# The EU's Sustainable Finance and FinTech Agenda: Breaking the silos

**Discussion Paper – Final Version**

**for:**

**Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)**

*by:*

Martin Gauss

Kommunalkredit Public Consulting GmbH

Türkenstrasse 9

1092 Vienna - Austria

T: +43 1 31631 224, m.gauss@kommunalkredit.at

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| AI HLEG | (EU) High-Level Expert Group on Artificial Intelligence |
| AIML | Artificial Intelligence and Machine Learning |
| API | Application Programming Interface |
| DG | Directorate-General |
| DG FISMA | DG for Financial Stability, Financial Services and Capital Markets Union |
| DLT | Distributed Ledger Technology |
| EBA | European Banking Authority |
| EC | European Commission |
| EIB | European Investment Bank |
| EIOPA | European Insurance and Occupational Pensions Authority |
| EPRS | European Parliamentary Research Service |
| ESAs | European Supervisory Agencies on financial issues |
| ESMA | European Security Markets Authority |
| EU | European Union |
| EU TEG | European Union Technical Expert Group |
| FSB | Financial Stability Board |
| GDPR | General Data Protection Directive |
| HLEG | High-Level Group on Sustainable Finance |
| ICO | Initial Coin Offering |
| ICT | Information and Communication Technology |
| IoT | Internet of Things |
| ISO | International Organisation for Standardisation |
| GHG | Greenhouse gas |
| HLEG | High-level Expert Group on Sustainable Finance |
| IFRS | International Financial Reporting Standards |
| NDC | Nationally Determined Contribution |
| P2P lending | Peer-to-peer lending |
| SDGs | Sustainable Development Goals |
| SDFA | Sustainable Digital Finance Alliance |
| SDI | Sustainable Development Investment |
| SME | Small and medium-sized enterprise |
| TCFD | Task Force on Climate-related Financial Disclosure |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |

This discussion paper is the fourth publication of a series of inputs to stimulate discussion in the realm of the project "Climate-friendly design of the EU budget and financial markets". The following analysis and recommendations shall serve as a basis for discussions during the forthcoming workshop of the Expert Network on Climate and Sustainable Finance in the EU on synergies between the European Commission's agenda on Financing Sustainable Growth and on FinTech.

The project "Climate-friendly design of the EU budget and financial markets" is financed by the European Climate Initiative (EUKI). EUKI is a project financing instrument by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). It is the overarching goal of the EUKI to foster climate cooperation within the European Union in order to mitigate greenhouse gas emissions. It does so through strengthening a cross-border dialogue and cooperation as well as through exchanging knowledge and experience.

The information and views set out in this publication are those of the author and do not necessarily reflect the official opinion of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

# 1 THE FINANCIAL SECTOR'S ROLE IN ADRESSING GLOBAL MEGATRENDS

Sustainability – with climate change and environmental protection among the key drivers – as well as digitalisation – the use of digital technologies in processes and businesses – are among global trends that will impact and define the future of the EU economy and society.

The European Union supports the transition to a low-carbon, more resource efficient and sustainable economy and has been at the forefront of efforts to build a financial system that supports sustainable growth. In 2015, landmark international agreements have been established with the adoption of both the UN 2030 Agenda with its 17 Sustainable Development Goals and the Paris Climate Agreement. Particularly the latter includes the commitment to align financial flows with a pathway towards low-carbon and climate resilient development[1].

The internet and digital technologies are transforming the lives we lead, the way we work and communicate as individuals, in business and in our communities and social networks; the global economy is rapidly becoming digital. Digitalisation, and the associated transformation, is thus a trend our societies need to deal with, seizing the associated opportunities, and managing the risks[2].

Capital markets and the wider financial sector play an important role in addressing the above-mentioned trends and can contribute to reap associated benefits, while considering key risks related, for instance, to financial stability and cybersecurity:

- through *sustainable finance*, the financial sector can help reach sustainability goals, re-orienting investments towards sustainable businesses and technologies, financing growth in a sustainable manner and over the long-term, thereby contributing to the creation of a low-carbon, climate resilient and circular economy;

- through *FinTech* – financial technologies, i.e. digital technologies applied in the financial services industry including the banking, investment and insurance sectors – offering new opportunities for both consumers and companies alike, with potentially huge impact on the industry's business models, efficiency gains, customer reach and product development.

In order to harness synergies, both subjects could potentially be combined – as expressed by the double responsibility of DG FISMA's recently created unit "Financial Technology and Sustainable Finance". While the overarching EU policies relevant to sustainability, digitalisation and capital markets are becoming increasingly intertwined, linkages between the sustainable finance and FinTech agenda seem to be not fully exploited yet.

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[1] See paragraph 2.1.c) of the Paris Agreement.

[2] The EU has devised a comprehensive set of policies in this context to address these challenges.

**Intentions and structure of the paper**

This paper sets out to break the silos between the EU agenda related to sustainable finance and to FinTech – as predominantly presented in the dedicated action plans – through making aware of the links between the two elements, *aiming at fostering FinTech activity dedicated to sustainable finance across European borders*. This shall contribute to advance the subject of sustainable finance, taking into account any associated risks and unintended consequences of using digital technologies.

Generally speaking, this endeavour requires the intersection of three areas: finance, sustainability and (digital) technology. In the European context, this means exploring synergies between the EU's sustainable finance and FinTech agenda, notably the respective action plans launched by the European Commission in March 2018. This paper thus attempts to inform a potentially more integrated future EU agenda on sustainable finance and FinTech.
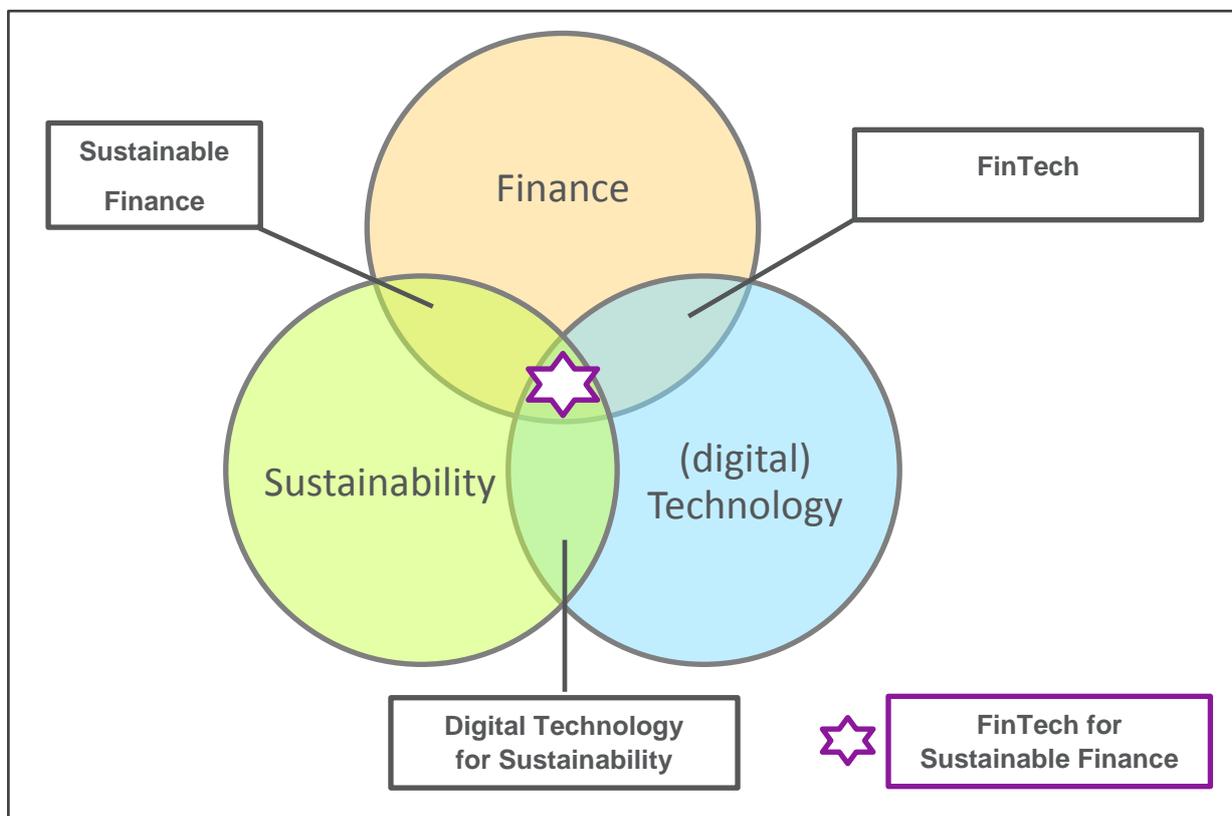


*Figure 1 "FinTech for sustainable finance" at the intersection of finance, sustainability and (digital) technology (Source: elaboration by the author).*

Based on an analysis of both the EU's sustainable finance and FinTech agenda (see Annex), this paper provides suggestions on how to harness opportunities resulting from linking both agendas. Finally, a set of conclusions and recommendations summarises the most important findings.

# 2    IDENTIFYING SYNERGIES

In its further development of the sustainable finance and FinTech agenda, the European Commission could seek synergies between the single measures, seizing opportunities from, inter alia, mainstreaming sustainable finance into the FinTech agenda, identifying concrete FinTech opportunities to support the implementation of the Sustainable Finance Action Plan, and building and expanding on relevant initiatives in the EU, while considering the risks and unintended consequences.

## 2.1    Mainstreaming Sustainable Finance into the FinTech agenda

The following measures could be considered for embedding the notion of sustainable finance in initiatives and measures taken under the FinTech Action Plan:

(i)    The EU FinTech Lab and the network of EU FinTech facilitators, including innovation hubs and regulatory sandboxes, could consider expanding capacity building and knowledge sharing efforts as well as piloting operations including FinTech solutions for sustainable finance, especially in the context of *RegTech*, one of the potential topics to be addressed by the EU FinTech Lab as mentioned in the FinTech Action Plan[3]. If appropriate, ESMA's potential guidelines on FinTech facilitators could refer to the relevance of sustainable finance, as well.

(ii)    Similar to activities already undertaken under the *EU AI Alliance*, the *EU Blockchain Observatory and Forum* and stakeholder fora under the *European Open Science Cloud* (launched in November 2018) could hold dedicated events and workshops relating to the potential contribution of the relevant digital technologies to sustainable finance (such as "*blockchain for sustainable finance*") and document lessons and examples in strategic documents on DLT/blockchain and Big Data, respectively.

(iii)    *The Ethical Guidelines on Trustworthy AI* and the related *Policy and Investment Recommendations* elaborated by the AI HLEG provide an excellent starting point on the nexus of AI and sustainability, which could be further exploited through engaging FinTech companies in the related discussions under the *European AI Forum*.

(iv)    Staff of the European Supervisory Agencies working on FinTech on the one hand (such as EIOPA's InsurTech Task Force) and sustainable finance on the other, could be connected to form common task forces within and across their organisations. The European Banking Federation, for example, has recently done so, now engaging with the European Commission on possible further actions.

(v)    EBA's *FinTech Knowledge Hub* – described in the agency's FinTech roadmap, could consider sustainable finance as a major trend to which the hub could contribute.

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[3] see section 2.4 of the FinTech Action Plan.

(vi) Vice-versa, the potential contribution of FinTech to sustainable finance should become an agenda item for the future "Sustainable Finance Platform" as planned under the Action Plan for Financing Sustainable Growth; measures for the promotion of dedicated FinTech solutions could be mentioned in a forthcoming Action Plan on Sustainable Finance (No.2) to anchor the subject in the sustainable finance agenda, as well.

(vii) A cross-cutting study could assess the potential and the most critical challenges of FinTech technologies for sustainable finance (addressing one of the key messages from the public FinTech Consultation by the Commission), as well as other research topics as suggested by the SDFA (2018), such as:

- o How can digital technologies help financial institutions better identify, analyse and integrate environmental and social risks into financial decision making?
- o How can financial centres leverage digital finance to improve sustainability?
- o How can digital finance transform the future of sustainable infrastructure financing?
- o How can digital technologies accelerate achievements of each SDG?

(viii) A public consultation could help gauge stakeholders' opinion on the subject, including the relative importance and possible actions.

## 2.2 Identifying concrete FinTech opportunities to support the implementation of the Action Plan on Financing Sustainable Growth

Among the spectrum of opportunities, the following FinTech use cases identified under the Action Plan on Financing Sustainable Growth could help meeting regulatory requirements.

*Regulatory technology (RegTech)* solutions for the following use cases could help advancing specific actions, such as:

- *Usability of the forthcoming EU taxonomy*
  The comprehensive and relatively complex classification system proposed by the EU Technical Expert Group (TEG) in its report raises concerns on its usability by the financial sector. The currently ongoing consultation and further work by the TEG might warrant the consideration of using digital technologies – considering general principles like interoperability and common standards – to facilitate the application of the taxonomy.

- *Digitalised public corporate reporting on sustainability*
  Action 9.1. of the Action Plan refers to a fitness check of EU legislation on public corporate reporting, including the NFI Directive to assess whether public reporting requirements for listed and non-listed companies are fit for purpose. It will include the evaluation of sustainability reporting requirements and the prospects for *digitalised* reporting. In order to report relevant information, companies might need to gather specific sustainability-related information demonstrating for instance environmental performance. This might draw on the use of digital to

gather, analyse and streamline reporting according to provisions in a forthcoming taxonomy, the Task Force on Climate-related Financial Disclosure (TCFD), and the Guidelines on reporting climate-related Information.[4],[5]

- *Green Bond reporting and verification*
  The reporting of environmental impacts and the respective verification are key components of the EU Green Bond Standard as proposed by the TEG in June 2019. Similar to the previous use case, impact reporting and (immutable) verification could be supported by digital technologies including blockchain, thereby lowering the transaction costs of green investments.

- *SDG reporting and verification*
  In analogy to reporting on green impacts, digital technologies can also be used to measure, report on and verify SDG impacts. A first initiative has been launched under the *Gold Standard for the Global Goals*.

- *Risk management for climate-induced financial risks*
  A variety of FinTech, consulting companies and think-tanks have already engaged in assessing climate-related risks including transition risks and physical risks for investment and lending portfolios, with the potential need for further finetuning, mainstreaming and consolidation of underlying methodologies[6].

- *Other FinTech opportunities to support the future sustainable finance agenda*
  Arranging dedicated brainstorming with financial sector representatives from asset managers, institutional investors, the insurance industry and the banking sector under the already existing technology-specific multi-stakeholder fora could result in devising sector-specific FinTech opportunities related to sustainable finance. A starting point could be relevant research questions mentioned in the previous chapter. Identified opportunities could be fed into FinTech *hackathons*, harnessing the creative power of start-ups, such as the *Climathon* organised through EIT Climate-KIC[7], a European climate innovation initiative.

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[4] In October 2019, the EU Commission organized a conference on how (digital) technology could drive the future of financial reporting within the capital market union. The Commission furthermore is developing the European Financial Transparency Gateway (EFTG), a pilot project exploring ways to solve the problem of data fragmentation through the use of distributed ledger technologies (DLT). See https://www.regonline.com/registration/checkin.aspx?EventID=2568629

[5] The financial market – in cooperation with the public sector – is meanwhile advancing in this field. See the recent joint investment by German institutions in an ESG data provider using an array of digital technologies mentioned in the next chapter.

[6] See for instance the presentations from the session on "Assessing climate-related risks and opportunities in investment and lending portfolios" held at the Austrian Climate Change Workshop in January 2019.

[7] https://climathon.climate-kic.org/en/

> **European Banking Federation: Identifying use cases**
>
> Based on a desk review of relevant sources, the European Banking Federation's (EBF) internal task force on FinTech & Sustainable Finance has already identified a series of use cases, including:
>
> (i) Cost-effective tracking of green asset performance, (ii) Traceability of sustainable supply chains (iii) Expanding its product offerings to underserved segments (financial inclusion) through e.g. mobile payment solutions, (iv) Risk reduction through identification of creditworthy customers, and (v) Matching clients' non-financial preferences with relevant financial products.

## 2.3 Building and expanding on relevant initiatives in the EU

There are several initiatives in Europe that already focus on the combination of the FinTech and sustainable finance, some of which are mentioned below[8]. The EU could consider extracting the lessons learnt and upscaling these initiatives through a dedicated programme.

- *Stockholm Green Digital Finance Centre*, a not-for-profit organisation tasked to accelerate green finance and investment through FinTech innovations, launched in May 2017, which shall serve for piloting creative solutions. The centre recently identified more than hundred digital applications in eight FinTech categories across Europe and a series of sustainable FinTech initiatives.

- The *Banking Environment Initiative's FinTech Taskforce*, convened by the University of Cambridge Institute for Sustainability Leadership (CISL), which – already in October 2017 – published a report on *Catalysing FinTech for Sustainability*, issuing ten recommendations on how to design collaboration between multinationals, financial institutions and start-ups for harnessing FinTech to help solve sustainability challenges in the real economy.

- *Sustainable FinTech Switzerland*, a project by the grassroots think tank *foraus* – Swiss Forum on Foreign Policy, aiming at the creation of the digital, sustainable financial industry of tomorrow by (i) building a community of experts and enthusiasts around the topic of sustainable, digital finance, (ii) fostering a constant and critical evaluation of the development of sustainable, digital finance on the policy level, and (iii) supporting the creation, development and refinement of sustainable, digital financial products.

- *Finance for Tomorrow,* promoting Paris as an international leader in sustainable finance, offering also the "FinTech for Tomorrow Challenge" – a competition for FinTech with solutions for financing the ecological transition, recognising FinTech as key stakeholders of the transition.

- *SDG-FinTech Initiative,* embedded in *Frankfurt Main Finance*, has been founded by FinTech start-ups to bridge between policy makers, corporations and start-ups in the area of sustainability, aiming at being a focal point for cooperation with start-ups, foster knowledge exchange especially between start-ups in developing and industrialised countries.

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[8] SDFA (2018) has mapped initiatives and examples for sustainable digital finance across G20 member states, i.e. beyond Europe.

- The German State of Hessen, as part of its engagement in the *Green Finance Cluster Frankfurt e.V.*, has recently invested jointly with other three German financial institutions in *Arabesque S-Ray*, a data provider of ESG metrics based on AIML, IoT sensors and devices, and big data analysis for the assessment of sustainability performance (Allianz SE, July 2019).

- *Digital Innovation Call in the context of the SDGs,* a governmental support programme led by Austrian governmental agency *aws,* offers attractive financial support to SMEs in digital product innovations with a clear contribution to one or more SDGs, which could present opportunities for FinTech in sustainable finance.

- *The Climate-KIC Accelerator,* a programme of the Knowledge and Innovation Community (KIC) by the European Institute of Innovation and Technology (EIT) focusing on climate-friendly solutions provides financial and coaching support for start-ups. The programme partners with the financial sector to increase funding volumes and design targeted solutions[9].

  Similarly, Climate-KIC's focus area on *Decision Metris & Finance* aims at mainstreaming climate into financial markets, democratising climate risk information and fostering bankable green assets, especially in cities. Respective initiatives include (i) financial markets and accounting, (ii) a low carbon city lab, iii) climate risk information, and iv) the Mission Finance campaign, for which the organisation regularly launches calls for project proposals.

- *The Swiss FinTech Innovation Lab* from the University of Zurich and the *Sustainable Digital Finance Alliance*, a not-for-profit foundation founded by UN Environment and ANT Financial have founded a new collaboration programme in 2019, aiming at accelerating the field of "Green Digital Finance", which will allow to develop knowledge on green fintech practices[10].

- APG, the largest Dutch pension delivery organisation, in cooperation with PGGM – a cooperative Dutch pension fund service provider – will cooperate on setting up the AI-supported *Sustainable Development Investment (SDI) Asset Owner Platform*. This will enable institutional investors to assess around ten thousand listed investments on their contribution to the SDGs, drawing on common definitions, SDI taxonomy and data source[11].

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[9] For instance, with the insurance companies Munich Re and ERGO, see http://climate-kic-dach.org/sidecall/

[10] https://www.uzh.ch/dam/fintech/media/university-of-zurich-and-the-green-digital-finance-foundation-launch-a-collaboration.pdf

[11] https://www.apg.nl/en/article/-Wereldwijd-%20SDI-Asset%20-Owner%20-Platform/1110

# 3   CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be drawn from the analysis:

- Overarching **EU policies** related to **sustainability and digitalisation** are becoming increasingly **intertwined**, with the European strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy of November 2018 mentioning **Sustainable finance and the EU Budget** as well as the **Digital Single Market** as major gears for driving the **required transition**;

- While the **Action Plans on Financing Sustainable Growth and on FinTech** set a series of specific targeted measures, they do **not cross-reference to each other**. The exception is Action 9.1 in the former, referring to the evaluation of the prospects for *digitalised reporting* in the context of public sustainability reporting requirements. The single measures thus potentially **lose out on synergistic effects**;

- Apart from the measures implemented under the **FinTech Action Plan** in accordance with its three objectives, **complementary actions** such as the set-up of the EU Blockchain Observatory and Forum and the establishment of the High-Level Group on Artificial Intelligence (AI HLEG) have been carried out under the **Digital Single Market strategy**, aiming at advancing the respective digital technologies of blockchain and AI;

- It is especially noteworthy that the AI HLEG in its recently elaborated documents refer to the **need to develop *Trustworthy AI***. This concept integrates a series of factors including the protection of the integrity of humans, society and the environment, mentioning **opportunities in the fields of climate action and sustainable infrastructure**, health and well-being, quality education and digital transformation among the potential contribution by the technology.

The following recommendations are made:

- *When seeking synergies between the sustainable finance and FinTech agenda, it is crucial to **respect general principles like interoperability, standardisation and using open-source solutions** to facilitate upscaling. The consideration of **risks** inherent to both subjects, including those related to **financial stability, consumer protection and especially cybersecurity** is equally important. Addressing the **unintended consequences** in terms of **potential economic, social and environmental impacts** is also critical*;

- Possible **synergies** from linking single measures **under both agendas** mostly relate to **overcoming limited knowledge sharing, lack of awareness, and to identifying use cases**, with the subject of limited (sustainability) data availability and use meriting its own analysis and structural approach for finding adequate solutions;

- **Mainstreaming sustainable finance in the FinTech agenda** could encompass the following actions: expanding efforts by the **EU FinTech Lab and the network of EU FinTech facilitators** to include sustainable finance (and especially *RegTech* solutions), **discussing** sustainable finance **use cases in technology-specific multi-stakeholder fora** like the EU Blockchain Observatory and Forum and the AI Alliance, **connecting staff** within and across ESAs currently working in isolation either under the subject of FinTech or sustainable finance, launching a **cross-cutting study** and conducting a **public consultation** on opportunities and challenges;

- Straightforward **FinTech opportunities** under the sustainable finance agenda could focus on *RegTech* to facilitate compliance, with use cases concerning the **usability of the taxonomy**, **digitalised public corporate reporting, green bond and SDG-related reporting and verification**. Other opportunities could be derived from **dedicated brainstorming** within multi-stakeholder groups or by **task forces within organisations** (like the European Banking Federation);

- The latest report on the **taxonomy** lists **ICT technologies**, in particular data-driven ones contributing to reducing greenhouse gas emissions, **as sustainable**. It notes, however, that do-no-significant-harm criteria are still to be assessed and that ICT technologies have **environmental impacts** that cannot be neglected. Similarly, ICT can contribute to climate change adaptation, and **linked to relevant financial and insurance activities**, could present important **use cases for FinTech**, attracting capital from sustainable investors;

- **Digitalised public corporate reporting on sustainability** could be a further use case, drawing on the Commission's recent learnings from a conference on how digital technology could drive the future of financial reporting as well as the pilot project on the *European Financial Transparency Gateway* using DLT. This could feed into the related Action 9.1. of the Action Plan on Sustainable Finance;

- A series of **promising initiatives** that focus on FinTech and sustainable finance **already exist in the EU**. Many of them engage in **pilot initiatives, creative processes to identify solutions or offering financial and coaching support for enterprises**. The Commission could **extract lessons learnt** from these and launch a dedicated programme for **upscaling these initiatives**.

_Priority recommendations_ *for a more-integrated EU sustainable finance and FinTech agenda:*

1. **Analyse the feasibility for setting-up a _European-level "Sustainable digital finance centre_",** which

   o bridges between *public and private ecosystem stakeholders of both FinTech and sustainable finance*, including supervisors, regulators, financial institutions, FinTech companies and associations, digital experts, sustainability experts, and covering a *broad spectrum of sustainability* including *green* (i.e. climate, energy and other environment-related issues) but also *social, governance and SDG-related matters*,

   o promotes the scaling-up *FinTech activities for sustainable finance across Europe* through, for instance, organising green and sustainable FinTech challenges benefitting from, for instance, external advice and coaching and regulatory support ("green regulatory sandbox")[12],

   o provides *knowledge management services*, documenting and disseminating successful business models for solving specific use cases, as well as awareness raising activities across ecosystem institutions and fora including the need to solve unintended consequences such as carbon emissions,

   o sets up and maintains *a European-level sustainable FinTech Directory*, categorizing relevant sustainable FinTech companies according to their type of sustainable or green business model[13];

   o builds on *interdisciplinary staff* with expertise in finance, sustainability and digital technology and is supported by a *conducive enabling framework* including political, economic, social and technological conditions.

2. **Consider the promotion of dedicated _green (sustainable) regulatory sandboxes_** through mainstreaming sustainability into the approach of regulatory sandboxes, coupling regulators and supervisors with (internal or external) sustainability experts for additional support.

3. **Advance the up-take and further scale-up of the afore-mentioned _RegTech_ use cases** by FinTech companies, potentially offering financial support, including,

   o defining the requirements for digitalising the taxonomy,

   o supporting pilots on green bond and SDG-related reporting and verification, and,

   o enhancing the *European Transparency Gateway Project* on digitalised public corporate reporting taking into account sustainability reporting.

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[12] See the UK Green FinTech Challenge including regulatory support as an example https://www.fca.org.uk/firms/fca-innovate/fintech-challenge

[13] See the Austrian FinTech Directory as a general example http://austrianfintech.directory/

# 4 SUMMARY OF EXPERT DISCUSSIONS

This section summarises the discussions during the fourth meeting of the Expert Network on Climate Finance in the EU on "The EU's Sustainable Finance and FinTech Agenda: Breaking the silos" held in Brussels on 27 November 2019. The previous chapters of this report have served as a background for the discussions of the (extended) expert network group.

## Interventions

### Intervention 1: Linking sustainable Finance and FinTech

DG FISMA cooperates across its units and across the European Commission on issues relevant to sustainable finance and FinTech and will seek further alignment in the future. The Commission also liaises with the *UN Secretary's Task Force on Digital Financing of the SDGs* and is aware of several potential use cases related to innovation regarding the use of data, business models and platforms dealing with identifying ESG preferences. By mid-December 2019, the Commission will be able to draw on the report by the *expert group on regulatory obstacles to financial innovation* (ROFIEG) and will view the recommendations also from a sustainable finance perspective[14]. Moreover, the Commission noted that the future European Sustainable Finance Platform will have a clear focus on advancing the taxonomy, only. On the EU FinTech Lab, the Commission stressed the fact that this initiative focuses on finding more effective licensing, with many technology challenges to be tackled by supervisors, with sustainability not being a priority.

The next Commission will accelerate action on climate change, working towards climate neutrality of the continent by 2050 (see *European Green Deal*[15]), which will also build on a renewed strategy on green finance. The latter will be accompanied by a public consultation in 2020. Stakeholders could support the Commission through participating in the consultation, continuing to provide expert advice (through research papers, etc.) and through communicating relevant initiatives, barriers and opportunities to the Commission.

### Intervention 2: Setting up relevant task forces – Lesson learnt

The European Banking Federation (EBF) noted that within the work stream of sustainable finance it also considers *the greening of finance* through technology support. Technology can enhance

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[14] See the ROFIEG's final report: *30 Recommendations on regulation, innovation and finance*, which also takes note of sustainable finance:
https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/191113-report-expert-group-regulatory-obstacles-financial-innovation_en.pdf

[15] See the Communication on the European Green Deal as of 11 Dec. 2019:  https://ec.europa.eu/info/files/communication-european-green-deal_en

monitoring, traceability and trust building, as confirmed by EBF desk research. EBF has also set up a task force with member banks on sustainable finance and FinTech in order to identify potential use cases, raising awareness and identify benefits but also risks for gathering a complete picture. The EBF also recommends the *democratization of data and information,* sharing these amongst European supervisors, thereby enabling a full digital market.

The task force has brought unexpected and good insights into both subjects, fostering the enthusiasm of the participants. Concrete deliverables might be defined once further information has been gathered and analysed, including the ROFIEG report on regulatory obstacles, which will be also applicable for certain green FinTech cases. *Catalysts*, such as the Stockholm Digital Finance Centre also play an important role in advancing the combined agenda.

### *Intervention 3: Green Digital Finance – recent Experiences*

The *Stockholm Green Digital Finance Centre* has carried out a desk-research study on mapping green FinTech across the EU, identifying a wealth of use cases and companies. These provide either solutions to existing barriers or entirely new revenue streams. Crowdfunding emerged as the single most represented FinTech solution in the study, allowing early stage finance for start-ups and ways to achieve growth, with angel investing emerging, as well. Digital impact investment is another new use case with several FinTech companies emerging. Blockchain, as distributed data base, records data in an immutable, transparent and verifiable way, being cost efficient through smart contracts that do not require intermediaries. It allows for instance for tokenization and trading of renewable energy. Spanish bank *BBVA* recently issued a green bond using blockchain technology, while the green asset wallet is a platform for green bond verification and reporting. Artificial intelligence is often combined with big data analysis for instance used for ESG company reporting. An example for IoT is *Robeco* using satellite data for detecting reforestation as engagement tool.

## General discussion

### *Opportunities*

- Green sandboxes could foster the creation of green business models,

- Fintech can help greening finance but FinTech companies could also make efforts to become greener themselves through energy efficiency measures, etc.; an example from Estonia is *TransferWise*, which jointly with other FinTech companies pledged to become climate neutral by 2030,

- ICT also features in the taxonomy, with potential use cases to be derived,

- Financial literacy is key too for greening banks and their portfolios, thereby also creating potential use cases for FinTech.

*Challenges*

- Unintended consequences like high energy consumption of ICT and related carbon emissions need to be tackled,

- The majority of financial institutions and FinTech companies currently do not focus on sustainability, but raising awareness could help,

- FinTech regulators are sometimes overwhelmed with technological issues, with limited capacity to consider sustainability matters,

- Staff in organisations sometimes does not feel comfortable discussing topics not directly related to its field of expertise, raising barriers to communication and information exchange.

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# ANNEX I THE EU'S SUSTAINABLE FINANCE AND FINTECH AGENDA

With its catalytic role in terms of contributing to the achievement of sustainability goals and applying advanced technologies to foster innovation and new business models as part of a digital transformation process, the financial sector is at the core of both the sustainable finance agenda and the FinTech agenda.

On a more general policy level, sustainable finance (and the EU budget) as well as the digital single market are major "gears" in the EU's long-term transition strategy[16].
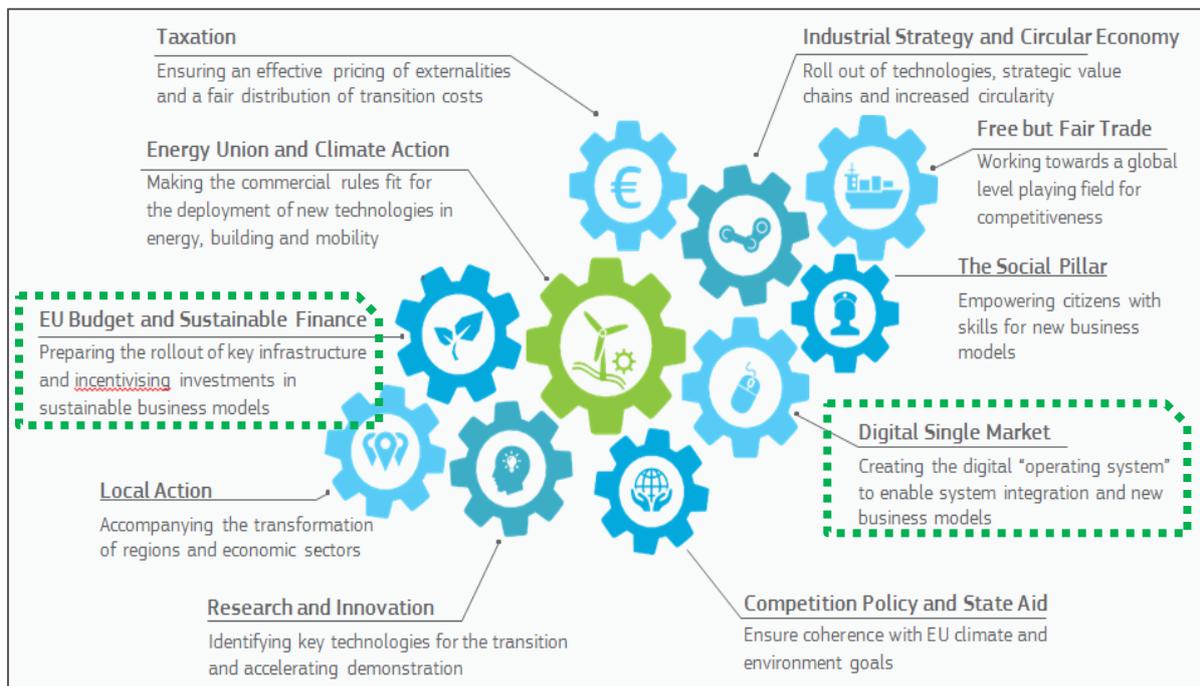


*Figure 2 Sustainable Finance and Digital Single Market as gears in the European Enabling Framework for the long-term transition to a prosperous, modern, competitive and climate-neutral economy* (adapted from European Commission, 2018a)

## The EU Sustainable Finance Agenda

**Background**

Sustainable finance is the provision of finance to investments taking into account environmental, social and governance considerations. It includes a strong green finance component that aims to support economic growth while reducing pressures on the environment, addressing greenhouse gas emissions and fostering climate resilience, tackling pollution, minimising waste and improving

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[16] A Clean Planet for all. A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (European Commission, November 2018).

efficiency in the use of natural resources. At the same time, sustainable finance encompasses awareness and transparency on the risks which may have an impact on the stability of the financial system, as well as on the need for financial and corporate actors to mitigate those risks through suitable governance arrangements[17].

At the core of the development of its sustainable finance agenda lies the EU's intention to integrate sustainability consideration in its financial policy framework in order to mobilise finance for sustainable growth (see Figure 3 below).
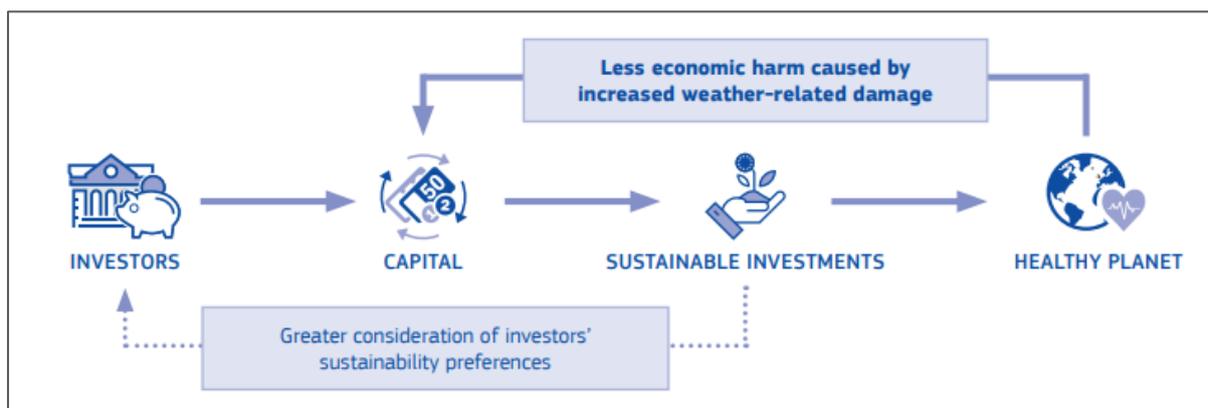


*Figure 3 The concept of sustainable finance* (European Commission, 2018a)

**Major milestones in the development of the EU's Sustainable Finance agenda**

The Paris Agreement, an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), has been adopted in December 2015 by the representatives of 196 state parties, including the EU. The targets under the EU's climate and energy framework simultaneously serve as the EU's Nationally Determined Contribution (NDC) under the Paris Agreement. In the same year, the international community adopted the UN 2030 Agenda, with its 17 SDGs at its core.

In December 2016, and as previously announced in its communication on the Capital Markets Union – Accelerating Reform, the EC established a High-level Expert Group on Sustainable Finance (HLEG) with a mandate to provide advice on how to (i) steer the flow of public and private capital towards sustainable investments, (ii) identify the steps that financial institutions and supervisors should take to protect the stability of the financial system from risks related to the environment, and (iii) deploy these policies on a pan-European scale.

The HLEG, comprised of 20 experts from the finance sector, civil society, academia and observers from European and international institutions, delivered an interim report in July 2017; its final report,

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[17] Through the proposed sustainability taxonomy published by the EU TEG in June 2019, the EU further specifies economic activities classified as "sustainable", focusing on substantial contribution to climate change mitigation and adaptation.

published in January 2018, issued eight priority recommendations as essential building blocks for further action, eight cross-cutting recommendations, several recommendations on financial institutions and sectoral issues, as well as numerous social and broader environmental sustainability recommendations.

At several places, the report also refers to the importance of FinTech entrepreneurs as an additional player joining the search for new ways of making finance greener and more connected, helping to connect the supply of capital with place-based priorities, mobilising their expertise through European financial centres to contribute to both climate action and wider sustainable development. The recommendations by the HLEG also form the basis of the respective EC's action plan adopted soon afterwards.

**The EU Action Plan on Financing Sustainable Growth**

*The Action Plan on Financing Sustainable Growth*, released in March 2018, shall contribute to raise additional private capital and to re-orient financial flows towards sustainable projects and economic activities, while safeguarding financial stability. Main aims and actions are presented below.
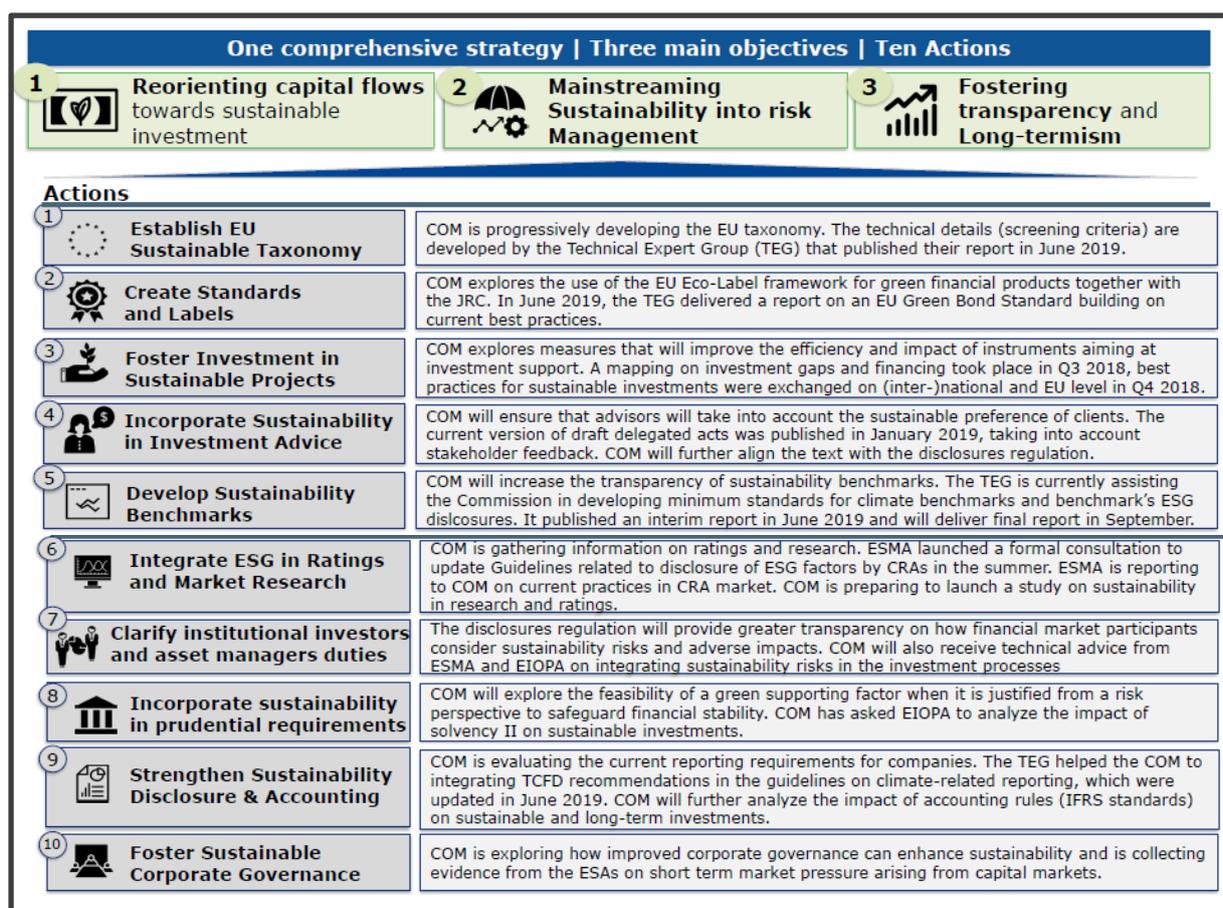


*Figure 4 Action Plan on Financing Sustainable Growth: 10 key actions and their status of implementation by June 2019 (Source: presentation of the European Commission at EBF steering committee meeting, 27 June 2019)*

Implementation of the action plan has started swiftly, with the Commission tabling a set of legislative proposals in May 2018 covering key recommendations by the HLEG and respective actions of its action plan related to (i) the establishment of a framework for sustainable finance, including a taxonomy, (ii) sustainability disclosure obligations, (iii) sustainability benchmarks and (iv) sustainability in investment advice. The Commission has so far proceeded with the implementation in accordance with its implementation timeline. Figure 4 above summarises its status of implementation as per June 2019.

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**Attracting sustainable finance: ICT technologies under the EU taxonomy** *(Action 1)*

A relevant outcome under the development of the EU sustainability taxonomy by the technical expert group on sustainable finance (TEG) is the classification of the information and communication technologies (ICT) sector under the activities that can make a substantial contribution to climate change.

Particularly for data driven solutions aiming at emission reductions, the taxonomy report of June 2019 mentions that climate change related mitigation criteria are not required, although do-no-significant-harm (DNSH) criteria have not yet been assessed. Similarly, the ICT sector can substantially contribute to or enable adaptation, for example through weather or early warning system related applications such as satellite tracking.

Linked to financial and insurance activities (as also mentioned under activities related to climate change adaptation in the Taxonomy), this could present use cases to be exploited by FinTech companies.

| Information and Communication Technologies (ICT) | Can climate change mitigation criteria change in future? | Do No Significant Harm criteria identified? | | | | |
|---|---|---|---|---|---|---|
| | | Adaptation | Water | Circular economy | Pollution | Ecosystems |
| Data processing, hosting and related activities | ✓ | Not yet assessed | | | | |
| Data-driven solutions for GHG emissions reductions | | Not yet assessed | | | | |

*Figure 5  The ICT sector can make substantial contribution to both climate change mitigation and adaptation according to the EU taxonomy* (Source: TEG Supplementary Report to the Taxonomy, June 2019).

At the same time the taxonomy recognised one of the major challenges of the ICT sector related to its energy consumption – currently accounting for 8-10% of European electricity consumption and up to 4% of its carbon emissions. Eligible activities under the taxonomy to improve energy efficiency of data centres, for instance, thus need to comply with technical criteria.

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The action plan does not explicitly link to FinTech or digital technologies, apart from Action 9.1., which refers to "…*the fitness check of EU legislation on public corporate reporting, including the NFI Directive to assess whether public reporting requirements for listed and non-listed companies are fit for purpose. It will include the evaluation of sustainability reporting requirements and the prospects for digitalised reporting. The conclusions of the fitness check will be published by Q2 2019 and will inform any future legislative proposals to be adopted by the Commission*". This could present an opportunity for engaging FinTech (see also chapter 2.2).

## The EU FinTech Agenda

**Background**

*FinTech*, or *financial technology*, refers to technology-enabled innovation in financial services. It spurs new business models, applications and processes, thus having a transformative effect on financial markets and institutions and on the provision of financial services as a whole (European Commission, March 2018a).

Investment in the application of FinTech represents billions of Euros and keeps increasing every year. The constantly evolving portfolio of technologies include, inter alia, artificial intelligence and machine learning (AIML), cloud services (such as computing, processing, hosting, data storage), distributed ledger technology (DLT, including blockchain), big data analytics, Internet of Things (IoT) and application programming interface (API)[18].

*RegTech* stands for *regulatory technology* and refers to the use of FinTech solutions for compliance purposes, bringing down compliance costs in areas like supervisory reporting, anti-money laundering, know-your-customer requirements, etc.

*InsurTech* stands for *insurance technology* refers to insurance enabled by or provided via new technologies, for example through automated devices, risk assessments and Big Data, but also insurance against new risks such as cyberattacks.

Main benefits of FinTech include,

- Potential for facilitating online relations with customers (i.e. digital customer relationships), thereby fostering access to financial services for and enhancing financial inclusion of consumers and businesses, particularly SMEs, through cross-border financial services and alternative lending and investment channels,

- Increasing opportunities and allowing for new business models, such as crowdfunding and peer-to-peer (P2P) lending,

- Improving customer experience through the "look and feel" of online interfaces in the area of retail financial services,

- Cross-border market access and service provision through reaping the benefits of digital networks, along with increased speed and traceability of transactions,

- Bringing down operational (and compliance) costs and increasing efficiency for the financial industry, thus contributing to the competitiveness of the European financial system and economy, potentially also leading to lower consumer prices for retail financial products and services,

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[18] for brief descriptions of these technologies, see the Annex to this document.

- From a European perspective, the contribution to creating a more competitive and innovative financial market through digital technologies[19].

**Major milestones in the development of the EU's FinTech agenda**

The three main pillars for the development of a dedicated FinTech agenda, notably the FinTech Action Plan, include the *Capital Markets Union*, the *Digital Single Market* and the *Single Market for Consumer Financial Services.*

The associated action plan to the latter, in particular, aims at supporting the development of an innovative digital world to overcome some of the existing barriers in the single market, and led to the creation of a dedicated commission-internal FinTech task force in November 2016, followed by a public consultation in early 2017 as basis for deriving required actions to support the development of FinTech and a technology-driven single market for financial services.

The public consultation gathered stakeholders' views on the impact of new technologies in financial services, and in particular on the following four FinTech-related policy objectives:

- *Fostering access to financial services for consumers and business*

- *Bringing down operational costs and increasing efficiency in the industry*

- *Making the single market more competitive and lowering barriers to entry*

- *Balancing greater data sharing and transparency with data security and protection needs.*

Many of the 182 respondents confirmed that FinTech (and technological innovation in general) were drivers of financial sector development with huge opportunities in terms of access to finance, operational efficiency, cost saving and competition, while cybersecurity, use, control and protection of data, liability issues, as well as fraud-related compliance issues (money laundering) were the predominant themes on the risk side.

Moreover, technological neutrality, proportionality in the regulatory framework for financial services, and integrity were considered to be the right principles to guide the EU approach on FinTech. The need for open dialogue and collaboration between regulators, supervisors and firms (whether start-ups or incumbents) was stressed by respondents as essential to support FinTech update in the EU (European Commission, March 2017a).

In May 2017, the EU Parliament through its own-initiative resolution invited the EC to take more action in FinTech sectors through drawing up a comprehensive FinTech Action Plan in the Framework of its Capital Market Union and Digital Single Market strategies in order to contribute to achieving an efficient and competitive, deeper and more integrated, stable and sustainable European financial

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[19] From a European perspective, another benefit of FinTech should be to contribute to the subject of sustainable finance.

system, provide long-term benefits to the real economy and address the needs of consumer and investor protection and of regulatory uncertainty.

**The FinTech Action Plan**

Responding to the outcomes of the consultation, the *FinTech Action Plan* presents a number of targeted initiatives to embrace the digitalisation of the financial sector, contributing to achieving a more competitive and innovative financial market. The *Action Plan* – released in March 2018, as its equivalent in sustainable finance – is part of the Union's strive for a digital single market, a true single market for consumer financial services and for building a capital markets union.

While considering the case for broad legislative or regulatory action or reform at EU level to be rather limited, the Commission set out a series of measures to reach its three main objectives as listed below and visually presented in Figure 5 below.

Alongside the FinTech Action Plan, the Commission published a set of legislative proposals relating to crowdfunding, including (i) *a proposal for a Regulation on European Crowdfunding Service Providers (ECSP) for Business* and (ii) a proposal for a Directive amending Directive 2014/65/EU on markets in financial instruments, amending the scope of MiFID II[20].
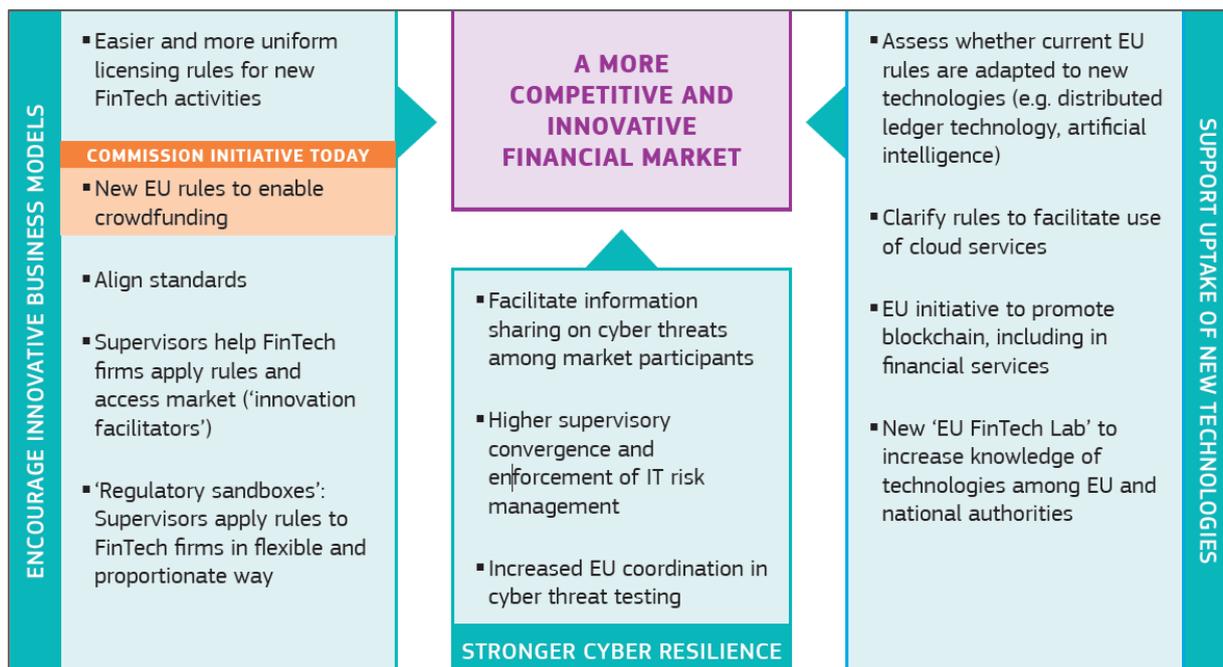


*Figure 5 The FinTech Action Plan (Source: Fact Sheet, EU Commission, March 2018)*

The action plan mentions important synergies between the Digital Market Strategy, the Cybersecurity Strategy, the Consumer Financial Services Strategy, the mid-term Review of the Capital Markets

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[20] See further information on EC's crowdfunding activities at https://ec.europa.eu/info/business-economy-euro/growth-and-investment/financing-investment/crowdfunding_en

Union and other documents related to the digital transformation. However, the document does not refer to the topic of sustainable finance.

Status of implementation

The actions mentioned in the document have been already implemented and are being advanced as listed below:

Regarding Objective I: *Enabling innovative business models to reach EU scale*

- On the invitation by the Commission, the ESAs have published a joint report on regulatory sandboxes and innovation hubs in January 2019, including a comparative analysis and best practices of the innovation facilitators. According to the report, a lack of cooperation between financial regulators across the EU could be hindering businesses from expanding their FinTech services beyond national borders. 21 EU members states currently have innovation hubs, while only 5 members states have regulatory sandboxes (EPRS, 2019).

- EBA published a *FinTech Roadmap* in March 2018 with its priorities for 2018 and 2019, envisaging a *FinTech Knowledge Hub*[21] to improve sharing of expertise and promote technological neutrality in regulatory and supervisory approaches, also interacting with the EU's FinTech Lab.

- EIOPA has set up the *InsurTech Task Force*[22] to analyse the use of Big Data. It maps the initiatives on the national level in this area, with a view to improving supervisory practices. At a later stage, the task force will also investigate the benefits and risks arising from the use of blockchain and smart contracts.

- On the request of the Commission, the European Securities and Markets Authority (ESMA) published *Advice on Initial Coin Offerings and Crypto-Assets* in January 2019.

- Jointly with the International Organisation for Standardization (ISO), the EC has established a FinTech Technical Advisory Group, to develop coordinated standards.

- The Commission supported the Application Programming Interface (API) Evaluation Group under the European Payment Council to promote the update of standardised APIs in line with the Payment Services Directive and the General Data Protection Directive (GDPR) as a basis for a European *open banking* eco-system.

Regarding Objective 2: *Supporting the uptake of technological innovation*

- A call for applications has been launched in March 2018 for the selection of members of the European Commission group of experts on "regulatory obstacles to financial innovation

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[21] https://eba.europa.eu/financial-innovation-and-fintech/fintech-knowledge-hub
[22] https://eiopa.europa.eu/Pages/Working%20Groups/InsurTech-Task-Force.aspx

(ROFIEG)" that will assist the Commission by providing high-level expertise on EU financial services legislation in relation to FinTech.

- Upon invitation by the EC, EBA issued guidelines on outsourcing arrangements, including cloud outsourcing, in February 2019,

- Support has been granted for the self-regulatory work of the cloud stakeholder working group on cloud switching from April 2018 onwards,

- Already under the *Digital Single Market*, the Commission

  o has set-up the *EU Blockchain Observatory and Forum* in late 2017 to help identify and provide analysis of the technological and organisational trends on blockchain and distributed ledger technologies (not limited to the financial sector), develop and provide expertise and support learning, as well as create a forum to engage with stakeholders for facilitating sharing of experiences and leading expert and public debate through involving authorities, regulators and supervisors[23].

  o has created the *High-Level Expert Group on Artificial Intelligence* (AI HLEG) in June 2018 to support the implementation of the European Strategy on AI, including the elaboration of recommendations on future-related policy development an on ethical, legal and societal issues related to AI. Meanwhile, the AI HLEG has delivered *Ethics Guidelines on Artificial Intelligence* (with the objective to build trust in human-centred AI), as well as *Policy and Investment Recommendations*, see the *textbox* below). The AI HLEG also steers the European AI Alliance, a multi-stakeholder forum for discussion of AI development and its impact on the economy and the environment, holding a first assembly in June 2019 including a workshop on AI's Social and Environmental Impact (so-called *Sustainable AI*).

- The International Association for Trusted Blockchain Application (INATBA) has been launched, being a Brussels-based multi-stakeholder organisation bringing together suppliers and users of distributed ledger technologies with representatives of governmental organisations and standard setting bodies from all over the world.

- The "Convergence" Global Blockchain Congress has been organized in November 2019 to define the future of blockchain and potentially also of the Next-Generation Internet.

- The EU FinTech Lab has been set up, aiming at providing training to regulators and supervisors and sharing knowledge and new technologies through demonstrations, expert discussion and workshops. A first meeting was held in June 2018 on the topic of cloud outsourcing in the banking and insurance sectors.

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[23] See https://www.eublockchainforum.eu/

**Protecting the integrity of humans, society and the environment:** excerpt from the AI HLEG Policy and Investment Recommendations for Trustworthy AI (June 2019).

*Fostering the development of AI solutions that address <u>sustainability challenges</u>, by launching competitions and missions for AI solutions tackling specific environmental problems, strengthening this component in the Horizon Europe missions, and enact a circular economy plan for digital technologies and AI in particular to incentivise companies to reduce the carbon footprint of data centres and devices (including smartphones).*

*Consideration must be also given to the sustainability of big data-driven AI and modern computing and AI architectures to ensure that the process of developing AI products and services also does not have an undue sustainability impact.*

**Opportunities of Trustworthy Artificial Intelligence:** AI HLEG Ethics Guidelines on Trustworthy AI (April 2019).

*Trustworthy AI can represent a great opportunity to support the mitigation of pressing challenges facing society such as an ageing population, growing social inequality and environmental pollution. This potential is also reflected globally, such as with the <u>UN Sustainable Development Goals</u>:*

- ***Climate action and sustainable infrastructure**: While tackling climate change should be a top priority for policy-makers across the world, digital transformation and Trustworthy AI have a great potential to reduce humans' impact on the environment and enable the efficient and effective use of energy and natural resources. Trustworthy AI can, for instance, be coupled to big data in order to detect energy needs more accurately, resulting in more efficient energy infrastructure and consumption…*

- ***Health and well-being**: Trustworthy AI technologies can be used – and are already being used – to render treatment smarter and more targeted, and to help preventing life-threatening diseases…*

- ***Quality education and digital transformation**: New technological, economic and environmental changes mean that society needs to become more proactive. Governments, industry leaders, educational institutions and unions face a responsibility to bring the citizens into the new digital era ensuring they have the right skills to fill the future jobs. Trustworthy AI technologies could assist in more accurately forecasting which jobs and*

<u>Regarding Objective 3</u>: *Enhancing security and integrity of the financial sector*

- Upon invitation of the Commission, the ESAs published the *Joint Advice on Information and Communication Technology (ICT) risk management and cybersecurity,* as well as *Joint Advice on the costs and benefits of developing a cyber resilience testing framework for significant market participants and infrastructures with in the whole EU financial sector* (both in April 2019).

<u>Outlook on potentially further actions</u>

In February 2019, the Commission's Vice President Valdis Dombrovskis stressed Europe's need to embrace FinTech for reasons of international competitiveness, mentioning the necessity of closer cooperation between the EU supervisory agencies[24]. Moreover, specific EU regulation on crypto assets[25] could be desirable, as well as a regulatory push to speed up instant payments in the context of the Payment Account Directive. Combined with European Central Bank's efforts to develop a common EU open banking scheme, the latter would introduce innovation in the EU's retail banking sector.

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[24] See summary report from the 3rd Annual Conference on Fintech and Regulation, https://www.fintech2019.eu/

[25] A crypto-asset (including digital currencies) is a type of private asset that depends primarily on cryptography and distributed ledger (or similar) technology; cryptography refers to the conversion of data into private code using encryption algorithms, typically for transmission over a public network (FSB, May 2019).

## ANNEX II FINTECH: DIGITAL TECHNOLOGIES AT A GLANCE

Digital technologies applied in the context of FinTech include, inter alia, mobile technology, artificial intelligence, social networks, machine learning, DLT/blockchain, cloud computing, big data analytics, Internet of Things. Their use cases are generally <u>not</u> limited to the financial sector and the portfolio of technologies is constantly expanding.

- **Artificial intelligence and machine learning (AIML) for automated advice and execution**

Artificial intelligence refers to systems that show intelligent behaviour: by analysing their environment, they can perform various tasks with some degree of autonomy to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices, e.g. advanced robots, autonomous cars, drones or Internet of Things applications (AI HLEG, April 2019). Mobile phones, e-commerce tools, navigation systems and many other different sensors constantly gather data or images. AIML can learn from this torrent of data to make predictions and create useful insights (European Commission, Digital Single Market – Artificial Intelligence for Europe).
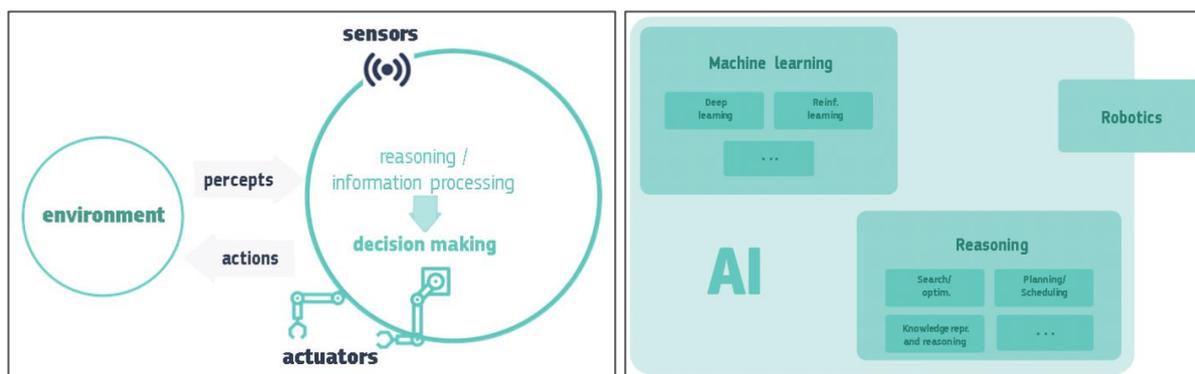


*Left*: A schematic AI system; *right*: A simplified overview of AI's sub-disciplines and relationship. (AI HLEG, April 2019).

Financial institutions are increasingly using AI and machine learning in a range of applications across the financial system including to assess credit quality, to price and market insurance contracts and to automate client interaction. Institutions are optimising scarce capital with AI and machine learning techniques, as well as back-testing models and analysing the market impact of trading large positions. Meanwhile, hedge funds, broker-dealers and other firms are using it to find signals for higher uncorrelated returns and to optimise trade execution. Both public and private sector institutions may use these technologies for regulatory compliance, surveillance, data quality assessment and fraud detection (FSB, 2017).

AIML can also be used by **robo-advisors**, which are applications combining digital interfaces and algorithms in order to provide services ranging from automated financial recommendations to contract brokering to portfolio management to their clients (FSB, February 2019).

- **Cloud computing and cloud services**

Cloud computing refers to the practice of using a network of remote servers, typically accessed over the internet, for the provision of IT services. Cloud computing offers advantages such as economies of scale, flexibility, operational efficiencies and cost effectiveness (FSB, February 2019).

The following table provides on overview on cloud service models as used by financial institutions and FinTech.

| Infrastructure as a Service (IaaS) | Platform as a Service (PaaS) | Software as a Service (SaaS) | Business Process as a Service (BPaaS) | Data as a Service (DaaS) |
|---|---|---|---|---|
| Supplies customers with IT infrastructure, provided and managed over the internet on a pay as you use basis e.g. servers and storage | Supplies customers with an on-demand environment for developing, testing, delivering and managing software applications over the internet | Allows customers to connect to and use cloud-based apps over the Internet on a subscription basis e.g. Microsoft office 365 | Automated business process delivered from a cloud service. BPaaS usually has a well-defined interface which makes it easy to be used by different enterprises | Uniting of the data and the software needed for its interpretation into a single consumer product made available to customers over a network, typically the Internet |

Cloud service models (FSB, February 2019).

- **Distributed ledger technology (DLT) including blockchain**

Blockchain is the best-known distributed ledger technology. A ledger is a database which keeps a final and definitive record of transactions. Records, once stored, cannot be tampered without leaving behind a clear track. Blockchain enables a ledger to be held in a network across a series of nodes, which avoids one centralised location and the need for intermediaries' services. This is particularly helpful to provide trust, traceability and security in systems that exchange data or assets.

It is important to avoid confusion between blockchain technologies and cryptocurrencies, which represent just one type of application of blockchain. Blockchain can underpin a wide range of applications in various sectors, which are not limited to cryptocurrency or FinTech (Source: FAQ on the FinTech Action Plan, European Commission, March 2018).

Although financial services and FinTech companies are among first explorers of this technology, its transformative impact goes potentially far beyond the financial sector, with use cases and applications in supply chain, energy, government, healthcare and sports[26].

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[26] See CONSENSYS webpage, https://consensys.net

**Crypto-assets** are digital assets recorded on a distributed ledger. The earliest and best-known example of crypto-assets is crypto-currencies, a special type of virtual currency (European Parliament, 2019).

Among others, blockchain-enabled solutions include **smart contracts**, which are programmable distributed applications that can trigger financial flows or changes of ownership if specific events occur. They can be used to automate process and business transactions, thus reducing transaction cost (FSB, February 2019)[27].

The EU FinTech Action Plan has a special focus on blockchain, which the Commission considers likely to become a key component of the digital economy and society.

- **Big Data Analytics**

Big Data consists of the use of highly developed IT tools to process very large sets of different types of data. Big Data may include consumer data from web pages, social media, internet browsing history, smart phone signals or data generated by using a payment card. For example, using Big Data technology, a financial institution could link a person's social media information with financial data about the person's savings activities. Financial institutions could therefore use this information to understand better the person's savings and investment habits. Financial institutions increasingly apply Big Data to everyday life financial services and will continue to do so in the future (Joint Committee of ESAs, Big Data Factsheet, undated).

The increased use of customer data or big data by financial institutions may lead to benefits to consumers, such as the development of more tailored, segmented and cheap offers based on more efficient allocation of risk and capital (EP, 2017).

- **Internet of Things (IoT)**

Software, sensors and network connectivity embedded in physical devices, buildings, and other items that enable those objects to: (i) collect and exchange data and (ii) send, receive and execute commands (FSB, February 2019). IoT is considered to be especially vulnerable to cyberattacks and therefore poses a particular challenge to cybersecurity, with a connected system being as safe as its weakest element (EP, 2017).

- **Application programming interface (API):**

API is a set of rules and specifications followed by software programmes to communicate with each other, and an interface between different software programmes that facilitates their interaction. API is used in "open banking", a system in which financial institution's data can be shared for users and third-party developers (FSB, February 2019).

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[27] For further educational videos on blockchain and smart contracts, see the website of the EU Blockchain Forum https://www.eublockchainforum.eu/knowledge