021.

[10] The "Earth system" refers to the interacting physical, chemical and biological processes of the Earth. Human life and societies are also an integral part of the Earth system. International Geosphere-Biosphere Programme (IGBP), "Earth system definitions," accessed April 25, 2022, http://www.igbp.net/globalchange/earthsystemdefinitions.4.d8b4c3c12bf3be638a80001040.html.

[11] Jacques Treiner, Fil conducteur pour une introduction à l'Anthropocène en début d'études supérieures, 2020, https://enseignerleclimat.org/resource/1.

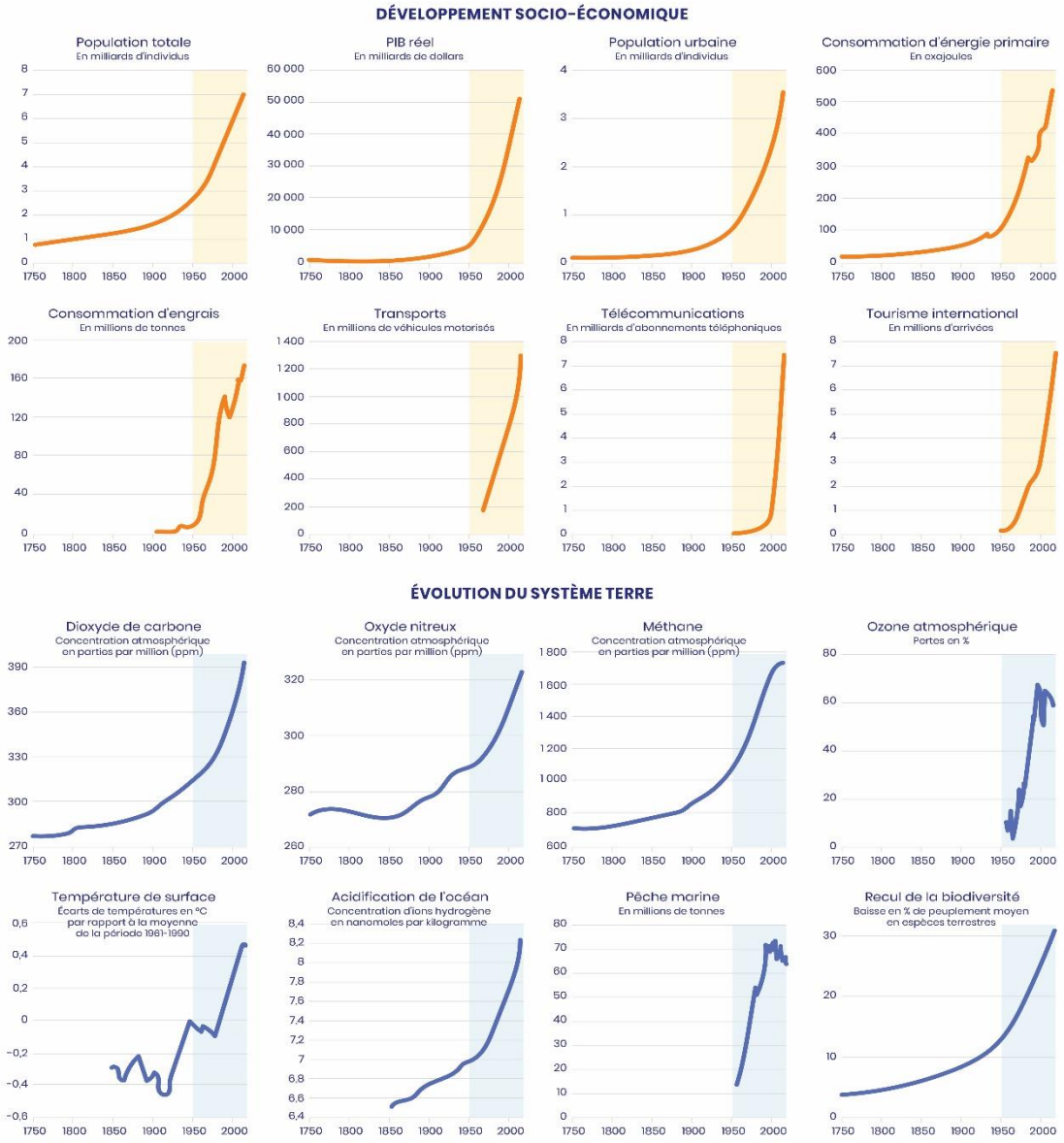


Figure 1 - The trajectory of the Anthropocene: the Great Acceleration (Source: Will Steffen et al., The Anthropocene Review, 2015).

These physical transformations are interdependent. Climate change and biosphere integrity are linked to the other seven planetary boundaries defined as indicators of the Anthropocene. These two planetary boundaries are themselves interdependent, and have been evolving in interaction with each other since the appearance of life on Earth[12]. Thus, climate change is one of the causes of the collapse of biodiversity[13]; and conversely, ecosystems contribute to the mitigation of climate change[14]. If we also include the depletion of finite resources in the ecological challenges, we can also see the link between the consumption of fossil fuels and climate change. Similarly, for materials derived from mining, the production of which destroys ecosystems are, for some, such as copper for example, useful for electrifying functions and thus limiting carbon emissions.

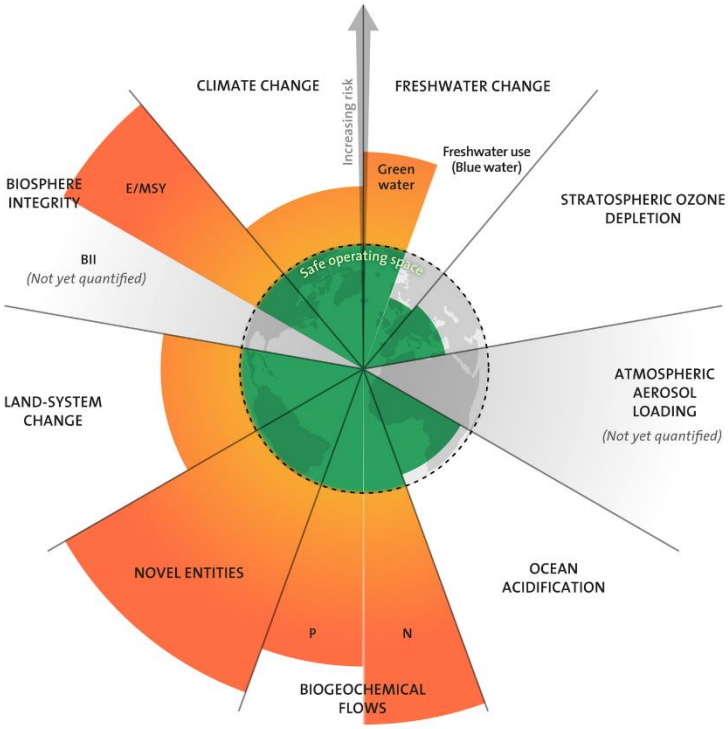


Figure 2 – Planetary boundaries – Nitrogen for the Stockholm Resilience Centre, on the basis of analyses by Wang-Erlandsson et al. 2022[15].

The Shift Project brings together all of these upheavals here under the notion of ecological challenges. This concept includes both issues related to the physical limits of the planet, and the social issues that arise from them.

[12] Steffen et al., "Planetary Boundaries".
[13] IPBES, "Summary for Policy Makers of the Global Assessment of Biodiversity and Ecosystem Services", 2019.
[14] IPCC, "Climate Change 2022: Impacts, Adaptation and Vulnerability - Summary for Policymakers", February 2022, https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/.
[15] Lan Wang-Erlandsson et al., "A planetary boundary for green water", Nature Reviews Earth & Environment 3 (26 April 2022): 380-292, https://doi.org/10.1038/s43017-022-00287-8.

Why discuss *ecological issues*?

Given the plurality of terms used to designate "transition" and their polysemy, a single terminology has been chosen for this report. Different concepts exist and are sometimes in competition with each other. They offer different approaches, complement each other and are relevant in different contexts.

Some of them are mainly linked to an approach that implements the solutions.

Sustainable development is probably the best known of them. Among the many definitions found in the Brundtland Report (1987), this was the term most cited: "Sustainable development is a mode of development that meets the needs of present generations without compromising the ability of future generations to meet their own needs. This notion is widely used in higher education: we talk a lot about sustainability in business schools in particular. However, it is often used in the sense of weak sustainability, according to which economic, human and natural capital are substitutable, whereas strong sustainability (non-substitutability between economic capital and natural capital) corresponds to a physical vision of the economy.

Sustainable development is probably the best known of them. Among the many definitions found in the Brundtland report (1987), the most cited was this translation of the term sustainable development: "Sustainable development is a mode of development that meets the needs of present generations without compromising the ability of future generations to meet their own needs[16]. This notion is widely used in higher education: we talk a lot about sustainability in business schools in particular. However, it is often used in the sense of weak sustainability, according to which economic, human and natural capital are substitutable, whereas strong sustainability (non-substitutability between economic capital and natural capital) corresponds to a physical vision of the economy.

The use of the framework provided by the **United Nations Sustainable Development Goals** (SDGs) is common in higher education. The SDGs are defined in the following way, "The Sustainable Development Goals give us a roadmap to a better and more sustainable future for all." [17] The result of negotiations among diplomats (with consultation with experts), they have various limitations: their selection and nomination are partly arbitrary (two SDGs for biodiversity and only one for climate, for example); it is difficult to distinguish between those that fall under the goals and means (both health and industry are included); potential contradictions are present (between the objective of growth and that of clean energy, for example, in the absence of decoupling observed until now) ; and finally, the lack of a hierarchy or method for making trade-offs may reduce their scope in practice (organizations, and especially companies, tend to consider the SDGs as equivalent and substitutable for each other instead of seeing them as all being essential). Nevertheless, this report uses the social objectives of the SDGs as a reminder of what the means (levers of action) mobilized should aim for.

Some notions are formulated more in the direction of the roles to be played by each actor, such as the terms corporate social responsibility (CSR) or organizational social responsibility (OSR), which are limited in relation to the Shift Project's perimeter, and are also polysemous. CSR sometimes focuses only on what happens inside organizations

[16] United Nations World Commission on Environment and Development, "Our Common Future", 1987.

[17] United Nations, "Sustainable Development Goals", United Nations, accessed 26 April 2022, https://www.un.org/sustainabledevelopment/fr/objectifs-de-developpement-durable/.

(governance, wage policy, etc.), to the detriment of external impacts. When CSR strategies focus on impacts outside the company, some do so with a philanthropic approach, without modifying the company's core business.[18] The diversity of interpretations of the notion of CSR makes it difficult to use in a systemic vision of the issues.

Other concepts focus on the changes to be made: these are the ones that will be favoured in this report. The notion of ecological transition, or ecological and social transition, is widely used in public debate in France.

Finally, like the Plan for Transforming the French Economy proposed by The Shift Project in February 2022, [19] we sometimes talk about economy transformation or companies transformation, just as we might speak of their ecological transition. The term transformation puts more emphasis on the action of transforming, and does not imply that a transition of the economy and businesses will lead to a new stable state.

Finally, like the Plan for Transforming the French Economy proposed by The Shift Project in February 2022, we sometimes talk about economy transformation or companies transformation, just as we might speak of their ecological transition. The term transformation puts more emphasis on the action of transforming, and does not imply that a transition of the economy and businesses will lead to a new steady state.

While the Shift Project's project for engineering schools opted for the term "social-ecological challenges," the term **"ecological challenges"** will be preferred in this report, as the former is often interpreted by management teachers as "social and ecological challenges" and can lead to frustration that the project is not intended to cover all social issues. However, social issues are not excluded from what is referred to here as "ecological issues," which refer to both physical constraints (climate, energy, resources, etc.) and their impacts on related societal goals.

B. Reducing the social and ecological consequences of human activities in a constrained world calls for far-reaching changes to our societal models

A systemic approach is required to address ecological issues: human activities are at the origin of transformations in the Earth system, transformations which are interdependent and, in turn, have consequences for human societies.

Biodiversity loss compromises global food security and access to drinking water. It has direct consequences on public health, amplifying "inequalities in access to medical care and healthy food". More broadly, it runs counter to the achievement of the UN's sustainable development goals on poverty, hunger, health, water, cities, climate, oceans and land.[20]

[18] Nathalie Lallemand-Stempak and Philippe Eynaud, Vers une autre gestion, Petits Manuels de la Grande Transition (Les Liens qui Libèrent, 2022).

[19] The Shift Project, "Le Plan de Transformation de l'Economie Française", accessed on 21 April 2022, https://ilnousfautunplan.fr/.

[20] IPBES, « Résumé à l'intention des décideurs du rapport de l'évaluation mondiale de la biodiversité et des services écosystémiques ».

Climate change, by having a large contribution to biodiversity loss, reinforces its consequences: the increased frequency and intensity of extreme weather events, such as heat waves, heavy rainfalls and droughts are already impacting food security and access to water. The effects of climate change are already causing migrations, and this is set to intensify over the coming decades. Economic losses are also clear, for example in agriculture, fishing and tourism, with disparities between regions.

As for the depletion of mineral resources (calorific and non-calorific), the resulting supply risk reflects the fragility of the West's development model, largely based on extractive industries. The effects of the war in Ukraine on Europe's energy supply and the inflation that resulted foreshadow what could happen in the future as a result.

Finally, all of these factors contribute to geopolitical tensions which can lead to conflict. According to IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), in 2019 there were "more than 2,500 conflicts over fossil fuels, water, food and land".[21]

The upheavals caused by human activities have and will have even more unpredictable consequences, for which we need to be prepared. Once planetary boundaries have been exceeded, and given the uncertainties of current models, it is becoming increasingly difficult to predict future changes to the Earth system, and therefore to take action (prioritise between different essential parameters, adapt our societies, etc.).

To anticipate and limit the social consequences of these crises, it is urgent to act: these upheavals are already here, and some of them are partly irreversible on the scale of a human lifetime. Of the nine planetary boundaries that have been defined as indicators of the Anthropocene, six have already been exceeded: climate change, biodiversity loss, biogeochemical cycles of nitrogen and phosphorus, land-use change, new chemical entities, and freshwater use. For many of these limits, a return to the previous state will not be possible for tens or hundreds of human generations.

To limit and cope with present and future crises, we need to transform the human activities that cause them. On the one hand, because human activities (including economic activities) must adapt to disturbances that are already underway and are set to worsen. On the other hand, human societies have the capacity to attenuate the pressures exerted on the environment, since they are at their origin. These two axes (mitigation and adaptation) call for profound changes in our economic systems.

All stakeholders in society have a share of responsibility in transforming human activities.

This report suggests that those involved in higher education in finance take their share of responsibility to contribute to the great challenge of transforming our modes of production and consumption.

[21] IPBES, « Résumé à l'intention des décideurs du rapport de l'évaluation mondiale de la biodiversité et des services écosystémiques ».

II. Economic and financial actors must play their part in the ecological transition

A. Finance has an impact on the Earth system

1. The term "finance" is understood in its broadest sense

Several different meanings, that are context-dependent, are given to the term "finance". It can refer to market finance, corporate finance, public finance, household and corporate savings, and so on.

Broadly speaking, finance is made up of "institutions responsible for creating money and channelling savings towards economic agents seeking funding". The Statistical Classification of Economic Activities in the European Community defines financial activities according to three categories:[22]

- banking activities (retail, commercial, investment and market banking, as well as central banking);
- asset management, research and brokerage;
- insurance, reinsurance and pension funds.

In this report, the term "finance" is used in a broad sense, encompassing:

- monetary creation and management, such as through the activities of central banks and commercial banks;
- project, activity or company financing, whether provided by development banks such as the AFD (French Development Agency), by European funds such as the ERDF (European Regional Development Fund), or by the private sector;
- the regulation and control of financial players, carried out in France by the AMF (Financial Market Authority) and ACPR (Prudential Supervision and Control Authority), which supervise financial activities;
- public finance activities, covering the financing of the State, local authorities and social organisations;
- market finance activities, such as research, automated trading, asset management, etc.
- corporate finance activities, concerning the financial decisions of companies;
- asset and savings management for private individuals;
- various types of investment funds, pension funds and sovereign wealth funds;
- the activities of entities involved in financing the economy outside the traditional banking circuit (shadow banking).

[22] The statistical classification of economic activities in the European Community (NACE) groups financial activities into categories 64 - Financial service activities, except insurance and pension funding; 65 - Insurance, reinsurance, pension funding; 66 - Activities auxiliary to financial services and insurance Eurostat, "NACE Rev. 2 - Statistical classification of economic activities".

2. Planetary boundaries are impacted by the financial sector

Assessing the impact of finance on planetary boundaries is complex. The analysis of the impact of finance on global warming, the best-documented planetary boundary, serves to demonstrate this.

To assess the impact of economic players on the climate, a greenhouse gas (GHG) emissions assessment of their activities must be carried out. GHG emissions of any given organisation have been classified in three different categories, known as ‘scopes’: 1, 2 and 3.

- Scope 1 covers direct emissions produced by fixed and mobile facilities located within the organisation’s scope, e.g. GHG emissions of the gas or oil-based heating system of the branches and offices of a retail bank.
- Scope 2 covers indirect emissions associated with the production of electricity, heat or steam imported for the organisation's activities. For example, the indirect emissions of a financial actor are related to the power consumption of its data centres.
- Finally, scope 3 covers indirect emissions across its entire value chain, and not accounted for under scope 2, which are "the consequences of an organisation's activities, but which come from GHG sources controlled by other entities". Emissions financed by a financial player's investments or loans are an example.

Unlike other sectors of the economy, **there is no global greenhouse gas emissions report for the finance sector**, which would enable us to accurately quantify all the emissions financed. Such information is difficult to obtain, on account of issues related to double-counting and to the consistency and comprehensiveness of the data. For example, some experts point out that "the complexity and multiplicity of their [of major commercial banks] activities have limited the implementation of GHG footprint assessments, including of all of the emissions that result from their activities".

Experts agree that scope 3 - indirect emissions - accounts for an overwhelming proportion of financial sector emissions (see figure 3). To limit oneself to scopes 1 and 2, or to exclude financing activities when analysing the activities of financial players, is to miss the main issue.

In order to understand the **carbon dependency of the financial sector, the key issue is to quantify the emissions financed**, i.e. the emissions induced as a result of holding a financial asset. **For the financial sector, investment and financing activities have the greatest impact on climate change.**

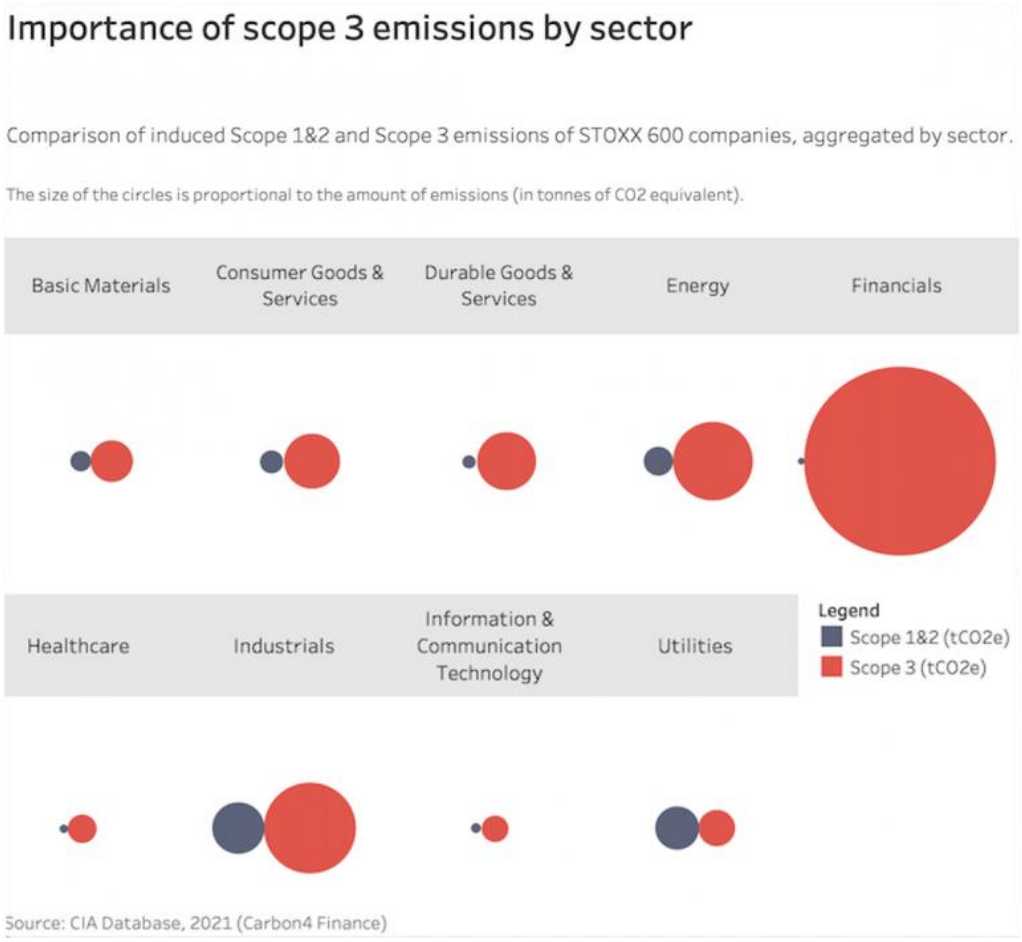


Figure 3: Emissions aggregated by sector of STOXX 600 companies, distinguishing Scope 1 & 2 from Scope 3

Source: Carbon4Finance[23]

As a financier of the various activities of the real economy, the finance sector is therefore involved in the impacts that human activities have on planetary boundaries. For example, when a bank lends to an industrial player to enable it to develop an activity that emits greenhouse gases (GHGs), or when an investor buys bonds issued by an oil company to finance the operation of a new field, etc., it can be said that such financial players contribute to the impact of such activities on the planet's limits. In that sense, finance actors have a share of responsibility in the emissions of the real economy.

Some studies attribute to banks the GHG emissions of the assets they finance in order to assess their trajectories with regard to Paris Agreement commitments. Based on an analysis of the financing and investment activities of six French banks, one report finds that **if current investment trends are maintained, "this would lead to warming of more than 4°C by 2100"**.

The IPCC considers that current estimated fossil fuel resources[24] **and stocks**[25] **exceed the carbon budget**[26] **available to meet the objectives of the Paris Agreement.** The carbon budget

[23] Carbon4Finance, « The Key to Facing the Energy Transition Is Scope 3 ».

[24] Resources represent the total estimated quantity of available fossil fuels, without taking into account the technical or economic feasibility of their extraction.

[25] Stocks correspond to the quantity of fossil fuels that can be extracted under existing economic operating conditions.

[26] The carbon budget refers to the estimated cumulative quantity of global CO2 emissions that must not be exceeded in order to limit global warming to a given temperature.

estimated by the IPCC is around 400 billion tonnes of CO2 for a 1.5°C temperature increase, and 1,150 billion tonnes of CO2 for a 2°C increase[27]. If all fossil fuel reserves and resources were used up, this would represent between 9,500 and 15,600 billion tonnes of CO2 emitted, far exceeding our carbon budget.

The International Energy Agency (IEA) stressed that achieving carbon neutrality entails putting a halt to the development of new oil and gas fields and coal mines, and also to the expansion of existing ones, in addition to projects underway in 2021.

This being said, most banks continue to finance this type of activity, whether it involves fossil fuel exploration or extraction projects (tar sands, Arctic or offshore oil and gas, etc.). **Between 2016 and 2019, the annual amount of funding to fossil fuels provided by the 35 largest banks in the world amounted to approximately US dollars 700 billion** (higher than Switzerland's annual GDP[28]).

[27] These budgets are estimated with a 67% probability.

[28] Countryeconomy.com, « Suisse - PIB - Produit intérieur brut 2022 ».

B. Finance is dependent on the Earth system and it is impacted by the ecological emergency

1. The economic-financial system is an integral part of the Earth system

Human activities draw material and energy flows from the earth system. These flows circulate in the form of goods, services and labour, which are produced and used. **Finance, viewed from the perspective of earth sciences, creates, circulates and destroys monetary flows representing the value of raw materials, goods and services extracted from the earth system**[29, 30].

Nevertheless, **neoclassical financial theory tends to reduce the Earth system to a sub-part of the economic system**. Finance operates a functional inversion of the hierarchy between the financial and socio-economic spheres and the Earth system. It is as if the Earth system were only a sub-part of the global production ecosystem. Neoclassical theory assumes, for example, that the biosphere has an intrinsic market value that can be determined by the rational decisions of investors. In this context, the effects on the environment become "market externalities", which can be compensated for through a process of market exchange in the economic sphere, according to a substitutability premise[31]. For example, preserved biodiversity or a stable climate that allows us to live on Earth are not substitutes, regardless of financial amounts involved.

However, the socio-economic sphere (and *a fortiori* finance) is dependent on the Earth system. The production of goods and services is physically limited by the quantity of resources in the Earth system (mineral resources, fossil fuels, biomass, etc.). However, the financial sector is not directly involved in the physical production of goods and services. The world of finance depends on the capacity of the socio-economic sphere to extract from the Earth system a sustainable flow of surplus energy - in other words, an adequate flow of physical resources - capable of perpetuating the functioning of human institutions[32]. **Finance is not an autonomous system that exists in its own right: it is the result of a multitude of social conventions and stakeholder issues**.

Finance is a sub-system of the economic system, which is itself part of the biosphere, which is integrated into the earth system[33].

[29] More specifically, the hydrosphere, geosphere and biosphere, and even the atmosphere and cryosphere.

[30] Lagoarde-Segot et Martinez, « Ecological Finance Theory: New Foundations ».

[31] Lagoarde-Segot et Martinez.

[32] Lagoarde-Segot et Martinez.

[33] Lagoarde-Segot et Martinez.

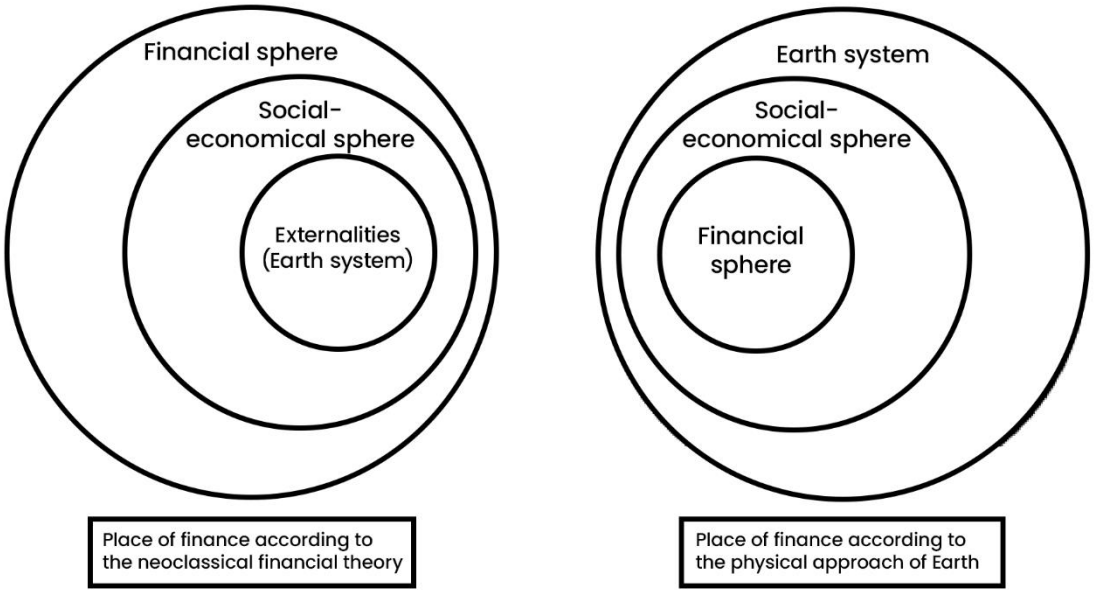


Figure 4: Schematic representation of the role of the financial sphere according to neoclassical theory or according to the Earth sciences Source: from Thomas Lagoarde-Segot et Enrique A. Martinez (2020)

2. The ecological emergency poses major risks for the financial system

The financial system - an integral part of the socio-economic system - is and will be affected by ecological upheavals. The UNEP states that "**the collective failure to understand that nature underpins the global economic system will lead to increasing financial losses**[34]. »

The Governor of the Banque de France stated in 2022: "**The increase in the frequency and intensity of extreme weather events could lead to non-linear and irreversible financial losses**[35] **»**. In 2015, the Chairman of AXA stated that "a world at +2°C might still be insurable, but a world at 4°C would certainly no longer be insurable"[36]. Pockets of uninsurability have already appeared in the western United States, where financial players are less and less willing to provide insurance for certain properties in response to extreme weather events (floods and mega-fires in California)[37].

Exceeding planetary boundaries imposes physical, transitional and liability risks on the economic and financial system. These three types of risk are closely linked and can be seen as mutually reinforcing or antagonistic, as the case may be.

[34] UNEP, « State of Finance for Nature ».

[35] Capital, « Le réchauffement climatique menace le système financier, avertit la Banque de France ».

[36] Bezat, « Climat ».

[37] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

a. Physical risks

Physical risks[38] are defined as the material impacts on economic players resulting from non-compliance with the planet's physical constraints. For example, reductions in agricultural yields due to climate change or the erosion of biodiversity, the depletion of non-renewable resources such as hydrocarbons or certain metals, etc[39,40].

In the field of finance, **physical risks** refer to the consequences of these material impacts on the value of financial assets, for example as a result of a decline in a company's profitability or the devaluation of certain assets such as industrial plants and real estate. Physical risks can result in a fall in the value of the financial assets issued by the entities (companies, governments, etc.) exposed (such as shares and bonds).

The Banque de France estimates that 42% of equities and bonds held by French financial institutions are issued by companies that are "highly or very highly dependent on at least one ecosystem service". If we consider upstream or indirect dependence on ecosystem services, all securities issuers are at least slightly dependent on all ecosystem services through their value chains[41].

Some assessments of financial assets' exposure to physical climate risk estimate annual global GDP losses of 7.1% without adaptation between now and 2080[42].These losses would be limited to 1.13% with adaptation. Climate-related risks will increase the frequency of banking crises, by up to 200% in all scenarios[43].

A positive feedback loop exists[44] **between physical risks and ecological transition: "the greater the physical risks, the greater the justification for transition.** Conversely, the longer a transition is postponed, the greater the physical risks [and liability] involved**"**[45].

b. The transition risks

Transition risks[46] designate the economic and financial impacts resulting from the transition towards a society that takes greater account of the planet's limits. These risks may materialise as

[38] Physical risk is the term usually used to refer to the risks associated with climate change. We use this term to describe the physical risks arising from failure to comply with all the physical constraints we have identified in this report (global warming, collapse of biodiversity, depletion of fossil and mineral resources, etc.)

[39] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[40] AFD - Agence Française de Développement, « 3 risques que l'effondrement de la biodiversité fait peser sur la finance ».

[41] Banque de France, « Un « printemps silencieux » pour le système financier? »

[42] Mandel, A., 2020: Risks on Global Financial Stability Induced by Climate Change. Cité dans Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[43] Intergovernmental Panel on Climate Change (IPCC).

[44] A positive feedback loop accentuates the phenomenon or imbalance, whereas a negative feedback loop always tends to return the system to equilibrium.

[45] AFD - Agence Française de Développement, « 3 risques que l'effondrement de la biodiversité fait peser sur la finance ».

[46] There is also the question of orderly or disorderly transition. The IPCC points out, however, that even if the date of introduction of a new standard is known, its impact could be unanticipated due to the dynamics of the political economy of transition, which brings together opposing interests. See Intergovernmental Panel on Climate Change (IPCC), "Climate Change 2022 - Mitigation of Climate Change"

a result of regulatory developments, technological breakthroughs or changes in consumer demands and habits[47,48].

There is a positive feedback loop between the implementation of the ecological transition and the transition risks: the more the economy reduces its ecological impacts, the more the transition risks increase, while the physical risks[49] stabilise[50].

The transition represents a potential risk for the financial system: from the point of view of climate change alone, the transition to a low-carbon society, via new standards for example, **could lead to a sharp fall in the value of carbon assets, or stranded assets.** The Bank of England has indicated that up to $20 trillion of carbon assets could be at risk of being stranded[51], equivalent to 8 times France's GDP in 2021[52]. As an example, main Euro zone banks cumulatively holds a stock of fossil assets[53] representing 95% of their equity capital. This implies that **in the event of a massive loss in the value of these assets - linked to the transition to a low-carbon economy - these banks would be bankrupt, or on the verge of bankruptcy**. This banking crisis would then rapidly turn into a major economic crisis, spreading into the real economy[54]. Globally, the world's 60 largest banks hold $1.35 trillion in fossil fuel assets, equivalent to the financial system's exposure to US subprime mortgages[55] in 2007[56].

Morevover, there is an amplifying feedback loop between the financial-economic system and the climate; climate disruption implies systemic financial risks. Finance, in turn, contributes to these disruptions by continuing to finance business *as usual* and by failing to massively reallocate its flows towards the ecological transition. This in turn amplifies the financial climate risks[57].

The Banque de France and the Bank for International Settlements (BIS) assert that: "**Financial stability and climate stability can be considered as two interdependent public goods**. This consideration can be extended to other environmental degradations caused by humans, such as the erosion of biodiversity. Consequently, [these issues] **will require profound transformations in the governance of our socio-economic and financial systems"**.[58] »

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47 Intergovernmental Panel on Climate Change (IPCC).

48 AFD - Agence Française de Développement, « 3 risques que l'effondrement de la biodiversité fait peser sur la finance ».

49 Physical and transition risks are linked here by a negative feedback loop: the more transition risks increase, and reduce ecological impacts, the more physical risks stabilise..

50 Lefournier et Grandjean, *L'illusion de la finance verte*.

51 Partington, « Mark Carney tells global banks they cannot ignore climate change dangers | Climate crisis ».

52 According to INSEE, French GDP will be €2,500.9 billion in 2021

53 The report emphasises that this represents "only the tip of the gigantic iceberg formed by all the sectors that will inevitably require a transition - aeronautics, automotive, petrochemicals, etc."» see Institut Rousseau, Les Amis de la Terre France, et Reclaim Finance, « Actifs fossiles, les nouveaux subprimes ? Quand financer la crise climatique peut mener à la crise financière ».

54 Institut Rousseau, Les Amis de la Terre France, et Reclaim Finance.

55 Exposure was around USD 1,370 billion.

56 Finance Watch, « A safer transition for fossil banking ».

57 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité ».

58 Bank for International Settlements, « The green swan - Central banking and financial stability in the age of climate change ».

c. Liability risks

Liability risks refer to the legal proceedings and compensation to which a financial player would be exposed if it were judged to have contributed to climate change, biodiversity erosion or other damage to planetary boundaries[59].

This risk is discussed in greater detail on page 76.

C. Substantial effort required

1. A massive need for investment in the ecological transition

Finance "creates and channels financial resources towards the economic players that need them"[60]. Its primary role is to finance the real economy. **The ecological transition requires the mobilisation of all financial players, public and private, in order to finance investments that contribute to this transition, and to stop financing activities that do not comply with planetary boundaries.**

As with every sector of the economy, finance must do its own contribution. The Paris Agreement sets it the objective of making "financial flows compatible with a pathway towards development that is low in greenhouse gas emissions and resilient to climate change"[61]. Finance plays a key role in the ecological transition, **since all its capital flows and stocks must be aligned with the agreement's mitigation and adaptation objectives**[62]. The IPCC emphasises that funding for reducing net greenhouse gas emissions and improving resilience to the effects of climate change is a key factor in the transition to a low-carbon economy[63].

The investments needed to make France's transition to carbon neutrality are estimated at €100 billion a year between now and 2030, including €70 billion in direct investment, equivalent to around 2.5 points of GDP[64,65]. At the European level[66],the European Court of Auditors has estimated that the conversion of the economy to mitigate climate change would require an annual investment of €1,115 billion[67] between 2021 and 2030, or almost 8% of its GDP in 2021.

Financing needs for adaptation to climate change are more difficult to determine than investment needs for mitigation of greenhouse gas emissions. This is because the indicators are more complex to determine, given that adaptation measures depend on the specific impacts of climate change in a given location and on the socio-economic context[68]. Societies' ability to adapt also depends on achieving some collectively defined social objectives, such as access to water, healthcare and energy. Achieving these social objectives is an "essential enabling

[59] Carney, « Breaking the Tragedy of the Horizon – climate change and financial stability ».

[60] Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l'intérêt général ».

[61] Article 2-1 c Nations Unies, Accord de Paris.

[62] Zamarioli et al., « The climate consistency goal and the transformation of global finance ».

[63] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[64] Ademe et Commissariat général au développement durable (CGDD), « Évaluation macroéconomique de la Stratégie nationale bas carbone (SNBC2) avec le modèle ThreeME ».

[65] France Stratégie, « L'action climatique : un enjeu macroéconomique - Note d'analyse ».

[66] Cour des comptes européenne, « L'action de l'UE dans le domaine de l'énergie et du changement climatique ».

[67] Investments break down as follows: €736 billion in the transport sector, €282 billion in the residential and services sector, €78 billion in networks, production and industrial boilers, and €19 billion in industry.

[68] Chenet, « Planetary Health and the Global Financial System ».

condition for adaptation to climate change", according to the IPCC[69]. Investments are particularly necessary in developing economies.

Despite the uncertainties, the UNEP estimates that 76 developing countries will need to invest between $160 billion and $340 billion a year by 2030, and between $315 billion and $565 billion a year by 2020, to adapt to climate change[70].

The United Nations Environment Programme (UNEP) estimates that, in order to meet internationally agreed targets on climate change, biodiversity loss and land degradation, **total cumulative investment in "nature-based solutions"**[71]**, i.e. solutions based on ecosystems, could amount up to 8,100 billion dollars** by 2050, which represents 8% of global GDP in 2021[72].

2. Investments in decarbonisation are severely insufficient

Despite the commitment agreed in the Paris Agreement to align all financial flows with climate change mitigation and adaptation objectives, the scale of the effort required remains considerable.

The IPCC points out that climate change mitigation and adaptation is suffering from a lack of funding, even though public and private funding for fossil fuels remains at worrying levels. This situation may be due to a perception of the risk/return profile of investments that favours fossil fuels, and in particular to **an underestimation of climate-related financial risks by financial institutions and markets**. This limits the reallocation of the capital needed for the transition to a low-carbon society. **The inconsistency of certain public policies, in particular fossil fuel subsidies**, creates uncertainty for economic and financial decision-makers and also represents an obstacle to the redirection of flows[73].

In addition, the IPCC estimates that **the speed at which climate finance is evolving "reflects neither the urgent requirement for ambitious climate action, nor the economic justification for ambitious climate action"**[74].There are also fundamental inequalities in access to financing capacity depending on a country's economic profile, particularly for so-called developing countries

The result is a drastic shortfall in funding for decarbonising the economy. On average between 2017 and 2020, 90% of global climate-related investment was directed towards mitigating global warming[75]. Despite this, **investment flows for mitigation remain far below what is needed, whatever the sector, type of economy or region of the world.** The gap in terms of value is widest in developing countries (Figure 5). The financing needs for adapting to climate change are estimated to be 5 to 10 times greater than current flows of public funding[76], despite the significant effects that global warming is expected to have on our societies and economies.

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69 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

70 UNEP, « Too Little, Too Slow - Adaptation Gap Report 2022 ».

71 Nature-based solutions are defined by the IUCN as "Actions that use ecosystems to address the challenges posed by global change to our societies, such as climate change, natural risk management, health, water supply and food security". To find out more, see IUCN France, "Nature-based Solutions".

72 The annual investment requirement would be $203 billion for forestry solutions, $193 billion for silvopasture, $7 billion for peatland restoration and $500 million for mangrove restoration. Source: UNEP, "State of Finance for Nature".

73 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

74 Intergovernmental Panel on Climate Change (IPCC).

75 Intergovernmental Panel on Climate Change (IPCC).

76 UNEP, « Too Little, Too Slow - Adaptation Gap Report 2022 ».

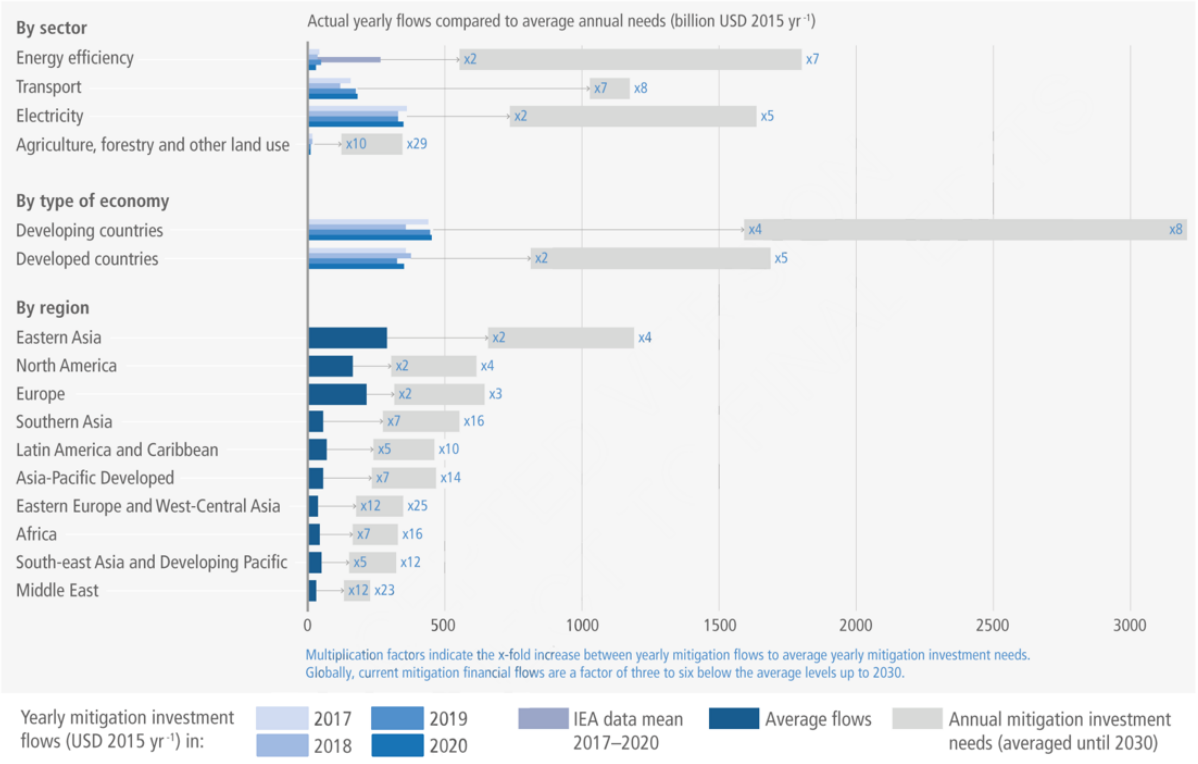

Figure TS.25: Mitigation investment flows fall short of investment needs across all sectors and types of economy, particularly in developing countries.

Figure 5: Assessment of investment needs for climate change mitigation by sector, by type of economy and by region
Source: IPCC, AR6 WGIII

IPCC experts warn that delays in climate-related investment and financing will lead to major *carbon lock-ins*[77], stranded assets, and additional costs. This will have a particular impact on urban infrastructure, the energy sector and transport[78].

The IPCC observes a lack of evidence that the growing attention of investors to climate change has had a direct impact on emissions reductions. According to these experts, this calls into question the feasibility of aligning financial flows with the objectives of the Paris Agreement, both in the short term (2030) and in the longer term (2050). This leads the IPCC to call for strong political governance, asserting that **regulators and political decision-makers can make up for these shortcomings by getting politically involved, in particular by issuing a clear direction and robust steering**[79].

3. Limited investments to preserve biodiversity

To date, climate change has received more attention than biodiversity in international talks. Thus, the conventions in favour of preserving biodiversity, **the frameworks for action and the quantified estimates of the investments required are less developed and fewer in number**

[77] The concept of "carbon lock-ins" refers to carbon-based technological choices that lock in an entity's trajectory over a period of time, preventing it from moving towards alternative technologies.
[78] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».
[79] Intergovernmental Panel on Climate Change (IPCC).

than for climate change. There is currently no international document requiring financial flows to be aligned with a trajectory that respects biodiversity and ecosystems[80].

Some researchers estimate that the erosion of biodiversity is a much more complex problem for the financial sector to consider. Although biodiversity is a global issue, it is intrinsically measured using local indicators. Gains in biodiversity in one place do not compensate for losses elsewhere, as is the case with GHG emissions. Compared with climate change, it is therefore more complicated to define biodiversity indicators that can be used in market finance[81].

The OECD estimates that global funding for biodiversity amounts to between 78 and 91 billion dollars a year. At the same time, **governments spend around 500 billion dollars a year on support that is potentially harmful to biodiversity**, i.e. five to six times more than total spending on biodiversity. The organisation points out that the total volume of financial flows harmful to biodiversity, including both public and private spending, is probably much higher[82].

D. Major obstacles to having the financial system take ecological issues into account

1. Reconciling divergent timeframes to ensure that the financial system truly takes ecological issues into account

The tragedy of horizons, formulated by Mark Carney in 2015, expresses the observation of irreconcilable timeframes, between the long-time of climate disruption and the short time of the socio-economic sphere[83]. This observation also applies to the erosion of biodiversity. This phenomenon would prevent finance from fully grasping the scale of the ecological emergency and taking the appropriate measures.

In the economic-financial sphere, corporate strategies are generally shorter than 3 - 5 years. When they are listed, their profitability requirements may be shorter-term: a horizon of three months to one year is common. **Investors look ahead 5 to 8 years, fund managers' profitability is measured on a yearly scale, while market professionals operate on a daily basis, or even in milliseconds for high-frequency trading. Regulatory authorities present horizons of less than 5 years.** Governments, on the other hand, have terms of office of between 4 and 5 years.

These short timescales of the economic-financial and political spheres are far removed from the ecological scale, and in particular from biogeochemical cycles which have a certain inertia. **The time it takes for the radiative forcing[84] linked to anthropogenic greenhouse gas emissions to take effect is estimated at around ten years[85].** Although the consequences of climate disruption and the erosion of biodiversity are becoming increasingly tangible, the deadlines for

[80] This is in contrast to climate change, for which Article 2-A c. of the Paris Agreement affirms the objective of making "financial flows compatible with a pathway to low greenhouse gas emissions and climate resilient development".

[81] Chenet, « Planetary Health and the Global Financial System ».

[82] OECD, « A comprehensive overview of global biodiversity Finance ».

[83] Carney, “Breaking the tragedy of the horizon - climate change and financial stability

[84] Radiative forcing is the radiative power that the greenhouse gas reflects back towards the ground. To find out more, see Jancovici, "What are greenhouse gases?

[85] Figure 7,17 p. 995, Forster et Storelvmo, " The Earth's Energy Budget, Climate Feedbacks and Climate Sensitivity ".

international political commitments are set at 2030, 2050 or even 2100 and beyond. **This heterogeneity of horizons is therefore a source of inertia[86].**

What's more, the high profitability requirement reinforces short-termism on the part of financial players. **As long as this profitability is not affected by one of the physical, transitional or liability risks, the incentive for financial players to act is not very important.**

Some players, such as Pascal Demurger, CEO of the MAIF Group, **are suggesting that this short-termism should be reconsidered.** He argues that it is in investors' own interests to take a long-term view. In this context, it would be up to them "to impose the long term and give up investing in the most polluting sectors.[87]"

This tragedy of time horizons is compounded by a tragedy of spatial horizons. The first populations to be affected by the consequences of climate disruption - and who, historically, are also those who have contributed the least to emissions - are not those who own financial assets to be devalued or stranded. Thus, "global warming [would be] much more than a tragedy of horizons, it would separate [humanity] in time and space. And according to wealth too[88]."

2. A search for profitability that is incompatible with ecological concerns

Some of the investments required for the ecological transition are not financially profitable. Many ecological transition investments have significant social or ecological added value, but little or no financial return.

Three profitability profiles can be distinguished for ecological transition investments:

- **Profitable investments, driven by a viable medium-to-long-term business model.** This type of investment easily attracts private capital, sometimes after subsidies in the start-up phase, as in the case of feed-in tariffs for renewable energies.
- **Investments with uncertain or long-term profitability (30 to 40 years),** as in the case of thermal renovation of buildings or the development of rail freight transport. This type of investment requires patient investors, such as public development banks, or high levels of public subsidies and guarantees. In addition, training and support for professional transitions, and for households and businesses most affected by the transition, also require investments whose profitability is not guaranteed.
- **Investments that are not financially profitable:** these investments are often neglected because, according to economist Jézabel Couppey-Soubeyran, "the vision of investments in the ecological transition has been reduced to those that are profitable, whereas these expenditures are just as indispensable". This applies to road and rail infrastructure to decarbonize mobility, decontamination, ecosystem restoration and other measures to protect and maintain biodiversity, and so on[89]. The necessary closure of certain carbon assets will also require financial contributions. Closing a coal-fired power plant, for example, costs money, both for the companies themselves and for governments.

[86] Lefournier et Grandjean, *L'illusion de la finance verte*.

[87] Agnoux et Marchand, « Covid-19 : « Réorienter l'économie pour la transition suppose de sacrifier le court terme »»

[88] Lefournier et Grandjean, *L'illusion de la finance verte*.

[89] Couppey-Soubeyran, « Jézabel Couppey-Soubeyran: "Let's not expect the environmental transition to always be profitable" ».

In addition, many investment projects are small-scale, and their promoters do not have access to market financing. The sources available to them are bank loans, subsidies and self-financing via savings. This type of investment is also important for the ecological transition.

Carsten Rolle, President of the German Industry Federation, estimates that "80% of decarbonization investments are currently not advantageous"[90] for the investors. For its part, McKinsey estimates that between 40% and 50% of decarbonization projects have a "positive investment profile", i.e. are cost-saving[91]. These figures should be treated with caution, however, as energy price trends make the profitability of decarbonization investments uncertain.

The European Union's High Level Expert Group on Sustainable Finance (HLEG) has asserted that **achieving the goals set by the Paris Agreement will require nothing less than a transformation of the entire financial system, its culture and its incentives[92].**

The investments required for the ecological transition therefore come up against the shareholder demand for profitability on the part of private finance, and against public debt reduction targets on the part of public finance.

3. A flawed vision of the impacts of climate change and the erosion of biodiversity

The work carried out by certain economists to assess the macroeconomic impact of climate change is helping to give financial players an erroneous view of the phenomenon. Based on cost-benefit analyses[93], this work uses macroeconomic models to calculate the "optimal" warming trajectory (and therefore the corresponding GHG emissions trajectory). The aim is to ensure that the current costs of transition investments are offset by the future damage avoided. The results of this work, based on disputed methods, drastically minimize the economic impact of global warming.

For example, William Nordhaus was awarded the "Nobel Prize in Economics[94]" in 2018 for integrating climate change into long-term macroeconomic analysis. According to his work, the optimal GHG reduction trajectory would lead to global warming of +3.5°C by 2100. Staying below 2°C, as advocated by the Paris Agreement, would therefore incur mitigation costs greater than those associated with global warming.

William Nordhaus' work has been widely criticised[95]. The model[96] he has developed to link global warming to the economy tends to dramatically underestimate the GDP losses associated with

[90] Le Monde, « Neutralité carbone : l'Allemagne fait les comptes ».

[91] McKinsey, « The net-zero transition - What it would cost, what it could bring ».

[92] HLEG, 2018, cité dans Lagoarde-Segot et Martinez, « Ecological Finance Theory: New Foundations ».

[93] Cost-benefit analyses are economic tools used mainly in the field of public investment. They aim to aggregate the economic, human and environmental costs and benefits of a project (building a motorway, airport, railway line, etc.) in a single calculation. On the one hand, they involve giving a monetary value to things that have none (time saved, deaths avoided, greenhouse gas emissions, destruction of the biosphere). Secondly, these costs and benefits need to be evaluated over the long term, i.e. the period of the investments made (using the discounting technique). This method, which depends largely on methodological and conventional choices, places the economist at the centre of the decision. In the context of climate change, the aim is to compare current costs (of transition investments) with future benefits (avoided damage). The aim is to achieve "intertemporal optimisation of consumption". See Pottier, Comment les économistes réchauffent la planète.

[94] Prix de la Banque de Suède en sciences économiques en mémoire d'Alfred Nobel, communément surnommé « Prix Nobel d'économie ».

[95] Steve Keen, « The appallingly bad neoclassical economics of climat change ».

[96] Dynamic Integrated Climate-Economy model ou modèle DICE.

global warming. For example, a warming of 6°C in 2100 (making the earth uninhabitable for humans) would only result in a loss of GDP of around 8.5%.

Criticisms include the fact that the model is based on the assumption that 87% of the economy will be unaffected by global warming, since it takes place indoors (offices, factories, etc.) and is therefore not exposed to climate hazards; the use of a simplistic damage function[97] [98]; and the choice of a high discount rate, which reduces future economic losses associated with global warming.

Climate change requires us to reduce our GHG emissions. The optimal trajectory for reducing GHG emissions, allowing for cost-benefit maximisation, **must take place "under the constraint of exhausting a defined carbon budget[99]".**

This type of economic evaluation, which helps to convey a false vision of the impacts of climate change, also applies to biodiversity. Numerous methods attempt to assess the economic value of nature: methods based on replacement costs, or on avoided damage, assessment of the recreational or aesthetic value of nature, methods based on preference surveys, and so on[100]. For example, one study assessed the economic value of the bee pollination service by considering the value of plant production for food, dependent on this pollination. This led to a figure of between 2.3 and 5.3 billion euros for France[101] (i.e. between 0.07% and 0.2% of its 2021 GDP), even though the ecological functions of bees go beyond the pollination of food plants[102].

4. Public finance constrained by the placing of public debts on the market

Transforming our economy to respect planetary boundaries implies that all public finance, State and local authority budgets, must be consistent with ecological issues[103].

The State's financing system determines the financial leeway available to public authorities to invest. In France, the placing of government debt on the market in the 1970s-1980s, followed by the Maastricht criteria linked to the adoption of the single currency, constrain the public deficit and debt[104] in a way that makes it difficult to envisage a massive and rapid investment effort by public authorities. Financing the ecological transition would therefore have to be on a constant budget. At present, public money, from public budgets and financial institutions, is mainly mobilised to leverage the private sector. The underlying idea is that "investing public money would have a

[97] The function used to calculate the damage caused by climate change.

[98] The Nordhaus damage function does not include a climate tipping point, but is based on the assumption that present income differences due to temperature differences can be used to predict the consequences of warming over time.

[99] Lefournier et Grandjean, L'illusion de la finance verte.

[100] The Other Economy, « Doit-on donner un prix à la nature ? »

[101] Commissariat général au développement durable, « Le service de pollinisation ».

[102] The Other Economy, « Doit-on donner un prix à la nature ? »

[103] I4CE, « Budgets publics, fiscalité et taxe carbone ».

[104] The Maastricht criteria are set out in Article 140 of the Treaty on the Functioning of the European Union (TFEU). They require Member States to keep their public deficit and debt below thresholds set at 3% and 60% of GDP respectively. The Stability and Growth Pact, introduced in 1997, defines a mechanism to ensure compliance with these rules.

multiplier effect on private money", enabling more funds to be raised[105]. In practice, this means delegating responsibility for financing the energy transition to the private sector[106].

Yet mobilising public finance for the ecological transition is necessary in many respects:

- **On the one hand, as we have seen, some of the investments required for the transition are not profitable projects under market conditions.** However, they bring social and ecological benefits that are not taken into account by a simple financial profitability analysis. In this context, credits from public banks can enable lending at low, so-called "concessional" rates, to launch operations at a lower cost to the user than if they were financed by private banks.
- **On the other hand, public procurement, whether for operating or investment needs, can help to fuel demand for transition projects,** and thus sustain the economic model of the companies behind these projects and the jobs linked to them[107] (policies to support the development of the wind turbine industry, for example). What's more, to finance a technology, the private sector needs to see it mature. For its part, the state can take technological risks that the private sector cannot.
- **What's more, the ecological transition of public assets requires a major mobilisation of public investment** (renovation of the building stock, ecological restoration of green spaces and public land; public transport network; work to adapt coastlines to rising sea levels, etc.)[108].
- **Last but not least, the sectors that will have to undergo profound change to enable the ecological transition to take place (fossil fuel extraction, processing and distribution, the automotive sector, industrial fishing, etc.) need to be supported in their evolution.** Similarly, the people employed in these sectors need to be supported in their retraining[109].

To steer national economic activity in the direction of the low-carbon transition, **the State must both continue to assume responsibility for part of the necessary investments (particularly in the transport sector), and create an economic environment that encourages companies and households** to invest in assets that contribute to this transition. The financial levers at its disposal include adjusting charges and subsidies, as well as equity investments and co-financing. They complement and coordinate regulatory action, and require a substantial budget to implement[110].

There are powerful obstacles to taking ecological issues into account, whether it's conflicting horizons that need to be reconciled, a quest for profitability that is incompatible with planetary boundaries, an erroneous vision of the impacts of climate change, or public investment constrained by debt reduction targets. The current financial framework and its tools are therefore inadequate to meet the challenge of ecological transition.

105 Vincenzo et al., « La financiarisation des politiques publiques ».

106 The Other Economy, « Lancer un plan de reconstruction écologique ».

107 The Other Economy, « Dette et déficit publics ».

108 The Shift Project, « Décarboner l'Administration publique ».

109 The Shift Project, « L'emploi : moteur de la transformation bas carbone. Dans le cadre du plan de transformation de l'économie française ».

110 The Shift Project, *Climat, crises : le plan de transformation de l'économie française*.

In addition to these structural obstacles, current and future financial players are generally untrained in ecological issues. Yet teaching these issues in finance is essential if we are to reintegrate our economic-financial systems within the limits of the physical world, both by making better use of existing tools and by proposing relevant developments for the financial system.

III. Teaching ecological issues in finance is paramount if we are to bring our economic and financial systems back within the boundaries of the physical world

A. University-level education in finance, a key challenge: Educate to transform

All those involved in finance have a role to play in bringing the economic system back into line with planetary boundaries, and training is a key factor to achieve this transformation.

Primary and secondary school curricula are defined by the Ministry of Education. It is therefore the State that determines the best way to educate young people about ecological issues. On the other hand, **in university education, training depends largely on the institutions, even though the State has a supervisory role in the academic system.**

In 2019, 38% of the population in full working age (25 to 64) hold a university degree[111].

- For the students involved in initial training, this is a key moment when they are building the role they will play in society as citizens and professionals. It is also the time when they are most able to grasp complex problems. It is therefore a fundamental stage in their intellectual development, and one in which teaching about ecological issues cannot be overlooked.
- For professionals in continuing education, a spell in higher education is an opportunity to update their skills and knowledge by integrating ecological issues, and to make a rapid impact within the organisations that employ them.

Finance is a management science, and management education is playing an important and growing part[112] **in higher education.** More than 19.6% of students in higher education in 2019-202 were studying management[113]. This shows how important it is for the ecological transition that higher education in management includes knowledge and skills linked to ecological issues.

A large majority of finance students (77%) believe that "financial institutions must play a major role in the ecological transition of the economy as a whole". Two-thirds of them want finance courses to teach more about the issues involved in the transition, so as to go beyond simply raising awareness[114].

Furthermore, financial players are finding it difficult to recruit senior staff trained in ecological issues[115]**.** The finance professionals and experts consulted mentioned the difficulty of recruiting professionals who, while not necessarily specialists in ecological issues, are able to integrate them into their financial work. As a consequence, a number of financial players,

[111] « État de l'Enseignement supérieur, de la Recherche et de l'Innovation en France n°14 ».

[112] The FNEGE recorded student numbers of around 18.2% and 18.4% between 2910 and 2015, compared with 19.6% for the 2019-2020 period.

[113] Dubois, « Observatoire des formations en Sciences de Gestion et Management ».

[114] WWF et Pour un réveil écologique, « Former à une finance écologique - Comment répondre à l'intérêt des étudiants pour la transition environnementale ? »

[115] Birdeo et Finance for Tomorrow, « Les métiers de la finance durable ».

particularly in the banking and insurance sectors, are developing initiatives to train their staff in-house.

Finance professionals have the weighty task of reinventing practices, tools and economic and financial models - and some are already doing so. **Finance training establishments have a fundamental role to play in preparing their students for their future or current professional life as well as training well-informed citizens**. In the current context, fulfilling this dual mission means fully integrating ecological issues into the training of students and professionals.

B. Ecological issues are not sufficiently taken into account in finance courses

In 2018, a survey conducted by the Veblen Institute found that "the teaching of finance seems to have been only slightly influenced by the great financial crisis of 2007-2008". In its analysis, the Institute explained the reasons for this inertia "partly by the dominance of a few 'reference' textbooks **that focus largely on the mathematical and technical aspects of finance, and often neglect the question of the impact of finance on society"**.[116] According to the study, there is no substantial analysis of the macroeconomic and social impact of finance in teaching manuals. Just as little is taught about the impact of financial crises on society, even less is taught about the impact of finance on ecological issues.

The IPCC report notes this lack of knowledge: "Gaps in knowledge remain. In particular, the underestimation of climate-related financial risk by public and private financial actors may explain why the current allocation of capital between financial institutions is often incompatible with mitigation objectives *(Rempel et al. 2020)*[117]». **The following review of the extent to which finance courses in France take account of ecological issues confirms this observation.**

1. A review of the extent to which finance courses have embraced ecological issues

In 2019, The Shift Project published a study including an overview of the consideration of ecological issues, and more specifically the challenges associated with the physical limits of the planet, in the curricula[118] provided in higher education[119].

In this report, the overview focuses on the consideration of ecological issues in initial and ongoing finance programmes[120] that are reference points in France. This overview takes a broader view of "ecological issues" than that used so far in this report, including responsible investment, sustainable development and climate risk modelling. A gradation of intensity has been introduced

[116] Couppey-Soubeyran et al., « Dix ans après la crise financière, comment enseigne-t-on la finance ? »

[117] IPCC AR6 WGIII – 15.6.1

[118] This study covered a non-representative sample of 34 institutions, including 4 universities, 6 business schools and 12 engineering schools.

[119] The Shift Project, « Mobiliser l'enseignement supérieur pour le climat ».

[120] By 'training', we mean the various courses that a finance student can follow in higher education, whether in initial or continuing education.

to distinguish curricula that merely address[121] ecological issues from those that adequately integrate them[122].

This process is explained in the following flowchart:

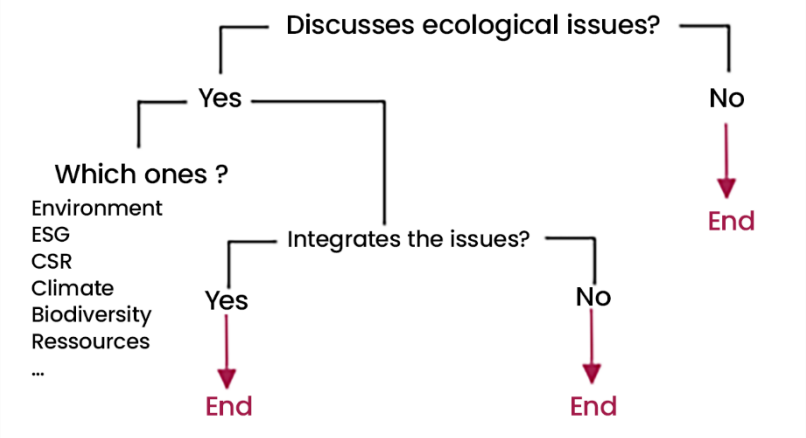

Figure 6: Decision flowchart for conducting the programmes assessment, The Shift Project

Behind the question of integrating ecological issues into curricula, there is the notion of overall consistency of teachings with regard to these issues. It's not enough to have a top-quality course on planetary boundaries - for example - among a majority of traditional finance courses reflecting business as usual, for a programme to include ecological issues. The curricula must therefore include a discussion of the systemic nature of ecological issues and their implications for the finance sector.

Our survey covers 77 higher education establishments, including 8 engineering schools, 22 business schools, 37 universities and 10 professional training organisations[123], **for a total of 1,399 unique finance training paths studied.** One university institute of technology (IUT) programme was also studied, using an adapted method.

This overview is not intended to be exhaustive. It seeks to examine a range of programmes that are representative of the possible paths for a student of finance. Each programme has been studied on the basis of the documentation available online on the websites of the various institutions. This does not, therefore, presage the quality of the programmes that are considered as addressing or integrating ecological issues.

[121] We have adopted a very inclusive definition of the verb "to address". All the courses for which we were able to ascertain that at least one course mentioned these issues at one time or another, whether marginally or in depth, are considered to be "addressing" ecological issues. Thus, the fact that a course 'addresses' these issues does not prejudge the degree of depth of the subject or the quality of the content

[122] If the course is recognised as addressing ecological issues, we refine the assessment to identify whether it integrates these issues. The difference between the terms addressing and integrating is that of a gradation of increasing intensity. Integrating ecological issues into training suggests that these subjects are considered in a more structural way, and no longer at the margins. In concrete terms, this means that there are several courses in which ecological issues are detailed and applied to financial matters. What's more, these courses should be an integral part of the curriculum, and not just optional.

[123] For the rest of the report, the terms "organisation" or "training organisation" will be used alternatively with the term "vocational training organisation". Here is a definition: "Continuing vocational training organisations offer services designed to promote the professional integration or reintegration of workers, to enable them to remain in employment, to promote the development of their skills and access to the various levels of vocational qualification, to contribute to economic and cultural development, to secure career paths and to their social advancement" see BPI France Création, "Organisme de formation professionnelle".

Each institution was invited to respond and add to our overview of the courses. A number of institutions responded to the survey, some of them making changes, including Edhec Business School, ESCP Business School, ESSEC, TBS Education and IAE Paris Sorbonne. The feedback received by The Shift Project beyond the allotted time could not all be integrated..

The detailed method of this overview is available in the appendix (see p.232).

Finance courses are not up to the ecological challenge

67 higher education institutes

10 training organizations analysed

1,400 unique training paths

A focus on the accounting, tax, and financial management program in 3-year university technical studies (IUT)

37 universities

22 business schools

10 training organizations

8 engineering schools

FINANCE STUDIES

5% have adequate * training on ecological issues

23% discuss ecological issues on a superficial level

72% do not give any part to ecological issues

Financial professionals must stop their contribution to harmful activities and massively finance the ecological transition..

How can they do that if they do not understand the planetary limits and its implications for finance?

* «adequate» means that the training shows the systemic character of the ecological stakes and its implications for the finance sector.

Finance training programmes do not prepare finance professionals for ecological issues: 72% of the training programmes do not address ecological issues, even with a very broad understanding of these issues. This proportion drops to 54% if professional training organisations are not included in the total. Thus, the majority of finance students receive no education on ecological issues.

Uneven presence across institutions

The courses offered by professional training bodies are the least likely to address ecological issues (91%), followed by engineering schools (68%). The best programmes in terms of addressing ecological issues are found in management schools, which cover these issues at a rate of 59%, followed by universities at 40%.

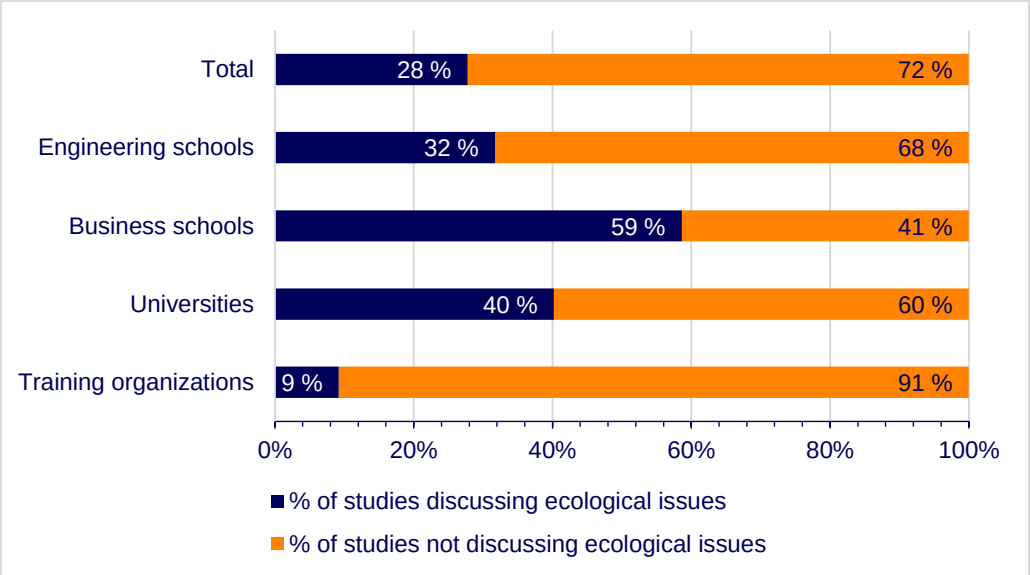

Figure 7: Training programmes addressing ecological issues by type of institution, The Shift Project

A minority of training programmes integrate ecological issues in depth

Only 5% of training programmes integrate ecological issues, i.e. provide adequate training in ecological issues. This implies that **most training programmes that address ecological issues do so only marginally.**

The majority of students who receive training in ecological issues do so in a largely marginal way, without considering the systemic nature of ecological issues and their implications for the finance sector.

On average, 5% of courses integrate ecological issues, with a maximum of 9% in business schools and a minimum of 2% in universities. Yet ecological issues are so fundamental that they require systemic change in our societies, including in financial practices and, *a fortiori*, in the way we teach them.

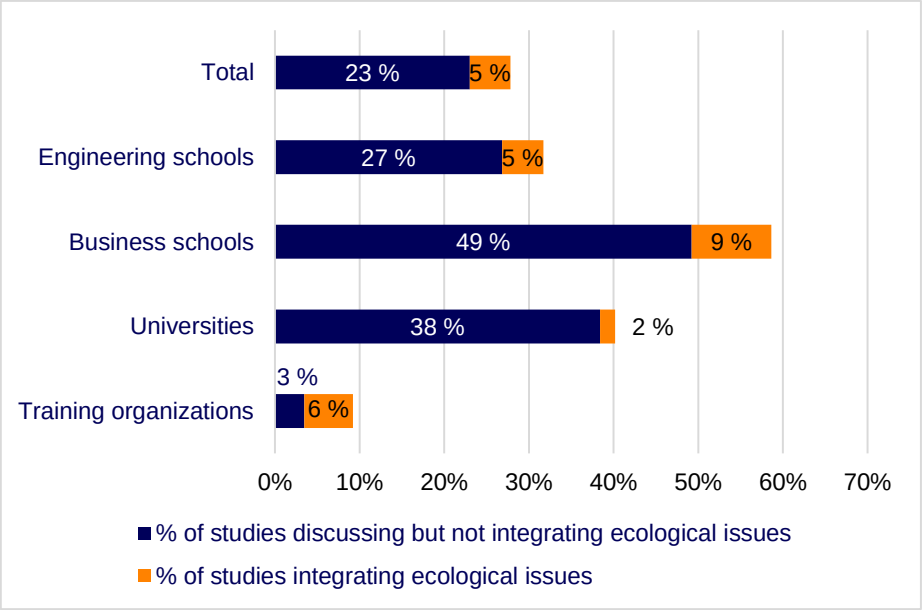

Figure 8: Share of finance training programmes addressing and integrating ecological issues, The Shift Project

Professional training organisations address ecological issues in 9% of their programmes, and include integrate them in 6%. Engineering schools address these issues in 32% of their programmes, but integrate them only in 5% of them. Universities address ecological issues in 40% of their programmes, but integrate them only in 2% of them. Lastly, 56% of business schools address ecological issues, but only 9% integrate them.

It should be noted that, within professional training organisations, the majority of programmes that deal with ecological issues also include them. Professional training organisations differ from other establishments on this point. This can be explained by the fact that they offer mainly continuing education programmes, which are more specialised than those offered by other establishments, and that ecological issues are therefore given more in-depth treatment.

Among the 1,399 training paths studied, only 5% incorporate ecological issues, which is clearly not enough. As the study did not analyse the content of the courses, **this figure is not indicative of the quality of the programmes integrating the issues at stake**.

The majority of continuing education programmes specialising in ESG issues (such as courses entitled "Green Finance" or "ESG Essentials") and considered to include ecological issues are very short: 80% of them last between 1.5 and 7 hours. Some programmes only cover ESG criteria for a few hours, which leads to a dilution of ecological issues in a much broader package that includes social and governance issues. Devoting just a few hours to these issues is not enough to cover the complexity of the implications of respecting planetary boundaries for financial practice.

A marked difference between continuing education and initial training

Finance professionals on continuing education programmes are less likely to be trained in ecological issues than students on initial education programmes. Indeed, initial training programmes deal more with ecological issues than continuing training programmes[124]. A majority of finance professionals are therefore unaware of how their business practices are changing in the light of ecological issues.

This marked difference can be explained by the fact that people who undertake continuing training do so with the aim of reinforcing certain specific knowledge in the practice of their profession (for example, the key points of the Basel III regulations, the risk of fraud in financial institutions). Thus, unless one specifically trains in ecological issues, these are seldom included in continuing education programmes that are not dedicated to them. However, it should be possible to maintain this specialisation in continuing education programmes while integrating ecological issues into them, in order to train professionals in financial practices that are more in line with planetary boundaries.

> *For example, certain fundamental elements of finance, such as the calculation of the cost of capital or the rate of return on investment, can be nuanced from an ecological perspective. In particular, these calculations require the use of a discount rate, which is known to devalue the future in relation to the present, and therefore reduce the probability that more sustainable projects will be carried out.*

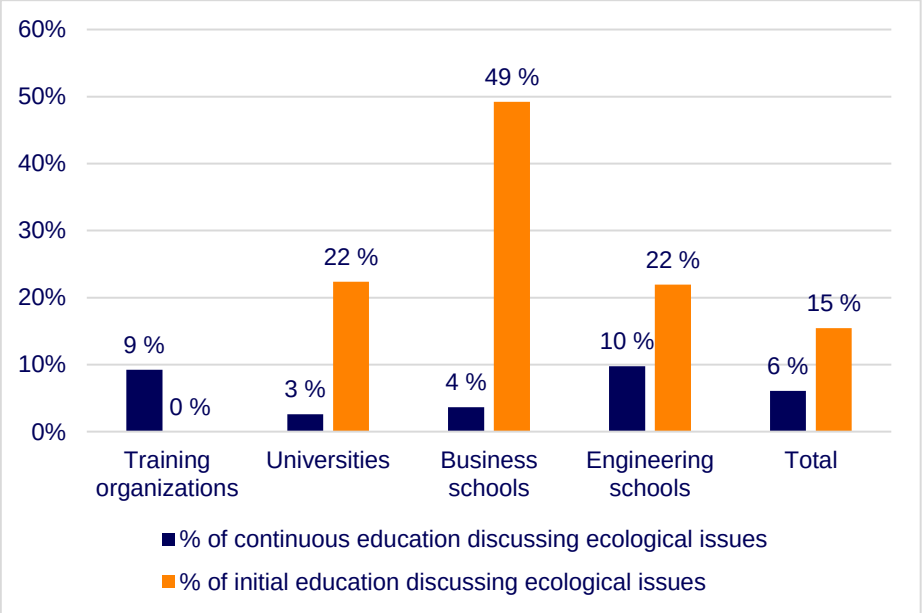

Figure 9: Share of programmes addressing ecological issues based on the mode of education (initial or continuing) and the type of institution, The Shift Project

In business schools, for example, 49% of initial education programmes address ecological issues, whereas only 4% of continuing education programmes do so [125].

[124] The exception to this observation concerns training organisations, where the few initial training courses do not address ecological issues at all.

[125] Tout établissement confondu, il y a 798 formations continues, 400 formations initiales et 201 formations à la fois initiales et continues.

3. Specialised and optional courses are not panacea

Focus on the specialised training courses

The few programmes that integrate ecological issues are specialised in these matters.. These programmes are mainly specialised in sustainable finance, green finance, or even focused on climate change and finance. Even if it is interesting to have specialised programmes on ecological issues, it is unfortunate that those issues are not integrated in general, initial or continuous training in finance. This situation overlooks the vast majority of students who do not show an interest in these issues and follow a traditional finance curriculum.

> *As an example, a finance professional wishes to improve himself in risk analysis and attends a 24-hours course focused on risk management in finance. This training will address the traditional content of the subject: credit risk, liquidity risk, technology risk, without however including for example the physical risks linked to the biodiversity decline or climate change. Nevertheless, taking into account those issues is nowadays a must in each risk analysis, as they complexify the traditional financial risks.*

Focus on the courses: mandatory or optional?

This inventory lists 952 courses addressing the ecological challenges, among them 206 are given in professional training organisations, 415 in universities, 302 in business schools and 209 in engineering schools.

The optional nature of a course creates selection bias. These modules will rather attract people who are already interested in the ecological issues, to the detriment of those who are not aware of those issues.

To assess the level of ambition in integrating ecological issues into a programme, it is important to distinguish between the optional or mandatory nature of courses addressing ecological issues.. This information is scarcely available, but it seems that **at least 55% of the courses addressing the ecological issues are mandatory.** This rough figure is encouraging, but there is still a long way to go for the training institutions in finance. For instance, in business schools, 52% of the courses addressing the ecological challenges are mandatory, and 12% are optional. The information is not available for the last 36%.

In the training organisations, few training programmes address the ecological issues. When it is addressed, then the courses are mandatory.

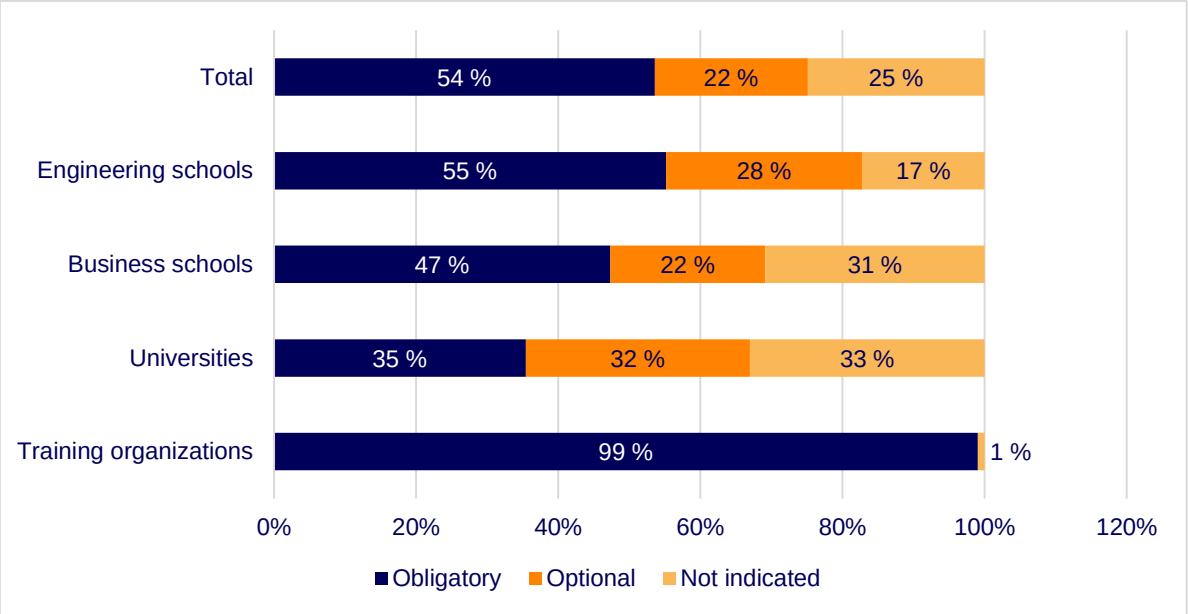

Figure 10: Share of studies discussing ecological issues as an obligatory topic, an option or "not indicated" in the curricula per type of school, The Shift Project

4. The new IUT (University Institute of Technology) programmes lack the opportunity to integrate the ecological issues

The IUT are parts of the universities that provide a post-secondary education aimed at preparing the students for technical and professional functions in production, applied research and services. There are 108 IUT for a total of 120 900 students in 2020. Training programmes in IUT are constantly evolving: in 2021, the 2-years university technology degree (DUT) became the 3-years university technology bachelor's degree (BUT).

There is one BUT in finance: accounting, tax and financial management (GC2F). The first edition of the second year of the GC2F programme took place in 2022.

The BUT broad outlines of the skills and knowledge are established on a national level. Therefore, the GC2F BUT training programmes all have the same objective, with some specificities in the training itself according to the orientations of their universities of affiliations or the local area of activity.

At the publication of this study, there was no detail of the content of those programmes on the IUT websites. Therefore, the analysis of the programme's contents was more delicate than for the other institutions.

The content analysis was made using two different methods (see the detail in appendix, page 232):

- Through a reading of the highlights; of the national programme;

- Through keywords search to verify that all the elements have been clearly identified. The same pattern was used on the syllabi analysis on the ClimatSup Business project[126].

Results show that **the GC2F training programmes of the IUT do address the ecological challenges,** using various resources and two different ways of teaching and evaluating[127].

Those challenges are *a priori* addressed superficially, without integrating them in the structure of the programme. It is regrettable that the opportunity to overhaul the programmes to more structurally include ecological issues was not seized.

5. An information sometimes difficult to access

Realising this state of the art was the occasion to note that accessing the information online regarding the content of the training may be difficult. This suggests that **the students do not necessarily make a well-informed choice.**

It is particularly true for business schools, as the accessibility of the names of the courses given in their programmes varies a lot. The school's websites encourage people to download the booklets to have more information. This requires sharing personal data (name, phone number, email address), opening the door to potential future solicitations, even though the content of the booklets is often not detailed.

Universities websites often offer a more direct access to information regarding the training programmes, the names of the courses if often written, and sometimes, even syllabi are included. To a lesser degree, access to information is often more straightforward on engineering schools' websites, as the courses names are at least written down. Finally, the titles of the courses and the key points of the content of the professional training organisations' teachings are accessible for the vast majority..

[126] The Shift Project, « Educating the actors of tomorrow's economy » (Train the economic actors of tomorrow), 8th of November 2022.

[127] One of the learning and assessment situations aims at « adopting an eco-responsible approach » when creating an organisation. The other aims at building « useful models for decision making, in a sustainable development approach » as well as writing « arguments for advise the decision maker integrating the 3 pillars of sustainable development ». See Ministère de l'enseignement supérieur, de la recherche et de l'innovation, « Annex 12 - Licence professionnelle « Bachelor Universitaire de Technologie » - Gestion des entreprises et des administrations ». (Ministry of higher education, Research and Innovation, « Annex 12 - Professional bachelor - University Bachelor of Technology » - Business and administration management

Transparency of Information, a Necessity

The difficulties of accessing the programme's contents and the unequal level of information collected across the establishments raise the question of the information awareness of the students.

In order for all students to make an informed choice when they are selecting a particular programme, we propose making it mandatory and accessible to provide information on the programmes such as: the number of ECTS credits, the number of hours, the courses offered, and their syllabi..

Given that, it would be extremely useful to standardise the training programmes booklets. The information would be easily readable and comparable between establishments.

In Belgium, those practices are recommended by the academy certifying the post-secondary training programmes. Following are the outlines of those practices, as defined by the Research and Post-secondary Education Academy (ARES) of the Wallonia-Brussels federation:

« All information related to the establishment activities are useful to potential and current students, as well as to graduates, stakeholders, and the public. This is why the establishment provides information related to their activities, including the proposed training programmes and the selection criteria, the learning outcomes targeted by the programmes, and the qualifications they lead to. They also provide information related to teaching, learning and evaluation conditions, success rate, apprenticeship possibilities offered to students as well as to graduates. »

Given the influence of this academy, those recommendations are widely followed. Therefore, all Belgium universities publish the information related to their training programmes. 80% of the High schools, post A-levels professionalising training organisations publish that information. It allowed the project Education4Climate, led by a team of Shifters from Belgium, to perform an algorithmic analysis of 88 863 courses, to assess their integration of the ecological issues[128].

[128] The Shifters Belgium, « Education4Climate ».

PART 2

DEVELOPMENTS IN FINANCE ARE NOT UP TO THE TASK WITH ECOLOGICAL ISSUES

I. An ecological transition to be led in a context of a deregulated finance and a financialised global economy

Since the 1970-1980s, two processes have notably contributed to build finance as it is today: a deregulation of finance and a movement of financialisation of the global economy.

The deregulation of finance has accompanied the gradual disengagement of the State from the financial sector, therefore reducing its leverage, and making it extremely difficult to re-engage in the future. Financialisation of the economy favoured the development of a hypertrophied finance, with capitals flowing largely into secondary financial markets, to the detriment of the real economy. Thus, while finance developed to take on a central role in the economy, the public authorities simultaneously withdrew from it.

Resources[129]

Marion Cohen and Alain Grandjean, 'Rôle et Limites de La Finance', *The Other Economy*

Grégoire Niaudet, Mireille Martini, 'La finance aux citoyens', *Secours-Catholique* 2018

A. Deregulation of finance and withdrawal of the States

Following the Second World War, the finance sector was strictly controlled and monitored using a fixed exchange rate system, based on the convertibility of the dollar into gold. Transnational capital flows were also controlled, credit activities were regulated, and the banking and financial industries were segmented. States used to finance themselves by calling on their central banks or by mobilising domestic savings, by obtaining preferential loans from captive national audiences (such as pension funds or national banks)[130].

Central banks were subordinated to policies stated by the governments: monetary and budgetary policies were designed in a complementary way in order to deploy economic policies aimed at supporting and guiding activities[131]. This economic system experienced a stagflation process in the 1970s, i.e. a slowdown in economic growth coupled with an acceleration of the inflation[132].

[129] Throughout this report, educational resources are proposed, either because they help to synthesise certain knowledge, or because they go deeper on certain concepts.

[130] The Other Economy, « Rôle et limites de la finance » (Roles and limits of finance)

[131] The Other Economy.

[132] Plihon, « Les dangers de la financiarisation » (Dangers of Financiarisation).

In the 1970s, under the impulse of economic liberalism, western economies deregulated the credit sector by putting an end to the rules aiming at directly limiting the amount of credit that could be granted by the banks, and at orienting the credit according to economic sectors. It is at that time that « universal[133] » banks started developing, removing the specialisation of the banks by type of activity (e.g., retail bank, investment bank, local credit bank, etc.) or by geographical area[134].

This period of deregulation coincides with a return of banking crises. While those were rare during the Bretton Woods period, there were 117 systemic banking crises between 1970 and 2003, affecting 93 countries, and 51 less acute banking crises which affected 45 countries[135]. Those banking crises led to the development of a prudential international regulation, with the Basel agreements[136]. The aim of those agreements is to impose to banks a minimum level of capital to guarantee their capacity to absorb losses caused by the default of payment of their borrowers[137]. Those rules, with a strictly micro-economic approach (at the scale of each individual establishment), did not prevent the development of banking or systemic crises[138]. However[139], to bypass this rule, some banks started to "securitize" [140] their loans, so they do not appear in their statement, thereby reducing their incentive to properly analyse the credit risk[141]. This led to the development of *shadow banking*, a parallel banking system including investment and securitisation. By 2019, those practises accounted for 57 000 trillion dollars of assets, about 14% of the global financial system[142]. *Shadow banking*[143] is not subject to banking regulation, which makes it a source of significant risks[144].

In the meantime, the role of monetary policy, along with the governance and tasks of central banks, changed[145]. Central banks had to be independent of political power and concentrate their actions on maintaining **price stability, i.e. fighting inflation**. Therefore, monetary policies escaped the control of governments. These new central banking orientations have particularly been implemented in the European Union (EU) since the creation of the European Central Bank (ECB) in the 1990s occurred at a time when monetarist theories were at their peak. For example,

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133 This means that these banks carry out all banking activities (lending, deposit, means of payment, investment banking).

134 The Other Economy, « Rôle et limites de la finance » (Roles and limits of finance).

135 Boyer, Dehove, and Plihon, « Les crises financières » (Financial crises).

136 Basel comity was created in 1974, the agreements Basel-I were signed in 1988

137 The risk assessment model, called Value At Risk, was actually developed by the banking industry itself - and not by the state - and popularised by the bank J.P. Morgan. This marks the beginning of the incursion of companies into the regulatory domain, and illustrates the process of gradual complexification in finance. This growing complexity makes the regulatory task all the more difficult. See Scialom, La fascination de l'ogre ou comment desserrer l'étau de la finance (The fascination of the ogre, or how to loosen the stranglehold of finance).

138 Basel agreements were signed in 1988, about ten financial crises occurred between 1989 and 2000.

139 It's not just securitisation that has enabled banks to circumvent their regulatory obligations, but also the regulatory possibility for banks to define their own methodology for assessing credit risk. This allows them to drastically reduce the minimum level of capital they are required to hold. In practice, the methodologies are extremely complex, and virtually impossible for an outside operator to audit, for estimating the level of regulatory capital they must hold. These methodologies are impossible to compare from one financial institution to another. The future FRTB regulation is supposed to provide a partial response to this problem of non-comparability of regulatory capital calculation models, and to the underestimation of risks on securitised products. But its rules, published in January 2016, will not be implemented until 2024 or 2025, depending on the country.

140 Securitisation is the process by which a financial institution transforms the receivables in its portfolio into negotiable securities.

141 The Other Economy, « Rôle et limites de la finance ».

142 The Other Economy, « Le shadow banking » (Shadow Banking).

143 To learn more about *shadow banking*, see the dedicated sheet The Other Economy.

144 Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l'intérêt général » (Finance to citizens - Putting the finance at the service of the general interest)

145 The Other Economy, "La monnaie".

while for the FED, objectives of price stability and full employment are on the same level, the ECB's primary objective is price stability, a secondary objective being the contribution to the priorities of the EU (including "the protection and improvement of the quality of the environment") as defined in Article 3 of the EU Treaty.

After 2008, doctrine and practice evolved. Faced with the financial crisis, the regulating role of the central banks on the financial sphere (and monetary policy) was reaffirmed. The objective of financial stability[146] has returned to the core of their missions[147]. Since 2015, ecological issues have also become important as "climate change has profound consequences for price stability, due to its structural and cyclic effects on the economy and the financial system"[148], according to the ECB. A network of central banks has taken up the issue (see details of the *Network for Greening the Financial System (NGFS)* initiative on p.65).

The progressive deregulation of markets and the bringing of public debt on the market signal the withdrawal of states from the control of financial affairs. This has been seen by some as subjecting States to a financial guardianship, while others would see a State that conforms to 'markets discipline'.

B. A growing role of finance in the economy

Financialisation refers to "the increasing role of financial motives, financial markets, financial actors and financial institutions in the functioning of national and international economies"[149].The world economy became highly financialised in the 1970s, i.e. finance took on a growing role in the global economy[150]. For example, the size of financial markets, measured by the value of securities traded, increased 25-fold between 1980 and 2010 in France[151].

This financialisation is the consequence of economic and political developments that affected most Western economies by the end of the Bretton Woods system[152]. The fixed exchange rates system was then replaced by the current floating exchange rate system, in which currency price fluctuates in the foreign exchange market depending on offer and demand. This new system marks the beginning of speculation on currency rates. It thus created a new risk: the currency risk, which has been driving the development of financial derivatives[153].

During the 1980s, a period of financial liberalisation, the State's public debt was also brought to the market[154]. The pre-existing mechanisms which hitherto made it possible to finance public deficits at low cost were abolished. It is within this framework that what some researchers call the "debt order[155]" was gradually imposed, accompanied by intense bond emission activity. These activities generate fees for banks and promise 'safe' assets (government

[146] Stability bears multiple dimensions,whose aspects are price stability, financial stability and economic stability. More about this, see Villeroy de Galhau, "l'histoire des trois stabilités".
[147] The Other Economy, "Rôle et limites de la finance".
[148] ECB,"Déclaration relative à la stratégie de politique monétaire de la BCE".
[149] Epstein, *Financialization and the World Economy*.
[150] The Other Economy, "Rôle et limites de la finance".
[151] Plihon,"Les dangers de la financiarisation".
[152] The Bretton Woods system was in turmoil from 1968 onwards, and its end was ratified in 1973.
[153] The other economy,"rôle et limites de la finance".
[154] For more information on the different ways in which governments can theoretically finance their deficits and the mechanisms of bond debt financing, see The Other Economy, "Dette et déficit public".
[155] This expression is due to Benjamin Lemoine in the book of the same name. It represents the advent of debt as one of the central critéria by which public action is oriented.

bonds) for financial investors[156]. **Subsequently, the gradual lifting of controls on transnational capital movements marked the beginning of the free movement of capital**. From the 1980s onwards, Western countries, under the impetus of the United States, gradually opened up the market for their public debt securities to foreign investors. Financial players could then invest wherever they wished as well as settle in other countries by competing with local financial players. These policies were also promoted or even imposed on developing countries by the International Monetary Fund (IMF) and the World Bank in the spirit of the Washington consensus[157].

The opening of borders to capital movements, the relaxation of regulations on credit and banks, and in particular the departitioning of the credit markets for financial assets, have contributed to the phenomena of concentration and the emergence of multinational banking companies that are "too big to fail" or systemic banks[158]. This deregulation, via massive credit growth, has encouraged the development of international speculative movements that have destabilised national economies[159]. The free movement of capital has also facilitated tax evasion and money laundering in some tax havens[160].

By the end of 2020, the financial assets of the 29 largest jurisdictions[161] represented almost 600% of global GDP[162], or more than US$460 trillion, which justifies observers talking about financial hypertrophy. The French economists of *The Other Economy* believe that the financialisation of the economy favours a certain number of harmful effects, which end up impacting the financing capacities of the ecological transition, in particular:

1. **Periodic destabilisation of the economy** due to the unstable nature of liberalised finance, which is a source of crises that affect the whole economy. A report by the Council for Economic Analysis stated that the frequency of financial crises of all kinds doubled between the Bretton Woods period (1945-1971) and the post-1973 period (up to the early 2000s)[163,164]. This report detailed the destabilising effects of financial liberalisation policies as follows:

156 The Other Economy, "Rôle et limites de la finance".

157 Ibidem.

158 The Financial Stability Board, created by the G20 in 2009 in the wake of the subprime crisis, refers to these universal banks as "systemic entities". These are banks whose failure would be likely to cause a contagious collapse of the financial system as a whole. Read more on The Other Economy, "Les banques systémiques".

159 Secours Catholique - Caritas France,"La finance aux citoyens - Mettre la finance au service de l'intérêt général".

160 The Other Economy, « Rôle et limites de la finance ».

161 This group of 29 includes Argentina, Australia, Belgium, Brazil, Canada, the Cayman Islands, Chile, China, France, Germany, Great Britain and Ireland, Hong Kong, Indonesia, India, Ireland, Italy ,Japan, Korea, Luxembourg, Mexico, the Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, the United States, . See Financial Stability Board (FSB) table: Financial Stability Board (FSB), "Non-Bank Financial Intermediation Monitoring".

162 Financial Stability Board (FSB).

163 Boyer, Dehove and Plihon,"Les crises financières".

164 The economist Dominique Plihon lists numerous financial crises from the 1980s to the subprime crisis, which took various forms: stock market crises, real estate crises, banking crises, currency crises, sovereign debt crises. Plihon, "Des crises à répétition: des caisses d'épargne américaines aux subprimes".

Liberalisation areas	Observed effects	Explanations
Banking sector	Most banking crises were preceded by a banking system liberalisation	• Excessive risk taking • Exacerbated competition • Income degradation of the weakened banks
Stock market opening	Speculative stock market bubbles, both in advanced and most emerging countries	• Encourages speculation • Favours international investors trading • Traders' mimetic and gregarious behaviours
Capital account opening	• Crisis in countries that have prioritized capital account opening • No crises in countries that have maintained capital controls (China, India)	• Favours speculation • International capital inflows and outflows that destabilise the currency and banking system of countries affected by speculation
Foreign exchange market opening	• More frequent exchange rate crises • Increased exchange rate instability • Increased vulnerability of financial systems	• Weakens banks and companies subject to currency instability • Stabilisation of the exchange rate made difficult for central banks

Table 1: The destabilizing effects of financial liberalization policies, Dominique Plihon[165] after Boyer et al. 2004[166]

These destabilisations contribute to delays in the necessary transition towards a low-carbon economy: the financial and economic crises push to postpone the transition necessary investments and the implementation of environmental regulations because of the priority given to employment, economic recovery and growth[167].

2. The **shortening of companies' temporal horizon** through generalisation for listed companies of a management model aiming at maximising short term shareholder value. This method of corporate governance leads to the diversion of profit away from productive investment, with the aim of generating short-term profits, while increasing financial fragility of the company through growing indebtedness[168]. Competition between companies feeds this dynamic.

   This short-term logic (which is not limited to listed companies) can impact the ecological and climate transition strategies of companies, as those require medium- and long-term projections and substantial investments to decarbonise the company's activities or even to reorient them.

[165] Plihon.
[166] Boyer, Dehove and Plihon,"Les crises financières".
[167] The Other Economy, "Rôle et limites de la finance".
[168] The Other Economy.

3. **A diversion of financial activity from the real economy**: in the current banking system, most loans do not finance new real investments but the purchase of already existing assets. Indeed, the former head of the UK Supervisory Authority, Adair Turner, noted that in 2012, only 14% of bank loans to non-financial actors in the UK fed into productive business investment. Of the remainder, 65% went to residential property, 14% to office property and 7% to household consumption[169].

   As far as savings are concerned, they are largely geared towards purchasing existing assets on secondary markets. While this contributes to the liquidity of securities and the success of primary market issues, it does not provide new financing for the real economy[170]. Most of the money creation has therefore been captured by the real estate and financial markets, rather than financing productive activity. This feeds speculative bubbles, a major factor of financial crises.

   The orientation of credit and savings towards the purchase of existing assets without participating in the financing of the real economy obviously raises questions when one is aware of the financial needs for undertaking *e.g.* measures to adapt and mitigate climate change.

4. **Financial markets cannot integrate resource scarcity in a way that is clear enough** "for economic agents, companies and governments, to take it into account for their medium- and long-term policies," says researcher Nicolas Bouleau[171]. According to him, the end of an exhaustible resource necessarily produces a crisis of volatility due to the high uncertainty about this resource. Derivatives may hedge against price risks. However, "one cannot drive a company's energy transition with insurance, so that the financial markets, through this inescapable turmoil, mask the scarcity of exhaustible resources that we should collectively turn away from[172]".

5. Some earth scientists go far beyond, arguing that the financialisation of ecosystems is one of the main mechanisms by which human activity damages the biosphere[173]. According to them, financialisation promotes the abstraction between biomass and the economic activity around it. For example, financial practices and instruments such as securitisation and complex derivatives allow for only 2% of commodity futures contracts to result in the physical delivery of the product. It allows accumulating monetary wealth that can mask the reality of resource depletion or the destruction of ecosystem services, and threaten their resilience[174].

The twofold movement of financial deregulation and financialisation of the economy has confirmed, on the one hand, the gradual disengagement of the State from the financial sector and, on the other hand, the development of financial hypertrophy, to the detriment of the real economy. Thus, while finance was growing up to take over a central place in the economy, the public authorities were simultaneously divesting themselves from it.

169 Turner, *Reprendre le contrôle de la dette*.
170 The Other Economy, “Rôle et limites de la finance”.
171 Bouleau, “14. Les marchés financiers sont-ils des marchés d’opinion ?”.
172 Bouleau.
173 Nystrom and al, 2019 cited in Lagoarde-Segot and Martinez, 'Ecological Finance Theory: New Foundations'.
174 Nystrom and al., “Anatomy and resilience of the global production ecosystem”.

II. A profusion of initiatives but too little concrete progress

Finance has started to address ecological issues mainly through the prism of climate. Biodiversity is an emerging topic, but still little taken into account. The integration of other planetary boundaries is not yet on its agenda.

In 1997, the Kyoto Protocol brought climate onto the trading floor by laying the foundations for a carbon market[175]**.** The 2009 Copenhagen Accord was another milestone for the financial sector, as governments agreed to provide annually up to USD 100 billion from the North to the South for climate change mitigation and adaptation. However, it is only with the Paris Agreement and the Bank of England Governor Mark Carney's famous 'Tragedy of the Horizon' speech that the momentum started building up[176].

There are currently various policy and regulatory approaches that attempt to mobilise private finance for decarbonisation. Some regulatory frameworks are evolving to incorporate ecological issues, while voluntary initiatives are developing among financial actors. Companies are increasingly required to report on the environmental impact of their activities[177], not only to protect their reputation but also to comply with some of their customer's preferences. Nevertheless, this so-called "sustainable" or "green" finance that is developing still remains a niche market, which practices may give cause to accusations of greenwashing.

A. Regulations and voluntary initiatives are mainly focused on transparency

Article 2(1)(c) of the Paris Agreement endorses the commitment of States to "make financial flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development"[178].

At various levels, regulatory frameworks are being developed to bring financial activities in line with ecological issues. Financial actors are engaging themselves in initiatives through voluntary coalitions. Most of these initiatives and regulations call for transparency on behalf of financial actors and have not yet led to the transformation of the economy towards ecological transition.

1. Transparency requirements driven at French level

France is a forerunner in terms of climate reporting. Indeed, transparency requirements have been gradually introduced by the legislator: a first step was taken in 2001 via the law on new economic regulation, imposing on listed companies to include in their annual reports statements on the social and environmental consequences of their activities. The Grenelle 2 law goes further and introduces the "right to environmental information", which drives companies and

[175] Ansidei and Leandri, *La finance verte.*

[176] Mark Carney: Breaking the tragedy of the horizon - climate change and financial stability, 2015

[177] Some experts point out that attention is often focused on simple materiality, i.e. the risks that environmental issues pose to financial actors, to the detriment of dual materiality, which also analyses the risks to the environment of financial actors on global limits.

[178] United Nations, Paris agreement.

public players to indicate how they take into account "sustainable development" imperatives in their strategy[179].

In 2015, paragraph IV of Article 173 of the Law on Energy Transition for Green Growth (LTECV) goes further. It strengthens the transparency obligations of financial actors (mainly management companies and institutional investors) concerning the inclusion of criteria related to the respect of environmental, social and governance (ESG) objectives in their investment strategy, with a particular focus on climate risks. **The implementing decree requires, in particular, that the carbon footprint of portfolios shall be measured, that exposure to transition risk shall be analysed and that the mechanisms implemented by the players to contribute to the energy and ecological transition shall be specified[180].** However, the scheme does not specify a method for taking issues into account and actors are free to indicate that they do not take them into account, provided that they submit a detailed explanation, under the *comply or explain* principle[181].

In 2019, Article 29 of the Energy and Climate Law (ECL) adds a reporting obligation[182] for biodiversity risks[183]. Its implementing decree requires reporting to include investment strategies aligned with the objectives of the Convention on Biological Diversity treaties[184] and the Paris Agreement[185]. The decree also broadens the scope of the actors concerned by the regulation, including real estate funds, banks' portfolio management and investment activities, credit institutions and investment firms.

2. Measures to promote sustainable finance at EU level

Since 2018, the European Union has adopted numerous measures to "green" finance.

In 2018, the European Commission published an action plan to finance "sustainable growth". That plan sets three objectives: "redirect capital flows towards sustainable investments to achieve sustainable and inclusive growth; manage the financial risks induced by climate change, resource depletion, environmental degradation and social issues; and promote transparency and a long-term view in economic and financial activities[186]." It also specifies ten actions[187], including the definition of a unified classification system - a taxonomy - to define what is considered sustainable; transparency obligations for financial actors and products; and

179 Ansidel and Leandri, *La finance verte.*

180 For more information on the implementing decree: Ministry of Finance and Public Accounts, "Décret n° 2015-1850 of 29 December 2015 pursuant to Article L. 533-22-1 of the Monetary and Financial Code".

181 Ansidei and Leandri, La finance verte.

182 For a non-exhaustive historical review of the steps on reporting, see The Other Economy, "The implementation of extra-financial indicators would be enough to complete the accounting on a social and ecological level".

183 'Article 29 - LOI n° 2019-1147 du 8 novembre 2019 relative à l'énergie et au climat (1) - Légifrance', 29.

184 The decree specifies that these objectives concern the contribution to the reduction of pressures and impacts on biodiversity based on a biodiversity footprint indicator.

185 Ministry of Ecological Transition and Territorial Cohesion, "Loi énergie-climat et régulation des acteurs financiers: main advances in the decree implementing Article 29".

186 Ansidel and Leandri, *La finance verte.*

187 The 10 actions are: establish a unified EU classification system; create standards and labels for green financial products; strengthen support for sustainable projects; clarify the obligation for asset managers and institutional investors to take sustainability aspects into account in the investment process and strengthen their transparency obligations; develop sustainable indices; better integrate sustainability into ratings and research; require financial intermediaries to take into account clients' sustainability preferences in the provision of advice; integrate sustainability into prudential requirements; enhance corporate sustainability and transparency of companies on sustainability and integration into accounting rules; strengthen sustainability governance and mitigate short-termism in capital markets.

requiring financial intermediaries to take into account clients' sustainability preferences when providing advices[188].

Following the recommendations of this action plan, the European taxonomy has been defined, allowing the classification of "environmentally sustainable activities ». It sets six environmental objectives:

- Climate change mitigation;
- Climate change adaptation;
- Sustainable use of water and marine resources;
- Transition toward a circular economy;
- Pollution prevention and control;
- Ecosystems and biodiversity restoration and protection[189].

The regulation has defined four requirements that economic activities must comply with in order to be considered sustainable: they should substantially contribute to at least one out of the sixth environmental objectives defined here above; they should cause no significant harm to any other environmental objective (i.e. "*do no significant harm*" (DNSH) principle); they should comply with the defined technical criteria; they should respect the minimum governance and social guarantees. The taxonomy deals not just with low-carbon activities, it also deals with transition and transition-enabling activities[190]. After much debate, nuclear and gas-fired electricity have been included in the taxonomy as transitional energies, under certain life-cycle GHG emission conditions[191].

The European Union is not alone in having a taxonomy. China, the UK, Mexico, Canada and Russia are developing or deploying their own taxonomies. The question of how these taxonomies interact with each other and the implications for international companies and investors remains an open question for the time being.

The European Union has also introduced transparency requirements for financial actors and products through the Sustainable Finance Disclosures Regulation (SFDR). The Regulation introduces a distinction between three categories of products, based on self-declaration, subject to increasingly stringent transparency requirements: traditional investment "Article 6" products; products promoting environmental and/or social characteristics, or "Article 8" products; and "Article 9" products with a sustainable investment objective[192].

Furthermore, The European Commission has also amended the texts governing the distribution of financial instruments to better take into account clients' ESG preferences in the provision of advice and to stimulate demand for ESG products. **This led to revisions of the Markets in Financial Instruments Directive (MiFID) and the Insurance Distribution Directive (IDD)[193].**

A voluntary European standard for green bonds has been created, the European Union green bond standard (EUGBS), with the aim of developing the market for « green » bonds and

188 Ansidei and Leandri *La finance verte.*
189 European Commission,"EU taxonomy for sustainable activities".
190 Ansidei and Leandri *La finance verte.*
191 "EU under fire over inclusion of gas and nuclear in green taxonomy | EcoAct".
192 Ansidei and Leandri, *La finance verte*.
193 Ansidei and Leandri.

promoting “sustainable growth”[194]. This standard reinforces the information on the allocation of the funds raised, which must be in line with the taxonomy[195]. These green bonds are nevertheless criticised because they are self-declared by the issuers. There is no regulation on green claims, so the label is *de facto* uncontrolled[196].

3. Voluntary initiatives made by financial actors on a global scale

Numerous voluntary initiatives are being taken by financial actors around ecological issues. Here are the most significant ones.

The *Network of Central Banks and Supervisors for Greening the Financial System (NGFS)*, launched in 2017, is a coalition of central banks and supervisors. The aim is to share good practices, to contribute to the development of environmental and climate risk management in the financial sector, and to commit finance towards the transition[197].

In 2015, the G20 Financial Stability Board chaired by Mark Carney fostered the creation of a working group of private sector representatives on climate-related financial reporting: the *Task force on Climate-related Financial Disclosures (TCFD)*. In its June 2017 report, the TCFD proposes an international corporate reporting framework so that investors can better assess the climate risks faced by the companies in which they invest. The TCFD is a voluntary framework whose application is encouraged by supervisors, investors, some governments and the European Commission. **The Taskforce on Nature-related Financial Disclosures (TNFD), which took shape in 2020, is the counterpart of the TCFD for biodiversity[198].** The TNFD offers methods for identifying and managing biodiversity risks, and does not focus primarily on transparency.

The UN has also encouraged the development of a global coalition of financial services actors, which has resulted in the Glasgow Financial Alliance for Net-Zero (GFANZ). Its objective is to mobilise capital towards decarbonisation[199]. Four coalitions of industry professionals have emerged: the Net-Zero Banking Alliance, the Net-Zero Asset Manager Initiative, the Net-Zero Asset Owner Alliance and the Net-Zero Insurance Alliance.

Still under the aegis of the United Nations, voluntary frameworks involving banks, investors and insurers have been developed. These are the **Principles for Responsible Banking** (PRB)[200], the **Principles for Responsible Investment** (PRI)[201] and the **Principles for Sustainable Insurance** (PSI)[202] respectively. The overall objective of these global initiatives is to share a framework for aligning the practices of financial actors with ecological issues.

194 European commission, “European green bond standard”.
195 Ansidei and Leandri, *La finance verte*.
196 Lefournier and Grandjean, *L’illusion de la finance verte*.
197 NGFS, *“Origin and Purpose”.*
198 Ansidei and Leandri, *La finance verte.*
199 GFANZ, *“About Glasgow Financial Alliance for Net Zero”*.
200 United Nations Environment – Finance Initiative, « Principles for Responsible Banking ».
201 UNPRI, « What are the Principles for Responsible Investment? »
202 UNEP FI, « Principles for Sustainable Insurance ».

4. An extension of the "ethical" investment concept

Historically, "ethical" investment was based on policies excluding the financing of certain sectors (tobacco, alcohol, pornography, gambling, etc.) for ethical, moral or religious reasons.

More recently, these exclusionary policies have included some activities that are harmful to the climate, such as thermal coal, oil sands and shale gas. In 2020, the NGO Go Fossil Free identified that 1,200 institutions with $14 trillion in assets have established fossil energy exclusion or divestment policies, most often focused on coal[203].

Today, there are various investment strategies for investors:

- The classic investment that does not take into account ecological issues;
- Exclusion or 'ethical' investment, which is based on negative selection;
- Responsible investment, which includes best-in-class strategies[204];
- ESG thematic investment;
- Impact investing, which seeks a positive E or S impact as well as a financial return;
- Shareholder engagement.

Through these strategies, investors and bankers may seek to reduce their exposure to sectors potentially affected by transition risks. More importantly, they seek to protect their reputations which could be spoiled by such support[205].

The initiatives mentioned above, such as the Net Zero Asset Owners Alliance, aim to create new forms of shareholder dialogue, focused on climate issues. This is aimed at increasing pressure on listed companies[206].

These forms of shareholder engagement are nevertheless weakened by the significant resources required to carry them out, by the difficulty of tracing the actions and results obtained, or by obstacles to shareholder voting. For example, BlackRock claims to take up climate issues. Yet the leading asset manager is often criticised for opposing climate-friendly votes, for example by opposing a resolution targeting JP Morgan, asking it to define a strategy to reduce its scope 3 emissions[207].

B. Green finance has a marginal impact

1. Green finance remains a niche in traditional finance

Green finance refers to all financial transactions that support sustainable development, in particular by promoting the energy transition and the fight against global warming. It also includes initiatives by financial sector regulators and supervisors that contribute to these objectives[208].

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203 Ansidei and Leandri, *La finance verte.*

204 I.e. favouring companies with the best extra-financial ratings in a given sector of activity. See Novethic, "Best-in-class".

205 Ansidei and Leandri.

206 Ansidei and Leandri.

207 Ansidei and Leandri.

208 Banque de France, « L'éco en bref - La finance verte ».

In his famous speech in 2015, Mark Carney, then Governor of the Bank of England, emphasised that green finance is a niche, but that in the medium term it should not remain so in order to allow decarbonisation of our economies[209]. **However, despite the strong growth of green finance[210], it remains a very small minority. For example, green bonds represent less than 1% of the global bond market[211]**.

Respecting the Paris Agreement means aligning all financial flows with our climate objectives[212]. The entire financial sector must be transformed in order to contribute to the transition of the real economy. Green finance does not currently provide a response to the challenges. So traditional "brown" finance, which finances the business as usual, needs to make a concrete commitment to the transition**. Green finance must no longer be the green tree that hides the carbon forest.**

2. The impact of green financial products is debatable

IPCC experts are concerned about the risks of greenwashing[213] underlying the development of markets for sustainable financial products[214, 215]. This concern is shared by the *Securities and Exchange Commission* (SEC), which in March 2021 created the *Climate and ESG Task Force* to ensure that listed companies, investment advisors and funds comply with ESG disclosure rules[216].

Numerous recent studies attest to the existence of *greenwashing* in the field of sustainable financial products.[217,218,219]. For example, US institutional investors who have signed up to the Principles for Responsible Investment (PRI), a commitment to responsible investment, have portfolios of securities that do not have a better ESG score than those that do not[220]. In the United States, ESG mutual funds hold portfolios of firms with a record of compliance with labour and environmental laws worse than firms held by non-ESG funds, managed by the same financial institutions[221].

The IPCC also states that, to date, "there is as yet no evidence that green and sustainable financial products have significant impacts in terms of mitigation and adaptation to climate

[209] Carney, « Breaking the Tragedy of the Horizon – climate change and financial stability ».

[210] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[211] Ansidei and Leandri, *La finance verte*.

[212] Zamarioli et al., « The climate consistency goal and the transformation of global finance ».

[213] Greenwashing is defined as a communication message that misuses or abuses the ecological argument.

[214] Sustainable finance refers to all financial practices and regulations designed to promote the interests of the community over the medium to long term. It includes responsible finance, solidarity finance and green finance.

[215] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[216] U.S. Securities and Exchange Commission, « Enforcement Task Force Focused on Climate and ESG Issues ».

[217] Kim, Soohun et Yoon, Aaron, « Analyzing Active Fund Managers' Commitment to ESG: Evidence from the United Nations Principles for Responsible Investment ».

[218] Andrikogiannopoulou, Angie et al.

[219] Michaely, Roni, Ordonez-Calafi, Guillem, et Rubio, Silvina, « Mutual Funds' Strategic Voting on Environmental and Social Issues ».

[220] Gibson, Rajna et al., « Do Responsible Investors Invest Responsibly? »

[221] Raghunandan, Aneesh and Rajgopal, Shivaram, « Do ESG Funds Make Stakeholder-Friendly Investments? »

change"[222]. It also highlights a lack of research on the direct impact of ESG and sustainable investment on climate change indicators[223].

According to the IPCC experts, there is also a great deal of uncertainty, both in the short term and in the long term, on the feasibility of aligning financial flows with the objectives of the Paris Agreement[224]. They indicate that these green financial flows could nevertheless strengthen the ability of financial institutions to be aware of future climate impacts by helping to improve their understanding of the risks and opportunities associated with climate change, which remains a real challenge.

In addition, the experts say that **for new financial products to have an impact on the climate, they must "be combined with a strengthening of climate policy and a reduction in investments linked to GHG-emitting activities**[225]**".**

Green bonds: unproven ecological impacts

A green bond is a loan issued on the market by a company or public entity to investors to enable it to finance projects that contribute to the ecological transition. It differs from a conventional bond in that it provides detailed reporting on the investments it finances and the green nature of the projects financed[226]. The green bond market is estimated at $523 billion in 2021, up 75% over one year[227].

The IPCC considers that it is impossible to establish a link between an organisation's emission reduction and the use of the income from green bonds, due to data constraints[228]. More generally, it is difficult to establish a link between emissions reductions and specific financial instruments that primarily target climate-related activities, such as green bonds[229]. Green bonds are no exception to the general observation that there is no evidence that green and sustainable financial products have significant impacts in terms of climate change mitigation and adaptation to climate change[230, 231].

For the IPCC experts, the green bond market is suffering from a lack of requirements and consistency in terms of impact reporting. Nor is there any independent review of impact reports[232]. And even though, according to the latest report from the *Climate Bond Initiative*, 59% of issuers representing 74% of the amount of emissions report on the impacts after issuance, the

222 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

223 Instead, most existing studies assess the factors behind sustainable finance trends and their impact on sustainable investment, or the relationship between sustainable investment and corporate financial performance.

224 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

225 Intergovernmental Panel on Climate Change (IPCC).

226 Ministère de l'environnement, de l'Energie et de la Mer, « Les obligations vertes au service de la transition énergétique et écologique ».

227 Harrison, Caroline, MacGeoch, Matthew, et Michetti, Carlotta, « Sustainable Debt - Global State of the Market 2021 ».

228 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

229 Intergovernmental Panel on Climate Change (IPCC).

230 Tuhkanen, Heidi and Vulturius, Gregor, « Are green bonds funding the transition? Investigating the link between companies' climate targets and green debt financing ».

231 Ehlers, Torsten, Mojon, Benoît, and Packer, Frank, « Green bonds and carbon emissions: exploring the case for a rating system at the firm level ».

232 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

widespread **use of relative measures**[233] **does not allow to assess absolute progress in relation to climate and other objectives**[234]. What's more, impact measures are chosen by the issuer. They focus on achieving the specific objectives of the project financed by the green bonds and therefore **do not take into account the full impact of the project, which goes beyond its specific objective**. All projects have impacts on water use, pollution, employees, communities, etc. but if these effects are not the explicit purpose of the project and its expected benefits, they are not taken into account in the impact report. [235].

The link between green bonds and the ecological performance of the projects financed is therefore impossible to establish. Nevertheless, this type of bond is developing, claiming certain benefits in the financing of "green" projects. The central argument concerns in particular the lower cost of financing projects favourable to the ecological transition through these green bonds.

The return granted by investors to the organisations issuing a green bond, compared to what they would have demanded from these same organisations for an identical but conventional bond, is called "greenium", a contraction of *green and premium*.

The existence of this greenium is a matter of debate. A number of experts suggest that there is indeed a greenium[236] [237] [238], others suggest that its existence depends on the credibility of the green bond and its issuer[239], finally, other experts observe no greenium[240] [241], even refute the possibility that a greenium could exist[242] [243]. According to the latter, **green bonds and conventional bonds are in fact the same product. The investments financed by a green bond would have been financed under the same financial conditions by a conventional bond**.

233 Relative measures involve changes in relation to a baseline or threshold, for example, quantities saved, reduced or avoided; absolute measures, such as protected area, GHG emissions and resource use, do not.

234 Almeida, Miguel and Lonikar, Prashant, « Post-Issuance Reporting in the Green Bond Market 2021 ».

235 Almeida, Miguel and Lonikar, Prashant.

236 Pastor, Lubos, Stambaugh, Robert F., and Taylor, Lucian A., « Dissecting Green Returns ».

237 Baker, Malcolm et al., « Financing the Response to Climate Change : The Pricing and Ownership of U.S. Green Bonds ».

238 Zerbib, « The effect of pro-environmental preferences on bond prices: Evidence from green bonds ».

239 Pietsch, Allegra and Salakhova; Dilyara, « Pricing of green bonds: drivers and dynamics of the greenium ».

240 Larcker, David F. and Watts, Edward M., « Where's the greenium? »

241 Flammer, Caroline, « Corporate green bonds ».

242 Flammer, Caroline.

243 Ekeland and Lefournier, « L'obligation verte : homéopathie ou incantation ? »

The impossibility of greenium

The commitment by the issuer of a green bond to use the funds raised for the purposes of the ecological transition has no legal value, and the risk of non-repayment of the bond is the same as for a conventional bond issued by the same organisation[244, 245]. There is therefore no reason why investors should be willing to pay more for a green bond[246]. All the more so as buyers of green bonds are professional investors who act on behalf of customers and must respect their fiduciary duty, i.e. to provide their principal with the best possible return. They therefore cannot subscribe to a bond that, for a given level of risk, offers a lower return than others[247].

In addition, the mechanism for setting the price of a bond does not allow investors who agree to forego part of the bond's yield, to significantly influence the bond's yield. As a variation of a few basis points is not significant in terms of the volatility of credit premiums and interest rates, it is therefore not likely to influence the decision on the implementation of projects favourable to transition[248].

So, as Ivar Ekeland and Julien Lefournier point out, "the existence of each green bond, from issue to maturity, requires the concerted efforts of a multitude of players: companies finance green projects, labels are awarded, rating agencies give scores, auditors verify, and investors raise funds. **A production chain has been set up but at the end of it, the promised value (saving the climate) is missing". The green bond would then be a marketing pitch**, akin to greenwashing[249].

Paris Europlace points out that "the development of green bonds does not seem, in itself, to stimulate a net increase in green investments for issuers that would not have otherwise access to capital as easily"[250].

Although the positive ecological impact of projects financed by green bonds has not been established and the greenium provided by green bonds is debated, the attraction for green bonds can be explained by an image benefit[251] for issuing organisations. Issuing green bonds enables organisations to give visibility of their sustainable development strategy, attract new investor profiles such as socially responsible investors or foreign investors, and create new internal interactions, particularly between the finance and sustainable development departments[252].

244 Ansidei and Leandri, *La finance verte*.

245 Lefournier and Grandjean, *L'illusion de la finance verte*.

246 Flammer, Caroline, « Corporate green bonds ».

247 Lefournier and Grandjean, *L'illusion de la finance verte*.

248 Lefournier and Grandjean.

249 Ekeland and Lefournier, « L'obligation verte : homéopathie ou incantation ? »

250 Paris Europlace/Initiative Finance Verte et Durable de la Place de Paris quoted in Ekeland and Lefournier.

251 Flammer, Caroline, « Corporate green bonds ».

252 Shishlov, Nicol, and Cochran, « Environmental integrity of green bonds: stakes, status and next steps - Green Bonds Research Program Work Package 2 ».

Sustainability-linked bonds do not escape suspicion of greenwashing

Sustainability-linked bonds (SLBs) are bonds with an environmental, social or governance (ESG) constraint for the issuer. At the time of issue, the issuer sets one or more ESG objectives, the achievement of which is verified at a specific date using indicators, also set by the issuer. The cost of the SLB is indexed to the achievement of these ESG objectives, so as to act as an incentive for the issuer[253]. However, unlike green bonds, where issuers must allocate the funds to the project being financed, issuers of SLB can use the funds as they wish. This is because SLBs are not linked to green projects, but to the sustainability objectives defined by the issuer[254]. SLBs are significantly growing, but the amounts involved are still marginal, with US$ 103 billion issued in 2021[255].

As with green bonds, the potential impact of SLBs on the ecological transition are the subject of debate. SLBs have many shortcomings that could allow issuers to benefit from their advantages without improving their ESG performance[256, 257]: ESG objectives are defined by issuers and their achievement is mostly self-assessed, the penalty for not meeting objectives is paltry[258], Finally, SLBs are arranged[259] by banks that have commercial relationships with issuers. **These shortcomings lead some experts to assert that SLBs have been developed to enable financial players to claim that they are contributing to the ecological transition, whereas the number of projects that can be covered by green bonds is limited[260].**

3. Many financial labels, but questionable credibility

Numerous public and private labels have been developed for investment products. The IPCC states that, **although the labelling process does not necessarily lead to additional funding, it does have the merit of encouraging issuing institutions to incorporate these issues into their thinking**. This could encourage the identification of new green projects[261]. In 2022, there were four "green" labels and five "ESG" labels at European level, with varying levels of requirements[262]. The most widely used labels are the French Investissement Socialement Responsable (ISR) label and the Belgian Towards Sustainability label, each of which has more than 300 labelled funds and 100 billion in assets under management each[263].

The Inspectorate General of Finance (IGF) has stated the need for a radical overhaul of the government's SRI label, at the risk of exposing itself to an "inescapable loss of credibility and relevance". According to the IGF, "the ISR label makes a confusing promise to investors. It claims to have a social and environmental impact, but its requirements, based on the ESG ratings

253 Bacos and Verniest, « Les sustainability-linked bonds, un outil efficace de décarbonation ? »

254 The ECB has narrowed the scope of indicators applicable for GLA to be eligible for its collateral policy and asset purchase programmes, by requiring reference to at least one of the SDGs relating to climate change, or environmental degradation, or at least one of the environmental objectives defined by the European taxonomy for sustainable activities.

255 Orden and Calonje, « Sustainability-Linked Finance-Mobilizing Capital for Sustainability in Emerging Markets. »

256 Ul Haq and Doumbia, « Structural Loopholes in Sustainability-Linked Bonds ».

257 Lefournier and Grandjean, *L'illusion de la finance verte*.

258 Either because the issuer has defined a low penalty should the objective not be reached, or set a penalty deadline close to the expiration date of the bond, or because they have reimbursed the SLD before its expiration.

259 Banks organise the issuance of SLB e.g. by advising the issuer on the pricing of the bond and organizing potential investor meetings to promote it.

260 Lefournier and Grandjean, *L'illusion de la finance verte*.

261 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

262 Novethic, « Panorama des labels européens de finance durable - L'influence de la réglementation européenne ».

263 Ansidei and Leandri, *La finance verte*.

of issuers, cannot guarantee that funding will actually be channelled towards activities associated with a sustainable economic model ". In particular, the IGF suggests adding normative and sectoral exclusions in the label's terms of reference[264].

A review of the ISR label, called for by the IGF, is currently underway. The first recommended exclusions in the energy sector concern coal, shale oil and shale gas. Nevertheless, there are no plans to exclude companies that continue to develop projects that are "strictly incompatible with French and international climate objectives, in addition to generating significant social, human and environmental impacts", as Reclaim Finance points out[265]. Michèle Pappalardo, Chairwoman of the ISR labelling committee, has indicated that the forthcoming changes "will not have a major impact on the stock of funds already labelled". This gives rise to fears that the revision will be a cosmetic one, falling short of expectations[266].

4. ESG ratings come in for a lot of criticism

An ESG rating is a score assigned to an entity, usually a company, by a rating agency, on the basis of an evaluation system specific to that agency. This score is supposed to reflect the entity's performance in the environmental, social and governance fields. First introduced in the 1980s, ESG ratings have become the basis for most types of sustainable investment. It is used by investors, regulators and other stakeholders to quickly assess the sustainability and social responsibility of companies. At the end of 2021, the value of assets incorporating ESG criteria is estimated at nearly 40 trillion dollars worldwide[267].

Companies have a great deal of freedom when it comes to deciding whether or not to disclose ESG information, as well as the type of information to disclose. In fact, there are several competing standards for ESG information disclosure. These standards have been developed by different organisations (*Global Reporting Initiative, Sustainability Accounting Standards Board*, etc.) and can be applied on a voluntary basis. In addition, some of these standards are only valid in a specific country or region. Finally, the information is not systematically checked by a third party. The disclosure of ESG information allows opportunistic behaviour by companies wishing to appear more virtuous than they actually are.

By aggregating very different dimensions (environmental, social and governance), ESG ratings blur the information on ecological issues. Depending on the methodologies used by the rating agencies, the environmental score (the E dimension of the ESG score) may be poorly correlated with the overall ESG rating[268]. A company can have a good ESG score, without actually being environmentally friendly. The ESG score is not always a good proxy for environmental performance.

Rating agencies' analysis of ESG information is opaque. The ESG rating agencies use proprietary methodologies, the specific details of which are kept secret for reasons of competition and intellectual property. **As a result, the scores assigned by the rating agencies are only weakly to moderately correlated and difficult to interpret.** The correlation between ESG scores can vary between 0.38 and 0.71[269] with 1.00 representing a perfect correlation and -1.00

[264] Inspection Générale des Finances, « Bilan et perspective du label “investissement socialement responsable” (ISR) ».

[265] Institut Rousseau, Les Amis de la Terre France, et Reclaim Finance, « Actifs fossiles, les nouveaux subprimes ? Quand financer la crise climatique peut mener à la crise financière ».

[266] Institut Rousseau, Les Amis de la Terre France, et Reclaim Finance.

[267] « ESG assets may hit $53 trillion by 2025, a third of global AUM ».

[268] « OECD Business and Finance Outlook 2020 : Sustainable and Resilient Finance ».

[269] Berg, Kölbel, and Rigobon, « Aggregate Confusion: The Divergence of ESG Ratings ».

a perfect negative correlation. In comparison, the three largest credit rating agencies have a correlation ranging between 0.94 and 0.96 for their debt ratings. **This poor correlation is compounded by a lack of consistency in results from one agency to another, and even within the same agency, which makes it difficult to use those scores**. For example, with regard to a company's environmental score (the score obtained on dimension E of the ESG rating), the relationship between this score and the company's GHG emissions varies widely within the same rating agency and between rating agencies[270]. In some cases, a good environmental score is positively correlated with high GHG emissions. **Variations in the calculation methodologies used by the different agencies, as well as the presence of cognitive biases, may explain these differences[271] in at least four areas:**

- the agencies do not assess the same ESG characteristics of the company;
- they do not use the same indicators to measure the same ESG characteristics;
- they do not weight the ESG characteristics measured in the same way;
- and their measurement is influenced by the assessor's overall perception of the company.

ESG ratings fail to provide a forward-looking view of the environmental trajectory of companies[272]. For example, they attempt to give an indication of forward-looking development of companies by measuring in binary terms the presence of transition plans and objectives, but without taking into consideration the quality of these plans, their consistency with the objectives of 1.5°C or 2°C global warming, and without verifying their actual implementation.

The extent to which ESG analyses are taken into account in financial analysis is also problematic. This is because the information provided by the rating agencies is then restated "by buy-side and sell-side analysts, belonging respectively to the management companies of financial institutions or to independent brokerage firms". In short, the non-financial rating agency provides non-financial information. This rating is then combined with the financial information in the overall financial rating. The question then is how much weight this extra-financial rating should have in the overall financial rating. This new treatment of information raises questions as to the extent to which ESG issues are actually integrated into the overall financial analysis[273].

The use of ESG criteria introduces selection bias. On the one hand, it favours the largest companies which have the means to define and communicate transition strategies[274] and, on the other, it tends to "penalise countries characterised by a low level of democracy, transparency, human rights and ethical standards, where these criteria are difficult to apply[275] ». However, these are companies and countries that are already experiencing difficulties in accessing finance, and which often also have major needs in terms of adaptation to climate change.

Lastly, there has been a shift from the initial objective of ESG, which is to "bring financial management back to the fundamentals of the real economy[276] » in an ethical manner, towards a "financialisation of ESG analysis[277] », favouring profitability. In fact, to analyse meaningfully the environmental, social and governance issues, it is logical to take a qualitative approach. Such an approach is expensive to implement. In addition, this type of analysis does not allow the production of standardised quantitative data, that could be integrated into the

[270] « OECD Business and Finance Outlook 2020 : Sustainable and Resilient Finance ».

[271] Berg, Kölbel, and Rigobon, « Aggregate Confusion: The Divergence of ESG Ratings ».

[272] « OECD Business and Finance Outlook 2020 : Sustainable and Resilient Finance ».

[273] Revelli, « La place de l'investissement socialement responsable (ISR) dans le champ de la finance durable ».

[274] « OECD Business and Finance Outlook 2020 : Sustainable and Resilient Finance ».

[275] Ameli et al., « Higher cost of finance exacerbates a climate investment trap in developing economies ».

[276] Husson-Traoré, « La notation ESG s'est financiarisée au risque de se perdre, analyse Michelle van Weeren dans sa thèse ».

[277] *Ibidem.*

"mathematical models on which rest the artificial intelligence systems used by asset managers[278] ». As far as ESG is concerned, competitiveness has focused on the volume of companies covered by the ESG rating, rather than the quality of the analysis and its relevance". These qualitative analyses were then abandoned in favour of the development of a new market, which has led to an "ever-increasing concentration market and an almost total domination by American players[279] » moving away from the dual-material approach. **Ultimately, "the company's real environmental and social impacts are not really assessed**[280].

As the OECD points out, in the light of all these criticisms, ESG ratings are not a reliable tool for managing climate risks or for integrating climate change issues into the financial system[281]**.**

5. Financial reporting is not action

Some of the voluntary initiatives and regulations described above are aimed at financial information and transparency. They are based on a postulate of market efficiency[282] which, as a result of financial transparency regarding the climate footprint, biodiversity etc., of their assets, would be self-regulating thanks to the internal discipline of the markets.

IPCC experts believe that regulations on transparency requirements could act as a signal[283]. **However, these initiatives would have a limited impact on greenhouse gas emissions and would not be sufficient on their own to respond to the climate emergency**. Indeed, the IPCC states that "transparency about climate risks is unlikely to change investors' decisions or lead to disinvestment, particularly in emerging economies, because **the support and clear direction of regulatory and policy mechanisms are needed to incentivise institutional investors in the broadest sense**[284] »

These regulations and voluntary initiatives focusing on reporting do not currently pose constraints to guide financial flows in favour of the ecological transition, nor do they prohibit certain carbon-based investments, for example. Furthermore, these data (whether required by regulation or disclosed voluntarily) are not really usable or mutually opposable to each other. Indeed, IPCC stated that "the quality of the information is mediocre, comparisons are rendered difficult by the heterogeneity of formats, metrics and the absence of common scenarios: the financial implications are often not disclosed (which is the last straw in finance)[285] ».

Initiatives by private financial players relating to reporting or best practices remain voluntary. The frameworks come from the very players who are concerned by the principles and recommendations. **Those same players who define the frameworks will be the ones who have to apply them, which puts them in a position of judge and jury**.

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278 *Ibidem.*

279 *Ibidem.*

280 *Ibidem.*

281 « ESG Investing and Climate Transition : Market Practices, Issues and Policy Considerations ».

282 The concept of efficient markets cannot be proved to be true or false: it is a hypothesis that is not scientific in Popper's sense. The efficient market hypothesis states that in a market where all relevant information is available to market participants, the market price of a traded security is equal to its "fundamental value". See Chenet, "Climate Change and Financial Risk".

283 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

284 Intergovernmental Panel on Climate Change (IPCC).

285 Lefournier and Grandjean, *L'illusion de la finance verte*.

Furthermore, **the lack of robust metrics for assessing financial and climate risks may justify a wait-and-see attitude**, particularly from central banks. In a prudential context, for example, this can be seen in the sequential approach, which aims to accurately quantify the climate risk in terms of financial losses before any implementation of a macroprudential climate policy[286]. Thus, "the [*Network of Central Banks and Supervisors for Greening the Financial System*] agrees with calls for 'urgent action' on climate change, while asking to give central banks ... so that the lack of reliable quantitative information ultimately appears as a kind of justification for a wait-and-see attitude[287] ».

C. Companies face an increasing risk of being held responsible

1. Customer preferences must be better taken into account

76 % of the French consider that the impact of investments on the environment is an important topic[288]. Nevertheless, investors still prioritise investment security, profitability, and availability above environmental concerns. 67 % of the French consider that financial institutions should take into account sustainable development stakes in their economic activities, be it investing or insuring[289].

Many researches in finance confirm that people investing in sustainable investments, and specifically impact funds, accept to receive a lesser return if it complies with their extra-financial preferences[290,291,292].

It strengthens the responsibility of the firms from the financial sector to start a proactive process of teaching and promoting with their customers.

In such a context, financial advisors must understand what are sustainable financial products to present and recommend them to their customers. An investigation of 2 *Degrees Investing Initiative* noted the « lack of competence of a significant part of financial advisors concerning sustainable financial products ». This underlines the necessity to develop skills in the sustainable finance stakes[293].

This need is supported by the modifications of the directive markets in financial instruments (MFI) and the directive on insurance distribution (DID) introduced by the European Commission to integrate customers' preferences in terms of « sustainability »[294]. One objective is to mobilise savings in favour of the ecological transformation of the economy.

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286 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité ».

287 Kalinowski and Chenet, cités dans Scialom.

288 Opinion Way for AMF (the French financial market authority), « Les français et les placements responsables » (« The French and sustainable investments »).

289 Opinion Way pour for AMF.

290 Barber, Brad, Morse, Adair, and Yasuda, Ayako, « Impact Investing ».

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294 Find out more on « Vos préférences en matière de développement durable » (« Your preferences concerning sustainable development »).

2. The liability risk, finance in the dock

After the physical and transition risk, a third category threatens finance, the liability risk. It can be defined as all the « damages and interests a legal entity must pay should it be judged responsible for global warming »[295]. This concept of responsibility can also be extended to biodiversity loss and reaching other planet limits.

The French Prudential Supervision and Resolution Authority ("Autorité de contrôle prudentiel et de resolution", ACPR) and the Bank of France issued a joint memo noting that this liability risk is "not yet well analyzed by French banking institutions and insurance bodies", even if court proceedings are rising. According to a study, 1 328 climate litigations were counted in a year, between May 2018 and May 2019, of which ¾ are located in the United States and 6 in France[296]. These cases were not only against the states (Urgenda, The Case of the Century, etc.) but also against private stakeholders. For example, in 2021 in the United States, in the case *Conservation Law Foundation v. Shell Oil Product* US*,* the oil company Shell was accused of not considering climate in its investment decisions. In another case in Australia in 2018, a beneficiary accused a pension fund of not having given him enough information about the climate risk, preventing him from forming an informed opinion on how they manage the money (*Mark McVeigh v. Australian Retail Employees Superannuation Trust (REST))*[297]*.*

Financial operators can be exposed to the liability risk directly if they are judged responsible for contributing to the climate change consequences. They can also be exposed indirectly « to the counterparty risk, the market risk and the reputational risk if the institution is exposed through other companies judged responsible. »[298]

3. Companies are held responsible by civil society

Among the liability risks, the reputational risks refer to the customers' and investors' preferences evolution linked to ecological issues and the spreading of a poor reputation of a company or a sector.[299]

Even before regulatory changes or the generalisation of new habits of consumption, companies can be judged for their practices concerning climate, biodiversity, and other planet limits. **The reputational risk may take the form of a consumer boycott, a stock market collapse, a blockade of activity, etc.**[300]

Some associations, such as Finance Watch or Reclaim Finance, hold financial operators accountable for their commitment or lack of commitment to ecological issues. For example, in 2017, numerous environmental non-governmental organisations (NGOs) rallied to oppose the Dakota Access Pipeline project. This pipeline, which was supposed to go through Native American lands, raised questions on climate issues and human rights. Activists organised

295 « Le changement climatique : quels risques pour les banques et les assurances ? » (« Climate change : what are the risks that banks and insurance companies face? »).

296 Setzer and Byrnes, « Global trends in climate change litigation: 2019 Snapshot ».

297 Finance for Tomorrow, « Le risque climatique en finance » (« Climate risk in finance »).

298 « Le changement climatique : quels risques pour les banques et les assurances ? » (« Climate change : what are the risks that banks and insurance companies face? »).

299 Finance for Tomorrow, « Le risque climatique en finance » (« Climate risk in finance »).

300 AFD - Agence Française de Développement (French Development Agency) « 3 risques que l'effondrement de la biodiversité fait peser sur la finance » (« 3 biodiversity loss risks weighing on finance ») .

blocking actions, pointing out French investors' responsibility[301]. These investments were withdrawn faced with the increase of media coverage and activists' pressure. Three French NGOs have recently given formal notice to the first European bank arguing that it did not conform to its duty of care nor to its obligation to limit the climate risks linked to its activities. These organisations require halting all financial support to companies scheduling new oil and gas projects, as well as the adoption of an exit plan from this sector and measures of GHG emissions reduction in all domains. Should it refuse, the NGOs have announced they would sue the bank[302].

In such a context, investors, emitters, and intermediaries fear for their reputations. Some operators that were interviewed justify they do not offer « green » products for fear of being accused of greenwashing. This reputational risk gives additional control over greenwashing practices[303].

III. Financial professionals have to be prepared for an uncertain future

Students graduating in the coming years will end their careers in the 2060's. During their forty-year career path, finance will evolve throughout crises and disruptions caused by the reaching of physical limits. **The reflection on knowledge and skills to be taught has to integrate a prospective dimension to help programme directors and teachers better prepare their students by projecting themselves into an uncertain future. It consists in trying to anticipate the various potential evolutions of finance impacted by the crises created by ecological emergencies.**

Twelve potential evolutions have been considered. These evolutions were inspired by the publications and interviews made with finance experts. They do not intend to be comprehensive and are not exclusive. **These possible evolutions do not reflect the Shift Project's opinion, and the theories evoked are not endorsed by the Shift Project**. For the sake of clarity, these evolutions are classified into two categories:

- evolutions based on strengthening finance regulation,
- evolutions based on questioning the fundamental principles of economy and finance.

A. Strengthen regulation so that finance may do its share

Regulation can be an important lever to monitor financial activities and redirect flows according to climate and biodiversity commitments.

Even if the trend of recent financial history has been towards more deregulation, various regulatory evolutions may happen in the next few years or decades to bring answers in the context of crises resulting from ecological upheaval. The proposals here below aim at projecting ourselves in a very uncertain future, to think about the competencies and knowledge that students must acquire now to answer to tomorrow's challenge.

[301] Cuny, « Le climat s'invite aux assemblées d'actionnaires de BNP et Société Générale » (« Climate barge in the BNP and Société Générale shareholders meetings »).

[302] Alvarez, « Devoir de vigilance » (« Duty of care »).

[303] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

1. Evolution number 1: Develop a « brown » taxonomy

Economic European institutions could develop a « brown » taxonomy just like they did for a « green » taxonomy. **This « brown » taxonomy would create a common definition of economic activities considered harmful for the environment**, to redirect financial flows away from activities jeopardising planet limits[304].

This brown taxonomy would establish a common European standard to deter or forbid investments in some business sectors. In this context, operators of the economy would have to anticipate, and identify the said sectors, or adapt to these evolutions.

2. Evolution number 2: Change Basel III prudential standards

Basel III prudential standards could be reviewed to explicitly integrate climate risk as a complementary dimension of systemic risk. In terms of quantifying climate systemic risks, **this would open the door to a combination of quantitative and qualitative constraints applied to banks' portfolios and equity, so that they limit the accumulation of climate risks**[305].

3. Evolution number 3: Set up a management policy for stranded carbon assets

A bad bank could be developed at the ECB level to manage stranded carbon assets, that is to say, their closing, – under conditions[306] **– and redirect the flows towards sustainable activities.**

Competencies and knowledge will be necessary to manage these assets within the bad banks[307], and to conform to the regulatory conditions and redirect the flows, within private banks.

4. Evolution number 4: Generalise methods allowing to take into account ecological impacts

An accountability method taking into account the socio-ecological impacts of economic activity (like ecological accountability or the triple equity accountability) could be generalised, under the influence of regulatory and normative evolutions. This could help valuing resources and even provide new means of rewarding investments.

For example, it would be necessary to be able to mobilise suitable resources to set up a system of ecological accountability in an organisation, based on the knowledge of various developing models[308].

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304 Institut Rousseau, « Intégration des enjeux climatiques dans la politique monétaire de la Banque centrale européenne » (« Integration of climate stakes in the European Central Bank monetary policy »).

305 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

306 A serie of conditions were proposed in return for managing the closing of assets in the memo of Institut Rousseau, Les Amis de la Terre France, and Reclaim Finance, « Actifs fossiles, les nouveaux subprimes ? Quand financer la crise climatique peut mener à la crise financière » (« Fossil assets, the new subprimes? When financing climate crisis can lead to financial crisis »).

307 A bad bank allows recovering closed or closing assets.

308 For example, the CARE (Comprehensive Accounting in Respect of Ecology) model, the LIFTS (Limits and Foundations Towards Sustainability) model, the SeMA (Sense-Making Accountability) model etc.

5. Evolution number 5: Take into account ecological issues in the fiduciary duty

The current fiduciary duty compels the investors to take into account all risk factors. Complying with this duty could evolve towards the obligation to take into account the physical, transition, and responsibility climate risks. This could help the asset manager in prioritising ecological issues over short-term return investments.

6. Evolution number 6: Integrate climate and biodiversity risks at the core of banks and insurance practices

Regulation could impose on banks and insurance to integrate the foreseeable consequences of climate change (coastal erosion, sea level rise) and to prevent biodiversity loss (soil artificialization, population decrease of specific species) in their activity or project financing practices (in particular via interest rates) or their insurance fees. For example, granting credit for the purchase of a new house located in an area threatened by the sea level rise in 2050 would become difficult, if not impossible; ensuring such a purchase would also become more expensive.

Commercial banks could be obliged by regulation to require an ecological risk report on projects and activities before granting business credit.

A financial regulation in line with ecological emergency could also strictly regulate financial support to fossil fuels; integrate systemic risks; demand from banks a high level of equity which would reflect the risks borne by supporting fossil fuels; protect investors from climate risks, etc[309].

To avoid the emergence of uninsurable "pouches" and to ensure that everybody can be insured, new insurance practices could be developed.

In particular, the GIEC mentions that climate-risk pooling could be done at the state and regional levels. This practice is considered as being suboptimal because it conflicts with insurance schemes or would have a limited scope of application. **Parametric approaches are also being developed; but they do not exclude resorting to conventional compensation,** because the latter covers all the damages after an event linked to climate change[310].

7. Evolution number 7: Steer individuals' savings toward transition

The French State could embark upon a reform of savings to channel them massively toward the energy and ecology transition. For instance, part of the 1,200 billion euros of individual life insurance could be redirected through a new contract, supported by a state label. This contract would be illiquid for ten years, revitalising patient investment. It would be a lump sum payment, and it would offer the possibility to transfer money from other contracts without losing tax concessions while taking advantage of 100% state-guaranteed capital.

309 Institut Rousseau, Les Amis de la Terre France, and Reclaim Finance, « Actifs fossiles, les nouveaux subprimes ? Quand financer la crise climatique peut mener à la crise financière » (*« Fossil assets, the new subprimes? When funding climatic crisis can lead to financial crisis.»)*

310 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

This proposal comes from the IN GLOBO[311] project of the Shift Project, and other similar proposals were articulated in 2021, in particular by the Rexecode Institute. Such redirecting of savings would require evolutions at the banks and insurance companies level, and in particular training their customer advisors on the energy and ecology transition stakes.

New or reinforced regulations can help evolutions in favour of transition and validate the application of the new practices, ensuring consistency with planet limits. Some fundamental concepts that are currently the founding principles of economy and finance could evolve with ecology stakes, given that these principles are not immutable.

B. Economy and finance founding principles are not immutable

The disruptions which will happen in the years to come will inevitably shake the economic and financial system. These jolts will be so tremendous that they could question aspects of its functioning, which are today deeply rooted, to face the situation.

1. Evolution number 8: Fund the ecological transition through public financing and guarantee

Context and challenges

As explained above, the investments needed to change our economies and make them compatible with the Earth system limits are substantial. Let's not forget that making only the French energy transition means over-investing 2,5% of the GDP every year to reach carbon neutrality in 2050[312]. **Private stakeholders will not fund all the investments needed, in particular, if they are not profitable. In such a situation, mobilising the public budget is crucial.** Many transition investments are public investments (public transportation, energy retrofit of public buildings, maintenance and restoration of public natural resources, etc.).

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David Graeber, « Debt: The First 5,000 Years »

Institut Veblen, programmes « Monnaie et finance dans la transition écologique ». *(« Money and finance in ecological transition » programme)*

Debt and credit are human conventions that have existed for a long time and define economic exchanges. Nevertheless, these concepts as we know them today are not immutable. For example, interest-bearing loans were prohibited for a long time, and debts were regularly cancelled[313]. In this context, it is not unlikely that the debt concept or the focus on reducing public debt may evolve.

A recent France Stratégie report states that « European treaties suppose a path to debt reduction incompatible with the emergency of climate investments », which can be perceived as a move toward this evolution. Injection of public funding « whatever the cost » at the

311 Lepetit, « Rediriger l'épargne privée en faveur du climat : une solution porteuse d'espoir » ("Redirecting savings for the climate : a solution that brings hope") .

312 Pisani-Ferry and Mahfouz, « L'action climatique : un enjeu macroéconomique » (« Climate action : a macroeconomic challenge »)

313 Graeber, *Debt: The First 5,000 Years*.

beginning of the COVID crisis, or even previously during the 2008 crisis, has « shed light on the importance of public debt as an amortisation tool and short-term funding of the economy[314] ». According to this report, current budget governance of debt and public finances is one of « the only obstacles against using public debt as a climate investment lever ». Resorting to public debt appears like an « unavoidable financing tool » in a situation where the taxable amount is eroding, which reduces the States' capacity to fund public spending, without making the households bear more taxes. Therefore, France Stratégie suggests that **transition investment could only be borne by public debt if we revise budget rules and define a transition phase**. Some economists state that « the stability and growth pact is dead. Suspended thanks to COVID-19, it has been scorned and made ineffective for years. » They call for « a new set of simple and understandable principles that can help lead a countercyclical policy every time it is necessary and that ensure that the public investment crucial for climate transition is made[315] ».

Various options are possible

Evolution number 8.1: Coordinate the action of central banks and public investment banks

Central banks could coordinate their actions with those of the public sector investment banks (for instance in France the Banque publique d'investissement – BPI): the public investment bank would issue very long term « project bonds » with very low to zero rates, dedicated to funding the economies ecological conversion. Central banks would buy these bonds as soon as they are issued on the primary market, which would give liquidity to the public investment bank to fund the ecological transformation of the economy. This plan abides with the central banks' independence principle as well as the monetary financing prohibition of States[316].

Evolution number 8.2: Public debt monetisation

Public debt monetisation is a less conventional solution; the central bank credits the public purse account and capitalises a non-refundable debt. Governments could then define the use of the amounts allocated, and assign them to funding « green » projects or to support the stranding of « brown » sectors. This option can help support spending without increasing the outstanding debt, unlike quantitative easing (QE)[317, 318].

Evolution number 8.3: Cancel part of public debt

The question of cancelling part of public debt is a controversial topic on which economists have diversified positions. Some of them consider that the ECB **could cancel part of the public debt it holds in return for investments in ecological transition**. This is conceivable as central banks are neither subject to the solvency risk nor the solvency constraint, they cannot go bankrupt and have no objective to do benefits. But inflation can limit the feasibility of such debt cancelling policy[319].

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314 France Stratégie, « Soutenabilités ! Orchestrer et planifier l'action publique ». (« Manage and plan public action for a sustainable world »)

315 Monnet and Vallée, « Dette publique ». (« Public debt »)

316 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

317 Quantitative easing refers to the repurchasing of assets by a central bank. This way, the central bank provides liquidity to the financial circuit; it is an unconventional monetary instrument.

318 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

319 Scialom.

2. Evolution number 9: Central banks commit to observing planetary boundaries

Mobilising public debt as a climate investment lever will raise a debate on the Central Bank's role and responsibility[320].

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Laurence Scialom « Les banques centrales au défi de la transition écologique » (« Central banks facing the challenge of ecological transition »)

Context and stakes

Central banks' operation principles are also evolving over time. Thus, « central banks practices and their scope have been malleable over time, always adapting to the macroeconomic, institutional and political context »[321].

Central banks are detached from the profit maximisation logic, and represent the « greater interests of the payment community where the currency they issue circulate[322] ». Historically, they have pursued four principal objectives, of varying importance depending on the era:

- Unite and preserve the payment system;
- Ensure financial stability (through credit or the market maker as a last resort, or through prudential regulation);
- Maintain currency stability and its value (through an exchange rate objective or an inflation rate objective);
- Support the states financial needs during crisis[323].

During the 1940s, the public central bank model became widely used. In France, funding was directed, and resources were allocated to some high-priority sectors defined by the National Credit Authority[324]. In the 1980s, a large number of central banks became independent, focusing almost exclusively on the currency stability objective[325]. The prohibition of direct funding of states shows the functional separation between States and central banks[326]. Created in 1998, the European Central Bank (ECB) is independent and structures the Eurosystem[327]. Its main objective is to maintain price stability, that is preserving the Euro value[328]. **The secondary objective of ECB is to support general economy policies of the EU, in particular the economic ecological transition[329].**

Some researchers have been wondering whether we are at the beginning of a new consensus on central banking and its constituents. **A new dynamic seems to have emerged since 2007, marked by an awareness of the « financial climate risks and the necessity for finance to**

320 France Stratégie, « Soutenabilités ! Orchestrer et planifier l'action publique » ("Manage and plan public action for a sustainable world").

321 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité »(« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

322 *Ibidem*

323 *Ibidem*

324 This council consisted of ministries, employers and union representatives from different sectors.

325 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

326 The Other Economy, « La monnaie » (« Currency »).

327 The Eurosystem is made of the ECB and the national central banks of the eurozone.

328 European Central Bank, « ECB Mission ».

329 European Central Bank, « ECB Takes Further Steps to Incorporate Climate Change into Its Monetary Policy Operations ».

go green[330] **».** In such a context, it is possible to imagine various evolutions of national central banks and the ECB.

Possible variations to be considered

Evolution 9.1: Integrate the double materiality principle to central banks doctrine

Central banks could incorporate in their doctrine the double materiality principle, that is **taking into account not only the economic and financial consequences of climate change, biodiversity erosion and resources depletion (simple materiality), but also the impact of economic and financial choices on planet limits (double materiality).**

Central banks would then adopt a dynamic position, legitimated by « a generalised precautionary principle » incorporating the effects of irreversible damages caused to the climate system as well as to the economic and financial spheres[331].

Evolution number 9.2: The ECB reconsiders the neutrality of its currency policy

The ECB could « go green » on its currency policy and reconsider the market neutrality principle. This neutrality principle means that it refuses to favour one sector over another in case of share repurchases on the market, even if one sector is very carbon-emitting. As a matter of fact, it « duplicates the carbon biases of the financial market » which underestimates the financial climate risks[332]. Some observers have emphasised that ECB's unconventional currency policy favours carbon-emitting sectors, at the expense of climate stakes[333].

For example, the ECB could consider reviewing its collateral policy according to green criteria: it would refuse assets that are not low carbon as a guarantee for the loans it grants to commercial banks. If this access to liquidity criteria is very detrimental for carbon-emitting assets, this could bring a « precocious realisation of the transition risk while helping reallocate financial flows[334] ».

The ECB could redirect its quantitative easing to « green assets »: either through purchasing bonds issued by companies from non-polluting sectors, twisting its balance sheet structure in favour of green sectors, or purchasing bonds funding « green capital », with a lower energy and material consumption, and a higher recycling rate, which favours a low carbon-emitting economy[335].

During the summer of 2022, this market neutrality principle was undermined by the ECB which recognized the necessity to take into account climate change in its currency policy operations[336]. For instance, the ECB announced it would revise partly collateral measures according to green criteria[337].

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330 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité »(« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

331 Scialom.

332 Scialom.

333 Papoutsi, Piazzesi, et Schneider, « How unconventional is green monetary policy? »

334 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

335 Scialom.

336 Institut Rousseau, « Intégration des enjeux climatiques dans la politique monétaire de la Banque centrale européenne » (« Integration of climate change stakes in the currency policy of the European Central Bank »).

337 Various measures have been announced and in particular « The Eurosystem will limit the share of assets issued by entities with a high carbon footprint that can be pledged as collateral by individual counterparties when borrowing from the Eurosystem. », « ECB Takes Further Steps to Incorporate Climate Change into Its Monetary Policy Operations ».

Evolution number 9.3: The ECB develops a macro and micro prudential climate policy consistent with the stakes

The ECB is currently adapting its macro prudential tools sequentially: firstly, it develops robust metrics to evaluate financial climate risks, secondly, it adopts a macro precautionary framework incorporating climate risk. Although understanding before enacting standards is a rational approach, seeking more sophisticated models to measure more accurately financial losses may justify inaction. Some researchers consider that: « The NGFS calls for « urgent action » against climate change while asking for more reflection time for central banks... So, the lack of reliable quantitative information becomes a reason to wait and see[338]. » If financial climate risks knowledge can always be perfected, the cost of inaction will be an increase of climate damages[339].

An alternate approach would be to deploy a « **macro precautionary climate policy in parallel and simultaneously to building the knowledge on the nature and dynamics of financial climate risks**[340]. » This new approach could help recognize the epistemic uncertainty and align with the scientific consensus on climate change importance.

From a micro prudential point of view, several measures linked to climate issues could be taken. They relate to **adjusting the risk profile according to risk evaluation or climate impact of the funded project.**

The green supporting factor consists of reducing capital requirements for banks funding low-carbon projects, something one can achieve by reducing the risk weighting in the capital ratio computation. This solution may deteriorate the bank's financial robustness by increasing leverage at the expense of capital[341]. Moreover, a study considers that the green supporting factor effects, even if it is set at a high level, would be « too weak to trigger new projects on all the transition sectors »[342].

Its corollary, the brown penalising factor, could increase the capital requirements to fund activities harmful to climate: this capital increase would encourage reallocating finance flows. Higher capital requirements would be imposed as bankruptcy risk increases, which would strengthen banks' resilience[343]. According to a study, a penalising factor « should both be strong and apply to a small perimeter to expedite the exit plan of certain fossil fuel energies as well as limit the effects of the contraction of all the credits »[344].

Some instruments that redirect funding toward sectors that are a priority for the ecological transition could be used, such as minimum and maximum limits for credit or credit redirecting[345]. Banks could be obliged to integrate a mandatory transition banking plan to Pillar 2, in the frame of prudential regulation[346].

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338 Kalinowski and Chenet quoted in Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

339 *Ibidem.*

340 *Ibidem.*

341 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

342 I4CE, « Indexing capitall requirements on climate ».

343 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

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345 Scialom, « Les banques centrales au défi de la transition écologique - éloge de la plasticité » (« Central banks facing the challenge of ecological transition - eulogy of plasticity »).

346 Evain, « Include madatory banking transition plans with Pillar 2 »

3. Evolution number 10: Liquidity injection in the economy

Context and stakes

Like the debt concept or the central bank system, the currency institutional framework is not immutable. « Currency is based on the trust of those using it[347] ». Society is willing to accept a currency because public authorities guarantee its legal tender among other things. Each monetary system is also the product of the History and the distinctiveness of its country or monetary zone[348].

Resources

The Other Economy « La monnaie » (« Currency »)

Alain Grandjean, Nicolas Dufrêne, « Pour une monnaie écologique »(« For an ecological currency »)

Institut Veblen, « La transition monétaire au service du bien commun » (« The monetary transition to serve the common good »)

How money is issued in the European Union

The central bank is the « bank of all banks ». Each secondary bank has an account at the central bank which is fed in central currency. This scriptural central currency is created by the central bank to meet the liquidity needs of secondary banks. This currency does not circulate in the economy, it is only used for exchanges between banks, or between banks and the central bank. The central bank also has the monopoly of issuing banknotes that it provides to secondary banks, that is, the banknotes circulating in the economy. The quantity of money created in the economy depends on the monetary policy of the central bank. However, the secondary banks are those creating currency circulating in the economy[349] through the credits they grant[350].

Currency issuance structures the economic activity. As of now, central banks do not play any role in allocating money and play an indirect role in its volume[351].

Currency is issued as a counterpart when an economic public or private player is in debt, it is a debt currency.

- In this way, indebtedness increases as currency is issued, and the operator in debt owes interests.
- Yet, operators' indebtedness raises an important macroeconomic issue since it leads to a lack of investment as the operators seek above all to reduce their debt.
- This debt currency has an amplifying effect and does not regulate cycles: depending on the economic situation, money can be scarce or issued in excess[352].

[347] The Other Economy, « La monnaie » (« Currency »).

[348] The Other Economy.

[349] The central bank has the monopoly of issuing banknotes, but this banknote « manufacturing » is the consequence of money creation by the secondary banks. To learn more, refer to The Other Economy.

[350] The Other Economy.

[351] The Other Economy.

[352] The Other Economy.

Other mechanisms exist, other than debt currency, such as free currency (from all debt)[353].

- Free currency means a currency whose offset in the balance sheet of the bank that has created it is not a debt.
- Free currency does not create debt, it is free and can be used to relaunch economic activity in periods of recession. It can also replace progressively debt currency to reduce the debt of the economy[354].

This concept is not new: before using financial markets to finance itself, public authorities received free currency created by the central bank in the form of non-refundable or defaulted advances. **When the central banks became independent, the state deprived itself of the possibility to issue coins by transferring them to the private banks[355]**. Some consider that the « right to issue coins for free has been replaced by the obligation to be indebted and pay the interests of such debt »[356]. For others, this sovereign power has been excluded from the state perimeter so that political instability does not turn into monetary instability. Others claim that if the state can issue coins, including for itself, it will bring inflation if not hyperinflation.

« Central bank currency is the only debt-free currency » since « it is a public debt from the nation to itself, not a private debt to private organisations. » . Thus, central banks' equity can be negative without it going bankrupt. Eurosystem equity represents a very small share of its total balance sheet (3% at the end of 2015), therefore, it would matter little if those funds became negative[357]. And although the Treaty on the Functioning of the European Union forbids the ECB and the central banks to grant credit to public authorities, it does not forbid donation[358].

Some economists underline that the resort to free currency may lead to a crisis of confidence in currency, and therefore to currency crises. This could destabilise the whole economy and also the transition financing. The resort to such a mechanism is controversial.

Possible variations to be considered

Evolution 10.1: The Central Bank repurchases bonds without requesting reimbursement

This repurchase can target bonds financing the ecological transition or be subjected to financing such investments.

Evolution 10.2: Issue of « special » Treasury bonds without interests nor maturity date

It is possible to issue « special » Treasury bonds without interests nor maturity date, which would be repurchased by the central bank. These means could be allocated to the transition.

Evolution 10.3: Create a fund fed by the central bank

A special fund fed by the central bank could be created and it could be used as a guarantee for ecological transition financing.

Evolution 10.4: Give a direct endowment to citizens

353 Grandjean, « La “monnaie libre”, arme de désendettement massif » (« The “free currency”, a weapon of mass debt reduction ».

354 Grandjean.

355 Grandjean.

356 Grandjean.

357 Grandjean.

358 Grandjean.

The citizens could receive a direct endowment of currency issued by the central bank[359]. For example, this endowment could be allocated to accelerate the rhythm of thermal rehabilitation of buildings which would promote the ecological transition[360].

This cash distribution to economic operators is called helicopter money. In June 2021, the French official economic analysis council (« Conseil d'analyse économique ») has indicated in a memo that a direct cash transfer to the households could be a « new last resort tool to face a crisis » while better protecting « the monetary policy autonomy than a direct transfer to the states or a massive public debt buyout »[361].

4. Evolution number 11: The GDP halt in growth

One of the key indicators of growth is the Gross Domestic Product (GDP). It is defined as the « sum of gross value added from all institutional units[362] resident in the economy engaged in production activities[363] ». In practice, GDP provides an estimate of national production through the measurement of monetary flows. This only accounts for part of the economy as what is not monetarised – like climate or ecosystem services – is not included in national accounting. GDP is established « without deducting the depletion and damage of natural resources »[364].

Today, economic growth measured by the GDP increase is a major concern for politicians. **The indicator that used to be a measurement tool of economic flows is now the objective of economic policies.** In economic scenarios, transition scenarios, or energy or climate prospective analyses, growth emerges as an exogenous factor. It is an input rather than the result of economic activity which would be endogenous. **Therefore, there are few analyses made with an assumption of zero or declining GDP growth.**

Several works have shown that economic growth and energy consumption are historically closely correlated[365]. Yet, fossil fuels are predominant in the world energy mix, reaching around 80%. It implies a significant correlation between GDP growth, increase in resource consumption, and ecological impacts, among which are greenhouse gas emissions.

On one hand, respect for planetary boundaries implies fossil fuel withdrawal. On the other hand, fossil energy's finitude requires it. Conventional oil extraction peaked in 2008. Its production will never increase anymore, according to a statement from the International Energy Agency (IEA) in 2010. Extraction will therefore experience a decline, leading to a consumption decrease for this kind of conventional oil. **Fossil fuel withdrawal will happen, willingly or not.**

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359 Grandjean.

360 Grandjean and Dufrêne, *Une monnaie écologique* (« An ecological currency »).

361 Martin, Monnet, and Ragot, « Que peut encore faire la Banque centrale européenne ? - Les notes du conseil d'analyse économique » (« What can the European Central Bank still do? - Memo of the French official economic analysis council »).

362 That is to say on the units existing on the national territory.

363 United Nations, « System of National Accounts ».

364 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

365 If the correlation between energy and GDP is well established, their causal relations are still debated. We may refer to Ping-Yu Chen, Sheng-Tung Chen, and Chi-Chung Chen, « Energy Consumption and Economic Growth—New Evidence from Meta Analysis », *Energy Policy* 44 (mai 2012): 245-55, Panos Kalimeris, Clive Richardson, and Kostas Bithas, « A Meta-Analysis Investigation of the Direction of the Energy-GDP Causal Relationship: Implications for the Growth-Degrowth Dialogue », *Journal of Cleaner Production* 67 (mars 2014): 1-13, Anis Omri, « An International Literature Survey on Energy-Economic Growth Nexus: Evidence from Country-Specific Studies », *Renewable and Sustainable Energy Reviews* 38 (octobre 2014): 951-59, or to Giraud et Kahraman, « How Dependent Is Growth from Primary Energy? The Dependency Ratio of Energy in 33 Countries (1970-2011) ».

The question is: can GDP growth be compatible with a sustainable reduction in our exhaustible resource consumption and our ecological impacts? It is the issue of a feasible decoupling[366].

Decoupling GDP growth and resource consumption which truly respects planetary boundaries must meet several concomitant requirements. Decoupling has to be simultaneous:

- **Absolute:** GDP growth and resource consumption must evolve in opposite directions, increasing the former and reducing the latter,
- **Total:** GDP must be untied with consumption of any exhaustible resource and with any ecological damage,
- **Worldwide:** it must take place on a global scale, and not be limited to a local or regional area,
- **Sustainable:** it must take place on a long enough time frame so that one can qualify it as structural instead of circumstantial,
- **Quick:** it must take shape swiftly to prevent non-reversible ecological damages[367].

Feasible decoupling covering this whole set of requirements is highly arguable. Some forms of decoupling do exist, but their extent is insufficient to be up to the ecological challenges.

Based on these analyses, one must avoid aiming for growth at any cost, at the risk of putting climate action in jeopardy: **should there be a growth target, it has to be subordinate to climate target achievement and respect for planetary boundaries in general.**

In a world that will have withdrawn from fossil energies (willingly or not), a world experiencing shortages and various crises, GDP growth will be far from certain. In such a world, **the economic and financial system will have to adapt, learn to split capital to pay for low-carbon projects and activities, in a nutshell, do better with fewer resources.**

Economic research is studying links between economic growth and ecological challenges, which could be a useful base to stand on for integrating these challenges in economics and management education. There is a large variety in terms and approaches among economists: Tim Jackson on prosperity without growth[368], Herman Daly on steady-state economy[369], Eloi Laurent who proposes a guide to exit growth[370], extensive work on secular stagnation made up-to-date by former Secretary of the Treasury Larry Summers[371], study of energy transition impact on growth and lifestyles by Christian Gollier[372] or else Vaclav Smil's work on the very notion of growth[373].

On a larger scale, then comes the question of how relevant it is to think prosperity or progress based on an indicator limited to cash-flow increase, therefore built on money bustle. One can contemplate developing good health indicators for our societies and ecosystems instead[374]. Some indicators already exist, such as the inequality-adjusted human development

366 Ramos and Mossé, « Découplage et croissance verte » (« Decoupling and green growth »).

367 Ramos and Mossé.

368 Tim Jackson, *Prosperity without growth.*

369 Herman Daly, *Steady-state economy.*

370 Eloi Laurent, *Sortir de la croissance* (« Exiting growth »).

371 Laurence Henry Summers, « Accepting the Reality of Secular Stagnation - Point of view ».

372 Gollier, *Le climat après la fin du mois* (« Climate after the end of the month »).

373 Smil, *Growth: from microorganisms to megacities*.

374 Stiglitz, Sen, and Fitoussi, « Rapport de la Commission sur la mesure des performances économiques et du progrès social » (« Memo of the Council on the measurement of economic performances and social progress »).

index (IHDI); the World Happiness Report of the UN, which measures national happiness for every country; New Zealand and Finland added a human well-being indicator to their GDP.

Various options are possible:

Evolution 11.1: Changes in finance practices, linked with cessation of growth

The end of GDP growth is a possible evolution. Should it happen, the economic and financial system will have to adapt, learn to split capital to pay for low-carbon projects and activities, in a nutshell, do better with fewer resources.

Degrowth is an alternate transition scenario to the majority of transition scenarios for which researchers try to identify funding solutions.

Evolution 11.2: End of the focus on GDP growth target

End the focus on GDP growth target requires several adjustments. Firstly, the most relevant indicators should be thought of and developed and, to that extent, research could prove useful. Secondly, economic and financial practices should necessarily progress accordingly.

5. Evolution number 12: A fickle and inflationary global economy, with physical flows becoming less global

Globalisation is a recent process, defined by the French National Institute of Statistics and Economic Studies (« Institut national de la statistique et des études économiques », abbreviated INSEE) as « a growing interconnection on a global scale [...] due to a rise in flows of financial capital, goods and services[375] ». **Under the effect of increasing scarcity of material resources or geopolitical crises, physical flows could become less global - making world economies more volatile, affected by inflation and modifications of the exchange rate regime.**

The Russo-Ukrainian war and the COVID pandemic are good examples of public health and geopolitical crisis impacts on the world economy, including inflationary effects and market instability in Europe. **According to some observers, the rise in protectionist measures on a global scale points out an early stage of deglobalisation**[376].

Climate change will also affect volatility increase. On the one hand, extreme climate events bring about social and economic disruption, on the other hand, resources are in short supply - further fueling inflationary stress[377]. **The question as to how finance will adapt itself to these evolutions after a prolonged period of prosperity and macroeconomic stability remains open.**

Financial and economic tools are unsuitable when it comes to considering the increasing scarcity of material resources, whether they be energy, mineral, or natural[378]. It is a necessity to develop tools able to consider these systemic issues and train on how to use them.

375 INSEE, « L'essentiel sur... la mondialisation | Insee » (« Basics on…globalisation »).

376 Vanessa Gunnella and Lucia Quaglietti, « The economic implications of rising protectionism: a euro area and global perspective ».

377 Schnabel, « Monetary Policy and the Great Volatility ».

378 Bouleau, « FINANCE ET "BUSINESS AS USUAL", Flou du signal-prix, crises d'imminence constante, et préconisation de Solow » (« Finance and business as usual, vagueness of price signal, crisis constantly imminent and Solow recommendation »).

The evolutions introduced here are change options that may affect finance in the coming years, in the medium to long term. **Their goal is to stimulate reflection from educational teams on the necessary theoretical and practical tools to be developed and taught to adapt to such changes.** These evolution options are neither meant to foresee the future nor to cover all possibilities.

Faced with these many possibilities, suitable theoretical and practical tools have to be given to students so they can adapt to such changes. Consequently, as of today, they must be taught the knowledge and competence required to integrate planetary boundaries enforcement in their occupation, such as the ones suggested in the framework.

PART 3

WHAT SHOULD NEW GRADUATES IN FINANCE KNOW ON ECOLOGICAL ISSUES?

This part presents thinking frameworks and tools[379] for integrating ecological issues into management training, with a strong focus on finance training.

The question these elements aim to answer is: what must all management graduates know and be able to do to integrate ecological issues into their future work?

- **What resources? The Management knowledge and skills framework** (p.94) proposes:
  - **Knowledge and skills** to teach to all students in the fundamentals, to understand ecological issues and make the link with management;
  - **Examples** of knowledge and skills to implement the proposed framework;
  - **Resources** (courses, books, academic articles, etc.) to deepen and master fundamental elements.
  - **A focus** on the integration of ecological issues in digital technology, a subject that cuts across several disciplines (p.118);
- **For Whom?** It is primarily aimed at teachers and programme managers, but more broadly at all stakeholders in management education: school management, students, employers, institutional stakeholders, etc.

What should students majoring in Finance know and be able to do?

- **What resources? The Finance knowledge and skills framework** (p.123) proposes:
  - **Examples of knowledge and skills** to teach to all students specialising in Finance, to integrate ecological issues into their future work;
  - **Bibliographic references** to deepen and acquire the knowledge and skills mentioned.
- **For Whom?** This part aims primarily at teachers and people responsible for Finance education.

What should finance students who are aiming for careers in financing, risk analysis, regulation and compliance and asset management need to know and be able to do?

- **What resources?** The **Occupational Profiles** offer knowledge and skills in four business sectors or disciplines of finance, with knowledge and skills to go further than the financial fundamentals (Financing p.138, Risk Analysis p.148, Regulation and compliance p.155, Asset Management p.163).
- **For Whom?** This part aims primarily at teachers in those disciplines.

How to integrate core knowledge and skills into a course?

- **What resources?** Some elements on the **position of the educational system and teaching methods** adapted to the teaching of ecological issues (p.173).
- **For Whom?** This part aims primarily at teachers.

How to integrate core knowledge and skills into a programme?

- **What resources?**
  - Avenues for reflection on ways to **integrate new disciplinary fields into the teaching** and **ensure coherence within a programme** (p.176);

[379] The method for creating these different elements is available in the appendix. An Excel spreadsheet lists references and resources on the knowledge and skills of the management base. The financial base references are indicated in footnotes. All annexes and tools are accessible on the ClimatSup Business project webpage: https://theshiftproject.org/former-acteurs-economie-de-demain/.

- A proposal for an **application of the finance fundamentals in a specialised bachelor's degree in finance, a master's in corporate finance and a master's in market finance** (p.179).

- **For Whom?** This part aims primarily at people responsible for establishing and running programmes, at educational leaders as well as school managers.

I. The knowledge and skills framework: a framework for integrating ecological issues in a common core

The knowledge and skills framework formalises the knowledge and skills that must be taught to all students in business schools, starting with the basic courses taught in the core curriculum, so that they are able to take ecological issues into account in their future jobs and as citizens.

A good understanding of ecological issues is necessary to take effective and relevant decisions and actions as a professional and as a citizen. This involves acquiring knowledge related to ecological issues, defined as physical constraints and their implications for human societies. It is also necessary to develop the skills to put this knowledge into practice, to take it into account in one's decisions and actions[380].

Thus, in order to contribute to climate change mitigation as a company executive, it is necessary to be aware of the objectives to be achieved and the levers for reducing greenhouse gas (GHG) emissions in one's sector, their potential and their limits. This is not enough: it is also necessary to know how to place these elements in a global and long-term vision that takes into account the decarbonisation of other sectors, be capable of reinventing the economic model of one's organisation, change the incentives of all one's teams, etc. **This is why this framework comprises skills and knowledge, since they act in synergy and are inseparable.**

The knowledge related to ecological issues is divided into three parts (see Figure 10[381], p. 96):

- Knowledge about **physical constraints** (on the periphery of the figure): the planetary boundaries that must not be exceeded else our ability to live sustainably in a safe ecosystem will be jeopardized, as well as the finitude of resources.
- Knowledge about **societal goals** (in the centre of the figure): these goals are collectively defined (notably within the framework of the United Nations), widely shared and recognised as what our societies should be moving towards. Their achievement depends on physical constraints.
- Knowledge of the **institutional, technical and human levers** that are available to human societies to achieve societal goals collectively designated as desirable, within physical constraints. Future graduates need to know these in order to drive ecological transition.

These different fields of knowledge do not all require the same level of teaching. It is not a question of becoming an expert in each of these subjects, and some can be taught in less depth than others.

The skills to be developed are those that will enable future graduates to mobilise their knowledge of the issues in order to meet the challenge of ecological and social transition, both as

[380] Aware of simplifying the concepts of knowledge and competence, our objective is more to make people understand the linking of the different components of the base and the importance of pedagogical approaches in their teaching, than to present the different debates on these notions.

[381] This representation is reminiscent of Kate Raworth's doughnut theory (Kate Raworth, *Dougnut economics: Seven Ways to Think Like a 21-st Century Economist*, Random House Libri) according to which the objective is to circumscribe humanity and therefore our economic systems between an environmental ceiling made up of planetary limits and a social floor that takes up the UN's sustainable development goals: i.e. to ensure everyone's essential needs while making sure that we do not exceed the planetary limits that make it possible to maintain life on Earth.

professionals and as citizens. The skills presented in this section are mainly cross-disciplinary skills, not specific to a discipline or a profession[382].

This framework, which links constraints, objectives and means, should be discussed in any institution wishing to be inspired by it, so that teachers and other stakeholders can make use of it (to organise workgroups for this purpose, see the section of the Guide to the Transformation of Trainings devoted to it in the report "ClimatSup Business – Educating the Actors of Tomorrow's Economy"[383]).

Resources

FORTES Collective, *Manuel de la grande transition*[384]

Ivar Ekeland, Aicha Ben Dhia, Jacques Treiner, *The environmental challenges of the 21st century* [385,386,387]

Jean-Michel Lourtioz, Jane Lecomte and Sophie Szopa (dir.) *Enjeux de la transition écologique. Enseigner la transition écologique aux étudiants de licence à l'université* [388]

Jacques Treiner, *Treiner, Fil conducteur pour une introduction à l'Anthropocène en début d'études supérieures.* [389]

François Gemenne and Aleksandar Rankovic, *Atlas de l'Anthropocène*[390]

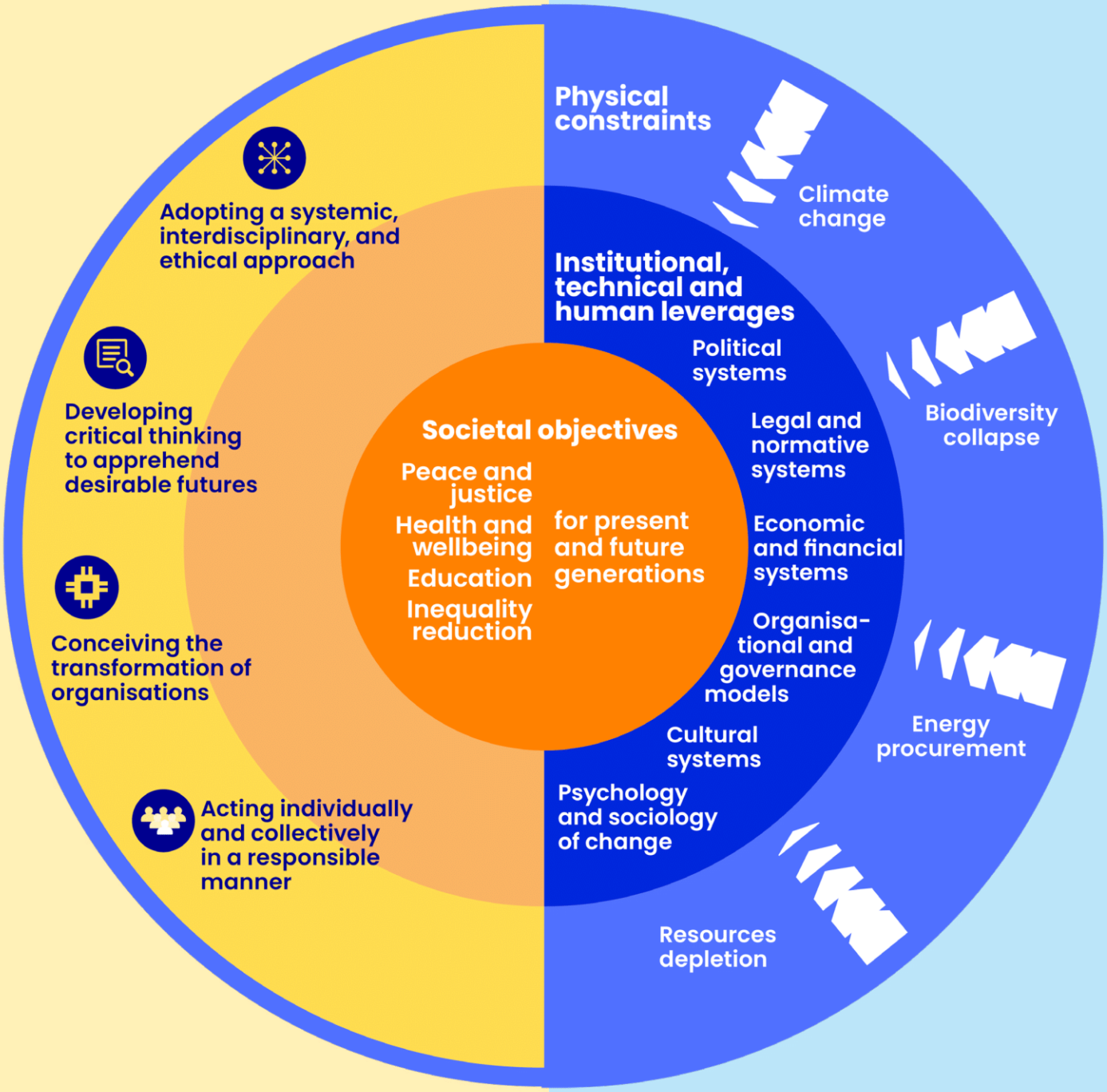
Gaël Giraud, audition for The Shift Project[391]

[382] For the adaptation of the base for different professional sectors, see below p. 93.
[383] The Shift Project, « ClimatSup Business - Educating the Actors of tomorrow's Economy ».
[384] Collectif FORTES, *Manuel de la grande transition* (Les Liens qui Libèrent, 2020).
[385] Introductory course on environmental issues for undergraduate students at the University of Paris-Dauphine, with the support of the University of Paris-Dauphine, the Madeleine Foundation and the 2050 Society. Ivar Ekeland, Aïcha Ben Dhia, and Jacques Treiner, The Environmental Challenges of the 21st Century, 2022, https://alignment-playbook.com/resource/467.
[386] English version of the course given at Paris-Dauphine University: Ivar Ekeland, Aïcha Ben Dhia, and Jacques Treiner, *The environmental challenges of the 21st century*, 2022, https://www.ceremade.dauphine.fr/~ekeland/lectures/Climate%20course%20_compressed.pdf.
[387] Course presentation and feedback from Ivar Ekeland and Aïcha Ben Dhia for The Shift Project: *Les défis environnementaux du XXIème siècle*, 28/012022, https://www.youtube.com/watch?v=QT5U-dwYj6A&list=PLX8LCkV3D8Upybb3Cr8h7eV_cgfRRicjD.
[388] Jean-Michel Lourtioz, Jane Lecomte, et Sophie Szopa, *Enjeux de la transition écologique. Enseigner la transition écologique aux étudiants de licence à l'université*, 2021, https://laboutique.edpsciences.fr/produit/1240/9782987526629/enjeux-de-la-transition-ecologique.
[389] Treiner, *Fil conducteur pour une introduction à l'Anthropocène en début d'études supérieures*.
[390] François Gemenne, Aleksandar Rankovic, et Atelier de cartographie de Sciences Po, *Atlas de l'Anthropocène* (Presses de Sciences Po, 2021).
[391] *De quel changement de paradigme économique les crises écologiques sont-elles porteuses ?*, 2022, https://www.youtube.com/watch?v=-4IsYSWqEhU&list=PLX8LCkV3D8Upybb3Cr8h7eV_cgfRRicjD&index=6.

TRAINING THE CITIZEN MANAGER OF THE 21ST CENTURY

SKILLS FOR THE TRANSITION

KNOWLEDGE RELATED TO ECOLOGICAL ISSUES



A. Knowledge: physical limits

The four physical limits selected here are those that encompass all planetary boundaries, namely climate change and biodiversity collapse, as well as the depletion of energy and non-energy resources. Climate change and the integrity of the biosphere are indeed the two fundamental planetary boundaries, which encompass all others[392]. The depletion of mineral resources is not included in the planetary boundaries, as it does not in itself bring about changes in the Earth system, but it is a very real constraint for human societies as they are currently developing. The issues related to the depletion of energy resources are presented separately from other resources because of their central place in recent economic development.

These fields of knowledge are far removed from what is usually taught in management training, but a minimal understanding of these subjects is essential. Knowing the major trends at work and the orders of magnitude is a prerequisite for understanding what the upheavals occurring in the Earth system imply for our societies. This understanding is essential for analysing the relevance of the solutions to be found and for projecting ourselves into the world as it will evolve in the course of this century. On this point, the various stakeholders approached during the project (teachers, students, professionals, etc.) were unanimous.

[392] Within the planetary boundaries as defined by the Stockholm Resilience Centre, climate change and biosphere integrity are considered central because they interact with all other planetary boundaries, and significant changes in climate or biosphere integrity could single-handedly tip the Earth system into a new geological era. Steffen et al, "Planetary Boundaries".

1. Climate change

Economic activities, and more broadly human organisations, have major impacts on the climate. Understanding the physical mechanisms of climate change as well as its economic and social causes and consequences is essential so managers can be actors in the transition.

Here are some paths regarding content.

Resources

IPCC, Sixth assessment report summary for policymakers[393]

Haut Conseil pour le Climat (HCC), Annual reports[394]

Contextualisation

- Definition of climate (notably the difference between meteorology and climatology,
- Historical evolution of climate since the ice-age,
- Main institutions that work and are legitimate on climate (IPCC, HCC, etc.),
- International climate negotiations: functioning, history and limitations.

Mechanisms

- Physical functioning of the climate: physical causes of climate change, causal chains, feedback loops, thresholds, physical consequences;
- Social and economic causes of climate change;
- Orders of magnitude of the main factors of GHG emissions;
- Know the notion of greenhouse gas emission balance (carbon accounting) and the different scopes;
- Social and economic consequences of climate change;
- Notions of mitigation and adaptation to climate change;
- Carbon neutrality: physical mechanism and limits of the concept on a non-global scale.

Relations, interactions

- Interactions between climate change and other physical constraints: loss of biodiversity, depletion of energy and non-energy resources,
- Interactions between climate change and societal objectives,
- Link between climate, energy and the economy (e.g., Kaya equation).

Perspectives and limits

- IPCC scenarios: methods and lessons learned
- Local climate change mitigation and adaptation strategies (examples for France: the National Low Carbon Strategy (SNBC) and the National Climate Change Adaptation Plan (PNACC); the Shift Project's proposals for decarbonisation, ADEME and NegaWatt scenarios);
- Main company responses and their critical analysis:
- Regulation and taxation
- Technical innovations and their limits (energy efficiency, carbon capture and storage, geoengineering, new energy sources and carriers, etc.)
- Social innovations, including sobriety
- Organisational responses: offsetting, greenwashing, new economic models, etc.

[393] IPCC, "Climate Change 2021: The Physical Science Basis3; IPCC, 3Climate Change 2022: Impacts, Adaptation and Vulnerability"; IPCC, "Climate Change 2022: Mitigation of Climate Change - Summary for Policymakers", April 2022, https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/.

[394] For example: Haut Conseil pour le Climat, « Dépasser les constats, mettre en œuvre les solutions », juin 2022, https://www.hautconseilclimat.fr/wp-content/uploads/2022/06/Rapport-annuel-Haut-conseil-pour-le-climat-29062022.pdf.

2. The collapse of biodiversity

Resources

IPBES, Report 2019[395]

The biosphere is being severely disrupted by human activity: the diversity of life is disappearing at a rate unprecedented in human history. This collapse is having major impacts on ecosystems and the functions they provide, with potentially dramatic consequences for humans. The collapse of biodiversity is linked to climate change and other planetary boundaries. Understanding the issues related to living organisms is an essential step in the training of managers so that they understand their importance and their multiple interactions with human organisations and activities.

Here are some paths regarding content.

Contextualisation

- Definition of the biosphere, living organisms, biodiversity and the concept of ecosystems;
- Historical evolution of biodiversity and 6th mass extinction;
- Main institutions that work and are legitimate on biodiversity (IPBES, COP biodiversity, IUCN, etc.);
- International negotiations on biodiversity: functioning, history and limits.

Mechanisms

- Basic mechanisms of life and evolution;
- 5 direct drivers of biodiversity loss;
- Changes in land and sea use (agricultural expansion, urbanisation, infrastructure development, aquaculture development, etc.);
- Direct exploitation of organisms (e.g., fishing);
- Climate change;
- Pollution;
- Invasive exotic species;
- Social and economic consequences of biodiversity loss;
- Main indicators of the state of biodiversity;
- Major representations of and relations with "nature" in our societies.

Relations, interactions

- Concept of "one health" and understanding the interdependence of human and environmental health;
- Links between biodiversity loss and global warming, between resource exploitation and biodiversity.

Perspectives and limits

- Main societal responses and their critical analysis: tools for protecting, restoring, rehabilitating and enhancing biodiversity, and their limitations;
- Local strategies to preserve and restore biodiversity: e.g. National Biodiversity Strategy in France (SNB).[396]

[395] IPBES, "Summary for Policymakers of the Global Assessment of Biodiversity and Ecosystem Services".

[396] « Stratégie nationale biodiversité 2030 », Ministère de la Transition Ecologique, consulté le 24 avril 2022, https://www.ecologie.gouv.fr/strategie-nationale-biodiversite.

3. Energy supplies

Energy is the mainstay of most societies, powering the machines that enable us to live, heat, feed, provide care, move and communicate, etc. The ecological emergency is intimately linked to energy. It is essential to understand this link in depth, particularly in the light of climate change and the omnipresence of fossil fuels. Reducing the dependence of our activities on energy flows is becoming a strategic, financial, ecological and social necessity.

Here are a few paths relating to content.

Resources

IEA, "*Net Zero by 2050*"[397]

The Shift Project, Approvisionnement pétrolier futur de l'union européenne[398]

Contextualisation

- Definition of energy, law of energy conservation;
- Different types of fossil fuels (conventional and non-conventional) and alternatives (renewable, nuclear);
- Historical evolution of the consumption of these energies, phenomenon of energy addition;
- Main institutions working and having legitimacy on energy (International Energy Agency, etc.);
- Main points of discord and actors.

Mechanisms

- Distribution of energy production (geographically and by type of energy), consumption (by country and sector) and energy rates of return;
- Geopolitics of energy: origin of oil and gas products and associated risks, evolution of consumer countries, etc.
- Production peaks.

Relations, interactions

- Link between climate, energy and economy (example: Kaya equation);
- Systemic nature of energy in our societies: links with food, transport, building, industry, etc.
- Outline of French and European energy policies.

Perspectives and limits

- Limitations of the different means of energy production linked to the finiteness of resources (use of materials, land use, conflicts of use, etc.) or to environmental and social issues (social acceptance, pollution, destruction of biodiversity, risks of accidents, etc.);
- Main energy scenarios (IEA, RTE, Ademe, etc.);
- Concepts of energy sobriety and efficiency.

[397] International Energy Agency (IEA), "Net Zero by 2050 - A Roadmap for the Global Energy Sector", October 2021, 224.
[398] "The future of oil supply in the European Union" (The Shift Project, May 2021), https://theshiftproject.org/en/article/oil-what-are-the-risks-for-the-future-of-europes-supply-the-new-shifts-report-about-peak-oil/.

4. The exhaustion of mineral resources (excluding energy resources)

The development of societies is closely linked to the availability, extraction, processing, use and end-of-life management of mineral resources. They are indispensable in our food systems, our industrial system, our health systems, our travel, etc. They also have an important role to play in the transition of our economies towards less carbon-intensive energy. They are the mainstay of most sectors of activity, just like energy resources, but they create dependencies and risks for these sectors: depletion of resources, possible fluctuations in their price and quality, etc.

Here are a few paths regarding content.

Resources

Zenon Research, "Fluxes, not stocks"[399]

ADEME, "L'épuisement des métaux et minéraux: faut-il s'inquiéter ?"[400]

Contextualisation

- Definition of mineral resources (metallic and non-metallic), use and role;
- Consumption trends, notion of strategic raw materials.

Mechanisms

- Notions of deposit, reserve and burn rate and the different factors that affect them;
- Geopolitics of mineral resources: origin of resources and associated risks, evolution of consumer countries, notion of criticality, etc.
- Notion of circular economy and recyclability and limits of recycling.

Relations, interactions

- Interactions between energy production and mineral resources (material intensity of energy production, need to use more and more energy to extract increasingly diluted materials);
- Link between electrification of uses and mineral resources;
- Link between agriculture and materials;
- Links between resource extraction and climate change (e.g., increased demand for metals related to electrification of uses), biodiversity (e.g., impacts of mining on ecosystems) and societal objectives (e.g., working conditions in mining).

Perspectives and limits

- Organising sobriety: ways of reducing the use of materials (economy of functionality rather than ownership and obsolescence, eco-design, etc.).

[399] François de Rochette and Greg De Temmerman, "Fluxes, not stocks: the real challenges of metallic resources for the energy transition" (Zenon Research, 2022), https://www.zenon.ngo/insights/fluxes-not-stocks-the-real-challenges-of-metallic-resources-for-the-energy-transition.

[400] Alain Geldron, "L'épuisement des métaux et minéraux : faut-il s'inquiéter ?" (ADEME, June 2017), https://librairie.ademe.fr/dechets-economie-circulaire/1889-epuisement-des-metaux-et-mineraux-faut-il-s-inquieter-.html.

B. Knowledge: institutional, technical and human levers

Institutional, technical and human levers are those that human societies can use to achieve societal goals collectively designated as desirable, while responding to the imperatives posed by the physical world. We propose here some important categories of knowledge for future managers to understand how the organisations of which they will be a part fit into larger human systems, which are constrained by physics and have impacts on their environment and thus on society. This description does not claim to be exhaustive.

For each of the proposed categories, students must acquire knowledge of:

- Contextualisation: definition, history, temporal and geographical perimeters;
- Mechanisms, modes of operation
- Relations and interactions with physical constraints and societal objectives, and with other institutional, technical and human levers
- Risks, limits
- Perspectives: solutions, prospective studies.

1. Political systems

Private organisations interact with politics: many of them, such as companies, professional or public interest associations, influence politics. Conversely, political decisions embodied in national or international regulations define the framework for action by organisations. Political decisions are central to the implementation of ecological transition. Management students must acquire knowledge that enables them to understand how politics can play a role in preserving the general interest within a framework constrained by these power relationships.

Examples

- Know the decision-making institutions at different territorial levels and in different countries in relation to ecological issues;
- Know the links between energy resource exploitation and political power;
- Know the interactions between organisations and politics: lobbying, advocacy, consultations, regulations;
- Know the systems of representation (political, scientific, community, etc.) and their limits.

2. Legal and standards systems

In connection with political systems, laws and standards are crucial for the preservation of the environment and ecological transition. Having basic knowledge of the functioning of legal systems allows one to understand how to utilise these laws and standards in favour of ecological transition.

Examples

- Know the origin of the main laws and standards related to the environment (e.g., pollution and health impacts) and the changes they have brought about in society and the economy;
- Be familiar with environmental protection laws and standards at various levels: national laws, international standards, European directives;
- Be familiar with the main legal approaches to environmental protection: hard law, soft law, self-regulation, authorisation schemes, etc.;
- Know the hierarchy of standards, including those not specifically dedicated to environmental protection, and the binding force of public and private law, in order to understand how to ensure that the general interest prevails;
- Know the mechanisms of decision-making, e.g., the organisation of lobbying in the European Union;
- Know the effectiveness of laws and standards, as well as their limits;
- Know the benefit of laws and standards, especially at the international level, to promote change without being burdened by unfavourable competitive conditions;
- Be familiar with examples of climate-related lawsuits (around 2,000 worldwide to date) brought on different legal grounds against states, companies and financial actors.

3. The economic and financial system

Companies are part of an economic and financial system whose functioning and social and environmental consequences must be understood. The study of its history, its limits and the evolutions necessary to take into account ecological issues, could contribute to a shift towards an economic model that is sustainable for all, in present and future generations. To, achieve this, it is important that students are exposed to several currents of economic thought.

This category of knowledge encompasses concepts from economic and financial theories, economic policies as well as the physical reality to which they refer. Examples of content include.

Resources

Alain Grandjean and Marion Cohen, *The Other Economy*[401]

The Shift Project, *Climate, crises: the plan to transform the French economy*[402]

Economic theories and tools

- Know the main economic theories, the historical context of their emergence, their links with the human and social sciences and the way they integrate physical constraints or not;
- Be familiar with economic theories that aim to integrate ecological issues and envisage possible trajectories other than perpetual growth, such as degrowth or post-growth;
- Know the indicators of value creation and human development, their history and their limits, particularly in relation to ecological issues, and the associated controversies. For example, to know the limits of the GDP indicator in responding to ecological issues, particularly the state of knowledge on the decoupling of GDP and environmental pressures, and know alternative indicators;
- Be familiar with the concept of sustainable development and its limits, as well as the concepts of weak and strong sustainability.

[401] "The Other Economy", s. d., https://theothereconomy.com.

[402] The Shift Project, *Climat, crises : le plan de transformation de l'économie française* (Odile Jacob, 2022).

Economic policies

- Know the diversity of economic policies implemented in the world, the political and theoretical context of their emergence and evolution; know their strengths and limitations in taking into account ecological issues;
- Know the fundamentals of carbon markets, their scope and limitations.

Physical economy

- Know the relationship between the economy and the physical world: e.g., materials and infrastructure needed for products and services; the link between GDP, energy and greenhouse gas emissions;
- Know the dynamics of economic globalisation, its externalities (especially negative ones) and the interdependencies between countries;
- Know the environmental and social issues of certain emblematic sectors: energy production, electronics and digital technology, food industry, construction, transport, plastics, tourism, distribution, etc.:
  - Impacts on climate, natural resources, biodiversity, health, inequalities, etc., and ways to mitigate these impacts;
  - Dependence of these sectors on climate, life, resources, etc., and resilience factors
  - Possible transformation plans.
- Know the concepts of physical risks, transition and responsibility.

Financial system

-
- Understand the role of finance (money, debt, economic cycles) and their evolution based on anthropology, history, philosophy and ethics; [403]
- Understand how the financial system is integrated in the economy, which is itself part of the biosphere and therefore of the Earth system - know these terms and concepts, understand the place of finance in this context;[404]
- Be familiar with ecological accounting and the principle of double materiality, i.e., the company's dependencies on the environment (financial materiality) and its impacts on the environment (impact materiality, or environmental and social materiality);[405]
- Be familiar with the concepts of green and sustainable finance, extra-financial reporting, ESG indicators, etc., as well as their limits and their limited place in traditional finance;
- Be aware of works giving orders of magnitude of financing needs for ecological transformation (adaptation, mitigation, biodiversity, etc.);[406]
- Know the theory and practice of discounting, its effects on the consideration of ecological issues (e.g., discounting leads to an underestimation of long-term environmental degradation).[407]

[403] Christophe Revelli and Thomas Lagoarde-Segot, "Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper", *Post-Crisis Finance Network*, January 2022, https://pocfin.kedge.edu/documents-de-travail.

[404] Revelli and Lagoarde-Segot.

[405] BL Evolution, "Double matérialité : comment appréhender ce nouveau principe et quelles implications pour le reporting extra-financier ?", 2022, https://bl-evolution.com/Docs/202202_Insight_Double-Materialite_BLevolution.pdf.

[406] The IPCC proposes for example, an estimation of financing needs to mitigate climate change (IPCC, "Climate Change 2022: Mitigation of Climate Change", April 2022, 124.); UN Environment Programme for nature-based solutions to mitigate climate change, the depletion of biodiversity and the degradation of soils (UNEP, "State of Finance for Nature - Tripling investments in nature-based solutions by 2030", 2021.)

[407] Antonin Pottier, *Comment les économistes réchauffent la planète*, Seuil, Anthropocène, 2016.

4. Organisational and governance models

Most of the students in business schools will be managers or future managers and will make and influence many decisions. The governance of organisations plays a decisive role in their orientation. Knowledge of a variety of governance models and their respective capacity to respond to the challenges of ecological transition is fundamental.

Resources

Nathalie Lallemand-Stempak and Philippe Eynaud (dir.), *Vers une autre gestion*, collection Petits Manuels de la Grande Transition[408]

Examples

- Know the diversity of legal forms of organisation and their associated modes of governance, their advantages and disadvantages in taking into account ecological and social issues;
- Know the recent paradigm shift between managerial governance and shareholder governance;
- Know the limits of the current modes of governance in companies from the point of view of taking ecological issues into account, and the proposals for change (for example, the quality of a company carrying out missions);
- Know the main obstacles to the democratisation of decision-making in organisations (for example, the iron law of oligarchy)
- Know the main principles and limits of multi-stakeholder governance, inclusive governance, and governance of the commons; and examples of companies governed according to these principles
- Be familiar with the debate on the tragedy of the commons (Hardin)[409] and the governance of the commons (Ostrom)[410], and the effect of the privatisation of the commons.

5. Cultural systems

Culture shapes our relations with nature and with the physical world. It is also closely linked to the relationship we have with ecological transition: consumption, comfort, constraint, the general interest, etc. Understanding one's own culture and knowing about other cultural paradigms makes it possible to take a step back from what is conveyed by one's own culture and imagine other relationships with the world (see below, competence "Developing a critical mind to envisage desirable futures", p. 111).

Examples

- Be familiar with the main findings of anthropological work on the relationship between human societies and (the rest of) nature [411]
- Be familiar with work on the cultural component of the Western model of development[412]
- Be familiar with historical and philosophical works on the place of technology in Western societies.

[408] Lallemand-Stempak and Eynaud, *Vers une autre gestion*.
[409] Garrett Hardin, *The Tragedy of the Commons*, 1968.
[410] Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press (Cambridge, UK, 1990).
[411] Philippe Descola, *Par-delà nature et culture* (Gallimard, 2005).
[412] Arturo Escobar, *Encountering Development: The Making and Unmaking of the Third World* (Princeton University Press, 1995).

6. The psychology and sociology of change

The relationship of human beings with themselves, with others and with the world passes through their reason, their emotions and their social dimension. Understanding these psychological and social dimensions is important for anyone who aspires to be an actor in transition. The transformations to be achieved individually and collectively, in our organisations and societies, are significant. They require a good understanding of the psychological and social mechanisms that they set in motion, the resistance they can provoke, the cognitive and emotional biases, and the social determinisms in play.

Resources

William F. Lamb et al., "Discourses of Climate Delay"[413]

Psychological and sociological approaches are rich in information on the difficulties individuals and societies have in taking ecological issues into account in their decisions.

Examples

- Know the main cognitive biases, errors of perception and attribution: anchoring[414], framing[415], basic error of attribution, halo effect, etc.;
- Know the psychological mechanisms and rationalisation of inaction;[416,417]
- Know and identify the individual and collective sources of resistance to change;
- Understand the individual, collective and structural aspects underlying the inertia of ecological transition;
- Know the notions of social determinism and power relations between social groups
- Distinguish between the notions of instrumental and value-based rationality, and the different forms of authority;[418]
- Be familiar with models of decision-making in an organisational context and the limits of the rationality of actors (rational decision model and bounded rationality model) [419], political model[420], garbage can model[421]);
- Know the different levers of motivation (intrinsic, extrinsic, notion of psychological contract).[422]

[413] William F. Lamb et al., "Discourses of Climate Delay", *Global Sustainability* 3 (2020): e17, https://doi.org/10.1017/sus.2020.13.

[414] Amos Tversky et Daniel Kahneman, "Judgment under Uncertainty: Heuristics and Biases", *Science* 185, nº 4157 (1974): 1124-31, https://doi.org/10.1126/science.185.4157.1124.

[415] Amos Tversky and Daniel Kahneman, "The Framing of Decisions and the Psychology of Choice", *Science* 211, nº 4481 (1974): 453-58, https://doi.org/10.1126/science.7455683.

[416] Lamb et al., "Discourses of Climate Delay".

[417] Matthew J. Hornsey and Kelly S. Fielding, "Understanding (and Reducing) Inaction on Climate Change", *Social Issues and Policy Review* 14, nº 1 (janvier 2020): 3-35, https://doi.org/10.1111/sipr.12058.

[418] Max Weber, *Economie et société, tome 1*, 1921.

[419] James G. March et Herbert A. Simon, *Les organisations*, 1958.

[420] Andrew M. Pettigrew, *The Politics of Organizational Decision-Making*, Tavistock, 1973.

[421] M. D. Cohen, J. G. March, et J. P. Olsen, "A Garbage Can Model of Organizational Choice", *Administrative Science Quarterly*, 1972.

[422] Denise Rousseau, "Psychological and Implied Contracts in Organisations", *Employee Responsibilities and Rights Journal*, s. d.

C. Knowledge: societal objectives

Ecological transition aims to put humanity back on a trajectory that allows the preservation, or even the improvement, of living conditions for the greatest number of individuals (in the meaning of well-being, and not only of material conditions). It is therefore essential to understand what is meant by the notion of 'living conditions', which is subjective in nature, and therefore to refer to the social consensus relating to them, which we refer to as societal goals. Achieving these goals implies creating the conditions that will allow realising them: it is impossible to address the subject of societal objectives without dealing with their interactions with physical constraints and institutional, technical and human systems. In particular, physical constraints are a determinant of present and future living conditions.

Thus graduates must also know:

- the different societal objectives most commonly shared,
- the evolution and current status of their achievement at different scales,
- the main mechanisms likely to promote them,
- the interactions between the different objectives and with each of the physical constraints.

This part of the Toolkit does not pretend to deal with the subject of societal goals in its entirety. It lists a number of societal goals that are agreed upon by most local, national and international organisations, and suggests ways to link these goals to physical constraints. The societal goals mentioned are based on the social component of the United Nations Sustainable Development Goals[423].

1. Peace and justice

Sustainable Development Goal (SDG) no. 16: "Peace, justice and strong institutions"

Examples of interactions with physical constraints

- Tensions over resources can lead to conflicts: monopolisation of energy resources, conflicts over access to drinking water, etc.
- Climate justice: exposure to climate change differs according to people, territories and social classes, which do not all have the same means to cope with it and whose vulnerability therefore varies. The countries that have contributed the least to climate change are also often the ones most affected by its consequences. Responsibility for action to mitigate and adapt to climate change must therefore take these factors into account in the interests of justice (in addition to responsibility for emissions).

2. Health and well-being

SDG n° 1: "No poverty", n° 2: "Zero hunger" and n° 3: "Good health and well-being"

Examples of interactions with physical constraints

- The collapse of biodiversity hinders the clean-up of air and water, normally carried out by organisms in the natural environment;
- Climate change and the collapse of biodiversity are reducing agricultural yields and disrupting water resources, leading to poorer diets for the less well-off and creating public health problems;

[423] United Nations, "The 17 sustainable development goals", accessed on 24 April 2022, https://sdgs.un.org/fr/goals.

- Health systems depend on energy for their functioning (transport, drug production and equipment), which could be compromised if energy becomes scarcer or more expensive;
- Resource scarcity could also impact the price of medical equipment.

3. Education

SDG nº 4: "Quality education"

Examples of interactions with physical constraints

- Climate education contributes to the emergence of climate change adaptation policies;
- The education system depends on physical parameters for its functioning (transport system, heated or air-conditioned buildings, equipment, etc.). Climatic events and energy constraints could therefore undermine its functioning.

4. Reduction of inequalities

SDG nº 5: "Gender equality" and nº 10: "Reduced inequalities"

Examples of interactions with physical constraints

- The poorest countries and individuals are on average the most affected by the consequences of climate change;
- The richest countries and individuals are responsible for the largest share of greenhouse gas emissions;[424]
- Women are more affected than men by the consequences of climate change, which contributes to increased gender inequalities;[425]
- International climate negotiations take into account the principle of "common but differentiated responsibilities and respective capabilities";[426]
- The rise in fossil fuel prices, in conjunction with their scarcity, can cause economic crises and weaken the less well-off;
- Tensions over resources (water, food, etc.) tend to exacerbate social tensions and increase discrimination (gender, religion, etc.).

[424] Lucas Chancel et al., "World Inequality Report 2022" (World Inequality Lab, 2022), 115-35, https://wir2022.wid.world/chapter-6/.
[425] S. Nazrul Islam and John Winkel, "Climate Change and Social Inequality", DESA Working Paper (United Nations, October 2017), https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf.
[426] Pierre Barthélémy, "Le principe de responsabilité dans les négociations climatiques : impasse ou nouveau départ ?", IDDRI, 10 December 2015, https://www.iddri.org/fr/publications-et-evenements/billet-de-blog/le-principe-de-responsabilite-dans-les-negociations.

D. The skills of a citizen manager

The cross-disciplinary skills that must be acquired in order to integrate ecological issues as a professional and as a citizen are organised into four macro-competences (see **Figure**).

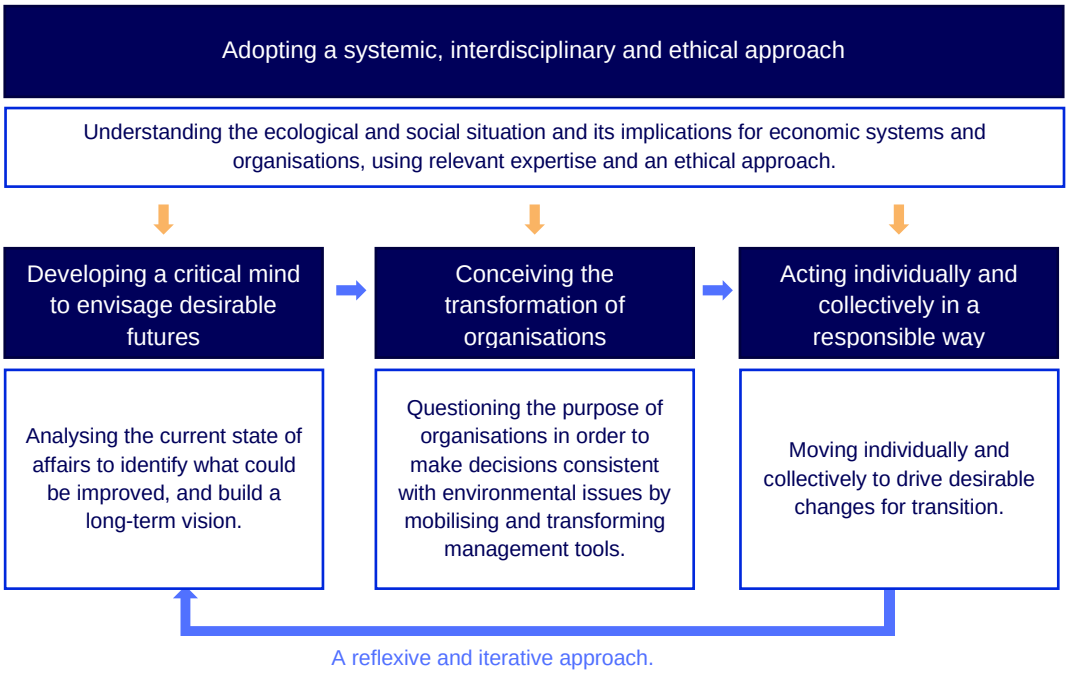


Figure 11 – The major skills of the citizen manager.

1. Adopting a systemic, interdisciplinary and ethical approach

This entails linking the interactions between organisations and economic systems, physical constraints and societies, using the relevant expertise and asking ethical questions. **This approach must permeate all the skills to be developed to integrate ecological issues.**

Adopting a systemic approach means dealing with the elements of a problem as a whole, including the interactions between these elements. In particular, the management student must be able to situate economic systems and organisations in their complex interactions with physical constraints and human societies. This is done by taking into account the interactions between different scales, from local to global. The objective is to be able to manage the complexity of a situation and determine the consequences of an action at different spatial and temporal scales.

Resources

Donella Meadows, *Thinking in Systems*[427]

Linking the knowledge of different disciplinary fields in a context of decision-making aqnd action, means knowing how to mobilise relevant disciplinary fields within the natural sciences (physics, biology, geology, etc.), the engineering sciences and the human and social sciences (philosophy, sociology, anthropology, law, etc.) to understand the situation - in particular the ecological situation - and to guide its actions. The graduate must be able to identify and collaborate with experts in these fields in order to integrate their assessments and recommendations in the decision-making process. The profile of management graduates is of a general nature, and their role may involve leading different fields of expertise.

Resources

Clémence Seurat et Thomas Tari (dir.), *Controverses mode d'emploi*[428]

Examples

- Start from practical cases such as climate refugees, the textile industry, overfishing, etc., and try to identify all the components of the system, and explain them from different angles, at different scales, and using different fields of knowledge.
- Identify and analyse different socio-technical consensuses and controversies (e.g., autonomous cars, 5G...).
- Know how to work with people from different disciplinary fields and with different working cultures: e.g. researchers in natural or social sciences, engineers, etc.

Discerning the ethical challenges means being able to identify the moral theories to which discourses and practices are related, to question the appropriateness of the current state of affairs and one's own positions and opinions, and to adopt an ethical approach to guide one's action, i.e. include moral reflection in one's actions. This requires questioning one's values and imagining the society to which one wants to contribute, as a citizen and as a professional.

[427] Donella Meadows, *Thinking In Systems: A Primer*, Chelsea Green Publishing, 2008.
[428] Clémence Seurat and Thomas Tari, *Controverses mode d'emploi* (Forccast et Presses de Sciences Po, 2021), https://controverses.org/mode-demploi/.

Examples

- Identify the values and representations underlying a decision in order to promote change: for example, which mode of individual transport should be more socially valued, a luxurious SUV, an electric car, a cargo bike? Each can convey membership of a social class, social and ecological impacts, a sense of responsibility and general interest, etc.
- Identify one's different spheres of responsibility, individual (as a citizen and as a professional) and collective (company, local authority, association, State, etc.), and the links between these different spheres.
- Question the type of society that our decisions will favour: improvement of health, impact on biodiversity and on climate change, reduction of inequalities, etc.

Draw on philosophy and one's knowledge of the links between physical constraints and social issues to imagine a desirable society, in the light of the notions of ethics and responsibility. [429]

2. Developing a critical mind to envisage desirable futures

Taking a historical and intercultural approach provides tools to look at our world critically, to understand why it is the way it is, and to imagine how it might be different. It is the basis for bold forward thinking, which must also be consistent with the physical constraints of the world.

Adopting a historical and intercultural approach allows integrating one's fields of study and activity in history in the long-term, and to situate them in relation to other cultures. This implies having the tools and knowledge to position the relationships between economic systems, business management methods, and social and ecological issues in a historical approach. Finally, it is important to know how to situate one's relationship with nature among other approaches from different cultures.

Resources

Jean-Baptiste Fressoz, Frédéric Graber, Fabien Locher et Grégory Quenet, *Introduction à l'histoire environnementale*[430]

Philippe Descola, *Par-delà nature et culture*[431]

Examples

- Study the history of economic development based on fossil fuels.
- Take a historical approach to the emergence of marketing as a means of encouraging consumption.
- Study the history of the evolution of management disciplines: history of the impact of consumption on the climate, context of the emergence of green finance and societal marketing, etc.
- Study the history of climate and pollution conflicts, which illustrate the turmoil that took place during the construction of the current economic model.
- Study the history of responses to environmental damage by companies (CSR, lobbying, greenwashing, green finance, etc.), public policies (environmental law, regulations, etc.) and nature conservation movements.
- Use anthropology to gain perspective on one's relationship with nature, especially in comparison with non-anthropocentric societies. [432]
- Using anthropology to step back from the Western development model to see it in perspective. [433]

[429] Collectif FORTES, *Manuel de la grande transition*, 114-18; Collectif FORTES, 130-34.
[430] Jean-Baptiste Fressoz et al., *Introduction à l'histoire environnementale*, Repères (La Découverte, 2014).
[431] Descola, *Par-delà nature et culture*.
[432] Descola.
[433] Escobar, *Encountering Development*.

Applying a critical mind, entails knowing how to mobilise knowledge to analyse the current state of affairs, discourses and opinions. Critical thinking can be used, for example, to question dominant discourses and narratives related to ecological issues or management.

Resources

Elena Pasquinelli et Gérald Bronner, "Éduquer à l'esprit critique"[434]

Examples

- Understand how knowledge is constructed, how to search for information, and how to assess the relevance and reliability of sources.
- Draw on knowledge of the philosophy of science to understand scientific construction, the area of validity of scientific theories, the difference between science and dogma, etc.
- Analyse the debates that call into question scientific consensuses.[435]
- Question the meaning of words to reveal their political dimension: what economic, political and ecological paradigms do the notions of "sustainable development" or "CSR" represent? What are their different meanings? To which practices are they linked?[436]
- Mobilise the human and social sciences, especially history, to deconstruct the dominant discourse on our economic systems[437], on technology (the neutrality of technology, equivalence between technical progress and human progress), etc.
- Analyse the different narratives on the relationship between humans and nature: the rationale of domination, assimilation to a reservoir of resources, nature as a sanctuary, symbiosis between humans and nature, etc.

Envisage desirable futures consistent with physical constraints implies building new narratives as much as engaging in a prospective process that is consistent with physical constraints. The prospective approach must take into account the uncertainties and limitations of how the physical world is perceived, and rely on the human and social sciences.

Examples

- Understand existing scenarios and their limitations, e.g. IPCC scenarios and their uncertainties.
- Identify the limits and uncertainties of technical solutions.
- Know how to search for and verify data, and reason using orders of magnitude when available data is insufficient.
- Build desirable and realistic narratives by calling on different disciplinary fields belonging to the natural sciences, engineering sciences and the humanities and social sciences.
- Know how to use scenarios and prospective studies, understand their interests and limits.

[434] Elena Pasquinelli and Gérald Bronner, "Éduquer à l'esprit critique : bases théoriques et indications pratiques pour l'enseignement et la formation" (Conseil scientifique de l'éducation nationale), accessed on 24 August 2022, https://www.reseau-canope.fr/fileadmin/user_upload/Projets/conseil_scientifique_education_nationale/Ressources_pedagogiques/VDEF_Eduquer_a_lesprit_critique_CSEN.pdf.

[435] The science history book "Les Marchands de doute" gives several examples, including on climate change: Naomi Orsekes and Erik M. Conway, Les Marchands de doute (Le Pommier, 2012).

[436] For the context of emergence and the political dimension of CSR, see *Vers une autre gestion*, section "3.2. La responsabilité sociale de l'entreprise". Lallemand-Stempak and Eynaud, *Vers une autre gestion*, 65-81.

[437] Eve Chiapello recounts in "Vers une autre gestion" the experience of the Alternative Management major created in 2007 at HEC Paris, which aimed to "develop critical reflexivity towards capitalism". Lallemand-Stempak et Eynaud, 53-60.

- Identify the consequences of an action or an innovation at different temporal and spatial scales and by considering the indirect, unanticipated or undesired effects (potential rebound effects, changes in use, unintended use, etc.).

3. Conceiving the transformation of organisations

Future graduates must know how to mobilise management tools and practices to make decisions that are consistent with ecological issues within their organisation. The functions of strategist and decision-maker, and the tools for decision-making, are placed in the service of ecological transition. This is the reflection and decision phase, upstream of action.

Resources

Nathalie Lallemand-Stempak and Philippe Eynaud (dir.), *Vers une autre gestion*, collection Petits Manuels de la Grande Transition[438]

Questioning the purpose and social utility of an organisation, product, service or tool: make the link between organisations, the narratives they mobilise, as well as the products or services they provide, and their impacts on societies and the environment. The aim is to apply critical thinking to the role of organisations, and in particular companies, to their activities and management tools and practices, in relation to ecological and social issues, in order to design more virtuous models.

Resources

Clémence Seurat and Thomas Tari (dir.), *Controverses mode d'emploi*[439]

Examples

- Conduct a multi-stakeholder analysis.
- Analyse debates about a product or service.
- Take into account the multiplicity of organisational forms by reflecting on the relevance of the management tools used. For example, identify the human resource management models best suited to an organisation according to its goals, size, age.[440]
- Identify the political dimension of management tools. For example:
  - the utilisation of quantifiable indicators in the evaluation of public action, and the choice of these indicators, are the result of political power relations; [441]
  - accounting choices, such as the accounting balance that represents a company's result, depend on the dominant players in the economic system;[442]
  - marketing has an impact on social norms, by promoting certain standards of consumption.
- Question the dominant cultures in the company, for example the culture of growth.

Incorporating a strategy or business model in a context of physical constraints is a key skill for future graduates. This includes analysing the risks and opportunities of a company in relation to physical constraints, and designing its contributions to collective goals of reducing negative impacts. This can apply to existing companies whose activities should be transformed, redirected or even stopped, as well as to new companies or organisations designed from the outset according to ecological and social issues.

Resources

Resources[443] and feedback from experience[444] of the courses "Energy, Business, Climate & Geopolitics" of Pierre Peyretou, Alexandre Joly, Aurélien Acquier and Charles Sirot for the ESCP.

The Shift Project, "Climate risk analsis"[445]

Emmanuel Bonnet, Diego Landivar and Alexandre Monnin, *Héritage et fermeture*[446]

[443] ESCP Business School, « Energy, Business, Climate & Geopolitics », Commons For Future, accessed on 22 August 2022, https://commonsforfuture.escp.eu/energy-business-climate-geopolitics.

Examples

- Analyse the risks and vulnerabilities of a company in the face of energy and resource constraints and the effects of ecological crises (physical risks, transition risks, vulnerability to the economic and social consequences of crises linked to the ecological emergency)[447], in particular by conducting a risk analysis according to a scenario under physical constraints. [448,449]
- Analyse business strategies in the light of ecological issues (mitigation and adaptation), based on the knowledge of various scenarios and sector-specific environmental and social issues.
- Conceive a company's contributions to sectoral, national and international regulations to create a regulatory framework relevant to ecological issues.
- Include a product or business model in a circular economy approach using the results of an environmental assessment: sustainable procurement, eco-design, industrial and territorial ecology, economy of functionality, responsible consumption, extension of useful life, recycling.
- Be aware of work on the redirection and closure of organisations, infrastructures and activities that are incompatible with consideration relating to ecological issues. [450]
- Analyse the governance model of an organisation in relation to its goals. [451]
- Make decisions in a situation of uncertainty.
- Integrate ecological issues in an organisation's Green HRM (e.g., by implementing a remuneration system that encourages environmentally friendly behaviour).

Mastering multicriteria assessment tools and transforming existing tools, means being able to assess the environmental footprint and social impacts of a company, product, service, process or tool, and knowing how to transform existing assessment tools. This requires a critical examination of the tools used, and if such assessment tools exist.

Examples

- Interpret environmental and social assessments of a company, product, service, process (procurement) or tool (information system).
- Assess the relevance of the environmental and social assessment tools used: environmental and social life cycle analysis (LCA), greenhouse gas emissions, biodiversity indicators, resource indicators, autonomy of use, etc.
- Assess the reliability and relevance of information used for an environmental and social assessment.
- Be familiar with accounting, financial evaluation and multi-capital management control tools (e.g. LIFTS and CARE models).
- Transform existing assessment tools (e.g. decision matrices) by adding environmental and social criteria.
- Be aware of the limitations of the environmental and social indicators used.

[439] Seurat and Tari, *Controverses mode d'emploi*.
[440] Lallemand-Stempak and Eynaud, *Vers une autre gestion*, 112-13.
[441] Contribution of Corine Eyraud. Chiapello and Gilbert, *Sociologie des outils de gestion*.
[442] Christine Collette and Jacques Richard, *Comptabilité générale : les systèmes français et anglo-saxons* (Dunod, 2000). Cited by Chiapello and Gilbert, *Sociologie des outils de gestion*.
[443] ESCP Business School, « Energy, Business, Climate & Geopolitics », Commons For Future, accessed on 22 August 2022, https://commonsforfuture.escp.eu/energy-business-climate-geopolitics.
[444] Acquier and Peyretou, "Business education meets planetary boundaries: how to teach energy and climate in business schools?"
[445] The Shift Project, "Climate risk analysis ".
[446] Emmanuel Bonnet, Diego Landivar, et Alexandre Monnin, *Héritage et fermeture* (Éditions divergence, 2021).
[447] The Shift Project, "Climate risk analysis".
[448] The Shift Project, "Energy-climate scenarios: assessment and user guide" (AFEP, November 2019).
[449] Carbone 4, "Corporate strategy in the era of climatic emergency: Are old recipes (still) viable?" December 2021, https://www.carbone4.com/publication-strategie-analyse-par-scenario.
[450] Bonnet, Landivar, et Monnin, *Héritage et fermeture*.
[451] Entretien avec Julie Battilana. Lallemand-Stempak et Eynaud, *Vers une autre gestion*, 35-41.

- Understand the limits of management by indicators, for example by comparing the treatment of climate issues with the treatment of biodiversity issues
- Integrate the team's contribution to ecological transition in its objectives and assessment.

4. Acting individually and collectively in a responsible way

The role of managers does not end with having a prospective vision and decision making, it also lies in implementation. Leading an ecological transition requires deep transformations that are not all decided in advance and whose implementation is complex. It requires individual and collective mobilisation. Managing teams and demonstrating leadership requires the mobilisation of cognitive, emotional and social dimensions, while demonstrating creativity to reinvent organisations.

Involving one's emotions and taking into account those of others: Listening to one's emotions allows to refine or correct one's initial intuitions, with a view of acting in accordance with one's values. Knowing oneself, identifying one's emotions, also allows to understand others and to show empathy, for example during collective work. Connecting physically and emotionally to the subjects studied allows to refocus on one's values and to find the emotional resources to take action for transition.

Resources

Pédagogie de la transition, collective work coordinated by Cécile Renouard[452]

Examples

- Connect physically and emotionally to the subjects studied by meeting the people involved, by going in the field, by imagining the consequences for the territories and life, by imagining the emotions that situations would trigger in us in order to detect our own values.
- Explore literature, films, theatre, etc., to find tools to foster awareness and reconnect with one's emotions.
- Understand the defence mechanisms that can be mobilised by oneself or by others, in order to avoid succumbing to them and know how to respond to them: denial, rationalisation, displacement, refusal, overcompensation, etc.
- Apply communication methods that take into account one's own and others' emotions, such as non-violent communication.
- Be able to evolve in unstable environments, in organisations undergoing major transformations or crises.

Leading a group of people to transform organisations and the framework in which they operate: ecological transition depends on the ability to initiate and support change within organisations. To initiate action by a group, it is necessary to know how to analyse the power relationships in place, develop an influence strategy, negotiate, mobilise narratives, show leadership, and understand the levers for and the obstacles against change. Supporting change is necessarily a long-term process, hence the need to master change management techniques and set up collective and democratic governance involving all the stakeholders in the organisation. This skill applies within organisations but also externally, for the construction of regulatory frameworks relevant to ecological issues[453].

[452] Cécile Renouard et al., *Pédagogie de la transition*, Petits Manuels de la Grande Transition (Les Liens qui Libèrent, 2021).

[453] Group 2 of the IPCC thus emphasises the importance of governance with all the stakeholders to ensure resilient development in the face of climate change. IPCC, "Climate Change 2022: Impacts, Adaptation and Vulnerability".

Examples

- Apply knowledge of social psychology to the professional sphere, such as social influence: engagement theory, nudge, etc.
- Communicate in a way that enables conflict resolution and identifies the obstacles to these modes of communication: non-violent communication, Palo Alto work on paradoxical communication, etc.
- Analyse the structure of an organisation, its culture, the distribution of power, its incentive systems, in order to identify the transformations to be carried out and the methods for their implementation.
- Understand the different drivers of change in organisations and the levers to activate them.
- Know the different types of leadership and their effectiveness in implementing ecological transition.
- Build mobilising narratives to engage other inspirational forces.
- Utilise understanding of inaction (e.g., climate) to inspire action [454,455]
- Formulate jointly sectoral, national and international regulations with other actors (business groups, public authorities, trade unions, NGOs, etc.) in order to create a regulatory framework that is relevant to ecological issues.
- Apply the principles of multi-stakeholder governance to govern with a variety of actors: trade unions, public authorities, elected representatives, civil society, competing companies, etc.
- Develop the ability to adapt to working with actors from different cultures: trade unions, public authorities, elected representatives, associations, other companies, etc..

Demonstrating creativity to experiment: developing the capacity for innovation and creativity to experiment, particularly by drawing inspiration from the arts, will be invaluable for reinventing practices and organisations - beyond technological innovation alone.

Examples

- Find inspiration in artistic creation, in more frugal models (for example *low tech*[456]).
- Be inspired by innovative initiatives: companies that have changed their business model, etc. [457].
- Develop innovative solutions to the problems of environmental and social transformation of organisations, in particular by proposing organisational or social innovations, for example in the context of projects on concrete cases.

5. Demonstrating reflexiveness

This entails taking a critical look at one's own decision-making methods, decisions and actions. Adopting a reflective stance involves developing the ability to understand and question the values underlying one's decisions, and actively updating one's own knowledge.

Example

- Understand the different biases and errors of perception and attribution, in order to develop a critical look on one's own positions: rooting[458], framing[459], basic attribution

[454] Lamb et al., "Discourses of Climate Delay".
[455] Hornsey et Fielding, "Understanding (and Reducing) Inaction on Climate Change".
[456] See The Shift Project, "Training the engineer of the 21st century - Volume 1, Manifesto", March 2022, 124-25.
[457] Some of the companies that participated in the Citizens' Climate Convention may be interesting case studies: Business for Climate Convention, "A major shift towards regenerative business - Final report of the first Business for Climate Convention", accessed on 26 October 2022, https://cec-impact.org/ressource/rapport-final-de-la-premiere-convention-des-entreprises-pour-le-climat/.
[458] Tversky and Kahneman, "Judgment under Uncertainty: Heuristics and Biases".
[459] Tversky and Kahneman, "The Framing of Decisions and the Psychology of Choice".

error, halo effect, etc. *For example, study conspiracy theories and the construction of their discourses.*

E. Focus on digital technology

1. Why specifically integrate ecological issues in digital technology?

Although business graduates will each enter specific industries, it is certain that all of them will be exposed to digital technology to varying degrees: either as simple users of solutions - often becoming prescribers; or as decision-makers or consultants exposed to the digitisation of business processes; or as managers within an information systems department (ISD) and therefore decision-makers regarding solutions and their implementation; or finally as creators of solutions (digital entrepreneurs). The vast majority of them will therefore be players in what is known as the digitalisation[460] of the economy.

This digitalisation has been accompanied up to now with a large number of myths that require dismantling:

- **The first myth is that of intangibility**. The invisibility of the digital infrastructure supporting services, accompanied by ethereal terminology such as 'cloud/cloud', 'dematerialisation', or 'virtual', have cultivated the belief of a new economy without environmental impact. This is not the case: numerous studies and books[461] have highlighted the material pitfalls of the increasing use of digital technology both in terms of pressure on mineral resources (number and quantity of metals required, some of which are in competition with new renewable energies) and energy resources (including data centres), and in terms of loss of biodiversity (soil reclamation and pollution during the extraction and end-of-life phases of these mineral resources). It also has an effect on climate change (consumption of oil in the construction phase and of electricity, which is more or less carbon-based, in the use phase). Also to be taken into account is the water needed for production (extraction, for example, or the production of electronic chips) and use (cooling, for example). These impacts are growing at the same rate as that of uses, i.e. exponentially (+6% annual growth estimated for GHG emissions[462]).

[460] Digitalisation refers to the systematic digitalisation of company processes and new business models based entirely on digital technology.

[461] Mention can be made of the Shift Project reports (The Shift Project, "Towards Digital Sobriety", October 2018, https://theshiftproject.org/en/article/lean-ict-our-new-report/; The Shift Project, "Expanding Digital Sufficiency", October 2020, https://theshiftproject.org/en/lean-ict-2/.), Florence Rodhain, *La nouvelle religion du numérique* (EMS Editions, 2019)., the ADEME studies (ADEME, "Evaluation environnementale des équipements et infrastructures numériques en France", January 2022, https://librairie.ademe.fr/cadic/6700/impact-environnemental-numerique-rapport2.pdf.) and a work coordinated by Françoise Berthoud (Françoise Berthoud et al., *Impacts écologiques des technologies de l'information et de la communication : les faces cachées de l'immatérialité*, EDP Sciences, s. d.)

[462] The Shift Project, "Environmental impact of digital technology, 5-year trends and 5G governance", March 2021, https://theshiftproject.org/en/article/environmental-impacts-of-digital-technology-5-year-trends-and-5g-governance/.

- **The second is positive externalities.** The environmental benefits of digital technology could "far outweigh its drawbacks"[463] or be "essential to transition".[464]. While some uses, under certain conditions and taking into account all the effects (including rebound effects), may be positive overall, no scientific approach has been able to quantify the overall contribution of digital technology to the environment[465], no decoupling of the already heavily digitised global economy has been observed[466], and this is even less the case of the cost-benefit ratio of digital technology from the systemic standpoint, which cannot be positive without appropriate governance[467].
- **The last is the belief that all technological innovation is synonymous with social progress.** This theme is part of a very broad problem, digital technology being the glaring example. Numerous social problems linked to digital technology are emerging, such as cybersurveillance, the ethics of artificial intelligence (AI), the effects on health (especially children's health) of technologies and their uses, and the digital divide.

It is therefore necessary to provide these players in the field of digitalisation with a global perspective on the environmental and societal problems of digital technology so that they can acquire a systemic vision of it and thus become **actors in transformation that integrates digital technology in genuine sustainability.**

2. What should graduates know at the end of their education regarding the ecological challenges of digital technology?

All graduates, whatever their options and orientations, must be capable of critically analysing the uses of digital technology and at least know how to question the pertinence and impact of their choices that participate in the digitalisation of society.

Firstly, it is a question of knowing how to understand the materiality of the digital world: the information system and its relationship with the physical world, for example by explaining the life cycle of a digital service (LCA[468]). Secondly, to be able to identify the risks, both those that the digital system poses to the environment, but also those to which the digital system is exposed (double materiality approach). And, finally, to understand the dynamics underlying the growth of these risks and to be able to analyse them with a systemic approach.

[463] "(…) *the environmental benefits of digital solutions can largely outweigh their negative environmental impacts*", Commission Européenne, « Digital Solutions for Zero Pollution », 12 mai 2021, https://ec.europa.eu/environment/pdf/zero-pollution-action-plan/swd-digital-solutions_en.pdf.

[464] Guillaume Chevrollier and Jean-Michel Houllegatte, "Proposition de loi visant à réduire l'empreinte environnementale du numérique en France", Pub. L. No. 242 (2020), http://www.senat.fr/rap/l20-242/l20-2420.html.

[465] As emphasised by Gauthier Roussilhe, "Que peut le numérique pour la transition écologique ?", March 2021, https://gauthierroussilhe.com/ressources/que-peut-le-numerique-pour-la-transition-ecologique., and the 3rd workgroup of the IPCC: "*there is* medium evidence *that digitalised consumer services can reduce overall emissions, energy use, and activity levels"* (IPCC, "Climate Change 2022: Mitigation of Climate Change", April 2022.)

[466] *"Since 2015, improvements in global energy intensity have been weakening each year".* International Energy Agency (IEA), "Energy Efficiency 2019", accessed on 13 September 2022, https://www.iea.org/reports/energy-efficiency-2019.

[467] "*Digital technology supports decarbonisation only if appropriately governed* (high confidence)" (IPCC, "Climate Change 2022: Mitigation of Climate Change", April 2022.), The Shift Project, "Environmental impact of digital technology, 5-year trends and 5G governance".

[468] Through a life cycle assessment (LCA) approach, an analytical method for evaluating the environmental impact of a product or service according to several criteria (climate change, ocean and soil acidification, damage to biotic and abiotic resources, etc.).

These fundamentals, once acquired, should make it possible to understand the need for digital sobriety, to work on the paths of deployment of sobriety in companies (according to a holistic approach[469]) and explore alternative business models of digital technology.

Finally, it will be useful to acquire the necessary knowledge to be able to appreciate the real societal benefits of a digital service, its limits, risks and impacts, for example in the light of quantitative and qualitative studies of specific cases and open debate[470].

3. What are the courses and specialities in which these issues can be taught?

With regard to the possible careers and associated specialisations, the breadth and depth of the teaching suggested above may be adapted. Specialisations leading to the following careers, for example, would be well advised to offer substantial content:

- Digital entrepreneur,
- Risk manager,
- Consultant (in digital technology or strategy),
- Sales, marketing, product manager (for digital products and services),
- Digital operations (*product owner*, project manager, data analyst, purchasing service, digital information officer).

All the teaching could be attached to a transverse "Digital" discipline if it exists, or spread over various disciplines, such as:

- Economics, Strategy: digital and systemic business models;
- Entrepreneurship, Innovation, Strategy: positive externalities and cost/benefit ratios;
- Information systems management: environmental impacts (LCA), digital sobriety;
- Ethics: societal impacts of digital technology.

[469] The Shift Project, "Expanding digital sufficiency".
[470] The knowledge and skills to be acquired on digital environmental issues are detailed in the Excel spreadsheet that accompanies the knowledge and skills base, which can be downloaded from the report web page.

F. The contributions of the framework

The framework is intended to complement existing work, to which it adds a specialisation on management issues, and a part linked to knowledge of ecological issues (pre-existing work mainly focusing on skills).

Several works propose a framework of thought for teaching ecological issues, or related issues (sustainable development in particular). The framework proposed here is consistent with the reference works, as summarised in Table 2. **The framework approach makes it possible to give concrete expression to institutional reference frameworks** (CPU-CGE, UNESCO, European Union), which are broad and not specific to any one type of training.

The approach presented also proposes a set of knowledge, which is absent from the majority of reference systems often devoted exclusively to skills (apart from UNESCO's learning objectives), the bias being that a good level of knowledge about ecological issues and their implications for our societies is essential for understanding the complexity of ecological issues, and that the aim of the skills is to usefully mobilise the knowledge acquired in order to integrate it into one's professional and civic life. These two categories of elements must therefore be thought of in parallel, and are complementary and inseparable.

The elements presented are largely inspired by the work of the FORTES group [471] published in the Great Transition Manual[472] and the small manual *Vers une autre gestion*[473] with which we share the ambition to "rethink management in the era of ecological and social transition in the most collaborative way possible". This framework is an invitation for stakeholders in higher education management institutions to gather, exchange or debate on training and its relationship with ecological issues. The tool constituted by the framework is intended to serve as a support for discussion in order to fuel what will eventually be the choices of each institution.

[471] Collective of teachers and professors affiliated with the Campus de la Transition
[472] Collectif FORTES, *Manuel de la grande transition*.
[473] Lallemand-Stempak and Eynaud, *Vers une autre gestion*.

Macro-skills The Shift Project	6 gateways of the Great transition Manual	Skills DD&RS (CPU-CGE)	Learning objectives UNESCO	GreenComp skills[474]
Adopt a systemic, interdisciplinary and ethical approach	Oikos	Systemic	Systemic analysis	Systems thinking Problem framing
	Ethos	Responsibility and ethics	-	Embodying sustainability values
Develop a critical mind for envisaging desirable futures	Logos	Prospective scenarios	Anticipation	Futures literacy Exploratory thinking
	Ethos	Responsibility and ethics	Critical analysis	Critical thinking
Reflecting and deciding to trigger change	Nomos	Changes	Integrate normative resolution of problems	Adaptability
Act individually and collectively with responsibility	Praxis	Collectives	Collaboration strategy	Acting for sustainability
	Dynamis		Knowledge of oneself	Embodying sustainability values

***Table 2 – Proposal of correspondence between the skills of the Shift Project framework and those of different reference frameworks (according to the Great Transition Manual*, p. 351[475])**

[474] Bianchi, Pisiotis, and Cabrera Giraldez, "GreenComp - The European sustainability competence framework" (Joint Research Center - European Union, 2022).
[475] FORTES Group, *Great Transition Manual*.

II. A common framework of knowledge and skills for higher education in finance

A 'finance' framework of knowledge and skills complements the common framework in management by giving it a disciplinary perspective. It describes the knowledge and skills that should be taught to finance students in addition to (and not instead of) the management framework.

The knowledge and skills were identified on the basis of interviews and workshops with professors and lecturers. Interviews were also conducted with professionals in these fields. A non-exhaustive review of the literature, both academic and non-academic, was used to complete this process.

Resources

Christophe Revelli, *Finance and Economics Education in the Anthropocene Era: Embedding thourgh Sustainable Ontology*[476]

Thomas Lagoarde-Segot, *Ecological Money and Finance Exploring Sustainable Monetary and Finance Systems*

Finance professionals emphasise the lack of knowledge and skills related to ecological issues in the profession. Moreover, it seems that financial knowledge and know-how that take into account the planet's limits need to be further developed, in particular through research and practical experimentation.

The management knowledge and skills framework (see above, p. 94) answers the question: what should management students be taught in relation to ecological issues, regardless of the type of institution, programme or subjects taught? The finance framework answers the question: **what should finance students be taught in relation to ecological issues, in addition to the common management framework?**

Reminder of the management framework

Part of the answer to this question can already be found in the management framework. The purple boxes highlight the elements of this framework which importance for finance has been emphasised by professors and professionals.

Some elements of the finance framework specify elements of the common management framework by adapting them to the context of finance. For example, "applying a critical mind" is a competency from the management framework. In the finance framework, critical thinking is applied to the fundamental assumptions and postulates of finance, international accounting standards, etc.

Finally, there are also elements specific to finance that need to be taught in relation to ecological issues. For example, knowledge of French and European regulatory frameworks, and knowledge of the institutions that issue financial standards, complement the “knowledge of legal and standards system” that is part of the management framework. Depending on their complexity, this specific knowledge and skills may be used either in core courses intended for all management

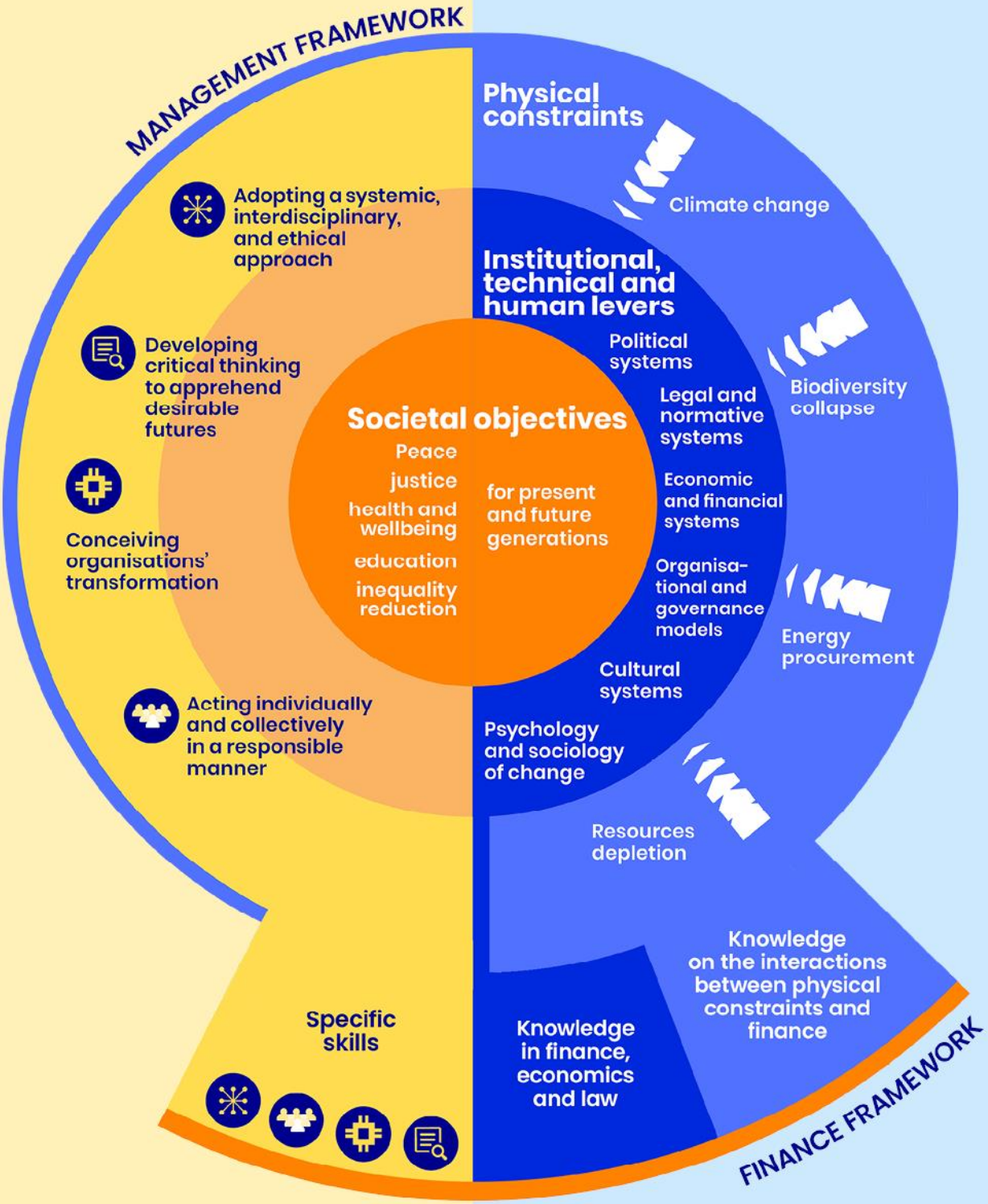
[476] Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

students or in specialised courses. It is up to the lecturers and pedagogical managers to distribute these elements between the courses and to add modules if necessary.

"MANAGEMENT" KNOWLEDGE AND SKILLS FRAMEWORK...

SKILLS FOR THE TRANSITION

KNOWLEDGE RELATED TO ECOLOGICAL ISSUES



COMPLETED WITH SPECIFIC KNOWLEDGE AND SKILLS FOR FINANCE STUDENTS

A. New knowledge requirements

1. Physical constraints and social objectives

Reminder of the management framework

A good knowledge of physical constraints and an understanding of the importance of ecological concerns for our societies are essential requirements for integrating these challenges into finance. **The consensus among the professionals and teachers interviewed emphasised the need for a clear understanding of these constraints and their profound impact on the economic and financial system.**

A fundamental aspect of this challenge is grasping the relative scales of annual greenhouse gas emissions and the remaining carbon budget, which is critical for effectively mitigating global warming to 1.5°C - 2°C.

Relations and interactions with finance

- **Understanding the role of finance in the biosphere**, its interactions with biodiversity, climate change, and planetary boundaries in general[477].
    - Understand how finance impacts the Earth system, and in particular the climate[478], the biosphere, and living organisms[479], through the financing of activities that are fossil fuel-based[480], damaging the biodiversity or leading to the depletion of resources.[481]
      Know the risks posed to financial actors by non-compliance with planetary boundaries: **physical risks, transition risks, and liability risks**[482]. For example, the risks posed by climate hazards to people and property, the historical progression of economic losses related to climate for insurance and reinsurance companies, and loss estimates based on different global warming scenarios[483,484]
    - Know the potential of finance and its limits in a world in transition and in a world that respects planetary boundaries[485]. Highlighting finance's pivotal role as a driving force for real-economy transition.[486,487,488]

[477] Lagoarde-Segot and Martinez, « Ecological Finance Theory: New Foundations ».

[478] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[479] IPBES, « Summary for policymakers of the global assessment report on biodiversity and ecosystem services ».

[480] « Banking on Climate Change - Fossil Fuel Finance Report ».

[481] Galaz et al., « Finance and the Earth System – Exploring the Links between Financial Actors and Non-Linear Changes in the Climate System ».

[482] Chenet, « Climate Change and Financial Risk ».

[483] Nyström et al., « Anatomy and resilience of the global production ecosystem ».

[484] Keys et al., « Anthropocene Risk ».

[485] Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l'intérêt général ».

[486] Institut Rousseau, « 2% pour 2°C ! »

[487] Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

[488] UNEP, « Too Little, Too Slow - Adaptation Gap Report 2022 ».

2. Financial and economic systems

Economic theories and tools

Reminder of the management framework

Knowledge of the major economic theories, the historical context of their emergence, their links with the human and social sciences, and how they do or do not incorporate physical constraints.

For example:

- **Know the differences between the German and Austrian historical schools and the neo-classical schools**. To understand their main ideas, which respectively opposed an interdisciplinary vision of economics, based on induction and refuting the idea of a universal theoretical system defining absolute laws in the social world, versus an exact theoretical science of economics, isolated from the other social sciences and based on assumptions of methodological individualism[489].
- **Know welfare economics and the Pigouvian tax, the Coase theorem,** and what these theories imply in terms of corrective action by the State and the utilitarian conception of nature. Understand the link between emissions trading and the "polluter pays" principle.
- **Know the concept of the time value of money** (*Time Value of Money*), **on which the concepts of discounting[490] and interest are based**. Understand its effects on the consideration of ecological challenges..
- **Understand the need to re-establish the material foundations of the economy**, based on the extraction and use of flow and stock resources, producing impacts on ecosystems and the climate[491, 492]. As stock resources are finite and recycling capacities limited, these stocks will eventually be irrevocably depleted[493].

- Know the **fundamental assumptions and postulates** on which economic theory is based and their limitations.
  - Critical knowledge of the theory of rational economic agents (homo economicus) and pure and perfect competition[494].
  - Be aware of the assumption of Jean-Baptiste Say, who founded modern economics, that resources are infinite and therefore not part of political economy.
- Know **the cost-effectiveness and cost-benefit analysis practices as applied to planetary boundaries** (in particular climate change), including their main differences and limitations.[495,496].

489 Lallemand-Stempak et Eynaud, *Vers une autre gestion*.

490 Pottier, « L'économie dans l'impasse climatique : développement matériel, théorie immatérielle et utopie auto-stabilisatrice ».

491 Pottier.

492 Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

493 Georgescu-Roegen, *The Entropy Law and the Economic Process*.

494 Pottier, « L'économie dans l'impasse climatique : développement matériel, théorie immatérielle et utopie auto-stabilisatrice ».

495 Pottier.

496 The Other Economy, « Doit-on donner un prix à la nature ? »

- Understand the **distinction between risk and uncertainty** according to Frank Knight, and what this implies in terms of forward-looking analyses, particularly in the light of climate change[497,498,499].

Economic policies

- **Understand how environmental concerns are taken into account by regulatory authorities and monetary institutions:** monetary policies targeting sustainable development objectives, replacing the market as the ultimate regulator of trade and the allocation of financial resources, etc.

    - Rethink growth indicators in the light of planetary boundaries (GDP limit, monetary growth model)[500].
    - Consider the effects of macroeconomic policies on planetary boundaries[501].
    - Explore different ways of looking at money, particularly in terms of its potential contribution to the ecological transition (free money, green money, alternative currencies, etc.).[502,503].
    - Know the environmental economy, degrowth and post-growth[504,505,506].

- Understand the **role of money in the economy** and its importance for the ecological transition[507], know the **principles of money creation**.
    - Know the role of bank credit in the economy.
    - Understand State financing practices and the difference between a managed financial system and a liberalised financial system (for example, between France in the 1950s and France in the 2020s).
    - Understand the concept of endogenous money[508,509], modern theories of money[510].

497 Lagoarde-Segot, *Ecological Money and Finance. Exploring Sustainable Monetary and Finance Systems*.

498 Walter, « Sustainable Financial Risk Modelling Fitting the SDGs: Some Reflections ».

499 Chenet, Ryan-Collins, and van Lerven, « Finance, Climate-Change and Radical Uncertainty ».

500 Stiglitz, Sen, et Fitoussi, « Rapport de la Commission sur la mesure des performances économiques et du progrès social ».

501 Fontana and Sawyer, « Towards post-Keynesian ecological macroeconomics ».

502 Grandjean et Dufrêne, Une monnaie écologique.

503 Lagoarde-Segot, *Ecological Money and Finance. Exploring Sustainable Monetary and Finance Systems*.

504 Tim Jackson, *Prospérité sans croissance*.

505 Herman Daly, *Économie stationnaire*.

506 Smil, *Growth: from microorganisms to megacities*.

507 Grandjean et Martini, *Financer la transition énergétique - Carbone, climat et argent*.

508 Svartzman, Dron, and Espagne, « From Ecological Macroeconomics to a Theory of Endogenous Money for a Finite Planet ».

509 Grandjean, « La “monnaie libre”, arme de désendettement massif ».

510 Galand et Grandjean, *La monnaie dévoilée*.

Physical economy

Reminder of the management framework

Know the **environmental and social challenges facing some emblematic sectors,** their impact on planetary boundaries, ways of mitigating this impact, the dependence of these sectors on the climate, on living organisms, on resources, etc., their resilience factors and any changes that are underway, planned or desirable.

- **Understand how a company can contribute to carbon neutrality.**
  - Understand the mechanisms of induced avoided[511] and negative emissions, the respective areas of application of these concepts and their limits[512,513].
  - Know the limits of carbon offsetting and voluntary carbon markets[514].
  - Understand the principle of additionality of investments, which means the ability of a funded 'green' project to generate a positive environmental impact compared to a baseline scenario.
- **Know carbon accounting methods** (carbon footprint, GHG Protocol) Understand the methodologies used for greenhouse gas emission assessments, their scope and differences.
- **Understand the different biodiversity indicators** and their materiality.
  - Understand the metrics used for biodiversity footprints, their scope and their differences. For example, Mean Species Abundance (MSA) used in MSA.km², i.e. the artificiality of one km² of a virgin ecosystem due to human activity.
  - Know of current tools for measuring the impacts and dependencies between living organisms and companies, such as CDC Biodiversité's Global Biodiversity score.
  - Be familiar with the methods used by financial institutions to measure the impact of their activities, such as the Biodiversity Impacts Analysis - GBS (BIA-GBS) or the Corporate Biodiversity Footprint (CBF).

Financial system

Reminder of the management framework

Know the **principles of ecological accounting and its field of relevance**. Be able to mobilise the appropriate resources, drawing on knowledge of the different models being developed. Understand the debates that drive them and their limitations. In particular: the idea that natural capital is an asset to be preserved and a "loan" that the user must repay (for example by rehabilitating damaged ecosystems in the case of impacts on biodiversity).

Be familiar with the concept of negative and positive **externalities**, have a critical understanding of these concepts and practices and their integration into economic models[515].

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511 Ademe, « Emissions évitées, de quoi parle-t-on ? »

512 « Net Zero Initiative ».

513 Dugast, « Net Zero Initiative : Un référentiel pour une neutralité carbone collective ».

514 Dugast, « Ne dites plus “compensation” ».

515 For further information, see : The Other Economy, « Doit-on donner un prix à la nature ? »

- **Understand the mission and role of finance in the Anthropocene** era from an anthropological, sociological, historical and political perspective.
    - History of the **development of the economic and financial system**: why was it structured as it is today?[516,517]
    - Function of finance, money, debt, financial aggregates, public and private financial institutions, financing mechanisms, market organisation, etc.[518]
- Know the **fundamental assumptions and postulates** underlying financial theory and their limitations. For example, the theory of market efficiency, modern portfolio theory, etc.[519].
- Be familiar **with the critical contribution of the social sciences to financial practices, and in particular the sociological approach to financial markets,** which demonstrates the performative nature of financial theory (for example, when the teaching of finance is reduced to the transmission of a series of techniques such as financial mathematics, asset valuation, etc., it tends to naturalise the hypothesis of the efficiency of financial markets)[520,521] .
- Know the concept of **embedded finance** through the theories of ecological economics and ecological finance[522,523].
- **Know the history of "sustainable finance", its impact** and its relative importance compared with traditional finance.
    - Know social and solidarity finance and impact finance: their pillars, their players and their performance compared to traditional finance..
    - Know the main approaches used in sustainable finance, depending on the financial players involved, and their impact and limitations[524,525,526].
- **Know the methodologies that enable a carbon-neutral scenario to be established**: *Science Based Targets initiative* (SBTi), *Net Zero Initiative* (NZI), etc.
- **Know the different methods for assessing alignment based on science-based targets.**
    - Assess the deviation from a sector benchmark: net environmental contribution (NEC), carbon impact analytics.
    - Assess the target trajectory compared to a sector trajectory: *Transition Pathway Initiative*
    - Assess the estimated trajectory based on current facilities and 5-year investment forecasts: *Assessing low-Carbon Transition* (ACT), *Paris Agreement Capital Transition* (w)

516 Revue d'économie financière, *40 ans de libéralisation financière*.

517 Chambost, Lenglet, and Tadjeddine, *The Making of Finance, Perspectives from the Social Sciences*.

518 Graeber, *Debt: The First 5000 Years*

519 Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

520 Chambost, Lenglet, and Tadjeddine, *The Making of Finance, Perspectives from the Social Sciences*.

521 Couppey-Soubeyran and al., « Dix ans après la crise financière, comment enseigne-t-on la finance ? »

522 Polanyi, *La grande transformation*.

523 Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

524 Revelli, « Re-Embedding Financial Stakes within Ethical and Social Values in Socially Responsible Investing (SRI) ».

525 Ansidei and Leandri, *La finance verte*.

526 Lefournier and Grandjean, *L'illusion de la finance verte*.

- **Know climate scenarios and stress tests concerning financial risks** linked to climate issues, their temporality and their macro-prudential and monetary implications. Understand their scope and limitations (approach players individually rather than systemically, contradictory underlying assumptions, etc.)
- Know **the main suppliers of extra-financial data (Morningstar, Moody's, etc.), their methods and their limitations**[527,528,529].
- Understand the concept of **stranded assets** and the current thinking on the various methods of getting rid of them[530].
- Understand **the development of shadow banking** and how this phenomenon is an obstacle to the ecological transition (regulation and control are difficult)[531,532].
- Know **the main non-governmental organisations** (NGOs) making proposals to reform the financial system (Finance Watch, Reclaim Finance).

Financial instruments and techniques

- **Know the main "traditional" financial products, their materiality, their risks and their impact on planetary boundaries.**
- Be familiar **with the limits of green bonds**[533] **and sustainability-linked bonds** (SLBs), blue bonds, transition bonds, etc. in terms of their practical contribution to redirecting financial flows towards projects that have a positive impact on the environment[534].
- Know **the side-effects of derivatives on the ecological transition,** in that they can mask the increasing scarcity of resources and can have an impact on financial stability (e.g. subprimes)[535, 536, 537, 538] .
- Be familiar **with materiality analysis methods** (carbon footprint, biodiversity footprint, risk exposure) that take into account dual materiality (financial materiality and impact materiality)
    - Understand that there is a wide variety of impact measurements and that measuring the impact of a fund is not yet a stable body of knowledge and remains an area of research[539].

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527 Lefournier et Grandjean.

528 Kotsantonis and Serafeim, « Four Things No One Will Tell You About ESG Data ».

529 Drempetic, Klein, and Zwergel, « The Influence of Firm Size on the ESG Score ».

530 Institut Rousseau, Les Amis de la Terre France, et Reclaim Finance, « Actifs fossiles, les nouveaux subprimes ? Quand financer la crise climatique peut mener à la crise financière ».

531 Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l'intérêt général ».

532 The Other Economy, « Le shadow banking ».

533 Ekeland and Lefournier, « L'obligation verte : homéopathie ou incantation ? »

534 Lefournier and Grandjean, *L'illusion de la finance verte*.

535 Bouleau, "Finance and Business as Usual, Blur of Price Signal, Crises of Constant Imminence, Solow's Recommendation".

536 Bouleau, « 14. Les marchés financiers sont-ils des marchés d'opinion ? »

537 Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l'intérêt général ».

538 Mackenzie, « Is Economics Performative? »

539 Agrawal and Hockerts, « Impact investing: review and research agenda ».

- Understand the principle of intentionality of impact.[540].

- Know **the abuses of securitisation** at the root of the 2008 financial crisis[541].

3. Legal and standards systems

- Know **French and European regulatory bodies** (AMF, ACPR, ESMA, etc.).
- Be familiar **with the institutions that issue transition-related financial standards**: *International Sustainability Standards Board (ISSB), the Basel Committee, the Network of Central Banks and Supervisors for Greening the Financial System (NGFS), the Financial Stability Board, the ECB, central banks and their mandates*.
- Know **French and European regulatory frameworks and international initiatives**, the main thrusts, who they apply to and the role of each player[542].

    - In France: article 29 of the Loi Energie Climat (LEC), article 173 of the Loi sur la Transition Energétique, etc
    - At international level: Task Force on Climate Related Financial Disclosures (TCFD), Task Force on Nature-related Financial Disclosures (TNFD), etc.
    - At European level: European Commission strategy for sustainable finance, *European taxonomy, Sustainable Finance Disclosure Regulation (SFDR), Markets in Financial Instruments Directive (MIFID), Corporate Sustainability Reporting Directive (CSRD)*, etc.

- **Understand European and international prudential regulations** and how they relate to each other; understand their scope of application and their limits.
- Know companies' legal obligations concerning the disclosure of non-financial information.
- Know **the main national and European labels** (Greenfin, SRI, European Ecolabel, etc.), their scope and the debates surrounding them. For example: the key points of the Inspectorate General of Finance's report on the SRI label[543] (particularly the exclusion of fossil fuels).

[540] Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

[541] Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l'intérêt général ».

[542] AMAFI, « Finance Durable - Cartographie réglementaire ».

[543] Inspection Générale des Finances, « Bilan et perspective du label "investissement socialement responsable" (ISR) ».

B. New skills requirements

1. Adopting a systemic, interdisciplinary and ethical approach

Adopting a systemic approach

- **Draw the link between the traditional economic approach and its effects on ecological issues** and, reciprocally, incorporate the challenges of physical constraints and social objectives into the economy[544].
- **Analyse the physical, transitional and accountability** risks associated with climate change, loss of biodiversity and reaching planetary boundaries in your business.

Linking the knowledge of different disciplinary fields

> **Reminder of the management framework**
>
> Know how to work with people from different disciplines and with different working cultures.

- **Leverage the critical contribution of social sciences to understand that finance is a social construct**, and deconstruct a certain scientism, i.e. the idea that the methodologies and certainties of the 'hard' sciences apply in every respect to the social sciences and constructs, of which economics and finance are a part. For example, mobilise anthropology to show the interrelationship between social, cultural and natural dimensions in human behaviour in finance (by analysing relationships to money, wealth, debt, risk, etc.)[545,546,547] .
- **Adopt a method that recognises induction** as opposed to purely formal *counterfactual* logic[548].
- **Know how to rely on the social sciences** to be able to integrate qualitative elements into financial thinking and develop the ability to make informed decisions under constraint and in situations of uncertainty.

Discerning the ethical challenges

- **Question the supposed neutrality of financial models**, and the performativity of financial technics[549,550,551].

[544] Fontana and Sawyer, « Towards post-Keynesian ecological macroeconomics ».

[545] Chambost, Lenglet, and Tadjeddine, *The Making of Finance, Perspectives from the Social Sciences*.

[546] Graeber, *Debt: The First 5000 Years*.

[547] Lagoarde-Segot, « Diversifying Finance Research ».

[548] Lallemand-Stempak et Eynaud, *Vers une autre gestion*.

[549] Boudewijn De Bruin, *Ethics and the Global Financial Crisis - Why Incompetence is Worse than Greed*.

[550] Chambost, Lenglet, and Tadjeddine, *The Making of Finance, Perspectives from the Social Sciences*.

[551] Marti and Gond, « When Do Theories Become Self-Fulfilling? »

- Understand how the mathematical structures of models can lead to poor professional practice (e.g. the Li copula) and how to overcome these limitations[552,553].
- Explain the beliefs and visions of the world and the economy underlying the different models used (for example, bank risk models, which are probabilistic and backward-looking, and stress tests, which pile up different models that are sometimes inconsistent with each other) [554,555,556].

2. Developing a critical mind to envisage desirable futures

Adopt a historical and intercultural approach

- **Understand the mission and role of finance in the era of the Anthropocene, from a historical perspective**[557].
- **Question the production of universal laws in economics** and especially in finance, based on a description of institutions and a comparative analysis of situations in space and time, and restore the full force of historical analyses[558,559].

Applying a critical mind

- **Question the fundamental assumptions and postulates** underlying financial theory through the prism of epistemology, philosophy, sociology, psychology, and history[560,561,562,563] .
- **Question the viability of financial models**, their legitimacy, and their compatibility with sustainability objectives[564].
- **Have a critical view of the general, universal** theories of finance formalised in mathematical terms - which are necessarily simplifications of the real world and can lead economics and finance not to consider new phenomena that challenge their mathematical models (e.g. the Li copula).[565,566]

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552 MacKenzie and Spears, « “The formula that killed Wall Street” ».

553 Walter, « Sustainable Financial Risk Modelling Fitting the SDGs: Some Reflections ».

554 Chenet, Ryan-Collins, and van Lerven, « Finance, Climate-Change and Radical Uncertainty ».

555 Lagoarde-Segot, *Ecological Money and Finance. Exploring Sustainable Monetary and Finance Systems - à paraître*.

556 Walter, *Le modèle de marche au hasard en finance*.

557 Secours Catholique - Caritas France, « La finance aux citoyens - Mettre la finance au service de l’intérêt général ».

558 Graeber, *Debt: The First 5000 Years*.

559 Revue d’économie financière, *40 ans de libéralisation financière*.

560 MacKenzie and Millo, « Constructing a Market, Performing a Theory: The Historical Sociology of Financial Derivatives Exchange ».

561 Walter, *Le modèle de marche au hasard en finance*.

562 Walter, « The Financial Logos ».

563 Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

564 Dron, « Pour une régulation écosystémique de la finance ? »

565 MacKenzie and Spears, « “The formula that killed Wall Street” ».

566 Dziwok and Jäger, « A Classification of Different Approaches to Green Finance and Green Monetary Policy ».

- **Adopt a critical view of climate risk models,** particularly their probabilistic approach based on analysis of the past. Understand why this is no longer relevant in a changed climate era[567].
- **Adopting a critical view of the tools used to motivate investment** such as cost-benefit analysis and discount rates, which have the effect of delaying action in favour of the climate[568,569].
- **Develop a critical look at international accounting standards** for a sustainable economic and financial system.
- **Develop a critical view of the methods used to calculate the rate of return on an investment** (net present value, internal rate of return). For example, understand that these calculations do not take into account natural or human capital, and understand that they devalue the future and induce a short-term bias.
- **Inquire into the real-world effects of economic and financial theories** (particularly on the practices of financial players).
- **Question and redefine the relevance of financial metrics**, models, and statistical indicators used as practical tools.
- Develop a critical understanding of ESG criteria, impact measurement practices in impact finance, and other extra-financial metrics[570,571,572,573,574].

Envisage desirable futures consistent with physical constraints

- **Understand the scenarios for achieving global carbon neutrality** and the implications for each sector. Understand the methodologies that make it possible to work within this framework: ACT, SBTi, and get to know the suppliers of scenarios and data.
- **Anticipate the economic sector's evolution** in the light of climate scenarios.
- **Monitor regulations,** new indicators, and new methods for integrating ecological issues into financial practice.

3. Conceiving the transformation of organisations

Question the purpose and social utility of an organisation, product, service or tool

- **Analyse financial products** to understand their impact on the ecological transition.
- **Question the tools used in finance**, such as algorithms, the assumptions underlying certain models and the accounting system.

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567 Chenet, Ryan-Collins, and van Lerven, « Finance, Climate-Change and Radical Uncertainty ».

568 Pottier, *Comment les économistes réchauffent la planète*.

569 Grandjean and Giraud, « Comparaison des modèles météorologiques, climatiques et économiques : quelles capacités, quelles limites, quels usages ? »

570 Revelli, « Re-Embedding Financial Stakes within Ethical and Social Values in Socially Responsible Investing (SRI) ».

571 Lefournier et Grandjean, *L'illusion de la finance verte*.

572 Kotsantonis and Serafeim, « Four Things No One Will Tell You About ESG Data ».

573 Drempetic, Klein, and Zwergel, « The Influence of Firm Size on the ESG Score ».

574 Gourdel et al., « The double materiality of climate physical and transition risks in the euro area ».

- **Develop a critical understanding of current methods** of calculating rates of return on an investment, the net present value (NPV), the internal rate of return of an investment (IRR), and the weighted average cost of capital (WACC).
    - Understand that these calculations do not take into account human capital or natural capital (such as depletion of resources, greenhouse gases, biodiversity, and ecosystem services).
    - Understand the calculation parameters, particularly the role of a discount coefficient which devalues the future and produces a short-termist bias.
    - Look critically at the practices of internalising any negative externalities (direct or indirect usage value, non-use value, etc.)[575].
    - Understand the benefits and the limits of price signals to reduce ecological impacts (price signals are a tool which need accompanying measures such as standards, public investment, etc.)[576].
    - Have a critical understanding of the practices of monetisation, commodification and financialisation of nature, and understand the underlying theories (substitutability, market efficiency) and the risks of under-estimation due to their incommensurability.
    - Know of and understand qualitative approaches to integrating ecological issues and guiding financial action.

Master multi-criteria assessment tools and transform existing tools

> **Reminder of the management framework**
>
> Be capable of sourcing data, of critically judging data quality, in order to inform concrete actions.

- **Use ESG data and handle databases**. Understand their boundaries and their limits.
- **Use non-financial data**, know their scope and their limits[577,578,579,580].

4. Demonstrate reflexivity

- **Question one's beliefs and practices**, adapt to changes in regulations or standards[581].

[575] For further details, see the factsheet from The Other Economy, « Doit-on donner un prix à la nature ? »

[576] Bouleau, "Finance and Business as Usual, Blur of Price Signal, Crises of Constant Imminence, Solow's Recommendation".

[577] Lefournier et Grandjean, *L'illusion de la finance verte*.

[578] Kotsantonis and Serafeim, « Four Things No One Will Tell You About ESG Data ».

[579] Drempetic, Klein, and Zwergel, « The Influence of Firm Size on the ESG Score ».

[580] Gourdel et al., « The double materiality of climate physical and transition risks in the euro area ».

[581] Bagley et al., « A Path to Developing More Insightful Business School Graduates ».

III. Avenues of knowledge and skills to be taught in finance, risk analysis, regulation and compliance, and asset management

Four occupational profiles suggest avenues of knowledge and skills to be taught to students preparing for careers in finance, risk analysis, regulation and compliance, and asset management. These occupational profiles are complementary to, and do not replace, the management framework or the finance framework. The four career paths were selected on two criteria: they are specific to finance, and they impact, and/or are impacted by, the ecological transition.

For the four career paths, the occupational profiles provide:

- Knowledge adding to the management framework and to the finance framework, primarily aimed at students in specialisation;
- Skills in addition to those of the management framework and of the finance framework, or which refine them.

The knowledge and skills were identified based on interviews and workshops with professors and lecturers. Interviews were also undertaken with professionals in these fields. Four working groups were created, comprising Shifters who are professionals in these career sectors. Lastly, a non-exhaustive review of academic and non-academic literature completed the venture.

The occupational profiles refine and complete the "discipline" perspective provided by the finance framework (p.138). They answer the question: what should be taught to students preparing for careers in finance, for example, about ecological issues?

> **Reminder**
>
> *This question is already partly answered in the "management" framework or in the "finance" framework. Elements of these foundations are highlighted in purple when professors and professionals emphasised their importance for the career in question.*

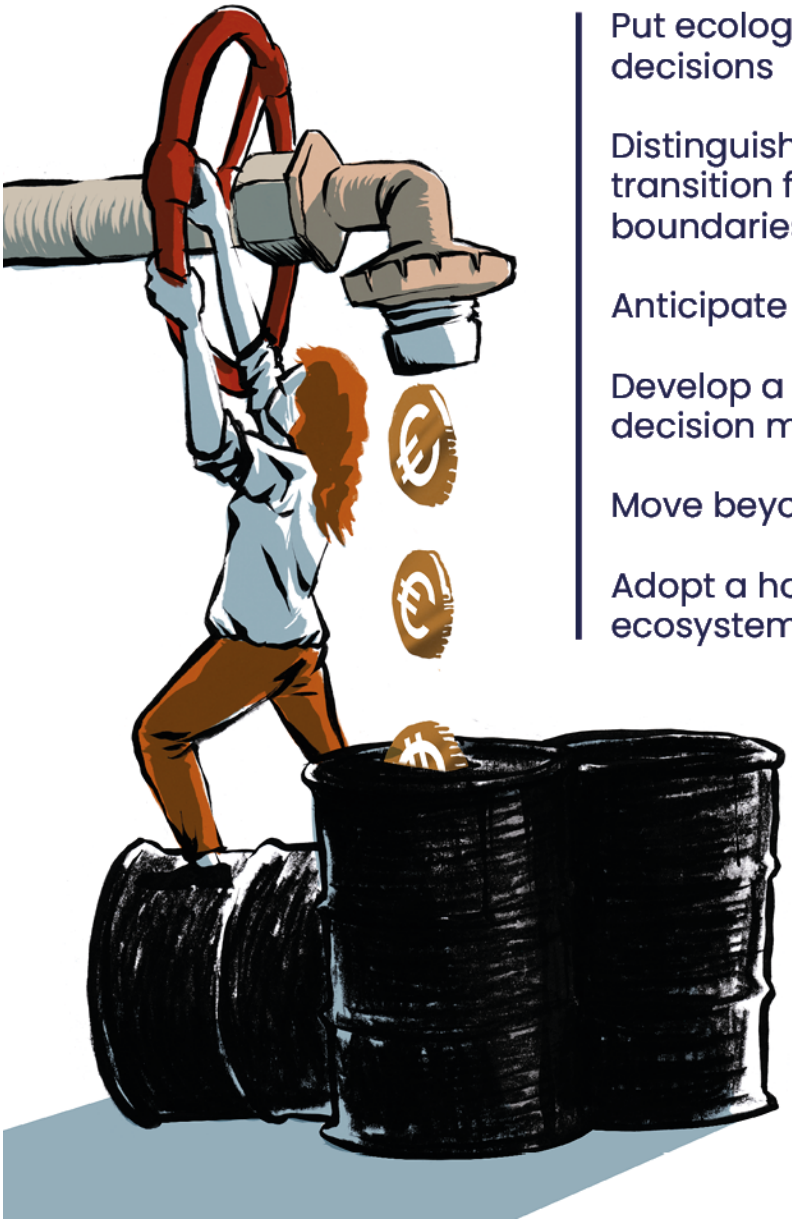
OCCUPATIONAL PROFILE

PROJECTS AND BUSINESSES FINANCING

Role in the ecological transition

- Finance ecological transition
- Decline harmful investments
- Rethink the paradigm of risk vs profitability

Examples of knowledge and skills



- Put ecological issues at the heart of financing decisions
- Distinguish an asset that enables ecological transition from one that is harmful to planetary boundaries
- Anticipate new risks
- Develop a critical understanding of investment decision methods
- Move beyond monetary profit as the sole objective
- Adopt a holistic vision of the actor and his local ecosystem

1. The role of players financing projects and businesses in taking account of ecological issues

Project and business financing professions are central to the finance sector, and involve a wide range of public, private and citizen stakeholders: public finances (the State, public administrations, local authorities); European funds such as the European Regional Development Fund (ERDF); development banks such as AFD; public investment banks, private banks, corporate finance, asset management in some cases, but also private funds such as corporate foundations, public interest foundations, etc. Alternative financing such as crowdfunding and microfinancing are also concerned.

Financers play an important role in the ecological transition, since they are at the heart of the decision to allocate capital to projects and businesses that commit society to a trajectory which is more, or less, consistent with planetary boundaries. As such, it is their responsibility to truly understand the nature of projects they consider for financing, and their ecological impacts. More fundamentally, they must identify the limitations of conventional decision-making tools in integrating the long-term timeframe, including irreversible ruptures, which are a feature of ecological issues and the risks they entail. In this regard, they have the opportunity to be part of the necessary evolution of financing practices, to redirect investment flows towards the ecological transition. Irrespective of these developments, they must renounce ecologically harmful financing.

a. Understand the ecological impact of projects

To be capable of making an informed decision, those involved in financing must consider the beneficial or harmful nature of a project for the ecological transition. To do so, they must be able to use project analysis tools and methodologies beyond those of the financial field. For example, life-cycle analyses show the ecological impact of goods, services, or processes throughout their value chain by collating and quantifying the physical flux of materials and energy over their entire life-cycle[582]. Another example involves using the carbon balance, and comparing the assessment of an activity in advance of a given project with the projected assessment after completion of the same project. In the field of finance, the European Union's green taxonomy can also be an indicator of what constitutes an ecologically sustainable activity. It is equally important to be aware of potential carbon lock-ins, linked to financing infrastructures or technologies which lock an entity into a certain carbon trajectory for a long period.

A project should be analysed in its global context: in which employment pool, or social and environmental ecosystem, will it participate? This holistic analysis is useful to assess whether a project is desirable, considering its local context. For example, should snow cannons be financed in a ski resort? This question will be answered differently if we consider projected global warming, and conflicts around access to water, which will not be available for inhabitants of the valley or for agriculture if it is stored for snow cannons.

Finally, the players behind these projects should be taken into account, for example by evaluating the credibility of a company's environmental commitments in view of its previous trajectory, its promises, and the means allocated to achieving them. Those involved in financing can be assisted with this by sectoral methodologies such as, for climate purposes, *Assessing*

[582] Extraction of the energy and non-energy raw materials needed to manufacture the product, its distribution, use, collection and disposal at end-of-life, as well as all phases of transport. For more information, see Ademe, « Qu'est-ce que l'ACV ? »

Low-Carbon Transition (ACT), *Science Based Target initiative* (SBTi) and, for biodiversity, *Mean Species Abundance* (MSA) from IPBES, *Global Biodiversity Score* (GBS) by the biodiversity branch of the French Caisse des Dépôts et Consignations, and Iceberg Data Lab's *Corporate Biodiversity Footprint* (CBF). Some banks, particularly development banks, work to accompany the players they finance in order to influence their consideration of ecological issues.

The funder of a project has a responsibility to judge its worth based on its impact on the climate and biodiversity, on the resources used, their criticality, and any potential conflicts of use.

b. Identify the limitations of conventional decision-making tools

Tools which are traditionally used for funding decisions do not take adequate account of ecological issues. This results in under-funding of transition-related projects, and over-funding of environmentally-harmful projects.

Assessing the profitability of projects does not allow ecological issues to be taken into account.

The profitability of projects is calculated by discounting their related future cash flows. This discounting method has several limitations in terms of taking ecological issues into account. Firstly, all decision-making parameters are related to a monetary value. However, **a stable and liveable climate, and preserved biodiversity are immeasurable material services**. Attempting to put a monetary value on a unit of climate or a unit of biodiversity is based on the assumption that it is possible to substitute a monetary value – a social construct – for the conditions permitting the appearance of life on earth – which is governed by the laws of physics and biology. **Neither can this method capture the threshold effects induced by global warming.** With the acidification of oceans, to which project should the disappearance of the Great Barrier Reef and its associated life forms be attributed? **Lastly, it fails to take account of the inertia of Earth's system, which requires that difficult decisions be taken now, in order to avoid long-term catastrophic damage**. And yet, this calculation is used to assess the internal rate of return (IRR) and the net present value (NPV), which play an important role in financing decisions. The same limitations apply to assessing externalities with a view to internalising them.

Project risk management must evolve to take account of ecological issues

Those involved in project financing need to understand the impact of ecological issues on risk-analysis methods. Specifically, they need to understand the limitations of the probabilistic backward-looking approach and the interaction between financial risks and those induced by ecological issues (see the risk-analysis profession sheet below for a detailed explanation). These are emerging risks, which will certainly multiply. They are likely to intersect (feedback loops) and will not necessarily all be predictable. This requires skills of decision-making under uncertainty, in the same way as risk-analysis professions. These skills will be based on multi-disciplinary knowledge, along with qualitative assessment.

Tools used to assess the profitability and risk of projects need to be updated to truly integrate ecological issues in the process of investment decisions. **Reallocating financial flows towards projects for the ecological transition therefore requires an evolution in practices, which would benefit from academic research.** Unless they succeed in rapid internal reform, financial actors will find themselves facing increasingly stringent reglementary constraints to finance the

transition, and an increasingly unstable economic environment, due to the growing consequences of exceeding our planetary boundaries (such as extreme climate events, famines, wars, etc).

c. Helping to develop financing practices

Much of the investment needed for the environmental transition is not profitable in a market economy. This includes for example ecological restoration, environmental upgrades, etc. Public financial intermediaries, such as public investment and development banks, already play a major role in "financing large and long-term projects, and those generating positive externalities". They offer subsidies and can act as financial catalysts. These actors are one of the ways in which the State can fulfil its role as insurer and risk-taker[583]. **Therefore, skills already exist. They need to become widely available in the public and private sectors, and to rigorously take account of planetary boundaries**[584].

Respect for planetary boundaries must become a priority when financing decisions are taken by public and by private actors. As well as intrinsically non-profitable projects, we must also fund numerous projects which are favourable to the transition even though less profitable than fossil-fuel equivalents.

Ethics must once again play a role in funding decisions. This means questioning the socio-ecological utility of each project. For example, a funder would find it difficult to select a project, regardless of its profitability, if ecosystem destruction were in the balance (and they were capable of appreciating this), despite an undeniable profitability in the short term.

Financing practices which are more respectful of planetary boundaries do exist, yet they struggle to become widespread. However, finance as a whole need to come into line with ecological issues, so an upgrade to the next level is therefore necessary.

d. Renounce ecologically harmful financing

Public and private actors in financing must commit to stop supporting ecologically harmful projects. Regarding the climate for example, the IEA has called for a termination of investment in new oil and gas facilities[585]**.** Numerous financial institutions have made commitments in this regard. Certain executive committees are committed to defining clear guidelines concerning the type of environmentally damaging projects and businesses which must be denied all funding. At the same time, practices to accompany project or business developers towards alternatives which preserve natural capital are encouraged. Unfortunately, these initiatives remain in the minority and numerous banks continue to finance fossil fuels on a massive scale[586].

Furthermore, it is the role of public institutions to indicate to private actors which investments should be avoided, and to set an example by refusing to finance projects and businesses which are not in line with the transition.

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583 Plihon et Rigot, « Acteurs Financiers Publics, Un Rôle Stratégique Face à La Transition Énergétique ».

584 The subsidy, donation and philanthropy professions are operated by public banks, public administrations, ministries, local authorities, development funds such as the ERDF, corporate foundations, public interest or public utility foundations. These professions involve the same type of work as in corporate finance, analysing the substance of projects, except that the objective is the common good rather than profitability.

585 International Energy Agency (IEA), « Net Zero by 2050 - A Roadmap for the Global Energy Sector ».

586 Rainforest Action Network et al., « Banking on climate chaos. Fossil fuel finance report 2022 ».

Systemic banks also have a major responsibility. Their weight in the economy gives them *de facto* great influence and major responsibility. Yet like all private businesses, they have a duty to maximise shareholder value. In this context, how can they abandon profit-seeking to make choices favouring the ecological transition, without a clear framework set by public authorities?

Customers also have a role to play. Yet due to the lack of traceability, most banking customers have no idea of the role played by their savings which are used to finance harmful activities.

The necessary improvements to the system of financing are massive and require the efforts of all players: though financial institutions have a central role, shareholders must also forego part of their financial profitability; customers must be able to allocate savings in the knowledge of what they will finance; and the State must impose and enforce a framework allowing for the respect of planetary boundaries.

2. New knowledge requirements

a. Physical constraints and social objectives

> **Reminder**
>
> Make the link between physical constraints, social objectives, their implications for the company, and investment strategies.

- **Be familiar with the technical elements which make it possible to distinguish between an asset which is harmful to planetary boundaries and one that enables transition.** For example:
    - Be aware of, and able to work with, the concepts of carbon budget, financed emissions, difference between greenhouse gases, understanding of scopes 1, 2 and 3, greenhouse gas balance, the principal sectors contributing to emissions and by what order of magnitude.
    - Understand the issues surrounding resources, their sources, how they are exploited, their criticality, the sectors using them, their impacts, their relative prices, etc.
    - Understand biodiversity issues, know how they can impact the value chain of certain sectors (agribusiness).
    - Know the risks of the industrial transition for the main sectors of the economy, and the associated social risks.

b. Economic and financial system

> **Reminder**
>
> **Be aware of the orders of magnitude of the impact of different sectors of the economy on biodiversity, the climate, resource depletion.**

Know the principle of dual materiality, i.e. the company's dependence on the environment (financial materiality) and its impact on the environment (impact materiality or environmental and social materiality)[587].

Develop a critical understanding of current methods of calculating rates of return on investment, net present value (NPV), internal rate of return on investment (IRR), weighted average cost of capital (WACC).

Understand how a company can contribute to carbon neutrality: understand the mechanisms of induced, avoided and negative emissions and their limits; know the limits of carbon offsetting and carbon finance.

Understand biodiversity indicators and their materiality: understand methodologies used for biodiversity footprint, their scope and their differences.

Know the principles of ecological accounting[588,589] (particularly the concepts of ecological and human capital), question the triple bottom line using the triple depreciation line[590, 591].

- **Know the main financing tools, their materiality, their risks, and their impact on planetary boundaries.**
    - **Know the tools of sustainable financing** (green bonds, impact loans, etc.) their areas of application, their limits and their impacts. Understand the topic of intentionality and additionality of investments, and effective impact[592].
    - **Know the various types of responsible financing**, what they are used for, who they are aimed at, and how they work: crowdfunding, ethical finance, social banking.
- **Understand the role of public investment and development banks** in financing projects that generate positive environmental impacts.
- **Understand the principle of risk-weighted assets (RWA), such as the green and brown weighted factor** and the scope of application of these supports and disincentives to investment depending on the type of project or business.
- **Understand methods to assess long-term strategies to lower emissions at the level of a company or a financial portfolio.**
    - Know the various methods of evaluating the alignment of science-based targets. For example: evaluation of the deviation from a sector reference, evaluation of the target trajectory compared to a sectoral trajectory, evaluation of the estimated trajectory in relation to current facilities and projected investment over 5 years.
    - Understand the Paris Agreement Capital Transition Assessment (PACTA) method for bank loans.

[587] BL Evolution, « Double matérialité : comment appréhender ce nouveau principe et quelles implications pour le reporting extra-financier ? »

[588] For example the CARE (Comptabilité Adaptée au Renouvellement de son Environnement), LIFTS (Limits and Foundations Towards Sustainability), and SeMA (Sense-Making Accountability) models, etc.

[589] Rambaud and Chenet, « How to Re-Conceptualize and Re-Integrate Climate Finance Into Society Through Ecological Accounting? »

[590] Rambaud and Richard, « The “Triple Depreciation Line” instead of the “Triple Bottom Line”: Towards a genuine integrated reporting ».

[591] Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

[592] Revelli, « Re-Embedding Financial Stakes within Ethical and Social Values in Socially Responsible Investing (SRI) ».

- **Understand methods of assessing the impact of companies and investments on biodiversity**, as developed by the mean species abundance (MSA) for example.
- **Understand strategies for the preservation of nature** and tools to measure prospective biodiversity footprint, to integrate them in financing decisions for projects with potential impact on biodiversity.

c. Legal and standards systems

- **Know the Equator principles**[593] (identification of environmental risks), the **Poseidon principles** (maritime transport), etc, in project financing.
- **Understand European taxonomy:**
  - **Knowledge of its six objectives** (mitigation, adaptation to climate change, sustainable use and protection of water and resources, protection and restoration of biodiversity and ecosystems, pollution prevention and control, transition to a circular economy) and what they imply for financing of projects and businesses.
  - **Knowledge of the "Do No Significant Harm" concept**, which requires avoiding significant harm to any of the EU's six environmental objectives. For example: hydro-electric dams may supply low-carbon electricity but are problematic for biodiversity.
  - Understand the calculation of the green share in relation to European taxonomy.

[593] Equator Principles, EP4.

3. New skills requirements

a. Adopt a systemic, interdisciplinary and ethical approach

Combine knowledge from different disciplines

- **Know how to consult or collaborate with technical experts** in order to mobilise their skills to assess, among other things, the viability of a project in terms of planetary boundaries and the benefits of investing in it. Understand the challenges and limits of such cooperation (divergent interests in particular).
- **Question the relevance of financing a project, product or business** in terms of the resources to be mobilised, their criticality, potential conflicts of use, and usefulness.
- **Measure the alignment of loan portfolios with climate scenarios**, especially using the PACTA method[594].

Understand ethical issues

> **Reminder**
>
> **Question the type of society favoured by funding decisions**: improvement in health, effect/impact on biodiversity and on climate change, reduction in inequality, etc.
>
> **Identify one's areas of responsibility** in relation to funding decisions.

- **Incorporate concepts of philosophy and ethics in financing**, so that each project or business funded has been validated by comparing its true economic utility with the environmental damage it entails.

b. Developing a critical mind to envisage desirable futures

Applying a critical mind

- **Question the use of discount rates** in investment decisions, because of their tendency to favour the present over the future[595].
- **Question fiduciary duty** in the light of ecological issues.
- **Question practices of assessing the economic value of nature**[596].

Envisage desirable futures which are consistent with physical constraints

- **Monitor** new "sustainable" long-term financing practices.
- **Monitor methods for integrating the value of carbon and of biodiversity in companies' balance sheets**, such as carbon-adjusted EBITDA[597].

[594] Paris Agreement Capital Transition Assessment.

[595] Pottier, *Comment les économistes réchauffent la planète*.

[596] The Other Economy, « Doit-on donner un prix à la nature ? »

[597] Axylia, "Vérité 40 Index".

c. Conceiving the transformation of organisations

Question the purpose, and the social utility, of a company, a product, or a service

- **Distinguish between a project or business that is harmful to planetary boundaries and one which enables transition.**
- Discern the actual impact of a project or business on planetary boundaries.
- Know how to establish whether a business or project is consistent with the requirements of the green taxonomy.
- Assess the relevance of funding infrastructure, in terms of locked-in emissions, i.e. future greenhouse gas emissions over the lifetime of the infrastructure, caused by decisions taken today.

Incorporating a strategy or business model in a context of physical constraints

> **Reminder**
>
> Making decisions in a situation of uncertainty, using a scenario-based approach.

- **Put ecological issues at the centre** of the financing decision.
- **Integrate the impact on planetary boundaries** into the assessment of an investment's internal rate of return (IRR), weighted average cost of capital, WACC, or net present value (NPV), while being aware of the limits of the principle of environmental externality.
- **Analyse a green project to obtain a green loan:**
  - Identify the relevant indicators to negotiate with project sponsors to justify whether or not investments have a positive ecological impact.
  - Know how to monitor them over time.
- **Adopt a comprehensive view of the company, its activity and the ecosystem in which it operates**: its current activities and future trajectory, its objectives for decarbonisation and to reduce its impact on the Earth system, the socio-economic system in which it operates, to understand the risks of an investment and be able to assess its long-term impact correctly.
- **Know how to set up and monitor green covenants (commitment to do's and don'ts)** to ensure that financed projects respect planetary boundaries[598].

[598] Equator Principles, EP4.

Mastering multi-criteria assessment tools and transforming existing tools

Reminder

Be able to source data and make critical judgements about data quality in order to inform concrete actions.

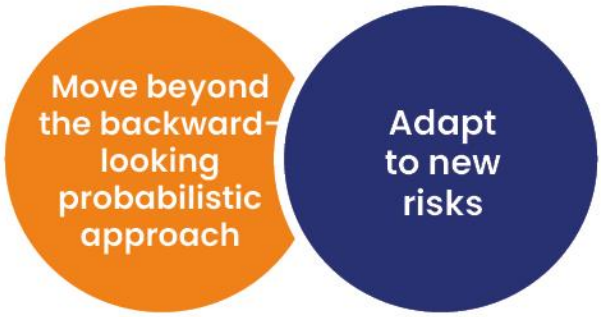
Know how to use non-financial data relating to biodiversity, climate and resource depletion impacts.

- Know **how to carry out due diligence for a project linked to the energy transition, to infrastructure funding, etc.**
- Develop and generalise **tools that focus the financing decision on the project or company's impact on planetary boundaries.**
- **Carry out a conscientious assessment of the ecological impact of an activity, and ensure compliance with the *Do No Significant Harm* principle.**

OCCUPATIONAL PROFILE

RISK ANALYSIS

Role in the ecological transition



Examples of knowledge and skills

Understand the risks linked to ecological stakes (climate, biodiversity, resources) and its intersections with classic financial risks (credit, market, liquidities, ...)

Conduct scenario-based analyses using both quantitative and qualitative, analytical information

Design and executing climate stress tests that embrace a systemic perspective.

Integrate the double materiality approach into one's analyses (financial and impact materiality)

1. The role of risk analysts in taking ecological challenges into account

Risk management is at the very heart of the finance profession, whether it is in banking, insurance or private equity. As a matter of fact, finance allocates financial flows as a function of the anticipated risk-return trade-off, the objective being the optimisation of the risk according to the expected return, and vice versa. Risk analysis also plays a key role in the insurance business, in order to forecast the probability of losses and calculate the level of insurance premiums.

a. Go beyond the probabilistic *backward-looking* approach

Risk analysis in finance is based on a backward-looking approach, via the extrapolation of historical data. The underlying idea to this extrapolation is one of continuity between past, present and future. As an example, this is the basis of the Basel III prudential regime, which defines banks' capital requirements on the basis of risk as the latter has materialised in the past[599].

However, ecological challenges are subject to non-linear and unpredictable changes. This implies that from now on, **probabilities of future risks occurrence can no longer be based solely on the analysis of the past**. Exceeding planetary boundaries thus marks a break with the extrapolative probabilistic approach that is at the heart of the notion of risk.

The whole notion of risk, central to finance and particularly to risk analysis, needs to be reassessed. We have entered an era of radical uncertainty in Knight's sense of the word[600], for which future possibilities are neither known nor modelled in terms of probability. Yet the tools of finance were developed to manage risk, not radical uncertainty.

It is thus about understanding that the metrics and methods used in financial decision-making, formulated for the notion of risk, are no longer relevant. Moreover, « the difficulty of breaking with the dogma of precise, systematic quantification as a justification for public action creates a "**bias towards inaction**[601]"». In this context, these tools need to evolve in order to understand uncertainty. As a result, finance professionals need to acquire skills for decision-making under uncertainty.

«Making decisions in a situation of radical uncertainty calls for the acceptance of more forward-looking, qualitative and analytical methodologies, giving up probabilistic approaches such as those based on scenario analysis[602].» Additionally, the decision must be guided by moral considerations, keeping in mind the well-being of future and present generations around the globe[603].

b. Taking ecological challenges into account to better apprehend the financial risks

Traditional financial risks have become even more complex in the face of ecological challenges, for the climatic related ones in particular. Risk analysts must prepare regarding these

599 Lagoarde-Segot, *Ecological Money and Finance. Exploring Sustainable Monetary and Finance Systems - not published at the time of writing*.

600 Frank Knight developed the concept of radical uncertainty, as opposed to risk. Risk can be measured by calculating probabilities, whereas radical uncertainty cannot. Find out more « Qu'est-ce que « l'Incertitude radicale ? » («What is «Radical Uncertainty »? »)

601 Lagoarde-Segot, *ibid.*

602 Lagoarde-Segot, *ibid*.

603 Lagoarde-Segot, *ibid*.

developments in their risk analysis, at the intersection between traditional financial risks and ecological issues. Below are a few examples of these intersections, which are by no means exhaustive.

Credit risk is the risk that a borrower will not repay all or part of their loan in the agreed upon timeframe. The intersection of this risk with climate change was for example materialised in the winter of 2021. An extreme cold snap, the severity of which was linked to climate change[604], hit Texas. This led to a series of failures in the electrical system, resulting in long power cuts for 10 million people, an increase in the cost of electricity up to 10,000 US dollars and the bankruptcy of four companies and public services[605].

Market risk is the risk of variations in the value of financial instruments. The consequences of exceeding planetary boundaries have increasingly unpredictable impacts, which can affect the value of these instruments (a company's shares or bonds, the price of raw materials, etc.)

Liquidity risk, corresponding to the ability to buy or sell certain financial instruments, may vary suddenly. The ability of companies, particularly financial institutions, to raise cash flow on the markets could be suddenly impacted by large-scale ecological phenomena, which are difficult to predict at present.

Operational risk is the most obvious impact to consider. It covers the direct physical impact of a climatic phenomenon (e.g. Hurricane Irene in New York City), as well as the indirect impact of a chain failure of physical systems leading to a failure of a financial market (e.g. the polar vortex in Texas).

Model risk represents the potential losses incurred by an institution as a result of decisions based on models. Financial markets operate widely by anticipating the future values of financial instruments (such as the present value of future net cash flows) or by anticipating the behaviour of counterparties (ability to repay a debt for example). Many activities make use of more or less complex models to estimate values and their probabilities, to help make decisions or form prices. These models are largely based and calibrated on the observation of past values and phenomena, as well as on established logics. Climate change and biodiversity loss can greatly disrupt these approaches, by introducing uncertainty, variability, different causality and so on.

Data and technology related risks are not, in principle, directly impacted by ecological challenges. The type of risk relating to technological assets is potentially more related to operational risks (such as flooding or fire in data centres). One of the data-related challenges would be for example to integrate the impacts of climate change into financial market data. Furthermore, the transition will require the termination of certain activities and therefore generate closure technologies[606]. These risks relating to the place of certain technologies in the transition may be more predictable than other financial risks.

In the field of insurance, IPCC experts note the risk of under-insurance. This is justified in particular by the different risk perceptions of policyholders and insurers, which can lead to contrary assessments of premium levels and consequently to under-insurance[607]. The business models of insurance companies will necessarily be impacted by the systemic effects of climate change. Providing appropriate insurance products will therefore be a challenge for the sector[608].

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604 Henson, « Climate Change May Have Worsened Deadly Texas Cold Wave, New Study Suggests ».

605 Busby et al., « Cascading Risks: Understanding the 2021 Winter Blackout in Texas ».

606 Bonnet, Landivar, et Monnin, *Héritage et fermeture, une écologie du démantèlement (Heritage and Closure, an Ecology of Dismantling)*

607 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

608 Intergovernmental Panel on Climate Change (IPCC).

Similarly, the risks of environmentally sustainable investment are perceived as high, due to developing technologies or the lack of credibility of public policy commitments. Their yield is not just financial, it is also ecological and social, since it benefits society as a whole. Conversely, the risks of carbon-based investments are structurally undervalued by the financial markets, since they are based solely on financial return without including ecological impacts. Extrapolating from the past, these investments are not analysed using a forward-looking approach[609].

2. New knowledge requirements

a. Physical constraints and social objectives

- **Knowing the technical elements that make it possible to distinguish an asset which is harmful to planetary boundaries from one that has a neutral impact or is favourable to the transition**. For example:
    - Carbon budget, financed emissions, difference between greenhouse gases (GHG), understanding of scopes 1, 2 and 3, greenhouse gas emissions balance, main sectors contributing to emissions and by which orders of magnitude.
    - Understanding the issues associated with resources (energy and non-energy), where they come from, their criticality, how they are exploited, which sectors use them, what the ecological and social impacts are, what the relative prices of resources are, etc.
    - Understanding biodiversity issues and how they can impact the value chain in different sectors (e.g. agribusiness, pharmaceuticals).

- **Understanding the concepts of climate forecast modelling** and knowing how to interpret the underlying assumptions.

b. Economic and financial system

> **Reminder**
>
> Understand the principles of double materiality, i.e. that financial players have an impact on planetary boundaries and that they are affected by the risks associated with exceeding these limits.
>
> Knowing the different types of risk linked to ecological challenges (climate, biodiversity, depletion of resources, reaching planetary boundaries), the risks weighing on financial players are linked to these issues (physical, transition and liability). Consider the possible intersections of these risks linked to ecological challenges with traditional financial risks (credit, market, liquidity, etc.)
>
> Knowing the orders of magnitude of the impact of the different sectors of the economy on biodiversity, the climate and the depletion of resources.

- **Understanding the limitations of the traditional financial risk framework** in taking ecological issues into account.

[609] Lagoarde-Segot, *Ecological Money and Finance. Exploring Sustainable Monetary and Finance Systems - not published at the time of writing.*

- Understanding risk analysis methods and why the traditional framework does not capture the risks arising from ecological issues (backward looking approach)[610].
- Understanding that mathematical risk models are based on assumptions and technical, historical and social foundations[611].
- Understanding that the intersection of traditional financial risks and the risks associated with ecological issues is dynamic and can change over time.

- **Be familiar with the different types of uncertainty**: probabilistic uncertainty (extrapolation of risk into the future on the basis of historical data) and radical uncertainty in Knight's sense of the word[612] (when there is no calculable probability of a specific future occurrence).
- **Understanding non-financial risk analysis.**
  - Be familiar with the main suppliers of extra-financial data, their methods and limitations[613,614,615]
  - Understanding the value of the dual materiality approach (financial materiality and impact materiality) in taking risks into account[616]
- **Familiarity with risk assessment tools** for ecological issues, such as ClimINVEST for the physical impacts of climate change.
- **Understand the principles of climate stress tests**, knowing their scope, the models they use, the underlying macroeconomic frameworks and their limitations (especially considering the fact that some tools are used but were not designed for these applications).
- **Understanding Value at Risk (VaR) calculation models** and how they do not apply to climate risks.

c. Legal and regulatory systems

- **Be familiar with the main regulations that affect the way financial institutions take account of the risks associated with ecological issues** (the Basel III regulation for example) and their limits.
- **Familiarity with the ISO 14091 standard** on climate change related risk assessment.
- **Familiarity with the ISO 14090 standard** on the management of adaptation to climate change.

610 Chenet, Ryan-Collins, et van Lerven, « Finance, Climate-Change and Radical Uncertainty ».

611 Walter, *Le modèle de marché au hasard en finance*.

612 Knight, *Risk, uncertainty and profit*.

613 Lefournier and Grandjean, *L'illusion de la finance verte*.

614 Kotsantonis and Serafeim, « Four Things No One Will Tell You About ESG Data ».

615 Drempetic, Klein, and Zwergel, « The Influence of Firm Size on the ESG Score ».

616 Gourdel et al., « The double materiality of climate physical and transition risks in the euro area ».

3. New skills requirements

a. Adopting a systemic, interdisciplinary and ethical approach

Adopting a systemic approach

- **Understanding the interrelationship between the risks associated with ecological issues** (currently considered in silos) **and their implications in terms of systemic financial risks.**
- **Understanding the interrelationship between ecological issues related risks and the various types of financial risk.**
- **Know how to analyse the technical, historical and social foundations of the mathematical models used for risk analysis, and question their relevance to the contexts in which they are used.**[617].

b. Developing a critical mind to envisage desirable futures

Applying a critical mind

- **Develop a critical view of the methods used to assess the risks** associated with ecological issues.
- **Convince oneself of the relevance of the indicators to be taken into account** in a risk analysis, and the analysis methods to be used.

Envisioning futures that are desirable and consistent with physical constraints

- **Knowing how to carry out scenario-based risk analyses, based on qualitative, quantitative and analytical information.** Understand the benefits of such an approach.
- **Monitor** developments of practices and models in insurance, reinsurance and risk analysis.

c. Conceiving the transformation of organisations

Incorporating a strategy or business model in a context of physical constraints

- **Analyse the risks associated with ecological issues in different sectors and companies** (including their value chain), combining quantitative and qualitative risk analysis[618].
  - For example, at a company level, knowing how to map processes and the associated risks, identifying the organisation's vulnerabilities to the various climate risks, etc.
  - Analysing the sources and consequences of risks
- **Integrate the dual materiality approach** (financial materiality and impact materiality) into one's analyses[619].
- **Model the risks associated with ecological issues,** knowing how to deal with the uncertainty inherent in the occurrence of extreme climatic events and no longer relying solely on risk analysis based on observation of the past.

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[617] Walter, *Le modèle de marche au hasard en finance*.

[618] The Shift Project et Afep, « Scénarios énergie-climat - évaluation et mode d'emploi ».

[619] Gourdel et al., « The double materiality of climate physical and transition risks in the euro area ».

- **Define a risk management and permanent control system** by identifying processes, owners and risk scenarios that take into account ecological issues. Identify first-level controls and the implementation of second-level controls to cover these risks.
- **Apply rating modulation methods according to the vulnerability of the investment,** in particular via risk weighted assets (RWA), the green weighting factor or the brown penalising factor.

Mastering multi-criteria assessment tools and transforming existing tools

- **Carry out in-depth due diligence on a company's risks** related to ecological issues, without relying exclusively on public documents.
- **Know how to assess the quality of extra-financial data.**
- **Design and carry out climate stress tests**, taking into account the long time horizons over which the effects of climate change are expected to become stronger.
- Develop coherent tools for this type of exercise, embracing a systemic, macro vision, and not just a micro vision at the level of financial institutions alone.
- **Define the governance for monitoring the various risks associated with ecological issues.**

OCCUPATIONAL PROFILE

REGULATION AND COMPLIANCE

Role in the ecological transition

- Assess the tangible impacts of the controlled activities
- Evolve regulation to consider planetary boundaries

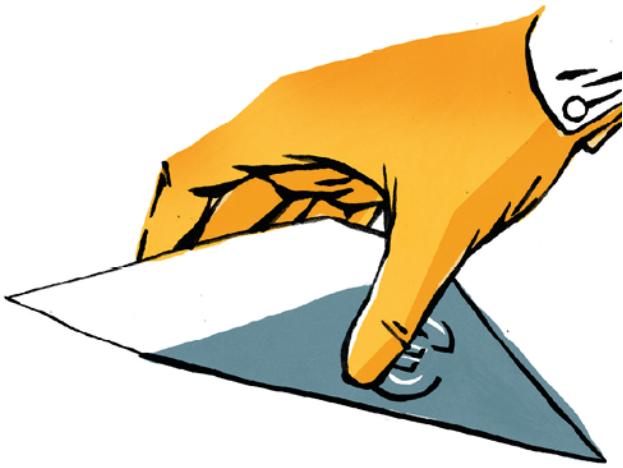
Examples of knowledge and skills

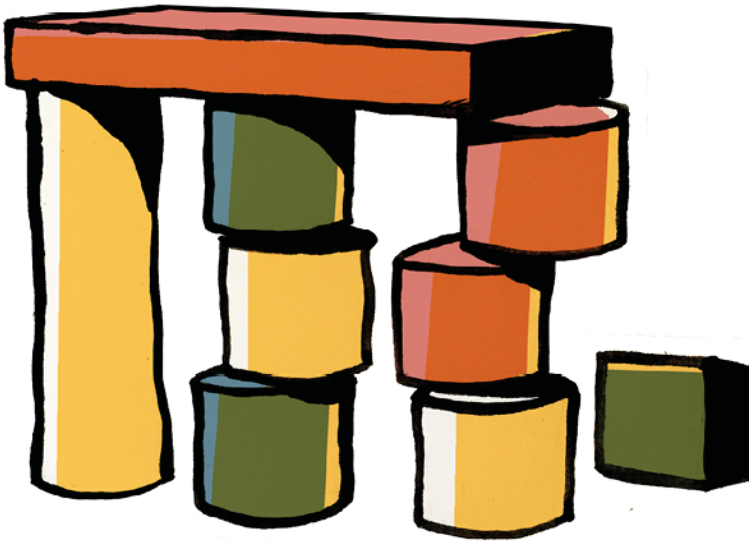
Master regulations and best practices regarding ecological issues

Understand the professions, practices, and financial products, their materialities and their impacts, in order to better audit them

Shift practices towards respecting planetary boundaries

Prevent, detect and deter greenwashing





1. The role of regulatory and compliance bodies in addressing ecological issues

The regulatory and compliance professions involve different types of players. At the regulatory level, there are the authorities responsible for regulating, supervising and controlling the banking and financial sector. Their mission is to apply and enforce the regulatory framework, to manage and control the risks posed by banking, insurance and financial activities.

At an operational level, the counterparts to the regulatory professions are the compliance officers, who are responsible for 'permanent control' and ensuring that practices comply with the regulations in force. Compliance is essential in the banking and insurance sectors, but also within companies.

In the opinion of those interviewed, **the regulatory and compliance professions are seen as strategic in all financial institutions for the coming years**. At present, these are shortage occupations, the supply of qualified people is lower than the demand from the various players.

a. Develop current regulations towards greater consideration of respect for planetary boundaries by financial players

Legislation is enacted at national level, and in finance often comes from the transposition of EU directives or European regulations, which are directly applicable.

Within this framework, the AMF (Autorité des Marchés Financiers - Authority of Financial Markets) has regulatory powers, which enable it to regulate financial markets[620] in France. The AMF sets out the rules and procedures for applying the law, through its General Regulation. The AMF's doctrine, which complements it, is a user's guide to the applicable regulations. The AMF has a certain power to interpret and apply laws passed at national and international level[621]. In this sense, it has means to take action towards the ecological transition, within the limits of the frameworks defined. Moreover, it is involved in the development of European and international regulations. This participation in supranational regulations enables it to push for the inclusion of ecologically ambitious objectives in the law.

For its part, **the French prudential supervision and resolution authority (ACPR) monitors the application of regulations in the financial sector**, and more specifically in banks and insurance companies. Responsible for ensuring the stability of the financial system, it has a macro-prudential dimension. It has the power to impose sanctions and can take administrative police measures. The ACPR's macro-prudential vision requires its staff to be trained and aware of the systemic issues linked to planetary boundaries. This supervisory position and sanctioning power are particularly necessary to drive financial institutions towards greater consideration for their impact on planetary boundaries and vice versa.

Regulators can therefore play their part in the ecological transition by developing and interpreting the various laws in such a way as to give ecological issues a leading place. These professionals also have the opportunity to support legislators towards in-depth control of finance as part of the ecological transition.

The importance of their role is underlined by the IPCC experts. They assert that political intervention and leadership are central to responding to the lack of certainty of financial players

[620] The actors and products that fall under the AMF's remit include financial markets, listed companies, financial transactions, financial intermediaries, collective investment schemes, etc.

[621] AMF, « Faire évoluer la réglementation ».

and redirecting financial flows. They also believe that **stronger guidance from regulators and political decision-makers has the potential to improve the perception of climate-related risks**[622].

Some experts suggest "entrusting financial market authorities with the task of banning certain financial products such as credit default swaps on sovereign debt of countries in the South, [...] food speculation funds and investments in the extractive industries. We could also ban (or tax) certain forms of trading, such as high-frequency trading[623]."

b. Understanding the underlying factors of controlled activities to better assess their impact

The mission of supervision and compliance professionals is to monitor the effective respect of the standards laid down. To do this, it is necessary that these players understand the underlying principles of the standards as well as the controlled activities in order to better assess their impact on planetary boundaries and to be able to analyse their compliance - or non-compliance - with the law and physical constraints.

For this group of professions, the challenge is to be able to detect greenwashing. Compliance aims to evolve a company's practices so that, *at the very least*, they comply with applicable regulations. If it fails in this task, the company risks sanctions from the supervisor and may incur credibility costs through liability risk.

Supervision and compliance professionals therefore need a threefold competence in financial law, a good understanding of planetary boundaries as well as in finance, particularly in the area of finance in which they operate.

Finance is a complex sector. This makes it all the more difficult to technically understand the practices used. Some stakeholders have pointed out that it is in the interests of regulatory or compliance officers to have prior experience in the area of finance which they will have to monitor. However, there is a risk of conflicts of interest and cronyism that could hinder strict control of the ecological impact of activities.

When regulations are drawn up, particularly at European level, the regulator works with lobbies. The lobbies bring a technical understanding of the subject, but their goal is to protect their interests in the enactment of regulations. **It is therefore important that regulators are at least trained to manage these divergent interests, in order to promote the public and ecological interest in the enactment of laws that are relevant in practice**.

The complexity of finance creates opacity in practices and can complicate regulatory work. This in turn can have an impact on the effectiveness of standards. This is the case with systemic banks, for example, whose complexity could be defused by separating commercial banking activities from trading activities[624].

Finally, it is up to the regulator to supervise and penalise activities that are harmful to planetary boundaries. **This fundamental role of monitoring compliance with standards requires human and financial resources if it is to be carried out properly**.

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622 Intergovernmental Panel on Climate Change (IPCC), « Climate Change 2022 - Mitigation of Climate Change ».

623 Parrique, *Ralentir ou périr : l'économie de la décroissance*.

624 Scialom, *La fascination de l'ogre ou comment desserrer l'étau de la finance*.

2. New knowledge requirements

a. Physical constraints and social objectives

Reminder

A good knowledge of physical constraints and an understanding of the importance of ecological issues for our societies are essential prerequisites for integrating these issues into finance. All the professionals and professors interviewed agreed on emphasising the importance of understanding these constraints.

In particular, this means knowing the orders of magnitude of annual greenhouse gas emissions in comparison with the remaining carbon budget in order to contain global warming to 1.5°C - 2°C.

b. Economic and financial system

Reminder

Know the principle of dual materiality, i.e. a company's dependence on the environment (financial materiality) and its impacts on the environment (impact materiality or environmental and social materiality)[625].

Know the orders of magnitude of the impact of the different sectors of the economy on biodiversity, the climate and the depletion of resources.

Know the different types of risk (physical, transitional, reputational) and the existing tools for assessing them.

Understand biodiversity indicators and their materiality: understanding the methodologies used for biodiversity footprints, their scope and their differences.

Understand how a company can contribute to carbon neutrality: understand the mechanisms of induced, avoided and negative emissions and their limits; know the limits of carbon offsetting and carbon finance.

Understand the principles of ecological accounting, its area of relevance and its limitations[626,627].

Financial products and techniques

- **Know the main "traditional" financial products, their materiality, their risks and their impact on planetary boundaries**.
- **Know about "sustainable" products and the associated financial mechanisms**:

[625] BL Evolution, « Double matérialité : comment appréhender ce nouveau principe et quelles implications pour le reporting extra-financier ? »

[626] For example, the CARE (Comptabilité Adaptée au Renouvellement de son Environnement), LIFTS (Limits and Foundations Towards Sustainability) and SeMA (Sense-Making Accountability) models.

[627] Rambaud and Chenet, « How to Re-Conceptualize and Re-Integrate Climate Finance Into Society Through Ecological Accounting? »

- **Green "shares"**: know the main criteria for distinguishing between listed companies and value, by analysing their reporting, their impacts on ecological issues.
- **Green bonds**: critical understanding of their actual ecological impact, additionality, understanding the bond's financing objective and the operation of any covenants binding the issuer.
- **Investment funds**, such as a collective investment organisation, which promote sustainable management by adhering to a specific label.
- **Derivatives or "sustainable" financial contracts**, their scope and limitations.

Financial system

- **Know the different types of financial players and their roles**: supervisors (AMF, ACPR, ESMA), rating agencies, the European Financial Reporting Advisory Group (EFRAG), etc.
- **Know the Principles for Responsible Investment** (PRI) from the UN.
  - Understanding the reporting requirements of the UN.
- **Understand extra-financial risk analysis.**
  - Understand the main suppliers of extra-financial data, their methods and limitations.
- **Know the best-known sustainable labels**, their obligations and their limitations.
  - For example: the Greenfin labels, green growth financing, SRI, etc.
- Understand **prudential regulations from the perspective of climate, biodiversity and resource depletion risks**[628].
- **Have an understanding of the main finance professions and the impact they can have on planetary boundaries.**
  - Compliance professionals need to understand the professions they will be auditing: in order to have an operational approach and enough perspective over practices in finance, asset management, etc.
- **Understand the principle behind the ECB's climate risk stress-tests for banks**, their scope and their limits**.**

[628] Chenet, Ryan-Collins, et van Lerven, « Finance, Climate-Change and Radical Uncertainty ».

Legal and normative systems

- Have a good knowledge of **the French and European regulatory frameworks and international voluntary frameworks**, their main lines, to whom they apply and the role of each player[629] (level 1 of the pyramid of standards in Community law).
    - For example, in France: article 29 of the Energy and Climate Act (LEC), article 173 of the Energy Transition Law, AMF position-recommendation 2020-03[630], the Duty of Vigilance Law, the Sapin II Act, the PACTE Act, etc.
    - At European level: European Commission strategy for sustainable finance, European taxonomy[631], *Sustainable Finance Disclosure Regulation* (SFDR)[632], *Markets in Financial Instruments Directive* (MIFID), *Non-Financial Reporting Directive* (NFRD), *Corporate Sustainability Reporting Directive* (CSRD), *Solvency II,* etc.
    - At international level: *Task Force on Climate Related Financial Disclosures* (TCFD), *Taskforce on Nature-related Financial Disclosures* (TNFD), etc.
- **Know the delegated and implementing acts** that clarify regulations and directives (level 2 of the pyramid of standards in Community law).
- **Know level 3 of the standards pyramid,** which is non-binding, consisting mainly of ESMA's Guidelines, Recommendations and Q&A and the European Commission's Q&A.
- **Know the various voluntary initiatives** (Green Bonds Principles, etc.) and their limitations.
- **Know the codes and laws of governance** and anti-fraud and anti-corruption measures.
- Know and understand **the institutions of the European Union, France and the United States** that adopt, enact and apply laws.
- **Know the ISO 14091 standard** on climate change related risk assessment.
- **Know ISO 14064-1 and ISO TR 14069**, which set out the requirements for organisations to quantify, report, design and manage the quantification of direct and indirect GHG emissions.

3. New skills requirements

a. Adopting a systemic, interdisciplinary and ethical approach

Adopting a systems approach

- Understand the interconnection between climate risks, linked to resources and biodiversity - which are currently considered in silos - and their implications in terms of systemic financial risks.

629 AMAFI, « Finance Durable - Cartographie réglementaire ».

630 Position - Recommandation 2020-03 de l'AMF.

631 Une connaissance de ce règlement, à la fois des définitions qu'il attribue aux actifs durables mais aussi aux notions qu'il contient (atténuation vs adaptation au changement climatique, économie circulaire) permettra aux futures fonctions de conformité de cerner un actif qui n'est pas durable, d'anticiper les questions et de challenger les acteurs de la finance afin de prévenir des risques de *greenwashing*.

632 Notamment les différences entre les articles 6, 8 et 9 relatifs à une gradation dans l'intensité de l'intégration des indicateurs environnementaux.

- Be able to make the link between ecological issues and regulations.
- **Know how to work with lobbies**, understanding the issues involved and the limits of such cooperation (divergent interests in particular).
- Understand the effects of regulation on the real economy and the political stakes involved[633].

Identifying the ethical issues

- Adopt an ethical compliance approach, in the spirit of the legal text, avoiding circumventing regulations or taking advantage of legal loopholes.

b. Developing a critical mind to envisage desirable futures

Applying a critical mind

- **Detect and prevent greenwashing.**
  - Question, using one's knowledge, the information provided by an issuer or producer, to base oneself solely on a factual and unbiased analysis.
- Beyond compliance with the regulatory framework, **put into perspective a company's practices in relation to ecological issues.**
- Take **a critical look at labels**, their scope and their real impact.
- Understand **the mechanisms for controlling and managing financial flows**, their limitations and areas for improvement.[634]

Envisioning desirable futures that are consistent with physical constraints

- Keep **a regulatory and legal watch** on physical constraints and identify the link with their activity.
- **Monitor best practices in one's sector** in relation to ecological issues.

c. Conceiving the transformation of organisations

Incorporating a strategy or business model in a context of physical constraints

- **Ensure compliance with regulatory obligations relating to ecological issues,** in particular regarding corporate financial reporting.
- **Apply regulatory and international frameworks**, as well as best practices, for example when designing products or drafting brochures.
- **Define controls** to ensure the proper implementation of regulations relating to the variety of ecological issues.
- **Contribute to the debate on mechanisms for controlling and regulating** financial flows.

Mastering multi-criteria assessment tools and transforming existing tools

633 Dron, « Pour une régulation écosystémique de la finance ? »

634 Dron.

- **Source data and build scenarios** for extra-financial reporting.
- **Handle measurements, metrics and data** relating to ecological issues.

d. Acting individually and collectively in a responsible way

Leading a group of people to transform organisations and the framework in which they operate

- **Participate in the integration of regulations** relating to ecological issues into a company's practices, for example by modifying culture, processes and tools.
- **Provide regulatory support to those responsible for implementing the Disclosure regulation** within a company.
- **Disseminate and explain regulation and best practices in relation to ecological issues, internally** for example by writing Q&A or implementation procedures.
- **Work seamlessly** with the various finance professions.

OCCUPATIONAL PROFILE

ASSET MANAGEMENT

Role in the ecological transition

- Aim at social usefulness
- Implement engaged shareholding
- Manage its portfolio towards aligned goals

Examples of knowledge and skills

Master the levers of influence of asset managers for a better integration of planetary limits

Question the social usefulness of a company, product or services regarding ecological stakes

Develop a critical understanding of portfolio management methods

Understand ESG criteria and their limitations

1. The role of asset managers in taking ecological issues into account

Having emerged in the 1980s, **asset management is a financial activity that consists of generating an economic return from financial securities or assets, owned or entrusted by an investor**. Asset management is mainly carried out by professional investment funds. Today, the world's largest asset manager is BlackRock, with assets under management of $9,000 billion, equivalent to three times France's GDP.

In France, the majority of the 630 asset management companies are independent of banking and insurance groups, but when we look at the share of assets under management, the majority are backed by banking or insurance groups. Asset management business is mainly focused on institutional investors (insurers, pension funds, other institutional investors and banks), which accounted for 73% of assets under management in 2017.[635].

Investments can be made in different asset classes, such as equities, bonds, real estate, etc[636]. Asset management operates in the unlisted and listed markets, in the primary and secondary markets. The latter is a kind of second-hand market, where existing securities are traded after they have been issued on the primary market.

On the equity markets, asset management mainly operates on the secondary market. Some specialist funds operate on the primary market when companies are floated on the stock market. When it focuses on the secondary market, asset management plays an indirect role in the real economy. **It contributes to the pricing of assets and their liquidity on the markets**. The price is the result of a balance between investors' supply and demand. It also helps to ensure a certain liquidity of securities circulating on the markets.

In the bond and private equity markets, asset managers are mainly involved in the primary market, lending capital to organisations so that they can carry out their projects and ensure their development. Pension funds and institutional investors are more active in the bond market.

Asset managers can play a role in the transition by committing to shareholder support for the companies under management or by steering their portfolios towards objectives in line with planetary boundaries. These players must also guide their clients, the asset owners, to look beyond the profit horizon and consider companies for their social usefulness.

a. Practising shareholder engagement and aiming for long-term impact

Shareholder engagement involves taking a stand on certain issues and trying to influence portfolio companies so that they improve their practices over the long term. In this case, the aim is to respect planetary boundaries by helping companies towards more respectful practices and reducing their ecological impact. Shareholder engagement can take several forms: discussions with management at informal meetings, public communication on the progress of the engagement process and on the company's shortcomings in the extra-financial area, use of voting rights at the annual general meeting of shareholders (voting and questions at the general meeting, refusal of proposed resolutions, support or filing of external resolutions) and the threat of disposing of the company's assets. Shareholder engagement is an important transformative practice for asset managers, and is their main lever when operating on the secondary market.

635 Galanti et Le Quéré, « Industrie de la gestion d'actifs : de l'émergence à l'apparition de nouveaux risques ».

636 David P. Stowell, *Investment Banks, Hedge Funds, and Private Equity*.

Shareholder engagement can take the form of an individual practice. The asset manager then negotiates directly with the company's management to make commitments in favour of the ecological transition of their activities and the closure of their fossil fuel assets. For example, in the case of private equity and unlisted companies, the role of the asset manager may be closer to that of an advisor helping to steer the company's strategy.

Investors can also form coalitions to obtain greater leverage, although we have seen that these commitments are not binding (PRI, *International Investor Group on Climate Change* (IGCC) *Net Zero Asset Owners Alliance* (NZAOA)*, Net Zero Asset Managers Alliance (NZAMA)* etc.).

These forms of collective shareholder activism make it possible "to pool resources while increasing the pressure exerted on listed companies[637]**"**. The aim of these initiatives is to improve investor's monitoring methods and make companies evolve, rather than to exclude them from portfolios. **At present, these forms of collective shareholder support remain a minority and fragile. They require substantial resources, and it is difficult to trace the actions taken and the results achieved**[638].

Shareholder engagement can have an effect on company practices[639]. Its effectiveness is proportional to the investor's level of influence (measured by the share of the company held by the investor or the fact of being of the same nationality as the target company) and to the company's experience in implementing practices that respect physical and social constraints. It is inversely proportional to the cost of the requested reforms.

If the asset manager does not succeed in obtaining enough substantial efforts from the company, he can divest it from his portfolio. However, divestment opens the door to the purchase of the assets by another player, potentially less scrupulous about respecting planetary boundaries. **Divestment is therefore the last solution for a responsible manager, since the first priority is to allow these assets to transition or become stranded**.

The management of stranded fossil-fuel assets is an important topic for the transition of the financial sector, for which various responses may emerge. One idea could be to create **management companies specialising in the management of compromised companies and assets** that have to fail. Inspired by the bad bank model, this could be an interesting instrument for allowing assets to run aground.

It is possible - and even desirable - that in the future new individual and collective commitment practices will develop, so that asset managers can effectively play their part in the ecological transition. Legislators and regulators are also likely to reinforce their obligations to align with planetary boundaries.

b. Steering your portfolio towards objectives of alignment with planetary boundaries

In the long term, an asset manager should no longer hold products in their portfolio whose underlying assets are highly GHG-emitting or destructive to ecosystems. This is consistent with an economy where fossil-fuel assets will have been stranded and companies will have made the transition. Portfolios would then reflect the real economy that respects planetary boundaries.

637 Ansidei et Leandri, *La finance verte*.

638 Ansidei et Leandri.

639 Julian F. Kölbel et al., « Can Sustainable Investing Save the World? Reviewing the Mechanisms of Investor Impact ».

To achieve this objective, asset managers involved in sustainable finance are changing the content of their portfolios so that the assets held are consistent with respect for planetary boundaries and represent the different sectors of the real economy.

On the bond market, most transactions take place on the primary market. In this way, the asset manager can grant capital to a company supporting projects that are compatible with ecological issues, thereby helping to finance the ecological transition. When the asset manager invests in private equity, he can also provide capital where there is little, thereby enabling the financing of certain activities aimed at respecting planetary boundaries. These practices are major levers for the asset manager operating in these markets.

In the equity market, which consists mainly of secondary market transactions, portfolio management is a lever whose impact on the ecological transformation of the economy is controversial. Several methodologies are used by asset managers to align their portfolios with the ecological transition. For example, by using the **European taxonomy**[640] to measure the exposure of their portfolios to activities compatible with a low-carbon, resilient and resource-efficient economy[641]. Other methodologies, which only take into account the issue of climate change, are based on **aligning portfolios with a low-carbon trajectory**. This involves selecting assets (e.g. company shares) whose GHG emissions reduction trajectory is compatible with a given trajectory limiting the rise in temperature to below a specific level.

There are many methodologies, with their advantages and limitations. However, it is important to stress that **asset managers should always aim to implement practices that have a real impact on the economy's compliance with planetary boundaries**. This is precisely a point of debate.

The most recent review of the academic literature on the subject[642] **did not provide evidence of a link between sustainable investors' capital allocation decisions and companies' investment activities or operating practices**[643]. The academic literature provides evidence that capital allocation can affect asset prices but does not provide evidence to judge whether this effect is significant. Furthermore, there is no clue that this change in price translates into a change in behaviour from companies. There is limited empirical evidence that capital allocation can have an effect on company growth, especially for small start-ups in immature markets.

Neither is there a consensus on the usefulness of portfolio temperature alignment measures for evaluating the portfolio's impact on the transition of the real economy.[644]

Beyond the debates on methodology, there is also a debate on the relevance of portfolio alignment strategies in generating an impact on the real economy[645]. In particular, because certain short-term actions to decarbonise a portfolio can have a counterproductive effect on the

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640 It should be noted that only 0.4% of FTSE All Cap Index funds are aligned with the European taxonomy. (This index is derived from the FTSE Global Equity Index Series, which captures 98% of the world's investable market capitalisation.) Voir Dai et al., « “Do No Significant Harm” and “Minimum Safeguards” in Practice ».

641 EU Technical Expert Group on Sustainable Finance, « Financing a Sustainable European Economy - Technical Report ».

642 Julian F. Kölbel et al., « Can Sustainable Investing Save the World? Reviewing the Mechanisms of Investor Impact ».

643 This study was mentioned by 2 Degrees Investing Initiative in the document "Science-Based Targets For Financial Institutions - Position Deck + Consultation" published in February 2020, to explain their withdrawal from the Science Based Targets Initiative for Financial Institutions development team.

644 Institut Louis Bachelier et al., « The Alignment Cookbook - A Technical Review of Methodologies Assessing a Portfolio’s Alignment with Low-Carbon Trajectories or Temperature Goal ».

645 Hendrik du Toit, « Ninety One’s Hendrik du Toit: Net Zero is a pipe dream without total inclusion ».

decarbonisation of the economy. For example, by reducing exposure to emerging countries that depend on polluting industries and energy sources, an asset manager can instantly improve the carbon intensity of their portfolio. In doing so, however, they deprive these countries of the resources they need to make the transition. In this case, the action of aligning the portfolio has no impact on reducing emissions either. It only results in a redistribution of emissions between investors.

Lastly, it should be emphasised that most of the methodologies focus mainly on climate change. **Knowledge is not as advanced for resource depletion or biodiversity**, where impact and dependence relationships are at least as complex as for climate, and remain little studied. Some biodiversity metrics are emerging, such as the Mean Species Abundance (MSA) of the IPBES, the Global Biodiversity Score (GBS) of the biodiversity branch of the Caisse des Dépôts et Consignation, the Biodiversity Impact Analytics (BIA) of Carbon4 Finance and the Corporate Biodiversity Footprint (CBF) of Iceberg Data Lab.

At present, asset management - like the finance sector - is not doing its part to limit the impacts of climate change, damage to biodiversity and extraction of materials. **If the asset management industry fails to transform itself radically in order to respect planetary boundaries, the future of this line of business in a world in transition could be called into question**.

c. Guiding customers to think beyond profitability only, considering assets for their social usefulness

Monetary profit as the central objective of asset management needs to be discussed. **Is it really desirable to contribute to the economic health of companies that are jeopardising the Earth's habitability**?

This means that **asset managers can no longer base their decisions solely on the notion of profitability**. This means rethinking the classical perception of fiduciary duty, which requires asset managers to put their clients' interests first. Some financial players consider that it is in their clients' interests to integrate ESG issues into their investment decisions. However, these considerations are only those of players specialising in green or responsible finance. This disparate assessment of fiduciary duty underlines the need to rethink it in depth and for all financial players, in order to include the risks associated with exceeding planetary boundaries. **It would therefore be an obvious error of judgement not to incorporate as a fundamental principle the risks posed by climate change, the erosion of biodiversity or the depletion of material resources** on the assets under management (simple materiality). Similarly, it would constitute a breach of fiduciary duty to invest in an asset whose activities undermine planetary boundaries (double materiality).

The role of the asset manager would then be to guide his client, the asset owner, in order to invest in assets in line with planetary boundaries. This diversion from ecologically harmful assets may imply a lowering of return requirements for the investor. The asset manager would then take on the role of adviser so that his client accepts to lower his return requirements and turn away from funds that are harmful to planetary boundaries. This could involve marketing initiatives, promoting a better image for the investor, and of course underlying assets that are more robust to climate, resource and biodiversity risks. **Impact investing is developing in response to these challenges, with the aim of combining social and financial return on investment**. Some of these impact funds, known as "finance first", prioritise profitability, making the achievement of

ecological objectives subordinate to an overriding profit objective. "Impact first" funds favour environmental and social impacts[646].

The Global Impact Investing Network (GIIN) defines four fundamental characteristics of impact investing, including **rationality**, based on science, as seen above, and **intentionality**, that is to say the investor's intention to have a positive social or environmental impact through his investment[647]. A fifth and complementary characteristic is **additionality**, which refers to an improvement in the quality or quantity of the company's environmental or social results compared with no investment at all[648]. However, **impact investment remains largely a minority among all asset management practices**.

2. New knowledge requirements

a. Physical constraints and social objectives

> **Reminder**
>
> Making the link between physical constraints, social objectives, their implications for the company and investment strategies.

- **Know the technical elements that allow distinguishing between an asset that is harmful to planetary boundaries and one with a neutral impact or favourable to the transition.** For example:
  - Carbon budget, financed emissions, portfolio carbon footprint, difference between greenhouse gases (GHG), understanding scopes 1, 2 and 3, greenhouse gas emissions assessment, main sectors contributing to emissions and by what orders of magnitude.
  - Understand the issues related to resources (energy and non-energy), where they come from, their criticality, how they are exploited, which sectors use them, what the ecological and social impacts are, what the relative prices of resources are, etc.
  - Understand biodiversity issues, know how they can impact the value chain of different sectors (e.g. agribusiness, pharmaceuticals).
  - Understanding the risks inherent in an industrial transition for the main sectors of the economy, and the associated social risks.

b. Organisational and governance models

- **Understand how a general meeting of shareholders works** and the different ways asset managers can have leverage.

[646] Pour un Réveil Ecologique, « Les cahiers du réveil - la Finance verte ».

[647] The GIIN, « Core Characteristics of Impact Investing ».

[648] Pour un Réveil Ecologique, « Les cahiers du réveil - la Finance verte ».

c. Economic and financial system

Reminder

Know the principle of dual materiality, i.e. a company's dependencies on the environment (financial materiality) and its impacts on the environment (impact materiality or environmental and social materiality).[649].

Know the orders of magnitude of the impacts of the different sectors of the economy on biodiversity, the climate and the depletion of resources.

Understand the different types of risk (physical, transitional, reputational) and the tools available to assess them

Critical understanding of the concepts of risk and return, risk and return measurement and their limitations. Knowledge of the theory and practice of discounting, its effects on the consideration of ecological issues (for example, discounting leads to underestimating some long-term environmental degradations).

Understand biodiversity indicators and their materiality: understanding the methodologies used for the biodiversity footprints of their portfolio, their scope and their differences.

Understand how a company can contribute to carbon neutrality: understand the mechanisms of induced, avoided and negative emissions and their limits; know the limits of carbon offsetting and carbon finance.

- **Be familiar with different asset management practices and their relevance to ecological issues:**
  - Know the different strategies for managing the risks and opportunities associated with ecological issues: shareholder support, divestment, sectoral exclusion or inclusion, stock-picking, etc., their advantages and limitations;
  - Understand the logic of active ownership as part of asset portfolio strategies as a vector for internal transformation and achieving impact;
  - Know the different types of ESG selection, e.g. Best-in-Class, Best-in-Universe, etc., and the limits of ESG criteria;
  - Know the principles of passive management and its limitations for transforming the sector in line with ecological challenges.
- **Understand the concept of fiduciary duty** and its limits in terms of taking ecological issues into account.
- **Critical understanding of Markowitz's modern portfolio theory**[650].
- **Know portfolio performance assessment methods that take into account ecological issues**, in particular:
  - Understand the main metrics for assessing carbon, biodiversity and resource impact
  - Understand climate scenarios, carbon budgets and their sector-specific breakdown, underlying assumptions and in particular negative emissions

[649] BL Evolution, « Double matérialité : comment appréhender ce nouveau principe et quelles implications pour le reporting extra-financier ? »

[650] Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».

- Understand the Paris Agreement Capital Transition Assessment (PACTA)[651] method
- Know trajectory alignment methods by contraction and convergence.
- Understanding the calculation of the green share in relation to European taxonomy.

- **Understand the alignment of investment portfolio with the Paris Agreement**, know the main methodologies used and their limitations[652, 653].
- **Understand the difference between a portfolio's alignment and its contribution to achieving the objectives of the Paris Agreement**[654].
- **Know the principles of non-financial rating and the players involved.**
  - Understanding the challenges of non-financial reporting.
- **Understanding ESG labels and their limits** when it comes to taking ecological issues into account[655,656,657].
  - Understand the methodologies used to assess ESG criteria and the limits of this indicator: transparency issues, respective weightings of E, S and G, divergence between rating agencies.
  - Understanding the impact and intentionality concerns behind ESG criteria.
- **Know the main carbon data modelling methodologies, their scope of application** and their limitations.
  - Bottom-up methodologies, based on statistical regressions, and top-down methodologies based on sector averages.
- **Know the main associations specialising in responsible investment issues** (Forum pour l'Investissement Responsable (FIR), Acteur de la Finance Responsable (AFR)).

d. Legal and regulatory systems

- **Understand the European taxonomy** and its implications for asset management.
- **Know about investor coalitions and voluntary standards**, principles for responsible investing, International Investor Group on Climate Change (IGCC), Net Zero Asset Owners Alliance (NZAOA), Net Zero Asset Managers Alliance (NZAMA), etc.).
- **Understanding SFDR reporting.**

651 « Paris Agreement Capital Transition Assessment ».

652 Institut Louis Bachelier et al., « The Alignment Cookbook - A Technical Review of Methodologies Assessing a Portfolio's Alignment with Low-Carbon Trajectories or Temperature Goal ».

653 Raynaud, Tankov, et Voisin, « Alignement des portefeuilles sur une trajectoire de 2 °C : science ou art ? »

654 Raynaud, Tankov, et Voisin.

655 Lefournier et Grandjean, *L'illusion de la finance verte*.

656 Kotsantonis et Serafeim, « Four Things No One Will Tell You About ESG Data ».

657 Drempetic, Klein, et Zwergel, « The Influence of Firm Size on the ESG Score ».

3. New skills requirements

a. Adopting a systemic, interdisciplinary and ethical approach

Combining knowledge from different disciplines

- **Evaluate portfolio performance** while taking into account climate, biodiversity and the depletion of mineral and energy resources.
  - Know how to calculate a portfolio temperature score.
  - Measuring the alignment of portfolios with climate scenarios, in particular through the PACTA method.
  - Being able to define the green, grey and brown parts of a portfolio.
  - Apply trajectory alignment strategies by contraction or convergence.
- **Value companies** by integrating their impact on planetary boundaries.

Identifying the ethical issues

- **Be able to develop a thought process based on concepts of philosophy and ethics in investment**. For example, by questioning the ethics of any investment that destroys the environment or by questioning the limits of fiduciary duty.

b. Developing a critical mind to envisage desirable futures

Applying a critical mind

- **Have a critical view of current asset management practices**[658].
- **Have a critical view of passive management** and the different ways in which it can be implemented.
- **Question fiduciary duty** in the light of ecological issues.

Envisioning desirable futures that are consistent with physical constraints

- **Monitor methods for integrating the value of carbon and biodiversity into companies' balance sheets**, such as carbon-adjusted EBITDA[659].
- **Monitor** the issues of resource depletion, biodiversity and climate.

c. Conceiving the transformation of organisations

Questioning the purpose and social utility of a company, product or service

- **Analyse the main directions of the climate, biodiversity and material impact strategies of companies** and business sectors.
- **Question the social utility** of a company, product or service in the light of ecological issues.

Incorporating a strategy or business model in a context of physical constraints

- **Take into account geopolitical, geographical (emerging or "developed" countries) and industrial constraints in investment strategies linked to ecological issues.**

[658] Galanti et Le Quéré, « Industrie de la gestion d'actifs : de l'émergence à l'apparition de nouveaux risques ».

[659] Axylia, « Indice Vérité 40 ».

- **Conduct a robust extra-financial analysis** of a company or sector from the perspective of ecological issues
  - Identify risks and opportunities for companies in relation to ecological issues.
- **Know how to allocate financed emissions**, or *at the very least* understand the theory, impacts and scenarios[660].

Mastering multi-criteria assessment tools and transforming existing tools

- **Master the instruments of influence available to asset managers.**
- **Contribute to the development or improvement of methodologies and tools** for assessing the impact of a company or activity on ecological issues.
- Work with **extra-financial data, corresponding to damage to and dependence on resources, biodiversity and the climate, throughout its value chain**, and be aware of its limits[661,662].
  - Allocate the impact to an asset, determine whether this impact is additional, understand the problems of double counting.
  - Determine the intentionality of the impact.
- **Know how to classify your fund (article 6, 8 or 9) according to the SFDR regulation, and produce the appropriate reports.**
- **Make an informed choice among suppliers of extra-financial data.**

d. Acting individually and collectively in a responsible way

Involving one's emotions and taking into account those of others

- **Prepare and lead discussions with company management**, bearing in mind ecological issues (shareholder engagement).
- **Know how to involve investors** in their duty to ensure sustainability and impact.

660 Gerardi, Grandjean, et Martinez, « La quantification des émissions de gaz à effet de serre des institutions financières ».
661 Revelli, « Finance and Economics Education in the Anthropocene Era: Embedding through Sustainable Ontology - Working Paper ».
662 Heeb et Kölbel, « The Investor's Guide to Impact - Evidence-based advice for investors who want to change the world ».

IV. How can we teach ecological issues?

A. Seize the ecological challenges to reinforce the development of a critical mindset

Resources

Pédagogie de la transition, ouvrage collectif coordonné par Cécile Renouard[663]

Retours d'expérience de professeurs lors de l'évènement de publication de la version intermédiaire du présent rapport (vidéo)[664]

Teaching about ecological issues involves a number of changes in teaching methods, as well as new attitudes on the part of teachers. Among these is the question of the neutrality of teaching. Is there a risk that incorporating the issues related to the ecological transition will make teaching prescriptive, or does it, on the contrary, enable the necessary debates to come to light?

There is a debate going on in the economics and management sciences that form the basis of finance: are they neutral or normative? Among the teachers who consider that current teaching is not prescriptive, that it aims to transmit neutral techniques and practices, appears **the fear that teaching ecological issues will break with the posture of neutrality**. Some expressed their concerns at the idea of imposing values on students, or even proselytising, which would run counter to their role as teachers.

It therefore seems important to assert that economics and management practices are part of normative choices, which already impose a framework of values on students. As mentioned above (see Part 1, p.18), management methods, the sciences and tools of management, economics and finance convey a certain vision of the world. Experts stress the influence of the dominant ideology on economic and management practices. Similarly, the way companies operate today, as taught to students, is not neutral. For example, it is imbued with a certain vision of nature, often presented as a reservoir of resources to be exploited, with ecological impacts presented - at best - as negative externalities.

The teaching of ecological issues can, on the contrary, be seized as an opportunity to develop critical thinking by highlighting conflicts of values. Incorporating these new elements into finance courses would enable debates to emerge, by exploring the different ideologies and frames of reference conveyed by the various solutions put forward in the face of the challenges of transition. Far from imposing any bias, this teaching must be based on scientifically established facts, and the debates raised must be supported by scientific data, by broadening the disciplinary scope of the teaching to include the natural sciences, engineering sciences and the human and social sciences.

This debate calls into question the role of teachers. For example, some teachers see themselves as having a professionalisation mission: their main objective would be to prepare their students for a competitive job market. From this perspective, their role would be first to prepare students as well as possible so that they can access socially recognised positions, with high levels of responsibility and high incomes[665]. So what room is there for challenging the status quo?

[663] Renouard et al., *Pédagogie de la transition*.

[664] From 2h 5min 38s to 2h 21min 57s. *« ClimatSup Business - Educating the actors of tomorrow's economy » : intermediate report*.

[665] This can be seen as partly due to the influence of rankings, which value institutions according to the income level of their graduates, and partly to the expectations of students, often seen as customers in business schools.

Without necessarily being antagonistic to the desire to develop students' critical minds, this approach gives teachers other priorities.

B. Integrate new subject areas into finance courses

Integrating ecological issues into a management or finance course does not simply mean teaching the same disciplines differently. Taking a systemic view requires making the link between one's own discipline, in this case finance, and the many other fields that help us understand the physical constraints, the related social issues and the responses that our societies need to give.

To properly understand ecological issues, teachers need to be trained in them. The teachers consulted on the subject of knowledge of physical constraints in the base emphasised a strong need for training to be able to integrate these elements into their thinking. This reaction is confirmed by the results of the questionnaire sent out to management teachers in the report "Training the actors of tomorrow's economy": more than 40% of teachers mention a need for training to incorporate ecological issues more fully into their lessons.

Reflections on the integration of these issues into teaching can be carried out via working groups, through the creation of communities of practice and research projects. As the experience of an ESCP course on energy-climate issues illustrates, knowledge of ecological issues for management courses "is not available 'off the shelf'": integrating these issues into business management courses requires dedicated work. This can take the form of mixed working groups (teachers, programme managers, students, etc.) dedicated to integrating these issues into core or specialised courses, or for a particular discipline, for example. In addition to dedicated working groups, making the link between ecological issues and financial practice opens up questions that fall under research, and are for the time being poorly investigated, in particular because of the lack of interdisciplinarity in management and economics research (see the report "Training the players of tomorrow's economy[666]").

Finally, in the classroom, the role of facilitator could be favoured over that of expert. It does not seem possible, or necessarily desirable, to make finance teachers experts in ecological issues, even if they have received training in these subjects. Indeed, some teachers often feel illegitimate to teach content related to issues that they do not fully master; all the more so as the research topics of research-professors are often far removed from these subjects. Moving from a position of expert to one of facilitating the collective construction of knowledge could make it possible to teach these issues right away while overcoming a feeling of illegitimacy. This stance could remain relevant even after teachers have acquired a great deal of expertise in these issues, insofar as **these are constantly evolving fields of knowledge that require continuous updating.**

C. Adapting teaching methods

For many teachers, integrating ecological issues into the classroom means rethinking not only the content, but also the teaching methods. We raise two issues here, for which the answers remain open.

How can we get students to take action? Incorporating ecological issues into your professional life means making a significant effort to transform your organisation or company. Teachers dealing with these issues are faced with the question of moving into action: students may

[666] The Shift Project, « Educating the actors of tomorrow's economy », 8 novembre 2022.

understand the issues and their links with the economic world, but still not know how to act. Active teaching methods can help solve this equation by putting students in a position to concretely provide responses to ecological issues. As part of the "ClimatSup Business - Training for tomorrow's economy" report, several institutions shared their experience of courses along these lines: for example, the "Acting for the climate" course run by Xavier Blot and Hans Schlierer at EM Lyon, the "Creativity" seminar run by Fanny Reniou and Baptiste Bahu at IAE Rennes, and the "Designing tomorrow" seminar at ESCP.

How to manage students' eco-anxiety? The emotional impact of these issues cannot be underestimated. Manifestations of eco-anxiety are common among young people and involve a wide range of emotions: worry, fear, anger, pain, despair, guilt, shame and hope[667]. Avenues often suggested to avoid leaving students feeling powerless are **to present means of action and solutions** - after highlighting the scale of the issues, but without minimising them. **As players, or future players, in the world of finance, the role these students can play in the ecological transition can be a major one**. Addressing ecological issues means facing up to this emotional dynamic, and ideally helping to support it, which is something new for many teachers. However, they note a lack of practical alternatives that are clear and up to the challenges, which can leave students feeling uneasy[668]. Beyond the content taught in class, one of the challenges for teachers is **to learn how to recognise and manage the emotional dynamics** associated with eco-anxiety. Exchanges within the teaching staff would certainly help to develop these skills.

If eco-anxiety is confirmed as a massive problem among students, **it should also be taken into account by institutions**, for example by offering monitoring and support beyond the classroom.

In addition, **the issue of eco-anxiety and, more broadly, the emotional burden also applies to the teachers themselves**. The match they perceive between their concerns and their activity, and the collective dynamic in which they can engage alongside their peers, are a means of overcoming it and a lever available to schools.

D. Remedy the lack of teaching materials

The small amount of teaching material available to teach ecological issues in finance is often cited as a hindrance. In particular, the lack of case studies on these subjects is a problem for teachers.

In this context, the practice of sharing courses should be encouraged. A number of institutions and teachers have already taken the plunge, going beyond the intellectual property rationale that often prevails. Dauphine's course on “The environmental challenges of the 21st century[669]” has been published under an open licence; ESCP has created a platform called *Commons for future*[670], which hosts the “Energy, Business, Climate and Geopolitics” course and its tools. A number of teachers from various institutions have posted their courses or presentation materials on the *Enseigner le climat* platform, co-created by The Shift Project and The Shifters association[671].

Similarly, initiatives from schools encouraging the creation of case studies related to ecological issues could be replicated. For example, Audencia organised a case study creation

667 According to a study carried out in ten countries on five continents. Hickman et al., « Young People’s Voices on Climate Anxiety, Government Betrayal and Moral Injury: A Global Phenomenon ».

668 Acquier et Peyretou, « Business education meets planetary boundaries: how to teach energy and climate in business schools? »

669 Ekeland, Ben Dhia, et Treiner, *The environmental challenges of the 21st century*.

670 ESCP Business School, « Commons For Future ».

671 « Plateforme pédagogique collaborative « Enseignerleclimat.org ».

session, bringing together research professors, companies and the Ministry of Culture around issues related to the ecological transition.

V. How can the framework be integrated into a programme?

A. How can new areas of knowledge be incorporated into teaching?

The need for interdisciplinary teaching to integrate ecological issues raises practical questions for teachers, but also for schools. How can we provide knowledge of the natural sciences, the humanities and social sciences in schools which, particularly in business schools, are largely specialised in management sciences?

Offering a core course dedicated to ecological issues may require the involvement of teachers from disciplines outside the business schools. Partnerships with institutions offering courses in energy engineering, biology, biodiversity, geopolitics, etc., can be developed to gain access to expertise that is rarely or never available in higher education management schools. This is what Audencia has done, for example, with its specialised Master's degree in 'Actors for Energy Transition' (MS APTE), awarded jointly by Audencia and Centrale Nantes, in partnership with the 'École de design Nantes Atlantique' and the 'École nationale supérieure d'architecture de Nantes'. This practice would undoubtedly benefit from becoming more widespread, not only in specialised courses but also in core courses.

Another approach is the diversification of disciplinary fields within the very institutions of management education. For example, the University of St. Gallen in Switzerland has a human and social sciences faculty, which allows for offering courses on the psychology of decision-making related to climate change to management students.

It should be noted that the disciplinary compartmentalisation mentioned here is mainly based on observations in business schools. The situation may be different in university programmes, which might possibly more easily benefit from the disciplinary diversity of other faculties.

Different strategies exist to integrate sustainability issues into curricula on sustainable finance, each with pros and cons[672] (see Table 3).

Mainstreaming strategies	Pros	Cons
Optional courses	- Low design cost - Likely in-depth exposure	- Self-selection bias
Fundamentals of finance course	- Existing course - All students are exposed to sustainability issues	- Limited exposure to sustainability
Fundamentals of sustainability course	- Existing course	- Limited exposure to sustainability

[672] Belinga, « Teaching Sustainable Finance ».

	- All students are exposed to sustainability issues	
Lifelong learning courses for executives and sustainable finance diplomas	- Low design cost - Likely in-depth exposure	- Self-selection bias
Masters level and specialist degrees	- In-depth exposure - Cross-disciplinary	- Self-selection bias - High course design costs

Table 3: Strategies for integrating sustainability issues according to Belinga & Morsing[673]

Introducing optional courses imply low course design costs for higher education institutions, whilst offering an in-depth exploration of the topics covered. Optional courses are however weakened by their inherent self-selection bias. Other approaches include introducing sustainability issues in fundamentals of finance courses; introducing sustainable finance in sustainability fundamentals' courses; lifelong learning courses for executives and sustainable finance certifications, as well as Masters and specialist degrees.

Education in finance must evolve to encourage a different approach to practices, in line with planetary boundaries. **Sustainability issues should not be optional in finance programmes. Rather, they should be integrated into the courses - the finance framework offers avenues for knowledge and skills in this regard. An example of how this framework can be applied in a bachelor's programme in finance, a master's programme in corporate finance, and a master's programme in market finance is also provided in this report (see page 179).**

In addition to changes to how finance is taught, basic sustainability knowledge and skills (see core management curriculum p.94) should be included in dedicated mandatory courses, either integrated prior to a specialisation in finance, in the first years of a Bachelor's degree for instance, or under compulsory remedial courses to be taken in addition to finance courses.

B. Introducing coherent changes to educational courses

1. Course coherence within an educational curriculum

Vastly heterogenous understandings of the ecological transition emerged from discussions with teaching professionals.

Some higher education teaching professionals, albeit a minority, consider that covering ecological issues are not under their remit and that primary and secondary education should cater to that. What emerges is that this category of teaching staff fails to make the link between their own teaching and research subject field(s) and ecological issues, or do not feel legitimate nor competent to cover issues related to the ecological transition - which relate to specific academic fields, outside of their field of expertise. Others are openly hostile to ecological discussions, which they consider ideological.

On the other hand, some teaching professionals are in strongly in favour of challenging *business as usual* and see it as their role to fully review the field of management in light of the known

673 Belinga.

planetary boundaries, including by looking at degrowth and other potentially controversial concepts.

In the middle of the spectrum, a number of teaching professionals consider they already mainstream sustainability issues in their curricula, for instance in subject field that tie in with one of the UN's 17 Sustainable Development Goals, or when certain stakeholders promote Corporate Social Responsibility (CSR) or ethical issues (in relation to questions that arise from managing stakeholders, human rights-related disputes or cases of discrimination, and from analysing non-commercial strategies, hybrid organisations or "sustainable" business models[674].

The risk of such a diverse set of positions within the teaching body on sustainability issues is that of a lack of coherence within core teachings given to students enrolled in a given curriculum and across courses, with some calling for challenging the system in full, and others referring to light changes, when not to the *status quo*.

This question is more so arduous that teachers' academic freedom is a central academic value. Moreover, understanding and embedding sustainability issues in teaching requires a certain amount of time, and the pace can vary across the teaching body. It is not a matter of calling into question the importance of academic debate in higher education in finance on ways to address the ecological transition. Rather, **it is the question of the responsibility each academic institution has to ensure that such debates and mainstreaming sustainability take place in a shared, science-based framework, giving sustainability the appropriate level of attention required.**

How can higher education bodies' approaches be made coherent?

First and foremost, teacher training must be looked at. A coordinated approach, with shared objectives and dedicated resources launched and implemented by University top management. In addition to sharing resources & content about planetary boundaries, **support to teaching staff could also benefit from support with the review and redesign of their courses in light of the ecological transition.** The guide book "ClimatSup Business - Educating the actors of tomorrow's economy[675]", targeted at Higher education managers, provides a method to initiate such changes in academic organisations. From an organisational point of view, bringing academic networks across research fields together is a good practice to promote. The ESCP Europe and the ESSEC schools have done so; ESCP, for instance, created a Sustainability department and the ESSEC launched a *Sustainability Guild* (see the report Educating the actors of tomorrow's economy[676] » to read their feedback). This being said, sustainability ought not be considered as a subject restricted to a small club that can do without the inputs of the wider educational community.

2. The need to integrate sustainability issues in comprehensive educational pathways

Regardless of the type of programme, links with students' previous training are needed to ensure they are able to gain the core knowledge.

For instance, some topics ought to be, or already are, covered at the start of a Bachelor degree at university level, or within the two-year intensive foundation degree that is the French *classes*

674 Si ces évolutions sont positives, le problème est qu'elles restent sur des ajustements mineurs et ne sont pas alignées avec les enjeux systémiques soulevés par la transition écologique.

675 The Shift Project, « Educating the actors of tomorrow's economy », 8 novembre 2022.

676 The Shift Project.

préparatoires (designed to prepare students to the competitive entrance exams to the *Grandes Écoles*, France's highly selective higher education establishments). To ensure that students selected have prior knowledge of sustainability issues, such higher education institutions should include those topics in their competitive entrance exams.

Lifelong learning courses, courses for students that have a non-finance academic background and curricula targeting international students with diverse credentials, should also aim to provide this shared knowledge and skills framework. Any updates to academic courses part of initial training should be included also in lifelong training courses, so that professionals can be trained in sustainability matters continuously. The content of a course related to ecological issues ought to consider the diversity of its students' credentials.

C. How to apply the content of the knowledge and skills framework into a given programme?

1. Applying the academic content of the management knowledge framework to a *Grande École* curriculum

Our management knowledge and skills framework includes academic content (in the form of knowledge and skills) related to ecological issues that ought to be provided to all management students in higher education, regardless of higher education institution, their curricula nor specialisation. Those are basic skills and knowledge that will enable management sciences students to understand ecological issues and equip them to address them and be actors of sustainable change.

How to apply this academic content to a curriculum? In which discipline should certain academic concepts be taught? How many hours should be dedicated to this content? An example of the integration of this academic content into a ***Programme Grande École*** *(PGE)* is provided in the report **« ClimatSup Business – Educating the actors of tomorrow's economy**[677] **» with a view of supporting Programme managers and teaching staff with those questions**. Academic content has first been split according to subject matter and discipline, then by academic year and by core course, within a standard PGE. Each higher education institution can look at this example and adapt it to the specificities of its curriculum.

Our focus has been on knowledge and academic content, and less on skills. Per their transversal nature, skills can be taught in multiple courses. Thus, we found linking each skill to the core courses of a given programme less important. This being said, each Head of programme should ensure that skill-based training includes ecological issues and is done in a coherent manner across the full curriculum (to avoid unnecessary repetitions for instance).

Teaching the content of the framework represents approximately 165 class-based hours of a *PGE*, out of which 48 hours given in two dedicated courses, created for that purpose, and named here "physical limitations and societal objectives". This represents 23% of the first three semesters of a standard *PGE*, and 33% of core courses (see Table 4: Indicative hours for teaching the content of the knowledge framework)

Indicative number of hours for teaching the content of the knowledge framework	165 h

[677] The Shift Project, « ClimatSup Business - Educating the actors of tomorrow's economy ».

Number of hours within the first three semesters of a standard PGE	720 h
% (in hours) devoted to teaching knowledge and skills related to ecological issues in the first three semesters of a standard PGCE	23 %
Number of hours dedicated to core courses of a standard PGE	504 h
% (in hours) of hours within core course devoted to teaching knowledge and skills related to ecological issues, in a standard PGE	33 %

Table 4: Indicative hours for teaching the content of the knowledge framework

2. Applying the academic content of the finance knowledge framework in the Third year of a Bachelor degree and at Masters level

Applying the content of the finance knowledge base is also subject to questions. To address those, an example is provided in the next pages, i.e. the application of content from the finance knowledge base to the third-year curricula of a Bachelor degree in finance, a Masters degree in corporate finance and another Master's degree in market finance[678]. A standard distribution of courses that would be applicable to all curricula offered by higher education institutions and to all previous educational backgrounds would not make sense. Each institution should therefore use the example below as a starting point to adapt from for the design of their individual academic programmes.

The content of the knowledge framework and the finance job descriptions have, to the extent possible, been matched to the most closely related courses available in the three years of academic specialisation (third year of a Bachelor degree, L3, and first and second year of a Master's degree, M1 and M2). The analysis underpinning this matching exercise was supported by re.boot[679], a non-profit organisation. Matching is on occasion random, on account of multiple courses available which could deliver some of the academic concepts.

The two following hypotheses underpin the example below of how to apply academic content:

- Only courses in finance, economics and accounting of the curricula of the third year of a Bachelor degree (L3) have been looked at, based on the assumption that **the management knowledge framework would have been covered elsewhere.** A description of the application of the academic content of the management knowledge framework to courses included in the first two years of a Bachelor degree, and in the third and final year, is provided within the example for a *Programme Grande École (PGE)* available in the report « ClimatSup Business – Educating the actors of tomorrow's economy »[680].
- The second assumption is that all students starting a master's degree in finance already have acquired the fundamentals included in the management knowledge framework and in the finance knowledge framework. A refresher course integrating this academic content should be provided to make sure this applies to all students. Note that the estimated time required to implement the finance knowledge framework does not take this refresher course into account.

678 Voir méthodologie détaillée en annexe.

679 « Association re.boot ».

680 The Shift Project, « ClimatSup Business - Educating the actors of tomorrow's economy ».

To note that some subjects, such as English or mathematics, are not matched with any content included in the knowledge framework. This does not mean that they cannot cover ecological issues, at least as a form of learning support. For example, debates can be organised in a language course, on topics covered in the knowledge framework, thereby inviting students to consider cultural differences in approaches to ecological issues, societal objectives or issues included in climate negotiations.

The content of the finance knowledge framework represents 156 hours of teaching, i.e. 11% of the total number of taught hours within a Bachelor and a Master's degree specialised in finance. volume of courses for a bachelor and master's degree specialised in finance.

It is important to note that this is in addition to teaching the management knowledge framework. Therefore, a student going into finance would have to follow 165 hours dedicated to the management knowledge framework and included into various fundamentals courses, and then 156 hours, included in specialisation courses in the curricula of the third year of a bachelor degree and in a masters in finance.

The finance knowledge framework represents approximately 30 teaching hours in an L3 in finance and between 112 and 140 hours in a master's degree in finance (see Table 5: Indicative number of hours for teaching the finance knowledge base).

In L3, the finance knowledge framework represents 6% of hours taught. We have considered that only the finance, economics and accounting courses should see their content evolve. When only these courses are considered, the 30 hours of core finance teaching represent 16% of course hours.

In L3, the finance knowledge framework represents 6% of total hours taught. On the assumption that only the finance, economics and accounting courses should see their content evolve, when only these courses are considered, the 30 teaching hours of the finance knowledge framework represent 16% of course hours.

As regards the Masters in Corporate Finance (M1 & M2), the finance knowledge framework represents 12% of total hours taught.

Curricula	Bachelor in finance (L3)	Masters in corporate finance (M1 & M2)	Masters in capital markets (M1 & M2)	Total L3, M1, M2
Indicative number of hours to teach the finance knowledge framework	30 h	112 h	140 h	156 h[681]
Number of hours of a standard curriculum	480 h	960 h	960 h	1 440
% of hours dedicated to ecological issues within a standard curriculum	6 %	12 %	15 %	11 %
Number of hours taught that include content from the finance knowledge framework[682]	192 h			

[681] Moyenne entre une L3 en finance et. un mater de finance d'entreprise et, une L3 en finance et un master de finance de marché

[682] Les cours concernés en L3 sont 3 cours de finance, 4 cours d'économie et un cours de comptabilité.

% of courses that integrate content from the finance knowledge framework and that are dedicated to teaching that content	16 %			

Table 5: Indicative number of hours for teaching the finance knowledge framework

First and foremost, a few points about the finance knowledge framework and job descriptions presented in the following pages:

- **The content is not prescriptive.** Its purpose is to provide a starting point for higher education institutions seeking to incorporate ecological issues into their curriculum on finance. The content should thus be adapted to the establishment's context, objectives and the curricula in question.
- **The content is not exhaustive,** notwithstanding the amount of work gone into identifying the main areas of knowledge. The numerous academic references provided in the finance knowledge framework (P;124) allow for exploring concepts further and for identifying additional ones.

Table 6: Proposed distribution of academic content by subject taught at L3 level

Année L3

Discipline Subject taught	Connaissances du socle finance *Academic content from the finance knowledge framework*	Indicative number of hours required
Finance	Students understands where finance fits in the biosphere, its interactions with biodiversity, climate change and planetary boundaries in general. Understands the principle of embedded finance through the theories of environmental economics and environmental finance.	18
	Is familiar with the notion of double materiality: understands how finance impacts the earth's system, in particular the climate, the biosphere and living organisms, through the financing of fossil fuel-based activities that damage biodiversity or lead to the depletion of resources. Understands the risks financial players face if they fail to respect planetary boundaries: physical risks, transition risks, liability risks, etc.	
	Understands the usefulness of finance and its limits in the current context marked by the need for a transition that respects planetary boundaries	
	Is familiar with the core assumptions and postulates that underlie financial theory, as well as their limitations, e.g. the theory of market efficiency, modern portfolio theory, the Capital Asset Pricing Model, etc.	
	Understands the history of "sustainable finance", its impact and its relative importance in relation to traditional finance. Knows about social and solidarity finance and impact finance: their pillars, the actors and their performance in relation to traditional finance. Understands the main approaches used in sustainable finance, according to financial players involved, their impact and limitations.	
	Is familiar with the sociological approach to financial markets, which proves the performative nature of financial theory	
Economics	Understands the role of currency in the economy, the principles of monetary creation and the impact of the ecological transition.	6
	Understands how companies can contribute to carbon neutrality	
	Understands cost-effectiveness and cost-benefit analysis practices applied to planetary boundaries (to climate change in particular), their differences and limitations.	
Accounting	Understands carbon accounting methods	6
	Understands existing biodiversity indicators and their physical translation in relation to ecological accounting	

Table 7: Proposed allocation of M1 academic content per subject matter taught in finance (1/3)

M1 year

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours required
Financial analysis	Understands the impact of the 'double materiality' concept on financial analysis	2
Financial markets	Is familiar with the main "standard" financial products, their materiality, their risks and their impact on planetary boundaries	4
Corporate finance	Is familiar with methods to be used within carbon neutrality approaches, e.g.: Science Based Targets initiative (SBTi), Net Zero Initiative (NZI), etc.	27
	Knows different existing methods to assess alignment on the basis of science-based targets	
	Knows technical aspects to distinguish between harmful asset to planetary boundaries and an asset that supports the transition	
	Knows the main financial tools, their materiality, their risks and their impact on planetary boundaries (sustainable finance tools, different types of responsible financial products)	
	Understands the role of Public Investment and Development banks in financing projects with a positive impact on the environment	
	Understands the principle of risk-weighted assets (RWA), such as the *green and brown weighted factor*, and the scope of such measures that support and also disincentive investment, depending on the type of project or activity.	
	Understands existing methods to evaluate long-term emission reduction strategies, at the level of a company or a investment portfolio	
	Understands nature conservation strategies as well as existing 'biodiversity footprint' prospective measurement tools, so that they can be used for investment decisions on projects with a potential impact on biodiversity.	
	Knows the Equator Principles (identification of environmental risks) and the Poseidon Principles (maritime transport), etc., in project finance.	

Table 7: Proposed allocation of M1 academic content per subject matter taught in finance (2/3)

M1 year *(continued)*

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours required
Portfolio management	Knows about different asset management practices and their relevance to ecological issues	15
	Is familiar with the various levers of influence available to asset managers and the workings of a general meeting of shareholders	
	Understands the concept of fiduciary duty and its limits in relation to taking ecological issues into account	
	Identifies greenwashing in finance, thanks to a nuanced appreciation of existing labels and extra-financial ratings	
	Is familiar with the main providers of extra-financial data (Morningstar, Moody's, etc.), their methods and their limitations	
	A critical understanding of Markowitz's modern portfolio theory	
Regulation	Understands how regulatory authorities and monetary institutions are taking ecological issues into account: (monetary policies targeting sustainable development objectives, dropping the notion that the market is the sole regulator of trade and of the allocation of financial resources, etc.).	19
	is familiar with the institutions that issue transition-related financial standards	
	Is familiar with regulatory actors at French and European level (the French Financial Markets Authority, *Autorité des marchés financiers*, AMF;, the French Prudential Supervision and Resolution Authority, *Autorité de contrôle prudentiel et de résolution*, ACPR; European Securities and Markets Authority, ESMA, *Autorité Européenne des Marchés Financiers*, AEMF; etc.)	
	Is familiar with the French and European regulatory frameworks and with international voluntary frameworks, the main approaches, scope and roles of different actors.	
	Understands European and international prudential regulations and how they fit together; understands their limitations	
	Knows about the main existing national and European labels (Greenfin, the French socially responsible investment label, *Investissement Socialement Responsable* (SRI), European Ecolabel, etc.), their scope and points of discussion.	

Table 7: Proposed allocation of M1 academic content per subject matter taught in finance (3/3)

M1 year *(continued)*

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours required
Regulation *(continued)*	Is familiar with existing climate change scenarios and with stress tests relating to financial risks associated with climate change, as well as with their timing and with their macroprudential and monetary impact.	
	Is familiar with the main non-governmental organisations (NGOs) active in reforming the overall financial system (Finance Watch, Reclaim Finance, etc.)	

Table 8: Proposed allocation of the academic content of M2 in Corporate finance per subject matter (1/2)

M2 year - Corporate finance

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours
Advanced financial analysis	Is familiar with existing materiality analysis methods (carbon footprint, biodiversity footprint, risk exposure) that take account of double materiality (the company's financial impact and its impact on society and the planet). Focuses on the *intentionality* of impact, ie. beyond the concept of double materiality.	4
Fixed income securities	Understands the limitations of green bonds and sustainability-linked bonds (SLBs), blue bonds, transition bonds, etc. in their practical contribution to redirecting financial flows towards projects with a positive impact on the environment.	2
Risks	Understands the limitations of the standard financial risk framework with taking ecological issues into account. Moves away from a 'risk/return' analysis to a 'risk/return/impact' analysis.	23
	Is able to integrate physical, transition and liability risks into their analyses.	
	Understands forward-looking climate modelling and underlying assumptions	
	Identifies greenwashing in finance, develops a nuanced understanding of existing labels and extra-financial ratings	
	Is familiar with different types of uncertainty: probabilistic uncertainty and radical uncertainty, as defined by Knight	
	Understands the principles of climate stress tests, their scope, models used, underlying macroeconomic choices and their limitations (in particular, the fact that some tools are used for such a purpose, yet not initially designed as such).	
	Knows risk assessment tools related to ecological issues	
	Knows the ISO14091 standard for assessing risks related to the impacts of climate change	
	Knows the ISO 14090 standard on structuring adaptation to climate change.	
	Understands non-financial risk analysis	

Table 8: Proposed allocation of the academic content of M2 in Corporate finance per subject matter (2/2)

***M2 year - Corporate finance** (continued)*

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours
Regulation	Understands of the European taxonomy, its six objectives and the concept of *Do No Significant Harm*	16
	Is familiar with the concept of stranded assets and with current thinking on methods for disposing of them	
	Is familiar with the main Delegated and Implementing Acts that clarify EU Regulations and Directives (Second level of legal norms in European Community law).	
	Is familiar with the third level of legal norms in European Community law, ie. non-binding and consisting mainly of ESMA Guidelines, Recommendations and Q&A, and of the European Commission's Q&A.	
	Is familiar with existing voluntary initiatives (Green Bonds Principles, etc.) and with their limitations.	
	Is familiar with the ISO 14064-1 and ISO TR 14069 standards, which set requirements for organisations in relation to the quantification, reporting, design and management of the quantification of direct and indirect GHG emissions.	

Table 9: Proposed allocation of the academic content of M2 in Financial markets per subject matter (1/3)

M2 year - Financial markets

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours
Fixed income securities	Understands the limitations of green bonds and sustainability-linked bonds (SLBs), blue bonds, transition bonds, etc. in their practical contribution to redirecting financial flows towards projects with a positive impact on the environment.	2
Portfolio management	Is familiar with existing materiality analysis methods (carbon footprint, biodiversity footprint, risk exposure) that take account of double materiality (the company's financial impact and its impact on society and the planet). Focuses on the *intentionality* of impact, ie. beyond the concept of double materiality.	32
	Understands the methods for assessing the impact of companies and of investments on biodiversity, as developed via the *Mean Species Abundance* (MSA) for example.	
	Understands the alignment of investment portfolios with the Paris Agreement, main methods used and their limitations.	
	Understands the difference between 1/ a portfolio's alignment with the Paris Agreement and 2/ its contribution to achieving the objectives of the Paris Agreement	
	Knows the methods used to assess the performance of a portfolio that takes ecological issues into account	
	Understands the principles of non-financial ratings and actors involved in rating	
	Understands ESG labels and their limits in terms of taking ecological issues into account	
	Is familiar with the main methodological approaches to modelling carbon data, their scope and limitations	
	Is familiar with the main non-for profit organisations specialised in responsible investment (Forum pour l'investissement responsable (FIR), Acteur de la finance responsable (AFR)	
	Understands Sustainable Finance Disclosure Regulation, SFDR, reporting	

Table 9: Proposed allocation of the academic content of M2 in Financial markets per subject matter (2/3)

M2 year - Financial markets *(continued)*

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours
Risks	Understands the limitations of the standard financial risk framework with taking ecological issues into account. Moves away from a 'risk/return' analysis to a 'risk/return/impact' analysis.	20
	Is able to integrate physical, transition and liability risks into their analyses.	
	Understands forward-looking climate modelling and its underlying assumptions	
	Is familiar with different types of uncertainty: probabilistic uncertainty and radical uncertainty, as defined by Knight	
	Understands the principles of climate stress tests, their scope, models used, underlying macroeconomic choices and their limitations (in particular, the fact that some tools are used for such a purpose, yet not initially designed as such).	
	Understands Value at Risk (VaR) calculation models and how they are not relevant to climate risks	
	Knows risk assessment tools related to ecological issues	
	Knows the ISO14091 standard for assessing risks related to the impacts of climate change	
	Understanding of non-financial risk analysis	

Table 9: Proposed allocation of the academic content of M2 in Financial markets per subject matter (3/3)

M2 year - Financial markets *(continued)*

Subject matter	Academic content from the finance knowledge framework	Indicative number of hours
Regulation	*Understanding of the European taxonomy, its six objectives and the concept of Do No Significant Harm*	16
	Understands how 'shadow banking' has developed and why it is an obstacle to the environmental transition (difficult to regulate and control)	
	Is familiar with the concept of stranded assets and with current thinking on methods for disposing of them	
	Is familiar with the main Delegated and Implementing Acts that clarify EU Regulations and Directives (Second level of legal norms in European Community law).	
	Is familiar with the third level of legal norms in European Community law, ie. non-binding and consisting mainly of ESMA Guidelines, Recommendations and Q&A, and of the European Commission's Q&A.	
	Is familiar with existing voluntary initiatives (Green Bonds Principles, etc.) and with their limitations	
	Is familiar with the ISO 14064-1 and ISO TR 14069 standards, which set requirements for organisations in relation to the quantification, reporting, design and management of the quantification of direct and indirect GHG emissions.	
Derivative	Is aware of the side-effects of derivatives on the ecological transition, i.e. potential to hide the increasing scarcity of resources and can have a negative impact on financial stability (subprimes for example).	3

PART 4

RECOMMENDATIONS TO ENSURE THAT ALL ACTORS IN FINANCIAL EDUCATION DO THEIR PART

The purpose of this section is to accelerate the involvement of various stakeholders within higher education in finance towards greater integration of ecological issues into the curriculum.

University management and leadership are primarily concerned with this transformation; their involvement is essential for the success of the educational transformation. They have significant levers to change both initial and ongoing education, although these levers vary depending on the type of institution (private schools, universities, business management institutes-IAE, technical universities-IUT, training organisations). They can now generalise the initial actions initiated by pioneers (see recommendations on p.193).

Within the institutions, students, who have been the catalysts for these changes, must continue to play their role as a spur (p.194)**; teachers** and **non-teaching staff** must engage in the transformation of education (p.196 and p.198).

However, educational institutions are part of an ecosystem where all other actors must also evolve to support their efforts. Maintaining the status quo will not ensure that 100% of students and professionals are educated about ecological challenges.

Recommendations are intended for the state and institutional framework actors because without them, the changes cannot proceed quickly or far enough. In 2019, The Shift Project emphasised the need for institutional support, especially from the Ministry of Higher Education and Research[683]. In February 2022, the working group "Teaching Ecological Transition in Higher Education" published a list of recommendations for the Ministry. The many discussions held with the higher education ecosystem in management as part of this project reinforce and specify these recommendations to accelerate a transformation up to the challenges (p.198).

Among other external stakeholders to the higher education institutions, organisations in the finance sector must integrate ecological issues into their operations (p.205); certification bodies must ensure that professionals have a minimum level of knowledge related to ecological issues (p.207); **alumni** must testify to the need for skills and support the institutional leadership in the changes they wish to initiate (p.212); **accreditations** must better guide institutions in considering ecological issues in their programmes (p.214); **rankings** must better reflect this (p.215); **academic finance associations** must contribute to advancing the discussion in finance in the context of ecological issues (p.216).

I. Higher education institutions have a crucial role to play in the transformation of curriculums

A. Higher education institutions leadership must drive transformation and provide resources

Higher education institutions are at the heart of transforming both initial and ongoing education in finance. At the institutional level, the transformation of finance education should be part of a **broader project to integrate ecological issues into all programmes to ensure that 100% of students and professionals in management are educated on these ecological challenges.**

The involvement of heads and presidents of institutions is essential for the success of educational transformation. They have significant leverage to evolve educational programmes,

[683] The Shift Project, « Mobiliser l'enseignement supérieur pour le climat ».

although the extent of their influence may vary depending on the type of institution (management schools, universities, business management institutes-IAE, technical universities-IUT, continuous education organisations, etc.). They must initiate this transformation, allocate the necessary resources, and ensure oversight to facilitate this transition quickly and effectively for all, while respecting the academic freedom of faculty members. They can already implement the initial actions initiated by pioneering institutions. **A detailed operational guide is available to them to quickly identify the actions to be taken and, beyond these initial actions, to initiate a genuine transformation project for their education. This guide is available in the report "ClimatSup Business - Educating the actors of tomorrow's economy."** The main recommendations in this guide include:

- **Training all staff: 20 hours** (at least 10 hours) **for management and administrative staff and 48 hours for teachers,** to understand the implications of planetary boundaries on management education.
- **Redefining the institution's strategy** to ambitiously and coherently integrate ecological issues into education, research, the campus, practices, and governance.
- **Allocating human and financial resources** in line with the required transformations**: at least 3% of the operating budget for a minimum of 3 years.**
- **Assessing one's starting situation** and identifying strengths to build upon (teachers, partners, etc.).
- **Facilitating consultation with all stakeholders** of the institution to define a common knowledge and competency framework.
- Ensuring that professors do not have **conflicts of interest between their teaching and professional activities.** If such conflicts exist, they should disclose them publicly.
- **Steering the integration of this framework** into all programmes consistently.
- **Collaborating with other institutions** to accelerate progress.

B. Students must engage and challenge their institutions

Students can play a pivotal role in driving the transformation of education and the campus environment at their institutions. Collectively, they have numerous levers that they should not underestimate in contributing to the increase of ecological issues in higher education.

Resources

Pour un Réveil Écologique, « Education and Ecological Transition Platform »[684]

Jouzel report, « Mobilising the learners »[685]

RESES, « The guide for advocating on your campus. »[686]

Report on the Shift Project's workshop on students' expectations and drivers[687]

1. Engaging in collective actions related to ecological issues

Student associations and collectives addressing ecological issues contribute to the evolution of education. Institutions pay attention to their

[684] Pour un Réveil Écologique, « Plateforme Enseignement et Transition écologique ».

[685] « Rapport Jouzel - Mobilisation des apprenant·e·s ».

[686] RESES, « Le guide pour faire du plaidoyer sur ton campus ».

[687] The Shift Project, « Intégrer les enjeux écologiques dans les formations d'école de commerce - Le point de vue des étudiants ».

students' satisfaction and often strive to meet their expectations. These associations initiate projects that involve students. Here are some possible levers for actions:

- **Getting involved in the environmental association at the institution** or creating one if it doesn't exist yet.
- **Join student collectives dedicated to ecological issues** beyond the institution ('Ecological Awakening' (in French 'Collectif pour un réveil écologique'), RESES (French network of student associations), etc.).
- **Contribute to the institution's projects** on ecological issues, such as programme redesign or discussions on teaching methods, by providing perspectives for better consideration of ecological issues.
- When possible, **participate in the governance bodies** of the institution to ensure that ecological issues are prioritised.
- **Provide feedback to the institution** (through the programme director or student representative on the board) **regarding the coherent integration of ecological issues into courses and programmes** (avoiding redundancy, addressing topics at the appropriate level of complexity, avoiding contradictions between courses, etc.).
- **For the Student Union:** financially support associations working for ecological transition.
- **Systematically incorporate ecological issues into associative activities**, even in non-environmental associations, for example by prioritising train travel over air travel for associative travel.
- **Affirm your willingness to engage in ecological issues during job interviews** to raise awareness of these expectations with employers.

Student life and associations also have a role to play in changing practices on campus and experimenting with ecological transformations on the ground. It is possible to have "ecological issues" or "CSR" (Corporate Social Responsibility) representatives in student associations to integrate this topic into all dimensions of student life.

Involvement in an association or collective also helps reduce eco-anxiety by acting with peers who share the same concerns.

2. Conveying expectations to teachers

Most teachers are receptive to their students' suggestions. **Students can explicitly ask in class about the connections between the subject being taught and ecological issues.** This will encourage teachers to incorporate ecological issues more into their courses.

3. Self-educating and mobilising all students

Self-educating (via readings, videos, conferences, etc) to be more relevant in the actions undertaken.

Organising awareness-raising activities (lectures, screening followed by debates…), training (weekend training with expert/ facilitator interventions), or even participation in events (COP, city councils, climate assemblies, etc.) contributes to strengthening the awareness or knowledge of all students about these issues.

C. Teachers must undergo training to better educate students about ecological issues

Many teachers also play a significant role in transforming education. They can act at the level of their institution, in their courses, and in their research to better integrate ecological issues into education, regardless of their institution's commitment. They have multiple levers of action.

They should **undergo training, adapt their courses to incorporate ecological issues, and, if possible, align their research** with topics related to these issues.

Like students, they can **communicate their expectations and those of their students to the institution's administration and contribute to mobilising their peers.** Involvement in collective actions addressing ecological issues, like students, also helps reduce eco-anxiety by working with peers who share the same concerns.

Recommendations on how to address ecological issues in classes are presented earlier in this report. (see part 3, p. 173).

1. Self-education to better prepare students to the ecological challenges

The report titled "ClimatSup Business - Educating the actors of tomorrow's economy" recommends that teachers in management undergo a minimum of **48 hours of training on planetary boundaries and their consequences for society and the economy**. This corresponds to the mandatory foundation for students.

- **Self-train**, especially using the resources contained in this report (p.91) and in the ClimatSup Business report.
- **Request training from one's institution** on ecological issues**.**
- **Train together with peers**, for example, by joining or initiating a community of practice on integrating ecological issues into finance, dedicating a department meeting to sharing practices on this topic, inviting teachers from other institutions to share their teaching and research practices, or participating in conferences.
- **Identify the connections between ecological issues and the content of one's course** by answering the question, "how does the knowledge taught during the course impact or is impacted by the ecological situation?"
- Illustrate theoretical concepts covered in class with **examples related to ecological issues**.
- **Develop courses and practical cases related to ecological issues**, drawing on the elements of the knowledge and skills foundation **and making them available to everyone if possible** (refer to the recommendations on "How can we teach ecological issues?", p.173).
- **Experiment with new teaching methods** to address planetary boundary-related issues more effectively[688].
- **Disclose any potential conflicts of interest in research and teaching.**

[688] Scarff Seatter et Ceulemans, « Teaching Sustainability in Higher Education: Pedagogical Styles that Make a Difference ».

2. Supporting students to question and enrich the teachings with regard to ecological issues

- Supporting and encouraging the **integration of ecological themes within projects**.
- **Engaging students to address ecological issues in classes** (oral presentations, workshops, etc.).
- Scheduling dedicated moments for **constructive reflection on teaching in relation to ecological issues**[689]**.**

3. [For teacher-researchers] Directing one's research towards ecological issues.

- **Systematically questioning** the links between one's research topics and ecological issues.
- **Getting closer to researchers** working on ecological issues within one's discipline or within interdisciplinary teams.
- **Taking part in research symposiums** related to ecological issues.
- **Inviting leading researchers** on the integration of ecological issues into their discipline to internal seminars.

Resources

Collectif Labos 1point5[690]

4. Getting involved in collective actions related to ecological issues

The formation of collectives or the collaboration with existing collectives is a major lever for transforming education. Higher education institutions also launch projects in which teachers can find many opportunities to ensure that ecological issues are well integrated into discussions.

- **Partnering with committed peers or creating an internal network of dedicated teachers for the integration of ecological issues into education.** For example, at ESSEC, a group of professors created the *Together* guild, bringing together professors from all departments interested in ecological issues who regularly meet to exchange and share ideas. The ESCP *Transition Network*, on the other hand, includes teachers, students, and *alumni*. At the national level, collectives have formed, such as "Teachers for the Transition" or "Teachers for the Planet.
- **Contributing to the institution's projects**, such as the redesign of a programme or discussions on pedagogical methods, while ensuring that ecological issues are well considered in the deliberations.
- Whenever possible, **getting involved in the institution's governance bodies** to ensure that ecological issues are prioritised.
- **Encouraging and assisting, when possible, the student association at one's institution that addresses ecological issues,** or encouraging students to create one if it does not yet exist.

[689] Sidiropoulos, « Education for Sustainability in Business Education Programmes ».

[690] Collectif Labos 1point5, « Labos 1point5 ».

D. The staff of educational institutions *(excluding teachers)* must support this transformation.

The staff of higher education institutions *(excluding teachers)* plays an important role in addressing ecological issues within the institutions, whether it concerns the content of teaching, research, or the campus environment. The roles they hold are diverse. They can draw inspiration from the suggestions mentioned for teachers to define the most appropriate actions to their specific situation.

In any case, **they can receive training on ecological issues, join or create collectives on these subjects, and participate in institutional discussions to ensure that these issues are properly taken into account.**

These higher education staff members must undergo a 10 hour training programme (ideally, they will undergo the same 48-hour training as teachers) to understand the implications of planetary boundaries on management education.

II. The State and actors within the institutional framework must contribute to accelerating this transformation of education.

The State and actors within the institutional framework play a decisive role in driving a dynamic of change across all educational institutions, establishing an incentivising academic framework, and allocating resources to promote the teaching of ecological issues on a mass scale.

The State also plays a crucial role in accelerating the integration of ecological issues by private financial actors (and business in general), which is a necessary condition to fuel change within educational institutions. Accelerating the ecological transition of businesses is a powerful lever for promoting educational transformation. It leads businesses to turn to higher education institutions to train their employees and recruit young graduates, prompting these institutions to develop programmes to meet this demand.

Furthermore, the State, through public finance, can play a significant role in the ecological transition by for example funding investments that may not be profitable under market conditions and by stimulating demand for transition projects through public procurement. **This action by public finance, in turn, has a ripple effect on the demand for skills and, consequently, on higher education institutions.**

The involvement of the State is essential because the current pace of greenhouse gas emission reduction by businesses is insufficient to meet the goals set out by the Paris Agreement. Other ecological issues, such as biodiversity collapse and resource depletion, are also inadequately addressed.

A. The need for a clear political impetus from the State

1. A state-led push for the integration of ecological issues into education

A **national strategy for higher education aligned with planetary boundaries** should be defined in collaboration with all internal stakeholders (ministries, institutional leadership, teachers, researchers, students) and external stakeholders (associations, businesses, local authorities) and should encompass three dimensions: research - education - campus.

This national strategy for higher education should:

- Outline **the key guidelines that institutions must adopt and tailor** to their specific contexts (while respecting institutional autonomy and academic freedom).
- **Reiterate the goal of having 100% of the population educated on ecological issues,** as set forth in the report "Raising Awareness and Educating on the Issues of Ecological Transition and Sustainable Development in Higher Education," led by Jean Jouzel, and enshrine it in law, with ambitious timeframes and intermediate milestones.
- **Establish a national observatory for ecological transition** to measure progress in its implementation.
- **Take into account the necessary continuity between secondary and higher education** in the teaching of ecological issues.
- **Mandate the HCERES** (High Council for the Evaluation of Research and Higher Education) **to assess the teaching of ecological issues in all programmes** of all institutions and its integration into research.

To ensure the coherence of this strategy, the State must define the broad outlines of the "ecological transition" it intends to pursue, so that economic and educational actors can choose to adopt them and have a clear direction and guidelines for making decisions.

Providing this direction and framework would enable teachers to approach these issues without hesitation[691]**.** It would involve defining the scope of the subject matter (physical issues as well as social objectives) and prioritising potentially conflicting objectives. For example, are we willing to forego growth opportunities in favour of reducing greenhouse gas emissions?

This clarification should be accompanied by a review of certain injunctions, especially for public servants, which may run counter to transition goals. For instance, Article L123-2 of the Education Code states that the public service of higher education contributes to "the growth and competitiveness of the economy" in second place and "raising awareness and education on the issues of ecological transition and sustainable development" in fourth place (bis). These objectives may sometimes be in conflict, and the hierarchical order of appearance suggests that growth takes precedence over ecological transition. This instruction may require clarification. This article is an example of the need to revise the institutional framework.

[691] Nowadays some teachers may feel uncomfortable addressing issues that are often perceived as political due to the principle of teaching neutrality.

The Ministry of Higher Education, Research, and Innovation should initiate transformative actions for industries and professions in the medium and long term in close collaboration with the Ministry of Labor, Employment, and Inclusion. A forward-looking reflection on the evolution of industries and professions should kickstart this transformative movement, aiming to develop a resilient and decarbonised society in the long term.

It is essential for the State to provide higher education actors with the human and financial resources needed to meet the ambitions of educational transformation. The objective being to ultimately train all students on professions while incorporating risks and means of action, enabling the economic and financial system to fit within planetary boundaries.

2. A State-led impetus geared towards economic and financial actors

Beyond higher education, **it is also up to the State to provide clear guidelines consistent with the ecological challenges so that both private and public organisations can align themselves with the ecological transition.** Hence, these organisations should be training all their employees and be recruiting graduates trained to support the transition.

The national low-carbon strategy (SNBC) and the national biodiversity strategy (SNB) must be placed at the heart of State's action. Each of the ministries, especially the Ministry of Economics and Finance, the Ministry of Industry, the Ministry of Agriculture and Food Sovereignty, and the Ministry of Labour, Full Employment and Integration, must take ownership of these strategies so they may guide their actions[692]. **The Ministries' roadmaps must prioritise GHG emissions, biodiversity and carbon footprint reduction over GDP growth.**

Collaboration between ministries must be encouraged to address inherently ecological challenges.

To set an example, ecological impact reduction targets (emissions, biodiversity, carbon, etc.) must be assigned to each ministry.

The State must define a comprehensive course of action based on clear objectives to address the ecological challenges, with sectoral and planned targets aiming to reduce GHG emissions and relieve pressure on ecosystems. **Economic actors must adopt these national objectives and course of action,** building on a clear timetable of measures to be implemented (e.g. the ban of a given technology by 2030), so that their own development and investment plans can be altered accordingly.

This impetus is indispensable for establishing a clear framework, and enabling economic and finance actors to plan ahead and adapt to this shift. Without it, they remain trapped within a "business as usual" trajectory, with no rational interest - or indeed running a risk - in acting in favour of ecological objectives. Some economic players have even specifically called for clear guidelines and rules.

[692] The evaluation of laws in terms of their alignment or lack thereof with the SNBC is a recommendation from the High Council for the Climate, to which we add adherence to the SNB. See "The High Council for the Climate recommends a more ambitious evaluation of laws".

B. The need for an incentive framework

1. Mobilising higher education for the ecological transition

The implementation of a National Strategy for Higher Education to respect planetary boundaries and achieve its goal requires the adaptation of the academic framework.

This means:

- **Requiring public accreditation bodies to include training in ecological challenges within their accreditation criteria.** These key bodies can verify that the ecological challenges are properly integrated into all higher education courses. The Hcéres reference framework and the National Training Framework (CNF in French) should be revised to promote the teaching of transition issues. The National Commission for the Evaluation of Training and Qualifications in Management (in French CEFDG for *Commission d'évaluation des formations et diplômes de gestion*), for its part, has just added a question on institutions' commitment to energy and social transition issues into the institutions and programmes' evaluation report and could take the process even further.
- **Requiring educational institutions to make public the information relative to the content of their study programmes (names of courses, ECTS, hours allocated) as well as their course syllabi**, so as to enable students and their families to take into account the integration of ecological issues in their choice of institutions and curriculum. This is already the established standard of practice in Belgium, for example.[693] To further develop this idea, it would be very useful to standardise training booklets. This would ensure the information is both readable and comparable between educational institutions.
- **Enable research by allocating human and financial resources,** particularly when it comes to the public sector, so that fundamental research can be carried out without concern for profitability.
- **Systematically assess the ecological impact of research programmes and projects** to guide research so that it serves, or at least does not exacerbate, the ecological crisis.
- **Make institutional funding conditional** on rigorous teaching of ecological issues.
- **Promote interdisciplinarity** both in research and teaching.
- **Support and encourage interinstitutional exchange of practices,** particularly via digital platforms that enable cooperation between higher education actors.
- **Promote and disseminate existing initiatives** (Virtual University Environment & Sustainable Development, in French Université Virtuelle Environnement et Développement durable or UVED, Teaching climate, teacher cooperatives…).
- **Encourage the development and facilitation of stakeholder networks**, particularly for teachers, to promote the exchange of best practices.
- **Systematically consult with these organised stakeholders** (teachers' associations, students associations…) to best meet their needs.

[693] Académie de recherche et d'enseignement supérieur (ARES), « Compendium de bonnes pratiques en matière d'assurance qualité - outil de soutien à la qualité des établissements d'enseignement supérieur ».

2. Establishing a financial framework that serves the transition

Financial players need a clear framework to define the contours of green finance because, today, green finance is an ubiquitous promise which nevertheless remains a vague and controversial idea.[694] Although risks associated with climate change are increasingly taken into account in finance, efforts remain insufficient in light of the urgency. Moreover, **the impact of current financial flows is far from being compatible with a carbon-neutral path, which calls for a proactive action on the part of the State.** As for biodiversity and resource depletion issues, they are virtually absent from the debate.

We also recommend strengthening the integration of transition objectives into regulation and monitoring. This regulatory enhancement may take various concrete forms, the evaluation of which is beyond the scope of this report. To illustrate, the following avenues should be considered:

- **Strengthen macroprudential and structural pillars[695].**
- **Ban financing and investment in activities damaging to planetary boundaries.** It should be remembered that banks have allocated $2.7 trillion in fossil fuel fundings since the Paris Agreement, with an annual increase in volume of funding since 2016.[696] The same observation holds true for the main French banks.
- **Introduce procedure for stranding fossil fuel assets[697].**
- **Review the fiduciary duty** to include the obligation to take account of physical, climate, transition and liability risks.
- In the event of the ECB resuming its asset purchase policy, it should **announce that it will no longer accept private bonds that do not have a rigorous and coherent plan for phasing out fossil fuels by 2040/2050[698].**
- Regarding financial institutions, **financial auditors must be able to ensure that the financial services** claiming compliance with ESG criteria, focusing on climate, biodiversity or other ecological issues, **have a tangible physical impact on the corresponding planetary boundaries.**
- **Expand the role of financial auditors[699] to checking the accuracy of the information related to ecological issues** produced by companies and the implementation of transition plans, including intermediate targets by 2050. Auditors should also be able to **impose sanctions on companies that fail to implement these plans.**
- They should also be able to control **the quality, type and duration of techniques for contributing to carbon neutrality**, to avoid double counting of carbon credits and to manage the accreditation of certifiers.
- **Require finance professionals to undergo and pass a minimum 48-hour long training course on ecological issues and societal objectives.** It should be noted that the « climate murals[700] » are designed to raise awareness, not provide training. (See recommendations for professional certification bodies p.207).

694 Jean Boissinot, *La finance verte*.

695 Emmanuel Carré et al., « Mettre la réglementation bancaire au service de la transition écologique ».

696 « Banking on Climate Change - Fossil Fuel Finance Report ».

697 Institut Rousseau, Les Amis de la Terre France, et Reclaim Finance, « Actifs fossiles, les nouveaux subprimes ? Quand financer la crise climatique peut mener à la crise financière ».

698 Reclaim Finance, « Quantitative easing et climat - Le sale secret de la Banque Centrale Européenne ».

699 Finance Watch, « The problem lies in the net - How finance can contribute to making the world reach its greenhouse gas net-zero target ».

700 « Fresque du climat ».

- **Require finance professionals who develop, use or market financial products, fund projects, or work in the field of risk analysis to attend and pass a bi-annual training course** to review financial concepts and practices aligned with ecological issues and their knowledge on the latest standards and challenges. This training could, for example, take the form of compulsory certification.
- **Compliance and monitoring authorities must see their human and financial resources strengthened** to ensure that they are able to carry out their duties in the context of the current regulatory proliferation and to support the necessary changes.

C. Giving educational institutions the resources to initiate their transition

1. Provide immediate training on ecological issues

Raise the employment and payroll ceilings on a permanent basis to:

- **Create positions** for teachers trained in ecological issues.
- **Create a management position for sustainable development label for higher education establishments (such as DD&RS in France) within each institution,** responsible for developing curricula to take greater account of ecological issues.

Increase available resources to universities so that they can implement the transformation of their teaching. To illustrate, the teaching transformation project described in the guide for university managers, presented in the « ClimatSup Business – Training for tomorrow's economy »[701], requires **resources estimated at 3% of the university operating budget for at least 3 years** for training alone. These resources must enable:

- **Training for the management team and lecturers.**
- **The implementation of teaching leave policies** to enable teachers to receive training, contribute to the transformation project (carrying out a general assessment, defining the teaching curriculum, etc.) and develop their courses to incorporate ecological issues.
- **The recruitment of temporary staff** to teach courses while lecturers are being trained or to supplement their teaching.
- **The recruitment of engineering teachers** to help lecturers adapt their course formats to ecological issues teaching, and **project managers** to help implement the transformation project.

To that end, the State will implement « a structured funding (methodology, toolbox, expertise) to support this fundamental change »[702] by mobilising funding at the European, national or local level. For example, future investment plans (such as Programme d'investissements d'avenir/ PIA in France) could be mobilised at the national level.

[701] The Shift Project, « ClimatSup Business - Educating the actors of tomorrow's economy ».

[702] Jouzel et Abbadie, « Sensibiliser et former aux enjeux de la transition écologique et du développement durable dans l'enseignement supérieur ».

2. Mobilise research production for educational content

The employment and payroll ceilings need to be raised on a permanent basis **to fund the recruitment of finance lecturer-researchers with research topics related to ecological issues.**

Theses and research into ecological issues should also be encouraged and funded over the long term within a transdisciplinary framework. Among other things, this will involve increasing the number of calls for research projects on topics related to ecological issues. Research into sustainable finance may, for instance, look into the management of stranded assets, the funding of non-profitable ecological reconstruction projects, financial practices aligned with planetary boundaries etc.

However, **as the ecological transition is not intended to remain a niche topic and only concern specialists, it is the integration of ecological issues into all finance research that should be encouraged, and research funding should be conditional upon this.**

3. Enabling the ecological transition of campuses

Higher educational institutions can take action on climate change at campus level. To that end, they could implement transition plans aimed at sufficiency and energy efficiency, in particular through thermal building renovation. The State could incentivise this transition on their campuses by providing the institutions with financial aid. This would enable higher educational institutions to set an example in their efforts to make the ecological transition.

The ambition to set an example in property management and in the operational running of institutions would be consistent with the need to integrate ecological issues into teaching. Some stakeholders report that some higher educational institutions' buildings are poorly insulated, have inefficient heating systems that waste energy, do not allow waste to be sorted and do not undertake any visible or significant projects to improve energy efficiency, due to a lack of resources and/or because it is not prioritised.

III. External stakeholders to the higher education institutions also have their role to play

A. Companies and financial institutions must integrate ecological issues into their organisation

First and foremost, companies and financial institutions must integrate ecological issues into their organisation.

- This requires **rigorous training for the board of directors and the executive committee on climate issues, the erosion of biodiversity and mineral and energetic resources. 20 hours of training** (minimum 10 hours) are required to gain a basic understanding of ecological issues and the link with finance.
- The people at the head of these entities must then **commit their organisations to a coherent and ambitious strategy for respecting planetary boundaries**, and develop their practices accordingly.
- **The organisation must also integrate the various risks** (physical, liability and transition risks for the climate, biodiversity and resource depletion) **into its risk management and strategy**.
- **Train all their teams** on ecological issues and their implications for their professional practice. Frequent training sessions to update this knowledge foundation must be ensured.

In addition, companies and financial institutions play a decisive role in the development of training courses. Higher education institutions in management are sensitive to their expectations with regards to skills and competencies. Companies and financial institutions are represented on training institutions' boards of directors. They contribute to the institutions' funding by calling on them for the continuing education of their managers, by funding their research chairs, and by earmarking the apprenticeship tax. By funding research, they also help to develop the knowledge framework informing education. Hence, they have a number of ways to exert a strong influence on the training courses that are developed.

- **Integrate ecological issues into their strategy,** operations and recruitment.
- **Ask educational institutions to provide initial and continuing training integrating ecological issues**, so as to ensure they have the skills needed to implement the ecological transition.
- **Get involved on the board of directors** of educational institutions to ensure that ecological issues are considered in training courses.
- **Make the allocation of their apprenticeship tax conditional** upon the integration of ecological issues in training courses.
- **Fund or co-fund research chairs in finance** or subjects related to ecological issues, potentially involving researchers from several educational institutions and disciplines. For example, the « *Finance Reconsidered* »[703] Chair at Kedge, funded by Candriam, is tasked with examining new models that promote the materiality of ESG criteria in asset management, asset pricing, and risk management. This type of funding raises questions such as the independence of research in higher education, and the fact that research is focused solely on potentially profitable subjects with a time horizon that is incompatible

[703] Kedge Business School, « Chaire Finance Reconsidered: Addressing Sustainable Economic Development ».

with fundamental research' needs. That's why complete independence of the research and publication of findings must be ensured.

- **Offer internships** on subjects related to ecological issues.

ESG, moving beyond the indicator for targeted impact (for more details, see p.72).

ESG has captured the attention of financial actors, however, its capacity to generate a positive impact on ecological issues has yet to be proven.

On the one hand, it lumps together elements that are unrelated; such as environmental, social, and governance aspects. This results in a dilution of each of these issues, which might be better addressed individually.

On the other hand, **the weighting between E, S and G is wholly variable and opaque.** The ESG rating therefore appears to be a tool that cannot be compared between the different rating agencies. Moreover, **the weighting scheme of this extra-financial rating with the overall financial rating is not disclosed either.** This raises questions as to the actual importance given to ESG criteria, especially ecological issues.

If the initial goal of focusing on ESG issues is to have a positive impact on each individual criteria, the current ESG scheme is not up to the task. Some actors believe that ESG is a single materiality indicator (outside-in), considering the impact of ESG-related risks on the company, rather than a double materiality indicator (inside-out), which would include the company's impact on ecological issues.

If overhauled completely, ESG could be a useful tool, but it does not constitute an end in itself. Financial actors should not lose sight of making a real impact. What really matters is the respect of planetary boundaries, in particular climate change and the erosion of biodiversity, as well as the awareness of other physical constraints, such as the depletion of energy and natural resources.

B. Certifications as a key lever for training finance professionals

There are a number of certifications designed to guarantee the qualifications of finance professionals. Some, such as the French Financial Markets Authority (Autorité des Marchés Financiers or AMF) exam[704], are compulsory for professionals in certain roles and attest to their minimum skills and knowledge of the financial, regulatory and ethical environment. Others, such as the *Chartered Financial Analyst* (CFA) certification, are voluntary-based and assume advanced mastery of the concepts taught therein. As a result, the training duration required to obtain a certification varies enormously. For example, the AMF exam requires around 25 hours of training, whereas level 1 of the CFA, which comprises 3 levels, requires alone a minimum of 300 hours of training.

It is also important to distinguish between « general » certifications, not specialised in « sustainable finance », and certifications specialised in « sustainable finance », which each have their own audience and reach professionals with different roles and responsibilities, all concerned by the ecological transition.

Concepts related to sustainable finance are included in the body of knowledge and skills of « general » certifications. This is true for the AMF « general » exam[705], where it has recently been reinforced, and for the *Chartered Financial Analyst* (CFA) certification[706].

General certifications are a means for reaching a large number of finance professionals. They play a structuring role in the training of professionals and are very widespread in finance. The inclusion of ecological issues in these qualifications therefore has a significant impact on finance professionals and training courses in the sector. For this reason, the AMF exam and level 1 of the CFA certification, two important certifications for the field, have been analysed as part of this project in order to draw conclusions and recommendations intended to apply to all certifications (and not solely to the AMF and the CFA).

Certifications dedicated to sustainable finance or ESG issues have also emerged in recent years as a result of the growing importance for these issues in the field. In France, for example, the AMF has developed a « sustainable finance exam ». Globally, the CFA Institute launched its own *ESG Investing Certificate*[707] three years ago and offers an online course dedicated to « climate finance[708] ». The English chapter of the CFA Institute also offers a *Certificate in Climate and Investing*[709]. **These specialised certifications are not mandatory and have a much smaller impact than general ones in terms of number of professionals trained.** Nevertheless, they can still benefit from the recommendations presented in this report.

[704] L'examen AMF est appelé aussi par abus de langage « certification AMF ». En réalité, l'AMF certifie uniquement les organismes qui organisent l'examen AMF et non les personnes qui le réussissent.

[705] AMF, « Certification professionnelle : la vérification des compétences et connaissances minimales et l'examen AMF ».

[706] CFA Institute, « Certificate in ESG Investing ».

[707] CFA Institute.

[708] CFA Institute, « Climate Finance ».

[709] CFA Institute UK, « Certificate in Climate and Investing ».

1. Insufficient learning content in general professional certifications

Taking ecological issues into consideration in general certifications is insufficient. It does not enable finance professionals to become aware of the connection between planetary boundaries and their profession, nor to understand the important and necessary contributions of finance of the ecological transition.

The limits of financial mechanisms to account for ecological issues are not discussed, which does not contribute to the development of critical thinking among professionals regarding the solutions available to them.

Ecological issues are often only addressed from the perspective of ESG criteria. The central and inescapable nature of physical constraints is diluted by other considerations (social and governance issues) **which, although important, are nonetheless of secondary importance, being conditioned by physical constraints.** With this type of approach, a company can obtain a good ESG rating while continuing to ignore planetary boundaries. For a more exhaustive critique of the ESG approach to finance, see page 72.

2. Recommendations for general certifications

- **Integrate ecological issues systematically and across the board** into general certifications. **The aim is to ensure that professionals acquire an understanding of physical limits, their implications for the proper functioning of the economy and finance, and the systemic nature of the ecological transition. Finance professionals must understand the essential contribution of finance to the ecological transition (and its vulnerabilities) to adapt their practices:** funding the mitigation of organisations' impact on planetary boundaries, improving the resilience of the real economy for upcoming crises, not exacerbating eco-systemic imbalances.

  This objective must, of course, be pursued by adjusting the ambition and learning content to the amount of time devoted to developing the certification, to its inherent learning aim, and to the attendees' profiles. **As an indication, content devoted to ecological issues must represent 25 %[710] of a general certification training** *(with a minimum of 11 %[711]).* This can be achieved without necessarily overloading the learning content, by not confining the concepts of sustainable finance to one section of the syllabus but instead spreading them across multiple courses to demonstrate their systemic nature.

- **Promote a critical assessment of the current consideration of ecological issues by finance** and advocate for practices that enable a genuine redirection of financial flows toward activities compatible with the ecological transition. For example, the AMF certification mentions SRI/ESG management approaches such as « ESG integration, *Best-in-Class, Best-in-Universe*, etc. » without mentioning their limits in generating impact for the ecological transition. **Finance professionals must not only be familiar with the mechanisms used by finance to take ecological issues into account, but they must**

[710] Soit l'équivalent du temps nécessaire à l'enseignement du socle finance ajouté au temps nécessaire à l'enseignement des connaissances du socle « gestion » liées aux contraintes physiques, aux objectifs sociétaux et à leurs implications sur la finance, l'économie et la comptabilité, le tout rapporté aux 960 heures d'un master en finance.
[711] Soit l'équivalent du temps nécessaire à l'enseignement du socle finance rapporté au volume horaire total de formation L3 – M1 – M2.

also be aware of their limitations, as highlighted by their effects on the real economy (see part 2, p.55).

- **Regularly update certification content** as knowledge on climate, resource depletion, biodiversity and financial regulation evolves.

3. Examples of knowledge and skills to include in general certifications

The examples of knowledge and skills mentioned below are based on management (see p.94) and finance (see p.123) knowledge and skills frameworks. For more examples and references, see the relevant sections. These knowledge and skill sets are broken down according to the themes covered in general certifications. Certification bodies may draw inspiration from them to develop their educational content.

Likewise, specialised certifications, which demonstrate similar biases as general certifications, are invited to include them in their training and assessments schemes.

Themes	Examples of knowledge and skills to be included
Regulatory and ethical environment	**Proposition to add concepts related to physical constraints** to the section covering topics related to the regulatory and ethical environment, which could be renamed « Physical, regulatory and ethical environment ». This section would include, for example: • **Knowledge of the main physical constraints** (global warming, biodiversity collapse, depletion of energy and non-energy resources). • **Knowledge of the way in which finance impacts the Earth system,** and in particular the climate, the biosphere and the living, through fossil-fuel-based activities' funding that is harmful to biodiversity or leads to the depletion of resources. • **Knowledge of the risks incurred by financial players as a result of non-compliance with planetary boundaries:** physical risks, transition risks, liability risks, and their interaction with traditional financial risks (credit, liquidity, etc.). • **Understanding the essential contribution of finance to the ecological transition:** funding the mitigation of organisations' impact on planetary boundaries, improving the resilience of the real economy for upcoming crises, not exacerbating eco-systemic imbalances. • **Considering the respect for planetary boundaries** as a professional challenge. • **Prevent, detect and dissuade *greenwashing*.** • **Understanding the implications of ecological issues for fiduciary duty**.

French, European and international institutional and regulatory framework	• **Knowledge of the Paris Agreement and in particular Article 2-1. c)**[712, 713]. • **Knowledge of European and French regulations on reporting obligations** (29 LEC, SFDR, CSRD etc.). • **Knowledge of European and international prudential regulations** related to ecological issues, how they relate to each other and their limitations.
Economy	• **Understanding the connection between economic growth, physical flows and physical constraints**. • **Understanding the concept of absolute decoupling** in relation to climate objectives. • **Understanding the connection between resource availability and inflation**. • **Understanding the limitations of the major economic theories in taking physical constraints into account**. • **Understanding economic theories aiming to integrate ecological issues** and envisioning alternatives to perpetual growth, such as degrowth or post-growth.
Accounting basics	• **Understanding the principles of ecological accounting**.
Quantitatives methods	• **Understanding the limits of actualisation** in accounting for ecological issues. • **Understanding the limits of using historical series** to predict future trends in a context of radical uncertainty, and in particular the increase in frequency and severity of extreme climate events. • **Understanding the effects of increasing frequency of extreme climate events** related to ecological issues on the statistical distribution of risks. • **Knowing how to use a scenario-based approach** for decision-making in situations of uncertainty. • **Be able to source extra-financial data**, understand it and assess its quality and relevance. • **Be capable of taking an epistemic step back from the difference between the natural sciences (based on the scientific method, which makes it possible to understand natural laws) and social sciences**, including finance (whose calculations are based on social constructs and are to some extent performative). • **Understanding the notion of epistemic bias**, putting into perspective the almightiness of calculations and algorithms (Li's copula, for example).

[712] Nations Unies, Accord de Paris.

[713] « Le présent Accord, en contribuant à la mise en œuvre de la Convention, notamment de son objectif, vise à renforcer la riposte mondiale à la menace des changements climatiques, dans le contexte du développement durable et de la lutte contre la pauvreté, notamment en : […] **Rendant les flux financiers compatibles avec un profil d'évolution vers un développement à faible émission de gaz à effet de serre et résilient aux changements climatiques** »

Financial statements analysis	• **Knowledge of ratios and measures of value accounting for planetary boundaries**, such as carbon-adjusted *earning before interest, taxes, depreciation, and amortisation* (EBITDA). • **Be able to assess the effects of ecological issues** on demand, selling prices, costs and margins. • **Use scenario analysis** to forecast changes that will affect financial statements as a result of ecological issues.
Corporate finance	• **Be able to assess the compatibility of business models with the respect of planetary boundaries** (e.g. the implications of a reduction in greenhouse gas emissions of at least 6% per year, increasing scarcity of mineral and fossil resources, etc.). • **Understanding the risks** incurred by ecological issues for economic and financial activities (physical, transitional and reputational risks) and how these risks intersect with traditional financial risks (liquidity, credit, market, etc.). • **Learning how to distinguish between risk and uncertainty** according to Frank Knight, and its implications in terms of prospective analyses, particularly in light of climate change. • **Knowledge of the limits of capital investment decision-making techniques**: namely the lens of actualisation that minimises future effects. • **Acquire theoretical and practical knowledge of environmental due diligence.**
Sustainable finance	• **Knowledge of ESG criteria limitations** in accounting for ecological issues. • **Knowledge of SRI/ESG management approaches' limitations (ESG integration, Best-in-Class, Best-in-Universe, Best effort, exclusions)** in terms of their ability to have a positive ecological impact. • **Knowledge of the green Taxonomy**. • **Understanding issues raised by passive management in relation to ecological issues**. • **Knowledge of the scope and limits of French SRI,** namely criticisms relative to the IGF. • **Knowledge of the limitations of green bonds and sustainability-linked bonds (SLB), blue bonds, transition bonds, etc.,** regarding projects additionality and their practical contribution to redirecting financial flows towards projects with a positive impact on the environment. • **Knowledge of the limitations of market efficiency theory** and its implications for the consideration of ecological issues.

Portfolio management	• **Knowledge of the limitations of mechanisms used in portfolio management to factor in ecological issues** (ESG integration, Best-in-Class, Best-in-Universe, Best effort, exclusions, etc.). • **Gain a critical understanding of passive management practices** from the ecological issues perspective. • **Take a critical view of climate risk models,** particularly their probabilistic approach based on past analysis. Understand why this is no longer relevant in a changed climate regime. • **Understanding the limits of value at risk in relation to ecological issues**, in particular the impossibility of replicating this practice for climate and other ecological issues. • **Understanding the strategy of shareholders' engagement** to foster corporate engagement with the ecological transition. • **Knowledge of the risks incurred by ecological issues on economic and financial activities;** understand the intersectionality of these risks (transition, physical, liability) with the risks associated with asset management (regulatory, economic and financial, monetary, etc.).

Table 10: **Examples of knowledge and skills to be included in certifications**

C. *Alumni* must relay the need for ecological challenges-related skills to their higher education schools and organizations

Alumni have an important role to play, owing to their direct link to the professional world. Indeed, *alumni* can **relay the need for ecological challenge-related skills in their new positions, as well as their concerns on the subject, to their former graduate schools and professors.**

Since acting collectively is the most efficient way to proceed, they can **constitute or join an *alumni* network engaged on the ecological challenges.** There already exist numerous *alumni* networks involved on the ecological challenges[714]. In this collective frame, they can contribute to either the evolution of the training proposed by their former graduate schools, or help students and other *alumni* to orient themselves towards professions that are aligned with the ecological challenges.

1. Drive the evolution of their alma mater's training curriculum

***Alumni* can act, by themselves or through their employer, to support school boards of direction and teachers that wish to implement the ecological challenges to the curriculum.**

- **Bring their companies to get involved with the school to testify on the importance of the ecological challenge in their sector of activity,** for instance by becoming a

[714] Presentations from several of these *alumni* networks can be found in the appendix to the "ClimatSup Business - educating the actors of tomorrow's economy", available for download on the website of the project: https://theshiftproject.org/en/article/training-tommorows-economic-actors/

partner or even board member of the school. This action is essential to legitimise to the teachers and directors of a school the work towards integrating the ecological challenges to the training curriculums.

- **Take part to the setup of courses integrating the ecological challenges.** For instance, the ESCP developed the *Energy, Business, Climate & Geopolitics*[715] course with the help of *alumni.*
- **Getting involved in the various councils and work groups of the graduate school** to ensure they take the ecological challenges into account, especially when reforming the teaching programmes and the skill repository.

2. Directly take part to the training to and raise awareness on the ecological challenges

- **Take part to the training** of students, alumni, and the various stakeholders of their institute on ecological challenges (through taking part to teaching activities, fresk organisation, articles and opinion pieces writing, …)
- **Kickstart some or take part to the events** organised in their school (Such as a Back-to-school climate Fresk)
- **Organise** awareness-raising events (themed discussions, invite experts, …).

3. Help students and *alumni* to move into careers that are better aligned with the ecological challenges

For *alumni* associations, that can involve:

- **To identify employers that have integrated the ecological challenges** in their operations and global strategy.
- **Spread inspiring career paths** or testimonies from *alumni* that work in ecologically-aligned jobs.
- **Organise a impact forum** of careers or companies.
- **Setup a regular poll for *alumni*** on the importance of ecological challenges in their career paths and on the means to get trained thereon.

Ambitions Transitions

Creation date: November 2021

Mission: Ambitions Transitions is an engaged *alumni* collective with higher education backgrounds. We **inspire, federate and facilitate *alumni* transitions and engagement towards an inclusive and durable society.**

Our drives:

- Helping engaged clubs to establish and connect
- Mutualise actions to strengthen impact.

Field of action:

- Teaching (revise training contents / support schools).
- Professions (company meetings / webinar / forum / inspirational career paths).
- raising awareness (writing editorials / new narratives / fresks / advocacy).

[715] ESCP Business School, « Energy, Business, Climate & Geopolitics ».

Main achievements:

- Organised the *Ambitions Transitions 2022* forum in April 2022 (+1100 visitors, 66 recruiting engaged organisations, 6 training organisations, 12 round tables and 12 workshops)
- Co-organised the closing evening of the University for the economy of tomorrow (UED) 2022, initiated by the sufficiency-themed Mouvement Impact France.

Projects:

- Organise the Ambitions Transitions 2023 forum - https://forum-ambitionstransitions.fr/
- Mobilising higher education *alumni,* beyond business schools and engineering schools (universities, undergraduate technology institutes (IUT), schools of architecture, of journalism, of communication…).
- Build synergies with the transition sector to act on higher education: "For an ecological wake-up", Alumni for the planet, …
- The mapping of transition stakeholders within the higher education transition ecosystem.
- Creation of local Ambitions Transitions branches in France (first in Lyon and Nantes)
- Bring support to the creation of collectives in higher education institutions.
- Produce a collectives creation kit.
- Organise in-person and online conferences.
- Opinion pieces writing.

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Once established, laureates also have leverage to bring their company on track for internal practices' effective transformation aligned with the ecological challenges. A young employee in a company, while he might not *a priori* have the same leverage as the executive managers, can get involved through employees' councils and organisations. Unions, for instance, can play a part in bringing up incentives for the employers to improve company practices. Additionally, one can join networks of finance professionals that are mobilised on those topics, such as Shifters in finance (*STiF*).

D. Need for the evolution of ranking and accreditation bodies.

This section summarises the recommendations from the «ClimatSup Business - Educating the actors of tomorrow's economy» report, which additionally proposes constructive examples of relevant economic indicators.

1. The necessary evolution in the accreditation of management graduate schools.

1. **Give an at least equal weight to courses on the ecological challenges as to other teaching matters.**
2. **Clearly define the ecological challenges, with a body of circumstantial information** allowing the teaching institutions to understand what is expected from them in substance, thereby avoiding spurious interpretations. **This definition must clearly lay out how central are the challenges linked to the physical limits of the planet.**
3. **Take into account the actions taken in terms of professorial training, in order to integrate the ecological challenges in the regular courses** - non-dedicated to ecological

transition - **or for courses that already integrate CSR aspects while the teacher is not trained to the physical challenges of the ecological transition.**

4. **Adopt a critical approach towards the existing assessment criteria, with regards to their impacts to the ecological challenges.** The entirety of current accreditation indicators must be assessed. For instance, criterions on **international mobility, number of students, researchers, publications.**
5. **Cross-reference the data collected from the teaching institutions with other sources (such as current students and *alumni*) for better representativity.**
6. **Use more quantitative reporting indicators** in addition to the qualitative ones.
7. **Improve transparency and access to information** through the requirement for teaching institutions to publish - as far as deemed possible (and excepting confidential data) - all transmitted information[716].
8. **Consult with students, companies, and other stakeholders from the civil society, in order to define said indicators.**
9. **Grant various gradings of validation for the integration process of ecological challenges within teaching institutions, following the example of the French DD&RS Label.**

2. A necessary evolution for the rankings of upper education schools of management.

1. **First of all, ensure that the ranking body is properly funded.**
2. **Bring a clear definition of the ecological challenges, with a body of circumstantial information** in order for the institutions to understand in substance what is expected from them, while avoiding spurious interpretation. **This definition must clearly lay out how central are the challenges linked to the physical limits of the planet.**
3. **Give an at least equal weight to the teachings on ecological challenges as to other ranking criterions.**
4. **Take into account the actions taken in terms of professorial training, in order to integrate the ecological challenges into the conventional, usual courses** (non-dedicated to the transition), **or for courses that already integrate CSR aspects while the teacher is not trained to the physical stakes of the ecological transition.**
5. **Adopt a critical approach towards the existing indicators, with regards to their impacts to the ecological challenges.** The ecological impact of current indicators used for accreditation needs to be assessed: **international mobility, number of students, researchers, publications, laboratories, or expected wage after graduation.**
6. **Cross-reference the data collected from the teaching institutions with other sources (such as current students and *alumni*) for better representativity.**
7. **Use more qualitative reporting indicators** in addition to the quantitative ones
8. **Improve transparency with regards to the aims and used method:**
    - **Clearly state the philosophy driving the ranking.**

[716] The CEFDG already publishes their reviews for the concerned institutions.

- **Ensure transparency in the methodology**[717].
- **Improve public access to information**: require the teaching institutions to publish - as far as deemed possible (and excepting confidential data) - all on-site transmitted information.

9. **Consult with students, companies, and other civil society actors** when defining new indicators.

E. Academic associations active in finance must favour consideration of the ecological challenges in finance.

Academic associations aim to stimulate, disseminate and promote their scientific knowledge. The many means available to them to encourage integrating the ecological challenges to finance trainings include:

- **Organise conferences and symposia** on the tight linkage between finance and ecological challenges.
- **Grant prizes and fundings** to research focused on the ecological challenges within finance.
- **Favour the publishing of research articles** that include the ecological challenges in their journals.
- **Publish manuals** whose contents help teachers to integrate the ecological challenges to finance teaching.
- **Lobby international authorities** on the importance of integrating ecological challenges to financial thinking.
- **Organise workshops** for researchers and professionals, on the consequences of the ecological challenges to the world of finance.

[717] Higher Education Sustainability Initiative, « Assessments of Higher Education's progress towards the UN Sustainable Development Goals, Volume 1 ».

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Appendices

Appendix 1 - Guiding principles for the project

The project "ClimatSup Finance - Training Finance Professionals for the Ecological Transition", which is the finance focus of the "ClimatSup Business - Educating the actors of tomorrow's economy" project, has followed a certain number of guiding principles, which were formalised at the beginning of the project as follows:

Serving the general interest

As The Shift Project has the status of a general interest association, this work is carried out in complete transparency, openness and consultation: all the results are public and can be reused by others, and all the players who wish to do so can take part in the process.

Respect the freedom of establishments

The Shift Project has no decision-making prerogatives within the partner establishments, and respects their specific characteristics and operations.

Respect the freedom to teach

The project team is not intended to take the place of the teachers, their goodwill is therefore decisive.

Working in consultation

Consultation is central to gathering the expectations and needs of stakeholders, gaining an on-the-ground vision, taking into account and building on existing initiatives, and working closely with the teams responsible for implementation.

This consultation process goes beyond the partner institutions, since the project invites other players to take part in the discussions: other higher education institutions, experts in the various disciplines involved, companies, etc.

Anticipating future changes in business skills alongside with companies

Leading the ecological transition requires financial players who are citizens, capable of understanding and serving the general interest, and with the skills needed by companies (and organisations) to transform themselves. It is from this perspective that professionals have been involved in the discussions.

Appendix 2 - Methodological note on the assessment of finance training courses in terms of their integration of ecological issue

The scope of the ClimatSup Finance project is focused on the initial and continuing education courses that provide practical training for current and future finance professionals.

This inventory is not intended to be exhaustive, but it does aim to list the significant courses that set the standard for training professionals in the various finance professions. The aim of the inventory of finance training courses in France is to provide a diagnosis of what already exists and also to identify the resources available in each institution.

The courses studied were based on the documentation available on the websites of the various establishments.

1. Scope of initial training

a. Training course selection criteria

The courses studied in this report are those specialising in finance and its various branches: banking, insurance, market finance, corporate finance, etc.

Accounting courses (BTS, DCG, professional licences) have been excluded from the scope of the study, as they provide training for careers in business in general, and not finance in particular. Similarly, courses that do not relate specifically to finance, such as general management courses, were not studied. Double-degree courses with a foreign institution were therefore excluded from the scope of our study.

The type of initial training and qualifications covered by our study can be summarised as follows:

Training courses within the perimeter, if specialised in finance	Training courses out of the perimeter
• Master • Master of Science (MsC) • Master's degree (Magistère) • Master (Mastère)[718] • Programme grande école (PGE) • Bachelor Universitaire de Technologie BUT (ex-DUT) • Optional courses • Licence • Bachelor • Summer/winter school	• Doctorate • CPGE • Diplôme de comptabilité et gestion – DCG • Diplôme supérieur de comptabilité et gestion (DSCG) • Licence (other than specialised in Finance) • PGE (other than specialised in Finance) • Bachelor (other than specialised in Finance) • Accounting trainings • BTS • …

[718] RNCP-registered level 7 professional qualification (BAC+5) RNPC: Répertoire National de la Certification professionnelle (French National repertoire of professional certification)

Table 11: Selection criteria for initial training courses

b. Method for identifying initial training courses

The survey of initial training courses was based on word of mouth and on various rankings of finance courses:

Ranking	Number of establishments considered
Financial Times 2021 Masters in Finance ranking[719]	The top 15 establishments
QS 2020 ranking of Masters in Finance in France[720]	The top 14 establishments
Eduniversal 2022 ranking of the 30 Masters in Banking and Finance[721]	The top 20 establishments
Eduniversal ranking of the 25 Masters in Market Finance and Portfolio Management[722]	The top 20 establishments
L'Étudiant 2022 ranking of engineering schools[723];	The top 20 establishments
Le Figaro étudiant 2022 ranking of engineering schools[724]	The top 20 establishments
Eduniversal 2022 ranking of the 15 insurance masters - law, management, actuarial science[725]	The top 15 establishments
Eduniversal 2022 ranking of the 25 Masters in Financial Engineering and Corporate Finance[726]	The top 15 establishments

Table 12: Rankings used to select the higher education institutions studied

719 Financial Times, « Masters in Finance pre-experience 2021 - Business school rankings from the ».

720 Arengi, « Le classement 2020 des meilleurs masters en finance en France » («The 2020 ranking of the best Masters in Finance in France»)

721 Eduniversal, « Classement Master Banque - Finance, top 30 2022 » («Master of Banking - Finance ranking, top 30 2022»)

722 Eduniversal, « Classement Master Finance de Marché et Gestion de Portefeuille, top 25 2022 » («Master of Market Finance and Portfolio Management ranking, top 25 2022»)

723 L'Etudiant, « Classement des écoles d'ingénieurs 2022 » («Engineering school rankings 2022»)

724 Le Figaro étudiant, « Classement 2022 des écoles d'ingénieurs excellence 2022 » («2022 ranking of engineering schools excellence 2022»)

725 Eduniversal, « Classement Master Assurance - Droit, Management, Actuariat, top 15 2022 » («Insurance Master's ranking - Law, Management, Actuarial science, top 15 2022»)

726 Eduniversal, « Classement Master Ingénierie Financière et Finance d'Entreprise, top 25 2022 » («Master's in Financial Engineering and Corporate Finance, top 25 2022»)

Where the institution is mentioned, all finance courses offered by the institution are included in the inventory, whether initial or continuing. Institutes of political studies offering finance courses have also been included in the analysis.

2. Scope for continuing education courses

a. Selection criteria for continuing education courses

The types of trainings & continuing education certificates in the scope of our study can be summed up as follows:

Courses within the scope, if done with a Finance major	Courses outside of the scope
• Master of Business Administration (MBA) • Executive education • Courses leading to qualifications or diplomas in general courses establishments or organisations • Short courses	• In-company & customised courses • Corporate university • Non-Finance specialised courses

Table 13: Scope of continuing education

b. Listing method for continuing education courses

Continuing education courses were listed using the same method as for initial training courses. Many higher education institutions also offer continuing education courses.

In addition, particular attention has been paid to training organisations that specialise in continuing education. These continuing education courses were identified by word of mouth.

3. Methodology for the survey

The « ClimatSup Finance – *Training Finance Professionals for the Ecological Transition* » project sought to assess the extent to which ecological issues are integrated into the leading finance courses. The aim was to determine the proportion of finance courses offered by the institutions identified that address ecological issues and the way in which these subjects are dealt with. More specifically, particular attention was paid to courses that integrate these issues into their teaching, according to a principle of gradation of intensity. Where indicated, the number of ECTS, course hours, concepts covered and the compulsory, elective or optional nature of the course were noted.

In this report, we look at the extent to which ecological issues are taken into account in the finance courses - initial and continuing - that are the gold standard in France[727]. The overview takes a broader approach of 'ecological issues' than what has been used so far in this report, including responsible investment, sustainable development and climate risk modelling. A gradation of

[727] By “courses” we mean the different training paths that a student can follow in higher education in France, whether in initial or continuing education.

intensity has been introduced to distinguish between courses that merely address ecological issues, and those that integrate them adequately.

This reasoning is explained in the diagram below:

A gradation of intensity has been introduced to distinguish between courses that merely address ecological issues, and those that integrate them adequately.

This reasoning is explained in the diagram below:

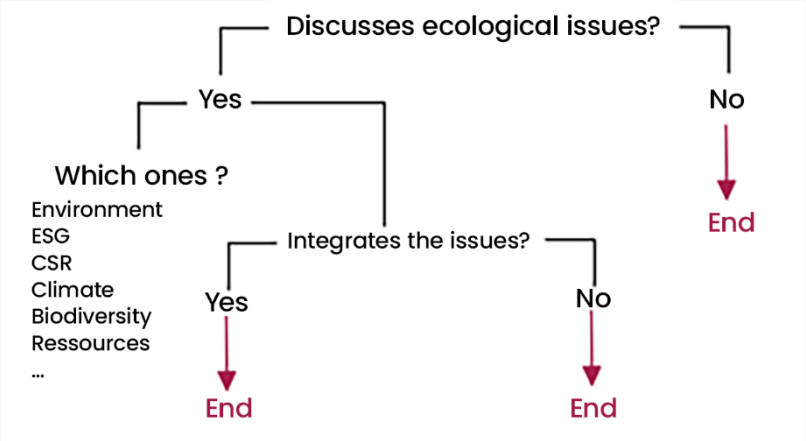

Figure 14: (Annexe) Logigramme de décision pour l'état des lieux du projet ClimatSup Finance, The Shift Project

a. Définitions

- « Address »: we have adopted a very broad definition of the verb "to address". All the courses for which we were able to ascertain that at least one course mentioned these issues at one time or another, whether marginally or in depth, are considered to be "addressing" ecological issues. Thus, the fact that a course 'addresses' these issues does not prejudge the degree of depth of the subject or the quality of the content.
- « Ecological challenges »: Similarly, we have adopted a broad definition of the notion of "ecological challenges". A course addressing these issues may therefore cover the environment, ESG, sustainable development, CSR, SRI, the climate, biodiversity, the depletion of resources, etc.
- « Training », refers to all higher education courses specialising in finance and renowned in the sector, whether initial or continuing training. These are training pathways, i.e. the different training courses that a finance student can follow at a given institution.
- « Integrate »: if the course is recognised as addressing ecological issues, we fine-tune the assessment to identify whether it integrates these issues. The difference between the terms addressing and integrating is that of a gradation of increasing intensity. Integrating ecological issues into training suggests that these subjects are considered in a more structural way, and no longer at the margins. In concrete terms, this means that there are several courses in which ecological issues are detailed and applied to financial matters. What's more, these courses should be an integral part of the curriculum, and not just optional.
  Behind the question of whether training courses integrate ecological issues, there is the idea that it is not enough to have a very good quality course on planetary boundaries (for example) to then have only business as usual finance courses, without integrating a systemic reflection on the ecological emergency.

It should be stressed that the analysis is based on the information available online. This information varies considerably from one establishment to another: there are, for example, cases where we have had access to the course syllabi and others where we have only been able to analyse the course brochure. In these cases, we relied on a cluster of clues from the information available in the brochure to determine whether or not the courses addressed ecological issues.

b. Special cases: AMF/CFA

A team of Shifters volunteers has contributed to fill in the inventory of the AMF (Autorité des Marchés Financiers) and CFA (Chartered Financial Analyst) certifications.

For each training course, it had to be checked whether it offered preparation for AMF and/or CFA certification.

This information was not initially included in the spreadsheet. However, these certifications devote a small part of their questions to sustainable finance. Thus, the fact that the courses prepare - or not - for AMF and/or CFA Institute certification can change their status in the inventory from "does not address ecological issues" to "does address ecological issues".

- ☐ The simplest case: when there is a specific course specifically devoted to preparing for CFA/AMF certification: it was considered that there was indeed an additional course
- ☐ In some cases, these certificates were awarded at the end of the training course, whose courses were all designed to prepare for certification. In this case, and when there was no explicit course indicating/comprising CFA / AMF, there were 2 possible cases:
    - Where ecological issues were addressed elsewhere, we have not added a line for CFA/AMF training (considering that these ecological issues have been addressed elsewhere in the other courses)
    - When ecological issues were not covered elsewhere (i.e. there were 0 courses covering ecological issues) but it was explicitly stated that the course was preparing for AMF/CFA certification: we have considered that the course covered ecological issues as part of the preparation for AMF/CFA certification.

c. Analysing and processing the results

The information gathered has been analysed using pivot tables, with the support of a Shifters volunteer.

To ensure the transparency and replicability of the results obtained, the full spreadsheet is available on the Shift Project website.

A team of Shifters then contacted the various institutions whose finance training courses had been examined. This made it possible to offer these institutions a right of reply and correction.

4. Focus on the Technology University (I.U.T)

a. Method of analysis

The treatment of IUTs in our study is relatively special, given that the curricula have changed from 2021 to become 3-year B.U.T. (university bachelor of technology) courses, instead of 2-year D.U.T. courses.

As part of this, the University Diploma in Technology (D.U.T.) in Business and Administration Management (GEA) has evolved to offer a new GC2F specialisation: accounting, tax and financial management. In 2022, this will be the first year of the second year of the BUT GC2F course.

The broad outlines of skills and knowledge are established at national level. BUT GC2F's training courses are therefore aimed at the same objective, with specific teaching methods depending on the orientations of the universities to which they are attached and the local area of activity..

The I.U.T. websites gave no details of this new curriculum, not even the names of the courses. This made it difficult to include them in the analysis in the same way as the other institutions.

We therefore took two approaches:

- Through a reading of the key points of the document (appendix 12 of the national programme[728]);
- Via a keyword search, using the same model as for the "ClimatSup Business" project, to check that all the elements have been identified.

Key words list:

Ecological issues	Energy supply	Resource depletion	Climate change	Biodiversity
ecologi- Planet Planetary boundaries Physical constraints Anthropocene Environment Sustainable Sustainability Sobriety Natur- Green Precautionary principle Degrowth Over-consumption	energy- Fossil Oil Gas Coal Electric Electricity Renewable Nuclear	Materials Metals Raw materials Extracti- Mining Resources Depletion Scarcity Recycling Circular	Climate Greenhouse gases Emissions Carbon Mitigation Mitigating Adaptation IPCC GHG Water Deforestation Desertification	Biodiversity Ecosystem Ecosystem Species Living Extinction Collapse Artificialisation Pollution Waste Destruction Habitat Erosion Biosphere IPBES Biological

[728] Ministère de l'enseignement supérieur, de la recherche et de l'innovation, « Annexe 12 - Licence professionnelle « Bachelor Universitaire de Technologie » - Gestion des entreprises et des administrations », 12.

Ecological issues in economics / finance	ClimatSup Business foundation
Responsab- ESG Ethics Impact ODD Systemic CSR SD Sustainable development Externalities	 Governance Interdisciplinary Prospecti- Critical Transform- Plan-

Table 14: List of terms used in the keyword search

b. Search results by keywords

The training reference framework includes:

- Resources, rated R
- Critical Learning, graded AC
- Learning and Assessment Situations, graded LAS

Resources	Contents
R1.04 Business management	*Keywords: CSR* Skills and/or description: - Analyse the influence of the environment on organisations - Present environmental issues in the management of organisations
R2.01 Environment economy	*Key words: Externalities* Skills and/or description: - Identify cases of externalities and collective goods
R3.02 Legal environment	*Keywords: CSR* Skills and/or description: - Knowing the different responsibilities (criminal, civil, CSR) of companies
R5.01 Environment economy	*Key words: Sustainable development, CSR policy, energy transition* Skills and/or description:

	- Characterise sustainable development in its three dimensions (economic, social, environmental) - Analyse the expected effects of environmental policy measures on the behaviour of stakeholders (CSR policies, negative externalities, positive externalities, failures, etc.), positive externalities, failures, etc.) - Analyse the opportunities and limits of sustainable development in terms of economic growth (circular economy, functional economy, energy transition).
R5.05 Expression/communication and general culture in Communication and information literacy	*Keywords: CSR* Skills and/or description: - Define an organisation's communication strategy, taking into account its CSR policy and the culture of the chosen organisation. - General knowledge: Analyse the major contemporary concepts arising from current socio-economic events (e.g. changes in work, the media, responsible consumption, e-health, uberisation, the impact of digital technology on the environment, etc.)
R5.06 English applied to business in Communication and information culture	*Theme covered:* The company of tomorrow (corporate strategy - the social economy - sustainable development - corporate citizenship)

Learning and assessment situations	Contents
LAS 3.01 Contribute to the development or creation of an organisation	Objectives of the LAS: - Adopt an eco-responsible approach
LAS 4.01 Participate in the creation or development of an organisation, in compliance with regulatory constraints and using a sustainable governance approach	Objectives of the SAE: - Construct models that are useful for decision-making, using a sustainable development approach. - Draft a set of arguments to advise decision-makers, incorporating the 3 pillars of sustainable development.

Table 15: References to ecological issues in appendix 12 of the BUT national programme, Ministry of Higher Education, Research and Innovation[729]

This keyword study leads to the conclusion that the national programmes of the B.U.T. GC2F national programmes address ecological issues. A priori, these issues are dealt with superficially, but they are not integrated structurally.

However, the lack of a standard method means that these results cannot be compared with the inventory carried out for the other establishments.

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[729] Ministère de l'enseignement supérieur, de la recherche et de l'innovation, 12.

Appendix 3 - Methodological note on the knowledge and skills base, as well as job descriptions

The foundation of knowledge and skills in management science published in the report «ClimatSup Business - Training the players of tomorrow's economy» and taken up in the report «ClimatSup Finance - Training for a finance that serves the transition» is a result of a collective effort. It is based on the knowledge and skills reference framework developed by The Shift Project for engineering students[730], which has been reworded thanks to numerous collaborations to meet the needs of management training courses.

The foundation of knowledge and skills in finance published in the report «ClimatSup Finance - Training Finance Professionals for the Ecological Transition » constitutes the financial version of the foundation of knowledge and skills in management sciences. The finance foundation is intended to complement the management foundation.

Method

The reference framework of knowledge and skills for engineering students has been developed on the basis of existing reference systems and studies[731], various works and experts' hearings, as well as discussions and consultations with stakeholders in these engineers' education, particularly within the schools of the INSA Group, a partner of the project[732].

This reference framework has been adapted to higher education institutions in management, with the support of a working group, consultations with stakeholders and experts as well as bibliographic research. A working group composed by teacher-researchers, students, alumni and people in charge of the redesign of the reference system of the school Audencia as well as The Shift Project's team and members of the Camus Transition (*Transition Campus)* banded together to work on the adaptation of the engineering reference **framework** for management training. This working group was assisted by hearing experts[733].

This foundation of knowledge and skills is also enriched by bibliographical contributions, cited in the foundation (see the report « Training the players of tomorrow's economy», Part 3).

An Excel spreadsheet of references and resources completes the foundation presented in the report. It offers teachers who would wish to go further additional resources on different examples mentioned in the foundation. It was made by a team of volunteers of The Shifters association, in collaboration with The Shift Project team.

730 Available for download from the project website: « Training the engineer of the 21st century» « Former l'ingénieur du XXIème siècle » : https://theshiftproject.org/former-les-ingenieurs-a-la-transition/. The download link is as follows : https://theshiftproject.org/wp-content/uploads/2022/03/Referentiel-V3.xlsx. Accessed on November 28th 2022.

731 These are the reference systems developed by l'ENPC, l'ENSIL ENSCI, Sup'EnR, the guide DD&RS (CPU et CGE, « Guide DD&RS ».) of the foundation Pour un Réveil Écologique (Pour un Réveil Écologique, « Socle de connaissances générales », 2019, enseignement.pour-un-reveil-ecologique.org.), from the UNESCO's learning objectives (UNESCO, «Education for sustainable development goals» « L'éducation en vue des objectifs de développement durable ».), as well as the work carried out by the Transition Campus Campus de la Transition (Collectif FORTES, *Manuel de la grande transition*.)

732 All the sources are detailed in the dedicated report (The Shift Project, « Training the engineer of the 21st century» « Former l'ingénieur du XXIe siècle - Volume 1, Manifeste ».)

733 The expert hearings held in public can be viewed on the Shift Project's YouTube channel.

The focus on the digital base, presented in a dedicated section has been put together by three members of The Shift's Project Digital working group, who have contributed to the work on digital sobriety carried out by The Shift Project.

The finance version of the skills and knowledge foundation is based on the reference framework of knowledge and skills for management sciences. It was developed based on workshops with professors and bearings with finance professionals. This foundation was reinforced on the basis of academic, institutional and association literature.

1. Business profiles: knowledge and skills to be taught in the professions in finance, risk analysis, regulation and compliance and asset management

In addition to the common core of knowledge and skills, the **job descriptions offer knowledge and skills to be taught to professionals** in finance, risk analysis, regulation & compliance, and asset management.

These four career paths were chosen according to four criteria: each of them had to represent careers impacted by ecological issues and/or having an impact on these issues. They must be occupations that attract a high volume of graduates, representing different job families. Lastly, they must be jobs specific to finance.

The job descriptions have been done in collaboration with various stakeholders, based on a triptych of practices:

- A mission of volunteer Shifters has been launched to call on the extensive expertise of professionals in each business family;
- Interviews with teachers-researchers and collaborative workshops were conducted;
- Interviews were also conducted with professionals from each business category.

A review of the literature, which is not intended to be exhaustive, has been carried out to examine in greater depth how ecological issues are integrated into the practices of these four job families.

The descriptions follow the structure of the knowledge and skills base.

2. Focus on The Shifters Project's objectives

The Shifters mission contributed to:

- Define the general knowledge and skills base or core curriculum to be taught to students in finance in relation with ecological challenges;
- Define the the knowledge and skills for these professions specific to the four business categories in finance in relation with ecological challenges;
- Identify these professions' evolution in relation to ecological challenges.

The reflection on Finance knowledge and skills has complemented the common core knowledge and skills base set out in the ClimatSup Business project.

The central questions on which The Shifters were asked to reflect on were:

- «What additional knowledge and skills related to environmental issues should be taught to finance students» (this will be used to define the common core finance curriculum)
- Then, «what knowledge and skills should be taught in addition to the core finance curriculum for people who will be working in the 4 targeted job categories?»

The responses to these questions were partly on the required knowledge and skills necessary today to integrate ecological challenges but also for mid-long term.

Appendix 4 - Breakdown of knowledge from the « finance » foundation in specialised finance programmes

In order to help programme managers and lecturers implement the knowledge contained in the finance foundation, the report proposes an example of how this knowledge can be applied to bachelor's degree programmes in finance, master's degree programmes in corporate finance and master's degree programmes in type.

The reflection focused on the knowledge of the « finance »foundation and the job descriptions, which were divided between the courses in these programmes. As the skills are cross-sectoral, each of them can be taught in several courses. Therefore, it seems less important to link each skill to the fundamental courses of a programme.

This work has been done in collaboration with the association Re.boot[734] which gathers a student community engaged in sustainable finance.

The steps of this breakdown are the following:

- Standard Bachelor's and Master's programmes have been realised by comparing the courses of several institutions.
- The knowledge from the « finance » foundation and the job descriptions have been divided between the subjects taught. An estimation of the required time to teach this knowledge has been made.

[734] https://www.reboot-asso.com/

List of abbreviations

ACT: Assessing low-Carbon Transition

AMF: *Autorité des marchés financiers* (Authority of Financial Markets)

BTS: *Brevet de technicien supérieur* (Advanced Technician Certificate, a French degree)

BUT: *Bachelor universitaire technique* (Technical university bachelor's degree, a French degree)

BPI: Banque Publique d'Investissement (French public investment bank)

CEFDG: *Commission d'évaluation des formations et diplômes de gestion* (National Commission for the Evaluation of Training and Qualifications in Management)

CFA: Chartered Financial Analyst

CGE: *Conférence des grandes écoles*

CNF: *Cadre national des formations*

CO_2: carbon dioxide

COP: Conference of the parties

CSR: Corporate Cocial Responsibility

CSRD: Corporate Sustainability Reporting Directive

DD&RS: *Développement durable et responsabilité sociétale* (a French higher edcuation label for *Sustainable development and societal responsability*)

DUT: *Diplôme universitaire technique* (Technical university degree, a French degree)

EBITDA: Earning before interest, taxes, depreciation, and amortisation

EFRAG: European Financial Reporting Advisory Group

ESG (criteria): Environmental, Social and Governance criteria

ESMA: European Securities and Markets Authority

GC2F: *Gestion comptable, fiscale et financière* (a specific technology bachelor's degree)

GDP: gross domestic product

GFANZ: Glasgow Financial Alliance for Net Zero

GHG: Greenhouse gases

HCERES: High Council for the Evaluation of Research and Higher Education (a French higher education body)

IAE: *Institut d'administration des entreprises* (Business Management Institutes, universities management departments)

IEA: International Energy Agency

IGF: *Inspection générale des finances* (Inspectorate General of Finance, a French body)

IMF: International Monetary Fund

IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPCC: Intergovernmental Panel on Climate Change

IRR: Internal rate of return

ISR: *Investissement socialement responsable* (Socially responsible investment, a French label)

IUT: *Instituts universitaires de technologie* (University institutes of technology)

LEC: *Loi énergie climat* (Energy and Climate Law)

LTECV: *Loi de transition énergétique pour la croissance verte* (Law on Energy Transition for Green Growth)

MS APTE: *Mastère Spécialisé Acteur pour la Transition Energétique* (a degree delivered by Audencia)

MSA: Mean Species Abundance

NEC: Net Environmental Contribution

NGFS: Network for Greening the Financial System

NPV : Net Present Value

NZI: Net Zero Initiative

NGO: Non-governmental organisation

OSR : Organizational Social Responsibility

PACTA: Paris Agreement Capital Transition Assessment

PRB: Principles for Responsible Banking

PRI: Principles for Responsible Investment

PSI: Principles for Sustainable Insurance

RNCP: *Répertoire national des certifications professionnelles* (French National repertoire of professional certification)

SBTi: Science Based Targets initiative

SBTN: Science Based Targets Network

SEC: U.S. Securities and Exchange Commission

SFDR: Sustainable Finance Disclosure

SLB: Sustainability Linked Bonds

SNB: *Stratégie nationale pour la biodiversité* (National Biodiversity Strategy)

SNBC: *Stratégie nationale bas carbone* (National Low-Carbon Strategy)

TCFD: Taskforce on Climate-related Financial Disclosures

TNFD: Taskforce on Nature-related Financial Disclosures

UN: United Nations

WACC: Weighted Average Cost of Capital

The Shift Project is a think tank working towards a post-carbon economy. As a non-profit organization recognized as being in the public interest and guided by the demands of scientific rigor, our mission is to enlighten and influence the debate on the energy transition in Europe. Our members are large companies that want to make the energy transition their priority.
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